Spatial Extension for GeoServer WPS v1.0

USER MANUAL

MANGO SYSTEM

GeoServer

Spatial Extension for GeoServer WPS v1.0 User Manual

이 책은 국토교통부 국토공간정보연구사업의 연구비지원(과제번호 14NSIP-B080144-01)을 받아 제작되었음을 알립니다.

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본 제품은 “GeoTools”, “GeoServer”에 의해 개발 또는 라이선스 된 오픈 소스 소프트웨어를 포함합니다. 관련 상세 정보는 아래에 기재된 사항을 참고해 주십시오.

- GeoTools: http://www.geotools.org
- GeoServer: http://geoserver.org

안내서 정보

안내서 제목: Spatial Extension for GeoServer WPS 사용자 안내서

발행일: 2016-12-31

소프트웨어 버전: Spatial Extension for GeoServer WPS 1.0

안내서 버전: 1.0

목 차

1 Web Processing Service

1.1. Web Processing Service

Web Processing Service(WPS)[1] 는 지리정보에 대한 다양한 처리 서비스(Geo-Processing[2] service)들을 웹에서 정의하고 실행할 수 있도록 하기 위한 표준 인터페이스이며 모든 OGC 표준 웹 서비스(Web Feature Service, Web Coverage Service 등)들과 상호호환성을 갖도록 정의됩니다.

일반적으로 WPS 는 특정 데이터에 직접 바인딩 되어 있지 않으며, 클라이언트에 의해 동적으로 주어지는 데이터 또는 데이터 참조(WFS 결과물 등)들을 입력으로 받아들여 이를 처리하는 프로세스 서비스들로 구성됩니다.

WPS 는 간단한 계산(버퍼 연산 등)에서부터 복잡한 분석 연산(기후 모델의 생성 등)을 지원하며, 원칙적으로 WPS 인터페이스를 기반으로 구현함에 있어 어떠한 제약사항도 없습니다. 즉 WPS 를 구성하는 프로세스는 목적에 맞게 다양하게 구현할 수 있다는 것입니다.

WPS 서비스의 주요 Operation 은 다음과 같습니다.

요청	응답	설명
GetCapabilities	XML	서비스 가능한 Process 에 대한 메타정보를 XML 로 반환
DescribeProcess	XML	프로세스에 대한 상세정보(input, output, 사용가능 포맷 등) 제공
Excute	XML 등	WPS 가 제공하는 프로세스들 중 하나를 실행하고 결과를 반환 WPS 의 결과는 Map, Feature, Coverage 및 이들의 조합 또는 사용자 설정 포맷 등 다양하게 정의 가능

[1] https://en.wikipedia.org/wiki/Web_Processing_Service

[2] Geo-Processing 이란 GIS 데이터를 조작하기 위해 사용되는 작업으로 하나 이상의 입력 데이터를 이용하여 자료 처리 후 결과물을 반환하는 형식이며, 일반적으로 중첩, 래스터 분석, 데이터 변환 등이 있습니다.

1.2. Operations

Web Processing Service 1.0.0 버전은 GetCapabilities, DescribeProcess, Execute 의 3 가지 Operation 으로 구성됩니다.

1.2.1. GetCapabilities

WPS 서버에서 제공하는 Operation 과 Process 목록에 대한 메타데이터를 제공합니다.

■ **HTTP Get Request**

```
http://127.0.0.1:8080/geoserver/ows?
    service=wps&
    version=1.0.0&
    request=GetCapabilities
```

■ **Response Document**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Capabilities xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xml:lang="en" service="WPS" version="1.0.0"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:ServiceIdentification>
    <ows:Title>Prototype GeoServer WPS</ows:Title>
    <ows:Abstract />
    <ows:ServiceType>WPS</ows:ServiceType>
    <ows:ServiceTypeVersion>1.0.0</ows:ServiceTypeVersion>
  </ows:ServiceIdentification>
  <ows:ServiceProvider>
    <ows:ProviderName>Mango System inc.</ows:ProviderName>
    <ows:ProviderSite xlink:href="http://geoserver.org" />
    <ows:ServiceContact />
  </ows:ServiceProvider>
  <ows:OperationsMetadata>
    <ows:Operation name="GetCapabilities">
      <ows:DCP>
        <ows:HTTP>
          <ows:Get xlink:href="http://127.0.0.1:8080/geoserver/wps" />
          <ows:Post xlink:href="http://127.0.0.1:8080/geoserver/wps" />
        </ows:HTTP>
      </ows:DCP>
    </ows:Operation>
```

```xml
    <ows:Operation name="DescribeProcess">
      <ows:DCP>
        <ows:HTTP>
          <ows:Get xlink:href="http://127.0.0.1:8080/geoserver/wps" />
          <ows:Post xlink:href="http://127.0.0.1:8080/geoserver/wps" />
        </ows:HTTP>
      </ows:DCP>
    </ows:Operation>
    <ows:Operation name="Execute">
      <ows:DCP>
        <ows:HTTP>
          <ows:Get xlink:href="http://127.0.0.1:8080/geoserver/wps" />
          <ows:Post xlink:href="http://127.0.0.1:8080/geoserver/wps" />
        </ows:HTTP>
      </ows:DCP>
    </ows:Operation>
  </ows:OperationsMetadata>
  <wps:ProcessOfferings>
    <wps:Process wps:processVersion="1.0.0">
      <ows:Identifier>statistics:AttributeJoin</ows:Identifier>
      <ows:Title>Join Features By Attributes</ows:Title>
      <ows:Abstract>Joins features to another features or attribute table based on a common
field.</ows:Abstract>
    </wps:Process>
    <wps:Process wps:processVersion="1.0.0">
      <ows:Identifier>statistics:BufferFeatures</ows:Identifier>
      <ows:Title>Buffer Features using Expression</ows:Title>
      <ows:Abstract>Buffers a features using a certain distance expression.</ows:Abstract>
    </wps:Process>
    ...
  </wps:ProcessOfferings>
  <wps:Languages>
    <wps:Default>
      <ows:Language>en-US</ows:Language>
    </wps:Default>
    <wps:Supported>
      <ows:Language>en-US</ows:Language>
    </wps:Supported>
  </wps:Languages>
</wps:Capabilities>
```

1.2.2. DescribeProcess

WPS 서버에서 제공하는 프로세스의 Input, Output 파라미터와 각 파라미터가 사용하는 포맷과 관련한 Mime Type, 파라미터 기본값, 프로세스 상태 지원 여부 등 메타데이터를 제공합니다.

■ **HTTP Get Request**

```
http://127.0.0.1:8080/geoserver/ows?
    service=wps&
    version=1.0.0&
    request=DescribeProcess&
    Identifier=statistics:BufferFeatures
```

■ **Response Document**


```
<?xml version="1.0" encoding="utf-8"?>
<wps:ProcessDescriptions xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xml:lang="en" service="WPS" version="1.0.0"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ProcessDescription wps:processVersion="1.0.0" statusSupported="true" storeSupported="true">
    <ows:Identifier>statistics:BufferFeatures</ows:Identifier>
    <ows:Title>Buffer Features using Expression</ows:Title>
    <ows:Abstract>Buffers a features using a certain distance expression.</ows:Abstract>
    <DataInputs>
      <Input maxOccurs="1" minOccurs="1">
        <ows:Identifier>inputFeatures</ows:Identifier>
        <ows:Title>Input Features</ows:Title>
        <ows:Abstract>Input features to be buffered.</ows:Abstract>
        <ComplexData>
          <Default>
            <Format>
              <MimeType>text/xml; subtype=wfs-collection/1.0</MimeType>
            </Format>
          </Default>
          <Supported>
            <Format>
              <MimeType>text/xml; subtype=wfs-collection/1.0</MimeType>
            </Format>
            <Format>
              <MimeType>application/json</MimeType>
```

```
            </Format>
            ...
          </Supported>
        </ComplexData>
      </Input>
      <Input maxOccurs="1" minOccurs="1">
        <ows:Identifier>distance</ows:Identifier>
        <ows:Title>Distance Expression</ows:Title>
        <ows:Abstract>The distance expression used to create distance. ex) 1000 or [field] or [field] * 0.5 
etc...</ows:Abstract>
        <LiteralData>
          <ows:AnyValue />
        </LiteralData>
      </Input>
      <Input maxOccurs="1" minOccurs="0">
        <ows:Identifier>quadrantSegments</ows:Identifier>
        <ows:Title>Quadrant Segments</ows:Title>
        <ows:Abstract>the number of line segments used to represent a quadrant of a 
circle.</ows:Abstract>
        <LiteralData>
          <ows:DataType>xs:int</ows:DataType>
          <ows:AnyValue />
        </LiteralData>
      </Input>
    </DataInputs>
    <ProcessOutputs>
      <Output>
        <ows:Identifier>result</ows:Identifier>
        <ows:Title>Result Features</ows:Title>
        <ComplexOutput>
          <Default>
            <Format>
              <MimeType>text/xml; subtype=wfs-collection/1.0</MimeType>
            </Format>
          </Default>
          <Supported>
            <Format>
              <MimeType>text/xml; subtype=wfs-collection/1.0</MimeType>
            </Format>
            <Format>
              <MimeType>text/xml; subtype=gml/3.1.1</MimeType>
            </Format>
            ...
```

```
          </Supported>
        </ComplexOutput>
      </Output>
    </ProcessOutputs>
  </ProcessDescription>
</wps:ProcessDescriptions>
```

1.2.3. Execute

HTTT Get/Post 기반의 프로세스를 실행하는 Operation 입니다. 다음 예는 Simplify 프로세스를 실행하는 요청문의 예입니다.

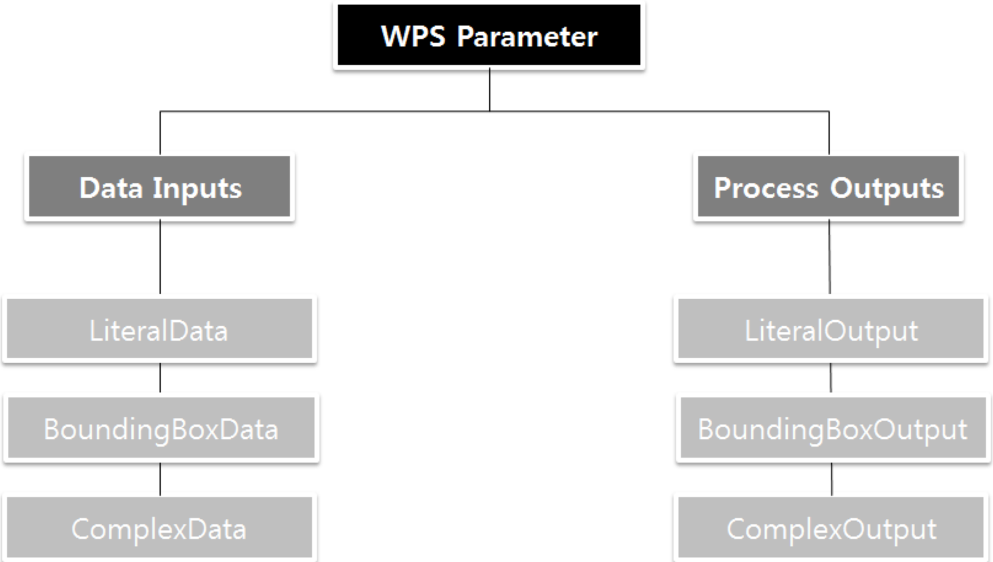
```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:Simplify</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:road"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>tolerance</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>30</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="application/json">
      <ows:Identifier>result</ows:Identifier>
```

```
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

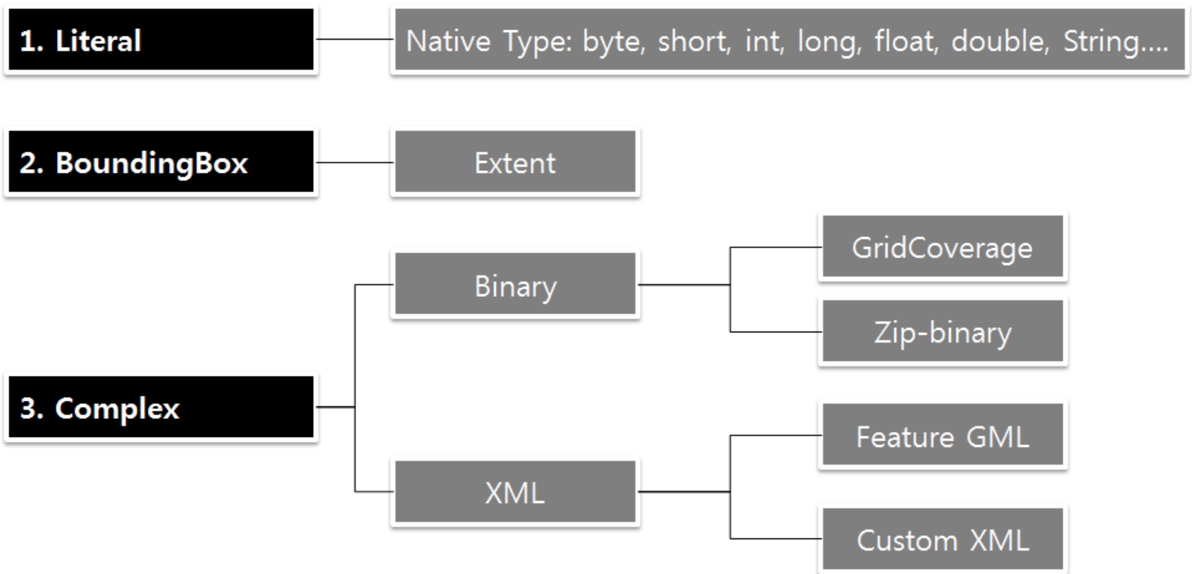
GeoServer 및 Spatial Extension for GeoServer 에서 제공하는 Process 에 대한 자세한 정보는 3 GeoServer Process Reference 장을 참고하십시오.

1.3. Input & Output Parameters

WPS 에서 사용되는 파라미터는 다음과 같이 Data Input 과 Process Output 으로 구분됩니다.



Data Input 파라미터는 LiteralData, BoundingBoxData, ComplexData 로, Process Output 파라미터는 LiteralOutput, BoundingBoxOutput, ComplexOutput 으로 세분화됩니다.



1.3.1. Literal

Literal 데이터 타입은 Java Native Type 을 포함하는 문자열로 전달되는 파라미터를 말합니다. 여기에는 byte, short, int, long, float, double, String 외 Enum, Filter Expression 등이 포함됩니다.

다음 예는 WPS 요청문에서 Literal 데이터가 사용된 예입니다.

```
<wps:Input>
  <ows:Identifier>joinType</ows:Identifier>
  <wps:Data>
    <wps:LiteralData>KeepAllRecord</wps:LiteralData>
  </wps:Data>
</wps:Input>
```

1.3.2. BoundingBox

BoundingBox 데이터 타입은 LowerCorner, UpperCorner, CRS(Coordinate Reference Sytem)로 구성된 최소경계 사각형을 나타내는 파라미터입니다. WPS 요청문에서는 다음과 같이 사용됩니다.

```
<wps:Input>
  <ows:Identifier>clip</ows:Identifier>
  <wps:Data>
    <wps:BoundingBoxData crs="EPSG:5181" dimensions="2">
      <ows:LowerCorner>0.0 0.0</ows:LowerCorner>
      <ows:UpperCorner>100.0 200.0</ows:UpperCorner>
    </wps:BoundingBoxData>
  </wps:Data>
</wps:Input>
```

1.3.3. Complex

Complex 데이터 타입은 Literal, BoundingBox 파라미터 외 모든 사용자 정의형 파라미터를 말하며, XML, GML, GeoJSON, 래스터 데이터(GeoTIFF 등), Filter Encoding, SLD(Styled Layer Descriptor) 등이 있으며 Process Parameter IO 를 구현해 확장이 가능합니다.

- **Geometry 의 WKT 포맷 활용**

```
<wps:Input>
  <ows:Identifier>poi</ows:Identifier>
  <wps:Data>
    <wps:ComplexData mimeType="text/xml; subtype=gml/3.1.1"><![CDATA[POINT(100
200)]]></wps:ComplexData>
  </wps:Data>
</wps:Input>
```

■ **WFS 서비스 데이터 활용**

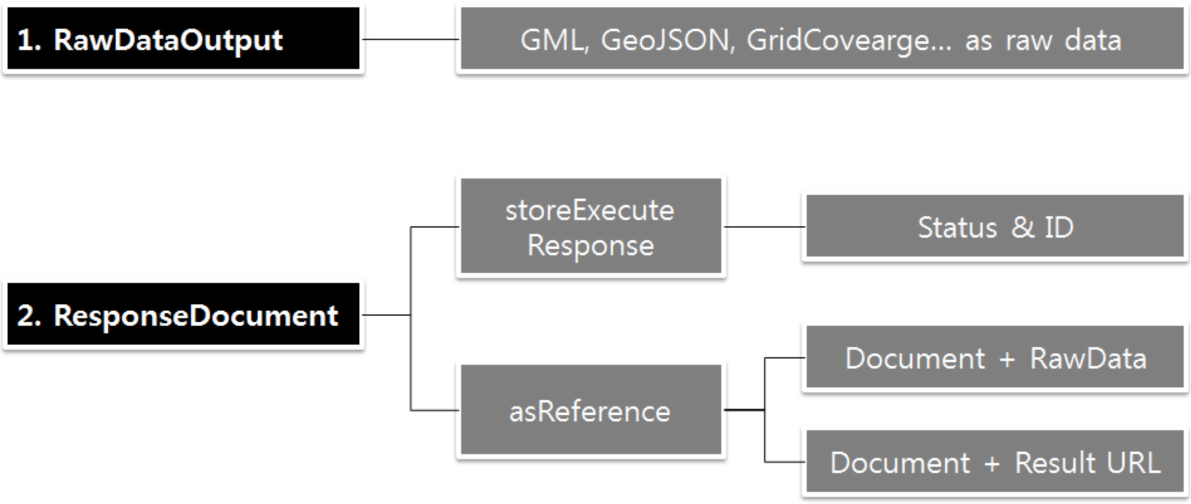
```
<wps:Input>
  <ows:Identifier>inputFeatures</ows:Identifier>
  <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
    <wps:Body>
      <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
        <wfs:Query typeName="foss:stores"/>
      </wfs:GetFeature>
    </wps:Body>
  </wps:Reference>
</wps:Input>
```

■ **WCS 서비스 데이터 활용**

```
<wps:Input>
  <ows:Identifier>coverage</ows:Identifier>
  <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
    <wps:Body>
      <wcs:GetCoverage service="WCS" version="1.1.1">
        <ows:Identifier>cite:dem</ows:Identifier>
        <wcs:DomainSubset>
          <gml:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#5181">
            <ows:LowerCorner>360798.47130000126 166606.5</ows:LowerCorner>
            <ows:UpperCorner>409658.47130000126 212476.5</ows:UpperCorner>
          </gml:BoundingBox>
        </wcs:DomainSubset>
        <wcs:Output format="image/tiff"/>
      </wcs:GetCoverage>
    </wps:Body>
  </wps:Reference>
</wps:Input>
```

1.4. Response Form

WPS 요청문에서 Process Output 을 요청하는 형식은 크게 RawDataOutput 과 ResponseDocument 2 가지가 있습니다.



1.4.1. RawDataOutput

RawDataOutput 으로 요청하는 경우에 응답은 XML, GML, GeoJSON, 래스터 데이터를 직접 반환합니다. 다음은 RawDataOutput 으로 xml 을 직접 반환하는 예입니다.

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS"
  ………………
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

Literal, BoundingBox, Complex(Custom XML 등) 등 요청 후 클라이언트에서 직접 사용하는 경우

```
<?xml version="1.0" encoding="utf-8"?>
<NearestNeighborIndex>
  <TypeName>apartment</TypeName>
  <Observed_Point_Count>4052</Observed_Point_Count>
  <Study_Area>1.047557075141607E9</Study_Area>
  <Observed_Mean_Distance>200.00446</Observed_Mean_Distance>
  <Expected_Mean_Distance>254.22844</Expected_Mean_Distance>
  <Nearest_Neighbor_Ratio>0.786712</Nearest_Neighbor_Ratio>
  <Z_Score>-25.973484</Z_Score>
  <P_Value>0.0</P_Value>
  <Standard_Error>2.087667</Standard_Error>
</NearestNeighborIndex>
```

1.4.2. ResponseDocument

ResponseDocument 로 요청하는 경우에 응답은 WPS 의 ExecuteResponse XML 형식으로 반환됩니다.

다음과 같이 Output 파라미터의 asReference 를 true 로 설정하는 경우에는 서버에 임시로 저장한 결과 데이터[3]의 URL 을 반환하고, 그렇지 않은 경우에는 RawData 포맷(XML)으로 반환합니다. XML 이외의 포맷에 대해서는 ExecuteResponse XML 내에 포함될 수 없습니다.


```xml
<wps:Execute version="1.0.0" service="WPS"
  ............
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:ResponseDocument storeExecuteResponse="false">
      <wps:Output mimeType="image/tiff" asReference="true">
        <ows:Identifier>result</ows:Identifier>
      </wps:Output>
    </wps:ResponseDocument>
  </wps:ResponseForm>
</wps:Execute>
```

```xml
<wps:ExecuteResponse service="WPS" version="1.0.0" …
  ………
  <wps:ProcessOutputs>
    <wps:Output>
      <ows:Identifier>result</ows:Identifier>
      <wps:Reference href="http://server/temp/gridcoverage/result_230_2123fds.tif" mimeType="image/tiff" />
    </wps:Output>
  </wps:ProcessOutputs>
</wps:ExecuteResponse>
```

ResponseDocument 의 storeExecuteResponse 를 true 로 설정하는 경우 현재 프로세스의 실행상태와 ID 를 반환하며, 이 값을 이용하여 프로세스의 상태와 Output 을 가져올 수 있습니다.


```xml
<wps:Execute version="1.0.0" service="WPS"
  ............
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:ResponseDocument storeExecuteResponse="true">
      <wps:Output mimeType="image/tiff" asReference="true">
        <ows:Identifier>result</ows:Identifier>
      </wps:Output>
    </wps:ResponseDocument>
  </wps:ResponseForm>
</wps:Execute>
```

```xml
<?xml version="1.0" encoding="utf-8"?>
<wps:ExecuteResponse xml:lang="en" service="WPS" serviceInstance="http://localhost:8090/geoserver/ows?"
statusLocation="http://localhost:8090/geoserver/ows?service=WPS&amp;version=1.0.0&amp;request=GetExecutionSta
tus&amp;executionId=142e4b6c-44e1-4aba-b8a2-6da8f0793198" version="1.0.0" …….>
  <wps:Process wps:processVersion="1.0.0">
    <ows:Identifier>statistics:KernelDensity</ows:Identifier>
    ………..
  </wps:Process>
  <wps:Status creationTime="2016-01-08T05:41:45.198Z">
    <wps:ProcessAccepted>Process accepted.</wps:ProcessAccepted>
  </wps:Status>
</wps:ExecuteResponse>
```

```
http://server/ows?service=WPS&version=1.0.0&request=GetExecutionResult&executionId=142e4b6c-44e1-4aba-b8a2-
6da8f0793198&outputId=result.tiff&mimetype=image%2Ftiff
```

[3] GeoServer WPS 설정 페이지에서 Resource 해제 시간을 설정할 수 있습니다.

1.5. Mime Type

현재 GeoServer WPS 에서 지원하는 Complex 파라미터의 포맷 별 Mime Type 은 다음과 같습니다. Mime Type 은 GeoServer Process Parameter IO 를 구현하여 확장이 가능합니다.

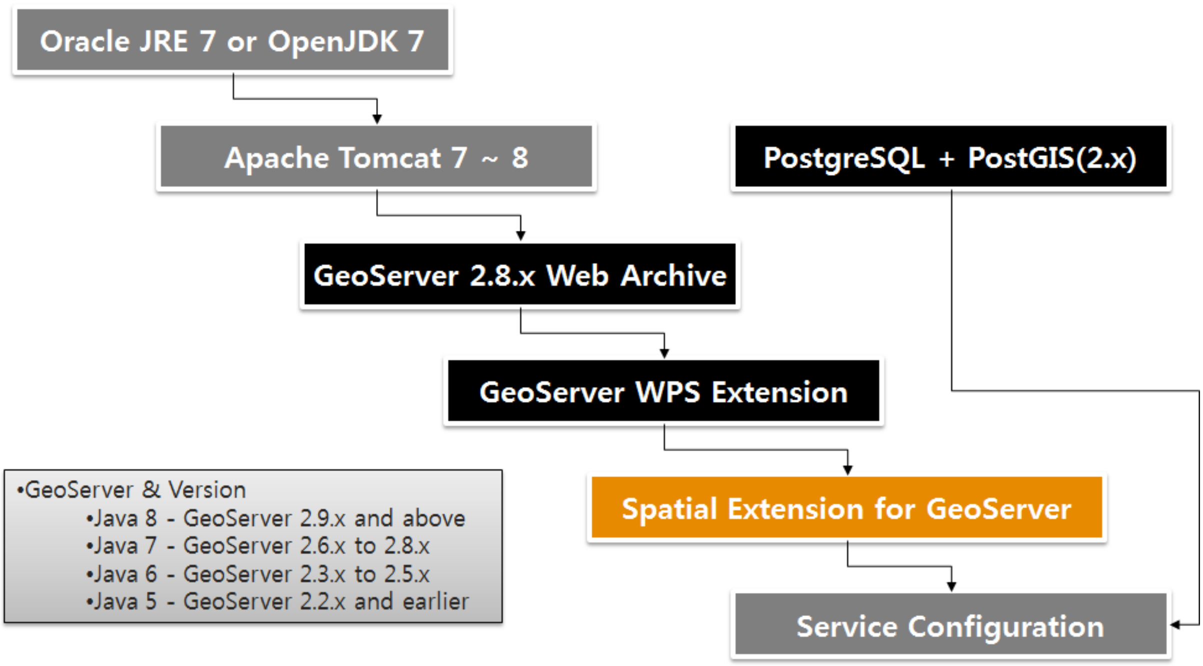
Category	Source	Format	Mime type
Geometry	Geometry	GML2.1	text/xml; subtype=gml/2.1.2
			application/gml-2.1.2
		GML3.1	text/xml; subtype=gml/3.1.1
			application/gml-3.1.1
		GeoJSON	application/json
		WKT	application/wkt
Feature Collection	Features WFS	GML2.1	text/xml; subtype=wfs-collection/1.0
			application/wfs-collection/1.0
		GML3.1	text/xml; subtype=wfs-collection/1.1
			application/wfs-collection/1.1
			text/xml; subtype=gml/3.1.1
		GeoJSON	application/json
		Shapefile	application/zip
Grid Coverage	WCS	GeoTiff	image/tiff
		Ascii	application/arcgrid
SLD	User	XML	text/xml; subtype=sld/1.0.0
			text/xml; subtype=sld/1.1.0
Filter	User	XML	text/xml; subtype=filter/1.0
			text/xml; subtype=filter/1.1
			text/plain; subtype=cql
XML	User	XML	text/xml
Literal	User	-	-

2 Installation

2.1. GeoServer 와 WPS Extension

GeoServer 는 여러 방법으로 설치가 가능합니다.

여기에서는 일반적으로 가장 많이 활용되는 Apache Tomcat 환경에서 GeoServer 를 설치하는 과정을 설명합니다. 기타 과정에서 대해서는 GeoServer Online 매뉴얼을 참고하시기 바랍니다.



현재 [Spatial Extension for GeoServer]는 GeoServer 2.5.x, 2.7.x, 2.8.x 버전에서 개발되었으며, GeoServer 2.5.x ~ 2.9.x 버전까지 테스트되었습니다.

다음은 GeoServer 2.8.5 버전을 기준으로 설치 과정을 설명합니다.

2.1.1. Java and Tomcat

GeoServer 2.8.5 은 Java 7 버전을 지원합니다. Java 의 설치 과정은 생략합니다.

Java	GeoServer	비고
Java 5	GeoServer 2.2.x and earlier	
Java 6	GeoServer 2.3.x ~ 2.5.x	Java 7 호환
Java 7	GeoServer 2.6.x ~ 2.8.x	LTS 버전: 2.8.x

Java 8	GeoServer 2.9.x and above	LTS 버전: 2.9.x

Tomcat 은 7 버전 이상을 사용하면 됩니다. 자세한 설치 과정은 생략합니다.

2.1.2. GeoServer and WPS Extension

Tomcat 에서 운영되는 GeoServer 를 설치하려면 Web Archive 버전(*.war)을 다운로드 후 Tomcat webapps 폴더에 복사만 하면 됩니다.

GeoServer 설치파일을 다운로드 하려면 우선 SourceForge[4] 연결합니다. 다음의 URL 에서 GeoServer 와 WPS Extension 을 다운로드 합니다.

- GeoServer
  - ✓ https://sourceforge.net/projects/geoserver/files/GeoServer/2.8.5/geoserver-2.8.5-war.zip

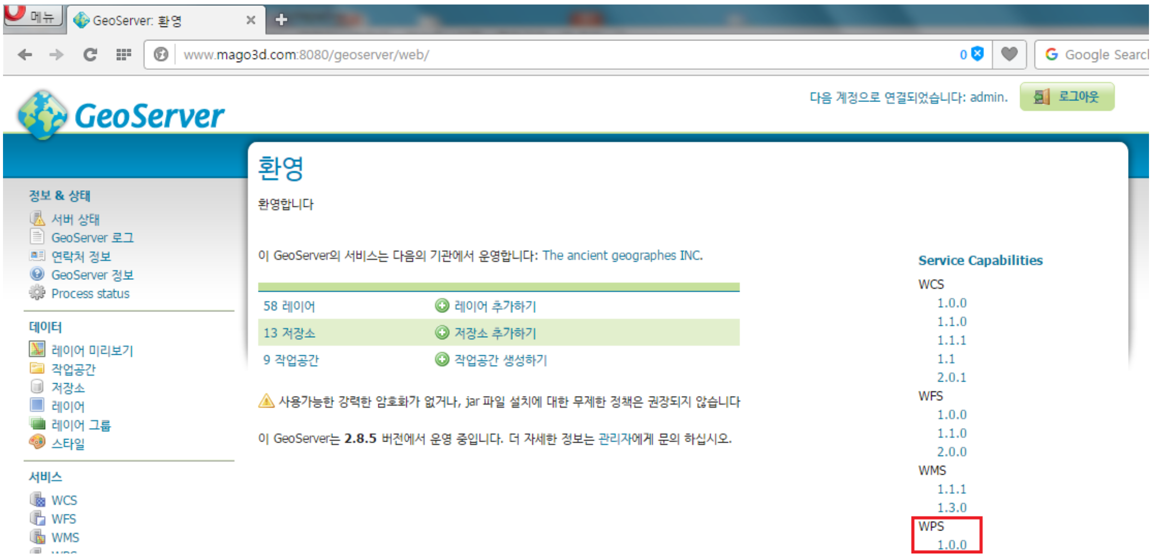
다운로드 한 geoserver-2.8.5-war.zip 파일의 압축 해제 후 geoserver.war 파일을 Tomcat 설치 폴더의 webapps 폴더에 복사합니다. 잠시 후 GeoServer 가 설치됩니다.

- WPS Extension
  - ✓ https://sourceforge.net/projects/geoserver/files/GeoServer/2.8.5/extensions/geoserver-2.8.5-wps-plugin.zip

다운로드 한 geoserver-2.8.5-wps-plugin.zip 파일의 압축 해제 후 포함된 모든 jar 파일을 webapps/geoserver/WEB-INF/lib 폴더 내에 복사합니다.

이제 Tomcat 서비스를 재 시작 후 GeoServer 관리자 페이지로 이동하면 다음과 같이 정상적으로 WPS Extension 이 설치된 것을 확인할 수 있습니다.

[4] https://sourceforge.net/projects/geoserver



2.2. Spatial Extension for GeoServer WPS

GeoServer WPS Extension 을 설치하면 Geometry, Vector, Raster 기본 WPS 프로세스가 제공되며, 이후 Spatial Extension for GeoServer WPS 를 설치하면 약 100 여개의 분석 프로세스가 추가됩니다.

우선 SourceForge[5] 연결합니다. 다음의 URL 에서 Spatial Extension for GeoServer WPS 설치파일을 다운로드 합니다.

- Spatial Extension for GeoServer WPS
  - ✓ https://sourceforge.net/projects/mango-spatialstatistics/files/GeoServer
    - ✓ gt-process-spatialstatistics-2.8.5.jar
    - ✓ gs-wps-spatialstatistics-2.8.5.jar

다운로드 한 2 개의 jar 파일을 webapps/geoserver/WEB-INF/lib 폴더 내에 복사합니다.

이제 Tomcat 서비스를 재 시작하면 설치가 완료됩니다.

[5] https://sourceforge.net/projects/mango-spatialstatistics

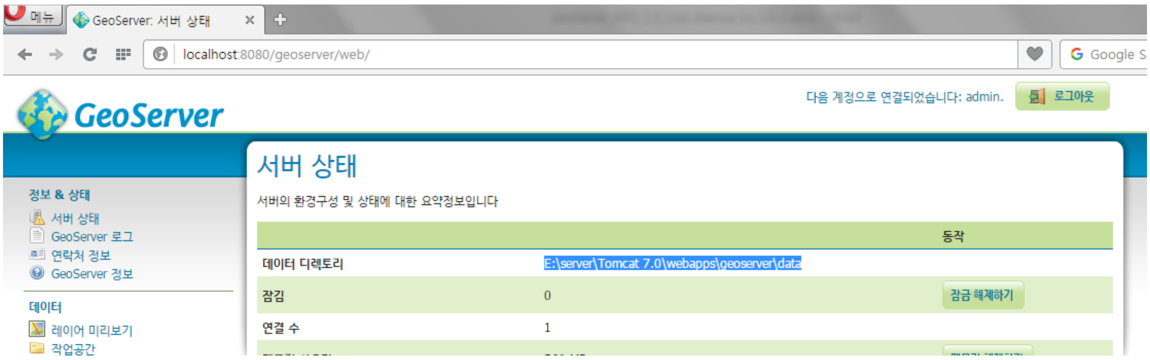
2.3. Server Configuration

운영환경에서 GeoServer 환경 구성

2.3.1. GeoServer Data Directory

GeoServer 를 처음 설치하면 GeoServer Data Directory 는 webapps₩geoserver₩data 폴더가 기본값입니다. 그러나 운영환경에서는 일반적으로 다른 드라이브나 폴더에 구성하는 것이 향후 확장성, 유지관리 측면에서 좋습니다.

GeoServer 관리자 페이지에서 [서버 상태] 페이지를 누르면 GeoServer Data Directory 의 위치를 다음과 같이 확인할 수 있습니다.



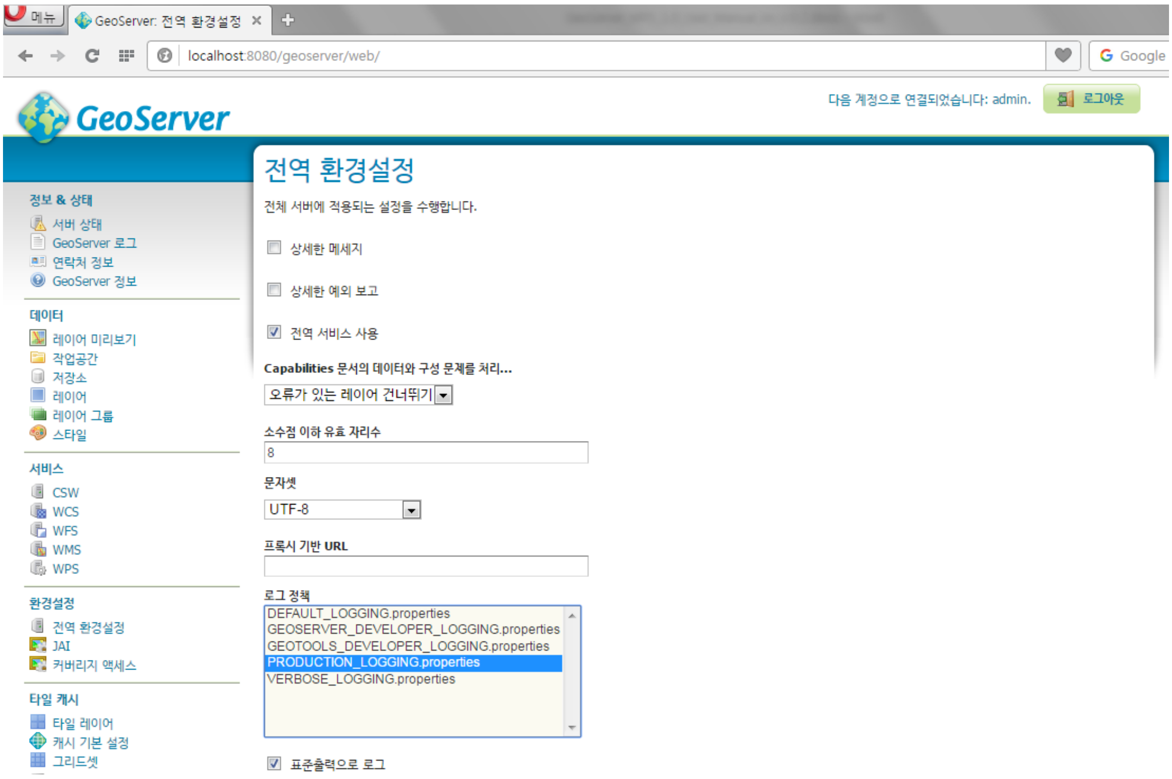
GeoServer Data Directory 를 옮기려면 Tomcat 서비스 종료 후 webapps₩geoserver₩data 폴더를 이동하고 webapps₩geoserver₩WEB-INF₩ 폴더의 web.xml 파일에서 다음 항목을 수정한 후 Tomcat 서비스를 재시작 하면 됩니다.

```
<context-param>
    <param-name>GEOSERVER_DATA_DIR</param-name>
     <param-value>C:₩workspace₩geoserver₩data</param-value>
</context-param>
```

2.3.2. Global Setting

개발된 웹 응용 프로그램이 정상적으로 운영되는 환경에서는 GeoServer 로그 정책을 변경하여 성능 및 하드웨어 유지관리 효율을 높일 수 있습니다.

이 정보는 GeoServer 관리자 페이지의 [전역 환경설정] 페이지를 눌러 확인할 수 있습니다.



GeoServer 를 처음 설치하면 [DFAULT_LOGGING.properties] 로그 정책을 따르며 오류 외에 일반적인 정보, 경고성 정보를 포함한 수많은 로그를 파일로 남깁니다. 로그 파일은 기본값으로 GeoServer Data Directory 내의 logs 폴더 내에 저장되며, 이 값 역시 변경이 가능합니다.

운영 환경에서 더 작은 오류를 남기려면 위 그림과 같이 [RODUCTION_LOGGING.properties]를 선택 후 페이지 하단의 

버튼을 눌러 정책을 변경하면 됩니다.

2.3.3. WFS Shape-zip Encoding 문제

GeoServer 의 WFS 서비스에서 Shapefile 을 압축 파일로 요청 (outputFormat=application/zip)하는 Shapefile 의 dbf 파일 한글이 깨지는 현상이 발생하는데 다음과 같이 설정하면 됩니다.

webapps₩geoserver₩WEB-INF₩ 폴더의 web.xml 파일에서 다음 항목을 추가한 후 GeoServer 를 재 시작하면 됩니다.

```
<context-param>
    <param-name>GS-SHAPEFILE-CHARSET</param-name>
    <param-value>x-windows-949</param-value>
</context-param>
```

2.3.4. Custom Projection

GeoServer 는 기본 좌표체계를 수정하거나 새로운 좌표체계를 추가할 수 있습니다.

TOWGS84 파라미터 추가 등 기존 좌표체계를 재정의하고자 하는 경우에는 GeoServer Data Directory 내의 user_projections 폴더에 epsg_overrides.properties 파일을 생성 후 다음과 같이 좌표체계를 추가하면 됩니다.

```
5174=PROJCS["Korean 1985 / Modified Central Belt", GEOGCS["Korean 1985", DATUM["Korean Datum 1985", SPHEROID["Bessel 1841", 6377397.155, 299.1528128, AUTHORITY["EPSG","7004"]], TOWGS84[-115.80,474.99,674.11,1.16,-2.31,-1.63,6.43], AUTHORITY["EPSG","6162"]], PRIMEM["Greenwich", 0.0, AUTHORITY["EPSG","8901"]], UNIT["degree", 0.017453292519943295], AXIS["Geodetic longitude", EAST], AXIS["Geodetic latitude", NORTH], AUTHORITY["EPSG","4162"]], PROJECTION["Transverse_Mercator", AUTHORITY["EPSG","9807"]], PARAMETER["central_meridian", 127.00289027777775], PARAMETER["latitude_of_origin", 38.0], PARAMETER["scale_factor", 1.0], PARAMETER["false_easting", 200000.0], PARAMETER["false_northing", 500000.0], UNIT["m", 1.0], AXIS["Easting", EAST], AXIS["Northing", NORTH], AUTHORITY["EPSG","5174"]]
```

만약 기존에 없는 새로운 좌표체계를 추가하는 경우에는 epsg.properties 파일에 위의 형식으로 좌표체계를 추가하면 되고, EPSG 코드는 반드시 유일한 숫자값이어야 합니다.

2.3.5. WPS Process Output Encoding 문제

벡터 데이터 출력 중 GeoJSON(application/json) 포맷 출력시 한글 깨지는 현상에 대한 해결책입니다. OpenLayers 등 JavaScript 기반의 응용프로그램을 개발하는 경우에 WFS 나 WPS 의 분석 결과 벡터 레이어로 GeoJSON 포맷을 사용하는 경우가 많습니다.

WFS 요청시에는 GeoJSON 의 기본 인코딩 UTF-8 을 사용하지만, WPS 에서 처리한 벡터 데이터를 GeoJSON 으로 요청하는 경우에는 JVM 에 설정된 파일 인코딩 기본값을 따릅니다.

따라서 ajax 등에서 처리하는 경우 한글이 깨지는 현상이 발생합니다. 이런 경우 다음과 같이 JVM 설정에서 다음과 같이 설정하면 한글 깨짐 현상을 방지할 수 있습니다.

```
-Dfile.encoding=UTF-8
```

JVM 및 Tomcat 운영환경에 필요한 더 많은 환경 구성은 다음을 참고하십시오.

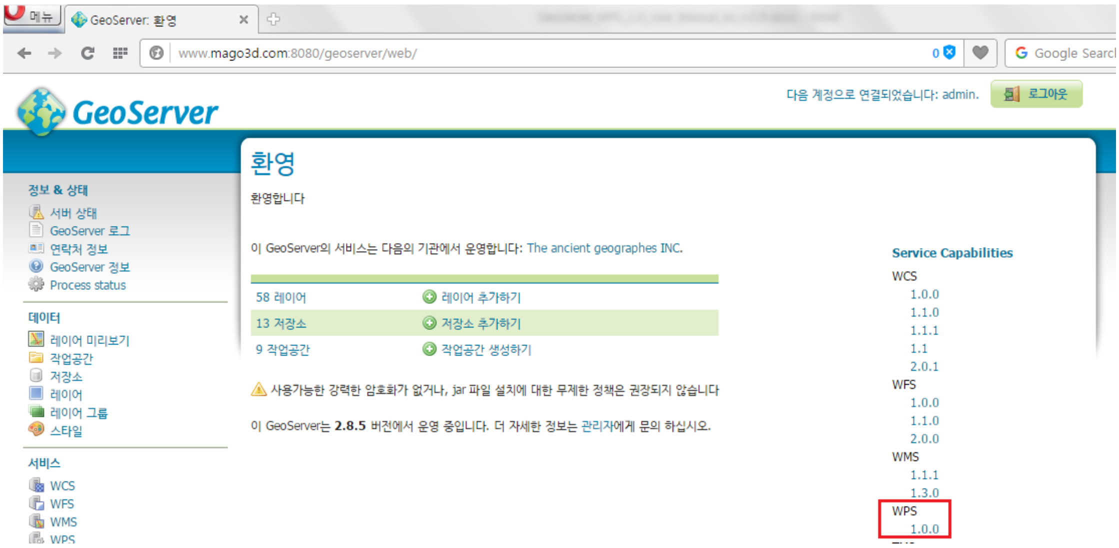
- http://docs.geoserver.org/stable/en/user/production/index.html
- http://geoserver.geo-solutions.it/edu/en/adv_gsconfig/gsproduction.html

3 Quick Start

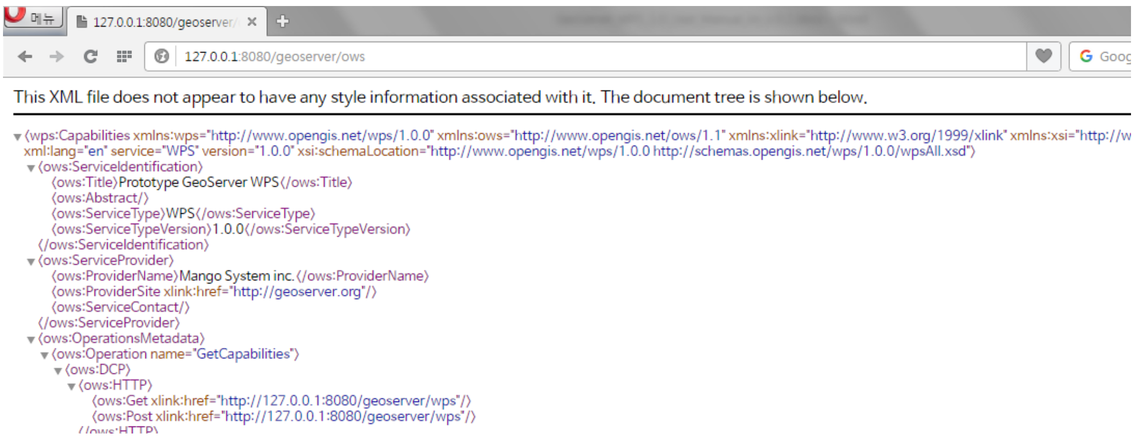
Web Browser 를 실행 후 GeoServer 관리자 페이지 URL 로 이동합니다.

3.1. Overview

GeoServer 에 로그인 후 시작 페이지의 오른쪽을 보면 현재 서비스 중인 OGC Web Service 의 목록이 표시됩니다. 이 목록들 중 WPS: 1.0.0 항목이 표시되면 GeoServer 의 WPS Extension 이 정상적으로 설치된 것입니다.



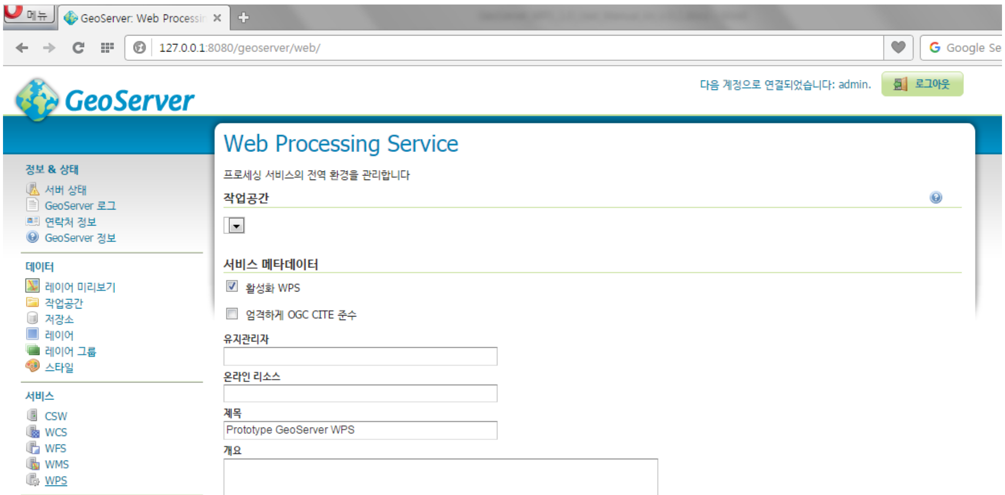
WPS: 1.0.0[6] 항목을 클릭하면 다음과 같이 WPS 의 GetCapabilities 문서를 확인할 수 있습니다.



6 http://127.0.0.1:8080/geoserver/ows?service=wps&version=1.0.0&request=GetCapabilities

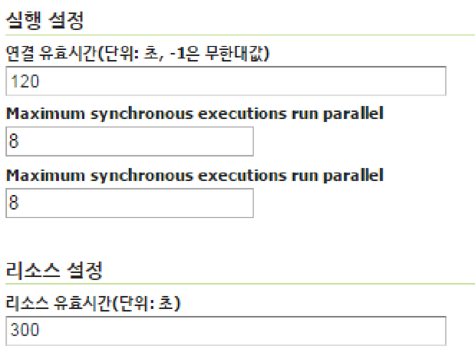
3.2. WPS Page

왼쪽의 메뉴 페이지에서 다음과 같이 [WPS] 링크를 클릭하여 Web Processing Service 페이지로 이동합니다. 여기에서는 WPS 서비스의 활성화 여부, 서비스 메타데이터, 실행 설정 등의 환경을 설정할 수 있습니다.



아래로 스크롤 하면 다음의 [실행 설정] 탭이 보입니다. [연결 유효시간]은 기본값이 120 초이며 이는 프로세스 실행 후 연결이 종료되는 시간입니다. WPS 프로세스의 처리 시간이 긴 경우 이 시간을 늘리면 됩니다.

[리소스 설정]의 [리소스 유효시간] 기본값은 300 초이며 이는 WPS 요청시 처리된 데이터를 서버에 남겨놓는 옵션(asReference 를 True 로 설정하여 요청하는 경우)을 설정한 경우 서버에 처리 결과를 보관하는 시간입니다.



더 많은 정보는 GeoServer 매뉴얼 [WPS Service page[7]] 편에서 확인할 수 있습니다.

3.3. WPS Request Builder

WPS Request Builder 를 활용하는 예입니다. WPS Request Builder 를 통해 GeoServer 에서 제공하는 Process 들의 메타데이터(DescribeProcess)와 파라미터(Data Input, Process Output)를 설정하거나 직접 실행 또는 다양한 WPS 요청문을 작성해 볼 수 있도록 구성되어 있습니다. 우선 왼쪽의 메뉴 페이지에서 [데모] 페이지 링크를 클릭하여 다음과 같이 GeoServer 데모 페이지로 이동합니다.

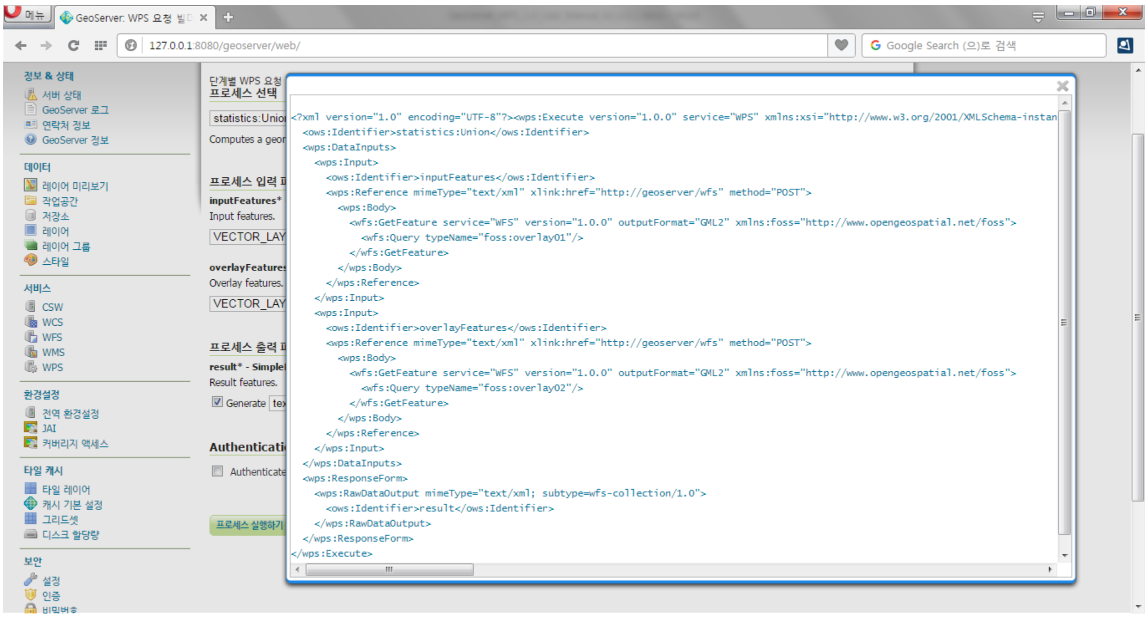
[WPS 요청 빌더] 페이지의 [프로세스 선택] 콤보박스에서 하나의 프로세스를 선택합니다.

다음과 같이 선택한 프로세스의 파라미터 정보를 확인할 수 있습니다.

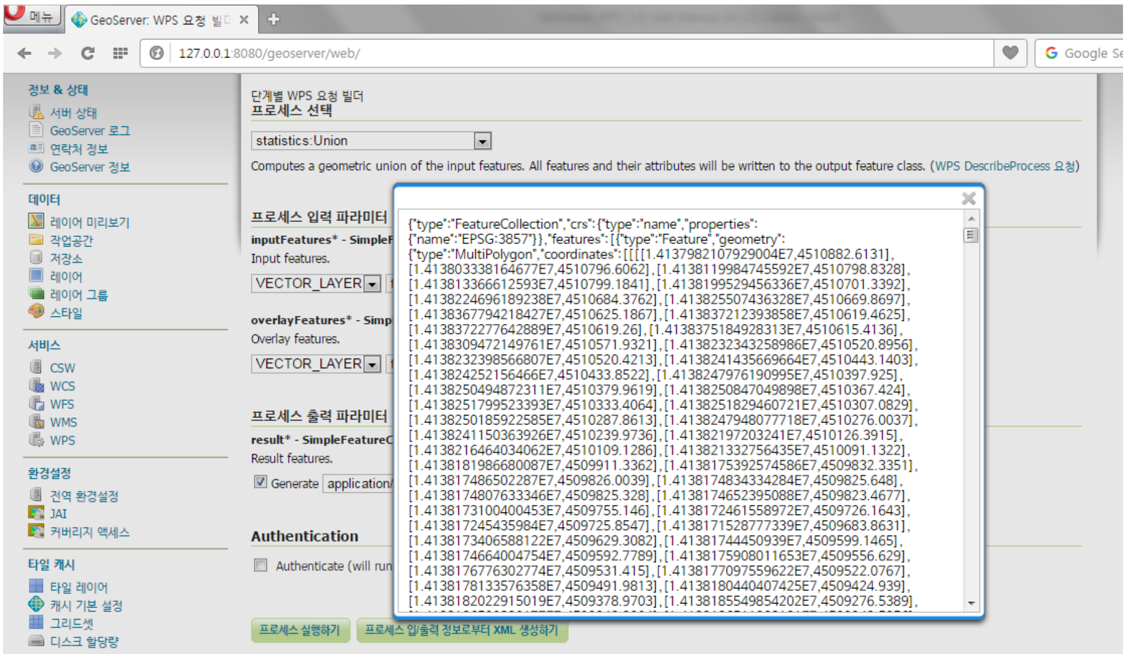
---

[7] http://docs.geoserver.org/stable/en/user/extensions/wps/administration.html

각각의 Input, Output 파라미터를 입력 후 **프로세스 입/출력 정보로부터 XML 생성하기** 버튼을 누르면 XML 로 구성된 WPS 요청문을 확인할 수 있습니다. 이렇게 생성된 요청문은 HTTP Post 방식으로 GeoServer 에서 실행하고 결과 데이터를 활용할 수 있습니다.



파라미터 설정 후 **프로세스 실행하기** 버튼을 누르면 다음과 같이 처리 결과를 확인할 수 있습니다. 다음 예는 2 개의 폴리곤 레이어의 Union Overaly 분석을 수행 후 GeoJSON 으로 출력한 예입니다.


메뉴
GeoServer: WPS 요청 빌더
127.0.0.1:8080/geoserver/web/
정보 & 상태
서버 상태
GeoServer 로그
연락처 정보
GeoServer 정보
데이터
레이어 미리보기
작업공간
저장소
레이어
레이어 그룹
스타일
서비스
CSW
WCS
WFS
WMS
WPS
환경설정
전역 환경설정
JAI
커버리지 액세스
타일 캐시
타일 레이어
캐시 기본 설정
그리드셋
디스크 할당량
단계별 WPS 요청 빌더
프로세스 선택
statistics:Union
Computes a geometric union of the input features. All features and their attributes will be written to the output feature class. (WPS DescribeProcess 요청)
프로세스 입력 파라미터
Input features.
VECTOR_LAYER
Overlay features.
VECTOR_LAYER
프로세스 출력 파라미터
Result features.
Generate
Authentication
{"type":"FeatureCollection","crs":{"type":"name","properties":
{"name":"EPSG:3857"}},"features":[{"type":"Feature","geometry":
{"type":"MultiPolygon","coordinates":[[[[1.4137982107929004E7,4510882.6131],
[1.413803338164677E7,4510796.6062],[1.4138119984745592E7,4510798.8328],
[1.413813366612593E7,4510799.1841],[1.4138199529456336E7,4510701.3392],
[1.4138224696189238E7,4510684.3762],[1.413825507436328E7,4510669.8697],
[1.4138367794218427E7,4510625.1867],[1.413837212393858E7,4510619.4625],
[1.413837227764289E7,4510619.26],[1.4138375184928313E7,4510615.4136],
[1.413830947214976E7,4510571.9321],[1.4138232343258986E7,4510520.8956],
[1.413823239856807E7,4510520.4213],[1.4138241435669664E7,4510443.1403],
[1.413824252156466E7,4510433.8522],[1.4138247976190995E7,4510397.925],
[1.413825049487231E7,4510379.9619],[1.4138250847049898E7,4510367.424],
[1.413825179952339E7,4510333.4064],[1.4138251829460721E7,4510307.0829],
[1.4138250185922585E7,4510287.8613],[1.4138247948077718E7,4510276.0037],
[1.4138241150363926E7,4510239.9736],[1.41382197203241E7,4510126.3915],
[1.413821646403406E7,4510109.1286],[1.413821332756435E7,4510091.1322],
[1.4138181986680087E7,4509911.3362],[1.4138175392574586E7,4509832.3351],
[1.413817486502287E7,4509826.0039],[1.413817483433428E7,4509825.648],
[1.4138174807633346E7,4509825.328],[1.4138174652395088E7,4509823.4677],
[1.413817310040045E7,4509755.146],[1.4138172461558972E7,4509726.1643],
[1.413817245435984E7,4509725.8547],[1.413817152877733E7,4509683.8631],
[1.413817340658812E7,4509629.3082],[1.413817444509393E7,4509599.1465],
[1.413817466400475E7,4509592.7789],[1.4138175908011653E7,4509556.629],
[1.413817677630277E7,4509531.415],[1.4138177097559622E7,4509522.0767],
[1.4138178133576358E7,4509491.9813],[1.4138180440407425E7,4509424.939],
[1.4138182022915019E7,4509378.9703],[1.4138185549854202E7,4509276.5389],
프로세스 실행하기
프로세스 입/출력 정보로부터 XML 생성하기

3.4. Performance Tips

WPS 는 WFS, WCS 서비스를 이용하여 원격의 벡터 또는 래스터 데이터를 Input 파라미터로 활용할 수 있습니다. 다음은 WPS 프로세스를 사용할 때 성능 향상을 위한 몇 가지 Tip 입니다.

3.4.1. WFS

Web Feature Service 는 DBMS 의 SQL 쿼리문을 OGC Filter Encoding 표준을 사용하여 지원합니다.

■ **벡터 데이터의 모든 피처 사용**

다음 예는 WPS 의 Input 파라미터가 벡터 데이터인 경우 WFS 를 이용하여 쿼리하는 과정이며, 전체 데이터를 쿼리하는 예입니다.

```
SELECT * FROM sgg
```

```
<wps:Input>
  <ows:Identifier>overlayFeatures</ows:Identifier>
  <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
    <wps:Body>
      <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
        <wfs:Query typeName="foss:sgg"/>
      </wfs:GetFeature>
    </wps:Body>
  </wps:Reference>
</wps:Input>
```

■ **벡터 데이터의 특정 필드와 필터 사용**

다음 예는 WPS 의 Input 파라미터가 벡터 데이터인 경우 WFS 를 이용하여 쿼리하는 과정이며, 특정 필드(gid, geom, pop_den 필드)와 공간 필터(BBOX Filter)를 이용하여 쿼리하는 예입니다. 즉, WPS 의 Input 파라미터에 사용될 데이터를 요청문 내에서 원하는 분석지역에 대한 데이터만을 필터링하여 처리속도를 높일 수 있습니다.

```
SELECT gid, geom, pop_den
FROM sgg
WHERE geom && ST_MakeEnvelope(14147434, 4509613, 14148345, 4524017, 3857)
```

```
<wps:Input>
  <ows:Identifier>inputFeatures</ows:Identifier>
  <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
    <wps:Body>
      <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
        <wfs:Query typeName="foss:sgg">
          <wfs:PropertyName>gid</wfs:PropertyName>
          <wfs:PropertyName>geom</wfs:PropertyName>
          <wfs:PropertyName>pop_den</wfs:PropertyName>
          <ogc:Filter>
            <ogc:BBOX>
              <ogc:PropertyName>geom</ogc:PropertyName>
                <gml:Envelope srsName="http://www.opengis.net/gml/srs/epsg.xml#3857">
                  <gml:lowerCorner>14147434 4509613</gml:lowerCorner>
                  <gml:upperCorner>14148345 4524017</gml:upperCorner>
                </gml:Envelope>
            </ogc:BBOX>
          </ogc:Filter>
        </wfs:Query>
      </wfs:GetFeature>
    </wps:Body>
  </wps:Reference>
</wps:Input>
```

3.4.2. WCS

Web Coverage Service 는 래스터 요청시 Subset, Resample, Reproject 기능을 제공합니다.

■ **래스터 특정 범위만 Subset**

다음은 WPS 의 Input 파라미터가 래스터 데이터인 경우 특정 영역만을 Subset (BoundingBox)하여 사용하는 예입니다.

```
<wps:Input>
  <ows:Identifier>data</ows:Identifier>
  <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
    <wps:Body>
      <wcs:GetCoverage service="WCS" version="1.1.1">
        <ows:Identifier>foss:dem30</ows:Identifier>
        <wcs:DomainSubset>
```

```
            <gml:BoundingBox crs="urn:ogc:def:crs:EPSG::5181">
              <ows:LowerCorner>179171.39881047895 436569.3290600816</ows:LowerCorner>
              <ows:UpperCorner>216221.0981287582 466869.08315843146</ows:UpperCorner>
            </gml:BoundingBox>
          </wcs:DomainSubset>
          <wcs:Output store="false" format="image/tiff"/>
        </wcs:GetCoverage>
      </wps:Body>
    </wps:Reference>
</wps:Input>
```

■ **래스터의 특정범위, 리샘플, 좌표변환 사용**

다음은 WPS 의 Input 파라미터가 래스터 데이터인 경우 특정 영역만을 Subset (BoundingBox)하거나, Resample (GridOffsets) 및 Reproject (GridBaseCRS)를 수행하는 예입니다. 즉, 원본 데이터의 좌표체계나 셀 크기가 다르더라도 WPS Process 의 파라미터에 맞도록 변환이 가능합니다.

```
<wps:Input>
  <ows:Identifier>data</ows:Identifier>
  <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
    <wps:Body>
      <wcs:GetCoverage service="WCS" version="1.1.1">
        <ows:Identifier>foss:dem30</ows:Identifier>
        <wcs:DomainSubset>
          <gml:BoundingBox crs="urn:ogc:def:crs:EPSG::5181">
            <ows:LowerCorner>179171.39881047895 436569.3290600816</ows:LowerCorner>
            <ows:UpperCorner>216221.0981287582 466869.08315843146</ows:UpperCorner>
          </gml:BoundingBox>
        </wcs:DomainSubset>
        <wcs:Output store="false" format="image/tiff">
          <wcs:GridCRS>
            <wcs:GridBaseCRS>urn:ogc:def:crs:EPSG::3857</wcs:GridBaseCRS>
            <wcs:GridType>urn:ogc:def:method:WCS:1.1:2dSimpleGrid</wcs:GridType>
            <wcs:GridOffsets>50.0 -50.0</wcs:GridOffsets>
            <wcs:GridCS>urn:ogc:def:cs:OGC:0.0:Grid2dSquareCS</wcs:GridCS>
          </wcs:GridCRS>
        </Output>
      </wcs:GetCoverage>
    </wps:Body>
  </wps:Reference>
```

```
</wps:Input>
```

4 WPS Process Reference

4.1. Process

2016 년 12 월 현재 WPS 로 제공하는 프로세스 목록은 다음과 같습니다.

대분류	중분류	소분류	Process
Vector Analysis	Spatial Unit Creation		Fishnet Grids by Count
			Fishnet Grids by Size
			Hexagonal Grids
			Triangular Grids
			Circular Grids
			Thiessen Polygon
			Delaunay Triangulation polygon
			Random Points
			Random Points per Features
	Calculation		Calculate XY Coordinate
			Calculate Area
			Calculate Length
			Calculate Field
			Calculate Count
			Sum Polygon Areas
			Extract Values to Points
	Extract		Select Features
			Clip with Geometry
			Clip with Features
	Overlay		Union
			Intersect
			Symmetrical Difference
			Difference
			Identity
			Update
	Proximity		Buffer Features using Expression
			Multiple Ring Buffer
			Near
			Polar Grids from Geometry
			Polar Grids from Features
	Aggregation		Point Statistics

		Aggregate Polygons
		Collect Events
		Spatial Join
		Attribute Join
		Buffer Point Statistics
		Sum Line Lengths
		Hexagonal Binning
		Rectangular Binning
		Circular Binning
		Spatial Clump Map
	Generalization	Dissolve
		Remove Polygon Holes
		Remove Polygon Part
		Simplify
		Densify
	Feature Tools	Feature to Point
		Singlepart to Multipart
		Multipart to Singlepart
		Feature Envelope to Polygon
		Points to Line
		Ring Maps
		Wind Rose Maps
		Hub Lines by ID
		Hub Lines by Nearest Distance
		Feature Vertices To Points
		Reverse Line Direction
		Create Points along Line
		Split Line At Vertices
		Split Line By Distance Expression
		Create Flow Map from Line Features
Raster Analysis	Descriptive	Basic Statistics
		Histogram
	Conversion	Raster To Polygon
	Classification	Reclass
	Extract	Extract by Geometry
		Extract by Extent
		Extract by Circle

		Raster Conditional Expression
	Density	Kernel Density Estimation
	Interpolation	Inverse Distance Weighted
		Thin Plate Spline
	Surface Analysis	Raster Profile
		Radial Line Of Sight
		Linear Line Of Sight
		Find Highest/Lowest Points
Spatial Statistics	Descriptive	Basic Statistics
		Pearson Correlation Coefficient
		Standardized Score of Dissimilarity
		Focal Location Quotients
	Distributions	Mean Center
		Median Center
		Central Feature
		Standard Distance
		Standard Deviational Mean
		Linear Directional Mean
	Point Pattern Analysis	Nearest Neighbor Statistic
		K-Nearest Neighbor Map
		Quadrat Method
		K-Means Clustering
	Global Spatial Auto-Correlation	Join Count Statistic
		Moran's I
		Geary's c
		Getis-Ord's General G
		Lee's S
		Lee's L
	Local Spatial Auto-Correlation	Local Moran's I
		Local Geary's c
		Local G(Gi*)
		Lee's Si
		Lee's Li

참고: 계속 업데이트 됩니다.

4.2. Vector Analysis

벡터 분석 및 처리와 관련된 프로세스 그룹입니다.

4.2.1. Spatial Unit Creation

격자, 헥사곤, 삼각형, 원, 티센 다각형 등 다양한 공간분석 단위를 생성하는 프로세스들로 구성됩니다.

4.2.1.1. Fishnet Grids by Count

Extent 와 Column, Row 개수를 정의하여 Fishnet 격자를 생성합니다.

■ **Syntax**

FishnetCount (ReferencedEnvelope extent, SimpleFeatureCollection boundsSource, Boolean boundaryInside, Integer columns, Integer rows): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
extent	The extent of the grids.	Complex	✓
boundsSource	Bounds Source Features.	Complex	-
boundaryInside	Bounds Inside.	Literal	-
columns	Number of columns.	Literal	✓
rows	Number of Rows.	Literal	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- boundsSource 파라미터를 설정한 경우 boundsSource 와 Intersect 되는 격자만 생성한다.

- boundsSource 파라미터를 설정하고 boundaryInside 파라미터가 True 인 경우 boundsSource 내부에 포함되는 격자만 생성한다.

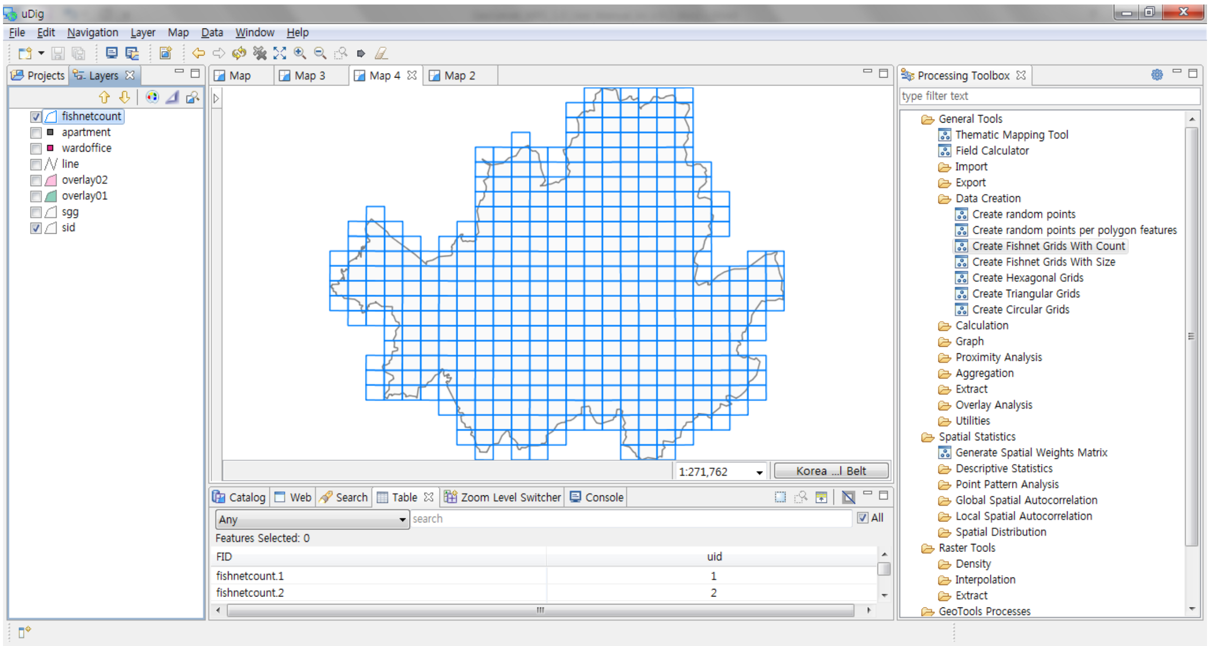
■ Request Examples

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:FishnetCount</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>extent</ows:Identifier>
      <wps:Data>
        <wps:BoundingBoxData crs="EPSG:3857" dimensions="2">
          <ows:LowerCorner>1.4111357E7 4498975.0</ows:LowerCorner>
          <ows:UpperCorner>1.4158036E7 4537337.0</ows:UpperCorner>
        </wps:BoundingBoxData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>boundsSource</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:sid"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>columns</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>25</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>rows</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>25</wps:LiteralData>
      </wps:Data>
    </wps:Input>
```

```
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

시도경계를 기준으로 가로/세로 25 개의 Fishnet 격자를 생성한 예입니다.



4.2.1.2. Fishnet Grids by Size

Extent 와 가로, 세로 크기를 정의하여 Fishnet 격자를 생성합니다.

■ **Syntax**

FishnetSize (ReferencedEnvelope extent, SimpleFeatureCollection boundsSource, Boolean boundaryInside, Double width, Double height): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
extent	The extent of the grids.	Complex	✓
boundsSource	Bounds Source Features.	Complex	-
boundaryInside	Bounds Inside.	Literal	-
width	Width of Each Cell.	Literal	✓
height	Height of Each Cell.	Literal	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- boundsSource 파라미터를 설정한 경우 boundsSource 와 Intersect 되는 격자만 생성한다.
- boundsSource 파라미터를 설정하고 boundaryInside 파라미터가 True 인 경우 boundsSource 내부에 포함되는 격자만 생성한다.

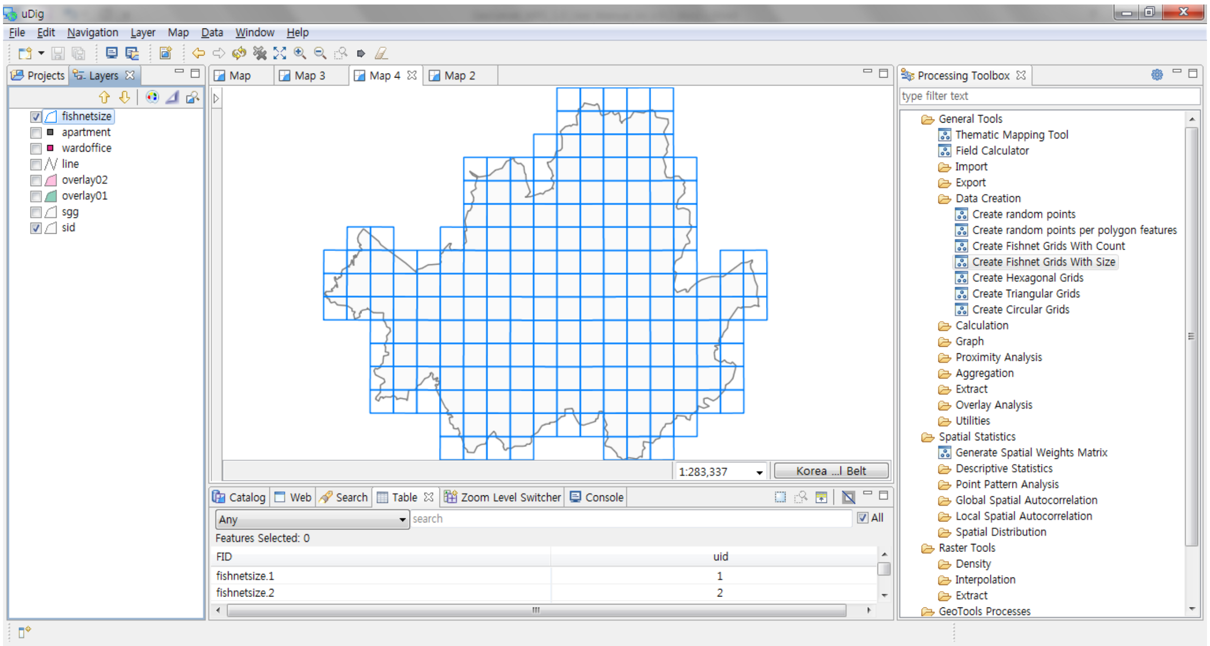
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
```

```
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:FishnetSize</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>extent</ows:Identifier>
      <wps:Data>
        <wps:BoundingBoxData crs="EPSG:3857" dimensions="2">
          <ows:LowerCorner>1.4111357E7 4498975.0</ows:LowerCorner>
          <ows:UpperCorner>1.4158036E7 4537337.0</ows:UpperCorner>
        </wps:BoundingBoxData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>boundsSource</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:sid"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>width</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>2500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>height</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>2500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

시도경계를 기준으로 가로, 세로 2,500 미터 간격의 Fishnet 격자를 생성한 예입니다.



4.2.1.3. Hexagonal Grids

Extent 와 크기를 설정하여 Hexagonal 격자를 생성합니다.

■ **Syntax**

Hexagon (ReferencedEnvelope extent, SimpleFeatureCollection boundsSource, Double sideLen, HexagonOrientation orientation): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
extent	The extent of the grids.	Complex	✓
boundsSource	Bounds Source Features.	Complex	-
sideLen	Side length, radius.	Literal	✓
orientation	Hexagon Orientation: FLAT (default), ANGLED.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- boundsSource 파라미터를 설정한 경우 boundsSource 와 Intersect 되는 헥사곤만 생성한다.
- sideLen 파라미터는 헥사곤 중심에서 모서리와의 거리를 말한다.

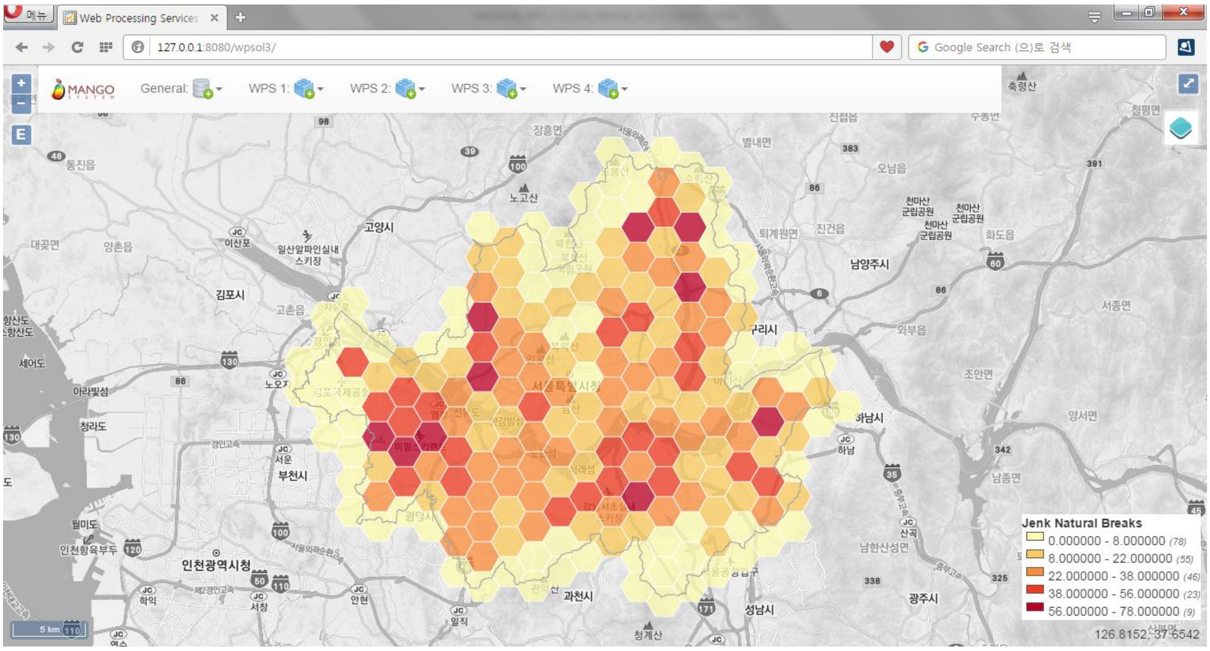
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:Hexagon</ows:Identifier>
```

```
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>extent</ows:Identifier>
      <wps:Data>
        <wps:BoundingBoxData crs="EPSG:3857" dimensions="2">
          <ows:LowerCorner>1.4111357E7 4498975.0</ows:LowerCorner>
          <ows:UpperCorner>1.4158036E7 4537337.0</ows:UpperCorner>
        </wps:BoundingBoxData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>boundsSource</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:sid"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>sideLen</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>1500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

시도경계를 기준으로 1500 미터 크기의 Hexagonal Grid 를 생성 후 각 셀별로 아파트 수를 계산 후 주제도를 작성한 예입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
Google Search (으)로 검색
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
Jenk Natural Breaks
0.000000 - 8.000000 (78)
8.000000 - 22.000000 (55)
22.000000 - 38.000000 (46)
38.000000 - 56.000000 (23)
56.000000 - 78.000000 (9)
126.8152, 37.6542
5 km

4.2.1.4. Triangular Grids

Extent 와 크기를 설정하여 Triangular 격자를 생성합니다.

■ **Syntax**

TriangularGrid (ReferencedEnvelope extent, SimpleFeatureCollection boundsSource, Double size, HexagonOrientation orientation): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
extent	The extent of the grids.	Complex	✓
boundsSource	Bounds Source Features.	Complex	-
size	Grid Size.	Literal	✓
orientation	Orientation: FLAT (default), ANGLED.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- boundsSource 파라미터를 설정한 경우 boundsSource 와 Intersect 되는 삼각형만 생성한다.

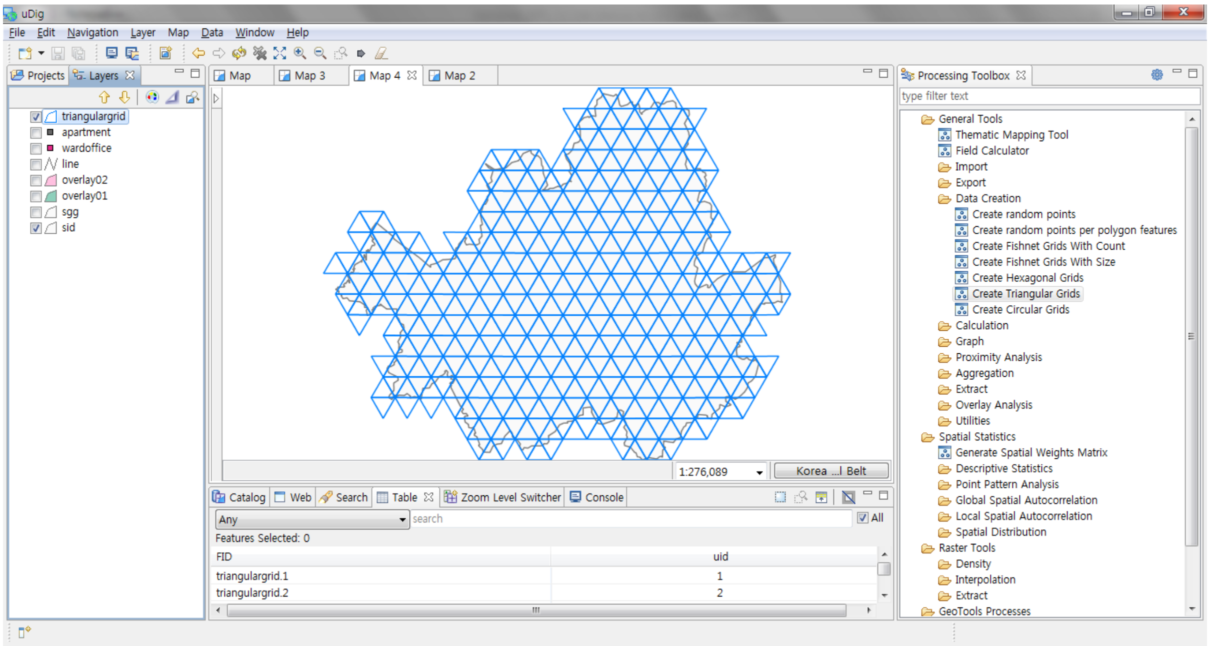
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:TriangularGrid</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
```

```
        <ows:Identifier>extent</ows:Identifier>
        <wps:Data>
          <wps:BoundingBoxData crs="EPSG:3857" dimensions="2">
            <ows:LowerCorner>1.4111357E7 4498975.0</ows:LowerCorner>
            <ows:UpperCorner>1.4158036E7 4537337.0</ows:UpperCorner>
          </wps:BoundingBoxData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>boundsSource</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:sid"/>
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>size</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>2500</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

시도경계를 기준으로 2500 미터 크기의 Triangular 격자를 생성한 예입니다.


uDig
File Edit Navigation Layer Map Data Window Help
Projects Layers
triangulargrid
apartment
wardoffice
line
overlay02
overlay01
sgg
sid
Map Map 3 Map 4 Map 2
1:276,089
Korea ...l Belt
Catalog Web Search Table Zoom Level Switcher Console
Any
search
All
Features Selected: 0
FID
uid
triangulargrid.1
1
triangulargrid.2
2
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Create random points
Create random points per polygon features
Create Fishnet Grids With Count
Create Fishnet Grids With Size
Create Hexagonal Grids
Create Triangular Grids
Create Circular Grids
Calculation
Graph
Proximity Analysis
Aggregation
Extract
Overlay Analysis
Utilities
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Interpolation
Extract
GeoTools Processes

4.2.1.5. Circular Grids

Extent 와 반경을 설정하여 Circular 격자를 생성합니다.

■ **Syntax**

CircularGrid (ReferencedEnvelope extent, SimpleFeatureCollection boundsSource, Double radius, CircularType circularType): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
extent	The extent of the grids.	Complex	✓
boundsSource	Bounds Source Features.	Complex	-
radius	Radius of the circle.	Literal	✓
circularType	Circular Type: Grid (default), Hex.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- boundsSource 를 설정한 경우 boundsSource 와 Intersect 되는 원을 생성한다.
- circularType 이 Grid 인 경우 격자형식의 원을, Hex 인 경우 헥사곤 생성 규칙을 따른다.

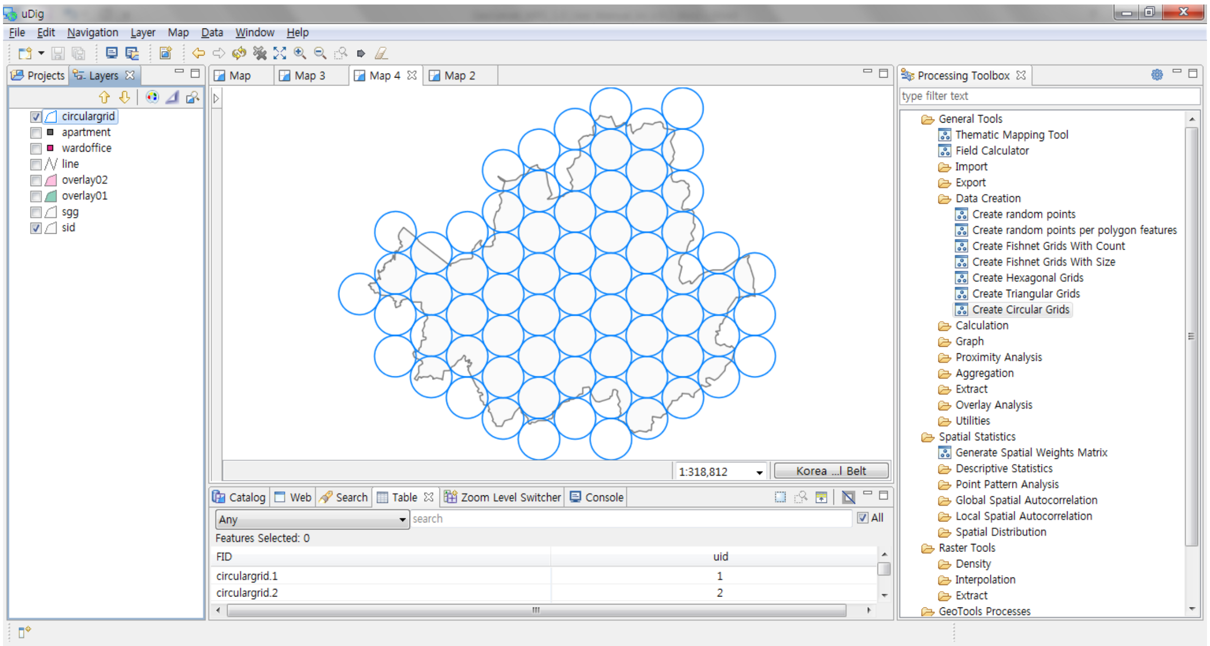
■ **Request Examples**

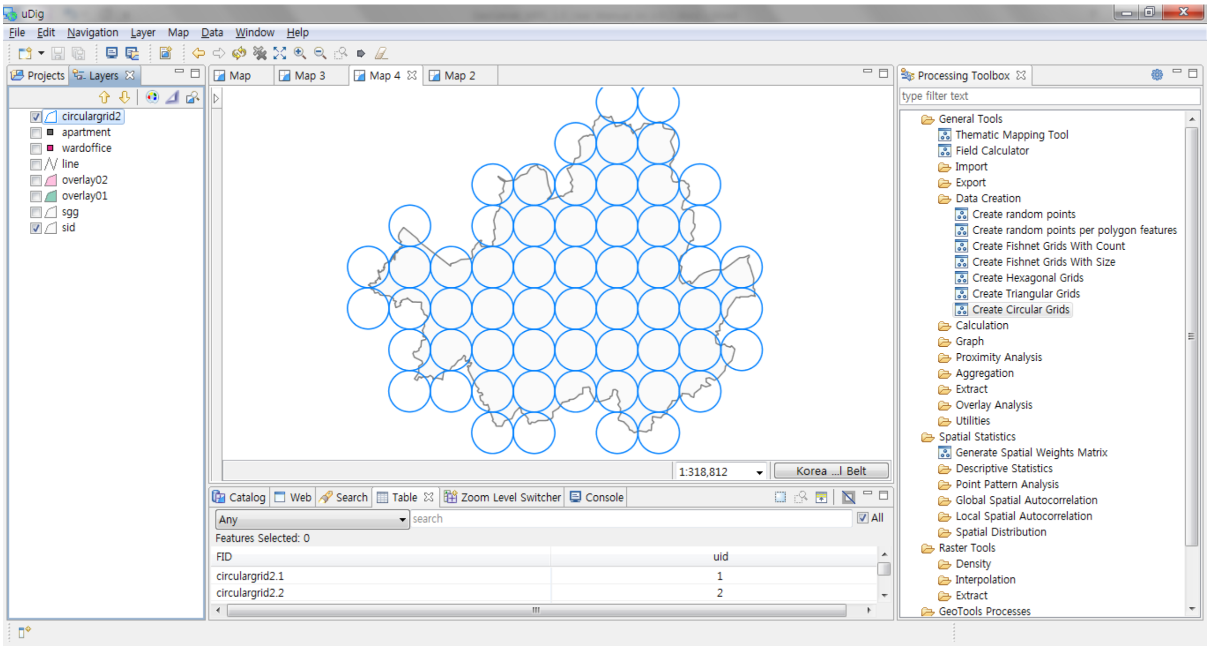
```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:CircularGrid</ows:Identifier>
```

```xml
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>extent</ows:Identifier>
      <wps:Data>
        <wps:BoundingBoxData crs="EPSG:3857" dimensions="2">
          <ows:LowerCorner>1.4111357E7 4498975.0</ows:LowerCorner>
          <ows:UpperCorner>1.4158036E7 4537337.0</ows:UpperCorner>
        </wps:BoundingBoxData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>boundsSource</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:sid"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>radius</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>2500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>circularType</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Hex</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

시동경계를 기준으로 반경 2500 미터의 Circular 격자를 Hexagon, Grid 옵션으로 생성한 예입니다.





4.2.1.6. Thiessen Polygon

입력 피처 레이어를 이용하여 Thiessen Polygon 을 생성합니다.

- **Syntax**

ThiessenPolygon (SimpleFeatureCollection inputFeatures, ThiessenAttributeMode attributes, Geometry clipArea): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The point input features from which thiessen polygons will be generated.	Complex	✓
attributes	Attribute mode: ONLY_FID (default), ALL (retain input feature's attribute).	Literal	-
clipArea	The clip area polygon geometry.	Complex	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

- inputFeatures 는 포인트, 라인, 폴리곤 모두 가능하지만, 무게중심점을 추출하여 Thiessen Polygon 을 생성한다.
- Attributes 파라미터가 ALL 인 경우 inputFeatures 의 모든 속성값을 유지한다.
- clipArea 파라미터가 주어지면 해당 영역으로 클립한 폴리곤을 반환한다.

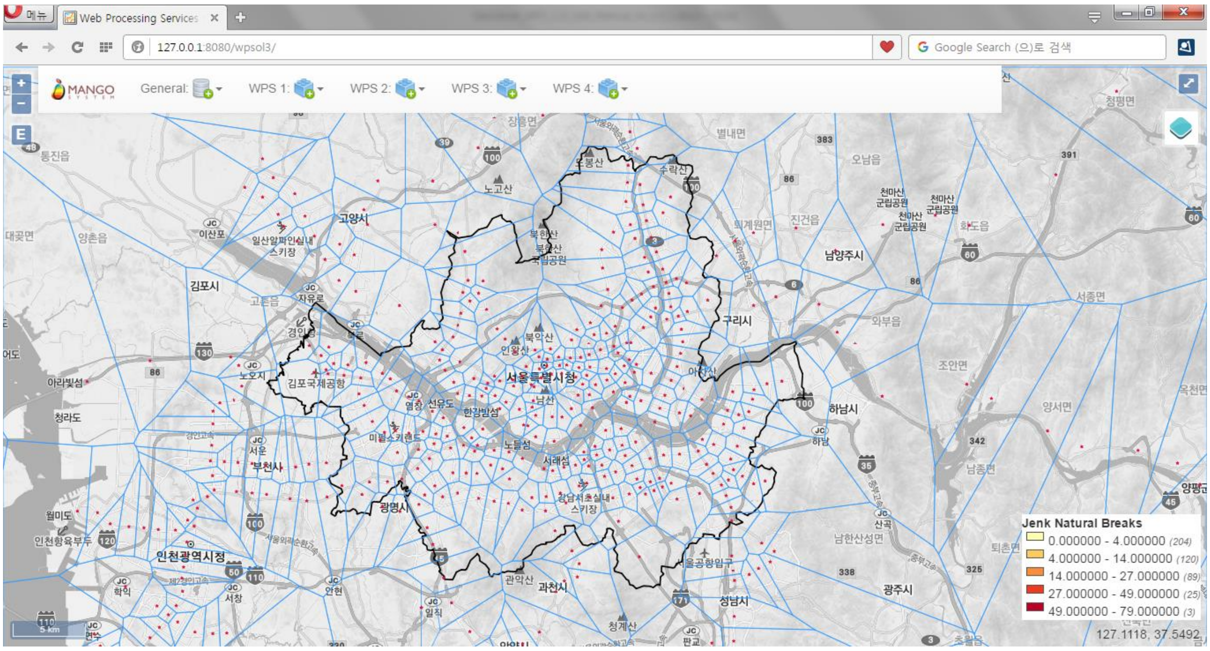
- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
```

```
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:ThiessenPolygon</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:stores"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>attributes</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>ALL</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

전국의 기차/전철역을 기준으로 현재화면 범위의 Thiessen Polygon 을 생성한 예입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
서울특별시청
Jenk Natural Breaks
0.000000 - 4.000000 (204)
4.000000 - 14.000000 (120)
14.000000 - 27.000000 (89)
27.000000 - 49.000000 (25)
49.000000 - 79.000000 (3)
127.1118, 37.5492

4.2.1.7. Delaunay Triangulation Polygons

입력 포인트 피처 레이어를 이용하여 Delaunay Triangulation Polygon 을 생성합니다.

- **Syntax**

DelaunayTriangulation (SimpleFeatureCollection inputFeatures, Geometry clipArea): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The point input features from which delaunay triangulations will be generated.	Complex	✓
clipArea	Clip area polygon.	Complex	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

- clipArea 파라미터가 주어지면 해당 영역으로 클립한 폴리곤을 반환한다.

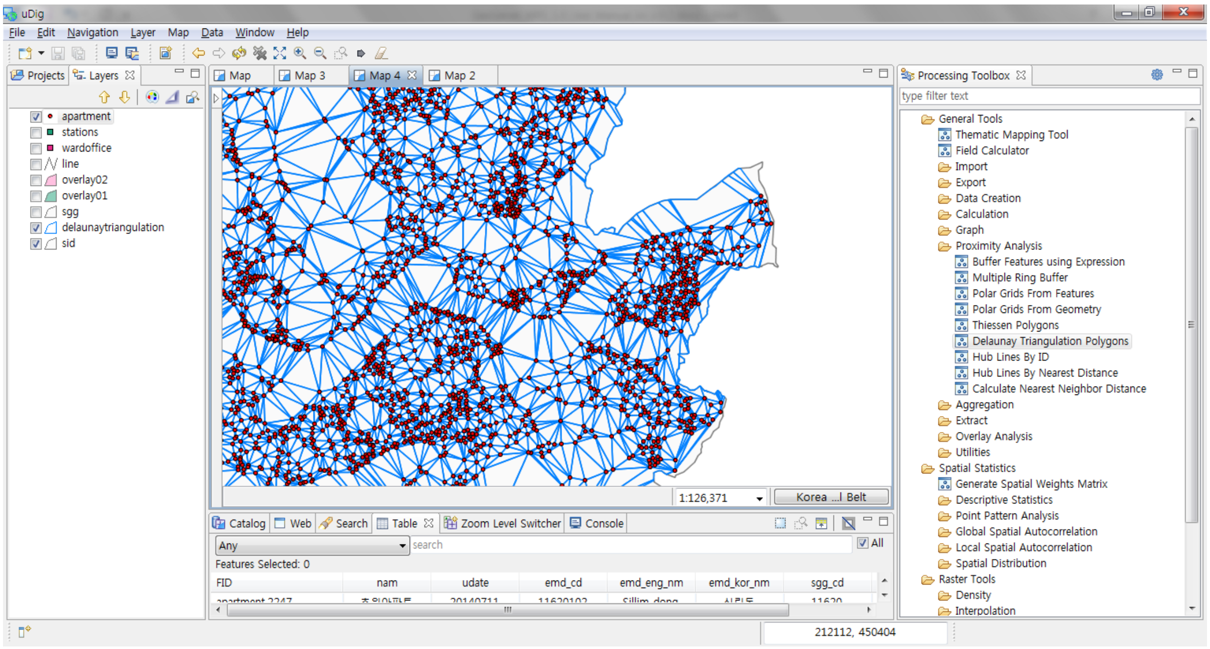
- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:DelaunayTriangulation</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
```

```
            <wps:Body>
               <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
                  <wfs:Query typeName="foss:apartment"/>
               </wfs:GetFeature>
            </wps:Body>
         </wps:Reference>
      </wps:Input>
   </wps:DataInputs>
   <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
         <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
   </wps:ResponseForm>
</wps:Execute>
```

■ Response

포인트를 이용하여 시도경계와 같은 특정 영역 내에만 Delaunay Triangulation Polygon 을 생성한 예입니다.



4.2.1.8. Random Points

Extent 또는 Polygon 피처의 Boundary 를 이용하여 설정한 수만큼의 Random Point 를 생성합니다.

■ **Syntax**

RandomPoints (ReferenceEnvelope extent, SimpleFeatureCollection polygonFeatures, Integer pointCount): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
extent	Random points will be generated inside the extent.	Complex	-
polygonFeatures	The features which contains the features into which the random points will be placed.	Complex	-
pointCount	The number of points to be randomly generated.	Literal	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- BoundingBox 또는 폴리곤 레이어를 기준 레이어로 사용할 수 있다.

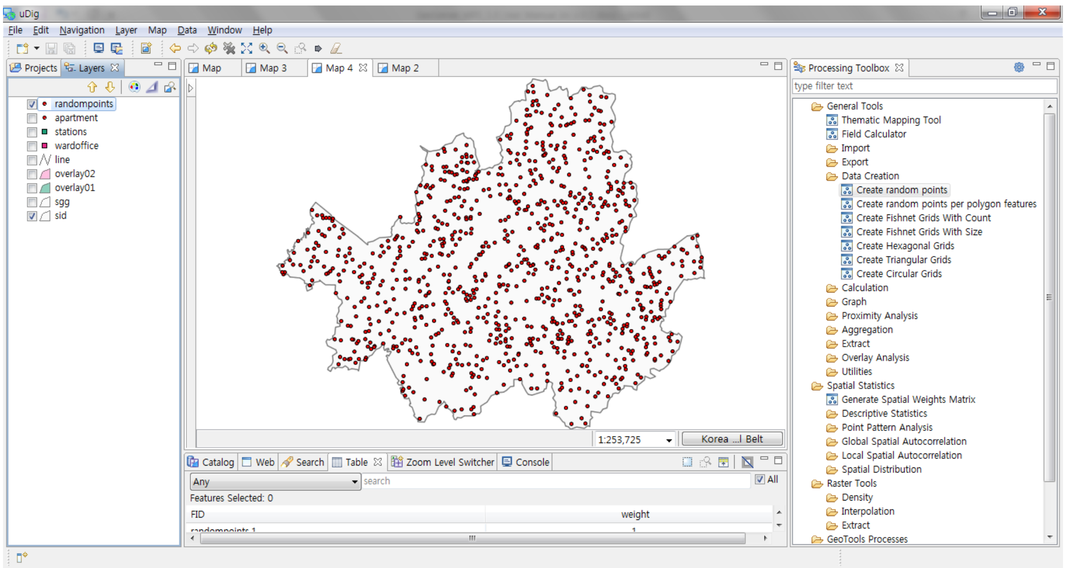
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RandomPoints</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
```

```
        <ows:Identifier>polygonFeatures</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:sid"/>
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>pointCount</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>1000</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

시도경계를 기준으로 1000 개의 Random Point 를 생성한 예입니다.



4.2.1.9. Random Points per Features

폴리곤 피처 레이어와 Expression 수식을 이용하여 각 피처마다 Random Point 를 생성합니다.

■ **Syntax**

RandomPointsPerFeatures (SimpleFeatureCollection polygonFeatures, Expression expression): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
polygonFeatures	The features which contains the features into which the random points will be placed.	Complex	✓
expression	Field or Expression representing Number of Points.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- Expression 파리미터를 숫자, 필드 또는 수식(여러 공간 및 속성 필드의 연산 조합)으로 입력이 가능하며, 수식을 이용하는 경우 폴리곤 레이어의 각 피처별로 랜덤 포인트의 개수 설정이 가능하다.

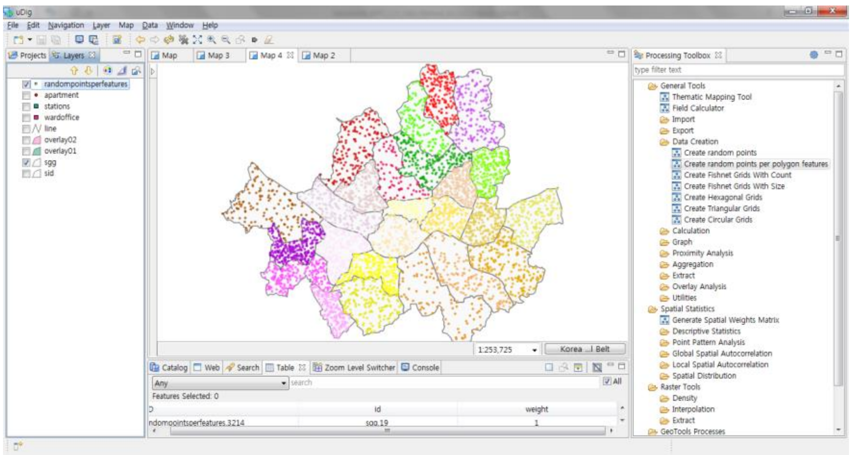
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RandomPointsPerFeatures</ows:Identifier>
```

```
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>polygonFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service=”WFS” version=”1.1.0” outputFormat=”GML3”
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>expression</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>[pop_den] / 100</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType=”text/xml; subtype=wfs-collection/1.1”>
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

시군별 인구밀도 속성정보를 이용한 Random Point 생성 예입니다.



4.2.2. Calculation

Geometry 또는 필드의 속성값을 이용하여 새로운 값을 계산하는 프로세스들로 구성됩니다.

4.2.2.1. Calculate XY Coordinate

X, Y 필드를 추가하여 각 피처별로 사용자가 설정한 좌표체계의 좌표값을 계산합니다.

■ **Syntax**

CalculateXYCoordinate (SimpleFeatureCollection inputFeatures, String xField, String yField, Boolean inside, CoordinateReferenceSystem targetCRS): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input features to be calculated.	Complex	✓
xField	X coordinate field that will be calculated.	Literal	-
yField	Y coordinate field that will be calculated.	Literal	-
inside	Centroid(False, Default), Inside(True)	Literal	-
targetCRS	The target coordinate reference system to use for reprojection. Ex)epsg:4326	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- inputFeatures 는 포인트, 라인, 폴리곤 모두 가능하다.
- inputFeatures 가 폴리곤이고 inside 가 Ture 이면 중심점은 반드시 폴리곤 내에 포함된다.
- targetCRS 가 Null 이면 원본 데이터의 좌표값을, 그렇지 않으면 좌표 변환한 값을 반환한다.

■ Request Examples

GeoServer 의 foss:stores 레이어를 WFS 로 불러온 후 xcoord, ycoord 필드에 EPSG:4326(WGS84 경위도) 좌표계의 좌표값을 계산하여 GML3 로 반환하는 결과입니다.

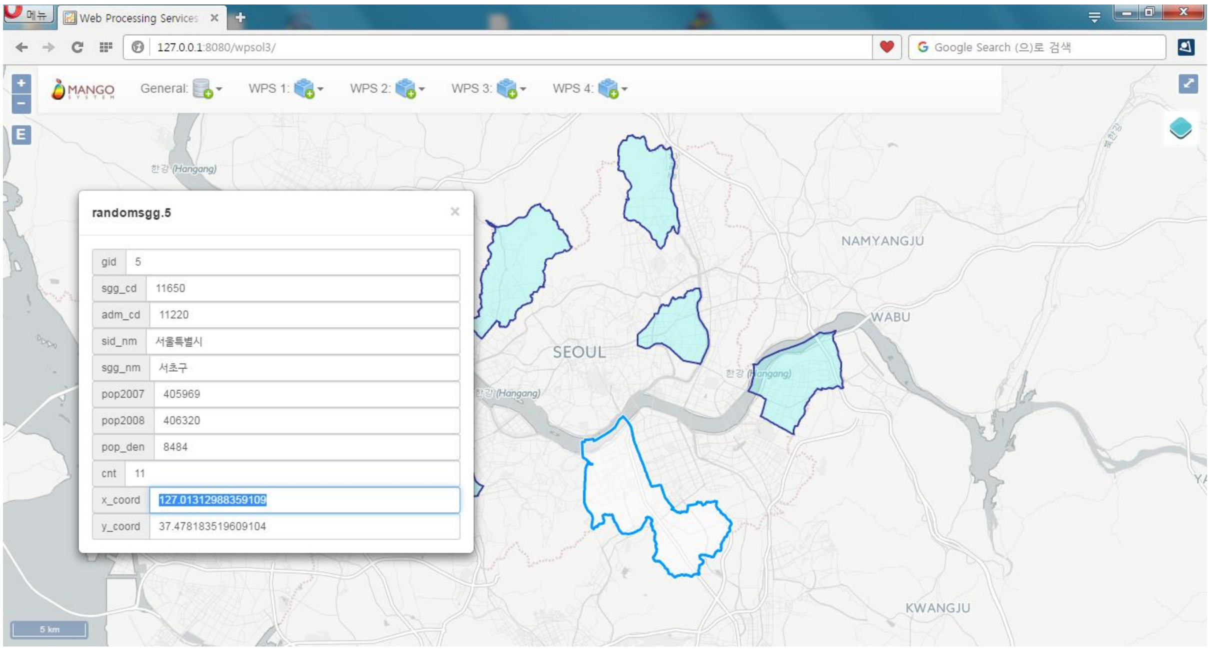
inside 값이 True 이므로 inputFeatures 가 Polygon 인 경우 중심점이 Polygon 내에 포함되도록 조정한 X, Y 값이 반환된다.

```xml
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:CalculateXYCoordinate</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:stores" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>xField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>xcoord</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>yField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>ycoord</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inside</ows:Identifier>
```

```
        <wps:Data>
          <wps:LiteralData>True</wps:LiteralData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>targetCRS</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>EPSG:4326</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

폴리곤 레이어의 중심값을 기준으로 xcoord, ycoord 좌표값을 EPSG:4326(WGS84 경위도) 좌표값으로 계산한 예입니다.



4.2.2.2. Calculate Area

폴리곤 피처 레이어의 면적 과 둘레를 계산합니다.

■ **Syntax**

CalculateArea (SimpleFeatureCollection inputFeatures, String areaField, String perimeterField): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input polygon features to be calculated.	Complex	✓
areaField	The area field that will be calculated. geom_area is a default.	Literal	-
perimeterField	The perimeter field that will be calculated.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- inputFeatures 는 반드시 폴리곤 이어야 한다.
- 면적, 둘레의 계산값은 inputFeatures 의 좌표계 단위를 따른다.

■ **Request Examples**

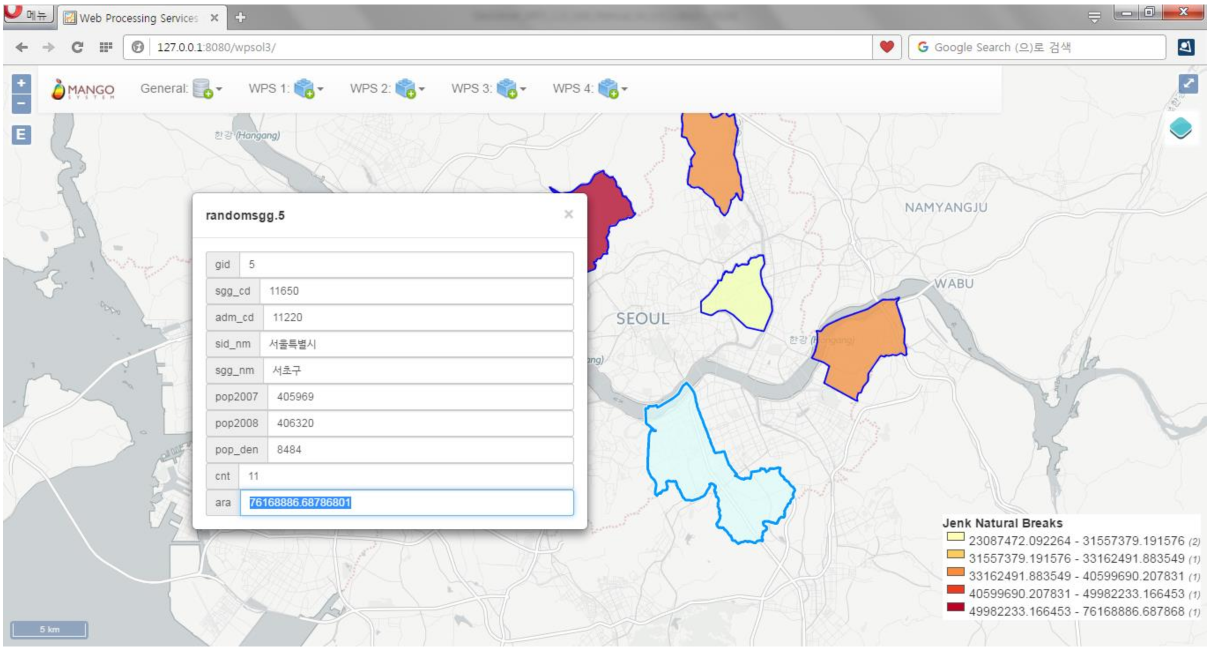
WFS 의 foss:randomsgg 레이어를 불러와 area, perimeter 값을 계산 후 GML 로 반환하는 결과입니다.

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
```

```
  <ows:Identifier>statistics:CalculateArea</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:randomsgg" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>areaField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>area</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>perimeterField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>perimeter</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

폴리곤의 면적값을 ara 필드에 계산한 결과입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
randomsgg.5
gid 5
sgg_cd 11650
adm_cd 11220
sid_nm 서울특별시
sgg_nm 서초구
pop2007 405969
pop2008 406320
pop_den 8484
cnt 11
ara 76168886.68786801
SEOUL
NAMYANGJU
WABU
한강 (Hangang)
Jenk Natural Breaks
23087472.092264 - 31557379.191576 (2)
31557379.191576 - 33162491.883549 (1)
33162491.883549 - 40599690.207831 (1)
40599690.207831 - 49982233.166453 (1)
49982233.166453 - 76168886.687868 (1)

4.2.2.3. Calculate Length

폴리곤 또는 라인 피처 레이어에 필드를 추가하여 길이(둘레)를 계산합니다.

- **Syntax**

CalculateLength (SimpleFeatureCollection inputFeatures, String lengthField):

SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input line or polygon features to be calculated.	Complex	✓
lengthField	The length field that will be calculated. geom_len is a default.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

- inputFeatures 파라미터는 폴리곤 또는 라인 피처 타입이어야 한다.
- 길이(둘레) 계산값은 inputFeatures 의 좌표계 단위를 따른다.

- **Request Examples**

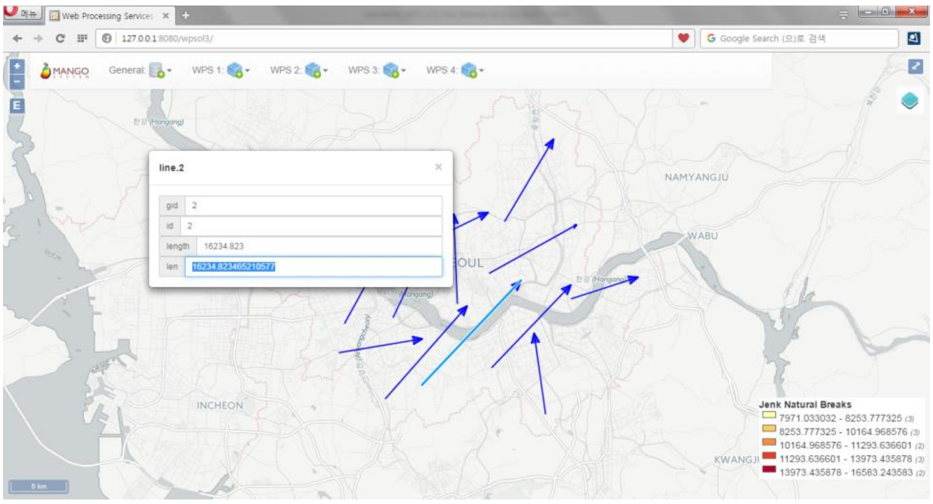
WFS 의 foss:line 레이어를 불러와 len(Geometry 의 길이)값을 계산 후 GML 로 반환하는 결과입니다.

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:CalculateLength</ows:Identifier>
```

```
    <wps:DataInputs>
      <wps:Input>
        <ows:Identifier>inputFeatures</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:line" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>lengthField</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>len</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
  </wps:Execute>
```

■ Response

라인의 길이를 len 필드에 계산한 결과입니다.



4.2.2.4. Calculate Field

사용자가 설정한 Expression 수식을 이용하여 새로운 필드값을 계산하거나 Geometry Type 을 변경합니다.

- **Syntax**

CalculateField (SimpleFeatureCollection inputFeatures, Expression expression, String fieldName): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The Input features to be calculated.	Complex	✓
expression	The simple calculation expression used to create a value that will populate the selected rows. ex) [population] / ([geom_area] / 1000000)	Literal	-
fieldName	The field that will be updated with the new calculation. Evaluated is a default.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

- Expression 에 의해 반환되는 값이 Geometry 인 경우 fieldName 은 무시되고 반환되는 데이터의 Geometry 값이 적용된다.

- **Request Examples**

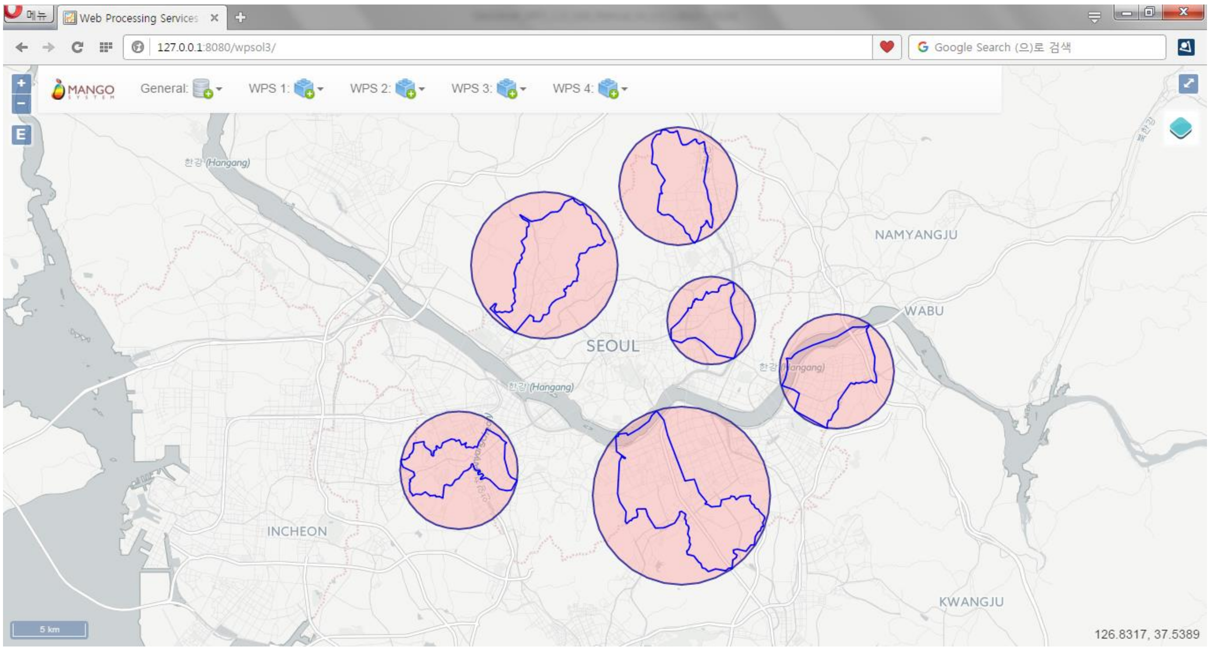
WFS 의 foss:randomsgg 레이어를 불러와 pop2008(인구수)와 도형의 면적(area([geom])을 이용하여 인구밀도를 계산하여 pop_den 필드에 값을 계산 후 GML 로 반환하는 결과입니다.

```xml
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
```

```xml
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:CalculateField</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:randomsgg" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>expression</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>round([pop2008] / (area( [geom] ) / 1000000))</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>fieldName</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>pop_den</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

다음은 mincircle([geom]) 을 처리한 예입니다. 이와 같이 필드의 연산을 이용한 속성값 계산뿐만 아니라 Geometry 변환까지 처리가 가능합니다.



■ Advanced Expression

Expression 파라미터의 다양한 활용 예제이며, [geom] 은 PostGIS, Shapefile 등의 Geometry 필드 이름입니다.

구분	Expression	반환값
일반 수식	round([pop2008] / (area([geom]) / 1000000))	Numeric
면적	area([geom])	Numeric
둘레/길이	geomLength([geom])	Numeric
중심점의 X 좌표	getX(centroid([geom]))	Numeric
폴리곤을 라인으로	boundary([geom])	Geometry
버퍼	bufferWithSegments([geom], 250, 16)	Polygon
무게중심점	centroid([geom])	Point
폴리곤에 포함되는 내부 점	interiorPoint([geom])	Point
폴리곤 또는 라인의 시작점	startPoint([geom])	Point
폴리곤 또는 라인의 끝점	endPoint([geom])	Point
폴리곤, 라인, 멀티포인트의 Convex Hull	convexHull([geom])	Polygon
폴리곤, 라인, 멀티포인트를 둘러싸는 최소 원	mincircle([geom])	Polygon
폴리곤, 라인, 멀티포인트를 포함하는 영역의 최소 반경 라인	minimumdiameter([geom])	Line
폴리곤, 라인, 멀티포인트를 포함하는 영역의 최소 반경 영역	minrectangle([geom])	Polygon

폴리곤, 라인, 멀티포인트를 포함하는 최소 8각형 영역	octagonalenvelope([geom])	Polygon
x offset, y offset 만큼 이동	offset([geom], 4000, 3000)	Geometry

4.2.2.5. Calculate Count

피처 레이어와 필터를 이용하여 피처 수를 계산합니다.

■ **Syntax**

CountFeatures (SimpleFeatureCollection inputFeatures, Filter filter): Integer

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features to be calculated.	Complex	✓
filter	The filter to apply	Complex	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	The number of features.	Literal	✓

■ **Constraints**

- 레이어와 필터를 이용하여 피처의 수를 계산하여 반환한다.

■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:CountFeatures</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
```

```
                <wfs:Query typeName="foss:emd" />
              </wfs:GetFeature>
            </wps:Body>
          </wps:Reference>
        </wps:Input>
        <wps:Input>
          <ows:Identifier>filter</ows:Identifier>
          <wps:Data>
            <wps:ComplexData mimeType="text/plain; subtype=cql"><![CDATA[sgg_nm =
'강남구']]></wps:ComplexData>
          </wps:Data>
        </wps:Input>
      </wps:DataInputs>
      <wps:ResponseForm>
        <wps:RawDataOutput>
          <ows:Identifier>result</ows:Identifier>
        </wps:RawDataOutput>
      </wps:ResponseForm>
    </wps:Execute>
```

■ **Response**

피처의 개수를 Integer 값으로 반환합니다.

4.2.2.6. Sum Polygon Areas

폴리곤 피처 레이어와 필터를 이용하여 모든 폴리곤 피처의 면적 합을 계산합니다.

■ **Syntax**

SumAreas (SimpleFeatureCollection inputFeatures, Filter filter): Double

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Polygon features.	Complex	✓
filter	The filter to apply	Complex	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	The area of features.	Literal	✓

■ **Constraints**

- 폴리곤 레이어와 필터를 이용하여 피처의 Geometry 면적 합을 반환한다.

■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:SumAreas</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service=”WFS” version=”1.1.0” outputFormat=”GML3”
xmlns:foss="http://www.opengeospatial.net/foss">
```

```
              <wfs:Query typeName="foss:emd" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>filter</ows:Identifier>
        <wps:Data>
          <wps:ComplexData mimeType="text/plain; subtype=cql"><![CDATA[sgg_nm =
'강남구']]></wps:ComplexData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput>
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

폴리곤 피처의 면적을 Double 값으로 반환합니다.

4.2.2.7. Extract Values to Points

포인트 피처와 래스터 레이어를 중첩하여 포인트의 속성필드에 래스터의 셀값을 계산합니다.

■ **Syntax**

ExtractValuesToPoints (SimpleFeatureCollection pointFeatures, String valueField, GridCoverage2D valueCoverage, ExtractionType valueType): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
pointFeatures	The input point features defining the locations.	Complex	✓
valueField	The value field to be calculated.	Literal	-
valueCoverage	The gridcoverage whose values will be extracted.	Complex	✓
valueType	Extraction type: Default, SlopeAsDegree, SlopeAsPercentrise, Aspect.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- valueField 가 Null 인 경우 evaluated 필드 이름을 사용한다.
- valueType 파라미터가 Null 인 경우 GridCoverage 의 원본 셀 값을 반환한다.
- valueCoverage 가 DEM 인 경우 valueType 은 SlopeAsDegree, SlopeAsPercentrise, Aspect 옵션을 사용할 수 있다.

■ **Request Examples**

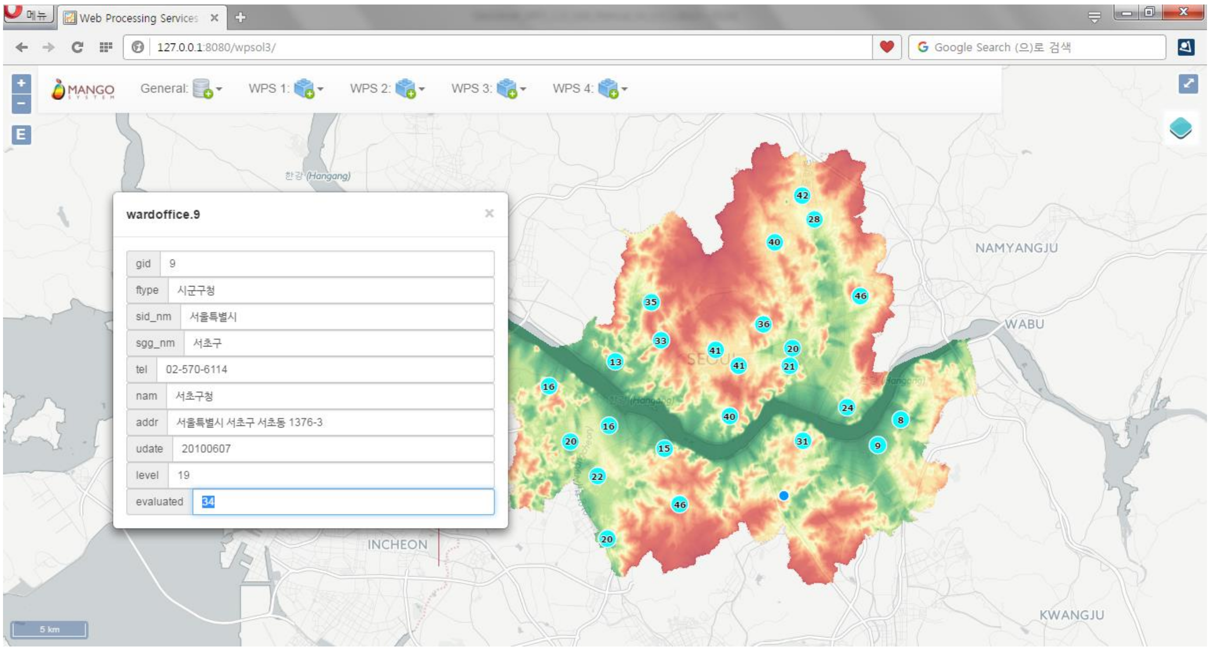
```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
```

```
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:ExtractValuesToPoints</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>pointFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:wardoffice" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>valueField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>evaluated</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>valueCoverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
          <wcs:GetCoverage service="WCS" version="1.1.1">
            <ows:Identifier>foss:seoul_dem30</ows:Identifier>
            <wcs:DomainSubset>
              <gml:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#5181">
                <ows:LowerCorner>179171.39881047895 436569.3290600816</ows:LowerCorner>
                <ows:UpperCorner>216221.0981287582 466869.08315843146</ows:UpperCorner>
              </gml:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff" />
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
```

```
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
   </wps:ResponseForm>
</wps:Execute>
```

■ Response

시군구청 포인트 데이터에 DEM 의 표고값을 계산한 결과입니다.



4.2.3. Extract

필터나 지오메트리를 이용하여 피처를 선택하거나 잘라내는 프로세스들로 구성됩니다.

4.2.3.1. Select Features (Query & Retype)

피처 레이어에서 공간 또는 속성필터와 필드 목록을 설정하여 피처를 선택합니다.

■ **Syntax**

SelectFeatures (SimpleFeatureCollection inputFeatures, Filter filter, String attributes): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features to be queried.	Complex	✓
filter	The filter to apply.	Complex	-
attributes	The comma separated fields list to include in output.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- 필터를 사용하여 특정 조건에 맞는 피처만 선택할 수 있다.
- 콤마로 분리된 필드를 설정하여 일부 속성정보만 선택하거나 필드 순서를 변경할 수 있다.

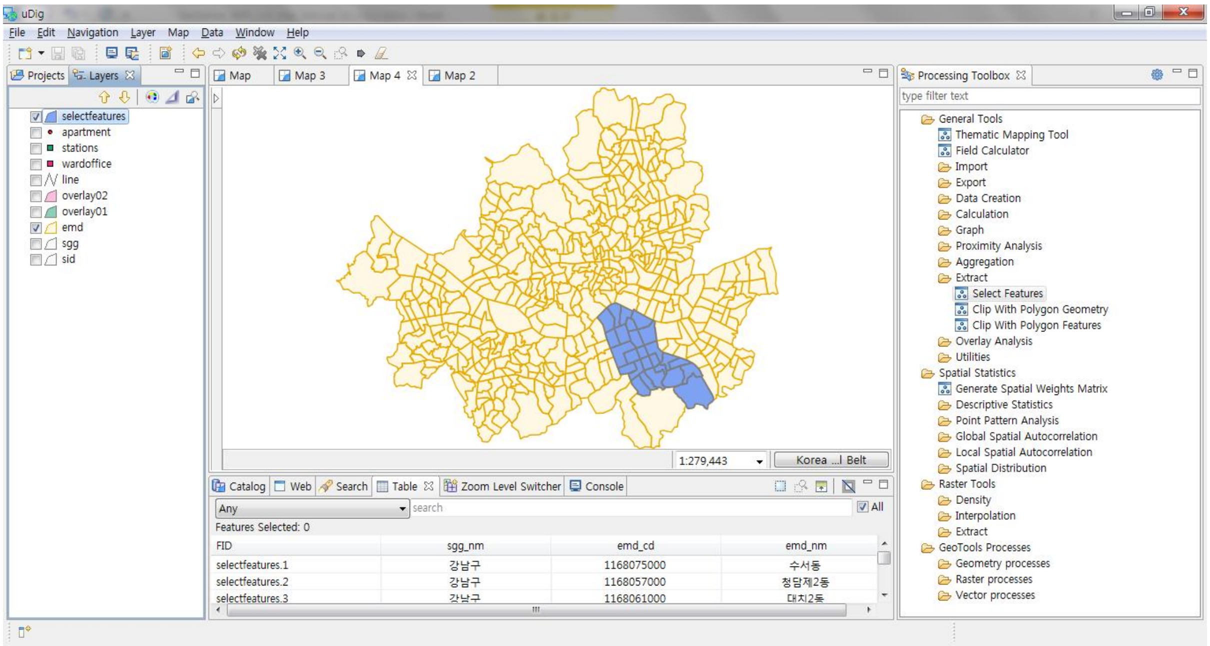
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
```

```
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:SelectFeatures</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:emd" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>filter</ows:Identifier>
      <wps:Data>
        <wps:ComplexData mimeType="text/plain; subtype=cql"><![CDATA[sgg_nm =
'강남구']]></wps:ComplexData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>attributes</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>gid, geom, sgg_nm, emd_cd, emd_nm</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

읍면동경계 데이터에서 강남구만 선택하고 geom, sgg_nm, emd_cd, emd_nm 필드만 추출한 결과입니다.


uDig
File Edit Navigation Layer Map Data Window Help
Projects Layers
selectfeatures
apartment
stations
wardoffice
line
overlay02
overlay01
emd
sgg
sid
Map Map 3 Map 4 Map 2
1:279,443
Korea ...l Belt
Catalog Web Search Table Zoom Level Switcher Console
Any
search
All
Features Selected: 0
FID sgg_nm emd_cd emd_nm
selectfeatures.1 강남구 1168075000 수서동
selectfeatures.2 강남구 1168057000 청담제2동
selectfeatures.3 강남구 1168061000 대치2동
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Calculation
Graph
Proximity Analysis
Aggregation
Extract
Select Features
Clip With Polygon Geometry
Clip With Polygon Features
Overlay Analysis
Utilities
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Interpolation
Extract
GeoTools Processes
Geometry processes
Raster processes
Vector processes

4.2.3.2. Clip with Geometry

Clip 할 폴리곤 Geometry 를 설정하여 피처 레이어를 잘라냅니다.

■ **Syntax**

ClipWithGeometry (SimpleFeatureCollection inputFeatures, Geometry clipGeometry): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features to be clipped.	Complex	✓
clipGeometry	The polygon geometry used to clip the input features.	Complex	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- clipGeometry 는 반드시 Polygon 또는 MultiPolygon 이어야 한다.

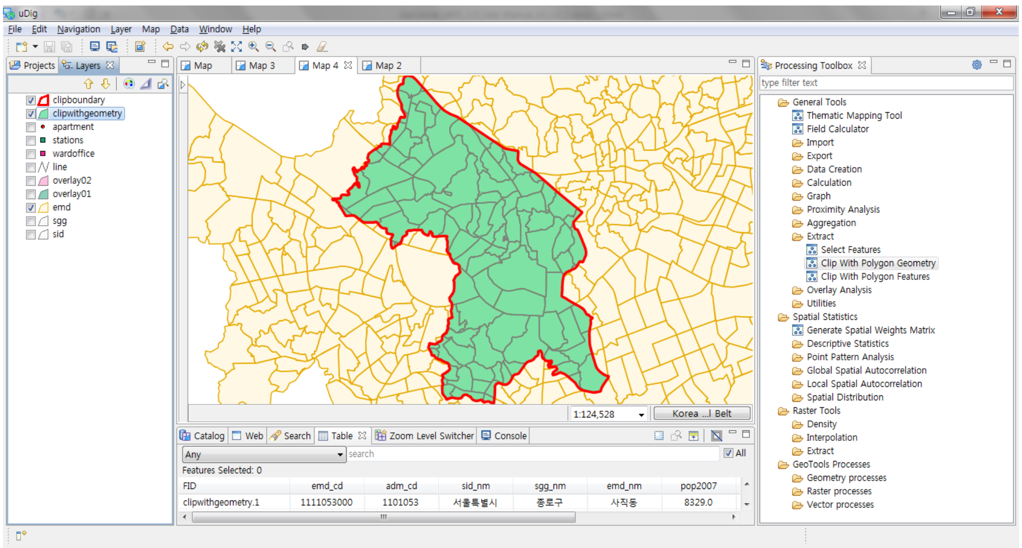
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:ClipWithGeometry</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
```

```
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:emd" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>clipGeometry</ows:Identifier>
        <wps:Data>
          <wps:ComplexData mimeType="application/wkt"><![CDATA[POLYGON ((14123807 4505796,
14139276 4505796, 14139276 4524167.5, 14123807 4524167.5, 14123807
4505796))]]></wps:ComplexData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

읍면동 경계 데이터에서 특정 영역(Geometry)만을 clip 한 결과입니다.



4.2.3.3. Clip with Features

Clip 할 폴리곤 피처 레이어를 설정하여 피처 레이어를 잘라냅니다.

■ **Syntax**

ClipWithFeatures (SimpleFeatureCollection inputFeatures, SimpleFeatureCollection clipFeatures): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features to be clipped.	Complex	✓
clipFeatures	The features used to clip the input features.	Complex	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- clipFeatures 는 반드시 Polygon 또는 MultiPolygon 피처 타입이어야 한다.

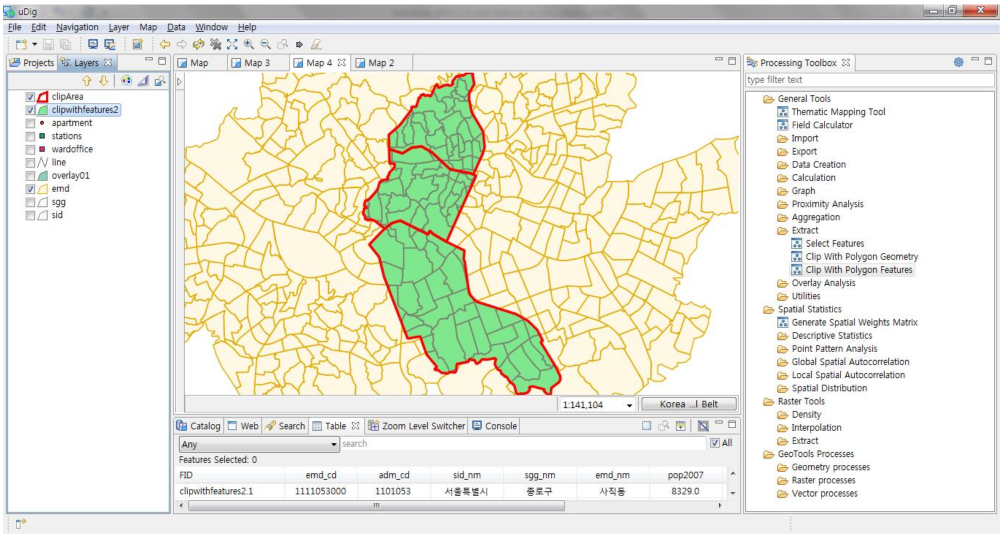
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:ClipWithFeatures</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
```

```
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:emd" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>clipFeatures</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:overlay02" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

임의의 폴리곤 레이어를 이용하여 읍면동경계 폴리곤 레이어를 clip 한 예입니다.



4.2.4. Overlay

Union, Intersect, Symmetrical Difference, Difference, Identity, Update 등 두 레이어 간의 Overlay 분석 프로세스들로 구성됩니다.

4.2.4.1. Union

두개의 입력 피처 레이어에 대한 Union Overlay 분석을 수행합니다. 출력 레이어는 두 피처의 모든 속성값이 유지됩니다.

■ **Syntax**

Union (SimpleFeatureCollection inputFeatures, SimpleFeatureCollection overlayFeatures): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features.	Complex	✓
overlayFeatures	Overlay features.	Complex	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- 입력 피처 레이어는 Point, Line, Polygon 모두 가능하며, 출력 레이어의 피처 타입은 inputFeatures 레이어를 따른다.
- 출력 레이어는 inputFeatures, overlayFeatures 의 속성값을 모두 포함한다.

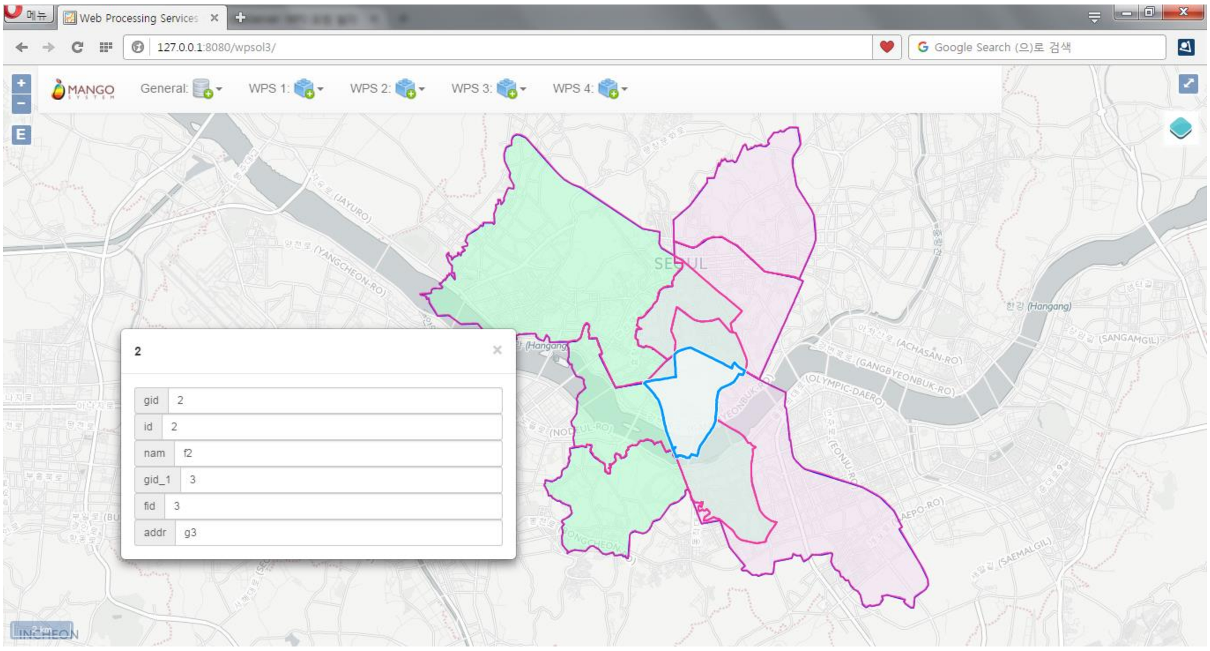
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
```

```
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:Union</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:overlay01" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>overlayFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:overlay02" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

두 폴리곤 레이어간 Union Overlay 분석을 수행한 결과입니다. 두 레이어의 속성값을 모두 포함합니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
Google Search (으)로 검색
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
SEOUL
2
gid 2
id 2
nam f2
gid_1 3
fid 3
addr g3
INCHEON

4.2.4.2. Intersect

두개의 입력 피처 레이어에 대한 Intersect Overlay 분석을 수행합니다. 출력 레이어는 두 피처의 모든 속성값이 유지됩니다.

■ **Syntax**

Intersect (SimpleFeatureCollection inputFeatures, SimpleFeatureCollection overlayFeatures): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features.	Complex	✓
overlayFeatures	Overlay features.	Complex	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- 입력 피처 레이어는 Point, Line, Polygon 모두 가능하며, 출력 레이어의 피처 타입은 inputFeatures 레이어를 따른다.
- 출력 레이어는 inputFeatures, overlayFeatures 의 필드값을 모두 포함한다.

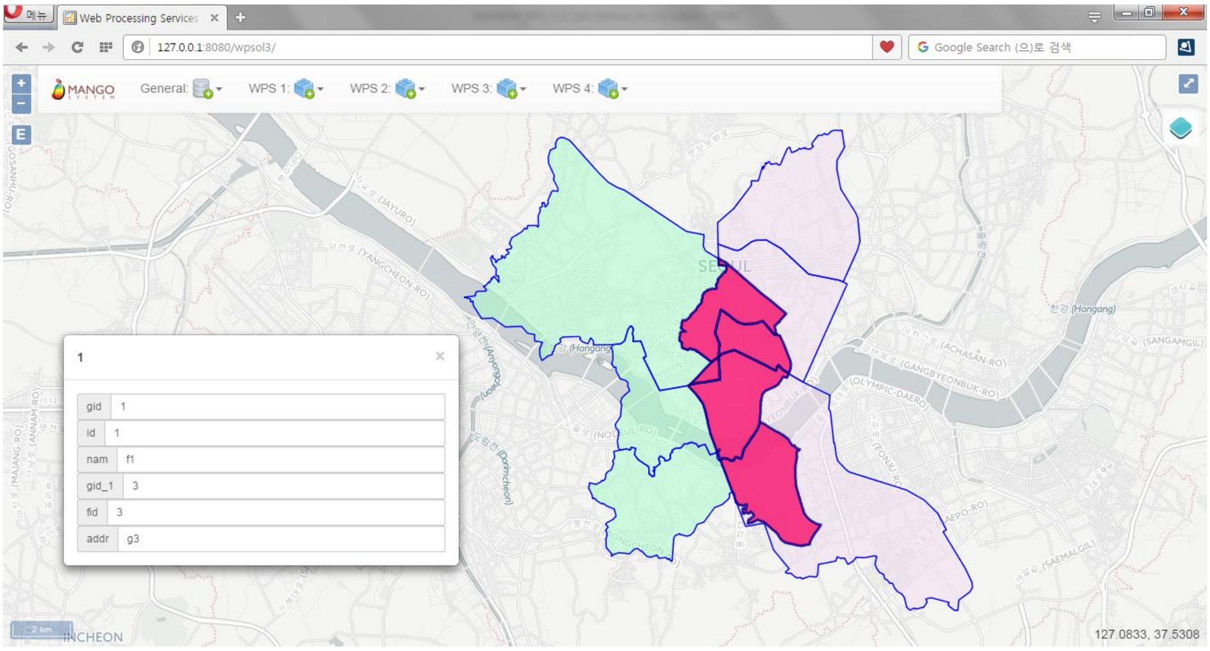
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:Intersect</ows:Identifier>
  <wps:DataInputs>
```

```xml
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:overlay01" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>overlayFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:overlay02" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

두 폴리곤 레이어간 Intersect Overlay 분석을 수행한 결과입니다. 두 레이어의 속성값을 모두 포함합니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
Google Search (으)로 검색
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
1
gid 1
id 1
nam f1
gid_1 3
fid 3
addr g3
127.0833, 37.5308

4.2.4.3. Difference

두개의 폴리곤 피처 레이어에 대한 Difference Overlay 분석을 수행합니다.

■ **Syntax**

Difference (SimpleFeatureCollection inputFeatures, SimpleFeatureCollection differenceFeatures): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features.	Complex	✓
differenceFeatures	Difference features.	Complex	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- 출력 레이어의 피처 타입과 필드는 inputFeatures 레이어를 따른다.

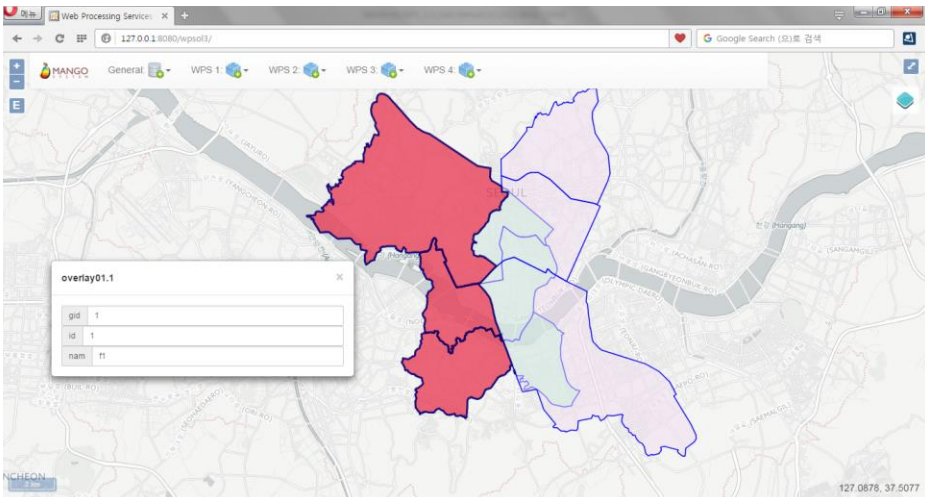
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:Difference</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
```

```
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:overlay01" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>differenceFeatures</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:overlay02" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

두 폴리곤 레이어간 Difference Overlay 분석을 수행한 결과입니다.



4.2.4.4. Symmetrical Difference

두개의 폴리곤 피처 레이어에 대한 Symmetrical Difference Overlay 분석을 수행합니다. 출력 레이어는 두 피처의 모든 속성값이 유지됩니다.

■ **Syntax**

SymDifference (SimpleFeatureCollection inputFeatures, SimpleFeatureCollection differenceFeatures): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features.	Complex	✓
differenceFeatures	Difference features.	Complex	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- 입력 레이어는 폴리곤 피처 타입이어야 하며, 출력 레이어의 피처 타입은 inputFeatures 레이어를 따른다.
- 출력 레이어는 inputFeatures, differenceFeatures 의 속성값을 모두 포함한다.

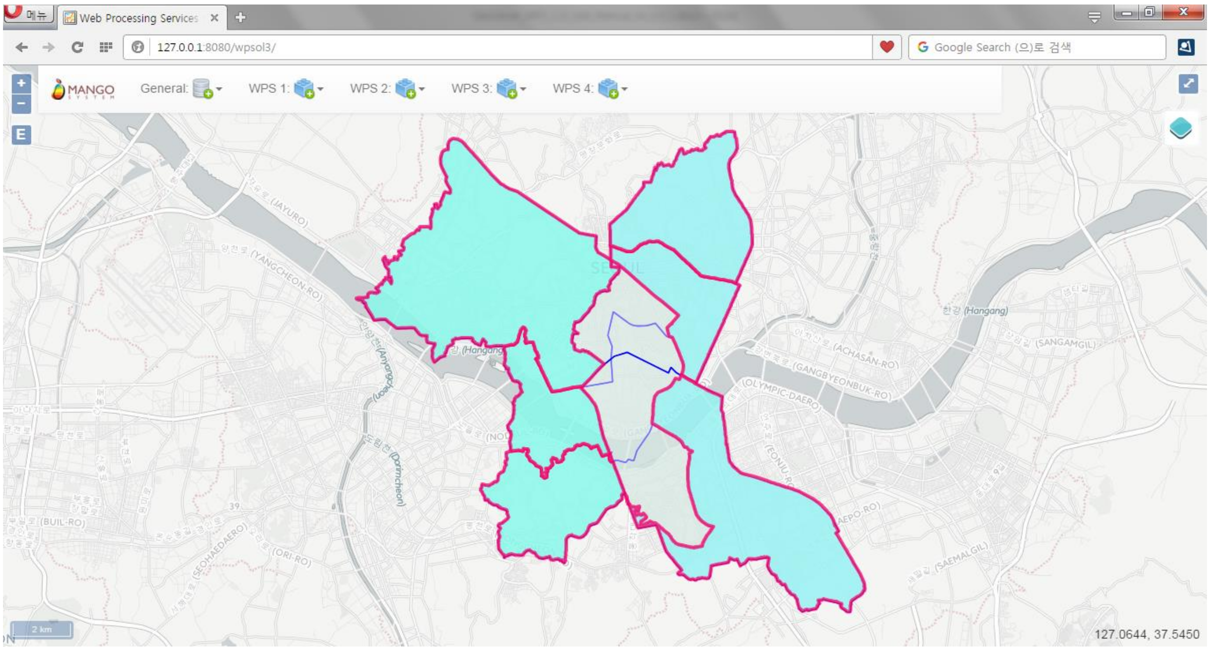
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:SymDifference</ows:Identifier>
  <wps:DataInputs>
```

```
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:overlay01" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>differenceFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:overlay02" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

두 폴리곤 레이어간 Symmetrical Difference Overlay 분석을 수행한 결과입니다. 두 레이어의 속성값을 모두 포함합니다.



4.2.4.5. Identity

두개의 폴리곤 피처 레이어에 대한 Identty Overlay 분석을 수행합니다.

- **Syntax**

Identity (SimpleFeatureCollection inputFeatures, SimpleFeatureCollection identityFeatures): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features.	Complex	✓
identityFeatures	Identity features.	Complex	✓

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

- inputFeatures, identityFeatures 는 반드시 Polygon 또는 MultiPolygon 피처 타입이어야 한다.
- 출력 레이어는 inputFeatures, identityFeatures 의 필드값을 모두 포함한다.

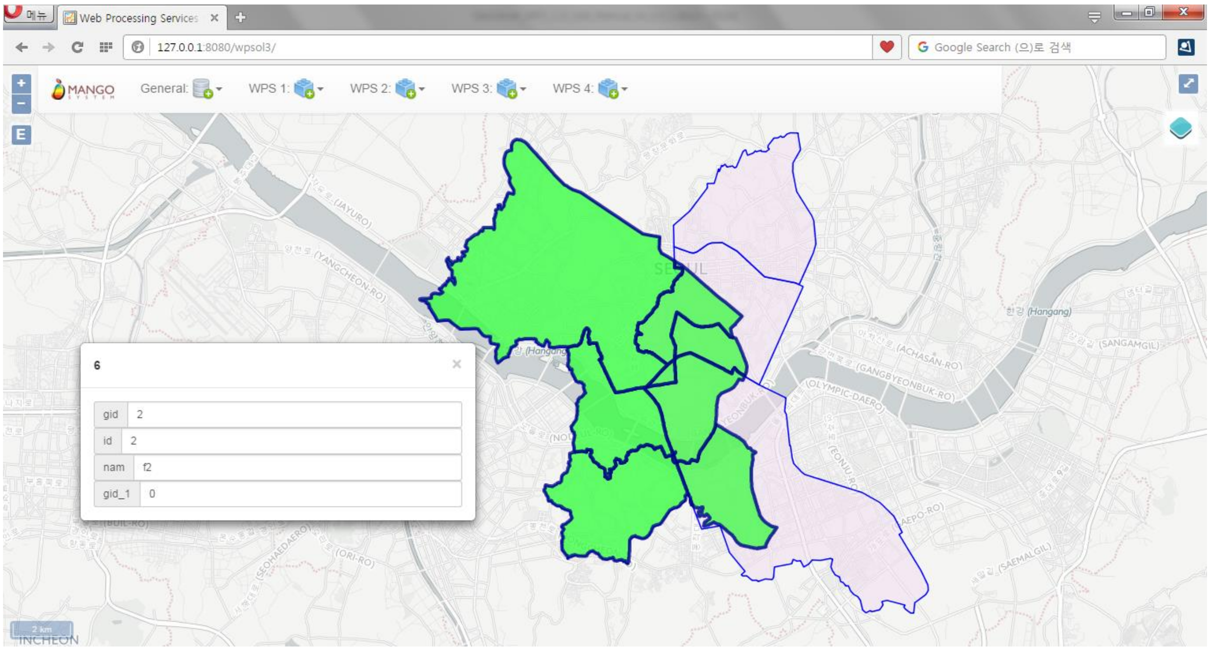
- **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:Identity</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
```

```
        <ows:Identifier>inputFeatures</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:overlay01" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>identityFeatures</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:overlay02" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

두 폴리곤 레이어간 Identity Overlay 분석을 수행한 결과입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
6
gid 2
id 2
nam f2
gid_1 0

4.2.4.6. Update

두개의 폴리곤 피처 레이어에 대한 Update Overlay 분석을 수행합니다.

■ **Syntax**

Update (SimpleFeatureCollection inputFeatures, SimpleFeatureCollection updateFeatures): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features.	Complex	✓
updateFeatures	Update features.	Complex	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- inputFeatures, identityFeatures 는 반드시 Polygon 또는 MultiPolygon 피처 타입이어야 한다.
- 출력 레이어는 inputFeatures, updateFeatures 의 필드값을 모두 포함한다.

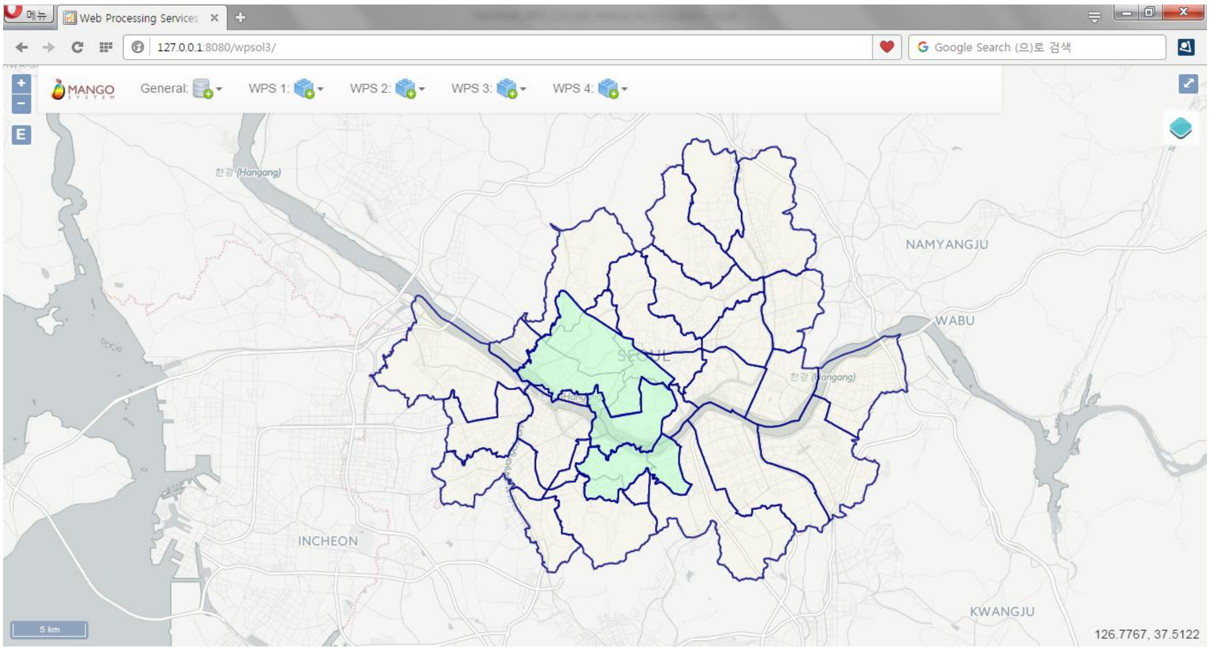
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:Update</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
```

```
        <ows:Identifier>inputFeatures</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:sgg" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>updateFeatures</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:overlay01" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

- **Response**

두 폴리곤 레이어간 Update Overlay 분석을 수행한 결과입니다. Input 레이어와 Update 레이어가 중첩되는 부분은 Update 레이어의 피처로 대체됩니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
Google Search (으)로 검색
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
E
NAMYANGJU
WABU
SEOUL
INCHEON
KWANGJU
5 km
126.7767, 37.5122

4.2.5. Proximity

버퍼 등 거리 연산 및 분석과 관련된 프로세스들로 구성됩니다.

4.2.5.1. Buffer Features using Expression

사용자가 정의한 Buffer 거리, Buffer 필드 또는 Buffer Expression 수식을 이용하여 Buffer 분석을 수행합니다.

■ **Syntax**

BufferFeatures (SimpleFeatureCollection inputFeatures, Expression distance, int quadrantSegments): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input features to be buffered.	Complex	✓
distance	The distance expression used to create distance. Ex) 1000 or [field] or [field] * 0.5 etc…	Literal	✓
quadrantSegments	The number of line segments used to represent a quadrant of a circle. Default is 8.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- inputFeatures 는 포인트, 라인, 폴리곤 모두 가능하다.
- distance expression 은 숫자, 숫자가 리턴되는 함수[8]식 모두 가능하다.

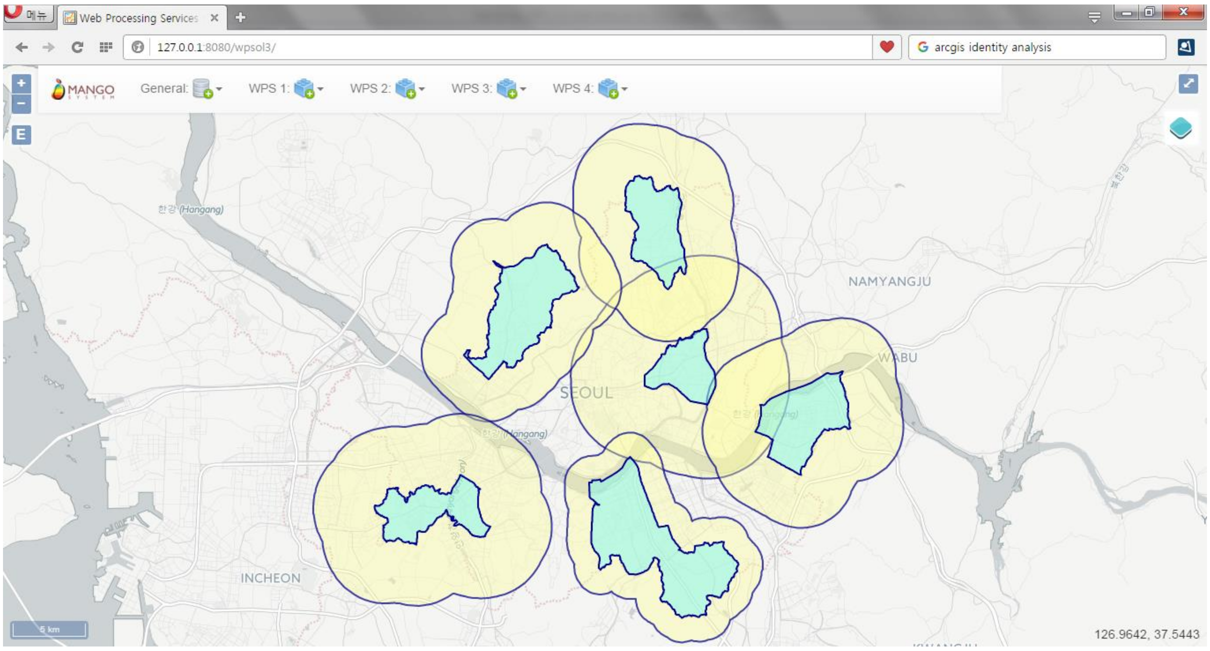
[8] http://docs.geoserver.org/stable/en/user/filter/function_reference.html 참조

■ Request Examples

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:BufferFeatures</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:randomsgg" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distance</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>[pop_den] / 2.0) * 0.5</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

폴리곤 레이어의 속성값을 이용하여 버퍼 거리를 Expression([pop_den] / 2.0) * 0.5)으로 표현하여 버퍼를 수행한 결과입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
arcgis identity analysis
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
NAMYANGJU
SEOUL
INCHEON
126.9642, 37.5443

4.2.5.2. Multiple Ring Buffer

콤마로 구분된 버퍼 거리를 기준으로 버퍼 분석을 수행합니다.

■ **Syntax**

MultipleRingBuffer (SimpleFeatureCollection inputFeatures, String distances, Boolean outsideOnly, Boolean dissolve): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input features to be buffered.	Complex	✓
distances	The comma separated list of buffer distances. Ex) 250,500,750,1000	Literal	✓
outsideOnly	The area inside of the input polygon features will excluded from the resulting buffer. Default is True.	Literal	-
dissolve	Determines if buffers will be dissolved to resemble rings around the input features. Default is False.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- inputFeatures 는 포인트, 라인, 폴리곤 모두 가능하다.
- Distance 의 단위는 inputFeatures 좌표계의 단위를 따른다.
- Dissolve 파라미터 값이 True 인 경우 inputFeatures 의 속성값은 무시되고 거리값만, False 인 경우 inputFeatures 의 속성값을 유지한다.

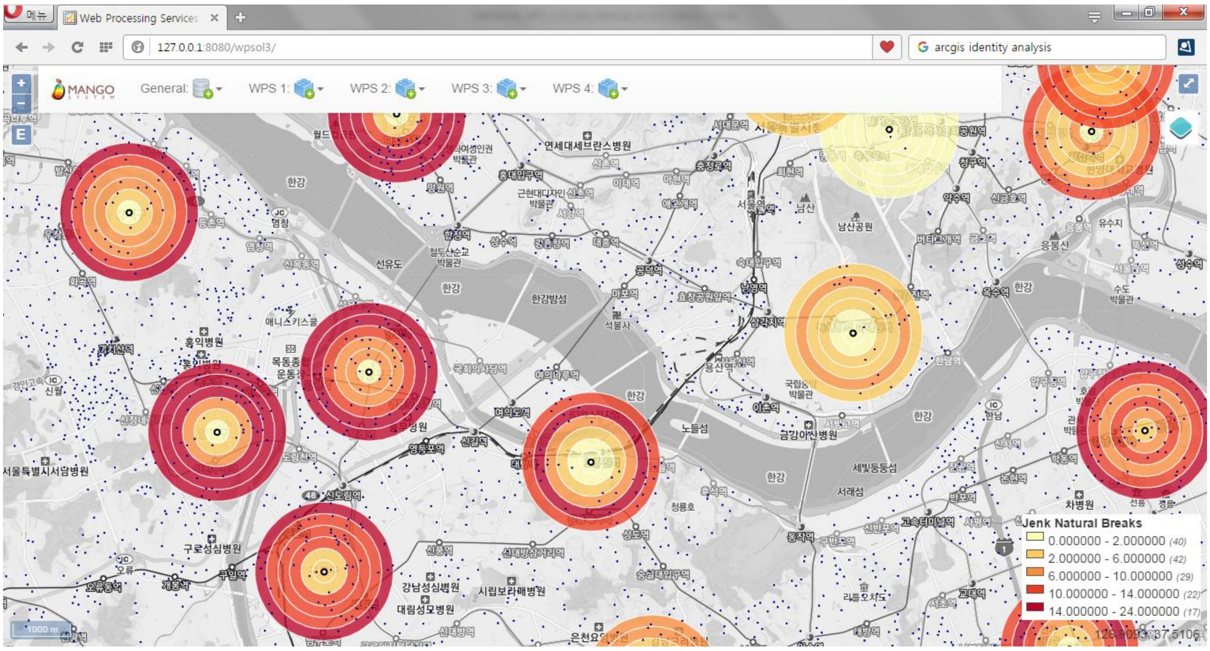
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
```

```
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:MultipleRingBuffer</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:wardoffice"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distances</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>250,500,750,1000,1250,1500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>outsideOnly</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>True</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

시군구청 포인트를 250,500,750,1000,1250,1500 미터 간격으로 Buffer 분석을 처리한 결과입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
arcgis identity analysis
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
Jenk Natural Breaks
0.000000 - 2.000000 (40)
2.000000 - 6.000000 (42)
6.000000 - 10.000000 (29)
10.000000 - 14.000000 (22)
14.000000 - 24.000000 (17)

4.2.5.3. Near (Nearest Distance & Attributes)

입력 피처 레이어를 기준으로 가장 가까운 Near 피처의 거리와 속성값을 계산합니다.

■ **Syntax**

Near (SimpleFeatureCollection inputFeatures, SimpleFeatureCollection nearFeatures, String nearIdField, Double maximumDistance): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input Features.	Complex	✓
nearFeatures	Near Features.	Complex	✓
nearIdField	Near ID field.	Literal	-
maximumDistance	Maximum distance.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- nearIdField 필드를 설정하지 않으면 피처의 내부 ID 를 사용한다.
- inputFeatures , nearFeatures 는 포인트, 라인, 폴리곤 모두 가능하며 두 Geometry 간의 최단거리를 계산한다.
- maximumDistance 가 설정되고 설정된 거리 안에 피처가 없는 경우 Null 값이 입력된다.

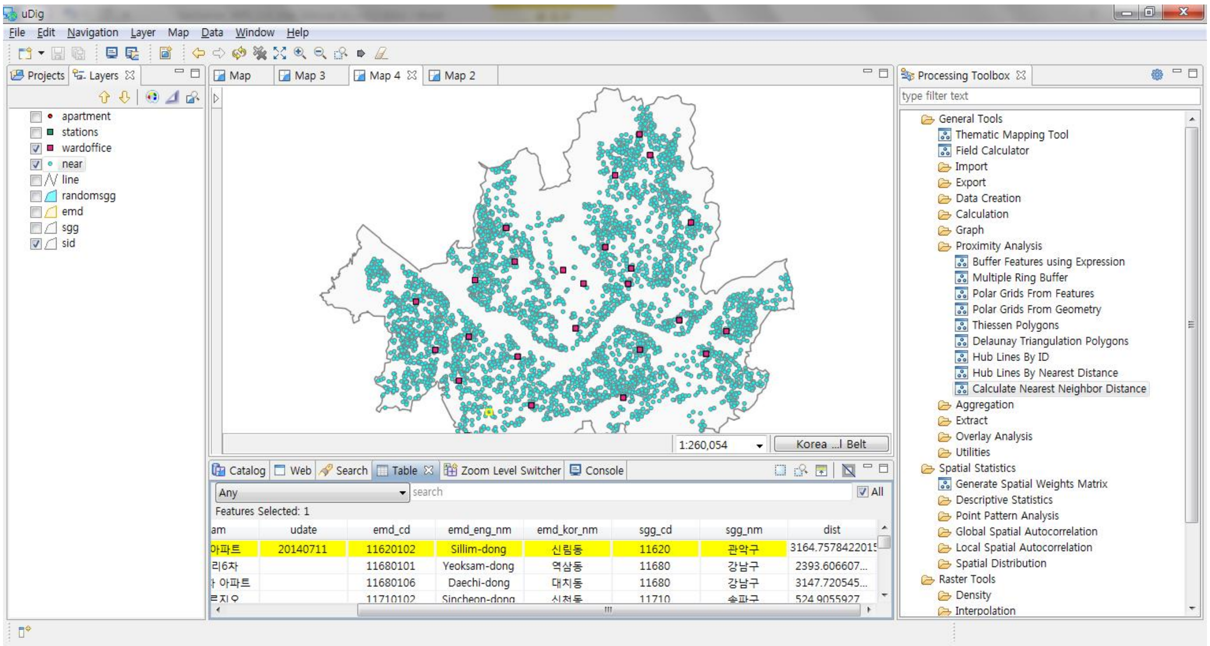
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
```

```
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:Near</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:apartment"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>nearFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:wardoffice"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

아파트와 시군구청간의 Near 분석을 수행한 결과입니다. 최단거리가 속성으로 계산됩니다.


uDig
File Edit Navigation Layer Map Data Window Help
Projects Layers
apartment
stations
wardoffice
near
line
randomsgg
emd
sgg
sid
Map Map 3 Map 4 Map 2
1:260,054
Korea ...l Belt
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Calculation
Graph
Proximity Analysis
Buffer Features using Expression
Multiple Ring Buffer
Polar Grids From Features
Polar Grids From Geometry
Thiessen Polygons
Delaunay Triangulation Polygons
Hub Lines By ID
Hub Lines By Nearest Distance
Calculate Nearest Neighbor Distance
Aggregation
Extract
Overlay Analysis
Utilities
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Interpolation
Catalog Web Search Table Zoom Level Switcher Console
Any
search
All
Features Selected: 1
am udate emd_cd emd_eng_nm emd_kor_nm sgg_cd sgg_nm dist
아파트 20140711 11620102 Sillim-dong 신림동 11620 관악구 3164.757842201
리6차 11680101 Yeoksam-dong 역삼동 11680 강남구 2393.606607...
아파트 11680106 Daechi-dong 대치동 11680 강남구 3147.720545...

4.2.5.4. Polar Grids from Geometry

기준 Geometry 와 콤마로 구분된 반경을 기준으로 방사형 Polar 격자를 생성합니다.

■ **Syntax**

PolarGridsFromGeometry (Geometry origin, String radius, RadialType radialType, Integer sides): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
origin	The center features of polar grids.	Complex	✓
radius	The list of radius(unit:data unit): Ex) 200, 300, 400, 500.	Literal	✓
radialType	Radial Type: Polar (Default), Base.	Literal	-
sides	The number of sides. Default is 8	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- 출력 레이어의 각 셀에는 angle, radius 값이 계산된다.
- sides 파라미터의 기본값(8)을 사용하는 경우 azimuth 필드가 추가되고 NE, N, NW, W, SW, S, SE, E 등의 방향값이 계산된다.

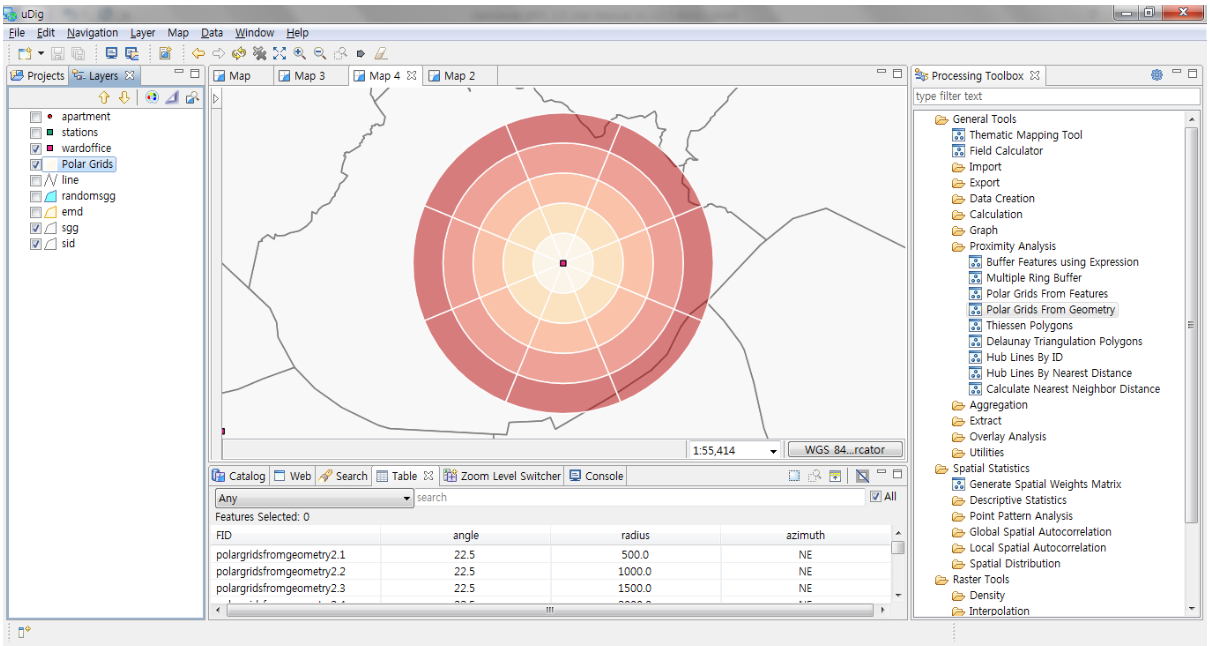
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
```

```xml
  <ows:Identifier>statistics:PolarGridsFromGeometry</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>origin</ows:Identifier>
      <wps:Data>
        <wps:ComplexData mimeType="application/wkt"><![CDATA[POINT (14136522.58319524
4513573.676204068)]]></wps:ComplexData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>radius</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>500, 1000, 1500, 2000, 2500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>radialType</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Polar</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

포인트(POINT (14136522.58319524 4513573.676204068))를 중심으로 반경 500, 1000, 1500, 2000, 2500 미터 간격의 Polar Grid 를 생성한 결과입니다.


uDig
File Edit Navigation Layer Map Data Window Help
Projects Layers
apartment
stations
wardoffice
Polar Grids
line
randomsgg
emd
sgg
sid
Map Map 3 Map 4 Map 2
1:55,414
WGS 84...rcator
Catalog Web Search Table Zoom Level Switcher Console
Any
search
All
Features Selected: 0
FID angle radius azimuth
polargridsfromgeometry2.1 22.5 500.0 NE
polargridsfromgeometry2.2 22.5 1000.0 NE
polargridsfromgeometry2.3 22.5 1500.0 NE
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Calculation
Graph
Proximity Analysis
Buffer Features using Expression
Multiple Ring Buffer
Polar Grids From Features
Polar Grids From Geometry
Thiessen Polygons
Delaunay Triangulation Polygons
Hub Lines By ID
Hub Lines By Nearest Distance
Calculate Nearest Neighbor Distance
Aggregation
Extract
Overlay Analysis
Utilities
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Interpolation

4.2.5.5. Polar Grids from Features

기준 피처 레이어의 개별 Geometry 와 콤마로 구분된 반경을 기준으로 방사형 Polar 격자를 생성합니다.

■ **Syntax**

PolarGridsFromFeatures (SimpleFeatureCollection origin, String radius, RadialType radialType, Integer sides): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
origin	The center features of polar grids.	Complex	✓
radius	The list of radius(unit:data unit): Ex) 200, 300, 400, 500.	Literal	✓
radialType	Radial Type: Polar (Default), Base.	Literal	-
sides	The number of sides.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- 출력 레이어의 각 셀에는 angle, radius 값이 계산된다.
- sides 파라미터의 기본값(8)을 사용하는 경우 azimuth 필드가 추가되고 NE, N, NW, W, SW, S, SE, E 등의 방향값이 계산된다.

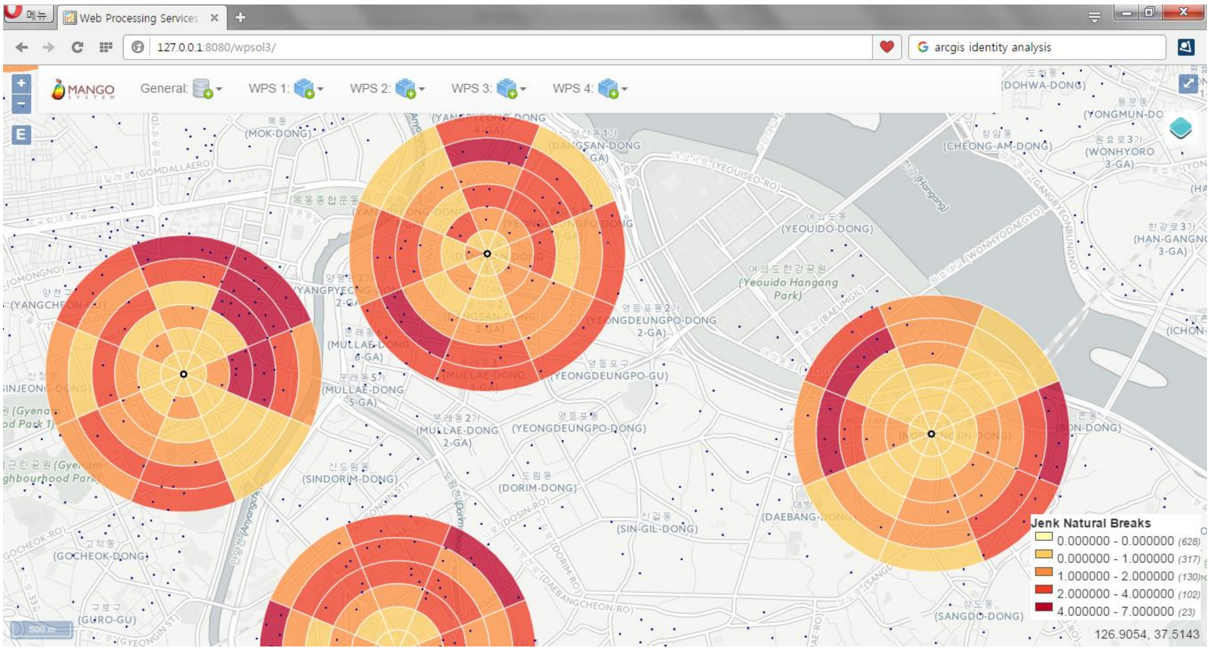
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
```

```
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:PolarGridsFromFeatures</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>origin</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:wardoffice"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>radius</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>500, 1000, 1500, 2000</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>radialType</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Polar</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

시군구청을 기준으로 반경 250,500,750,1000,1250,1500 미터의 8 방향 Polar Grid 를 생성 후 각 셀마다 아파트의 수를 계산할 결과를 지도화한 결과입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
arcgis identity analysis
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
Jenk Natural Breaks
0.000000 - 0.000000 (628)
0.000000 - 1.000000 (317)
1.000000 - 2.000000 (130)
2.000000 - 4.000000 (102)
4.000000 - 7.000000 (23)
126.9054, 37.5143

4.2.6. Aggregation

하나 또는 그 이상의 데이터를 중첩하여 새로운 값을 계산하는 프로세스들로 구성됩니다.

4.2.6.1. Point Statistics

폴리곤 피처 레이어와 중첩하는 포인트 레이어의 개수 또는 기초 통계값을 계산합니다.

■ **Syntax**

PointStatistics (SimpleFeatureCollection inputFeatures, SimpleFeatureCollection pointFeatures, String countField, String statisticsFields): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The polygon features to be calculated.	Complex	✓
pointFeatures	The point features to be calculated.	Complex	✓
countField	The count field. count is a default	Literal	-
statisticsFields	Centroid(False, Default), Inside(True)	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- inputFeatures 는 폴리곤, pointFeatures 는 포인트 피처 타입이어야 한다.
- countField 는 폴리곤 내에 포함되는 포인트의 개수가 저장되며, 기본값은 count 이다.
- Statistics Fields 는 다음과 같이 [함수명.필드명] 구조로 입력하며 사용가능한 함수는 다음과 같다. 예) Sum.pop, Mean.pop

입력값	반환 필드명

First: String 필드, Dissolve 대상 Feature 의 첫 번째 값	FST_필드명
Last: String 필드, Dissolve 대상 Feature 의 마지막 값	LST_필드명
Sum: Numeric 필드, Dissolve 대상 Feature 의 합	SUM_필드명
Mean: Numeric 필드, Dissolve 대상 Feature 의 평균값	AVG_필드명
Min: Numeric 필드, Dissolve 대상 Feature 의 최소값	MIN_필드명
Max: Numeric 필드, Dissolve 대상 Feature 의 최대값	MAX_필드명
Std: Numeric 필드, Dissolve 대상 Feature 의 표준편차	STD_필드명
Var: Numeric 필드, Dissolve 대상 Feature 의 분산	VAR_필드명
Range: Numeric 필드, Dissolve 대상 Feature 의 범위	RNG_필드명
Count: Dissolve 대상 Feature 의 수	CNT_필드명

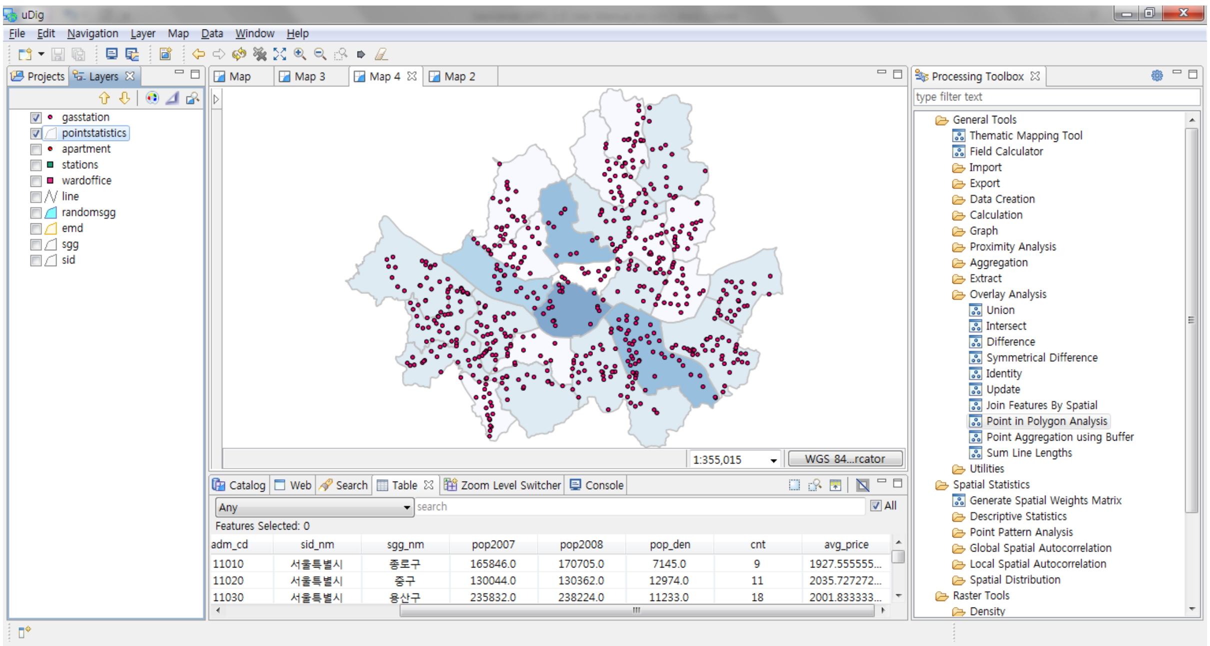
■ Request Examples

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:PointStatistics</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>polygonFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>pointFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:gasstation"/>
          </wfs:GetFeature>
        </wps:Body>
```

```
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>countField</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>cnt</wps:LiteralData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>statisticsFields</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>Mean.price</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
  </wps:Execute>
```

■ Response

시군구별 주유소의 유가 평균(Mean.price)을 계산 후 지도화한 결과입니다.



4.2.6.2. Aggregate (Union) Polygons

입력 폴리곤 피처를 Dissolve 하여 하나의 폴리곤 피처 레이어를 생성합니다.

- **Syntax**

UnionPolygon (SimpleFeatureCollection polygonFeatures, Boolean preserveHole): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
polygonFeatures	The polygon features to be processed.	Complex	✓
preserveHole	Preserve or remove hole (interior ring).	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

- preserveHole 파라미터가 False 이면 모든 Interior Ring 은 제거한 폴리곤을 반환한다.

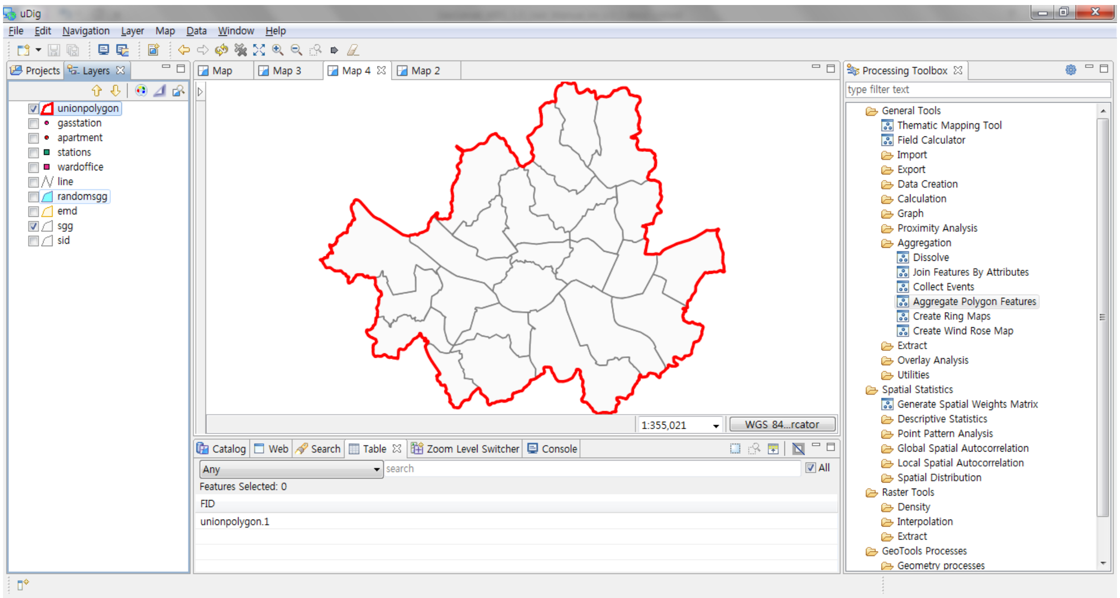
- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:UnionPolygon</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>polygonFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
```

```
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:sgg"/>
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>preserveHole</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>False</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

시군구 경계를 모두 Union 한 결과입니다. preserveHole 파라미터가 False 이기 때문에 InteriorRing(Hole)이 있을 경우 모두 제거합니다.



4.2.6.3. Collect Events

포인트의 위치가 동일하거나 특정 반경 내의 포인트 피처를 하나의 피처로 생성합니다.

■ **Syntax**

CollectEvents (SimpleFeatureCollection inputFeatures, String countField, Double tolerance): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features representing event or incident data.	Complex	✓
countField	The field to be calculated coincident points count. icount (Default).	Literal	-
tolerance	The tolerance distance for considering two points equal.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- countField 파라미터를 설정하지 않으면 icount 필드를 기본값으로 사용한다.
- tolerance 값이 0 이면 정확히 일치하는 포인트를, 0 보다 크면 tolerance 거리 이내의 피처를 동일한 것으로 간주한다.

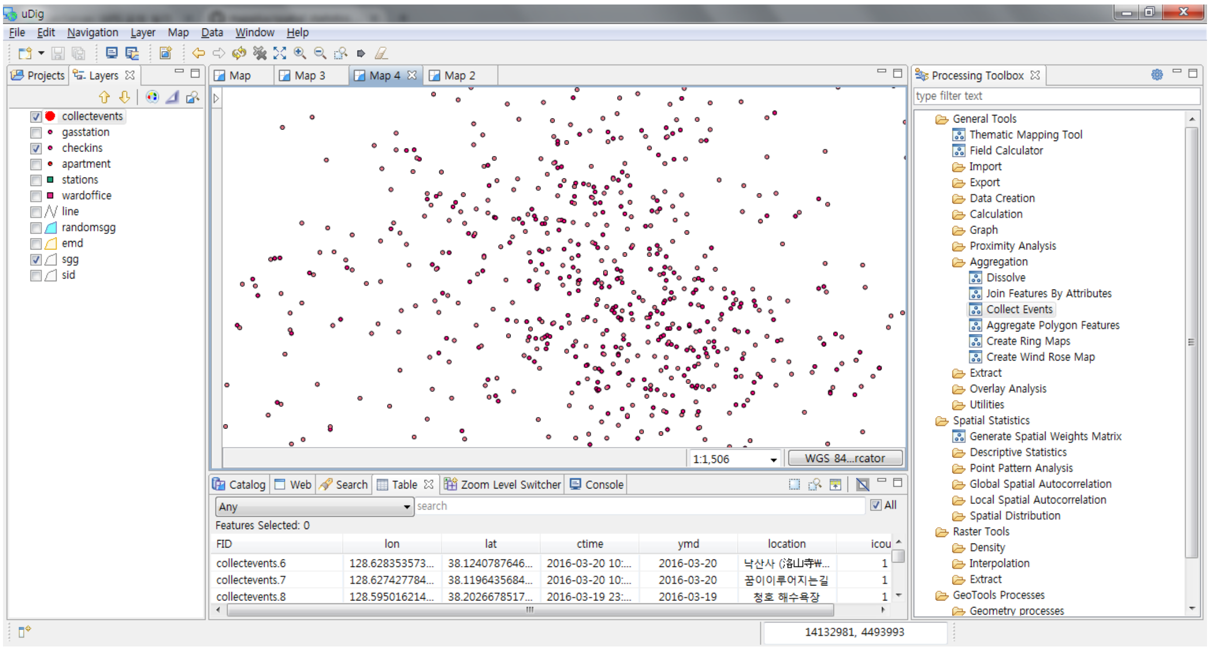
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
```

```
  <ows:Identifier>statistics:CollectEvents</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:checkins"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>countField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>icount</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>tolerance</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>5</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

설정한 거리 이내의 포인트들을 하나로 합친 결과입니다.


uDig
File Edit Navigation Layer Map Data Window Help
Projects Layers
collectevents
gasstation
checkins
apartment
stations
wardoffice
line
randomsgg
emd
sgg
sid
Map Map 3 Map 4 Map 2
1:1,506
WGS 84...rcator
Catalog Web Search Table Zoom Level Switcher Console
Any
search
All
Features Selected: 0
FID lon lat ctime ymd location icou
collectevents.6 128.628353573... 38.1240787646... 2016-03-20 10:... 2016-03-20 낙산사 (洛山寺#... 1
collectevents.7 128.627427784... 38.1196435684... 2016-03-20 10:... 2016-03-20 꿈이이루어지는길 1
collectevents.8 128.595016214... 38.2026678517... 2016-03-19 23:... 2016-03-19 청호 해수욕장 1
14132981, 4493993
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Calculation
Graph
Proximity Analysis
Aggregation
Dissolve
Join Features By Attributes
Collect Events
Aggregate Polygon Features
Create Ring Maps
Create Wind Rose Map
Extract
Overlay Analysis
Utilities
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Interpolation
Extract
GeoTools Processes
Geometry processes

4.2.6.4. Spatial Join

공간 관계에 기반하여 두 피처의 공간 조인을 수행합니다. 두 피처 레이어의 모든 속성값을 포함합니다.

■ **Syntax**

SpatialJoin (SimpleFeatureCollection inputFeatures, SimpleFeatureCollection joinFeatures, SpatialJoinType joinType, Double searchRadius): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features.	Complex	✓
joinFeatures	Join features.	Complex	✓
joinType	Join Type. KeepAllRecord, OnlyMatchingRecord	Literal	-
searchRadius	Search Radius.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- joinType 파라미터의 값이 KeepAllRecord 인 경우 공간 조인이 수행되지 않은 inputFeatures 의 모든 피처를 포함하여 반환한다.
- searchRadius 파라미터 값이 주어지면 searchRadius 내에 포함되는 피처와 조인한다.

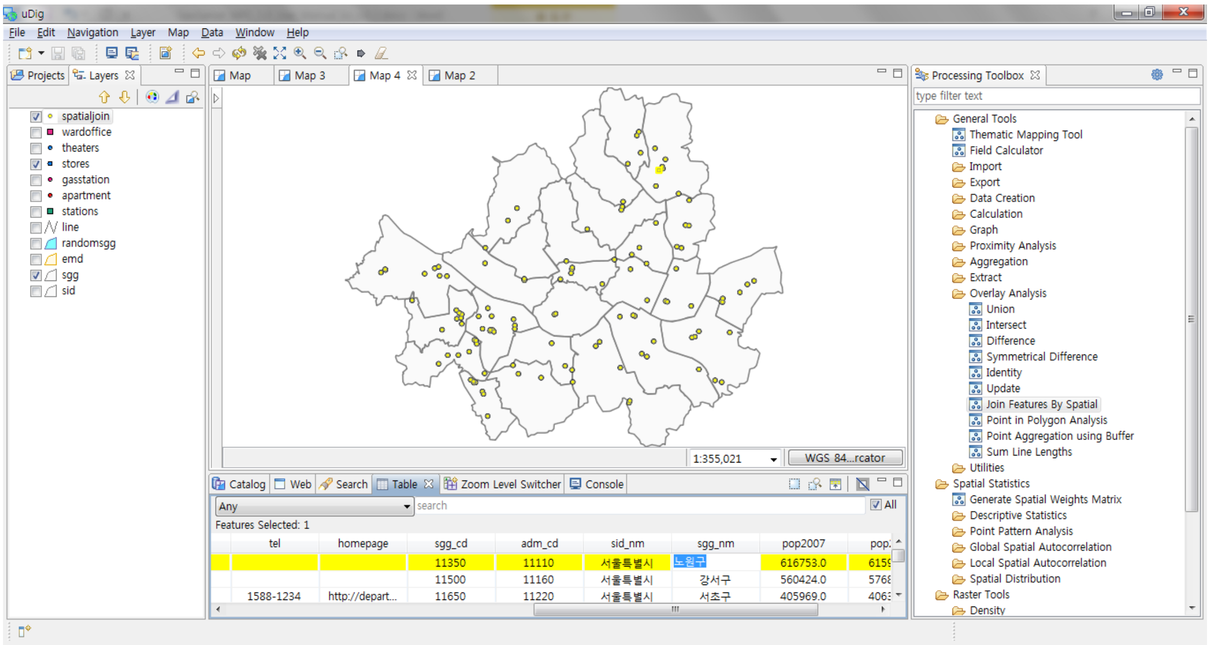
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
```

```
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:SpatialJoin</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:stores"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>joinFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>joinType</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>KeepAllRecord</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

대형매장 포인트 레이어가 속한 시군구 레이어의 정보를 Spatial Join 한 결과입니다. Pont 나 Line 레이어의 경우 탐색반경을 설정하여 가까운 피처의 속성을 가져올 수 있습니다.



4.2.6.5. Attribute Join

두개의 피처 레이어와 조인 필드를 이용하여 조인을 수행합니다. 두 피처 레이어의 모든 속성값을 포함합니다.

■ **Syntax**

AttributeJoin (SimpleFeatureCollection inputFeatures, String primaryKey, SimpleFeatureCollection joinFeatures, String foreignKey, Join.Type joinType): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features.	Complex	✓
primaryKey	Primary key field.	Literal	✓
joinFeatures	Join features.	Complex	✓
foreignKey	Foreign key field.	Literal	✓
joinType	Join type. INNER, OUTER	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- joinType 이 INNER 인 경우 조인되는 inputFeatures 의 피처만을 반환한다.

■ **Request Examples**

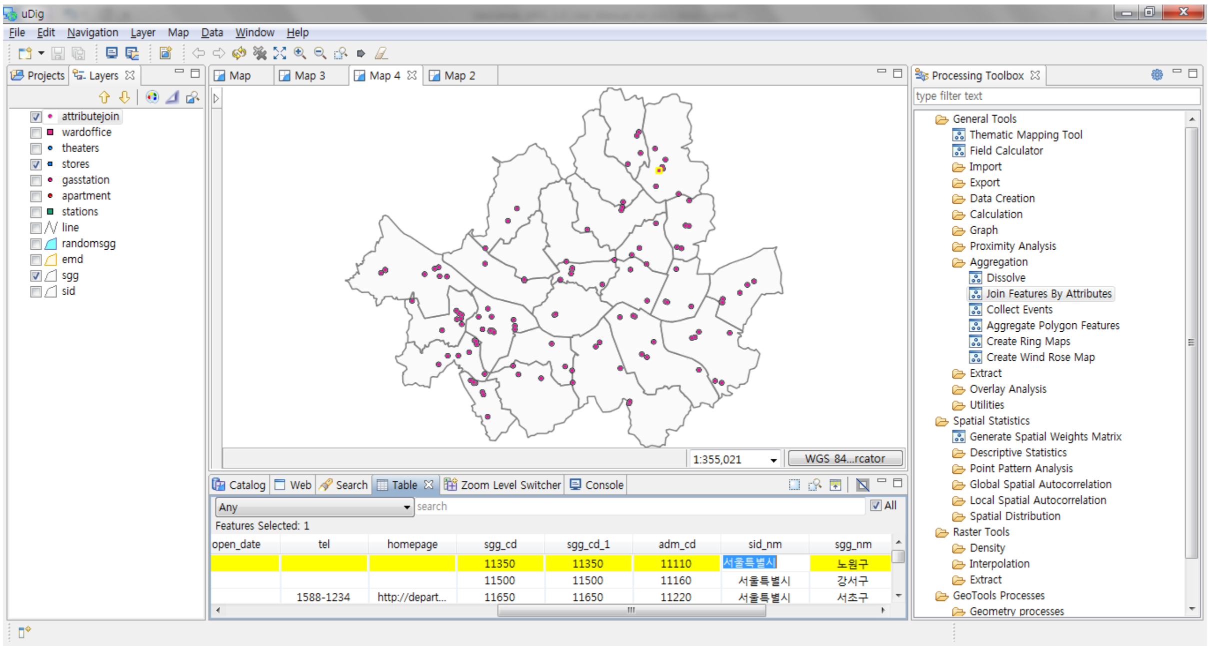
```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:AttributeJoin</ows:Identifier>
```

```
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:stores"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>primaryKey</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>sgg_cd</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>joinFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>foreignKey</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>sgg_cd</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>joinType</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>OUTER</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
```

```
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

대형매장과 시군구 행정경계의 시군구코드를 Join 필드로 사용하여 조인한 결과입니다.



4.2.6.6. Buffer Point Statistics

반경을 입력하여 반경 내 포함되는 포인트의 수 또는 속성정보의 통계량(합, 최대, 최소, 평균 등)을 계산합니다.

■ **Syntax**

BufferPointStatistics (SimpleFeatureCollection inputFeatures, Double distance, SimpleFeatureCollection pointFeatures, String countField, String statisticsFields): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features.	Complex	✓
distance	Search distance.	Literal	✓
pointFeatures	Point features.	Complex	✓
countField	Count field. Default is count.	Literal	-
statisticsFields	Statistics Fields: Function.PropertyName(First, Last, Sum, Mean, Min, Max, Std, Count)	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- countField 는 폴리곤 내에 포함되는 포인트의 개수가 저장되며, 기본값은 count 이다.
- Statistics Fields 는 다음과 같이 [함수명.필드명] 구조로 입력하며 사용 가능한 함수는 다음과 같다. 예) Sum.pop, Mean.pop

입력값	반환 필드명
First: String 필드, Dissolve 대상 Feature 의 첫 번째 값	FST_필드명

Last: String 필드, Dissolve 대상 Feature 의 마지막 값	LST_필드명
Sum: Numeric 필드, Dissolve 대상 Feature 의 합	SUM_필드명
Mean: Numeric 필드, Dissolve 대상 Feature 의 평균값	AVG_필드명
Min: Numeric 필드, Dissolve 대상 Feature 의 최소값	MIN_필드명
Max: Numeric 필드, Dissolve 대상 Feature 의 최대값	MAX_필드명
Std: Numeric 필드, Dissolve 대상 Feature 의 표준편차	STD_필드명
Var: Numeric 필드, Dissolve 대상 Feature 의 분산	VAR_필드명
Range: Numeric 필드, Dissolve 대상 Feature 의 범위	RNG_필드명
Count: Dissolve 대상 Feature 의 수	CNT_필드명

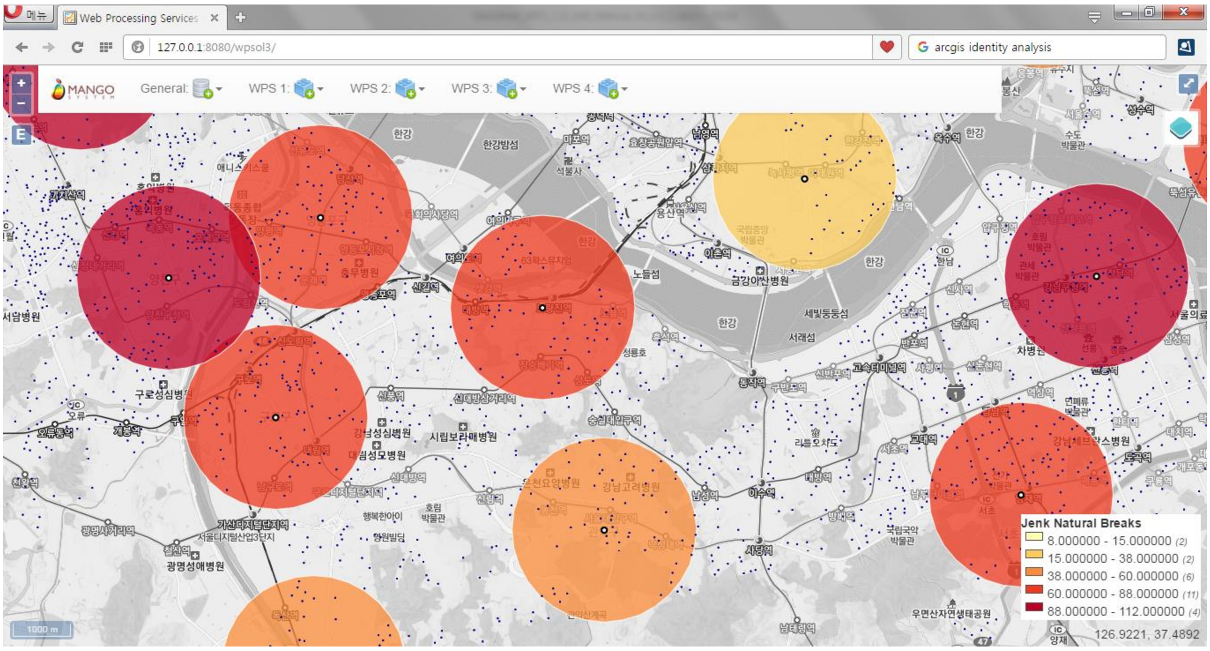
■ Request Examples

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:BufferPointStatistics</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:wardoffice"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distance</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>2000</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>pointFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
```

```
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:apartment"/>
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>countField</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>cnt</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

시군구청에서 2000 미터 내에 포함된 아파트의 수를 계산하여 지도화한 결과입니다.



4.2.6.7. Sum Line Lengths

폴리곤 피처와 교차하는 라인 피처 레이어를 클립하여 길이의 합과 교차되는 라인 피처의 수를 계산합니다.

■ **Syntax**

SumLineLength (SimpleFeatureCollection polygons, String lengthField, String countField, SimpleFeatureCollection lines): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
polygons	The polygon features that will be calculated.	Complex	✓
lengthField	The length field that will be calculated. sum_len is default.	Literal	✓
countField	The count field that will be calculated. line_cnt is default.	Literal	-
lines	The line features that will be calculated.	Complex	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- lengthField 는 폴리곤 피처와 중첩되는 라인들을 잘라낸 길이의 합이 저장되며, 기본값은 sum_len 이다.

- countField 는 폴리곤 내에 포함되는 라인의 개수가 저장되며, 기본값은 line_cnt 이다.

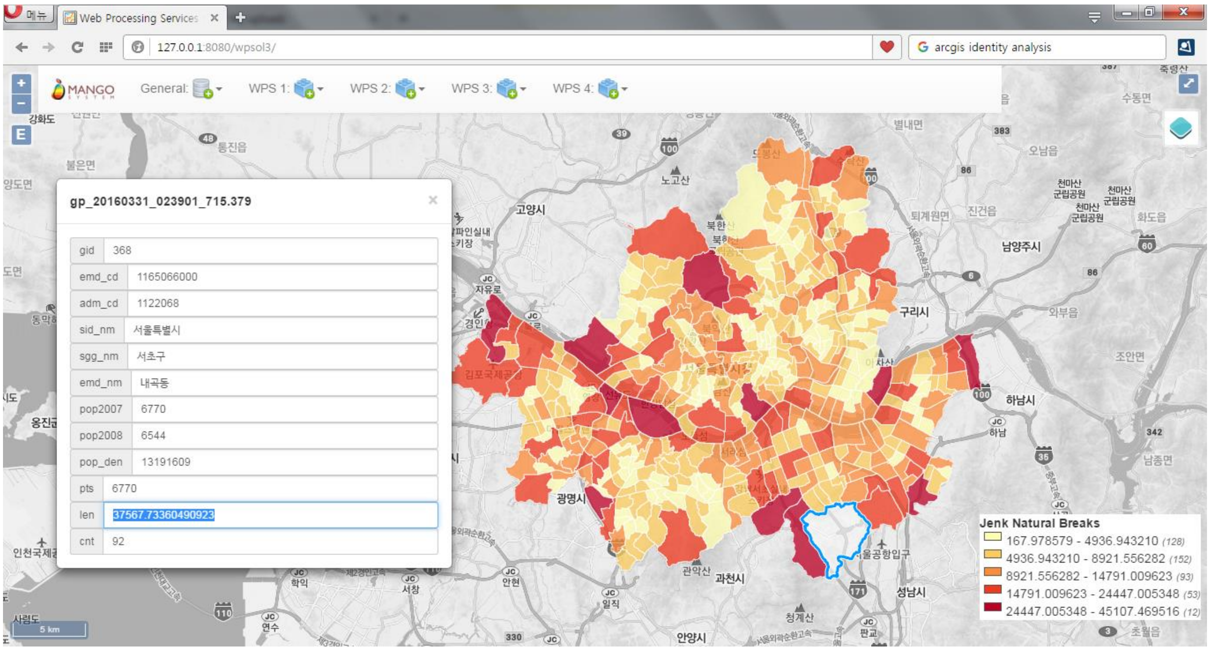
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
```

```
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:SumLineLength</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>polygons</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:emd"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>lengthField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>len</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>lines</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:road"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

읍면동별 주요도로의 연장을 계산한 후 지도화한 결과입니다.



4.2.6.8. Spatial Clump Map

포인트 피처와 반경 표현식을 이용하여 Spatial Clump Map 을 생성합니다.

■ **Syntax**

SpatialClumpMap (SimpleFeatureCollection inputFeatures, Expression radius, Integer quadrantSegments): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features to be buffered.	Complex	✓
radius	The radius expression used to create distance. Ex) 1000 or [field] or [field] * 0.5 etc...	Literal	✓
quadrantSegments	The number of line segments used to represent a quadrant of a circle. Default is 8.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- quatrantSegments 파라미터의 기본값은 8 이다.

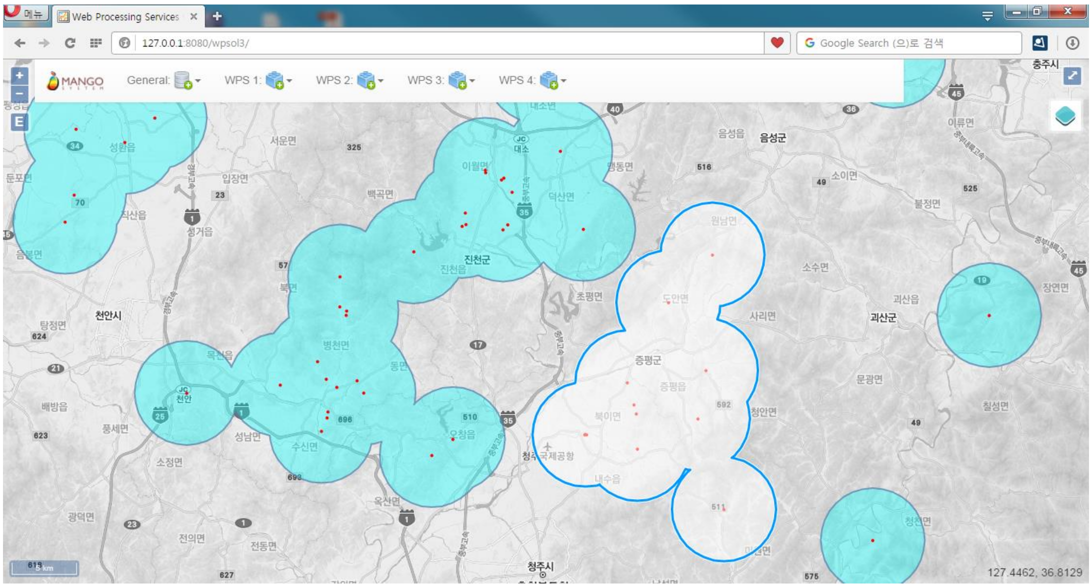
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:SpatialClumpMap</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
```

```
        <ows:Identifier>inputFeatures</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:outbreak" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>radius</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>5000</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.0">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
  </wps:Execute>
```

■ Response

반경 5km 를 설정하여 Spatial Clump Map 을 작성한 결과입니다.



4.2.6.9. Hexagonal Binning

포인트 피처, 범위, 반경을 이용하여 Hexagon 그리드를 생성 후 각 셀에 포인트의 수를 계산한 폴리곤 피처를 생성합니다.

- **Syntax**

HexagonalBinning (SimpleFeatureCollection features, Expression weight, ReferencedEnvelope bbox, Double size, Boolean validGrid): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
features	Input point features to be aggregated.	Complex	✓
weight	The numeric field or expression used to weight values. Ex) [field] or [field] * 0.5 etc…	Literal	-
bbox	The extent of the grids.	Complex	-
size	Size of the grids.	Literal	✓
validGrid	Returns only valid grid. Default is True.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

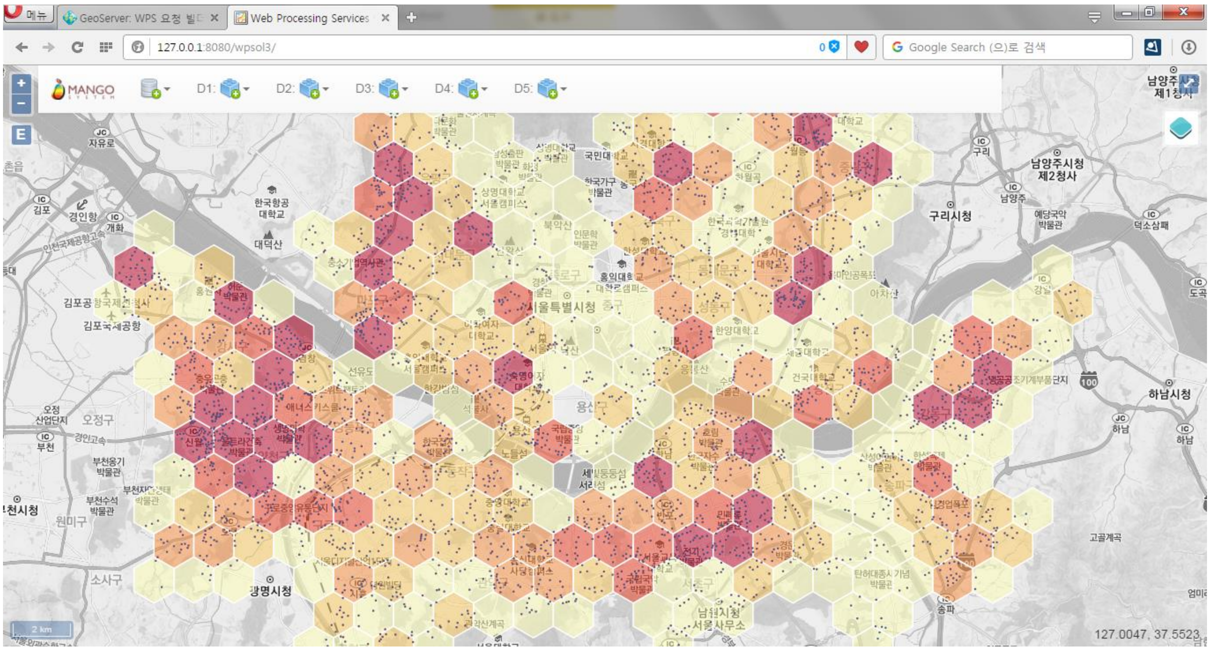
- bbox 가 Null 인 경우 features 데이터의 Extent 를 사용한다.
- weight 식이 주어진 경우 weight 의 값을 누적한다.
- size 는 0 보다 커야 한다.
- validGrid 파라미터의 기본값은 True 이며, 포인트의 개수가 0 이상인 그리드만 반환한다.

- **Request Examples**

```xml
<?xml version="1.0" encoding="UTF-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:HexagonalBinning</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>features</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:apartment"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>size</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>1500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.0">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```


- **Response**

서울시의 아파트 포인트 데이터를 1000 미터 크기의 Hexagon 을 생성 후 시각화한 결과입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
Google Search (으)로 검색
MANGO
D1:
D2:
D3:
D4:
D5:
서울특별시청
127.0047, 37.5523

4.2.6.10. Rectangular Binning

포인트 피처, 범위, 반경을 이용하여 Rectangle 그리드를 생성 후 각 셀에 포인트의 수를 계산한 폴리곤 피처를 생성합니다.

■ **Syntax**

RectangularBinning (SimpleFeatureCollection features, Expression weight, ReferencedEnvelope bbox, Double width, Double height, Boolean validGrid): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
features	Input point features to be aggregated.	Complex	✓
weight	The numeric field or expression used to weight values. Ex) [field] or [field] * 0.5 etc...	Literal	-
bbox	The extent of the grids.	Complex	-
width	Width of the grids.	Literal	✓
height	Height of the grids.	Literal	✓
validGrid	Returns only valid grid. Default is True.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

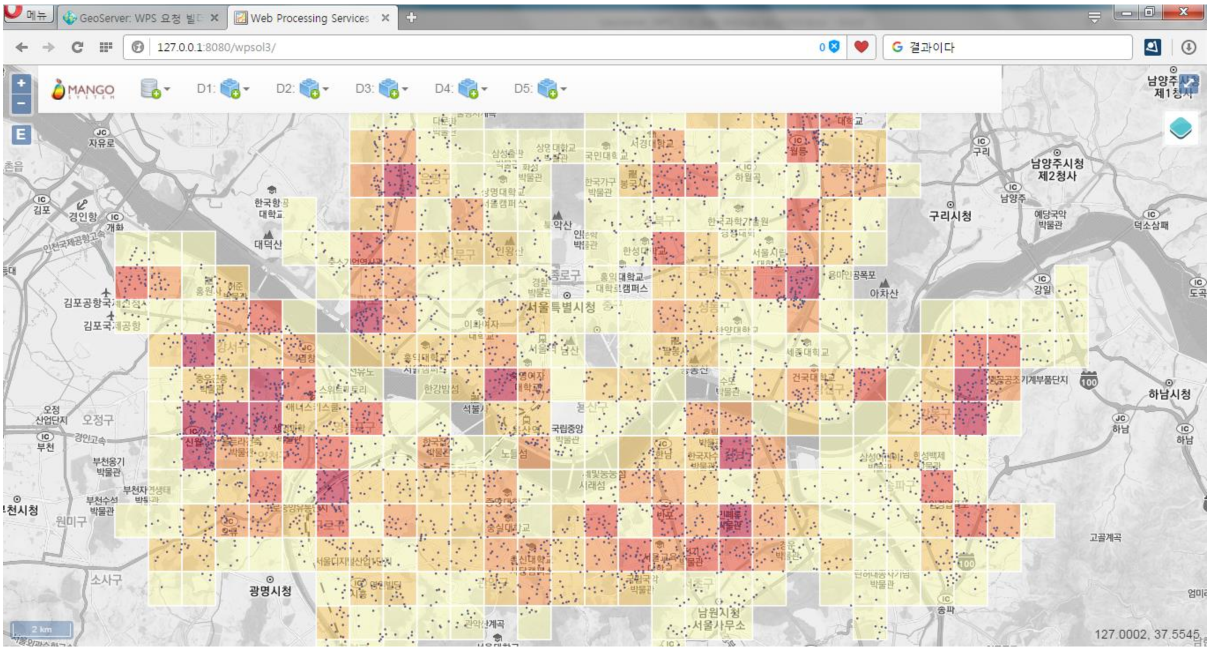
- bbox 가 Null 인 경우 features 데이터의 Extent 를 사용한다.
- weight 식이 주어진 경우 weight 의 값을 누적한다.
- width, height 는 0 보다 커야 한다.
- validGrid 파라미터의 기본값은 True 이며, 포인트의 개수가 0 이상인 그리드만 반환한다.

Request Examples

```
<?xml version="1.0" encoding="UTF-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RectangularBinning</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>features</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:apartment"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>width</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>1500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>height</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>1500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.0">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

서울시의 아파트 포인트 데이터를 1500 미터 크기의 Rectangle 을 생성 후 시각화한 결과입니다.



4.2.6.11. Circular Binning

포인트 피처, 범위, 반경을 이용하여 Circle 그리드를 생성 후 각 셀에 포인트의 수를 계산한 폴리곤 피처를 생성합니다.

■ **Syntax**

CircularBinning (SimpleFeatureCollection features, Expression weight, ReferencedEnvelope bbox, Double radius, Boolean validGrid): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
features	Input point features to be aggregated.	Complex	✓
weight	The numeric field or expression used to weight values. Ex) [field] or [field] * 0.5 etc...	Literal	-

bbox	The extent of the grids.	Complex	-
radius	Radiuss of the grids.	Literal	✓
validGrid	Returns only valid grid. Default is True.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- bbox 가 Null 인 경우 features 데이터의 Extent 를 사용한다.
- weight 식이 주어진 경우 weight 의 값을 누적한다.
- radius 는 0 보다 커야 한다.
- validGrid 파라미터의 기본값은 True 이며, 포인트의 개수가 0 이상인 그리드만 반환한다.

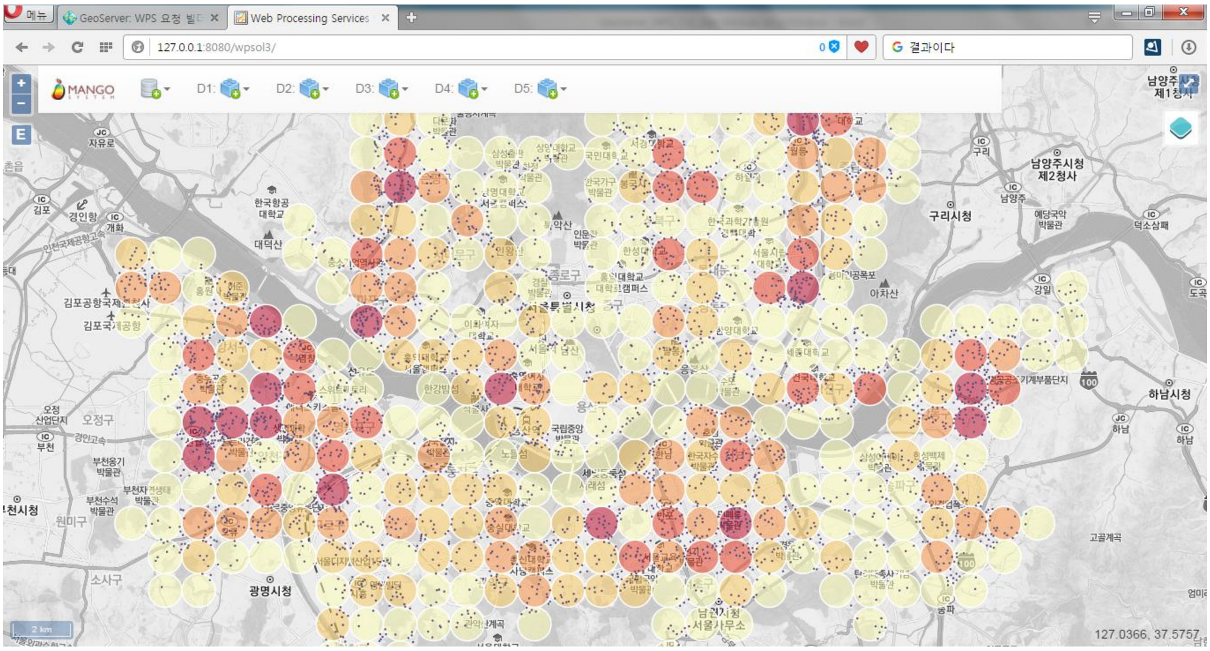
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:CircularBinning</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>features</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:apartment"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
```

```
    </wps:Input>
    <wps:Input>
      <ows:Identifier>radius</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>750</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.0">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

서울시의 아파트 포인트 데이터를 750 미터 반경의 Circle 을 생성 후 시각화한 결과입니다.



4.2.7. Generalization

Dissolve, Simplification 등 일반화와 관련된 프로세스들로 구성됩니다.

4.2.7.1. Dissolve

피처 레이어의 속성 필드와 집계 함수를 이용하여 Dissolver 분석을 수행합니다.

■ **Syntax**

Dissolve (SimpleFeatureCollection inputFeatures, String dissolveField, String statisticsFields, Boolean useMultiPart): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features.	Complex	✓
dissolveField	The field on which to dissolve features.	Literal	✓
statisticsFields	The fields and statistics with which to summarize attributes. Statistics fields(Function.PropertyName): First, Last, Sum, Mean, Min, Max, Std, Count.	Literal	-
useMultiPart	Specifies whether multipart features are allowed in the output features.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- useMultiPart 가 False 이면 Dissolve 된 피처들을 Single Part 로 변환하여 반환한다.
- Statistics Fields 는 다음과 같이 [함수명.필드명] 구조로 입력하며 사용 가능한 함수는 다음과 같다. 예) Sum.pop, Mean.pop

입력값	반환 필드명
First: String 필드, Dissolve 대상 Feature 의 첫 번째 값	FST_필드명

Last: String 필드, Dissolve 대상 Feature 의 마지막 값	LST_필드명
Sum: Numeric 필드, Dissolve 대상 Feature 의 합	SUM_필드명
Mean: Numeric 필드, Dissolve 대상 Feature 의 평균값	AVG_필드명
Min: Numeric 필드, Dissolve 대상 Feature 의 최소값	MIN_필드명
Max: Numeric 필드, Dissolve 대상 Feature 의 최대값	MAX_필드명
Std: Numeric 필드, Dissolve 대상 Feature 의 표준편차	STD_필드명
Var: Numeric 필드, Dissolve 대상 Feature 의 분산	VAR_필드명
Range: Numeric 필드, Dissolve 대상 Feature 의 범위	RNG_필드명
Count: Dissolve 대상 Feature 의 수	CNT_필드명

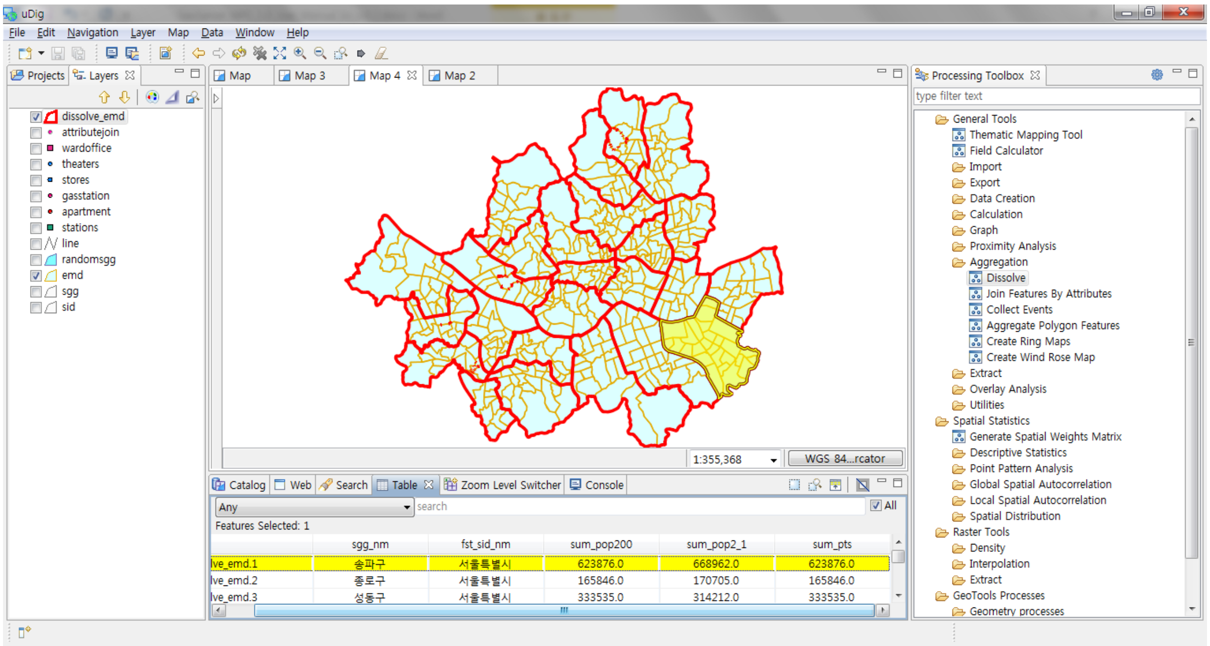
■ Request Examples

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:Dissolve</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:emd"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>dissolveField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>sgg_nm</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>statisticsFields</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>fst.sid_nm,sum.pop2007,sum.pop2008,sum.pts</wps:LiteralData>
```

```
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

읍면동 경계를 시군구이름(sgg_nm) 필드와 fst.sid_nm, sum.pop2007, sum.pop2008, sum.pts 집계필드를 설정하고 Dissolve 를 수행한 결과입니다.



4.2.7.2. Remove Polygon Holes

폴리곤 피처 레이어의 모든 Holes(Interior Rings) 또는 설정한 크기보다 작은 Holes 을 제거합니다.

■ **Syntax**

RemoveHoles (SimpleFeatureCollection inputFeatures, Expression minimumArea): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The polygon features to be removed.	Complex	✓
minimumArea	Remove holes smaller than this area expression. Ex) 10.0 or filter expression.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- minimumArea 는 숫자 또는 필드값 등을 조합하여 숫자를 반환하는 Expression 이 가능하다.
- minimumArea 파라미터의 값이 0 이면 폴리곤의 모든 Hole(Interior Ring)이 삭제되고, 0 보다 크면 해당 값보다 면적이 작은 Hole 만 삭제된다.

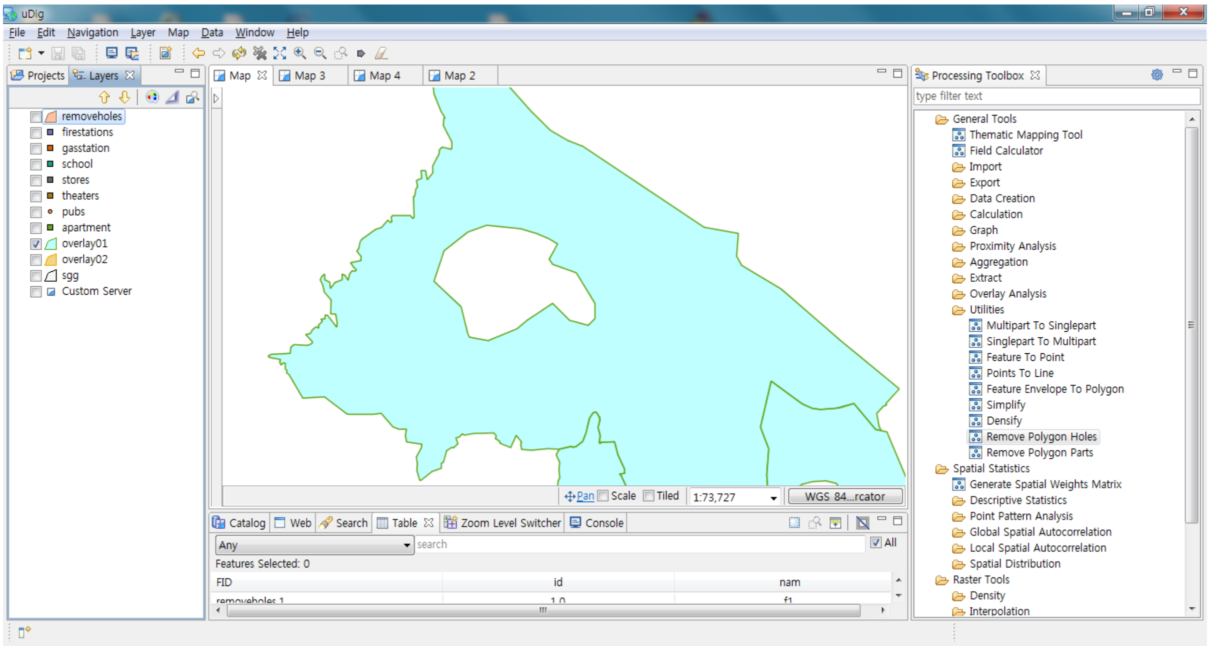
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
```

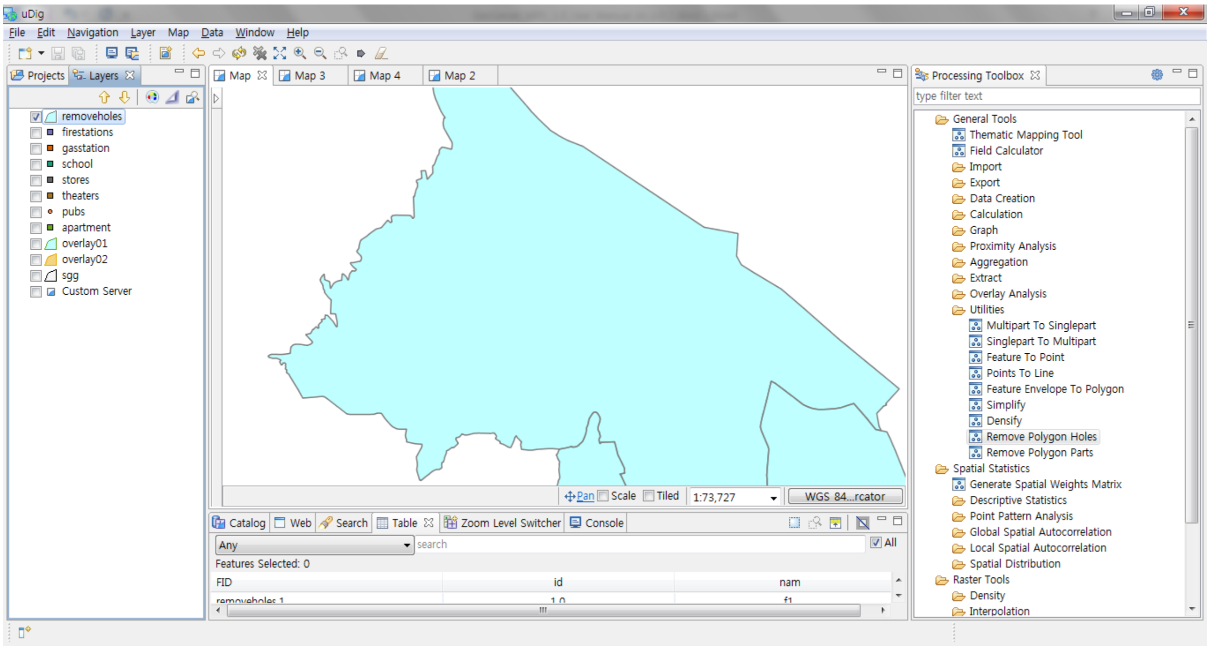
```
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RemoveHoles</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:overlay01"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>minimumArea</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>1000</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

Interior Ring(Hole)을 가진 폴리곤에서 Hole 을 제거한 예입니다.


uDig
File Edit Navigation Layer Map Data Window Help
Projects Layers
removeholes
firestations
gasstation
school
stores
theaters
pubs
apartment
overlay01
overlay02
sgg
Custom Server
Map Map 3 Map 4 Map 2
Pan Scale Tiled 1:73,727 WGS 84...rcator
Catalog Web Search Table Zoom Level Switcher Console
Any
search
All
Features Selected: 0
FID id nam
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Calculation
Graph
Proximity Analysis
Aggregation
Extract
Overlay Analysis
Utilities
Multipart To Singlepart
Singlepart To Multipart
Feature To Point
Points To Line
Feature Envelope To Polygon
Simplify
Densify
Remove Polygon Holes
Remove Polygon Parts
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Interpolation

⇩


uDig
File Edit Navigation Layer Map Data Window Help
Projects Layers
removeholes
firestations
gasstation
school
stores
theaters
pubs
apartment
overlay01
overlay02
sgg
Custom Server
Map Map 3 Map 4 Map 2
Pan Scale Tiled 1:73,727 WGS 84...rcator
Catalog Web Search Table Zoom Level Switcher Console
Any
search
All
Features Selected: 0
FID id nam
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Calculation
Graph
Proximity Analysis
Aggregation
Extract
Overlay Analysis
Utilities
Multipart To Singlepart
Singlepart To Multipart
Feature To Point
Points To Line
Feature Envelope To Polygon
Simplify
Densify
Remove Polygon Holes
Remove Polygon Parts
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Interpolation

4.2.7.3. Remove Polygon Part

Multipart Geometry 로 구성된 폴리곤 피처 레이어에서 설정한 크기보다 작은 Part 또는 가장 큰 면적의 Part 만 남기고 모두 제거합니다.

■ **Syntax**

RemoveParts (SimpleFeatureCollection inputFeatures, Expression minimumArea): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The polygon features to be removed.	Complex	✓
minimumArea	Remove polygon parts smaller than this area expression. ex) 10.0 or filter expression.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- minimumArea 는 숫자 또는 필드값 등을 조합하여 숫자를 반환하는 Expression 이 가능하다.
- minimumArea 파라미터의 값이 0 이면 MultiPolygon 을 구성하는 Exterior Ring 중 가장 큰 Ring 만 남기고 모두 삭제되고, 0 보다 크면 해당 값보다 면적이 작은 Ring 만 삭제된다.

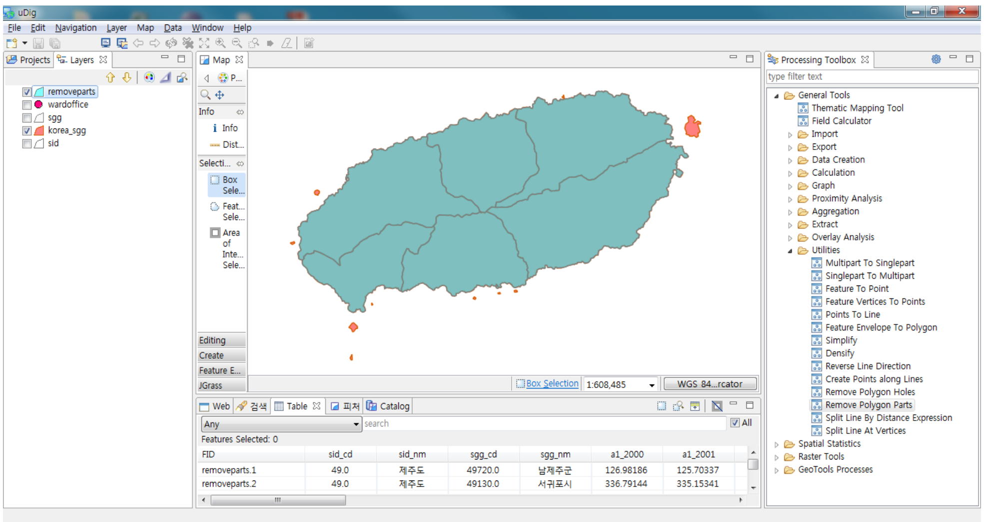
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
```

```
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RemoveParts</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

MultiPolygon 에서 특정 면적 이하의 Polygon 을 제거한 예입니다. 그림에서와 같이 면적이 작은 섬들이 모두 제거되었습니다.



4.2.7.4. Simplify

Douglas-Peucker 단순화 알고리즘을 사용하여 폴리곤 또는 라인 피처를 단순화합니다.

■ **Syntax**

Simplify (SimpleFeatureCollection inputFeatures, Expression tolerance, Boolean preserveTopology): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input line or polygon features to be simplified.	Complex	✓
tolerance	Distance tolerance to simplify ex) 10.0 or filter expression.	Literal	✓
preserveTopology	If True, ensures that simplified features are topologically valid. Default is True	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- tolerance 파라미터는 수 또는 수식을 사용할 수 있으며, Douglas–Peucker 알고리즘을 사용한다.

- preserveTopology 파라미터 값이 True 이면, Tolerance 값에 상관없이 최소한의 토폴로지 규칙은 유지된다.

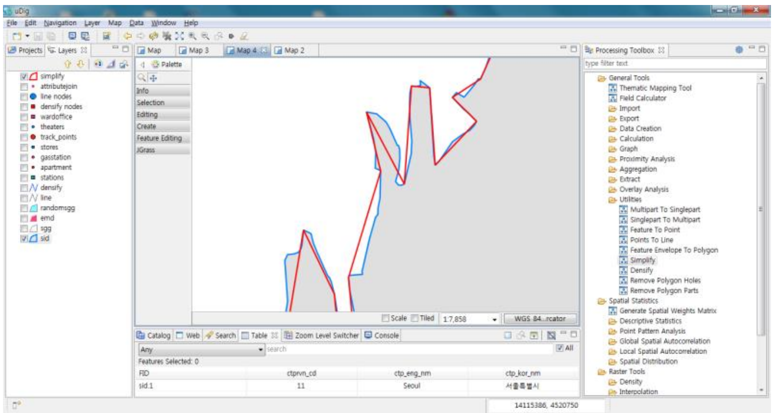
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
```

```
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:Simplify</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service=”WFS” version=”1.1.0” outputFormat=”GML3”
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:road"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>tolerance</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>5</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType=”text/xml; subtype=wfs-collection/1.1”>
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

파란선은 원본, 빨간 선은 Simplify 결과 입니다.



4.2.7.5. Densify

폴리곤 또는 라인 피처의 라인 세그먼트마다 설정한 Tolerance 간격의 버텍스를 추가합니다.

■ **Syntax**

Densify (SimpleFeatureCollection inputFeatures, Expression tolerance): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input line or polygon features to be calculated.	Complex	✓
tolerance	Distance tolerance to densify ex) 10.0 or filter expression.	Literal	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- tolerance 파라미터는 수 또는 수식을 사용할 수 있다.

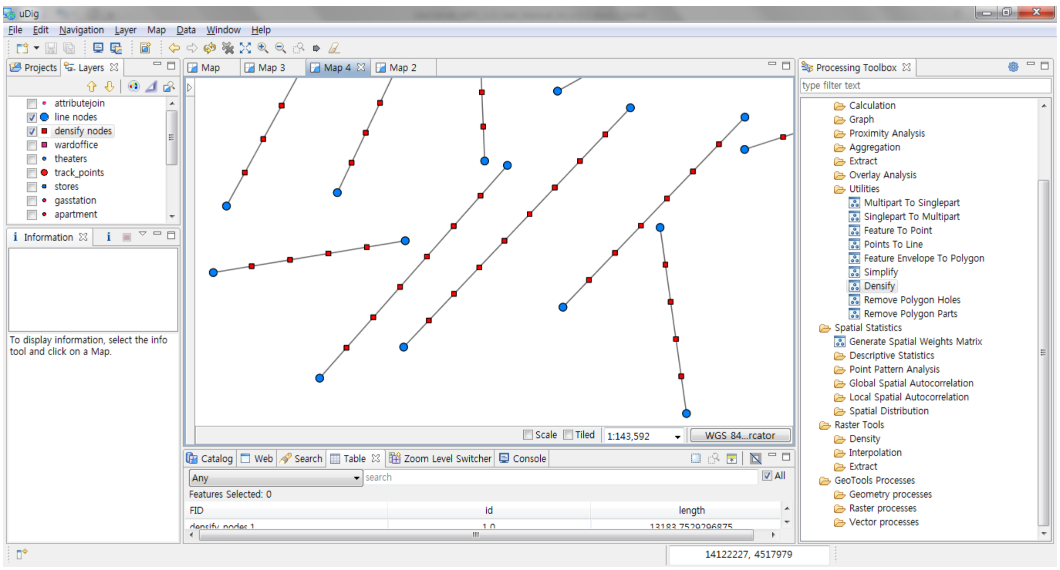
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:Densify</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
```

```
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:line"/>
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>tolerance</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>250</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

시작점, 종점으로 구성된 원본 라인에서 250m 간격의 Densify 를 수행한 결과입니다. 파란색은 원본 버텍스, 빨강색은 추가된 버텍스 입니다.



4.2.8. Feature Tools

Geometry 타입 변환, 포맷 변환 등 변환과 관련된 프로세스들로 구성됩니다.

4.2.8.1. Feature to Point

피처 레이어를 중심점 등의 포인트 피처 레이어로 변환합니다.

■ **Syntax**

FeatureToPoint (SimpleFeatureCollection inputFeatures, Boolean inside, Boolean singlePart): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input features that can be multipoint, line, polygon.	Complex	✓
inside	Centroid(False), Inside(True, Default)	Literal	-
singlePart	Centroid of each part. Default is False	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

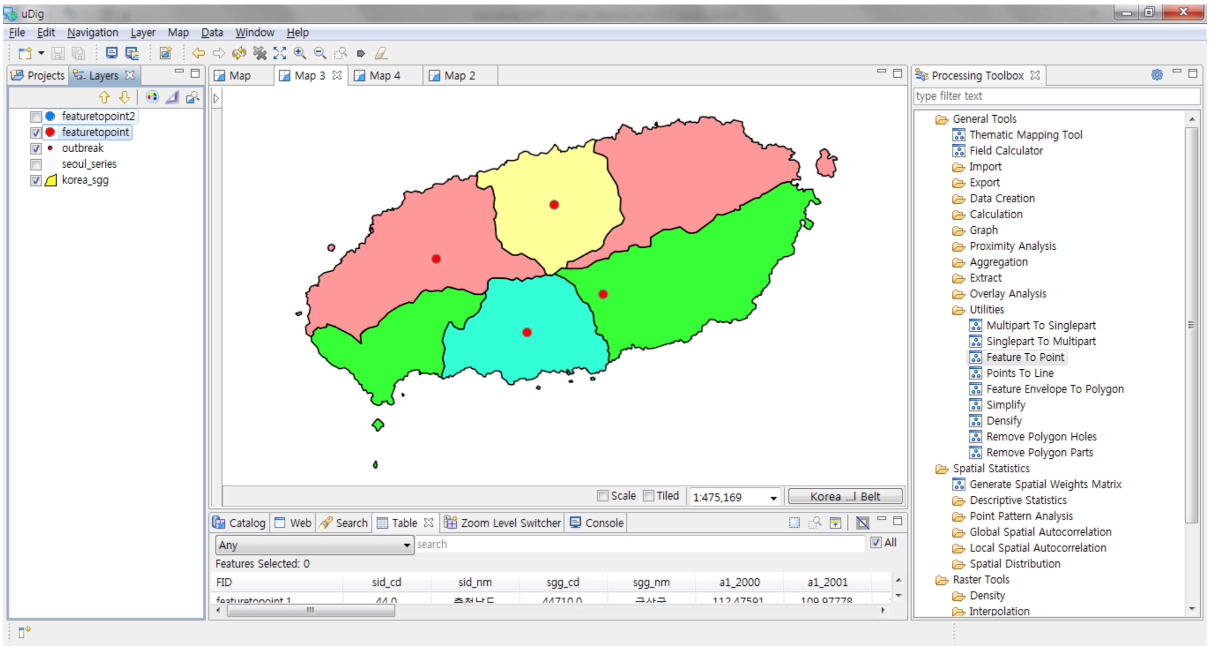
- inputFeatures 는 포인트, 라인, 폴리곤 모두 가능하다.
- inputFeatures 가 폴리곤이고 inside 가 Ture 이면 중심점은 반드시 폴리곤 내에 포함된다.
- singlePart 가 True 이고 Geometry 가 MultiPart 인 경우 모든 Part 의 Geometry 를 중심점으로 변환한다.

■ **Request Examples**

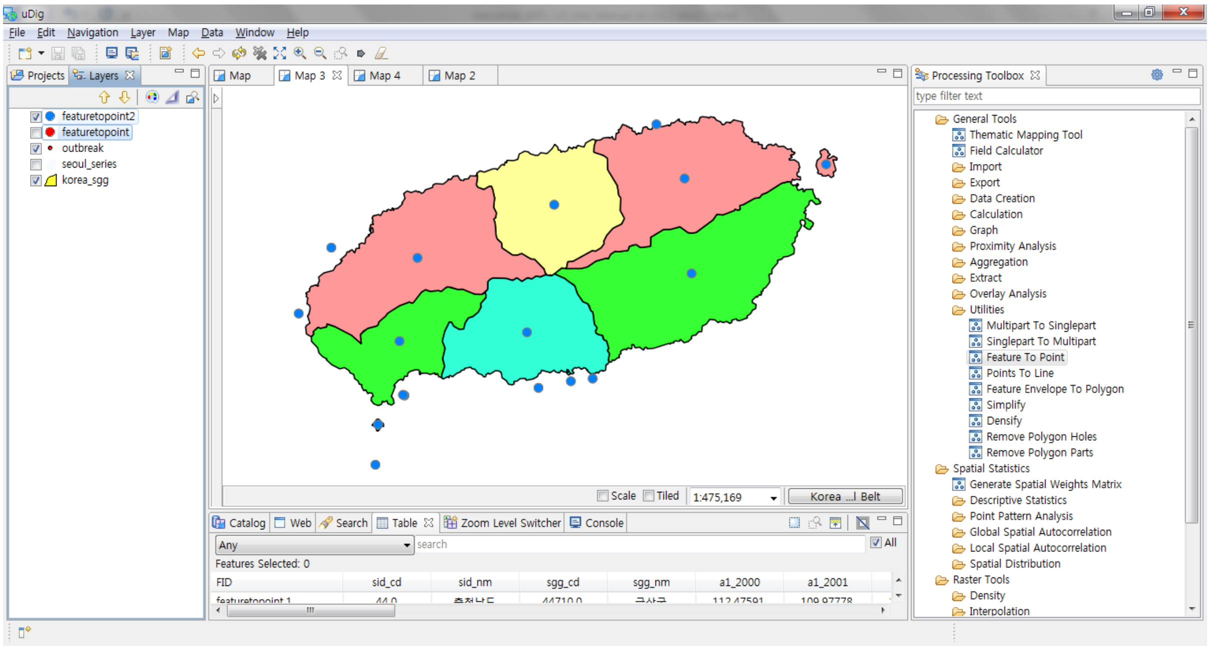
```xml
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:FeatureToPoint</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inside</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>True</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>singlePart</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>False</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

inside 파라미터가 True 이고 singlePart 파라미터가 True 인 경우입니다. MultiPolygon 인 경우 하나의 중심점이 변환됩니다.



inside 파라미터가 True 이고 singlePart 파라미터가 False 인 경우입니다. MultiPolygon 인 경우 Polygon 의 수만큼 중심점이 변환됩니다.



4.2.8.2. Multipart to Singlepart

MultiPart 로 구성된 피처 레이어를 SinglePart 피처 레이어로 변환합니다.

■ **Syntax**

MultipartToSinglepart (SimpleFeatureCollection inputFeatures): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features that can be any feature type.	Complex	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- inputFeatures 파라미터는 반드시 Multipart(MultiPoint, MultiLineString, MultiPolygon) 피처 타입이어야 한다.

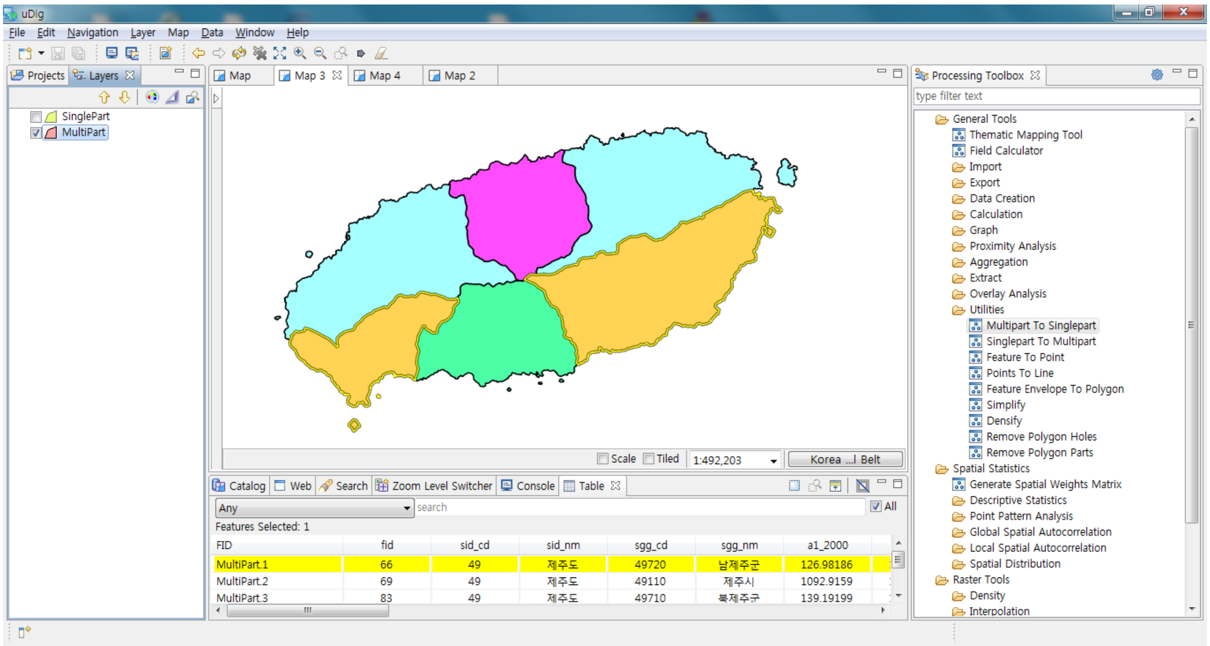
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:MultipartToSinglepart</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
```

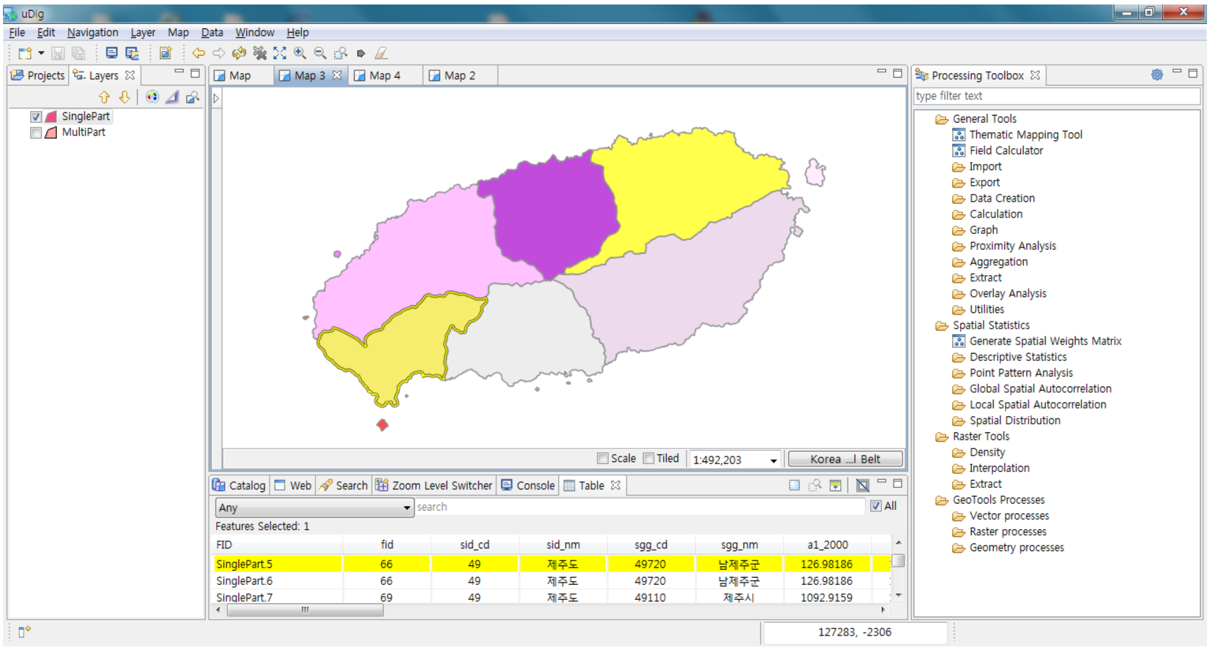
```
                    <wfs:Query typeName="foss:korea_sgg"/>
                </wfs:GetFeature>
            </wps:Body>
        </wps:Reference>
    </wps:Input>
</wps:DataInputs>
<wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
</wps:ResponseForm>
</wps:Execute>
```

■ Response

2 개 이상의 Polygon 으로 구성된 MultiPolygon 을 Single Polygon 으로 변환한 결과입니다.



⇩


uDig
File Edit Navigation Layer Map Data Window Help
Projects Layers
SinglePart
MultiPart
Map Map 3 Map 4 Map 2
Scale Tiled 1:492,203 Korea ...l Belt
Catalog Web Search Zoom Level Switcher Console Table
Any
search
All
Features Selected: 1
FID fid sid_cd sid_nm sgg_cd sgg_nm a1_2000
SinglePart.5 66 49 제주도 49720 남제주군 126.98186
SinglePart.6 66 49 제주도 49720 남제주군 126.98186
SinglePart.7 69 49 제주도 49110 제주시 1092.9159
127283, -2306
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Calculation
Graph
Proximity Analysis
Aggregation
Extract
Overlay Analysis
Utilities
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Interpolation
Extract
GeoTools Processes
Vector processes
Raster processes
Geometry processes

4.2.8.3. Singlepart to Multipart

SinglePart 로 구성된 피처 레이어를 속성값에 기반하여 MultiPart 피처 레이어로 변환합니다.

- **Syntax**

SinglepartToMultipart (SimpleFeatureCollection inputFeatures, String caseField, Boolean dissolve): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features that can be point, line, polygon.	Complex	✓
caseField	The field on which to aggregate features.	Literal	✓
dissolve	If true, neighborhood features are dissolved. Default is False	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

- Dissolve 파라미터가 True 인 경우 인접한 폴리곤 또는 라인을 Dissolve 한 Geometry 를 반환한다.

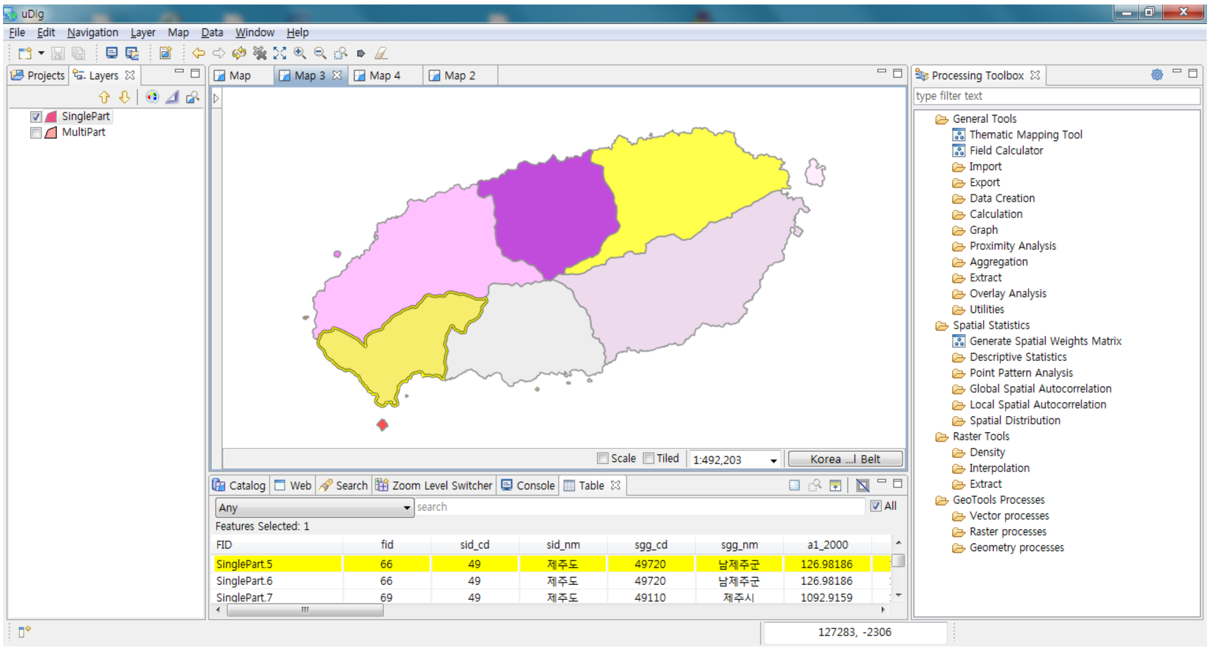
- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:SinglepartToMultipart</ows:Identifier>
  <wps:DataInputs>
```

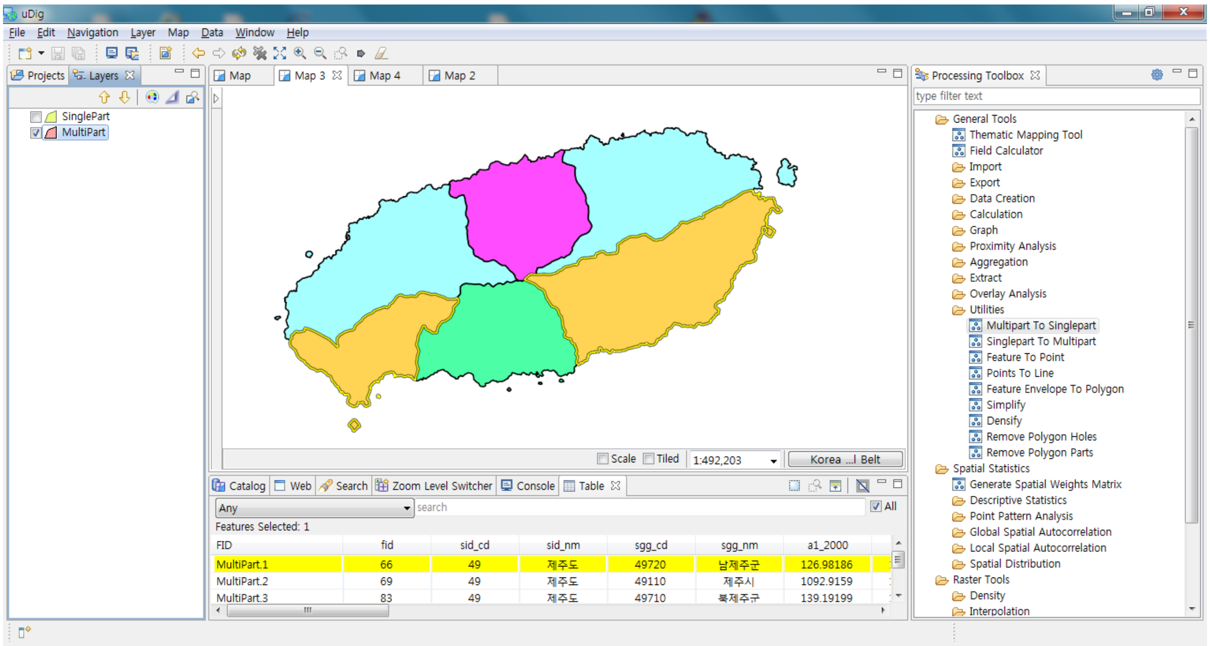
```
      <wps:Input>
        <ows:Identifier>inputFeatures</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:emd"/>
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>caseField</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>sgg_nm</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

Single Polygon 으로 구성된 레이어를 시군구 이름을 기준으로 다시 MultiPolygon 으로 변환한 예입니다.



⇩



4.2.8.4. Feature Envelope to Polygon

피처 레이어의 각 피처별 최소경계영역을 폴리곤 피처 레이어로 변환합니다.

- **Syntax**

FeatureEnvelopeToPolygon (SimpleFeatureCollection inputFeatures, Boolean singleEnvelope): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features that can be multipoint, line, polygon.	Complex	✓
singleEnvelope	Specifies whether to use one envelope for each entire multipart feature or one envelope per part of a multipart feature. Default is True	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

- singleEnvelope 이 False 이고 각 피처의 Geometry 가 MultiLineString, MultiPolygon 인 경우 Single Part 로 변환 후 각각의 Geometry 에 대한 Envelope 폴리곤을 반환한다.

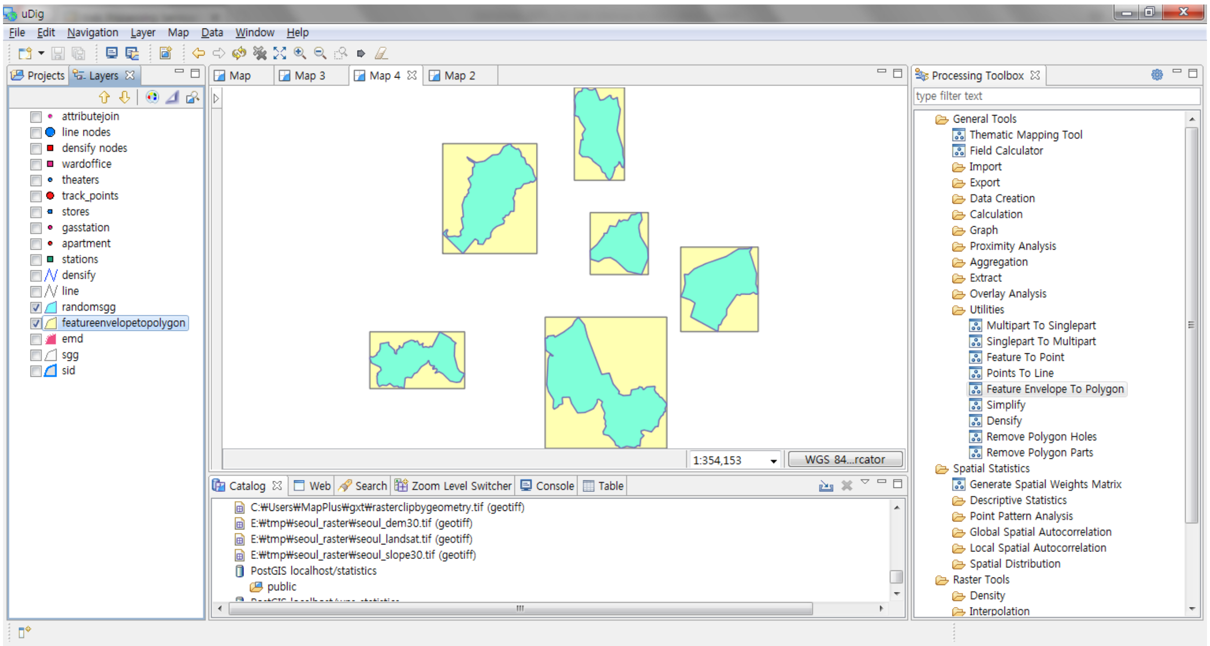
- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:FeatureEnvelopeToPolygon</ows:Identifier>
  <wps:DataInputs>
```

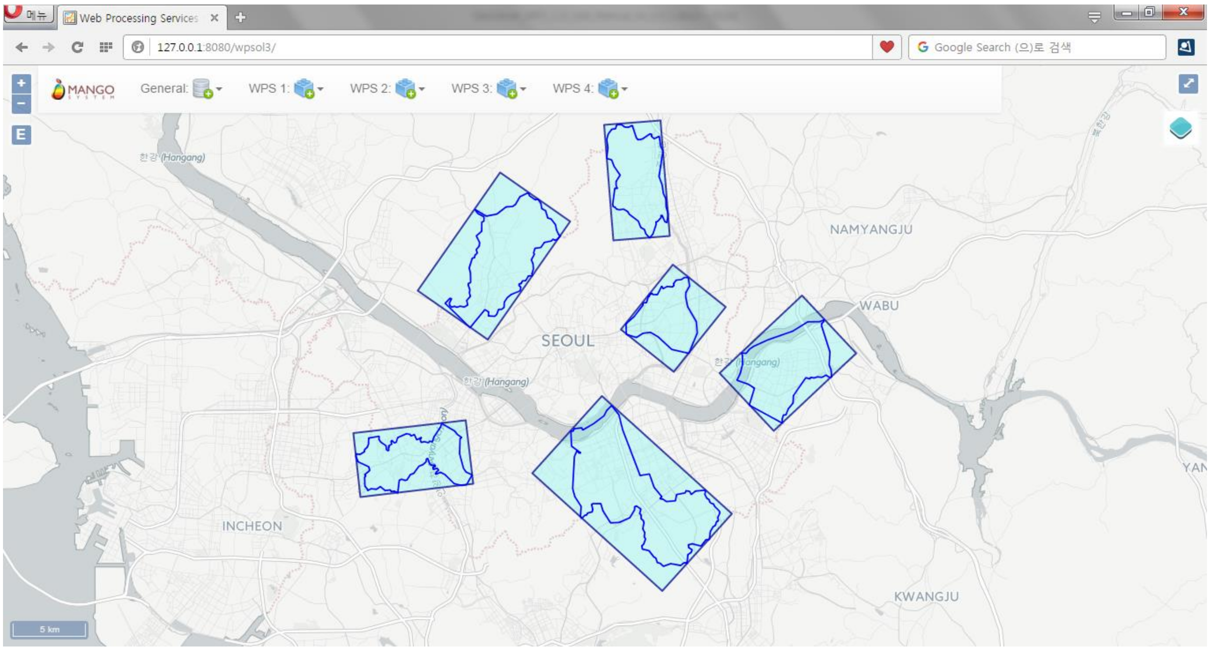
```
      <wps:Input>
        <ows:Identifier>inputFeatures</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:korea_sgg"/>
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>singleEnvelope</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>False</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

- **Response**

폴리곤 피처 Geometry 의 Envelope 을 Polygon 으로 변환한 결과입니다.



[Calculate Field] 기능을 이용하면 다음과 같이 폴리곤을 둘러싸는 최소경계 Envelope 을 얻을 수 있습니다.



4.2.8.5. Points to Line

포인트 피처 레이어에서 라인필드와 정렬 필드값을 설정하여 라인 또는 폴리곤 레이어로 변환합니다.

■ **Syntax**

PointsToLine (SimpleFeatureCollection inputFeatures, String lineField, String sortField, Boolean closeLine): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The point features to be converted into lines.	Complex	✓
lineField	Each feature in the output will be based on unique values in the Line Field.	Literal	-
sortField	By default, points used to create each output line feature will be used in the order they are found. If a different order is desired, specify a Sort Field.	Literal	-
closeLine	Specifies whether output line features should be closed. Default is False.	Literal	

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- lineField 파라미터를 설정하면 lineField 의 고유값에 따른 각각의 라인을 생성한다.
- sortField 파라미터를 설정하면 sortField 로 정렬한 포인트를 이용하여 라인을 생성한다.
- closeLine 파라미터가 True 인 경우 시작점과 끝점을 연결하여 폴리곤을 생성한다.

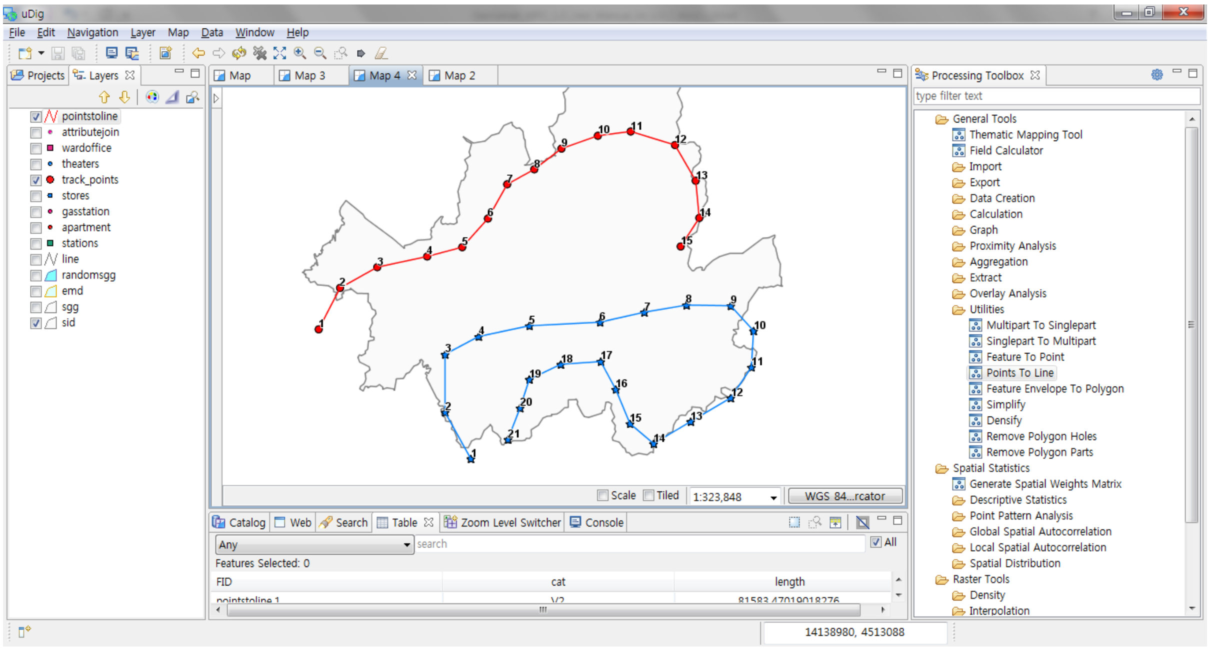
■ **Request Examples**

```xml
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:PointsToLine</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:track_points"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>lineField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>cat</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>sortField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>id</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>closeLine</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>False</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
```

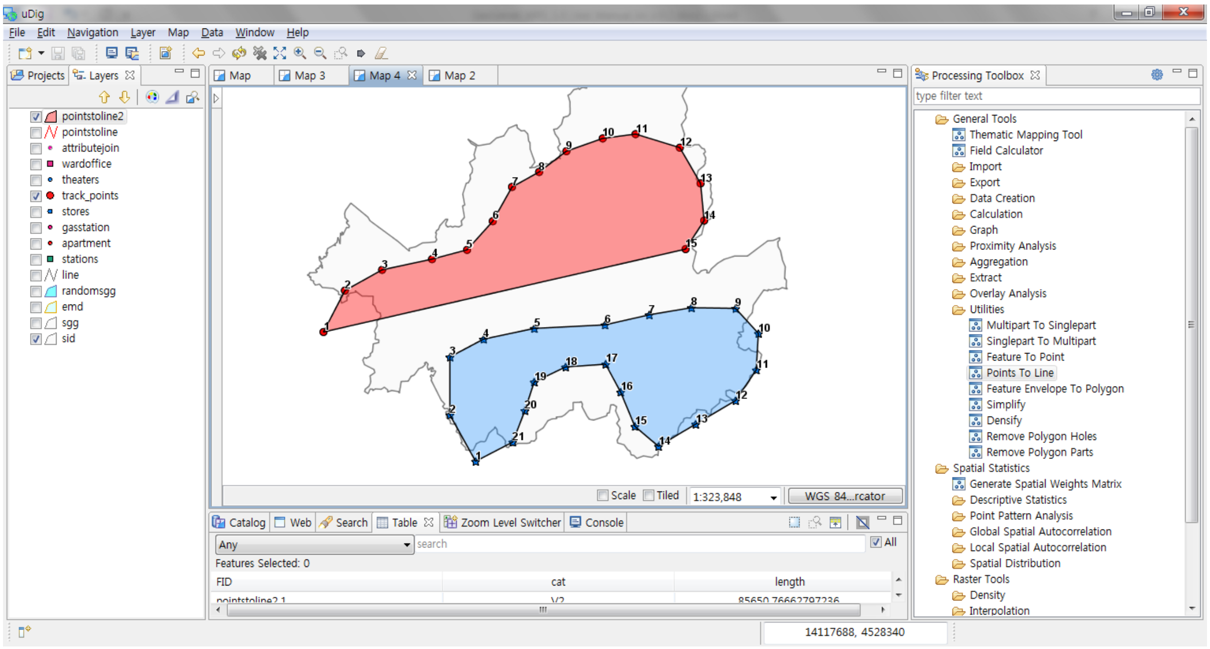
```
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

카테고리와 일련번호를 포함한 포인트를 Line 을 변환한 결과입니다. 일련번호 순서에 따라 라인이 생성되며 2 개의 카테고리로 구성됩니다.



위 예에서 closeLine 을 True 로 설정하면 폴리곤이 생성됩니다.



4.2.8.6. Ring Maps

피처 레이어의 콤마로 구분된 속성필드나 Ring 개수를 설정하여 Ring Map 을 생성합니다.

- **Syntax**

RingMap (SimpleFeatureCollection inputFeatures, String fields, String targetField, Integer ringGap): [SimpleFeatureCollection, SimpleFeatureCollection]

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features that can be point, line, polygon.	Complex	✓
fields	Comma separated field or ring count.	Literal	✓
targetField	Output ring value field. ring_val is default.	Literal	-
ringGap	Gap of rings.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
anchor	Anchor features.	Complex	✓
ringmap	Ring map features.	Complex	✓

- **Constraints**

- fields 파라미터는 콤마로 분리된 연도별 시계열 필드와 같은 연속적인 필드 또는 Ring 의 개수를 사용한다.
- targetField 가 Null 인 경우 ring_val 필드가 기본값이다.
- ringGap 파라미터는 1 ~ 9 까지 가능하며 1 이 기본값이다.
- Output 은 지시선을 표시하는 anchor 라인과 Ring Map 을 생성한 ringmap 폴리곤 2 개의 레이어를 반환한다.

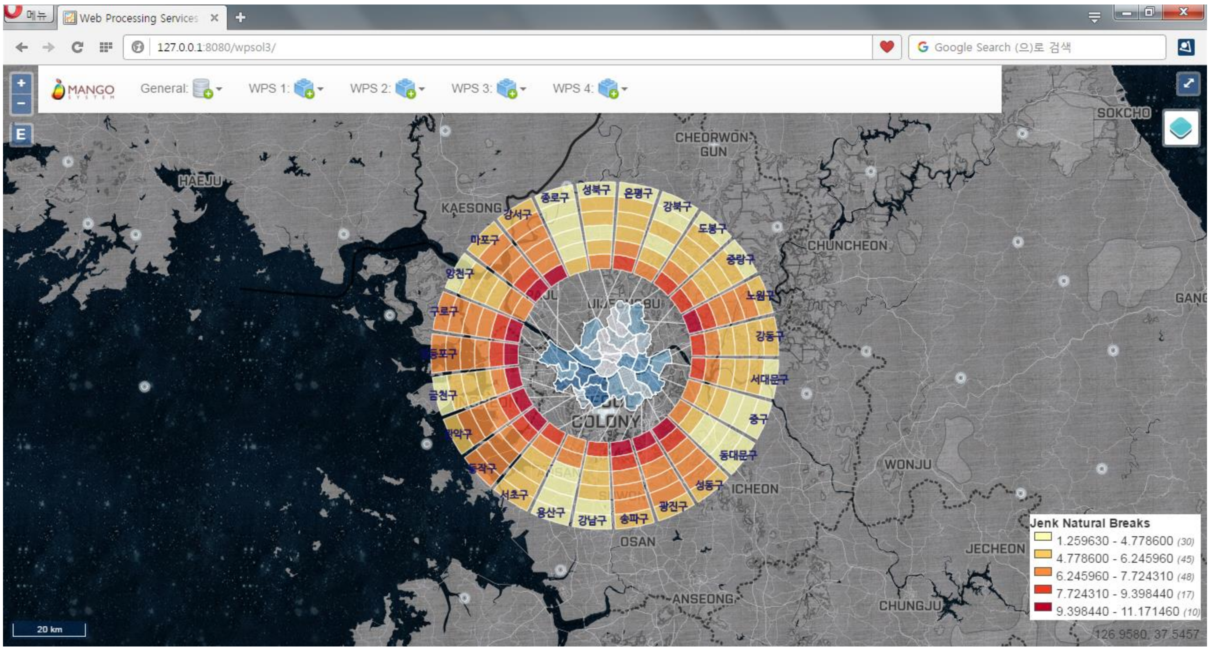
- **Request Examples**

```xml
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RingMap</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:seoul_series"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>fields</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a3_2000,a3_2001,a3_2002,a3_2003,a3_2004,a3_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>targetField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>ring_val</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:ResponseDocument>
      <wps:Output mimeType="text/xml; subtype=wfs-collection/1.0">
        <ows:Identifier>anchor</ows:Identifier>
      </wps:Output>
      <wps:Output mimeType="text/xml; subtype=wfs-collection/1.0">
        <ows:Identifier>ringmap</ows:Identifier>
      </wps:Output>
    </wps:ResponseDocument>
  </wps:ResponseForm>
```

```
</wps:Execute>
```

■ Response

서울시의 2000 년부터 2005 년까지의 인구자연증가율 속성을 이용하여 Ring Map 을 생성한 결과입니다.



4.2.8.7. Wind Rose Maps

포인트 피처 레이어와 중심점을 설정하여 Wind Rose Map 을 생성합니다.

■ **Syntax**

WindRoseMap (SimpleFeatureCollection inputFeatures, String weightField, Geometry center): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features that can be point, line, polygon.	Complex	✓
weightField	Weight field.	Literal	-
center	Center(geometry) of wind rose.	Complex	-

■ **Process Outputs**

Identifier	Description	Type	Required
anchor	anchor features.	Complex	✓
windRose	Wind rose features.	Complex	✓

■ **Constraints**

- weightField 파라미터는 Numeric 필드이어야 하며, 설정되면 이 필드 값의 합이 결과에 반영되고 그렇지 않으면 피처의 개수가 반영된다.
- Output 은 지시선을 표시하는 anchor 라인과 windRose 폴리곤 레이어를 반환한다.

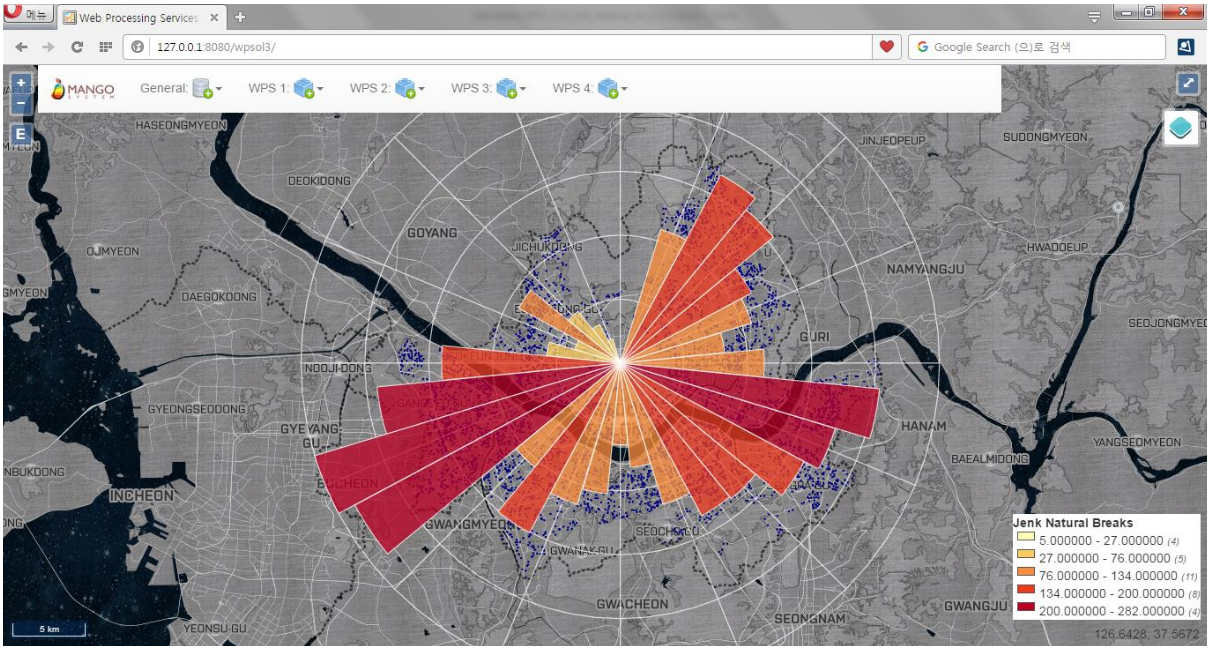
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:WindRoseMap</ows:Identifier>
```

```
    <wps:DataInputs>
      <wps:Input>
        <ows:Identifier>inputFeatures</ows:Identifier>
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:apartment"/>
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>center</ows:Identifier>
        <wps:Data>
          <wps:ComplexData mimeType="application/wkt"><![CDATA[POINT(14135161.941
4518394.452)]]></wps:ComplexData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:ResponseDocument>
        <wps:Output mimeType="text/xml; subtype=wfs-collection/1.0">
          <ows:Identifier>anchor</ows:Identifier>
        </wps:Output>
        <wps:Output mimeType="text/xml; subtype=wfs-collection/1.0">
          <ows:Identifier>windRose</ows:Identifier>
        </wps:Output>
      </wps:ResponseDocument>
    </wps:ResponseForm>
</wps:Execute>
```

- **Response**

서울시청을 중심으로 아파트의 분포를 Wind Rose Map 으로 생성한 결과입니다.


Jenk Natural Breaks
5.000000 - 27.000000 (4)
27.000000 - 76.000000 (5)
76.000000 - 134.000000 (11)
134.000000 - 200.000000 (8)
200.000000 - 282.000000 (4)

4.2.8.8. Hub Lines by ID

Hub 피처 레이어와 Spoke 피처 레이어의 조인 필드를 이용하여 최단거리 Hub 라인 피처 레이어를 생성합니다.

■ **Syntax**

HubLinesByID (SimpleFeatureCollection hubFeatures, String hubIdField, SimpleFeatureCollection spokeFeatures, String spokeIdField, Boolean preserveAttributes, Boolean useCentroid, Double maximumDistance): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
hubFeatures	Hub Features.	Complex	✓
hubIdField	Hub id field.	Literal	✓
spokeFeatures	Spoke Features.	Complex	✓
spokeIdField	Spoke id field.	Literal	✓
preserveAttributes	Preserve spoke feature's attributes. Default is True	Literal	-
useCentroid	Use centroid of feature. Default is True	Literal	-
maximumDistance	Maximum distance.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- useCentroid 파라미터가 True 이고 hubFeatures, spokeFeatures 의 Geometry 피처 타입이 라인 또는 폴리곤인 경우 Geometry 의 Centroid 를 이용하여 Hub Line 을 생성한다.

- maximumDistance 파라미터가 0 보다 큰 경우 이 거리 내에 있는 피처만을 대상으로 Hub Line 을 생성한다.

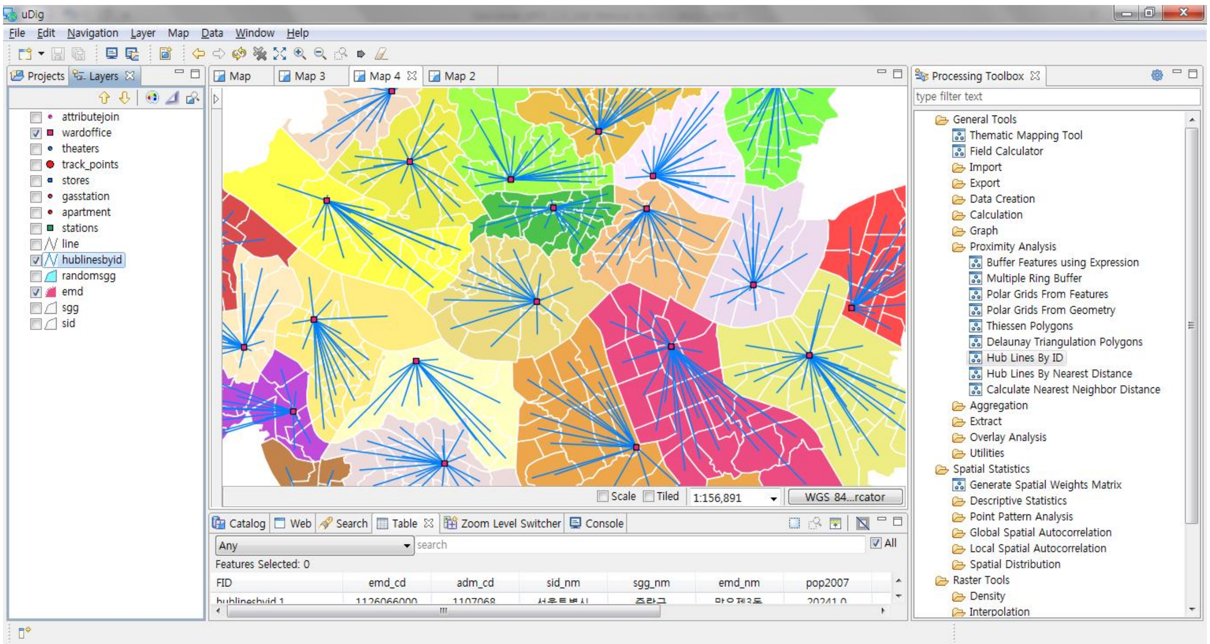
■ Request Examples

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:HubLinesByID</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>hubFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:wardoffice"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>hubIdField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>sgg_nm</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>spokeFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:emd"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>spokeIdField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>sgg_nm</wps:LiteralData>
```

```
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>preserveAttributes</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>True</wps:LiteralData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>useCentroid</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>True</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
  </wps:Execute>
```

■ Response

시군구청을 Hub 로 설정하여 읍면동 폴리곤을 Spoke 레이어로 설정하고 시군구 코드를 기준으로 Hub Line 을 생성한 결과입니다.



4.2.8.9. Hub Lines by Nearest Distance

Hub 피처 레이어와 Spoke 피처 레이어를 이용하여 Spoke 피처에서 가장 가까운 Hub 피처간의 Hub 라인 피처 레이어를 생성합니다.

■ **Syntax**

HubLinesByDistance (SimpleFeatureCollection spokeFeatures, SimpleFeatureCollection hubFeatures, String hubIdField, Boolean preserveAttributes, Boolean useCentroid, Double maximumDistance): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
spokeFeatures	Spoke Features.	Complex	✓
hubFeatures	Hub Features.	Literal	✓
hubIdField	Hub id field.	Literal	-
preserveAttributes	Preserve spoke feature's attributes. Default is True	Literal	-
useCentroid	Use centroid of feature. Default is True	Literal	-
maximumDistance	Maximum distance.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- useCentroid 파라미터가 True 이고 hubFeatures, spokeFeatures 의 Geometry 피처 타입이 라인 또는 폴리곤인 경우 Geometry 의 Centroid 를 이용하여 Hub Line 을 생성한다.

- maximumDistance 파라미터가 0 보다 큰 경우 이 거리 내에 있는 피처만을 대상으로 Hub Line 을 생성한다.

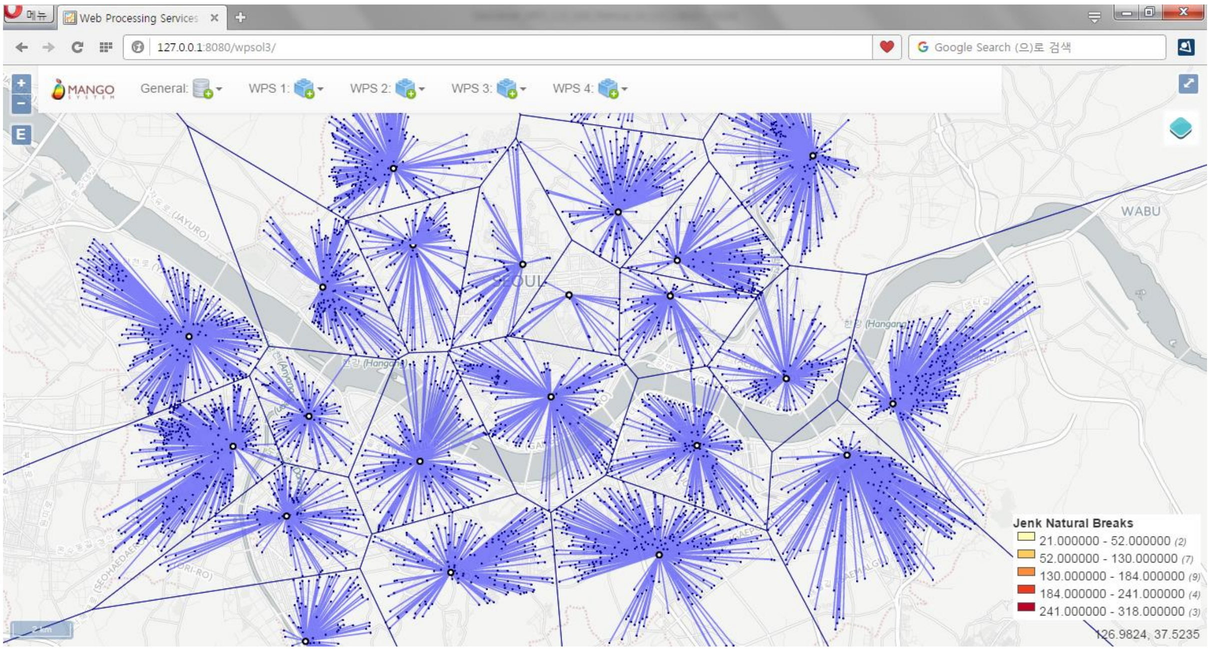
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:HubLinesByDistance</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>spokeFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:wardoffice"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>hubFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:apartment"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>preserveAttributes</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>True</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>useCentroid</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>True</wps:LiteralData>
      </wps:Data>
    </wps:Input>
```

```
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

시군구청을 Hub 로, 아파트 분포를 Spoke 로 설정하고 시군구청에서 가장 가까운 아파트를 연결한 결과입니다. 이는 그림과 같이 Thiessen Polygon 과 같은 영역 내에 위치하게 됩니다.



4.2.8.10. Feature Vertices to Points

폴리곤 또는 라인 데이터를 이용해 설정한 버텍스 위치에 따른 포인트 피처 레이어를 생성합니다

■ **Syntax**

VerticesToPoints (SimpleFeatureCollection inputFeatures, PointLocationType location): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input features that can be line or polygon.	Complex	✓
location	Specifies where an output point will be created. Default is All	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- inputFeatures 파라미터는 라인 또는 폴리곤 레이어 이어야 한다.
- location 파라미터는 다음과 같이 5 개의 옵션을 사용할 수 있다.

옵션	설명
All	라인 또는 폴리곤 지오메트리의 모든 버텍스, 기본값
Mid	라인 또는 폴리곤 지오메트리의 중간점
Start	라인 또는 폴리곤 지오메트리의 시작점
End	라인 또는 폴리곤 지오메트리의 끝점
BothEnds	라인 도는 폴리곤 지오메트리의 시작점과 끝점

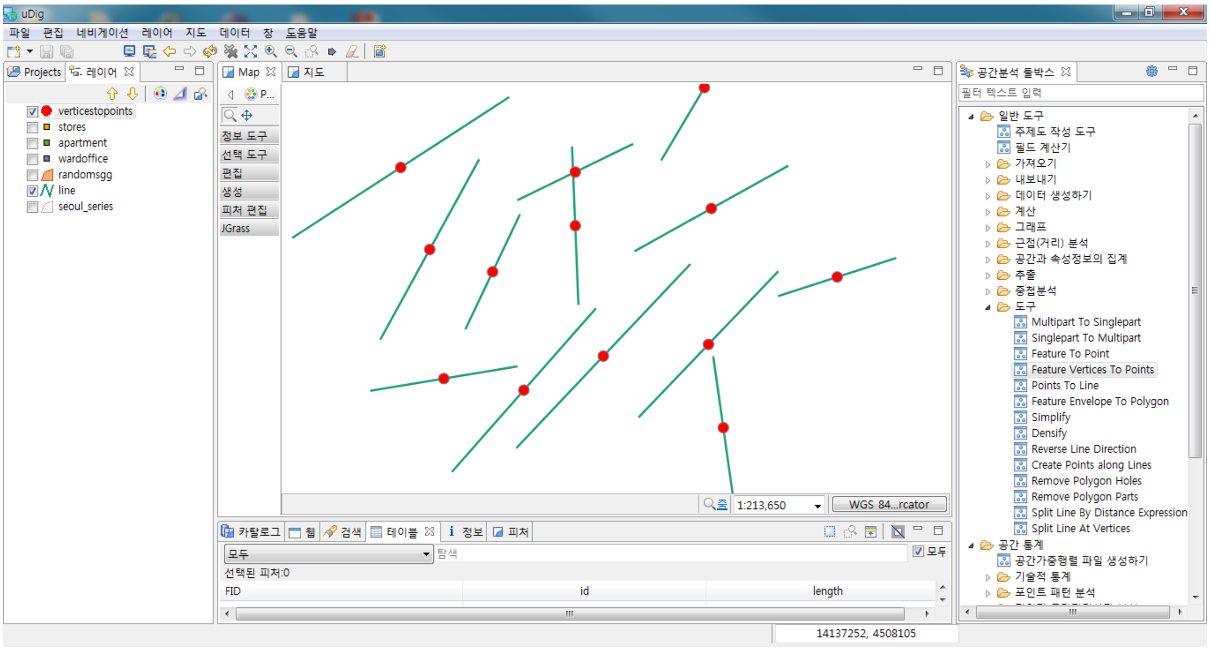
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
```

```xml
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:VerticesToPoints</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:line" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>location</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Mid</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

라인 피처의 Mid(중간점)을 포인트로 변환한 결과입니다.


uDig
파일 편집 네비게이션 레이어 지도 데이터 창 도움말
Projects
레이어
verticestopoints
stores
apartment
wardoffice
randomsgg
line
seoul_series
Map
지도
정보 도구
선택 도구
편집
생성
피처 편집
JGrass
1:213,650
WGS 84...rcator
카탈로그
웹
검색
테이블
정보
피처
모두
탐색
선택된 피처:0
FID
id
length
공간분석 툴박스
필터 텍스트 입력
일반 도구
주제도 작성 도구
필드 계산기
가져오기
내보내기
데이터 생성하기
계산
그래프
근접(거리) 분석
공간과 속성정보의 집계
추출
중첩분석
도구
Multipart To Singlepart
Singlepart To Multipart
Feature To Point
Feature Vertices To Points
Points To Line
Feature Envelope To Polygon
Simplify
Densify
Reverse Line Direction
Create Points along Lines
Remove Polygon Holes
Remove Polygon Parts
Split Line By Distance Expression
Split Line At Vertices
공간 통계
공간가중행렬 파일 생성하기
기술적 통계
포인트 패턴 분석
14137252, 4508105

4.2.8.11. Reverse Line Direction

라인 피처 레이어의 버텍스 순서를 변경합니다.

■ **Syntax**

FlipLine (SimpleFeatureCollection lineFeatures): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
lineFeatures	The input line features.	Complex	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

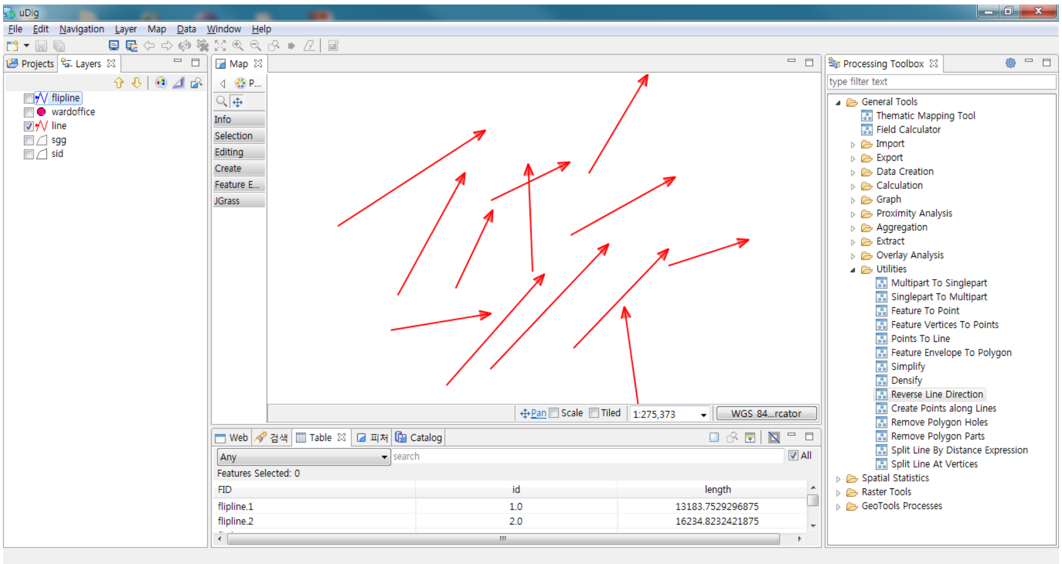
- lineFeatures 파라미터는 라인 레이어 이어야 한다.

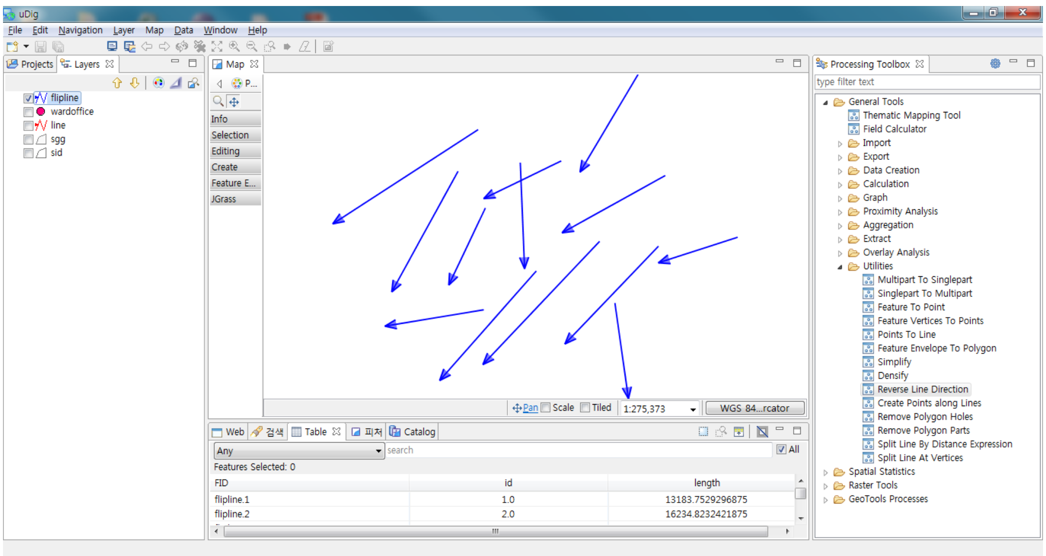
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:FlipLine</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>lineFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:line" />
```

```
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.0">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response





4.2.8.12. Create Points along Line

폴리곤 또는 라인 데이터를 이용하여 일정한 거리 간격의 포인트 피처 레이어를 생성합니다.

■ **Syntax**

PointsAlongLines (SimpleFeatureCollection lineFeatures, Expression distance): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
lineFeatures	The line or polygon features to be converted into points.	Complex	✓
distance	Field or Expression representing distance.	Literal	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output point features.	Complex	✓

■ **Constraints**

- inputFeatures 파라미터는 라인 또는 폴리곤 레이어 이어야 한다.
- distance 파라미터는 필드 또는 Function Expression 수식을 사용할 수 있다.

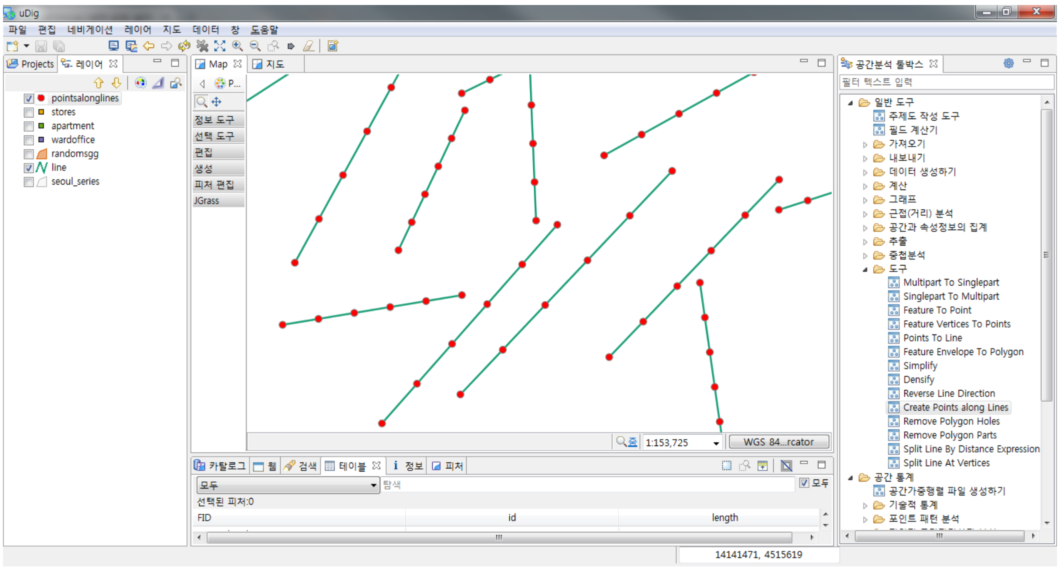
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:PointsAlongLines</ows:Identifier>
  <wps:DataInputs>
```

```
        <wps:Input>
            <ows:Identifier>lineFeatures</ows:Identifier>
            <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
                <wps:Body>
                    <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2"
xmlns:foss="http://www.opengeospatial.net/foss">
                        <wfs:Query typeName="foss:line" />
                    </wfs:GetFeature>
                </wps:Body>
            </wps:Reference>
        </wps:Input>
        <wps:Input>
            <ows:Identifier>distance</ows:Identifier>
            <wps:Data>
                <wps:LiteralData>geomLength( [geom] ) / 5</wps:LiteralData>
            </wps:Data>
        </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
        <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
            <ows:Identifier>result</ows:Identifier>
        </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

다음 예제는 라인 길이의 1/5 간격의 포인트를 생성한 결과입니다.



4.2.8.13. Split Line at Vertices

버텍스를 기준으로 분할한 라인 피처 레이어를 생성합니다.

■ **Syntax**

SplitLineAtVertices (SimpleFeatureCollection lineFeatures): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
lineFeatures	The line or polygon features that will be splitted.	Complex	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output line features.	Complex	✓

■ **Constraints**

- inputFeatures 파라미터는 라인 또는 폴리곤 레이어 이어야 한다.

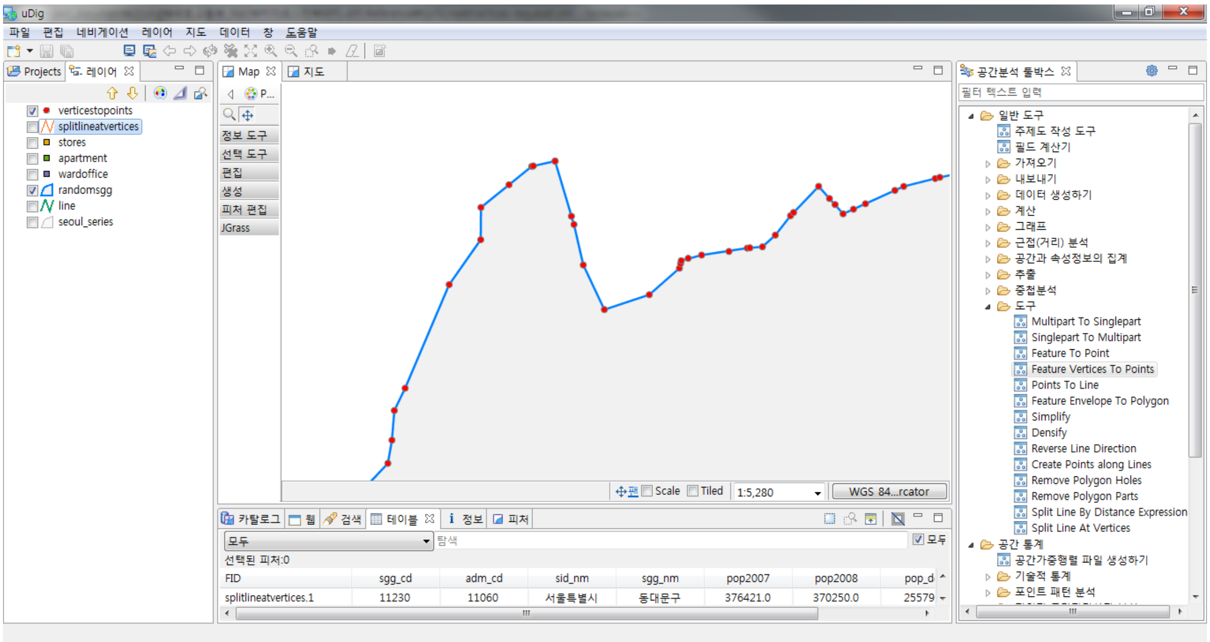
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:SplitLineAtVertices</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>lineFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:randomsgg" />
```

```
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

폴리곤 피처의 boundary 를 버텍스마다 라인 피처로 변환환 결과입니다.



4.2.8.14. Split Line by Distance Expression

설정한 거리 기준으로 분할한 라인 피처 레이어를 생성합니다.

■ **Syntax**

SplitLineByDistance (SimpleFeatureCollection lineFeatures, Expression distance): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
lineFeatures	The line features that will be splitted.	Complex	✓
distance	Field or Expression representing distance.	Literal	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output line features.	Complex	✓

■ **Constraints**

- inputFeatures 파라미터는 라인 또는 폴리곤 레이어 이어야 한다.
- distance 파라미터는 필드 또는 Function Expression 수식을 사용할 수 있다.

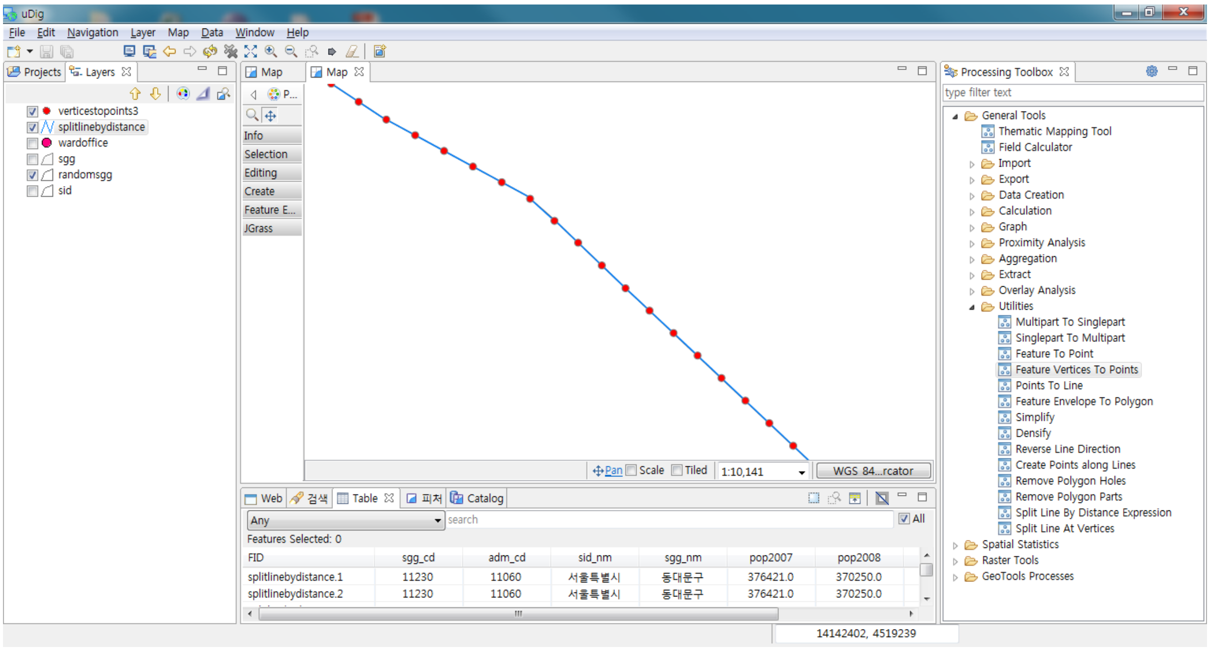
■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:SplitLineByDistance</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>lineFeatures</ows:Identifier>
```

```
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:randomsgg" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>distance</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>100</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

폴리곤 피처의 boundary 를 100 미터 간격의 라인으로 분할한 결과입니다.



4.2.8.15. Create Flow Map from Line Features

Origin-Destination 및 이에 대한 속성값으로 구성된 라인 피처 레이어를 이용하여 폴리곤 Flow Map 피처 레이어를 생성합니다.

- **Syntax**

FlowMap (SimpleFeatureCollection lineFeatures, Expression odValue, Expression doValue, Double maxSize): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
lineFeatures	The input line features.	Complex	✓
odValue	The o-d value expression. ex) [field] or [field] * 0.5 etc...	Literal	✓
doValue	The d-o value expression. ex) [field] or [field] * 0.5 etc...	Literal	-
maxSize	The maximum arrow size.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output polygon features.	Complex	✓

- **Constraints**

- lineFeatures 파라미터는 라인 레이어 이어야 한다.
- maxSize 파라미터가 Null 또는 0 이면 lineFeatures 의 Extent 의 넓이와 높이 중 작은값을 20 으로 나눈 값을 사용한다.

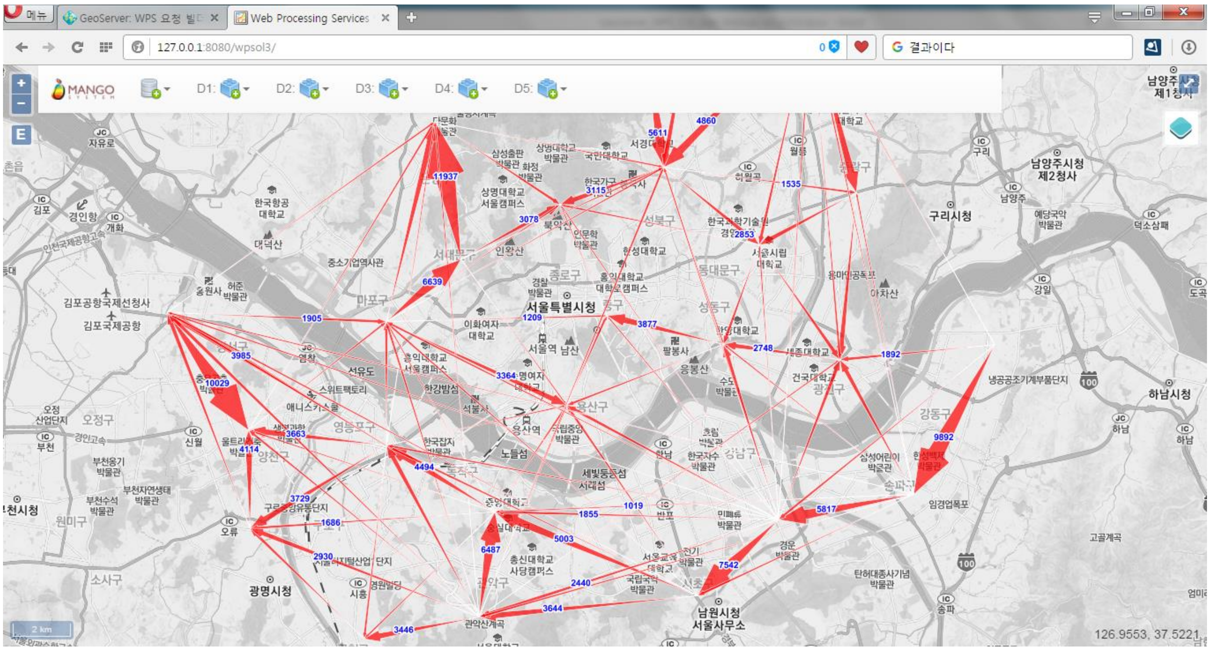
- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
```

```
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:FlowMap</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>lineFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:od_flow"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>odValue</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>o_d</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>maxSize</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>2500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.0">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

서울시 구별 인구이동 데이터를 이용하여 Flow Map 을 생성한 결과입니다.



4.3. Raster Analysis

래스터 분석 및 처리와 관련된 프로세스 그룹입니다.

4.3.1. Descriptive

래스터의 속성값에 대한 기초통계를 계산하는 프로세스들로 구성됩니다.

4.3.1.1. Basic Statistics

래스터 레이어와 특정 영역을 설정하여 영역 내 포함되는 래스터 셀값에 대한 기초통계(Sum, Minimum, Maximum, Mean, Standard Deviation 등)를 분석합니다.

- **Syntax**

StatisticsGridCoverage (GridCoverage2D inputCoverage, Geometry cropShape, Integer bandIndex): DataStatisticsResult

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputCoverage	The input gridcoverage to be calculated.	Complex	✓
cropShape	The Polygon or MultiPolygon to crop gridcoverage.	Complex	-
bandIndex	The zero-based band index, default index is a 0.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Result Statistics.	Complex	✓

- **Constraints**

- cropShape 이 Null 이면 입력 래스터의 전체 셀을 대상으로 통계를 작성한다.
- cropShape 의 Geometry 타입은 Polygon 또는 MultiPolygon 이어야 한다.
- bandIndex 는 zero-base 이며, 0 이 기본값이다.
- Output 은 XML 로 반환한다.

Request Examples

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:StatisticsGridCoverage</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputCoverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
          <wcs:GetCoverage service="WCS" version="1.1.1">
            <ows:Identifier>foss:seoul_dem30</ows:Identifier>
            <wcs:DomainSubset>
              <gml:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#5181">
                <ows:LowerCorner>179171.39881047895 436569.3290600816</ows:LowerCorner>
                <ows:UpperCorner>216221.0981287582 466869.08315843146</ows:UpperCorner>
              </gml:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>cropShape</ows:Identifier>
      <wps:Data>
        <wps:ComplexData mimeType="application/wkt"><![CDATA[POLYGON
((.........................................))]]></wps:ComplexData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response


```xml
<?xml version="1.0" encoding="utf-8"?>
<DataStatistics>
  <Item>
    <TypeName>dem</TypeName>
    <PropertyName>Value</PropertyName>
    <Count>678064</Count>
    <InvalidCount>0</InvalidCount>
    <Minimum>1.0</Minimum>
    <Maximum>754.0</Maximum>
    <Range>753.0</Range>
    <Ranges>1.0 - 754.0</Ranges>
    <Sum>4.2785658E7</Sum>
    <Mean>63.09973394841785</Mean>
    <Variance>7285.154424054373</Variance>
    <StandardDeviation>85.35311607700315</StandardDeviation>
    <CoefficientOfVariance>1.3526699834705607</CoefficientOfVariance>
    <NoData class="double">-9999</NoData>
  </Item>
</DataStatistics>
```

4.3.1.2. Histogram

래스터 레이어와 특정 영역을 설정하여 영역 내 포함되는 래스터 셀 고유값과 빈도수를 추출합니다.

■ **Syntax**

HistogramGridCoverage (GridCoverage2D inputCoverage, Geometry cropShape, Integer bandIndex): GridCoverage2D

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputCoverage	The input gridcoverage to be calculated.	Complex	✓
cropShape	The Polygon or MultiPolygon to crop gridcoverage.	Complex	-
bandIndex	The zero-based band index, default index is a 0.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Result Statistics.	Complex	✓

■ **Constraints**

- cropShape 의 Geometry 타입은 Polygon 또는 MultiPolygon 이어야 한다.
- bandIndex 는 zero-base 이며, 0 이 기본값이다.
- Output 은 XML 로 반환한다.

■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
```

```xml
  <ows:Identifier>statistics:HistogramGridCoverage</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputCoverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
          <wcs:GetCoverage service="WCS" version="1.1.1">
            <ows:Identifier>foss:landuse</ows:Identifier>
            <wcs:DomainSubset>
              <gml:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#5181">
                <ows:LowerCorner>179171.39881047895 436569.3290600816</ows:LowerCorner>
                <ows:UpperCorner>216221.0981287582 466869.08315843146</ows:UpperCorner>
              </gml:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>cropShape</ows:Identifier>
      <wps:Data>
        <wps:ComplexData mimeType="application/wkt"><![CDATA[MULTIPOLYGON
(((202045.8134286803 451170.87479061395, 202045.8134286803 456372.83051287895,
206947.46547550958 456372.83051287895, 206947.46547550958 451170.87479061395,
202045.8134286803 451170.87479061395)))]]></wps:ComplexData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

국토환경성평가지도 등 등급을 가진 래스터 레이어 중 특정 영역을 클립하여 통계를 작성한 결과입니다. 각 값(Value)에 대한 셀의 개수(Frequency)가 반환되므로 셀 하나의 면적(CellSize * CellSize)을 곱하면 등급별 면적이 산출됩니다.

```xml
<?xml version="1.0" encoding="utf-8"?>
<Histogram>
  <TypeName>landuse</TypeName>
  <PropertyName>Value</PropertyName>
  <Area>25498176.913556</Area>
  <CellSize>30.0</CellSize>
  <HistogramItem>
    <Value>1</Value>
    <Frequency>876</Frequency>
  </HistogramItem>
  <HistogramItem>
    <Value>2</Value>
    <Frequency>543</Frequency>
  </HistogramItem>
  <HistogramItem>
    <Value>3</Value>
    <Frequency>292</Frequency>
  </HistogramItem>
  <HistogramItem>
    <Value>4</Value>
    <Frequency>1345</Frequency>
  </HistogramItem>
  <HistogramItem>
    <Value>5</Value>
    <Frequency>765</Frequency>
  </HistogramItem>
</Histogram>
```

4.3.2. Conversion

백터 데이터와 래스터 데이터간의 변환 프로세스들로 구성됩니다.

4.3.2.1. Raster to Polygon

래스터 레이어를 폴리곤 레이어로 변환합니다.

■ **Syntax**

RasterToPolygon (GridCoverage2D inputCoverage, Integer bandIndex, Boolean weeding, String valueField): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputCoverage	The input gridcoverage to be converted.	Complex	✓
bandIndex	The zero-based band index, default index is 0.	Literal	-
weeding	Determines if the output polygons will be smoothed into simpler shapes. Default is False.	Literal	-
valueField	The field used to assign values from the cells. Default is value.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output GridCoverage.	Complex	✓

■ **Constraints**

- weeding 이 True 이면 Douglas-Puecker algorithm 을 이용하여 단순화한다. Tolerance 는 sqrt(0.5) * cell size 이다.
- valueField 가 Null 이면 value 이름의 필드를 사용한다.

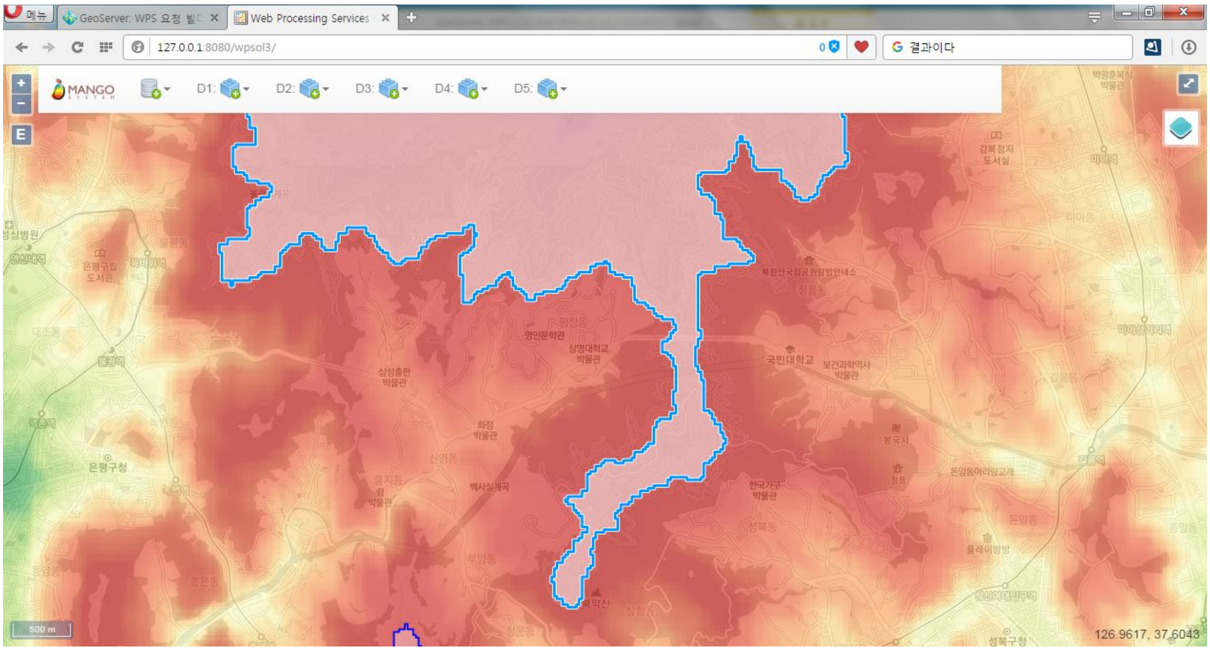
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?>
```

```xml
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RasterToPolygon</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputCoverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
          <wcs:GetCoverage service="WCS" version="1.1.1">
            <ows:Identifier>foss:seoul_dem30</ows:Identifier>
            <wcs:DomainSubset>
              <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#3857">
                <ows:LowerCorner>1.4111343323506365E7 4498971.750719266</ows:LowerCorner>
                <ows:UpperCorner>1.4158021303411832E7 4537343.6431004135</ows:UpperCorner>
              </ows:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>weeding</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>True</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.0">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

DEM 레이어에서 표고 250 미터 이상을 추출 후 폴리곤으로 변환한 결과입니다.


GeoServer: WPS 요청 빌더
Web Processing Services
127.0.0.1:8080/wpsol3/
MANGO
D1:
D2:
D3:
D4:
D5:
126.9617, 37.6043

4.3.2.2. Raster to Image

래스터 레이어를 WMS 파라미터를 이용하여 이미지로 변환합니다.

- **Syntax**

RasterToImage (GridCoverage2D coverage, String bbox, CoordinateReferenceSystem crs, Style style, Integer width, Integer height, String format, Boolean transparent, String bgColor): Image

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
coverage	The input gridcoverage to be converted.	Complex	✓
bbox	Bounding box corners (lower left, upper right): minx, miny, maxx, maxy.	Literal	-
crs	CRS for Bounding Box. Ex) EPSG:3857	Literal	-
style	Styled Layer Descriptor (SLD) style containing a raster symbolizer.	Complex	-
width	Image width in pixels of resulting map.	Literal	✓
height	Image height in pixels of resulting map.	Literal	✓
format	Output format of map. Valid values are image/jpeg, image/png (Default), and image/gif.	Literal	-
transparent	Map background transparency. Default is True.	Literal	-
bgColor	Hexidecimal red-blue-green color value for the map background color. Default is 0xFFFFFF (white).	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output image.	Complex	✓

- **Constraints**

- bbox 와 crs 파라미터가 Null 인 경우 coverage 의 Extent 와 좌표체계를 사용한다.
- style 파라미터가 Null 인 경우 최소/최대값을 이용한 Equal Interval Style 을 적용한다.

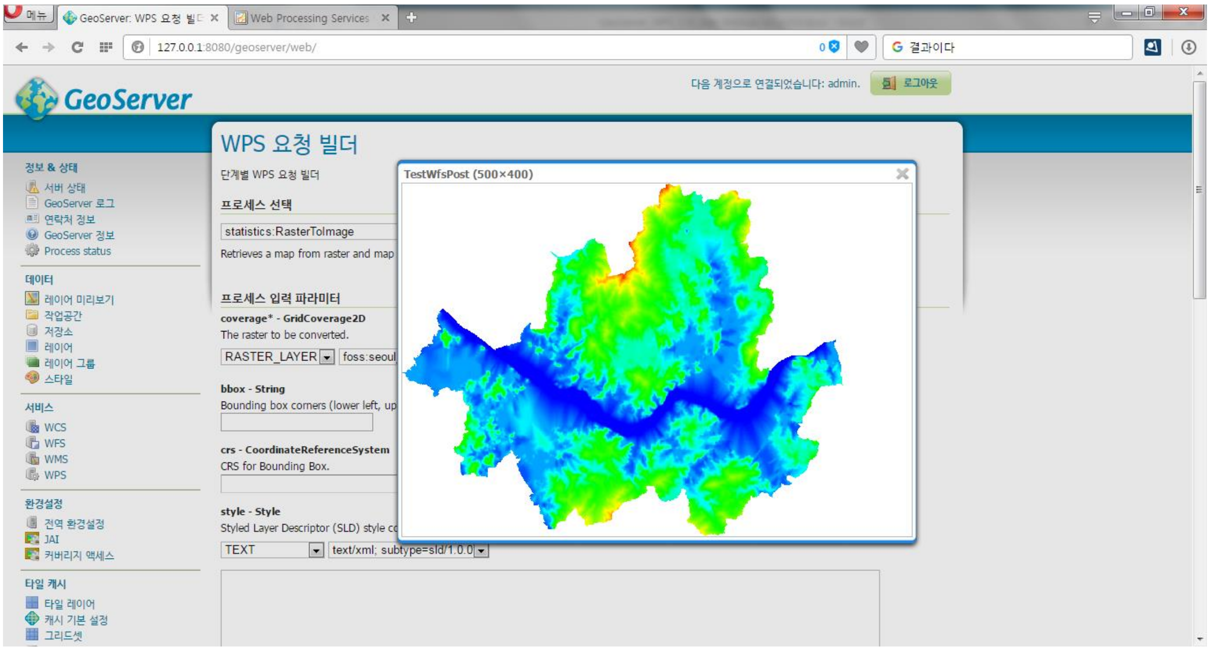
Request Examples

```xml
<?xml version="1.0" encoding="UTF-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RasterToImage</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>coverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
          <wcs:GetCoverage service="WCS" version="1.1.1">
            <ows:Identifier>foss:seoul_dem30</ows:Identifier>
            <wcs:DomainSubset>
              <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#3857">
                <ows:LowerCorner>1.4111343323506365E7 4498971.750719266</ows:LowerCorner>
                <ows:UpperCorner>1.4158021303411832E7 4537343.6431004135</ows:UpperCorner>
              </ows:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>width</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>500</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>height</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>400</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>format</ows:Identifier>
      <wps:Data>
```

```
          <wps:LiteralData>image/png</wps:LiteralData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>transparent</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>True.</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="image/png">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

서울시 DEM 레이어를 가로 500, 세로 400 픽셀의 이미지로 요청한 결과입니다. 요청한 결과는 OpenLayers 등에서 Image Layer 로 추가가 가능합니다.



4.3.3. Classification

래스터의 값을 특정 범위의 값들로 재분류 후 처리하는 프로세스들로 구성됩니다.

4.3.3.1. Reclass

래스터 데이터를 주어진 범위와 각 범위에 할당된 값으로 Reclass 합니다.

■ **Syntax**

RasterReclass (GridCoverage2D inputCoverage, Integer bandIndex, String ranges): GridCoverage2D

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputCoverage	The input raster to be reclassified.	Complex	✓
bandIndex	The zero-based band index, default index is a 0.	Literal	-
ranges	Ranges that defines how the values will be reclassified. ex) 0.0 30.0 1; 30.0 270.0 2; 270.0 365.0 3	Literal	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output GridCoverage.	Complex	✓

■ **Constraints**

- ranges 파라미터 범위 내의 값들은 NoData 값으로 처리한다.

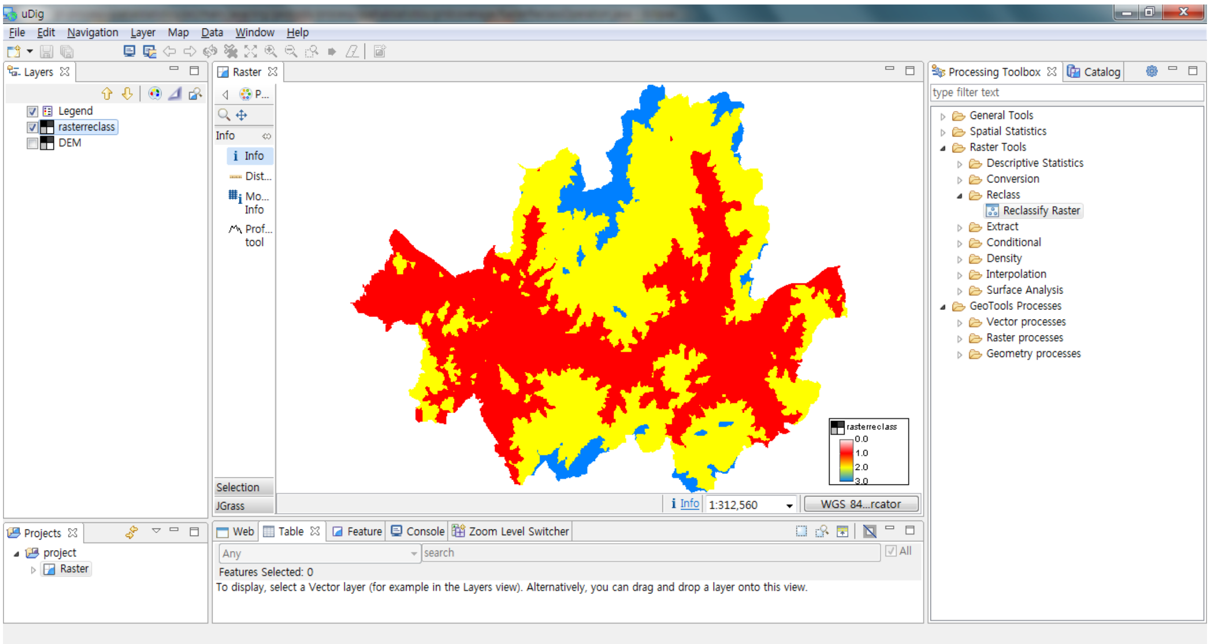
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RasterReclass</ows:Identifier>
```

```
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputCoverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
          <wcs:GetCoverage service="WCS" version="1.1.1">
            <ows:Identifier>foss:seoul_dem30</ows:Identifier>
            <wcs:DomainSubset>
              <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#3857">
                <ows:LowerCorner>1.4111343323506365E7 4498971.750719266</ows:LowerCorner>
                <ows:UpperCorner>1.4158021303411832E7 4537343.6431004135</ows:UpperCorner>
              </ows:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>ranges</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>0.1 30.0 1; 30.0 200.0 2; 200.0 500.0 3</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="image/tiff">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

서울시 DEM 레이어를 0.1 ~ 30.0 은 1 값, 30.0 ~ 200.0 은 2 값, 200.0 ~ 500.0 은 3 값으로 Reclass 한 결과입니다.


uDig
File Edit Navigation Layer Map Data Window Help
Layers
Legend
rasterreclass
DEM
Raster
Info
Info
Dist...
Mo... Info
Prof... tool
Selection
JGrass
rasterreclass
0.0
1.0
2.0
3.0
Info
1:312,560
WGS 84...rcator
Processing Toolbox
Catalog
type filter text
General Tools
Spatial Statistics
Raster Tools
Descriptive Statistics
Conversion
Reclass
Reclassify Raster
Extract
Conditional
Density
Interpolation
Surface Analysis
GeoTools Processes
Vector processes
Raster processes
Geometry processes
Projects
project
Raster
Web
Table
Feature
Console
Zoom Level Switcher
Any
search
All
Features Selected: 0
To display, select a Vector layer (for example in the Layers view). Alternatively, you can drag and drop a layer onto this view.

4.3.4. Extraction

Geometry, Extent 등을 이용하여 래스터를 추출하는 프로세스들로 구성됩니다.

4.3.4.1. Extract by Extent

Envelope 을 설정하여 이와 교차되는 래스터 데이터를 추출합니다.

■ **Syntax**

RasterClipByExtent (GridCoverage2D inputCoverage, ReferencedEnvelope extent):

GridCoverage2D

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputCoverage	The input gridcoverage to be clipped.	Complex	✓
extent	The Reference envelope to clip gridcoverage.	Complex	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output GridCoverage.	Complex	✓

■ **Constraints**

- Extent 파라미터는 BoundingBoxData 타입으로 다음과 같이 crs, dimensions, LowerCorner, UpperCorner 로 구성된다.

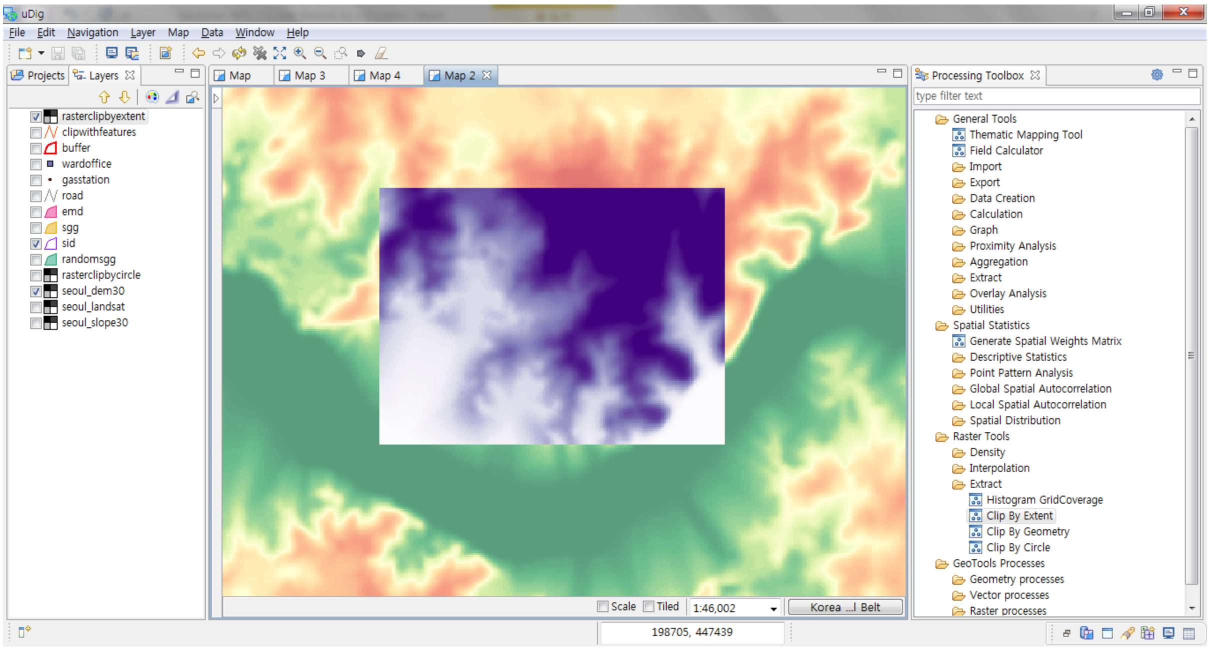
```
<wps:Data>
  <wps:BoundingBoxData crs="EPSG:3857" dimensions="2">
    <ows:LowerCorner>0.0 0.0</ows:LowerCorner>
    <ows:UpperCorner>1.0 1.0</ows:UpperCorner>
  </wps:BoundingBoxData>
</wps:Data>
```

■ **Request Examples**

```xml
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RasterClipByExtent</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputCoverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
          <wcs:GetCoverage service="WCS" version="1.1.1">
            <ows:Identifier>foss:seoul_dem30</ows:Identifier>
            <wcs:DomainSubset>
              <gml:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#5181">
                <ows:LowerCorner>179171.39881047895 436569.3290600816</ows:LowerCorner>
                <ows:UpperCorner>216221.0981287582 466869.08315843146</ows:UpperCorner>
              </gml:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>cropShape</ows:Identifier>
      <wps:Data>
        <wps:BoundingBoxData crs="EPSG:5181" dimensions="2">
          <ows:LowerCorner>196200.93382496 446742.832084541</ows:LowerCorner>
          <ows:UpperCorner>200948.405261965 450277.401141511</ows:UpperCorner>
        </wps:BoundingBoxData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="image/tiff">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

BoundingBox(MinX, MinY, MaxX, MaxY, CRS) 영역을 설정하여 래스터 셀을 추출한 결과입니다.



4.3.4.2. Extract by Geometry

Polygon Geometry 를 설정하여 이와 교차되는 래스터 데이터를 추출합니다.

- **Syntax**

RasterClipByGeometry (GridCoverage2D inputCoverage, Geometry cropShape): GridCoverage2D

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputCoverage	The input gridcoverage to be clipped.	Complex	✓
cropShape	The Polygon or MultiPolygon to clip gridcoverage.	Complex	✓

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output GridCoverage.	Complex	✓

- **Constraints**

- cropShape 의 Geometry 타입은 Polygon 또는 MultiPolygon 이어야 한다.

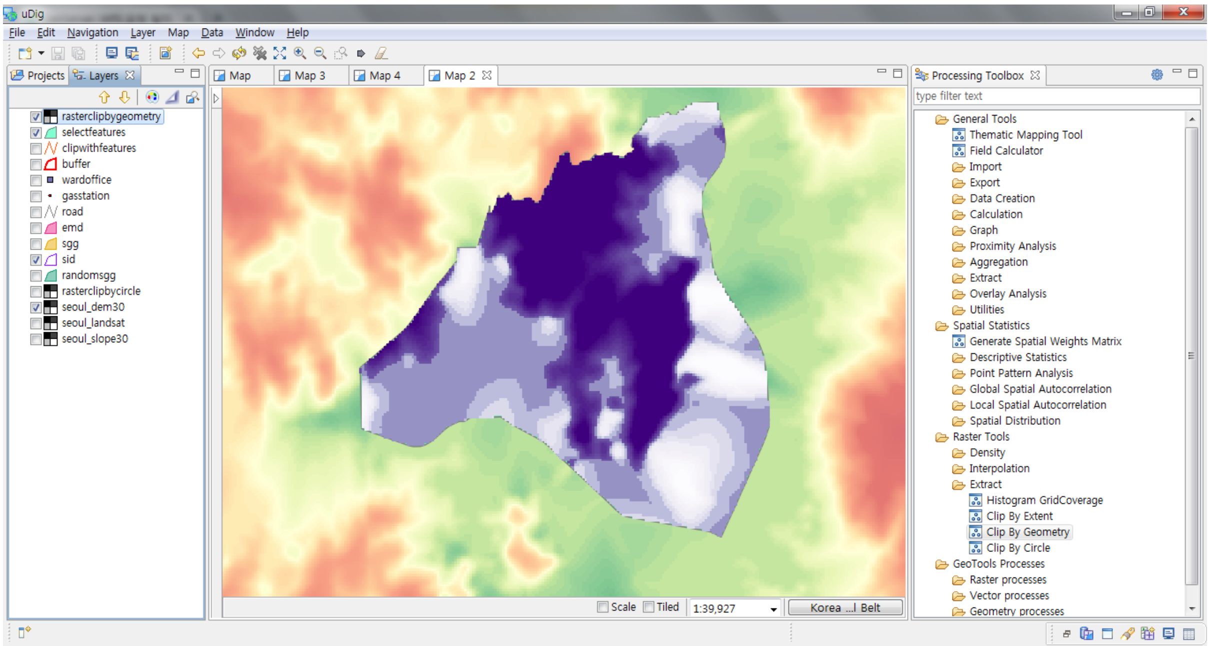
- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RasterClipByGeometry</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputCoverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
```

```
            <wcs:GetCoverage service="WCS" version="1.1.1">
              <ows:Identifier>foss:seoul_dem30</ows:Identifier>
              <wcs:DomainSubset>
                <gml:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#5181">
                  <ows:LowerCorner>179171.39881047895 436569.3290600816</ows:LowerCorner>
                  <ows:UpperCorner>216221.0981287582 466869.08315843146</ows:UpperCorner>
                </gml:BoundingBox>
              </wcs:DomainSubset>
              <wcs:Output format="image/tiff"/>
            </wcs:GetCoverage>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>cropShape</ows:Identifier>
        <wps:Data>
          <wps:ComplexData mimeType="application/wkt"><![CDATA[MULTIPOLYGON (((206338 456264,
............., 206338 456264)))]]></wps:ComplexData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="image/tiff">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

Polygon 또는 MultiPolygon Geometry 를 설정하여 래스터 셀을 추출한 결과입니다.


uDig
File Edit Navigation Layer Map Data Window Help
Projects
Layers
rasterclipbygeometry
selectfeatures
clipwithfeatures
buffer
wardoffice
gasstation
road
emd
sgg
sid
randomsgg
rasterclipbycircle
seoul_dem30
seoul_landsat
seoul_slope30
Map
Map 3
Map 4
Map 2
Scale
Tiled
1:39,927
Korea ...l Belt
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Calculation
Graph
Proximity Analysis
Aggregation
Extract
Overlay Analysis
Utilities
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Interpolation
Extract
Histogram GridCoverage
Clip By Extent
Clip By Geometry
Clip By Circle
GeoTools Processes
Raster processes
Vector processes
Geometry processes

4.3.4.3. Extract by Circle

중심점과 반경에 기반한 원을 설정하여 이와 교차되는 래스터 데이터를 추출합니다.

■ **Syntax**

RasterClipByCircle (GridCoverage2D inputCoverage, Geometry center, Double radius, Boolean inside): GridCoverage2D

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputCoverage	The input gridcoverage to be clipped.	Complex	✓
center	The center point of the circle defining the area to be extracted.	Complex	✓
radius	Radius of the circle defining the area to be extracted.	Literal	✓
inside	Default is True	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output GridCoverage.	Complex	✓

■ **Constraints**

- Inside 파라미터가 False 인 경우 원을 제외한 지역을 반환한다.

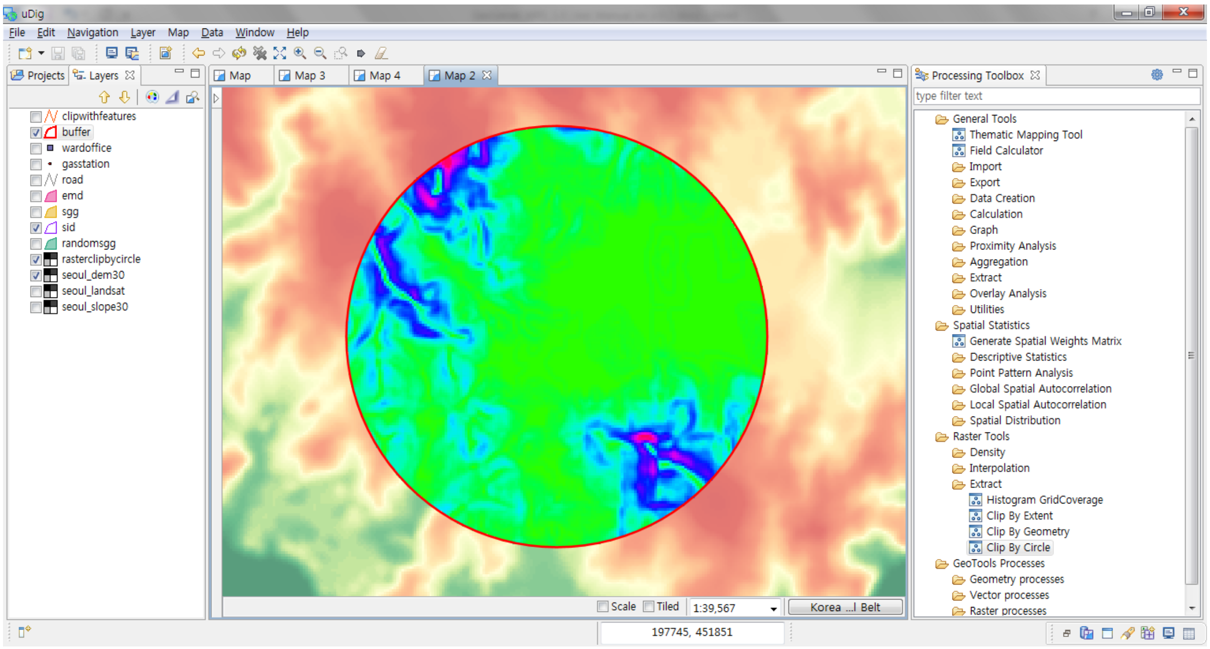
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RasterClipByCircle</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
```

```
        <ows:Identifier>inputCoverage</ows:Identifier>
        <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
          <wps:Body>
            <wcs:GetCoverage service="WCS" version="1.1.1">
              <ows:Identifier>foss:seoul_dem30</ows:Identifier>
              <wcs:DomainSubset>
                <gml:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#5181">
                  <ows:LowerCorner>179171.39881047895 436569.3290600816</ows:LowerCorner>
                  <ows:UpperCorner>216221.0981287582 466869.08315843146</ows:UpperCorner>
                </gml:BoundingBox>
              </wcs:DomainSubset>
              <wcs:Output format="image/tiff"/>
            </wcs:GetCoverage>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>center</ows:Identifier>
        <wps:Data>
          <wps:ComplexData mimeType="application/wkt"><![CDATA[POINT(197598
451746)]]></wps:ComplexData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>radius</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>1500</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="image/tiff">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

특정 포인트를 중심으로 반경 1500 미터의 원에 해당하는 래스터 셀만 추출한 결과입니다.


uDig
File Edit Navigation Layer Map Data Window Help
Projects Layers
clipwithfeatures
buffer
wardoffice
gasstation
road
emd
sgg
sid
randomsgg
rasterclipbycircle
seoul_dem30
seoul_landsat
seoul_slope30
Map Map 3 Map 4 Map 2
Scale Tiled 1:39,567 Korea ...l Belt
197745, 451851
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Calculation
Graph
Proximity Analysis
Aggregation
Extract
Overlay Analysis
Utilities
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Interpolation
Extract
Histogram GridCoverage
Clip By Extent
Clip By Geometry
Clip By Circle
GeoTools Processes
Geometry processes
Vector processes
Raster processes

4.3.4.4. Raster Conditional Expression

필터 조건에 맞는 래스터의 셀값을 True 값 또는 False 값으로 변환합니다.

■ **Syntax**

RasterCon (GridCoverage2D inputCoverage, Integer bandIndex, Filter filter, Integer trueValue, Integer falseValue): GridCoverage2D

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputCoverage	The input gridcoverage to be clipped.	Complex	✓
bandIndex	The zero-based band index, default index is a 0.	Literal	-
filter	A logical expression that determines which of the input cells are to be true or false. ex> Value > 250	Complex	✓
trueValue	The input whose values will be used as the output cell values if the condition is true.	Literal	✓
falseValue	The input whose values will be used as the output cell values if the condition is false. Default is NoData.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output GridCoverage.	Complex	✓

■ **Constraints**

- filter 파라미터의 필드 이름은 반드시 Value 이어야 한다.
- trueValue 와 falseValue 파라미터는 반드시 Integer 값이어야 한다.
- falseValue 파라미터값이 Null 인 경우 NoData 값을 적용한다.

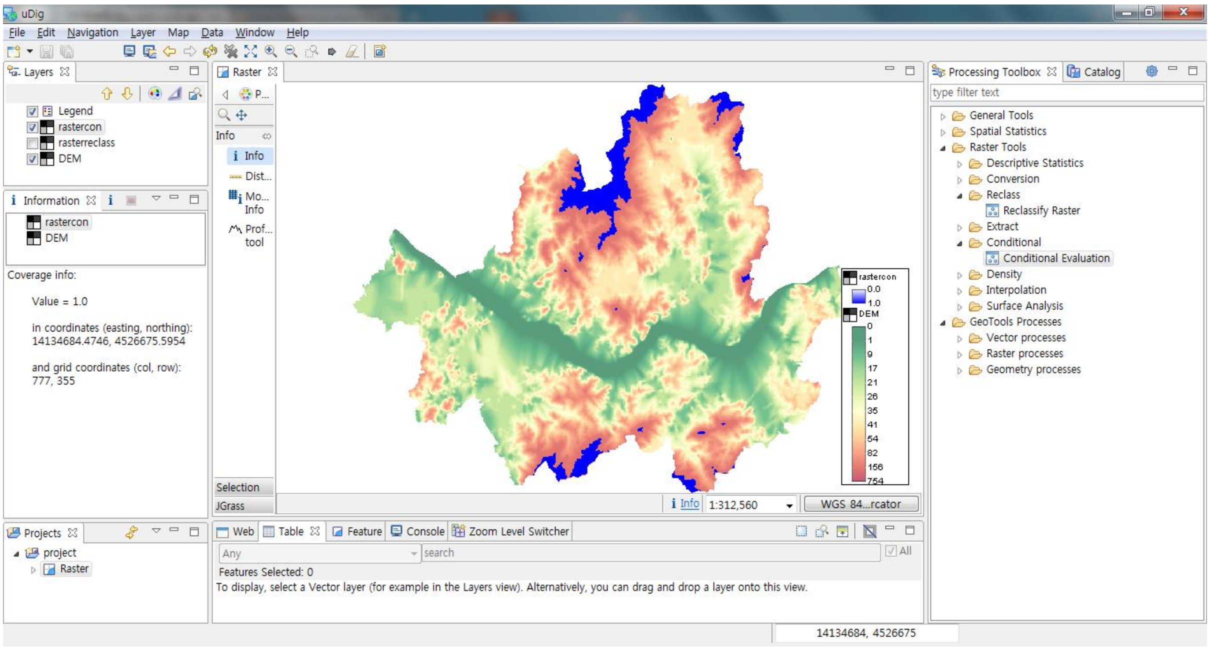
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
```

```
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RasterCon</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputCoverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
          <wcs:GetCoverage service="WCS" version="1.1.1">
            <ows:Identifier>foss:seoul_dem30</ows:Identifier>
            <wcs:DomainSubset>
              <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#3857">
                <ows:LowerCorner>1.4111343323506365E7 4498971.750719266</ows:LowerCorner>
                <ows:UpperCorner>1.4158021303411832E7 4537343.6431004135</ows:UpperCorner>
              </ows:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>filter</ows:Identifier>
      <wps:Data>
        <wps:ComplexData mimeType="text/plain; subtype=cql"><![CDATA[Value >
250]]></wps:ComplexData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>trueValue</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>1</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="image/tiff">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

특정 포인트를 중심으로 반경 1500 미터의 원에 해당하는 래스터 셀만 추출한 결과입니다.



4.3.5. Density

래스터의 밀도분석을 수행하는 프로세스들로 구성됩니다.

4.3.5.1. Kernel Density Estimation

포인트 피처와 다양한 커널 함수에 기반한 Kernel Density 분석을 수행합니다.

- **Syntax**

KernelDensity (SimpleFeatureCollection inputFeatures, KernelType kernelType, String populationField, Double searchRadius, Double cellSize, ReferencedEnvelope extent): GridCoverage2D

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input point features for which to calculate the density.	Complex	✓
kernelType	Kernel functions.	Literal	-
populationField	The field denoting population values for each feature.	Literal	-
searchRadius	The search radius within which to calculate density.	Literal	-
cellSize	The cell size for the output gridcoverage.	Literal	-
extent	The extent for the output gridcoverage.	Complex	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output GridCoverage.	Complex	✓

- **Constraints**

- Kernel Type[9]은 BINARY, COSINE, DISTANCE, EPANECHNIKOV, GAUSSIAN, INVERSE_DISTANCE, QUADRATIC, QUARTIC, TRIANGULAR, TRIWEIGHT, TRICUBE 로 구성된다.
- extent 파라미터가 설정되지 않으면 inputFeatures 레이어의 범위가 설정된다.
- cellSize 파라미터를 설정하지 않으면 Extent 의 Width 와 Height 중 작은 값을 250 으로 나눈 값을 사용한다.
- searchRadius 파라미터를 설정하지 않으면 Extent 의 Width 와 Height 중 작은 값을 30 으로 나눈 값을 사용한다.

■ Request Examples

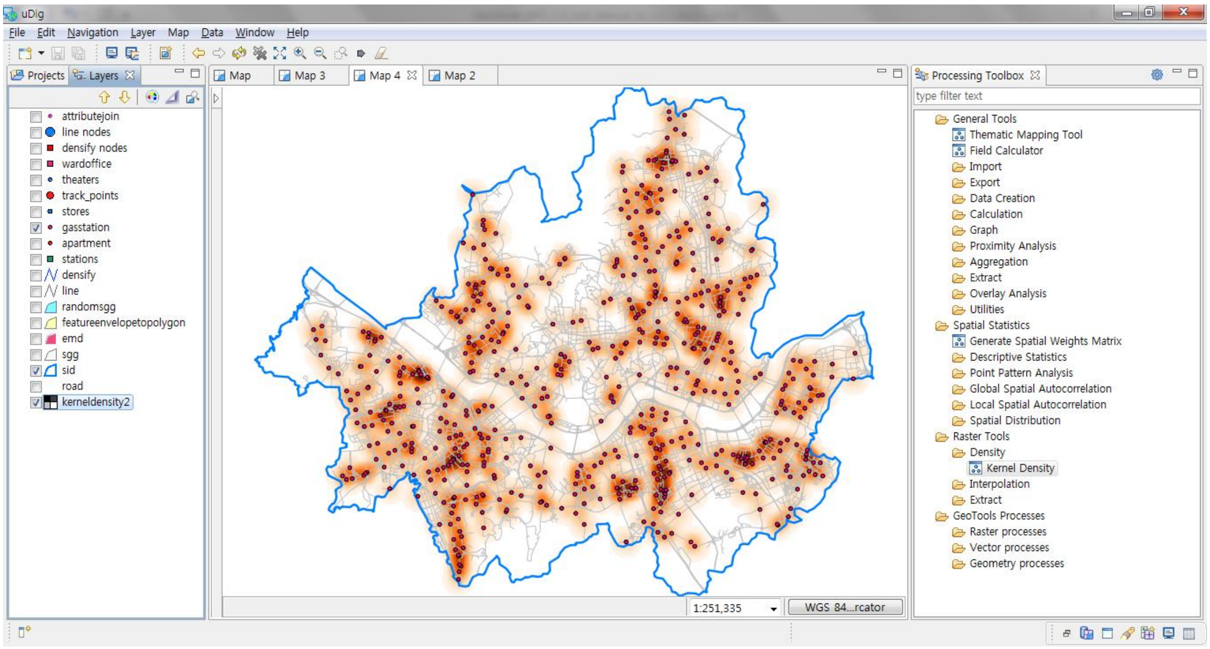
```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:KernelDensity</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:gasstation"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>kernelType</ows:Identifier>
      <wps:Data>
```

[9] https://en.wikipedia.org/wiki/Kernel_%28statistics%29

```
          <wps:LiteralData>QUADRATIC</wps:LiteralData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>cellSize</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>30</wps:LiteralData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>extent</ows:Identifier>
        <wps:Data>
          <wps:BoundingBoxData crs="EPSG:3857" dimensions="2">
            <ows:LowerCorner>1.4111357E7 4498975.0</ows:LowerCorner>
            <ows:UpperCorner>1.4158036E7 4537337.0</ows:UpperCorner>
          </wps:BoundingBoxData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="image/tiff">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

서울시 주유소 데이터를 이용하여 서울시 영역 기준 30 미터 셀 크기의 Kernel Density 분석결과입니다.


uDig
File Edit Navigation Layer Map Data Window Help
Projects Layers
attributejoin
line nodes
densify nodes
wardoffice
theaters
track_points
stores
gasstation
apartment
stations
densify
line
randomsgg
featureenvelopetopolygon
emd
sgg
sid
road
kerneldensity2
Map Map 3 Map 4 Map 2
1:251,335
WGS 84...rcator
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Calculation
Graph
Proximity Analysis
Aggregation
Extract
Overlay Analysis
Utilities
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Kernel Density
Interpolation
Extract
GeoTools Processes
Raster processes
Vector processes
Geometry processes

4.3.6. Interpolation

포인트와 속성값을 이용하여 Interpolation 을 수행하는 프로세스들로 구성됩니다.

4.3.6.1. IDW (Inverse Distance Weighted)

포인트 피처 레이어를 이용하여 Inverse Distance Weighted (IDW) Interpolation 분석을 수행합니다.

- **Syntax**

IDW (SimpleFeatureCollection inputFeatures, String inputField, Double power, RadiusType radiusType, Integer numberOfPoints, Double distance, Double cellSize, ReferencedEnvelope extent): GridCoverage2D

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input point features for which to calculate the density.	Complex	✓
inputField	The field that holds a height or magnitude value for each point.	Literal	✓
power	The exponent (default 2.0) of distance.	Literal	-
radiusType	The search radius type Variable, Fixed	Literal	-
numberOfPoints	The numberOfPoints is an integer value specifying the number of nearest input sample points to be used to perform the interpolation.	Literal	-
distance	The distance specifies the distance, in map units, by which to limit the search for the nearest input sample points.	Literal	-
cellSize	The cell size for the output gridcoverage.	Literal	-
extent	The extent for the output gridcoverage.	Complex	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output GridCoverage.	Complex	✓

- **Constraints**

- extent 파라미터가 설정되지 않으면 inputFeatures 레이어의 범위가 설정된다.
- cellSize 파라미터를 설정하지 않으면 Extent 의 Width 와 Height 중 작은 값을 250 으로 나눈 값을 사용한다.

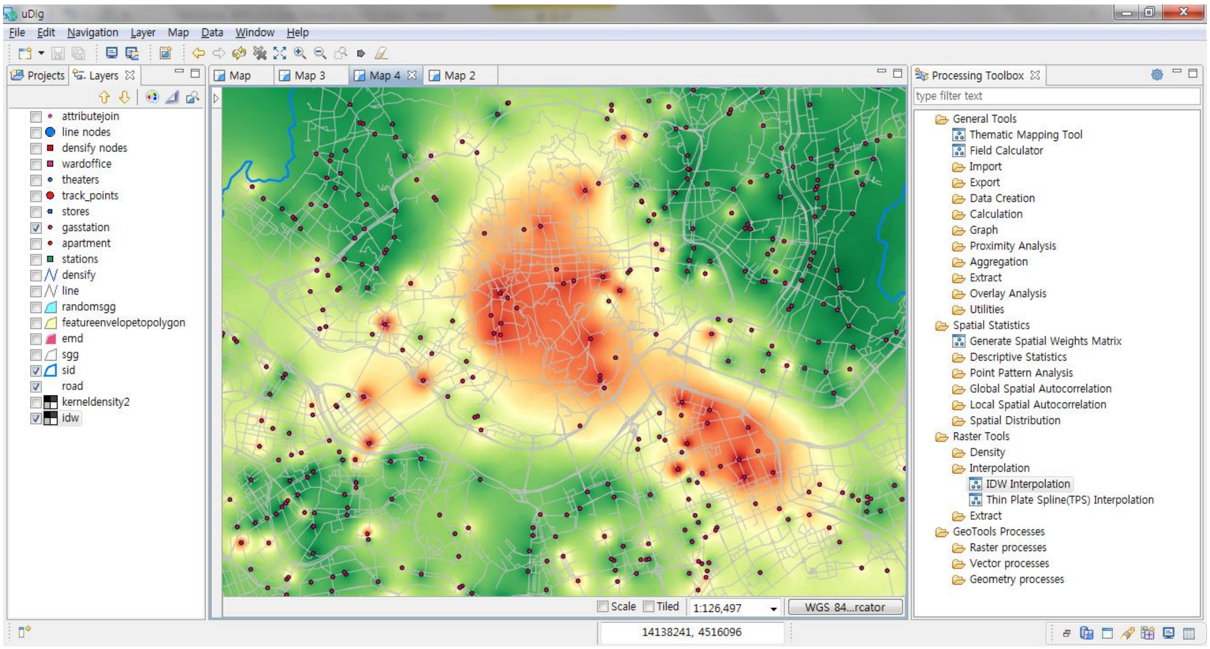
■ Request Examples

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:IDW</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:gasstation"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>price</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>power</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>2.0</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>radiusType</ows:Identifier>
      <wps:Data>
```

```
          <wps:LiteralData>Variable</wps:LiteralData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>numberOfPoints</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>24</wps:LiteralData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>cellSize</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>30</wps:LiteralData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>extent</ows:Identifier>
        <wps:Data>
          <wps:BoundingBoxData crs="EPSG:3857" dimensions="2">
            <ows:LowerCorner>1.4111357E7 4498975.0</ows:LowerCorner>
            <ows:UpperCorner>1.4158036E7 4537337.0</ows:UpperCorner>
          </wps:BoundingBoxData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="image/tiff">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

서울시 주유소의 유가정보를 사용하여 서울시 영역 기준 30 미터 셀 크기의 Inverse Distance Weighted (IDW) 분석을 수행한 결과입니다.


uDig
File Edit Navigation Layer Map Data Window Help
Projects Layers
attributejoin
line nodes
densify nodes
wardoffice
theaters
track_points
stores
gasstation
apartment
stations
densify
line
randomsgg
featureenvelopetopolygon
emd
sgg
sid
road
kerneldensity2
idw
Map
Map 3
Map 4
Map 2
Scale
Tiled
1:126,497
WGS 84...rcator
14138241, 4516096
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Calculation
Graph
Proximity Analysis
Aggregation
Extract
Overlay Analysis
Utilities
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Interpolation
IDW Interpolation
Thin Plate Spline(TPS) Interpolation
Extract
GeoTools Processes
Raster processes
Vector processes
Geometry processes

4.3.6.2. TPS (Thin Plate Spline)

포인트 피처 레이어를 이용하여 Thin Plate Spline (TPS) Interpolation 분석을 수행합니다.

■ **Syntax**

TPS (SimpleFeatureCollection inputFeatures, String inputField, Double cellSize, ReferencedEnvelope extent): GridCoverage2D

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input point features for which to calculate the density.	Complex	✓
inputField	The field that holds a height or magnitude value for each point.	Literal	✓
cellSize	The cell size for the output gridcoverage.	Literal	-
extent	The extent for the output gridcoverage.	Complex	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output GridCoverage.	Complex	✓

■ **Constraints**

- extent 파라미터가 설정되지 않으면 inputFeatures 레이어의 범위가 설정된다.
- cellSize 파라미터를 설정하지 않으면 Extent 의 Width 와 Height 중 작은 값을 250 으로 나눈 값을 사용한다.

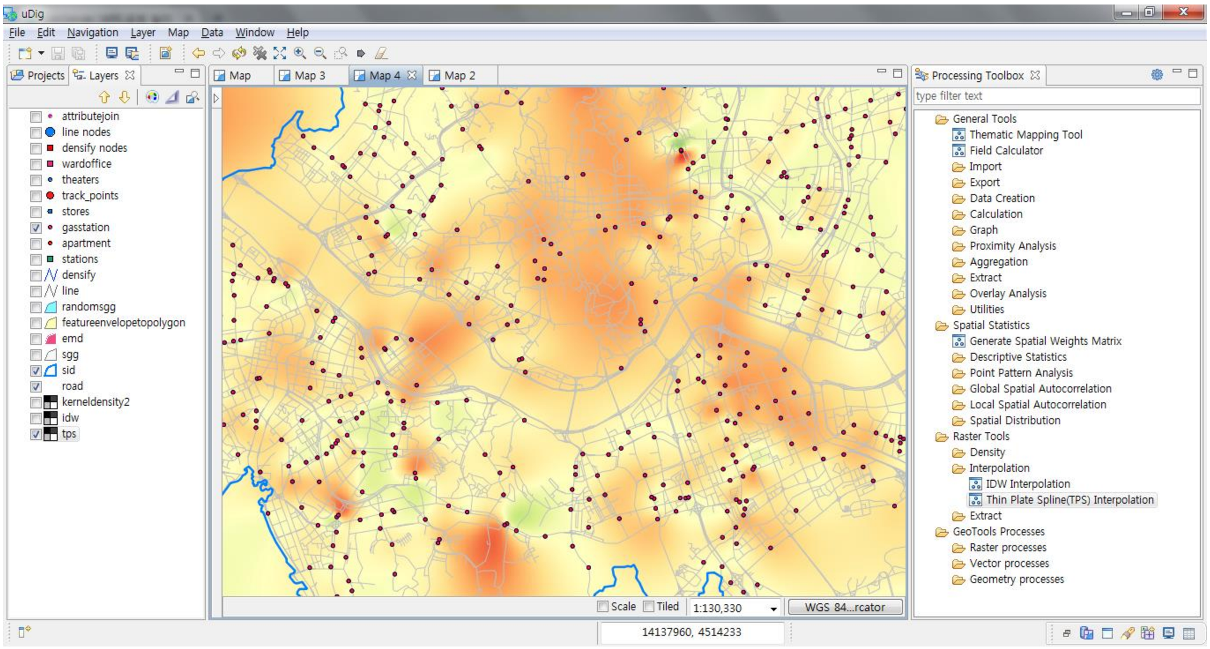
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
```

```xml
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:TPS</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:gasstation"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>price</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>cellSize</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>30</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>extent</ows:Identifier>
      <wps:Data>
        <wps:BoundingBoxData crs="EPSG:3857" dimensions="2">
          <ows:LowerCorner>1.4111357E7 4498975.0</ows:LowerCorner>
          <ows:UpperCorner>1.4158036E7 4537337.0</ows:UpperCorner>
        </wps:BoundingBoxData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="image/tiff">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

서울시 주유소의 유가정보를 사용하여 서울시 영역 기준 30 미터 셀 크기의 Thin Plate Spline (TPS) 분석을 수행한 결과입니다.



4.3.7. Surface Analysis

지형 분석을 수행하는 프로세스들로 구성됩니다.

4.3.7.1. Raster Profile

DEM 과 같은 래스터 데이터와 라인을 입력해 종단면(Profile)을 분석 후 포인트 레이어로 반환합니다.

■ **Syntax**

RasterProfile (GridCoverage2D inputCoverage, Geometry userLine, Double interval): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputCoverage	The input surface raster.	Complex	✓
userLine	LineString or MultiLineString geometry.	Literal	✓
interval	The interval of distance. Default = length of geometry / 20.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output line features.	Complex	✓

■ **Constraints**

- interval 파라미터가 설정되지 않으면 userLine 길이를 20 으로 나눈 값을 적용한다.
- Output 포인트 레이어는 distance(누적 거리)와 value(높이값 등 래스터의 셀 값) 필드를 포함한다.

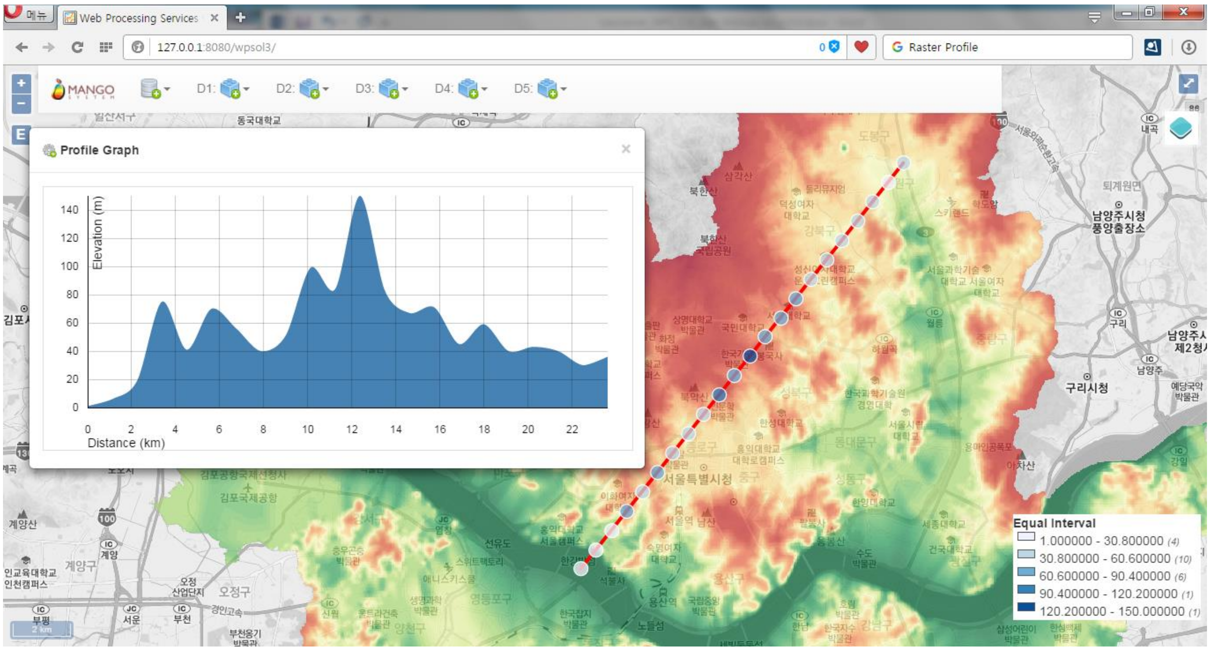
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
```

```
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RasterProfile</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputCoverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
          <wcs:GetCoverage service="WCS" version="1.1.1">
            <ows:Identifier>foss:seoul_dem30</ows:Identifier>
            <wcs:DomainSubset>
              <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#3857">
                <ows:LowerCorner>1.4111343323506365E7 4498971.750719266</ows:LowerCorner>
                <ows:UpperCorner>1.4158021303411832E7 4537343.6431004135</ows:UpperCorner>
              </ows:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>userLine</ows:Identifier>
      <wps:Data>
        <wps:ComplexData mimeType="application/wkt"><![CDATA[LineString(14130049 4513932,
14144040 4531525)]]></wps:ComplexData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.0">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

서울시 DEM 을 이용하여 Profile 분석 결과를 포인트 레이어와 그래프로 표현한 결과입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
Raster Profile
MANGO
D1:
D2:
D3:
D4:
D5:
Profile Graph
Elevation (m)
Distance (km)
Equal Interval
1.000000 - 30.800000 (4)
30.800000 - 60.600000 (10)
60.600000 - 90.400000 (6)
90.400000 - 120.200000 (1)
120.200000 - 150.000000 (1)

4.3.7.2. Radial Line Of Sight

DEM 래스터 데이터를 이용하여 관측지점과 반경을 이용하여 Radial Line Of Sight 분석을 수행합니다.

■ **Syntax**

RadialLineOfSight (GridCoverage2D inputCoverage, Geometry observerPoint, Double observerOffset, Double radius, Integer sides, Boolean useCurvature, Boolean useRefraction, Double refractionFactor): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input surface raster.	Complex	✓
observerPoint	The observer's coordinate.	Complex	✓
observerOffset	The observer's offset above the surface rater. The default is 0.0 units.	Literal	✓
radius	The radius from the observer point, for which the radial visibility will be calculated.	Literal	✓
sides	The number of sides. The default sides is 180.	Literal	-
useCurvature	Indicates whether the earth's curvature should be taken into consideration for the line-of-sight analysis. Default is False.	Literal	-
useRefraction	Indicates whether atmospheric refraction should be taken into consideration when generating a line of sight from a functional surface. Default is False.	Literal	-
refractionFactor	The refraction factor. The default refraction factor is 0.13.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output GridCoverage.	Complex	✓

■ **Constraints**

- useRefraction, refractionFactor 파라미터는 useCurvature 파라미터가 True 인 경우에만 적용된다.
- useCurvature 파라미터가 True 이고 useRefraction 파라미터가 False 인 경우 refractionFactor 는 0.13 을 적용한다.
- Output 라인 레이어는 Angle, Visible 필드를 포함하며, Visible 필드값이 1 인 경우 가시영역, 0 인 경우 비가시 영역이다.

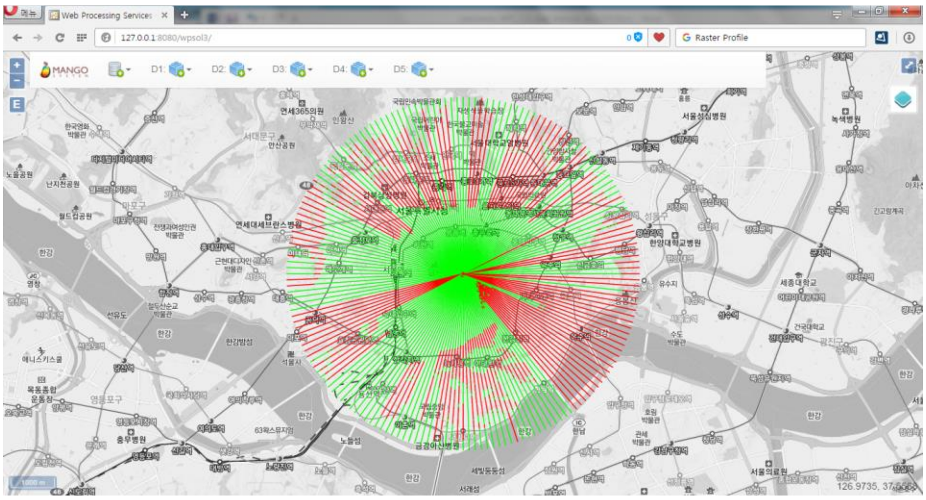
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:RadialLineOfSight</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputCoverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
          <wcs:GetCoverage service="WCS" version="1.1.1">
            <ows:Identifier>foss:seoul_dem30</ows:Identifier>
            <wcs:DomainSubset>
              <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#3857">
                <ows:LowerCorner>1.4111343323506365E7 4498971.750719266</ows:LowerCorner>
                <ows:UpperCorner>1.4158021303411832E7 4537343.6431004135</ows:UpperCorner>
              </ows:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>observerPoint</ows:Identifier>
      <wps:Data>
```

```
          <wps:ComplexData mimeType="application/wkt"><![CDATA[POINT(14136287.706512472
4516237.6022168035)]]></wps:ComplexData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>observerOffset</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>1.8</wps:LiteralData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>radius</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>5000</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.0">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

서울시 DEM 을 이용하여 남산을 기준점으로 5000 미터 반경의 가시권을 분석한 결과입니다.



4.3.7.3. Linear Line Of Sight

DEM 래스터 데이터를 이용하여 관측지점과 대상지점을 이용하여 Linear Line Of Sight 분석을 수행합니다.

■ **Syntax**

LinearLineOfSight (GridCoverage2D inputCoverage, Geometry observerPoint, Double observerOffset, Geometry targetPoint, Boolean useCurvature, Boolean useRefraction, Double refractionFactor): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputCoverage	The input surface raster.	Complex	✓
observerPoint	The observer's coordinate.	Complex	✓
observerOffset	The observer's offset above the surface rater. The default is 0.0 units.	Literal	✓
targetPoint	The target's coordinate.	Complex	✓
useCurvature	Indicates whether the earth's curvature should be taken into consideration for the line-of-sight analysis. Default is False.	Literal	-
useRefraction	Indicates whether atmospheric refraction should be taken into consideration when generating a line of sight from a functional surface. Default is False.	Literal	-
refractionFactor	The refraction factor. The default refraction factor is 0.13.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output GridCoverage.	Complex	✓

■ **Constraints**

- useRefraction, refractionFactor 파라미터는 useCurvature 파라미터가 True 인 경우에만 적용된다.

- useCurvature 파라미터가 True 이고 useRefraction 파라미터가 False 인 경우 refractionFactor 는 0.13 을 적용한다.

- Output 라인 레이어는 Visible 필드를 포함하며, Visible 필드값이 1 인 경우 가시영역, 0 인 경우 비가시 영역이다.

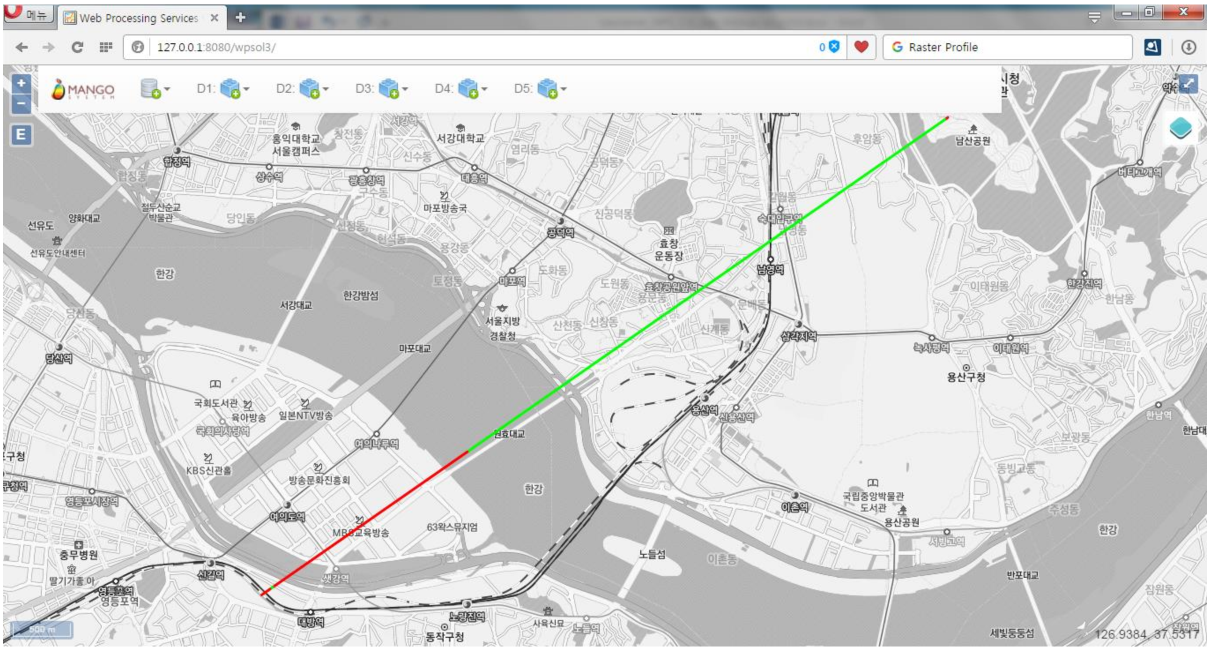
■ Request Examples

```
<?xml version="1.0" encoding="UTF-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:LinearLineOfSight</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputCoverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
          <wcs:GetCoverage service="WCS" version="1.1.1">
            <ows:Identifier>foss:seoul_dem30</ows:Identifier>
            <wcs:DomainSubset>
              <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#3857">
                <ows:LowerCorner>1.4111343323506365E7 4498971.750719266</ows:LowerCorner>
                <ows:UpperCorner>1.4158021303411832E7 4537343.6431004135</ows:UpperCorner>
              </ows:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>observerPoint</ows:Identifier>
      <wps:Data>
        <wps:ComplexData mimeType="application/wkt"><![CDATA[POINT(14136291.5572
4516245.7128)]]></wps:ComplexData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
```

```
        <ows:Identifier>observerOffset</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>1.8</wps:LiteralData>
        </wps:Data>
      </wps:Input>
      <wps:Input>
        <ows:Identifier>targetPoint</ows:Identifier>
        <wps:Data>
          <wps:ComplexData mimeType="application/wkt"><![CDATA[POINT(14128854.8064
4511075.0345)]]></wps:ComplexData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.0">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response

서울시 DEM 을 이용하여 남산을 기준점으로 여의도 방면의 가시선을 분석한 결과입니다.



4.3.7.4. Find Highest/Lowest Points

DEM 과 같은 래스터 데이터의 특정영역에서의 최고값, 최저값 위치를 찾아 포인트로 반환합니다.

■ **Syntax**

RasterHighLowPoints (GridCoverage2D inputCoverage, Integer bandIndex, Geometry cropShape, HighLowType valueType): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputCoverage	The input gridcoverage to be processed.	Complex	✓
bandIndex	The zero-based band index, default index is a 0.	Literal	-
cropShape	The Polygon or MultiPolygon to clip gridcoverage.	Complex	-
valueType	Value Type (Both, High, Low). Default is High.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output GridCoverage.	Complex	✓

■ **Constraints**

- cropShape 파라미터는 반드시 Polygon 또는 MultiPolygon 이어야 한다.
- valueType 파라미터는 Both, High, Low 값을 사용하며, Null 이면 High 값을 적용한다.

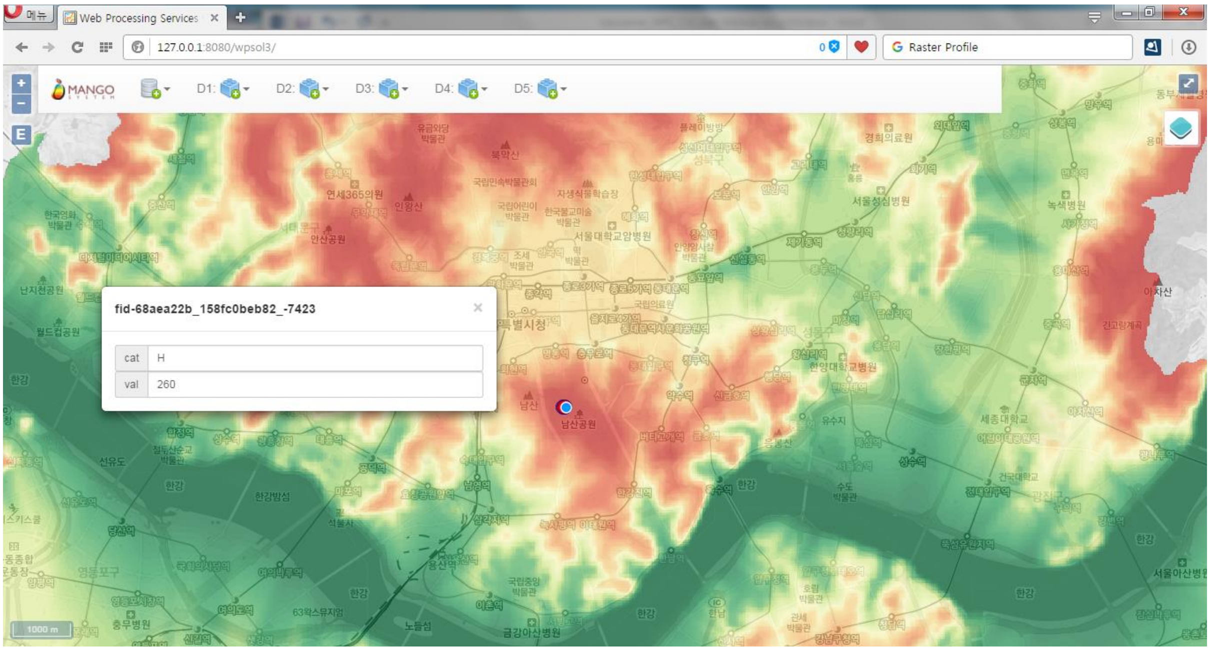
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
```

```
  <ows:Identifier>statistics:RasterHighLowPoints</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputCoverage</ows:Identifier>
      <wps:Reference mimeType="image/tiff" xlink:href="http://geoserver/wcs" method="POST">
        <wps:Body>
          <wcs:GetCoverage service="WCS" version="1.1.1">
            <ows:Identifier>foss:seoul_dem30</ows:Identifier>
            <wcs:DomainSubset>
              <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#3857">
                <ows:LowerCorner>1.4111343323506365E7 4498971.750719266</ows:LowerCorner>
                <ows:UpperCorner>1.4158021303411832E7 4537343.6431004135</ows:UpperCorner>
              </ows:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>valueType</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Both</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.0">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

서울시 DEM 을 이용하여 현재 지도의 범위를 기준으로 가장 높은 지점을 분석한 결과입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
Raster Profile
MANGO
D1:
D2:
D3:
D4:
D5:
fid-68aea22b_158fc0beb82_-7423
cat
H
val
260
1000 m

4.4. Spatial Statistics Analysis

공간통계 분석과 관련된 프로세스 그룹입니다.

4.4.1. Descriptive

Geometry 또는 필드의 속성값을 이용하여 통계정보를 계산하거나 계산하는 프로세스들로 구성됩니다.

4.4.1.1. Basic Statistics

피처 레이어의 필드값에 기반한 기초통계 분석을 수행합니다.

■ **Syntax**

StatisticsFeatures (SimpleFeatureCollection inputFeatures, String inputFields, String caseField): DataStatisticsResult

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The input features containing the field(s) that will be used to calculate statistics.	Complex	✓
inputFields	Single field or comma (,) separated numeric field(s) containing attribute values used to calculate the specified statistic.	Literal	✓
caseField	The field used to group features for separate statistics calculations.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output Statistics.	Complex	✓

■ **Constraints**

- caseField 파라미터가 설정되면 caseField 의 고유값별로 통계정보가 생성된다.
- Output 은 XML 로 반환한다.

Request Examples

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:StatisticsFeatures</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service=”WFS” version=”1.1.0” outputFormat=”GML3”
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputFields</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a3_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>caseField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>sid_nm</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

전국 시군구의 a3_2000 필드값을 이용하여 시군구별로 기초통계를 분석한 결과는 다음의 XML 포맷으로 반환됩니다.


```xml
<?xml version="1.0" encoding="utf-8"?>
<DataStatistics>
  <Item>
    <TypeName>korea_sgg</TypeName>
    <CaseValue>강원도</CaseValue>
    <PropertyName>a3_2000</PropertyName>
    <Count>18</Count>
    <InvalidCount>0</InvalidCount>
    <Minimum>0.24774</Minimum>
    <Maximum>7.81668</Maximum>
    <Range>7.56894</Range>
    <Ranges>0.24774 - 7.81668</Ranges>
    <Sum>79.64533043000002</Sum>
    <Mean>4.424740579444445</Mean>
    <Variance>6.976857255428096</Variance>
    <StandardDeviation>2.641374122578643</StandardDeviation>
    <CoefficientOfVariance>0.5969557028607279</CoefficientOfVariance>
  </Item>
  <Item>
    <TypeName>korea_sgg</TypeName>
    <CaseValue>경기도</CaseValue>
    <PropertyName>a3_2000</PropertyName>
    <Count>31</Count>
    <InvalidCount>0</InvalidCount>
    <Minimum>0.0</Minimum>
    <Maximum>15.46253</Maximum>
    <Range>15.46253</Range>
    <Ranges>0.0 - 15.46253</Ranges>
    <Sum>271.03358996</Sum>
    <Mean>8.74301903096774</Mean>
    <Variance>21.209124717119646</Variance>
    <StandardDeviation>4.605336547649872</StandardDeviation>
    <CoefficientOfVariance>0.5267444267635456</CoefficientOfVariance>
  </Item>
</DataStatistics>
```

4.4.1.2. Pearson Correlation Coefficient

2 개 이상의 속성필드를 이용하여 Pearson’s Correlation Coefficient 를 계산합니다.

■ **Syntax**

Pearson (SimpleFeatureCollection inputFeatures, String inputFields): PearsonResult

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features to be calculated.	Complex	✓
inputFields	The comma separated numeric field(s) containing attribute values used to calculate the specified statistic.	Literal	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Result Pearson Correlation Coefficient.	Complex	✓

■ **Constraints**

- Output 은 XML 로 반환한다.

■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:Pearson</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
```

```
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputFields</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>pop2008, pop_den</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

전국 시군구 행정경계의 두 필드를 이용하여 Pearson 상관 계수를 분석한 결과는 다음의 XML 포맷으로 반환됩니다.

```
<?xml version="1.0" encoding="utf-8"?>
<PearsonResult>
  <PropertyName Name="pop2008">
    <Item Name="pop2008">
      <Value>1.0</Value>
    </Item>
    <Item Name="pop_den">
      <Value>0.3002549407911261</Value>
    </Item>
  </PropertyName>
  <PropertyName Name="pop_den">
    <Item Name="pop2008">
      <Value>0.3002549407911261</Value>
    </Item>
    <Item Name="pop_den">
      <Value>1.0</Value>
```

```
      </Item>
   </PropertyName>
</PearsonResult>
```

4.4.1.3. Standardized Score of Dissimilarity

2 개의 속성필드값을 이용하여 표준화 상이점수(standardized score of dissimilarity, 집중도)를 계산합니다.

■ **Syntax**

StandardizedScores (SimpleFeatureCollection inputFeatures, Expression xField, Expression yField, String targetField): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which the standardized score of dissimilarity will be calculated.	Complex	✓
xField	X Value Field.	Literal	✓
yField	Y Value Field.	Literal	✓
targetField	Target Field. std_scr is default.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- targetField 파라미터를 설정하지 않으면 std_scr 이 기본값이다.

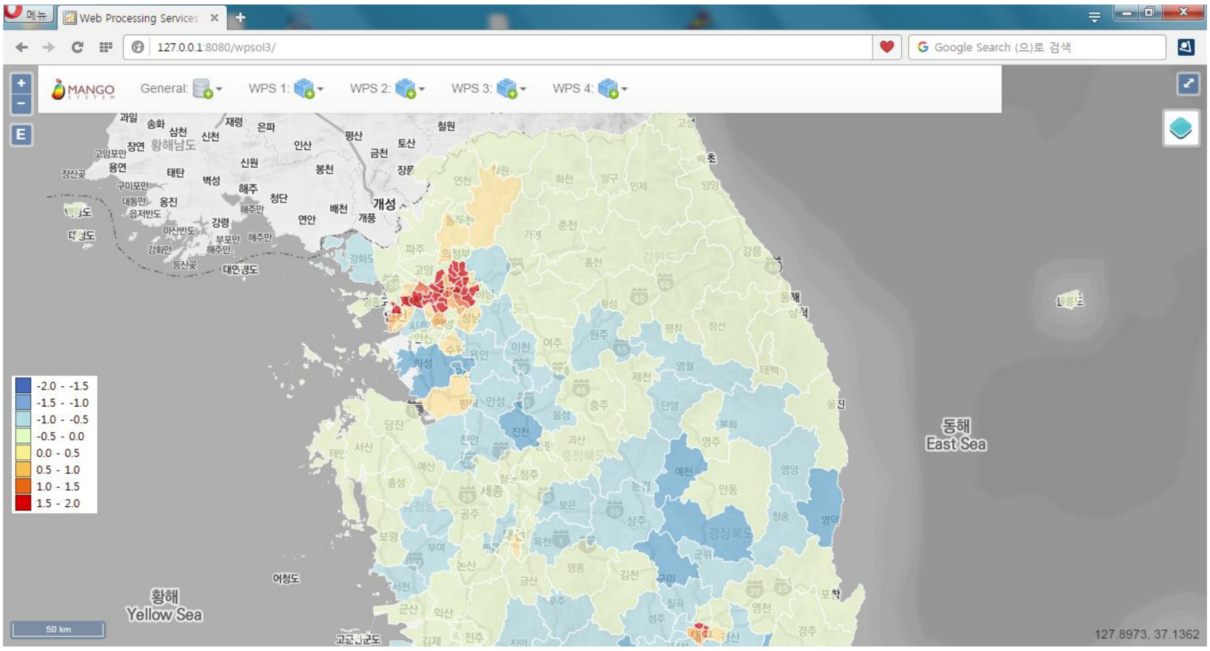
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:StandardizedScores</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
```

```
        <wps:Body>
          <wfs:GetFeature service= “WFS”  version= “1.1.0”  outputFormat= “GML3”
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>xField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a0_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>yField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a3_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>targetField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>std_scr</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType= “text/xml; subtype=wfs-collection/1.1” >
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
■
```

■ Response

전국 시군구 행정경계의 두 필드를 이용한 표준화 상이점수 분석결과는 다음과 같습니다. targetField 의 속성값을 이용하여 표준화 상이점수 결과를 시각화하면 됩니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
Google Search (으)로 검색
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
-2.0 - -1.5
-1.5 - -1.0
-1.0 - -0.5
-0.5 - 0.0
0.0 - 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
황해
Yellow Sea
동해
East Sea
50 km
127.8973, 37.1362

4.4.1.4. Focal Location Quotients

2 개의 속성필드값을 이용해서 공간적 입지계수(Focal Location Quotients, 특화도)를 계산합니다.

■ **Syntax**

FocalLQ (SimpleFeatureCollection inputFeatures, String fieldName1, String fieldName2, Double searchDistance): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which the focal LQ will be calculated.	Complex	✓
fieldName1	X Value Field.	Literal	✓
fieldName2	Y Value Field.	Literal	✓
searchDistance	The maximun search distance.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- Output 레이어의 필드는 flq, flqd, fz 값을 반환한다.

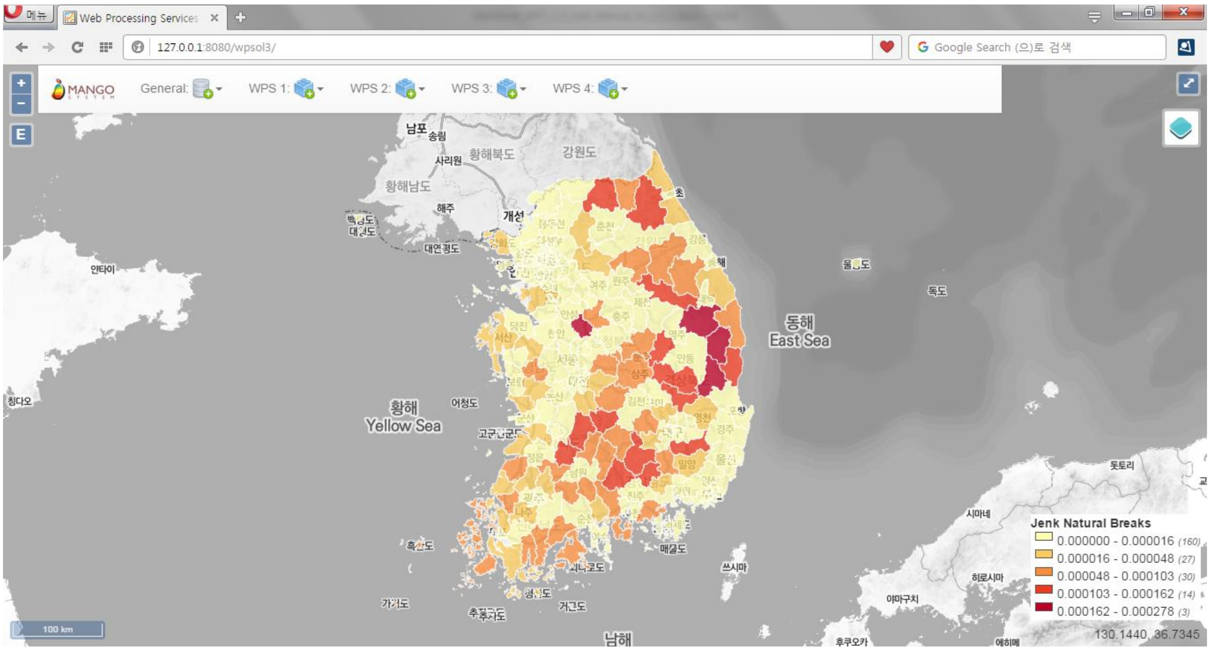
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:FocalLQ</ows:Identifier>
  <wps:DataInputs>
```

```
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>xField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a0_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>yField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a3_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

전국 시군구의 두 필드를 이용하여 지역 특화도를 분석 후 시각화한 결과는 다음과 같습니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
동해
East Sea
황해
Yellow Sea
Jenk Natural Breaks
0.000000 - 0.000016 (160)
0.000016 - 0.000048 (27)
0.000048 - 0.000103 (30)
0.000103 - 0.000162 (14)
0.000162 - 0.000278 (3)
130.1440, 36.7345
100 km

4.4.2. Distributions

벡터 데이터의 분포 패턴을 분석하는 프로세스들로 구성됩니다.

4.4.2.1. Mean Center

피처 레이어의 모든 피처들에 대한 지리적 중심점(geographic center 또는 center of concentration)을 반환합니다.

■ **Syntax**

MeanCenter (SimpleFeatureCollection inputFeatures, String weightField, String caseField, String dimensionField): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	A features for which the mean center will be calculated.	Complex	✓
weightField	The numeric field used to create a weighted mean center.	Literal	-
caseField	The field used to group features for separate mean center calculations.	Literal	-
dimensionField	A numeric field containing attribute values from which an average value will be calculated.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- inputFeatures 의 Centroid 를 이용하여 계산한다.

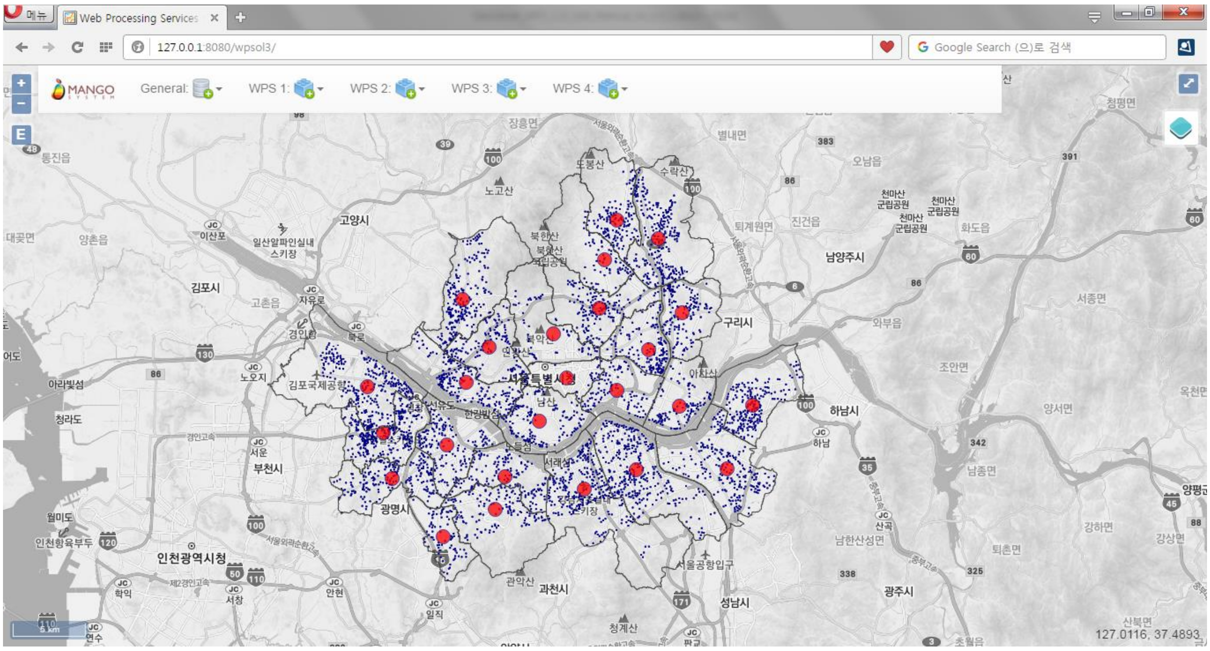
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
```

```
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:MeanCenter</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:apartment"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>caseField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>sgg_nm</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

서울시 아파트 분포에 대한 시군구별 Mean Center 를 분석한 결과입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
Google Search (으)로 검색
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
127.0116, 37.4893

4.4.2.2. Median Center

피처 레이어의 모든 피처들에 대해 총 거리의 합이 가장 최소가 되는 지점(Median Center)을 반환합니다.

- **Syntax**

MedianCenter (SimpleFeatureCollection inputFeatures, String weightField, String caseField, String attributeFields): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	A features for which the median center will be calculated.	Complex	✓
weightField	The numeric field used to create a weighted median center.	Literal	-
caseField	The field used to group features for separate median center calculations.	Literal	-
attributeFields	(Comma separated) Numeric field(s) for which the data median value will be computed.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

- inputFeatures 의 Centroid 를 이용하여 계산한다.

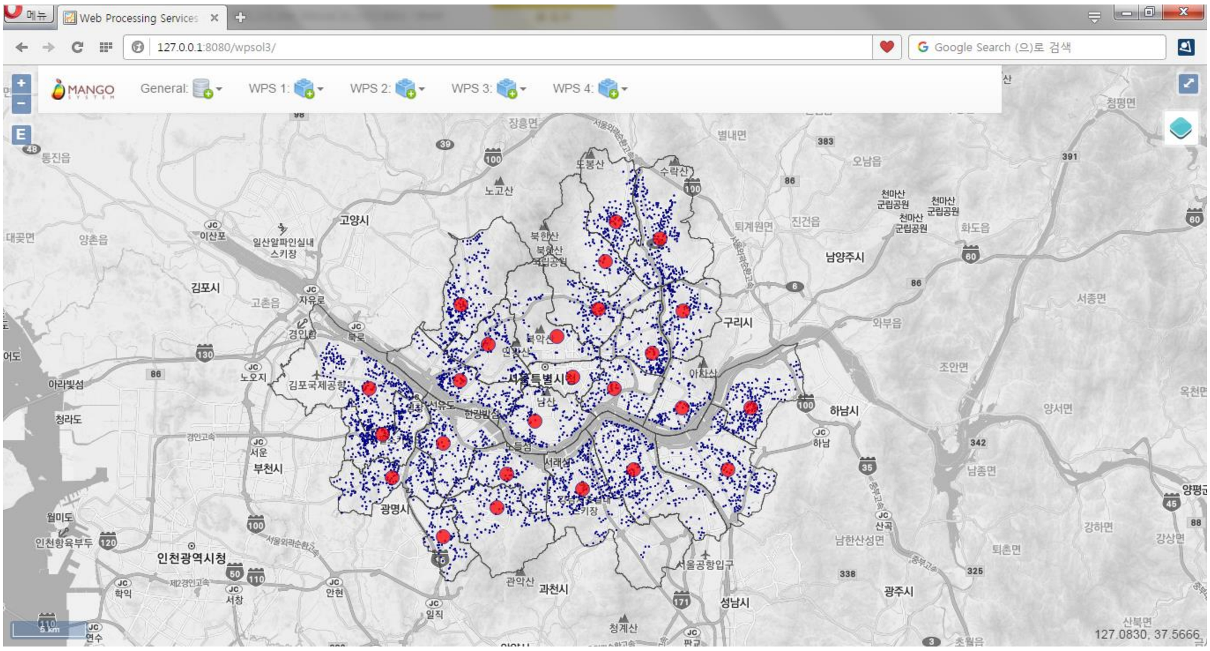
- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
```

```
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:MedianCenter</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:apartment"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>caseField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>sgg_nm</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

서울시 아파트 분포에 대한 시군구별 Median Center 를 분석한 결과입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
Google Search (으)로 검색
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
고양시
김포시
구리시
남양주시
하남시
부천시
광명시
과천시
성남시
광주시
인천광역시청
서울특별시
127.0830, 37.5666

4.4.2.3. Central Feature

피처 레이어의 모든 피처들에 대해 총 거리의 합이 가장 최소가 되는 피처(Central Feature)을 반환합니다.

■ **Syntax**

CentralFeature (SimpleFeatureCollection inputFeatures, DistanceMethod distanceMethod, String weightField, String selfPotentialWeightField, String caseField): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features containing a distribution of features from which to identify the most centrally located feature.	Complex	✓
distanceMethod	Specifies how distances are calculated from each feature to neighboring features. Euclidean (default) or Manhattan.	Literal	-
weightField	The numeric field used to weight distances in the origin-destination distance matrix.	Literal	-
selfPotentialWeightField	The field representing self-potential. The distance or weight between a feature and itself.	Literal	-
caseField	The field used to group features for separate central feature computations.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

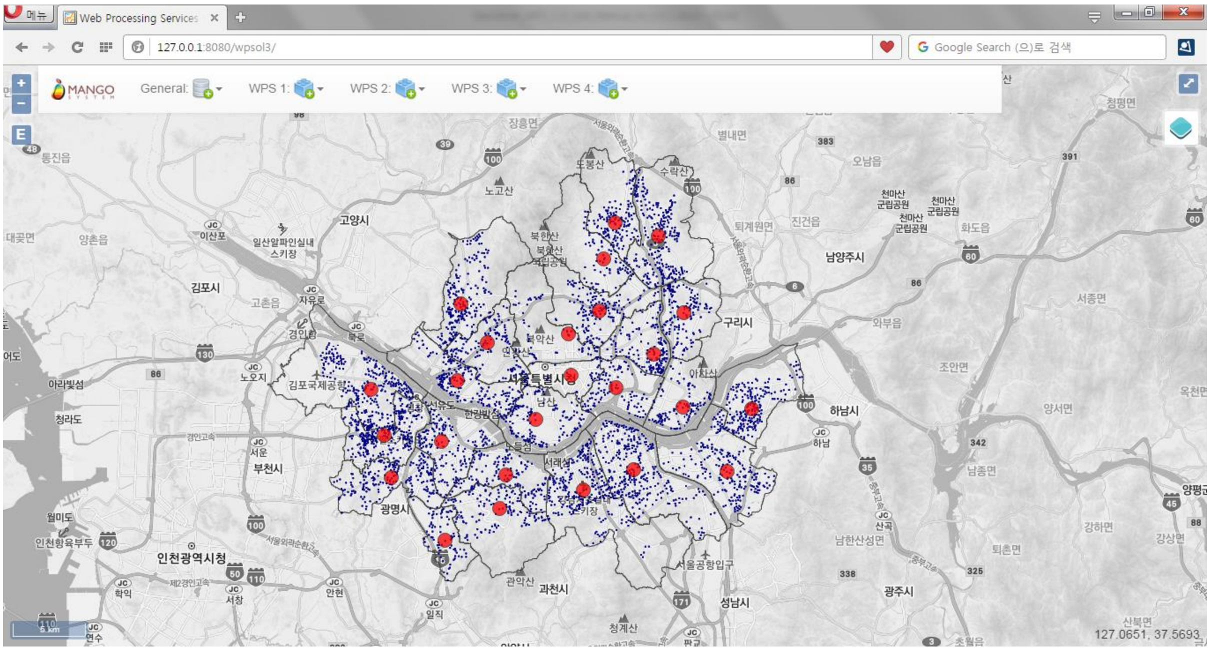
- inputFeatures 의 Centroid 를 이용하여 계산한다.

■ **Request Examples**

```xml
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:CentralFeature</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:apartment"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distanceMethod</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Euclidean</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>caseField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>sgg_nm</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

서울시 아파트 분포에 대한 시군구별 Central Feature 를 분석한 결과입니다.



4.4.2.4. Standard Distance

피처 레이어의 모든 피처들이 Mean Center 를 기준으로 집중되어 있는지 분산되어 있는지의 정도를 측정합니다.

- **Syntax**

StandardDistance (SimpleFeatureCollection inputFeatures, String circleSize, String weightField, String caseField): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features containing a distribution of features for which the standard deviational ellipse will be calculated.	Complex	✓
circleSize	The size (1, 2, 3) of output circles in standard deviations.	Literal	-
weightField	The numeric field used to weight locations according to their relative importance.	Literal	-
caseField	The field used to group features for separate standard distance calculations.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

- inputFeatures 의 Centroid 를 이용하여 계산한다.
- Circle 은 일반적으로 1_Standard_Deviation 인 경우 68%, 2_Standard_Deviation 인 경우 95%, 3_Standard_Deviation 인 경우 99%의 피처를 포함한다.

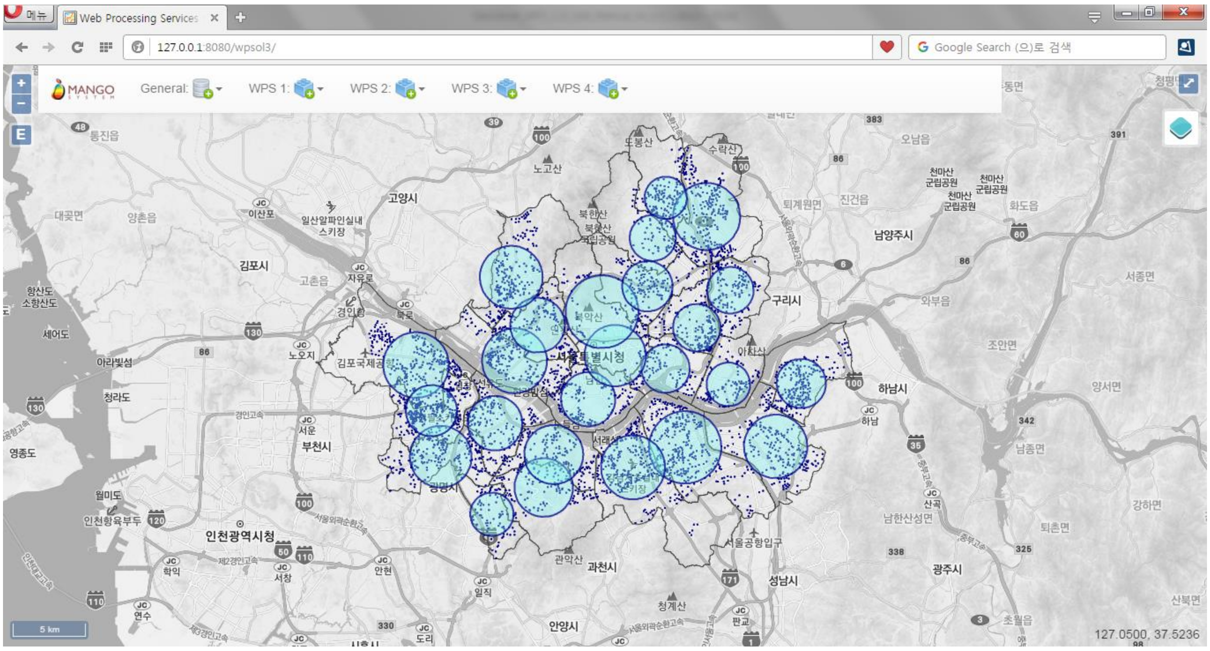
- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
```

```
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:StandardDistance</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:apartment"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>circleSize</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>1_Standard_Deviation</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>caseField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>sgg_nm</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

서울시 아파트 분포에 대한 시군구별 Standard Distance 를 분석한 결과입니다.


Web Processing Services
127.0.0.1:8080/wpsol3/
Google Search (으)로 검색
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
127.0500, 37.5236
5 km

4.4.2.5. Standard Deviational Ellipse

피처 레이어의 모든 피처들이 Mean Center 를 기준으로 집중되어 있는지 분산되어 있는지의 정도와 분포의 방향성을 측정합니다.

- **Syntax**

StandardDeviationalEllipse (SimpleFeatureCollection inputFeatures, String ellipseSize, String weightField, String caseField): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features containing a distribution of features for which the standard deviational ellipse will be calculated.	Complex	✓
ellipseSize	The size (1, 2, 3) of output ellipses in standard deviations.	Literal	-
weightField	The numeric field used to weight locations according to their relative importance.	Literal	-
caseField	The field used to group features for separate directional distribution calculations.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

- inputFeatures 의 Centroid 를 이용하여 계산한다.
- Ellipse 는 일반적으로 1_Standard_Deviation 인 경우 68%, 2_Standard_Deviation 인 경우 95%, 3_Standard_Deviation 인 경우 99%의 피처를 포함한다.

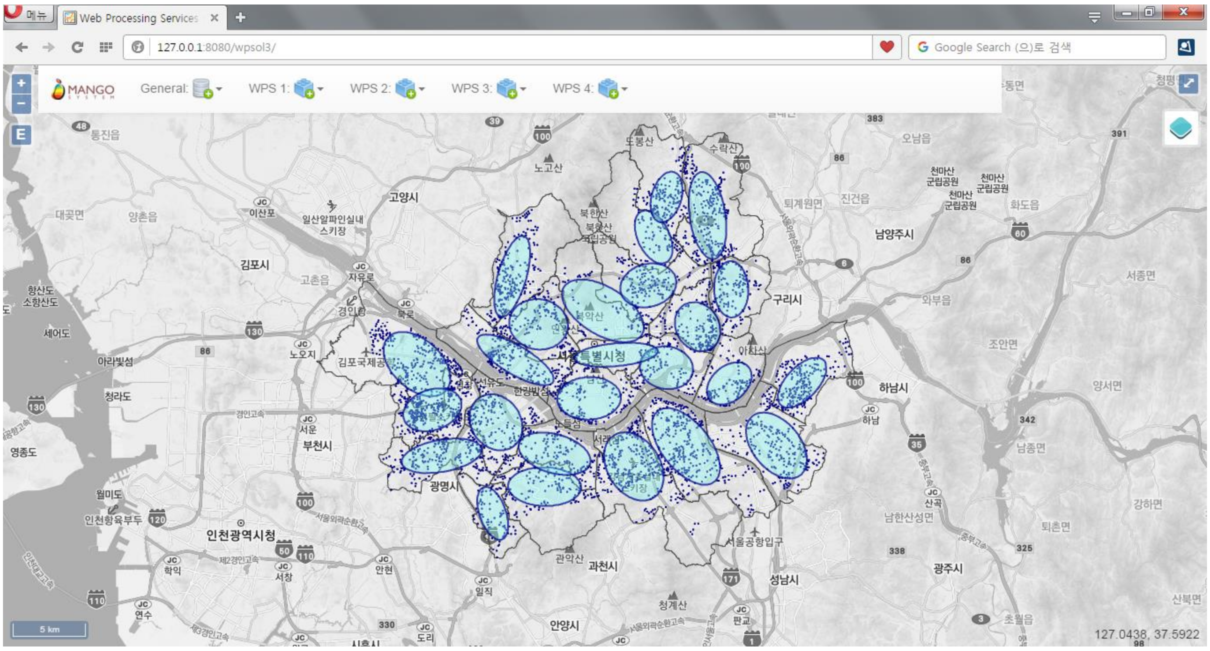
- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
```

```
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:StandardDeviationalEllipse</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:apartment"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>ellipseSize</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>1_Standard_Deviation</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>caseField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>sgg_nm</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

서울시 아파트 분포에 대한 시군구별 Standard Deviational Ecclipse 를 분석한 결과입니다.


메뉴
Web Processing Services
127.0.0.1:8080/wpsol3/
Google Search (으)로 검색
MANGO
General:
WPS 1:
WPS 2:
WPS 3:
WPS 4:
고양시
김포시
구리시
남양주시
하남시
부천시
광명시
인천광역시청
과천시
성남시
광주시
안양시
5 km
127.0438, 37.5922

4.4.2.6. Linear Directional Mean

라인 피처 레이어의 모든 피처들에 대한 지리적 중심, 평균 길이와 방향을 확인합니다.

- **Syntax**

LinearDirectionalMean (SimpleFeatureCollection inputFeatures, Boolean orientationOnly, String caseField): SimpleFeatureCollection

- **Parameters**
  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The line features containing vectors for which the mean direction will be calculated.	Complex	✓
orientationOnly	The From and To nodes are utilized in calculating the mean.	Literal	-
caseField	The field used to group features for separate directional mean calculations.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

- inputFeatures 는 반드시 라인 피처 타입이어야 한다.

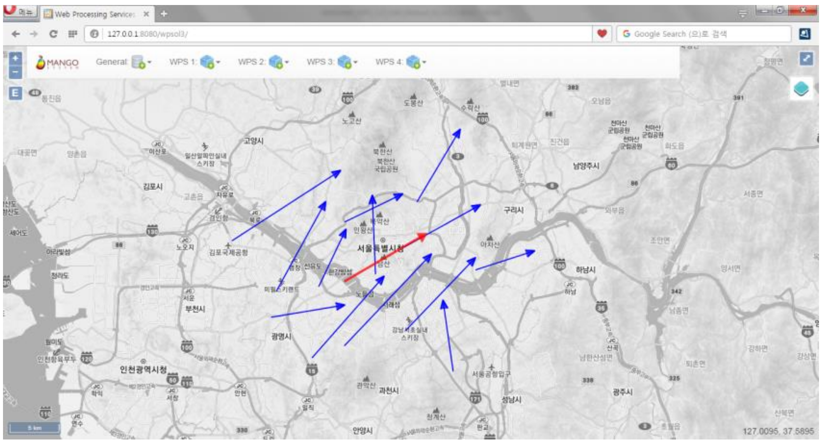
- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:LinearDirectionalMean</ows:Identifier>
  <wps:DataInputs>
```

```
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:line"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>orientationOnly</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>True</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

길이와 방향성을 가진 라인 레이어에 대한 Linear Directional Mean 분석을 수행한 결과입니다.



4.4.3. Point Pattern Analysis

포인트 데이터를 이용하여 패턴을 분석하는 프로세스들로 구성됩니다.

4.4.3.1. Nearest Neighbor Statistic

연구지역에서 피처 레이어의 각 피처별로 가장 가까운 피처와의 평균 거리에 기반한 Nearest Neighbor Index 를 계산합니다.

■ **Syntax**

NearestNeighborIndex (SimpleFeatureCollection inputFeatures, DistanceMethod distanceMethod, Double area): NearestNeighborResult

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features.	Complex	✓
distanceMethod	Specifies how distances are calculated from each feature to neighboring features: Euclidean (default) or Manhattan.	Literal	-
area	A numeric value representing the study area.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Result Nearest Neighbor Index	Complex	✓

■ **Constraints**

- inputFeatures 의 Centroid 를 이용하여 계산한다.
- area 파라미터를 설정하지 않으면 inputFeatures 의 Centroid 에 대한 Convex Hull Polygon 면적을 이용한다.
- Output 은 XML 로 반환하며, 반환된 Nearest Neighbor Ratio 의 값이 1 이면 Random, 1 보다 크면 분산, 1 보다 작으면 집중되어 있다고 볼 수 있다.

■ Request Examples

```xml
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:NearestNeighborIndex</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:apartment" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distanceMethod</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Euclidean</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response

서울시 아파트 분포에 대한 Average Nearest Neigobor 를 분석한 결과이며 XML 포맷으로 반환됩니다. Nearest Neighbor Ratio 가 1 보다 작으므로 Cluter 되었다고 설명할 수 있습니다.

```xml
<?xml version="1.0" encoding="utf-8"?>
<NearestNeighborIndex>
  <TypeName>apartment</TypeName>
  <Observed_Point_Count>4052</Observed_Point_Count>
  <Study_Area>1.047557075141607E9</Study_Area>
  <Observed_Mean_Distance>200.00446</Observed_Mean_Distance>
  <Expected_Mean_Distance>254.22844</Expected_Mean_Distance>
  <Nearest_Neighbor_Ratio>0.786712</Nearest_Neighbor_Ratio>
  <Z_Score>-25.973484</Z_Score>
  <P_Value>0.0</P_Value>
  <Standard_Error>2.087667</Standard_Error>
</NearestNeighborIndex>
```

4.4.3.2. Quadrat Method

Quadrat 분석방법을 이용하여 포인트 패턴을 분석합니다.

- **Syntax**

QuadratAnalysis (SimpleFeatureCollection inputFeatures, Double cellSize): QuadratResult

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The point features to be calculated.	Complex	✓
cellSize	The size of the grid cell.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	The Result of quadrat analysis	Complex	✓

- **Constraints**

- inputFeatures 의 Centroid 를 이용하여 계산한다.
- cellSize 파라미터를 설정하지 않으면 다음의 식을 이용하여 셀 크기를 계산한다.
  Math.sqrt((inputFeatures 의 BBOX 면적 * 2) / 포인트의 갯수)

- **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:QuadratAnalysis</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
```

```
        <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
          <wps:Body>
            <wfs:GetFeature service="WFS" version="1.0.0" outputFormat="GML2"
xmlns:foss="http://www.opengeospatial.net/foss">
              <wfs:Query typeName="foss:gasstation" />
            </wfs:GetFeature>
          </wps:Body>
        </wps:Reference>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

서울시 주유소 분포에 대한 Quadrate Method 를 분석한 결과이며 XML 포맷으로 반환됩니다.


```
<?xml version="1.0" encoding="utf-8"?>
<QuadratAnalysis>
  <TypeName>gasstation</TypeName>
  <FeatureCount>587</FeatureCount>
  <Area>1.4406602767217913E9</Area>
  <CellSize>2215.5254234488443</CellSize>
  <Columns>19</Columns>
  <Rows>16</Rows>
  <Number_of_Quadrats>304</Number_of_Quadrats>
  <Mean>1.930921052631579</Mean>
  <Variance>5.643254414819944</Variance>
  <Variance_Mean_Ratio>2.9225712812696134</Variance_Mean_Ratio>
  <Kolmogorov_Smirnov_Test>0.32209069225598863</Kolmogorov_Smirnov_Test>
  <Critical_Value_at_5percent>0.078001349515991</Critical_Value_at_5percent>
</QuadratAnalysis>
```

4.4.3.3. K-Nearest Neighbor Map

피처 레이어의 모든 피처들로부터 k 번째 가까운 피처를 연결한 라인 피처 레이어를 생성합니다.

■ **Syntax**

KNearestNeighborMap (SimpleFeatureCollection inputFeatures, Integer neighbor, Boolean convexHull): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features that can be point, line, polygon.	Complex	✓
neighbor	Number of Neighbors. Default is 1.	Literal	✓
convexHull	Add convex hull boundary to the output features. Default is True.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- Neighbor 파라미터는 1 이상이어야 하고 기본값은 1 이다.
- Output 레이어는 라인 피처 타입이다.

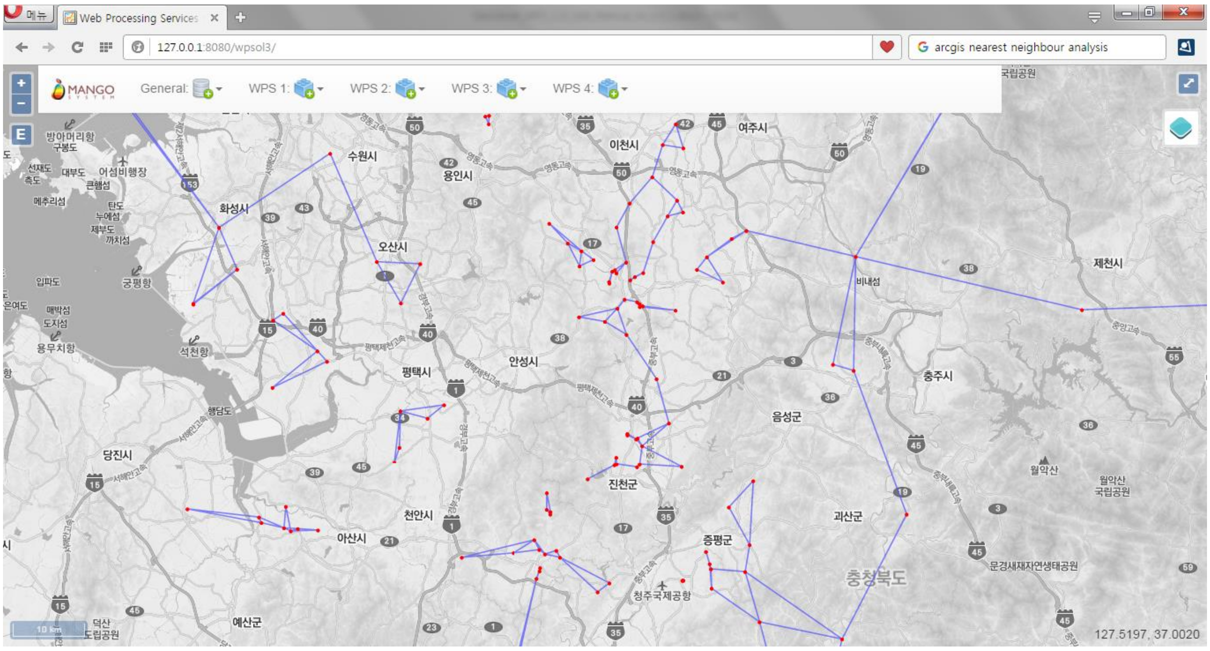
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:KNearestNeighborMap</ows:Identifier>
```

```
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:checkins"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>neighbor</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>2</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>convexHull</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>False</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

Neighbor 파라미터를 2 로 설정하고 실행한 K-Nearest Neighbor 결과입니다.



4.4.3.4. K-Means Clustering

피처 레이어의 모든 피처를 K-Means Clustering 알고리즘을 이용하여 K 개의 클러스터로 분류합니다.

■ **Syntax**

KMeansClustering (SimpleFeatureCollection inputFeatures, String targetField, Integer numberOfClusters): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	Input features to be clustered.	Complex	✓
targetField	The numeric cluster id field to be calculated. Default is cluster	Literal	✓
numberOfClusters	The number of clusters to be grouped. Default is 5.	Literal	✓

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- targetField 파라미터를 설정하지 않으면 기본값 cluster 필드를 사용한다.
- numberOfClusters 파라미터를 설정하지 않으면 기본값 5 를 사용한다.

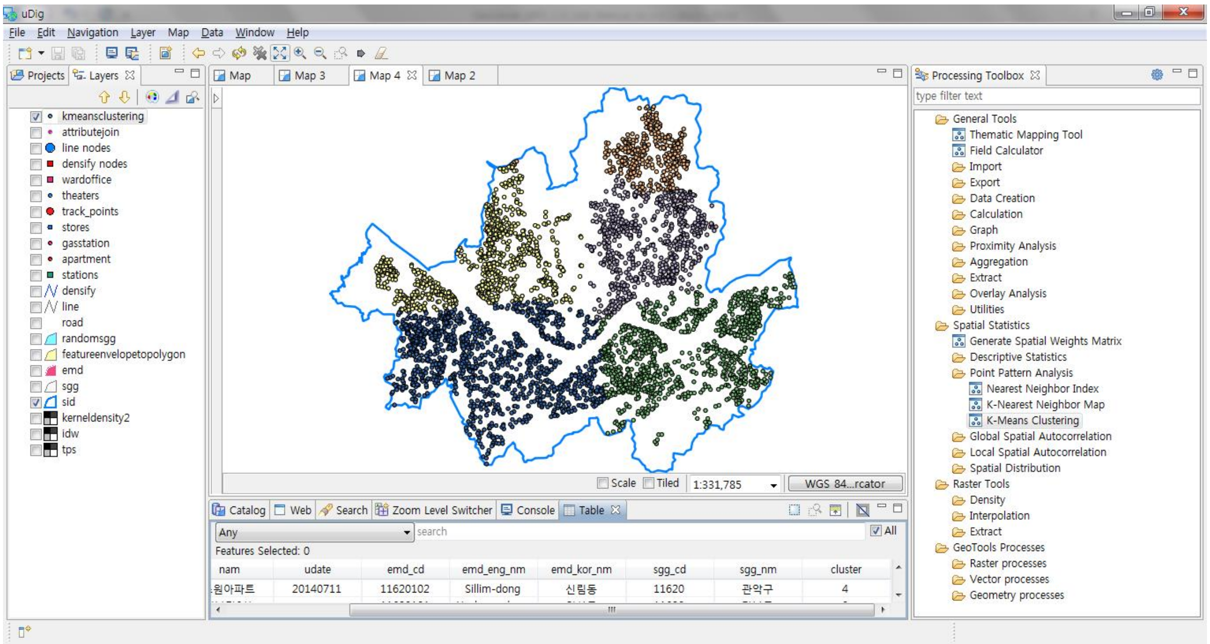
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:KMeansClustering</ows:Identifier>
```

```
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:apartment"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>targetField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>cluster</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>numberOfClusters</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>5</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

- **Response**

포인트 레이어를 5 개의 Cluster 로 설정하여 실행한 결과입니다.


uDig
File Edit Navigation Layer Map Data Window Help
Projects Layers
kmeansclustering
attributejoin
line nodes
densify nodes
wardoffice
theaters
track_points
stores
gasstation
apartment
stations
densify
line
road
randomsgg
featureenvelopetopolygon
emd
sgg
sid
kerneldensity2
idw
tps
Map Map 3 Map 4 Map 2
Scale Tiled 1:331,785 WGS 84...rcator
Catalog Web Search Zoom Level Switcher Console Table
Any search All
Features Selected: 0
nam udate emd_cd emd_eng_nm emd_kor_nm sgg_cd sgg_nm cluster
원아파트 20140711 11620102 Sillim-dong 신림동 11620 관악구 4
Processing Toolbox
type filter text
General Tools
Thematic Mapping Tool
Field Calculator
Import
Export
Data Creation
Calculation
Graph
Proximity Analysis
Aggregation
Extract
Overlay Analysis
Utilities
Spatial Statistics
Generate Spatial Weights Matrix
Descriptive Statistics
Point Pattern Analysis
Nearest Neighbor Index
K-Nearest Neighbor Map
K-Means Clustering
Global Spatial Autocorrelation
Local Spatial Autocorrelation
Spatial Distribution
Raster Tools
Density
Interpolation
Extract
GeoTools Processes
Raster processes
Vector processes
Geometry processes

4.4.4. Global Spatial Auto-Correlation

전역적 공간 자기상관을 분석하는 프로세스들로 구성됩니다.

4.4.4.1. Join Count Statistic

피처 레이어의 필드값에 기반한 바이너리 데이터(1 또는 Black, 0 또는 White 등)의 전역적 공간 자기상관을 측정합니다.

■ **Syntax**

JoinCount (SimpleFeatureCollection inputFeatures, Filter blackExpression, ContiguityType contiguityType): JoinCountProcessResult

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which join count statistics will be performed.	Complex	✓
blackExpression	Black Expression for 1 or True (for Black) value ex) [pop] > 1500.	Complex	✓
contiguityType	Contiguity Type(Queen, Rook, Bishops). Default is Queen.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Join Count Statistics.	Complex	✓

■ **Constraints**

- blackExpression 파라미터는 필드 또는 필드를 조합한 수식 모두 가능하다.
- Output 은 XML 로 반환한다.

■ **Request Examples**

```
<?xml version="1.0" encoding="utf-8"?>
<wps:Execute version="1.0.0" service="WPS" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.opengis.net/wps/1.0.0" xmlns:wfs="http://www.opengis.net/wfs"
```

```
xmlns:wps="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
xmlns:wcs="http://www.opengis.net/wcs/1.1.1" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.opengis.net/wps/1.0.0 http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:JoinCount</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:sgg" />
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>blackExpression</ows:Identifier>
      <wps:Data>
        <wps:ComplexData mimeType="text/plain; subtype=cql"><![CDATA[pop_den >
18890]]></wps:ComplexData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>contiguityType</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Queen</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

Queen 방식으로 Join Count 통계량을 분석한 결과이며, XML 포맷으로 반환합니다.

```xml
<?xml version="1.0" encoding="utf-8"?>
<JoinCountStatistics>
  <TypeName>sgg</TypeName>
  <ContiguityType>Queen</ContiguityType>
  <FeatureCount>25</FeatureCount>
  <BlackCount>11</BlackCount>
  <WhiteCount>14</WhiteCount>
  <NumberOfJoins>56</NumberOfJoins>
  <ObservedBB>11</ObservedBB>
  <ObservedWW>18</ObservedWW>
  <ObservedBW>27</ObservedBW>
  <ExpectedBB>10.8416</ExpectedBB>
  <ExpectedWW>17.561600000000002</ExpectedWW>
  <ExpectedBW>27.5968</ExpectedBW>
  <StdDevBB>5.487588556005269</StdDevBB>
  <StdDevWW>6.831669500202715</StdDevWW>
  <StdDevBW>3.9479960283667954</StdDevBW>
  <ZScoreBB>0.028865137825731742</ZScoreBB>
  <ZScoreWW>0.06417172259094052</ZScoreWW>
  <ZScoreBW>-0.15116529898002093</ZScoreBW>
</JoinCountStatistics>
```

4.4.4.2. Moran's I

피처 레이어의 위치와 속성값에 기반하여 전역적 Moran's I 공간 자기상관을 측정합니다.

■ **Syntax**

GlobalMoransI (SimpleFeatureCollection inputFeatures, String inputField, SpatialConcept spatialConcept, DistanceMethod distanceMethod, StandardizationMethod standardization, Double searchDistance): MoransI

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which spatial autocorrelation will be calculated.	Complex	✓
inputField	The numeric field used in assessing spatial autocorrelation.	Literal	✓
spatialConcept	Specifies how spatial relationships among features are conceptualized. Default is InverseDistance	Literal	-
distanceMethod	Specifies how distances are calculated from each feature to neighboring features. Default is Euclidean	Literal	-
standardization	Row standardization. Default is None	Literal	-
searchDistance	Specifies a cutoff distance for Inverse Distance and Fixed Distance options.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output XML.	Complex	✓

■ **Constraints**

- Output 은 XML 로 반환한다.

■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
```

```
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:GlobalMoransI</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a3_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>spatialConcept</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>InverseDistance</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distanceMethod</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Euclidean</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>standardization</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Row</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
```

```
    <wps:RawDataOutput mimeType="text/xml">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**


```
<?xml version="1.0" encoding="utf-8"?>
<MoransI>
  <TypeName>korea_sgg</TypeName>
  <PropertyName>a3_2005</PropertyName>
  <Observed_Index>0.070175</Observed_Index>
  <Expected_Index>-0.004292</Expected_Index>
  <Variance>0.000203</Variance>
  <Z_Score>5.230945</Z_Score>
  <P_Value>0</P_Value>
  <Conceptualization>InverseDistance</Conceptualization>
  <DistanceMethod>Euclidean</DistanceMethod>
  <RowStandardization>Row</RowStandardization>
  <DistanceThreshold>191807.950591</DistanceThreshold>
</MoransI>
```

4.4.4.3. Geary's c

피처 레이어의 위치와 속성값에 기반하여 전역적 Geary's c 공간 자기상관을 측정합니다.

■ **Syntax**

GlobalGearysC (SimpleFeatureCollection inputFeatures, String inputField, SpatialConcept spatialConcept, DistanceMethod distanceMethod, StandardizationMethod standardization, Double searchDistance): GearysC

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which spatial autocorrelation will be calculated.	Complex	✓
inputField	The numeric field used in assessing spatial autocorrelation.	Literal	✓
spatialConcept	Specifies how spatial relationships among features are conceptualized. Default is InverseDistance	Literal	-
distanceMethod	Specifies how distances are calculated from each feature to neighboring features. Default is Euclidean	Literal	-
standardization	Row standardization. Default is None	Literal	-
searchDistance	Specifies a cutoff distance for Inverse Distance and Fixed Distance options.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output XML.	Complex	✓

■ **Constraints**

- Output 은 XML 로 반환한다.

■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
```

```
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:GlobalGearysC</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a3_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>spatialConcept</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>InverseDistance</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distanceMethod</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Euclidean</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>standardization</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Row</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
```

```
      <wps:RawDataOutput mimeType="text/xml">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response


```
<?xml version="1.0" encoding="utf-8"?>
<GlobalGearysC>
  <TypeName>korea_sgg</TypeName>
  <PropertyName>a3_2005</PropertyName>
  <Observed_Index>0.908981</Observed_Index>
  <Expected_Index>1</Expected_Index>
  <Variance>0.00029</Variance>
  <Z_Score>-5.341097</Z_Score>
  <P_Value>0</P_Value>
  <Conceptualization>InverseDistance</Conceptualization>
  <DistanceMethod>Euclidean</DistanceMethod>
  <RowStandardization>Row</RowStandardization>
  <DistanceThreshold>191807.950591</DistanceThreshold>
</GlobalGearysC>
```

4.4.4.4. Getis-Ord's General G

피처 레이어의 위치와 속성값에 기반하여 전역적 Getis-Ord General G 공간 자기상관을 측정합니다.

- **Syntax**

GlobalGStatistics (SimpleFeatureCollection inputFeatures, String inputField, SpatialConcept spatialConcept, DistanceMethod distanceMethod, StandardizationMethod standardization, Double searchDistance): GeneralG

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which spatial autocorrelation will be calculated.	Complex	✓
inputField	The numeric field used in assessing spatial autocorrelation.	Literal	✓
spatialConcept	Specifies how spatial relationships among features are conceptualized. Default is InverseDistance	Literal	-
distanceMethod	Specifies how distances are calculated from each feature to neighboring features. Default is Euclidean	Literal	-
standardization	Row standardization. Default is None	Literal	-
searchDistance	Specifies a cutoff distance for Inverse Distance and Fixed Distance options.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output XML.	Complex	✓

- **Constraints**

- Output 은 XML 로 반환한다.

- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
```

```
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:GlobalGStatistics</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a3_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>spatialConcept</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>InverseDistance</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distanceMethod</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Euclidean</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>standardization</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Row</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
```

```
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response


```
<?xml version="1.0" encoding="utf-8"?>
<GStatistics>
  <TypeName>korea_sgg</TypeName>
  <PropertyName>a3_2005</PropertyName>
  <Observed_Index>0.004492</Observed_Index>
  <Expected_Index>0.004292</Expected_Index>
  <Variance>0</Variance>
  <Z_Score>4.275913</Z_Score>
  <P_Value>0.000019</P_Value>
  <Conceptualization>InverseDistance</Conceptualization>
  <DistanceMethod>Euclidean</DistanceMethod>
  <RowStandardization>Row</RowStandardization>
  <DistanceThreshold>191807.950591</DistanceThreshold>
</GStatistics>
```

4.4.4.5. Lee's S

피처 레이어의 위치와 속성값에 기반하여 전역적 Lee's S 공간 자기상관을 측정합니다.

■ **Syntax**

GlobalLeesS (SimpleFeatureCollection inputFeatures, String inputField, SpatialConcept spatialConcept, DistanceMethod distanceMethod, StandardizationMethod standardization, Double searchDistance): LeesS

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which spatial autocorrelation will be calculated.	Complex	✓
inputField	The numeric field used in assessing spatial autocorrelation.	Literal	✓
spatialConcept	Specifies how spatial relationships among features are conceptualized. Default is InverseDistance	Literal	-
distanceMethod	Specifies how distances are calculated from each feature to neighboring features. Default is Euclidean	Literal	-
standardization	Row standardization. Default is None	Literal	-
searchDistance	Specifies a cutoff distance for Inverse Distance and Fixed Distance options.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output XML.	Complex	✓

■ **Constraints**

- Output 은 XML 로 반환한다.

■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
```

```
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:GlobalLeesS</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a3_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>spatialConcept</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>InverseDistance</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distanceMethod</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Euclidean</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>standardization</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Row</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
```

```
    <wps:RawDataOutput mimeType="text/xml">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ **Response**

```
<?xml version="1.0" encoding="utf-8"?>
<GlobalLeesS>
  <TypeName>korea_sgg</TypeName>
  <PropertyName>a3_2005</PropertyName>
  <Observed_Index>0.065413</Observed_Index>
  <Expected_Index>0.090566</Expected_Index>
  <Variance>0</Variance>
  <Z_Score>0</Z_Score>
  <P_Value>1</P_Value>
  <Conceptualization>InverseDistance</Conceptualization>
  <DistanceMethod>Euclidean</DistanceMethod>
  <RowStandardization>Row</RowStandardization>
  <DistanceThreshold>191807.950591</DistanceThreshold>
</GlobalLeesS>
```

4.4.4.6. Lee's L

피처 레이어의 위치와 두 속성값에 기반하여 전역적 Lee's L 공간 자기상관을 측정합니다.

- **Syntax**

GlobalLeesL (SimpleFeatureCollection inputFeatures, String xField, String yField, SpatialConcept spatialConcept, DistanceMethod distanceMethod, StandardizationMethod standardization, Double searchDistance): LeesL

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which spatial autocorrelation will be calculated.	Complex	✓
xField	The numeric x field used in assessing spatial autocorrelation.	Literal	✓
yField	The numeric y field used in assessing spatial autocorrelation.	Literal	✓
spatialConcept	Specifies how spatial relationships among features are conceptualized. Default is InverseDistance	Literal	-
distanceMethod	Specifies how distances are calculated from each feature to neighboring features. Default is Euclidean	Literal	-
standardization	Row standardization. Default is None	Literal	-
searchDistance	Specifies a cutoff distance for Inverse Distance and Fixed Distance options.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output XML.	Complex	✓

- **Constraints**

- Output 은 XML 로 반환한다.

- **Request Examples**

```xml
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:GlobalLeesL</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a3_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>spatialConcept</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>InverseDistance</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distanceMethod</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Euclidean</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>standardization</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Row</wps:LiteralData>
      </wps:Data>
```

```
    </wps:Input>
  </wps:DataInputs>
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response


```
<?xml version="1.0" encoding="utf-8"?>
<GlobalLeesL>
  <TypeName>korea_sgg</TypeName>
  <PropertyName>a + b</PropertyName>
  <Observed_Index>0.42206509</Observed_Index>
  <Expected_Index>0.090566</Expected_Index>
  <Variance>0</Variance>
  <Z_Score>0</Z_Score>
  <P_Value>1</P_Value>
  <Conceptualization>0.42206509</Conceptualization>
  <DistanceMethod>Euclidean</DistanceMethod>
  <RowStandardization>Row</RowStandardization>
  <DistanceThreshold>0</DistanceThreshold>
</GlobalLeesL>
```

4.4.5. Local Spatial Auto-Correlation

국지적 공간 자기상관을 분석하는 프로세스들로 구성됩니다.

4.4.5.1. Local Moran's I

피처 레이어로부터 Anselin 의 국지적 Moran's I 통계량을 이용하여 통계적으로 유의미한 핫 스팟(hot spots), 콜드 스팟(cold spots), 공간 아웃라이어(spatial outliers)를 확인합니다.

- **Syntax**

LocalMoransI (SimpleFeatureCollection inputFeatures, String inputField, SpatialConcept spatialConcept, DistanceMethod distanceMethod, StandardizationMethod standardization, Double searchDistance): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which spatial autocorrelation will be calculated.	Complex	✓
inputField	The numeric field used in assessing spatial autocorrelation.	Literal	✓
spatialConcept	Specifies how spatial relationships among features are conceptualized. Default is InverseDistance	Literal	-
distanceMethod	Specifies how distances are calculated from each feature to neighboring features. Default is Euclidean	Literal	-
standardization	Row standardization. Default is None	Literal	-
searchDistance	Specifies a cutoff distance for Inverse Distance and Fixed Distance options.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

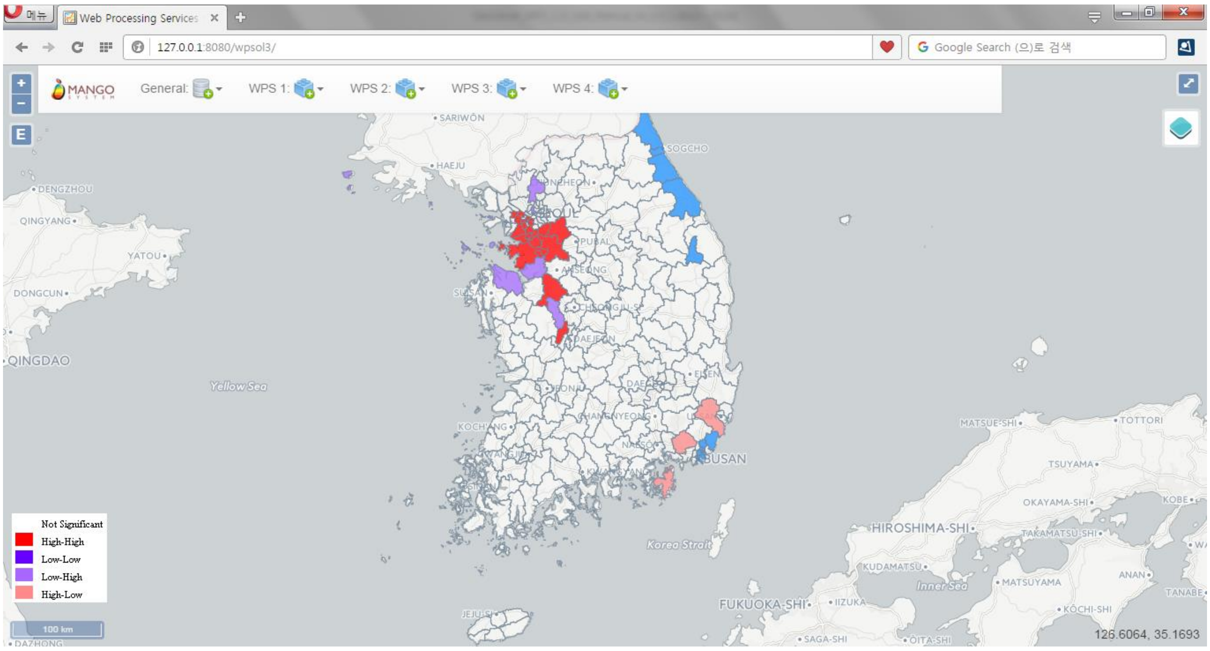
- Output 레이어는 inputFeatures 의 모든 필드를 포함해서 LMiIndex, LMiZScore, LMiPValue, LMizValue, LMiwzValue, COType 필드가 추가된다.

■ Request Examples

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:LocalMoransI</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a3_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>spatialConcept</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>InverseDistance</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distanceMethod</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Euclidean</wps:LiteralData>
      </wps:Data>
```

```
        </wps:Input>
        <wps:Input>
            <ows:Identifier>standardization</ows:Identifier>
            <wps:Data>
                <wps:LiteralData>Row</wps:LiteralData>
            </wps:Data>
        </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
        <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
            <ows:Identifier>result</ows:Identifier>
        </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response



4.4.5.2. Local G (Gi)*

피처 레이어로부터 국지적 Getis-Ord Gi* 통계량을 이용하여 통계적으로 유의미한 핫 스팟(hot spots), 콜드 스팟(cold spots)을 확인합니다.

■ **Syntax**

LocalGStatistics (SimpleFeatureCollection inputFeatures, String inputField, SpatialConcept spatialConcept, DistanceMethod distanceMethod, StandardizationMethod standardization, Double searchDistance): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which spatial autocorrelation will be calculated.	Complex	✓
inputField	The numeric field used in assessing spatial autocorrelation.	Literal	✓
spatialConcept	Specifies how spatial relationships among features are conceptualized. Default is InverseDistance	Literal	-
distanceMethod	Specifies how distances are calculated from each feature to neighboring features. Default is Euclidean	Literal	-
standardization	Row standardization. Default is None	Literal	-
searchDistance	Specifies a cutoff distance for Inverse Distance and Fixed Distance options.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

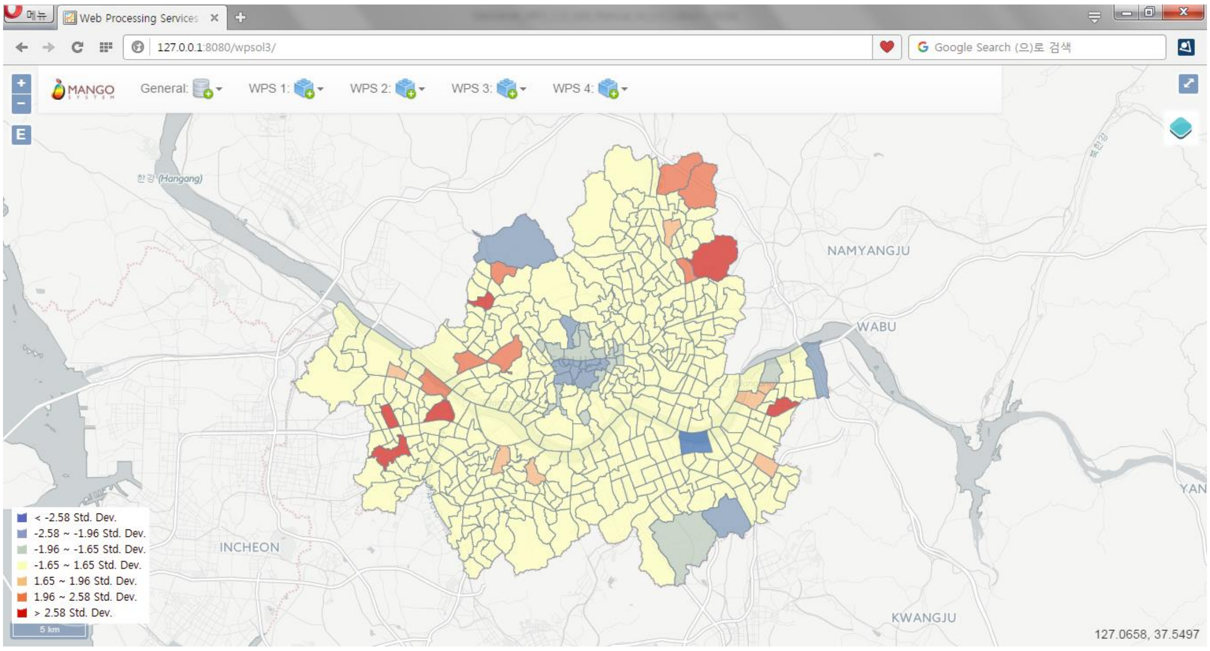
- Output 레이어는 inputFeatures 의 모든 필드를 포함해서 GiZScore, GiMean, GiVar, GiPValue 필드가 추가된다.

■ **Request Examples**

```xml
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:LocalGStatistics</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:emd"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>pts</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>spatialConcept</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>InverseDistance</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distanceMethod</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Euclidean</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>standardization</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Row</wps:LiteralData>
      </wps:Data>
```

```
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType=”text/xml; subtype=wfs-collection/1.1”>
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response



4.4.5.3. Local Geary's c

피처 레이어로부터 국지적 Geary's c 통계량을 계산합니다.

■ **Syntax**

LocalGearysC (SimpleFeatureCollection inputFeatures, String inputField, SpatialConcept spatialConcept, DistanceMethod distanceMethod, StandardizationMethod standardization, Double searchDistance): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which spatial autocorrelation will be calculated.	Complex	✓
inputField	The numeric field used in assessing spatial autocorrelation.	Literal	✓
spatialConcept	Specifies how spatial relationships among features are conceptualized. Default is InverseDistance	Literal	-
distanceMethod	Specifies how distances are calculated from each feature to neighboring features. Default is Euclidean	Literal	-
standardization	Row standardization. Default is None	Literal	-
searchDistance	Specifies a cutoff distance for Inverse Distance and Fixed Distance options.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- Output 레이어는 inputFeatures 의 모든 필드를 포함해서 LGcIndex, LGcZScore, LGcPValue 필드가 추가된다.

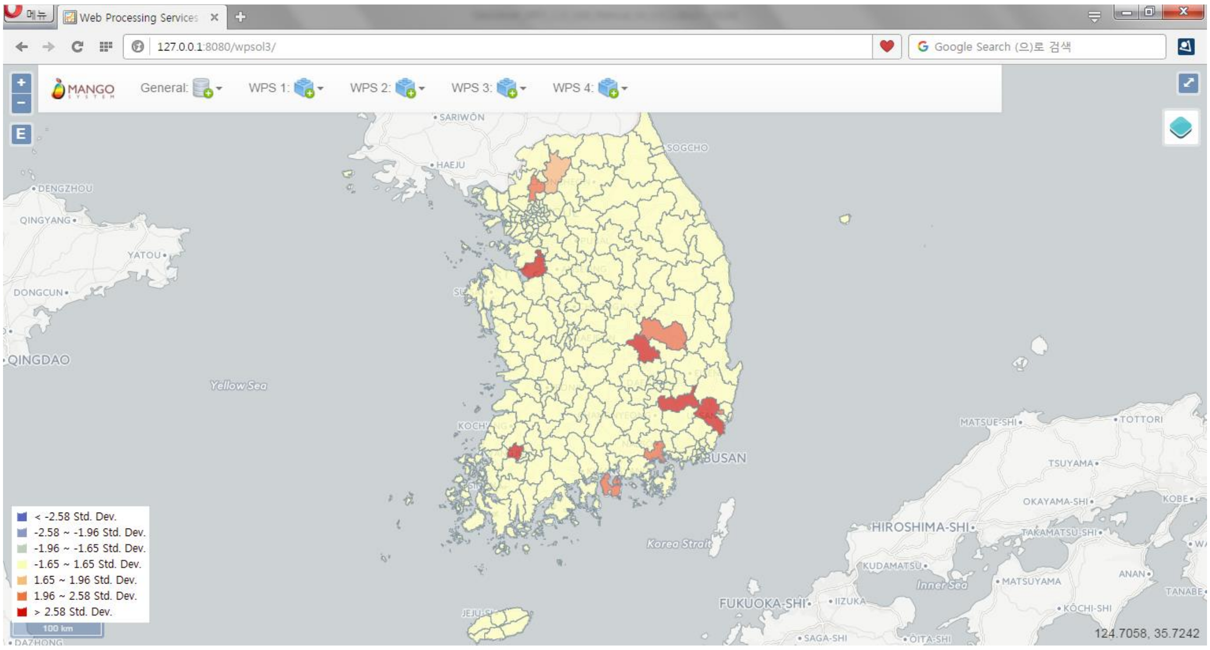
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
```

```
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:LocalGearysC</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:korea_sgg"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a3_2005</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>spatialConcept</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>InverseDistance</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distanceMethod</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Euclidean</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>standardization</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Row</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
```

```
  <wps:ResponseForm>
    <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
      <ows:Identifier>result</ows:Identifier>
    </wps:RawDataOutput>
  </wps:ResponseForm>
</wps:Execute>
```

■ Response



4.4.5.4. Lee's Si

피처 레이어로부터 국지적 Lee's S 통계량을 계산합니다.

■ **Syntax**

LocalLeesS (SimpleFeatureCollection inputFeatures, String inputField, SpatialConcept spatialConcept, DistanceMethod distanceMethod, StandardizationMethod standardization, Double searchDistance): SimpleFeatureCollection

■ **Parameters**

■ **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which spatial autocorrelation will be calculated.	Complex	✓
inputField	The numeric field used in assessing spatial autocorrelation.	Literal	✓
spatialConcept	Specifies how spatial relationships among features are conceptualized. Default is InverseDistance	Literal	-
distanceMethod	Specifies how distances are calculated from each feature to neighboring features. Default is Euclidean	Literal	-
standardization	Row standardization. Default is None	Literal	-
searchDistance	Specifies a cutoff distance for Inverse Distance and Fixed Distance options.	Literal	-

■ **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

■ **Constraints**

- Output 레이어는 inputFeatures 의 모든 필드를 포함해서 LLsIndex, LLsZScore, LLsPValue 필드가 추가된다.

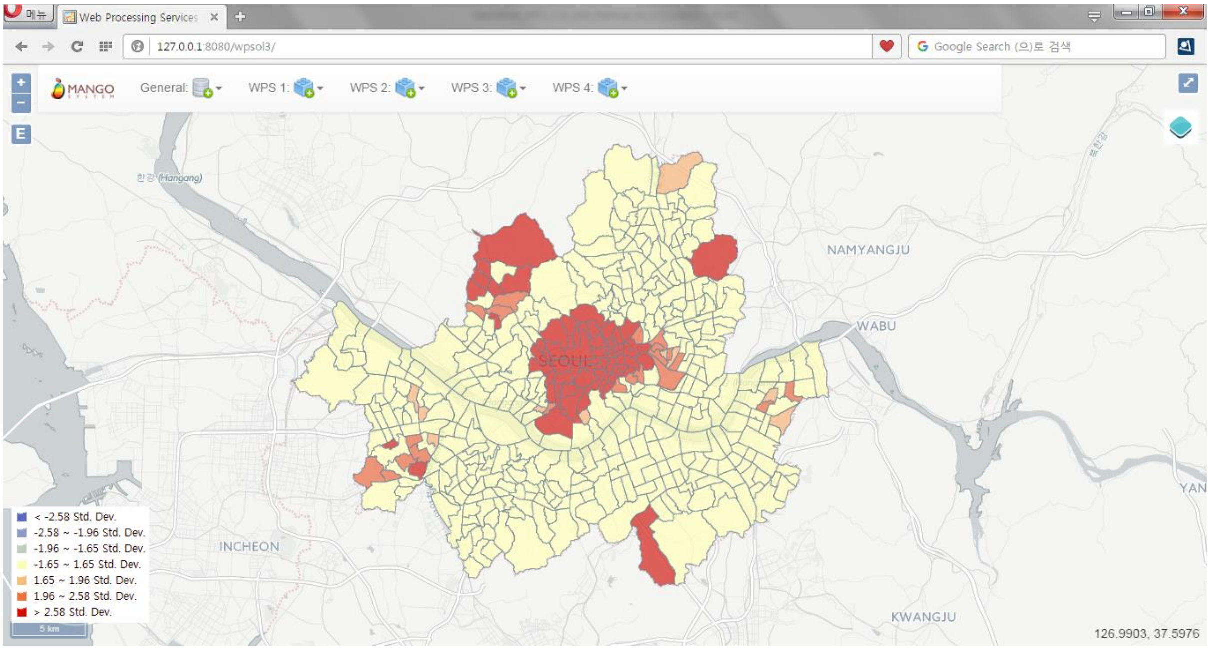
■ **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
```

```
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:LocalLeesS</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:emd"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>inputField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>pts</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>spatialConcept</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>InverseDistance</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distanceMethod</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Euclidean</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>standardization</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Row</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps:DataInputs>
```

```
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType="text/xml; subtype=wfs-collection/1.1">
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response



4.4.5.5. Lee's Li

피처 레이어와 두 속성값으로부터 국지적 Lee's L 통계량을 계산합니다.

- **Syntax**

LocalLeesL (SimpleFeatureCollection inputFeatures, String xField, String yField, SpatialConcept spatialConcept, DistanceMethod distanceMethod, StandardizationMethod standardization, Double searchDistance): SimpleFeatureCollection

- **Parameters**

  - **Data Inputs**

Identifier	Description	Type	Required
inputFeatures	The features for which spatial autocorrelation will be calculated.	Complex	✓
xField	The numeric x field used in assessing spatial autocorrelation.	Literal	✓
yField	The numeric y field used in assessing spatial autocorrelation.	Literal	✓
spatialConcept	Specifies how spatial relationships among features are conceptualized. Default is InverseDistance	Literal	-
distanceMethod	Specifies how distances are calculated from each feature to neighboring features. Default is Euclidean	Literal	-
standardization	Row standardization. Default is None	Literal	-
searchDistance	Specifies a cutoff distance for Inverse Distance and Fixed Distance options.	Literal	-

  - **Process Outputs**

Identifier	Description	Type	Required
result	Output features.	Complex	✓

- **Constraints**

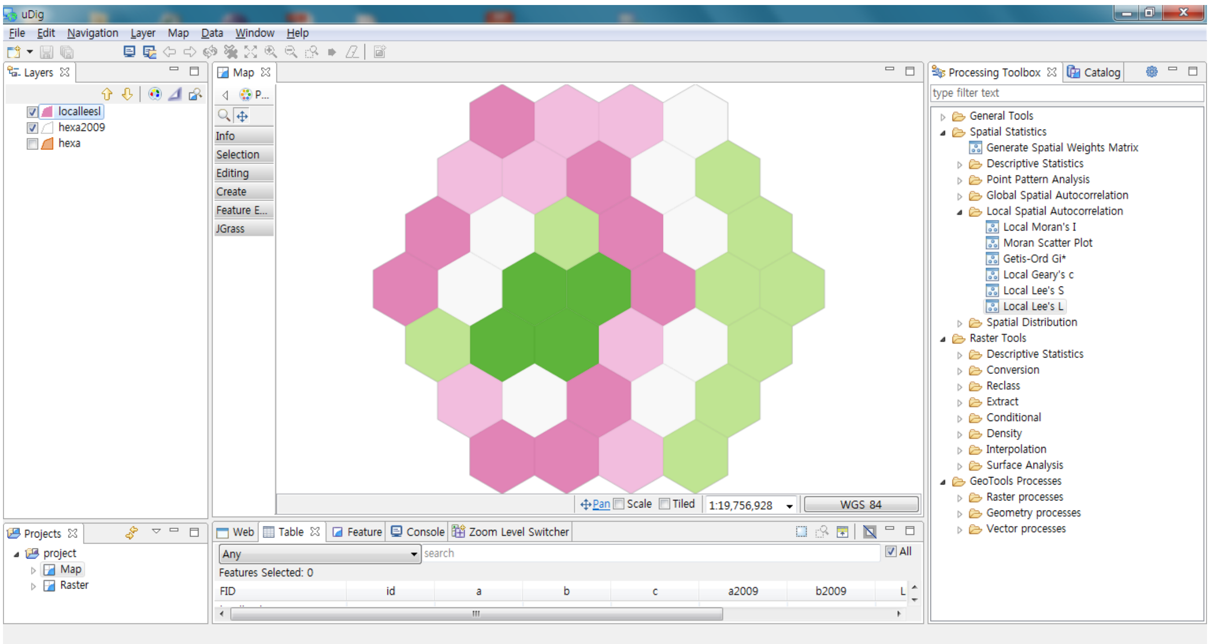
- Output 레이어는 inputFeatures 의 모든 필드를 포함해서 LLIIndex, LLIZScore, LLIPValue 필드가 추가된다.

- **Request Examples**

```
<?xml version="1.0" encoding="UTF-8"?><wps:Execute version="1.0.0" service="WPS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.opengis.net/wps/1.0.0"
xmlns:wfs="http://www.opengis.net/wfs" xmlns:wps="http://www.opengis.net/wps/1.0.0"
xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:gml="http://www.opengis.net/gml"
xmlns:ogc="http://www.opengis.net/ogc" xmlns:wcs="http://www.opengis.net/wcs/1.1.1"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsAll.xsd">
  <ows:Identifier>statistics:LocalLeesL</ows:Identifier>
  <wps:DataInputs>
    <wps:Input>
      <ows:Identifier>inputFeatures</ows:Identifier>
      <wps:Reference mimeType="text/xml" xlink:href="http://geoserver/wfs" method="POST">
        <wps:Body>
          <wfs:GetFeature service="WFS" version="1.1.0" outputFormat="GML3"
xmlns:foss="http://www.opengeospatial.net/foss">
            <wfs:Query typeName="foss:hexa2009"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>xField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>a2009</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>yField</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>b2009</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>spatialConcept</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>ContiguityEdgesNodes</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>distanceMethod</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>Euclidean</wps:LiteralData>
      </wps:Data>
```

```
      </wps:Input>
      <wps:Input>
        <ows:Identifier>standardization</ows:Identifier>
        <wps:Data>
          <wps:LiteralData>Row</wps:LiteralData>
        </wps:Data>
      </wps:Input>
    </wps:DataInputs>
    <wps:ResponseForm>
      <wps:RawDataOutput mimeType=”text/xml; subtype=wfs-collection/1.1”>
        <ows:Identifier>result</ows:Identifier>
      </wps:RawDataOutput>
    </wps:ResponseForm>
</wps:Execute>
```

■ Response



5 Web Processing Service Demo Application

5.1. Introduction

5.1.1. Goal

이 데모 프로그램의 목적은 다음과 같습니다.

- 분석기능을 JavaScript 환경에서 WPS(Web Processing Service)를 활용해 볼 수 있도록 구성
- OpenLayers[10] 3 환경에서 개발되었으며, WPS 결과물인 벡터 레이어의 경우 OpenLayers 3 가 제공하는 벡터 스타일링 기능을 활용해 시각화
- 예제 공간데이터는 실제 데이터와는 차이가 있으므로, 연구 또는 업무에 활용할 수 없습니다.

5.1.2. Open Source Libraries & Programs

데모 프로그램에 사용된 오픈 소스 라이브러리, 프로그램, 오픈 배경지도는 다음과 같습니다.

구분	오픈소스	비고
JavaScript Client	OpenLayers 3.13.1	
	Bootstrap 3.3.6	
	jQuery 1.12.0 / 2.2.0 + jQuery UI 1.11.4	
	geostats 1.5.0	
	evol.colorpicker 2.3.4	
Server	PostgreSQL 9.2 + PostGIS 2.0.3	
	GeoTools 13.6 + GeoServer 2.8.5 + WPS Extension	
	OpenGDS/Analysis WPS Extension	
	Apache Tomcat 7 or 8	
Base Maps	Open Street Map + Open Cycle Map	
	Stamen Design	
	MapBox + CartoDB	
	V-World Map	

10 http://openlayers.org/

Icons	GeoSilk

5.1.3. Spatial Data

데모 프로그램에 활용된 데이터 목록, 유형, 좌표체계, 공간범위 및 출처는 다음과 같습니다.

테이블명	설명	유형	좌표체계	공간범위	비고
apartment	아파트	Point	EPSG:3857	서울특별시	POI 수집
bank	은행	Point	EPSG:3857	전국	POI 수집
bugerking	버거킹	Point	EPSG:3857	전국	POI 수집
checkins	체크인	Point	EPSG:3857	전국	POI 수집
dunkindonuts	던킨도너츠	Point	EPSG:3857	전국	POI 수집
earthquake	지진발생 현황	Point	EPSG:3857	대한민국	기상청
emd	읍면동 경계	Polygon	EPSG:3857	서울특별시	통계청
emd_points	읍면동 중심점	Point	EPSG:3857	서울특별시	통계청
enterprise	1,000 대 기업	Point	EPSG:3857	전국	POI 수집
gasstation	주유소	Point	EPSG:3857	서울특별시	POI 수집
golf	골프장	Point	EPSG:3857	전국	POI 수집
hospital	병원	Point	EPSG:3857	서울특별시	POI 수집
kfc	KFC	Point	EPSG:3857	전국	POI 수집
korea_sgg	시군구 경계	Polygon	EPSG:3857	전국	통계청
line	라인	Line	EPSG:3857	서울특별시	-
lotteria	롯데리아	Point	EPSG:3857	전국	POI 수집
market	시장	Point	EPSG:3857	서울특별시	POI 수집
mcdonalds	맥도날드	Point	EPSG:3857	전국	POI 수집
metro	수도권 경계	Polygon	EPSG:3857	수도권	통계청
overlay01	폴리곤 1	Polygon	EPSG:3857	서울특별시	-
overlay02	폴리곤 2	Polygon	EPSG:3857	서울특별시	-
pubs	주점	Point	EPSG:3857	서울특별시	서울시
randomsgg	랜덤 경계	Polygon	EPSG:3857	서울특별시	-
road	주요도로	Line	EPSG:3857	서울특별시	교통 DB
school	학교	Point	EPSG:3857	서울특별시	POI 수집
seoul_series	서울 시군구경계	Polygon	EPSG:3857	서울특별시	통계청
sgg	서울 시군구경계	Polygon	EPSG:3857	서울특별시	통계청
sid	서울 시도경계	Polygon	EPSG:3857	서울특별시	통계청
stations	지하철/철도역	Point	EPSG:3857	전국	POI 수집
stores	대형매장	Point	EPSG:3857	서울특별시	POI 수집
theaters	극장	Point	EPSG:3857	서울특별시	POI 수집
toxic_office	위험물배출업소	Point	EPSG:3857	서울특별시	서울시
wardoffice	서울 시군구청	Point	EPSG:3857	서울특별시	POI 수집

5.1.4. How to install

설치하기 전에 PostgreSQL + PostGIS, Tomcat 7 이상 및 GeoServer 2.8.5 가 먼저 설치되어 있어야 합니다.

5.1.4.1. *Downloads*

다음의 URL 에서 설치에 필요한 파일을 다운로드 후 압축을 해제합니다.

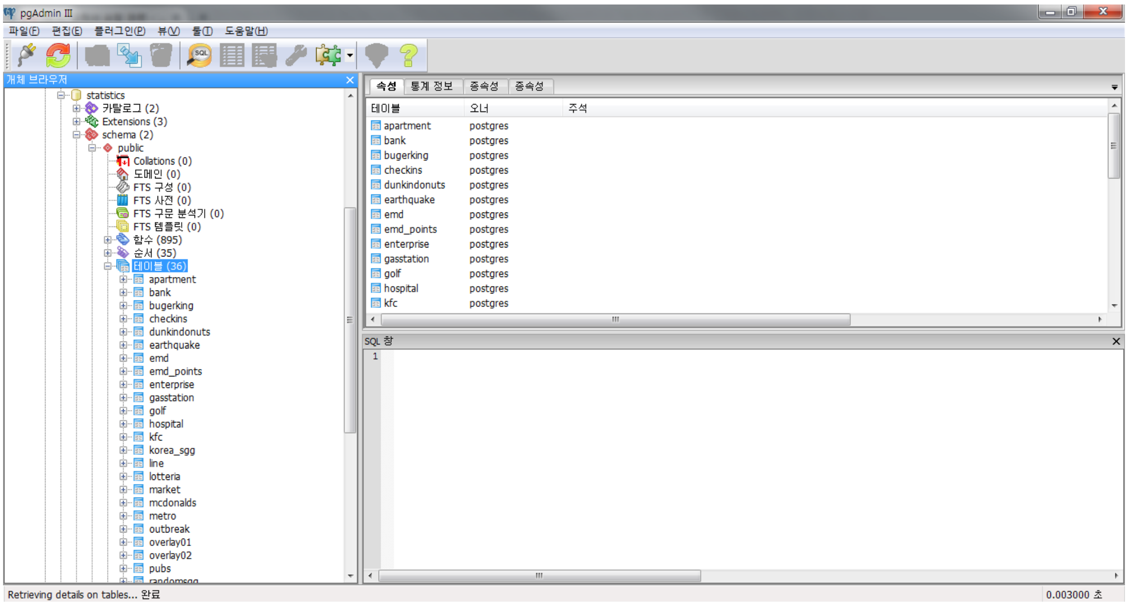
- 다운로드: https://sourceforge.net/projects/mango-spatialstatistics/files/GeoServer/demo/GeoServer-WPS-Demo.zip

압축 해제한 폴더에는 다음과 같은 3 개의 폴더로 구성되어 있습니다.

- PostGIS-2.0: statistics.backup 파일
- GeoServer-2.8.5: GeoServer data 디렉토리 관련 파일
- Tomcat: 데모 앱

5.1.4.2. *PostGIS*

사용할 PostGIS 데이터베이스에 statistics 이름의 공간데이터베이스를 생성 후 다운로드한 statistics.backup 파일을 복원합니다.



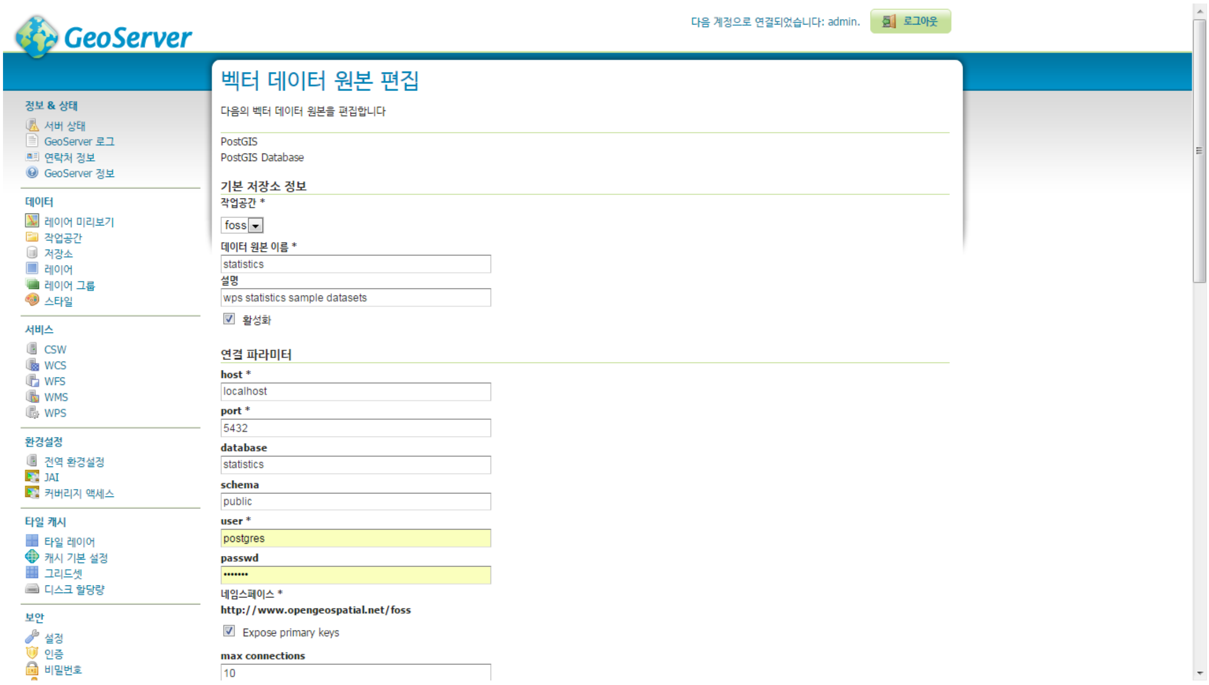
5.1.4.3. GeoServer

GeoServer 의 Data Directory 에 다운로드한 data, styles, workspaces 폴더를 복사한 후 GeoServer 를 재시작합니다.

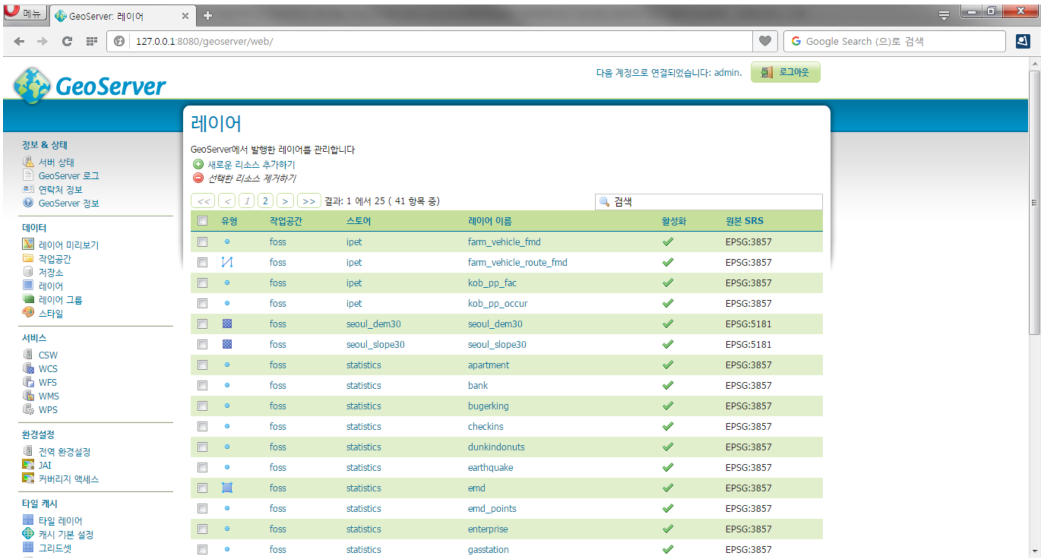
이제 PostGIS 연결정보를 확인해야 합니다.

우선 [저장소] 페이지로 이동하여 다음과 같이 statistics 저장소를 수정합니다.

수정 페이지에서 다음과 같이 user 및 passwd 정보를 설치한 PostGIS 계정으로 변경한 후 저장합니다.



이제 [서버상태] 페이지로 이동하여 하단의 [다시 불러오기] 버튼을 누르면 모든 레이어가 활성화됩니다. 만약 [레이어] 페이지에서 다음과 같이 레이어가 활성화되지 않는다면 연결정보를 다시 확인해 보시기 바랍니다.



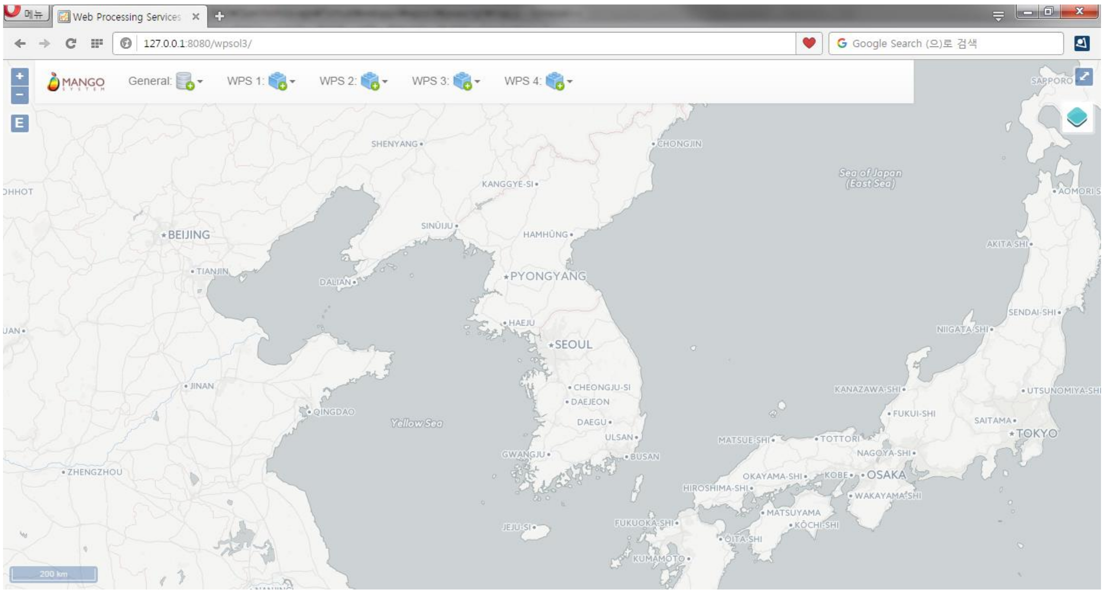
5.1.4.4. Web Apps.

Tomcat 의 webapps 폴더에 wpsol3.zip 파일 압축 해제 후 폴더를 복사합니다.

wpsol3 폴더의 javascript 폴더로 이동하여 map.js 파일을 텍스트 편집기로 불러와서 다음 항목을 GeoServer URL 로 수정합니다.

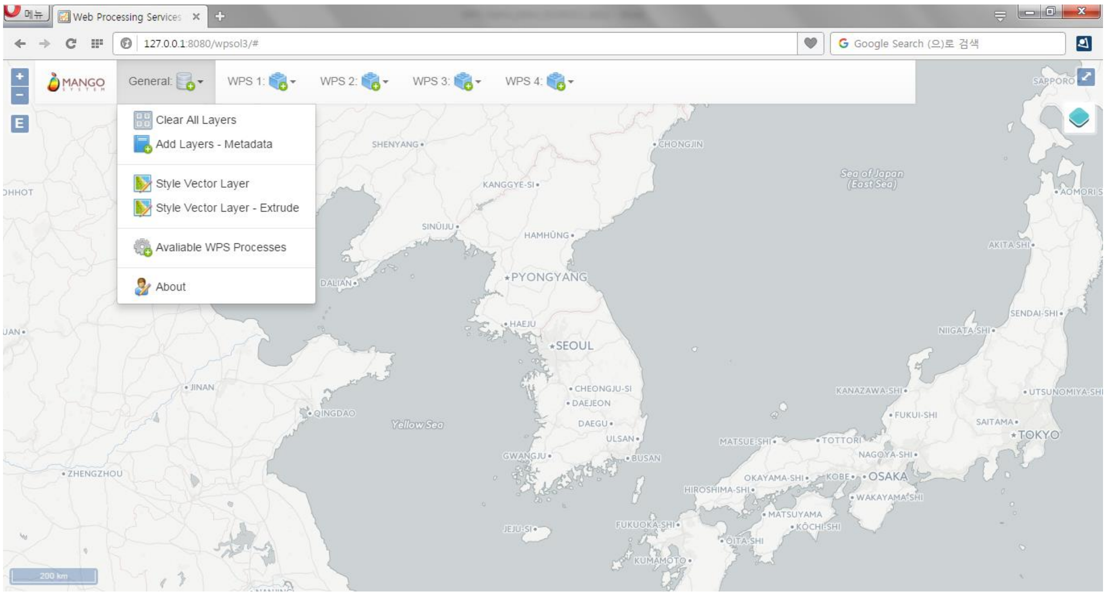
```
var SERVER              = '127.0.0.1:8080';
```

이제 브라우저를 열어 wpsol3(예: http://127.0.0.1:8080/wpsol3/) 주소로 이동합니다. 다음의 화면이 정상적으로 보이면 설치가 완료되었습니다.



5.2. Examples

웹 브라우저를 열어 http://127.0.0.1:8080/wpsol3 사이트에 접속하면 다음의 초기화면으로 이동합니다. 메뉴는 General, D1 ~ D5(추후 계속 업데이트됩니다)로 구성되어 있습니다.



5.2.1. General

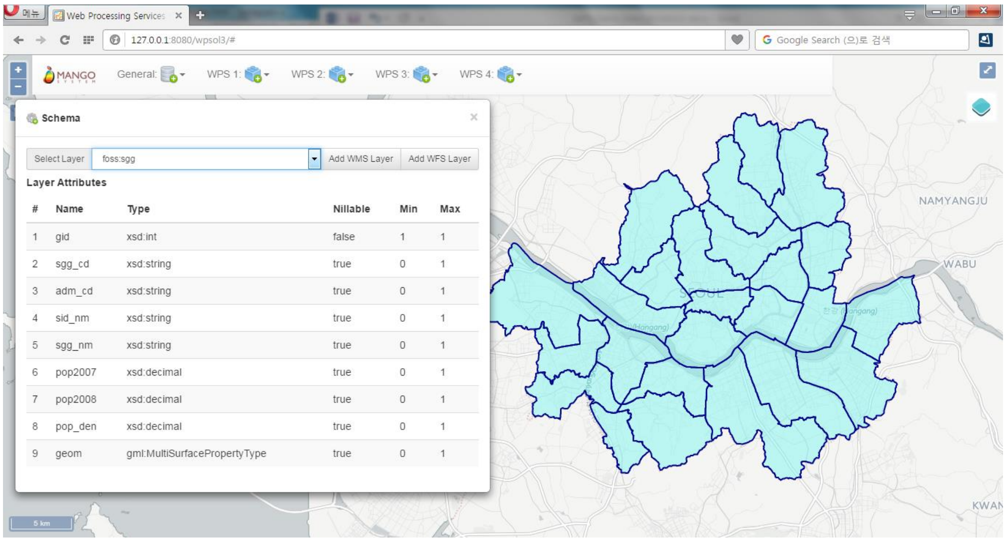
레이어 및 WPS 프로세스의 메타데이터 정보와 주제도 작성 도구로 구성되어 있습니다.

5.2.1.1. Clear All Layers

현재 지도에 추가된 모든 레이어를 제거하고 배경지도를 초기화합니다.

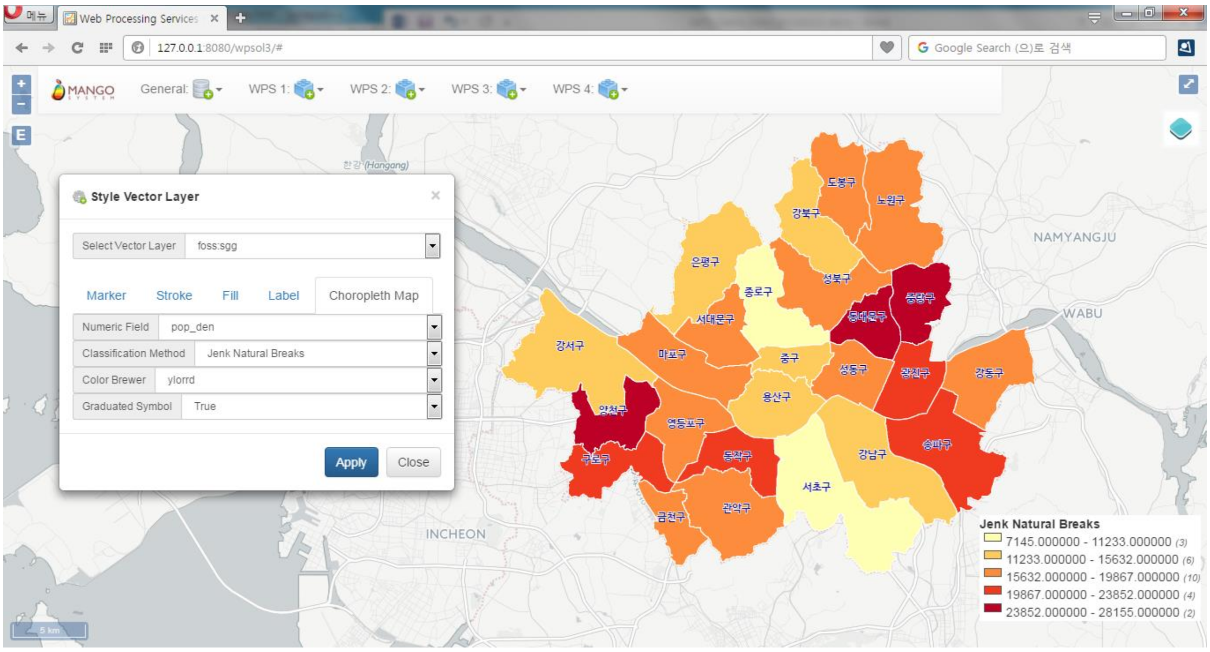
5.2.1.2. Add Layers - Metadata

서버에 등록된 모든 예제 데이터의 속성정보를 조회하고, WMS 또는 WFS 레이어로 추가할 수 있습니다.



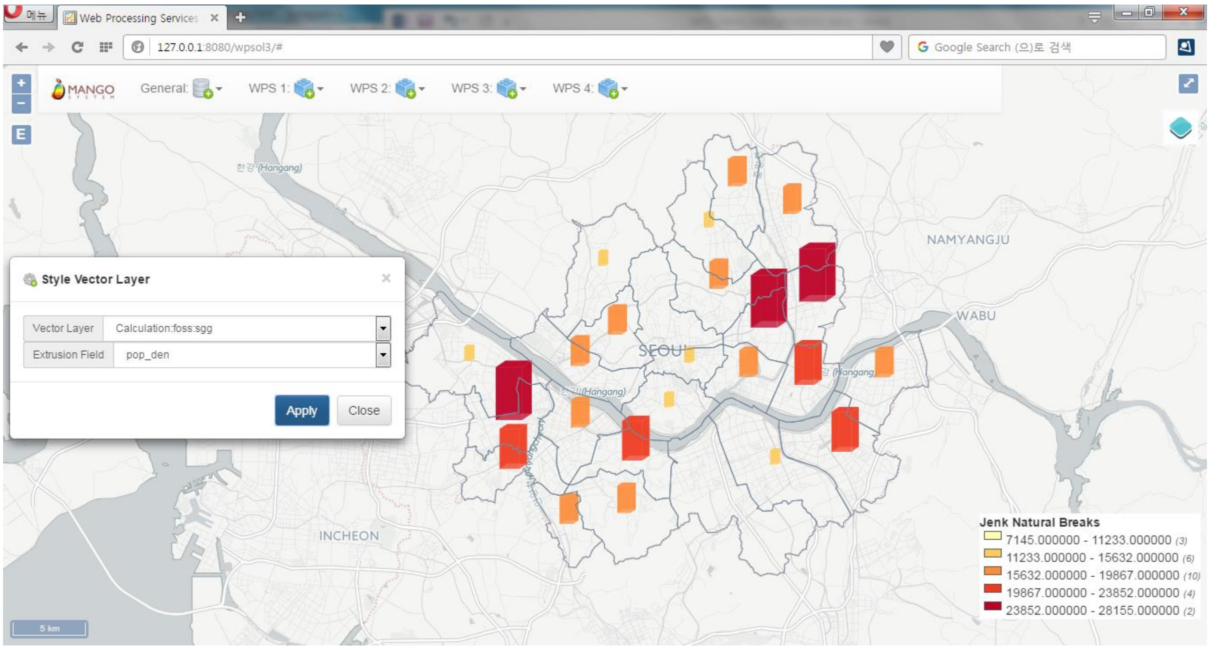
5.2.1.3. Style Vector Layer

WFS 레이어 또는 WPS 분석 결과 벡터 레이어의 스타일링 지원, 단일 심볼 또는 주제도를 작성할 수 있습니다.



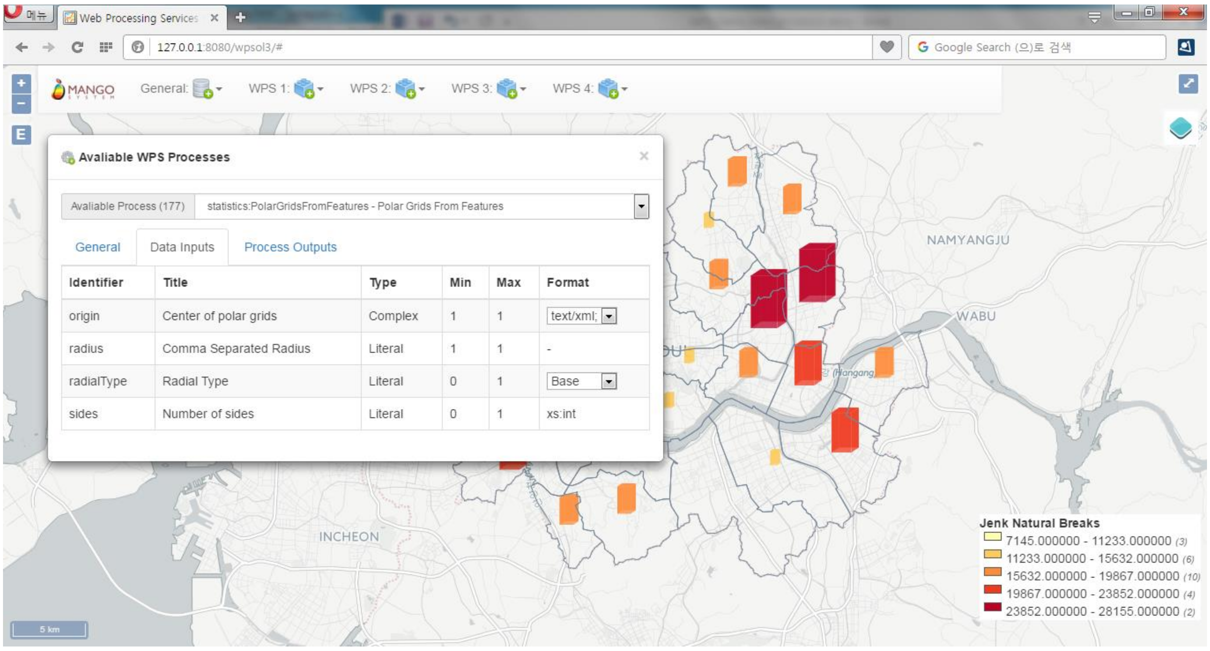
5.2.1.4. Style Vector Layer - Extrude

WFS 레이어 또는 WPS 분석 결과 벡터 레이어를 속성값을 이용하여 2.5D Extrusion 스타일링을 적용할 수 있습니다.



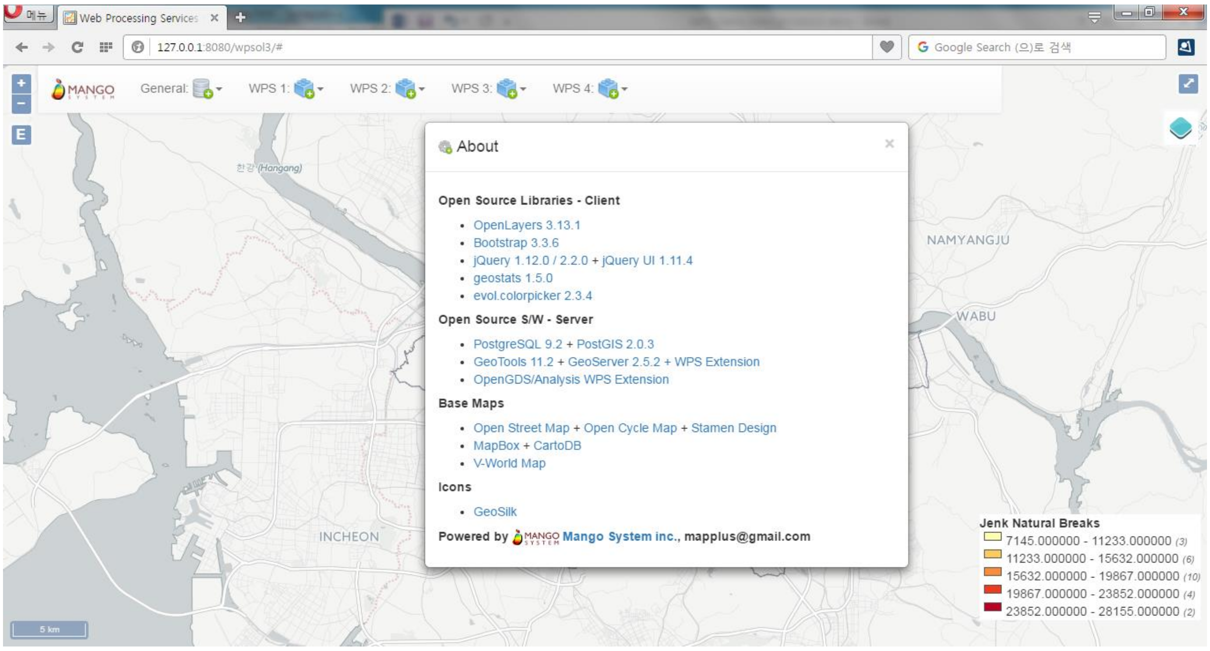
5.2.1.5. Available WPS Processes

서버에서 제공하는 WPS 의 개요, Input, Output 파라미터를 확인할 수 있습니다.



5.2.1.6. About

현재 데모 프로그램에 대한 정보를 확인할 수 있습니다.



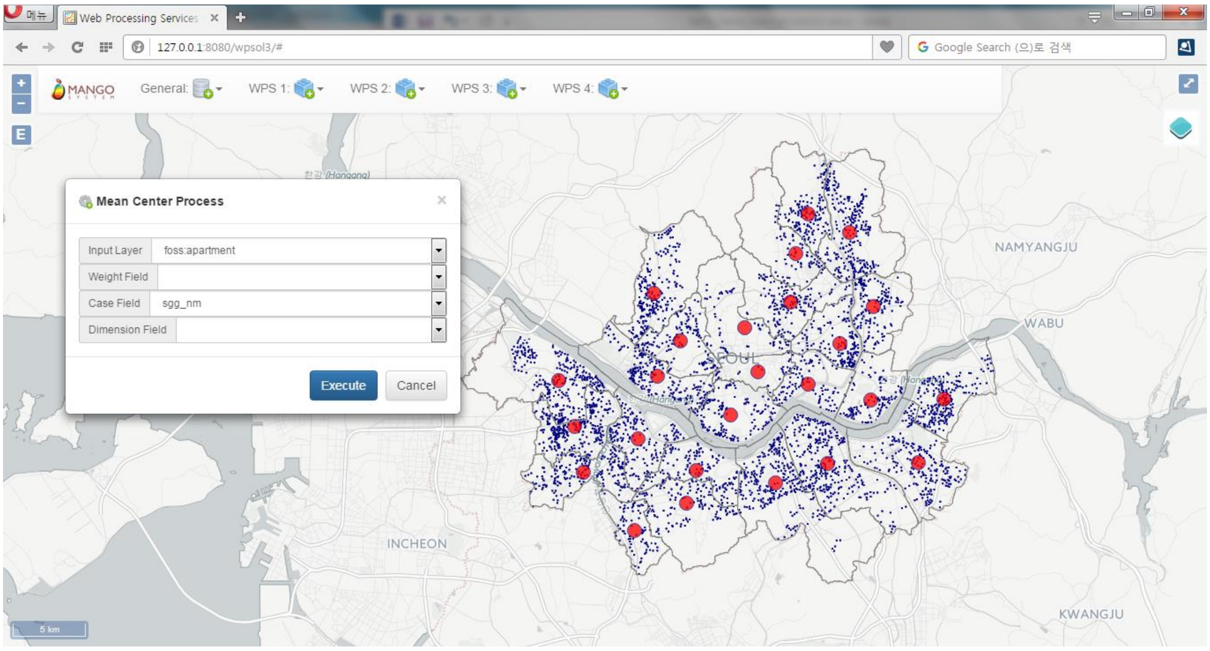
5.2.2. D1

데이터에 대한 분포 패턴을 분석할 수 있는 공간통계분석 기능입니다.

5.2.2.1. Mean Center

포인트 데이터의 Mean Center 를 분석하는 기능입니다.

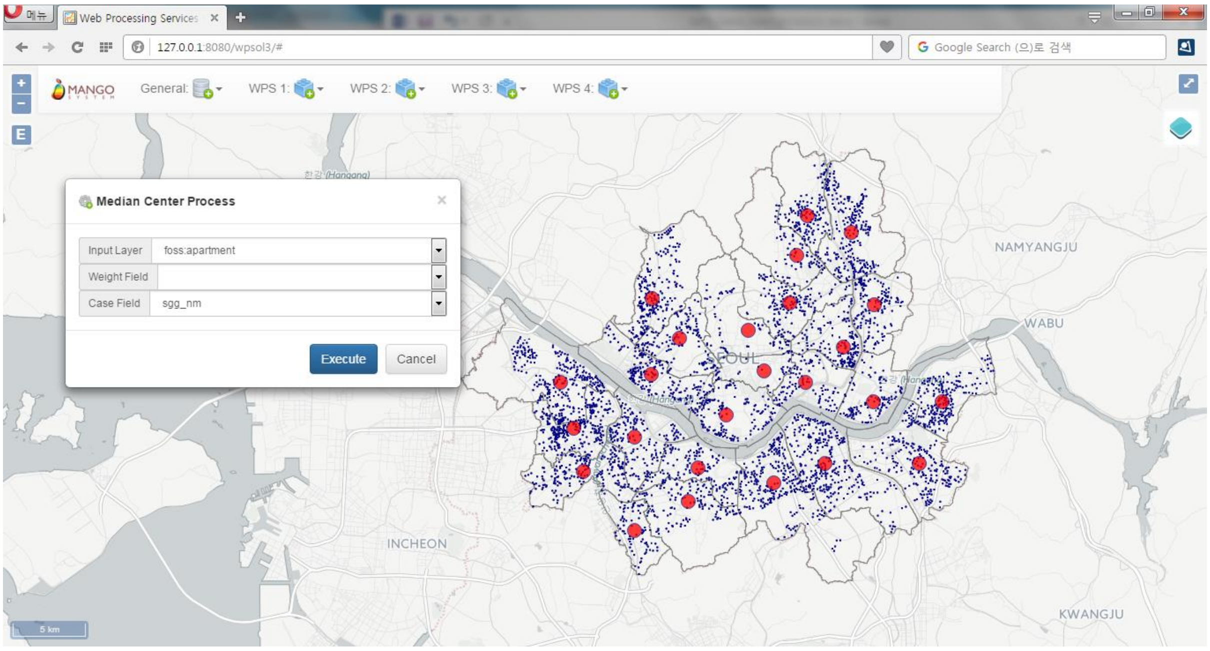
다음 예제는 서울시 아파트 데이터의 구별 Mean Center 를 분석한 결과입니다.



5.2.2.2. Median Center

포인트 데이터의 Median Center 를 분석하는 기능입니다.

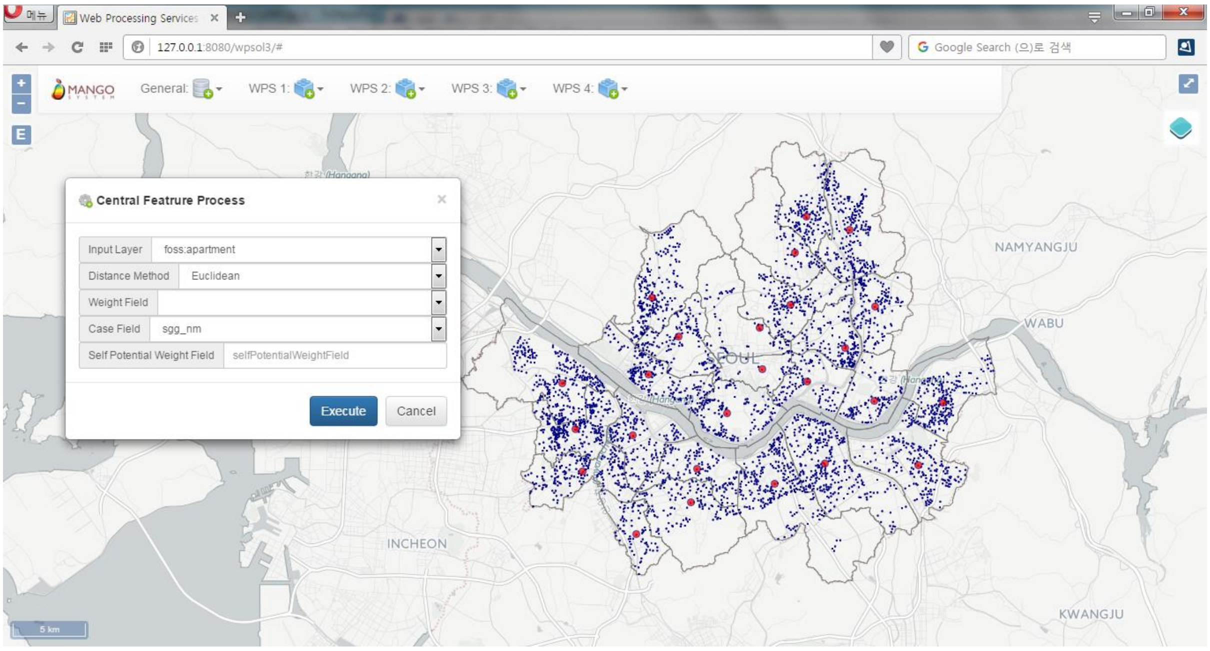
다음 예제는 서울시 아파트 데이터의 구별 Median Center 를 분석한 결과입니다.



5.2.2.3. Central Feature

포인트 데이터의 Central Feature 를 분석하는 기능입니다.

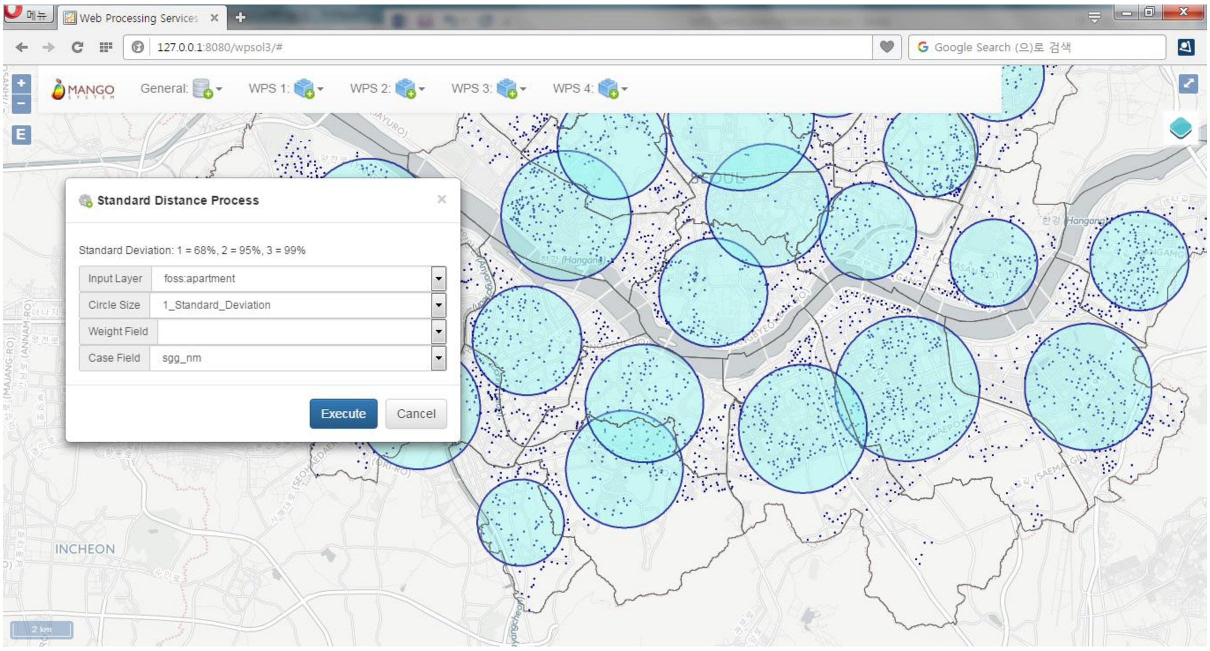
다음 예제는 서울시 아파트 데이터의 구별 Central Feature 를 분석한 결과입니다. Central Feature 는 원본 데이터의 피처에서 선택되므로 동일한 위치의 피처가 있는 경우 하나 이상의 피처가 선택될 수 있습니다.



5.2.2.4. Standard Distance

포인트 데이터의 Standard Distance 를 분석하는 기능입니다.

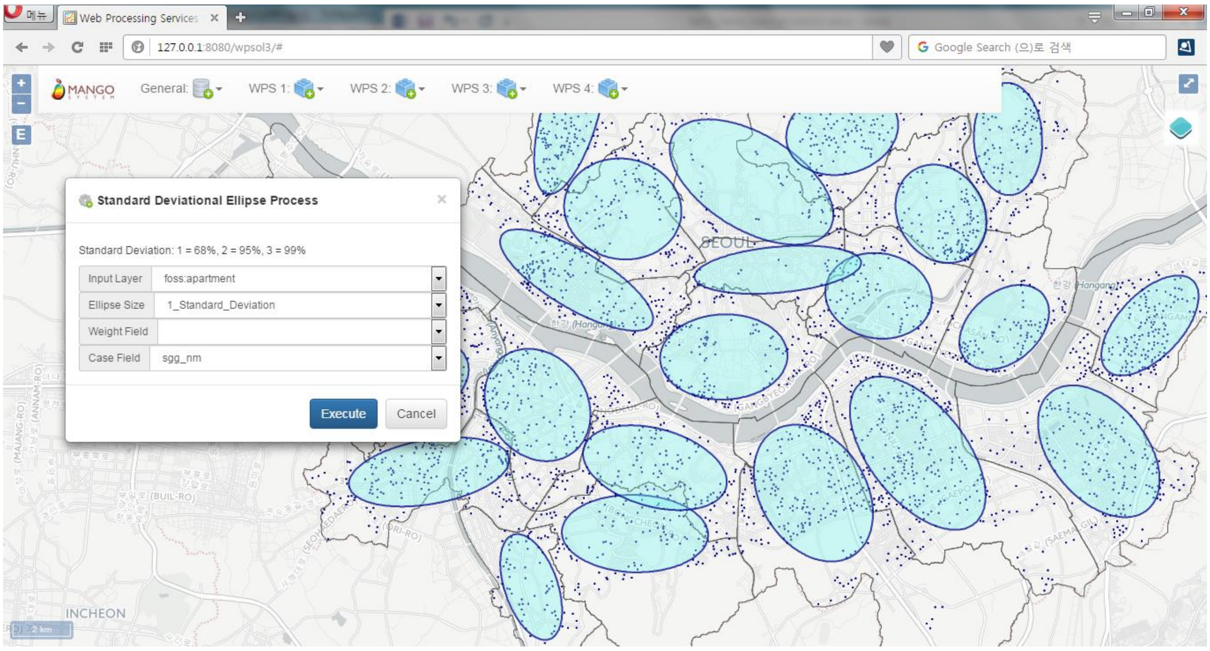
다음 예제는 서울시 아파트 데이터의 구별 Standard Distance 를 분석한 결과입니다.
Circle Size 는 약 1 = 68%, 2 = 95%, 3 = 99%의 원본 데이터를 포함합니다.



5.2.2.5. Standard Deviational Ellipse

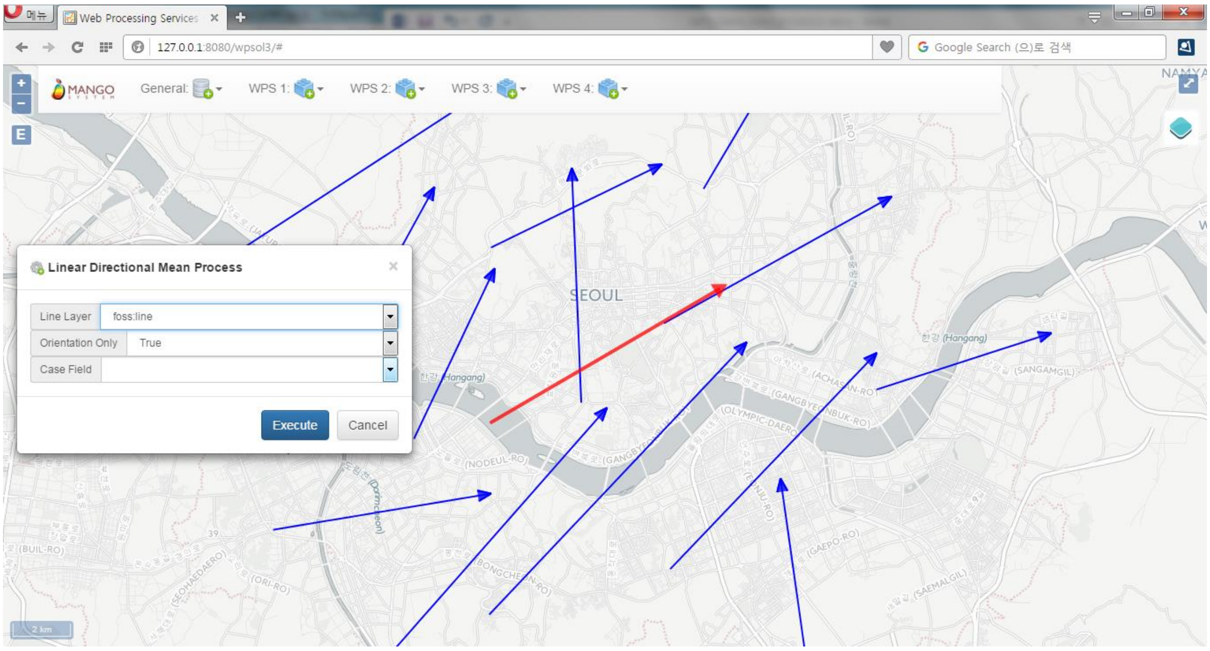
포인트 데이터의 Standard Deviational Ellipse 를 분석하는 기능입니다.

다음 예제는 서울시 아파트 데이터의 구별 Standard Deviational Ellipse 를 분석한 결과입니다. Ellipse Size 는 약 1 = 68%, 2 = 95%, 3 = 99%의 원본 데이터를 포함하며, Standard Distance 와는 달리 데이터 분포에 대한 방향성을 확인할 수 있습니다.



5.2.2.6. Linear Directional Mean

라인 데이터의 평균 길이와 방향성(Linear Directional Mean)을 분석하는 기능입니다.

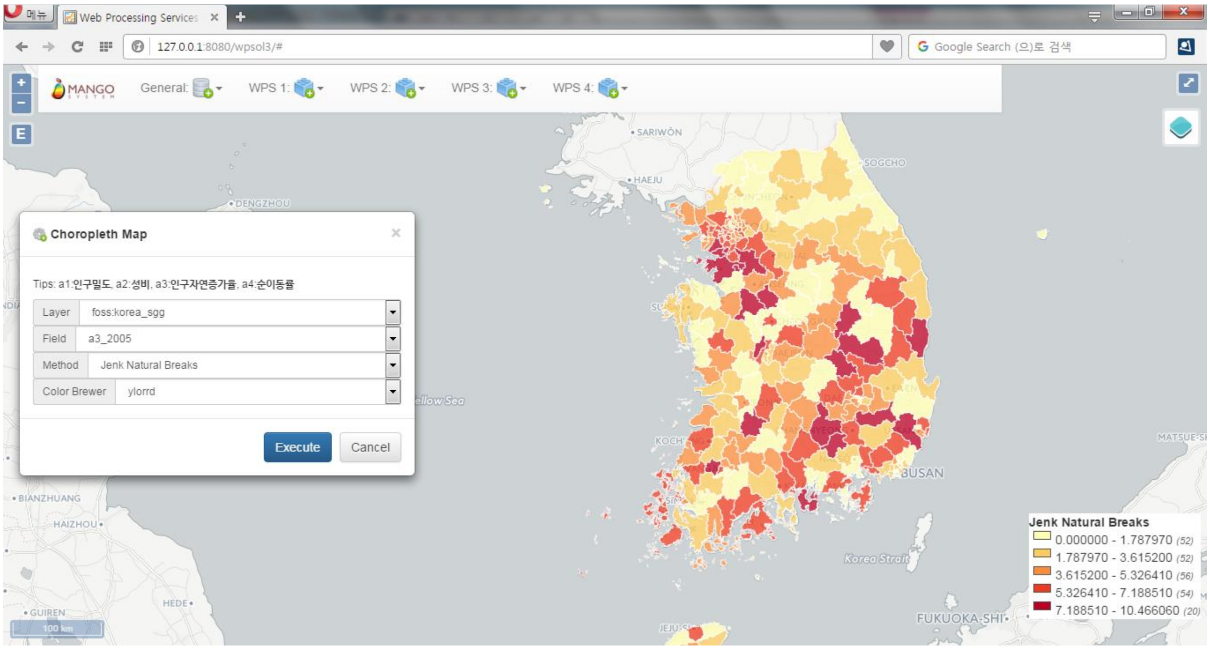


5.2.3. D2

5.2.3.1. Choropleth Map

서버의 단일 레이어를 불러와서 주제도를 작성하는 기능입니다.

다음 예는 전국 시군구 데이터의 2005 년 인구 자연증가율(a3_2005)을 Natural Breaks 분류로 주제도를 작성한 예이며, Equal Interval, Quantile, Standard deviation 급간 구분 방법과 Color Brewer[11]에서 제공하는 컬러 팔레트를 선택할 수 있습니다.

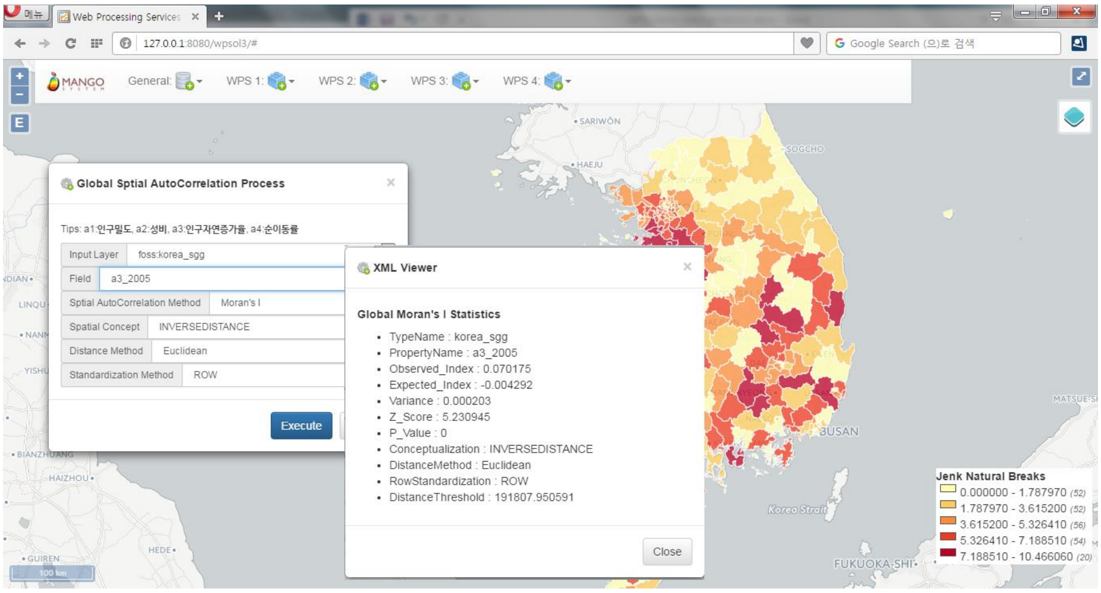


11 http://colorbrewer2.org/

5.2.3.2. Global Spatial AutoCorrelation

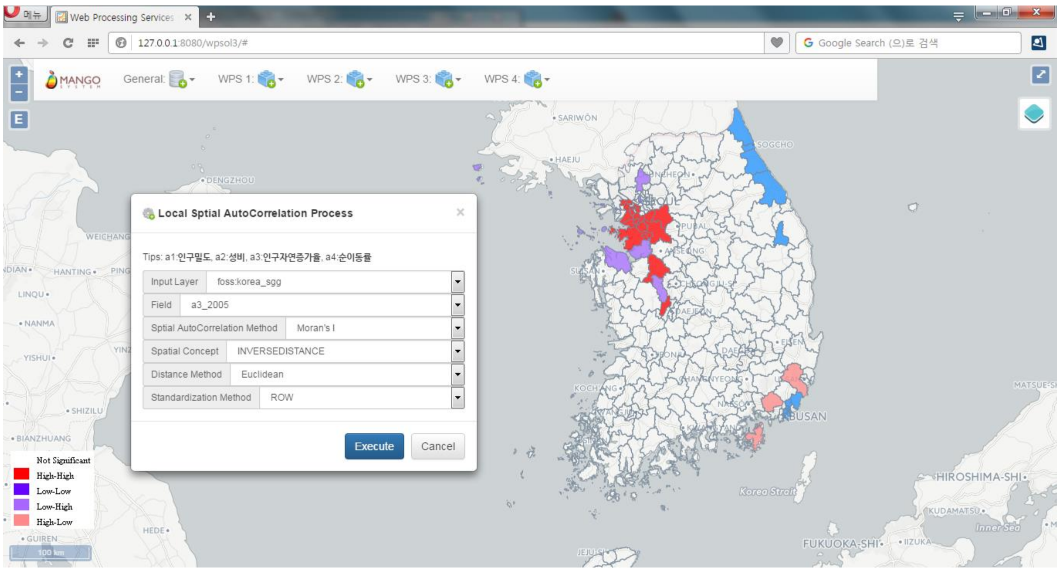
서버의 단일 레이어에 대한 전역적 공간 자기상관을 분석하는 기능입니다.

현재 Moran's I, Getis-Ord's G, Geary's c, Lee's S 4 개의 분석기법을 제공합니다.



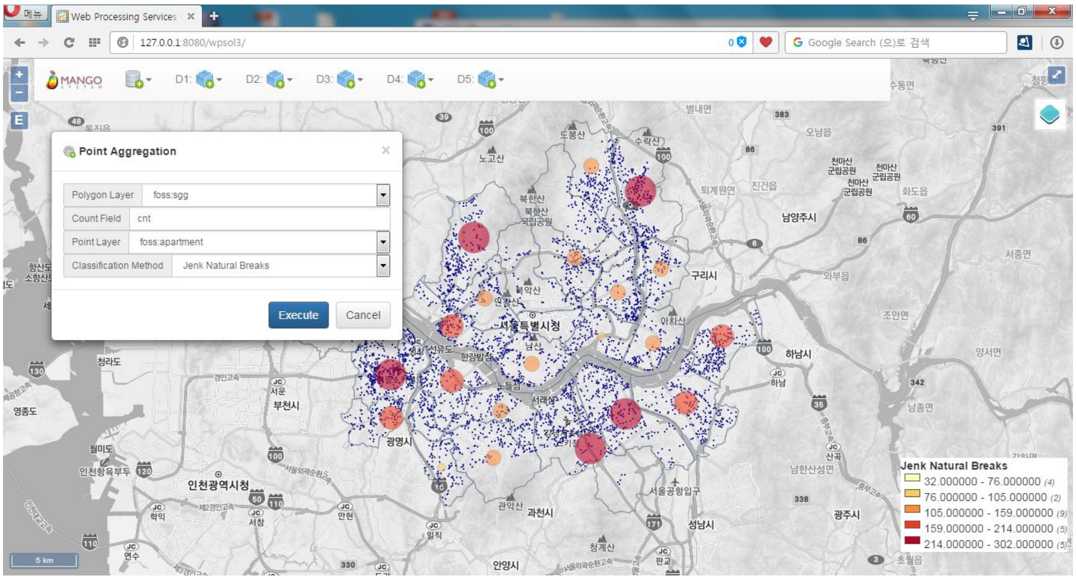
5.2.3.3. Local Spatial AutoCorrelation

서버의 단일 레이어에 대한 국지적 공간 자기상관을 분석 후 LISA Map 으로 표현하는 기능입니다. 현재 Moran's I, Getis-Ord's G, Geary's c, Lee's S 4 개의 분석기법을 제공하며, 각각에 대한 색상, 범례 표시 등을 확인할 수 있습니다.



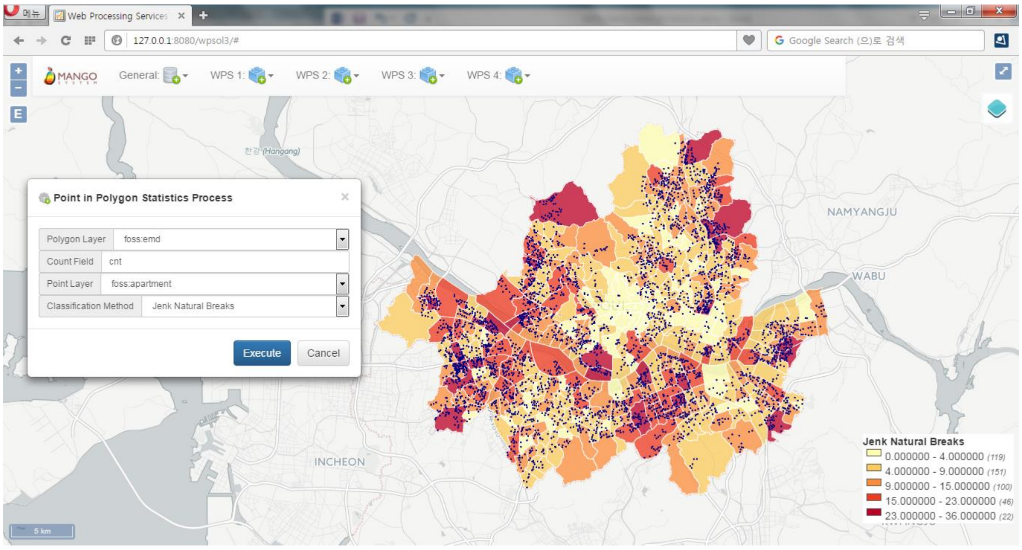
5.2.3.4. Point Aggregation -> Point Symbolizer

폴리곤 레이어의 각 피처에 포함되는 포인트 레이어의 피처 수를 계산 후 포인트 심볼의 크기로 주제도를 작성하는 WPS Chaining[12] 예입니다.



5.2.3.5. Point Aggregation -> Choropleth Map

폴리곤 레이어의 각 피처에 포함되는 포인트 레이어의 피처 수를 계산 후 주제도를 작성하는 WPS Chaining 예입니다.

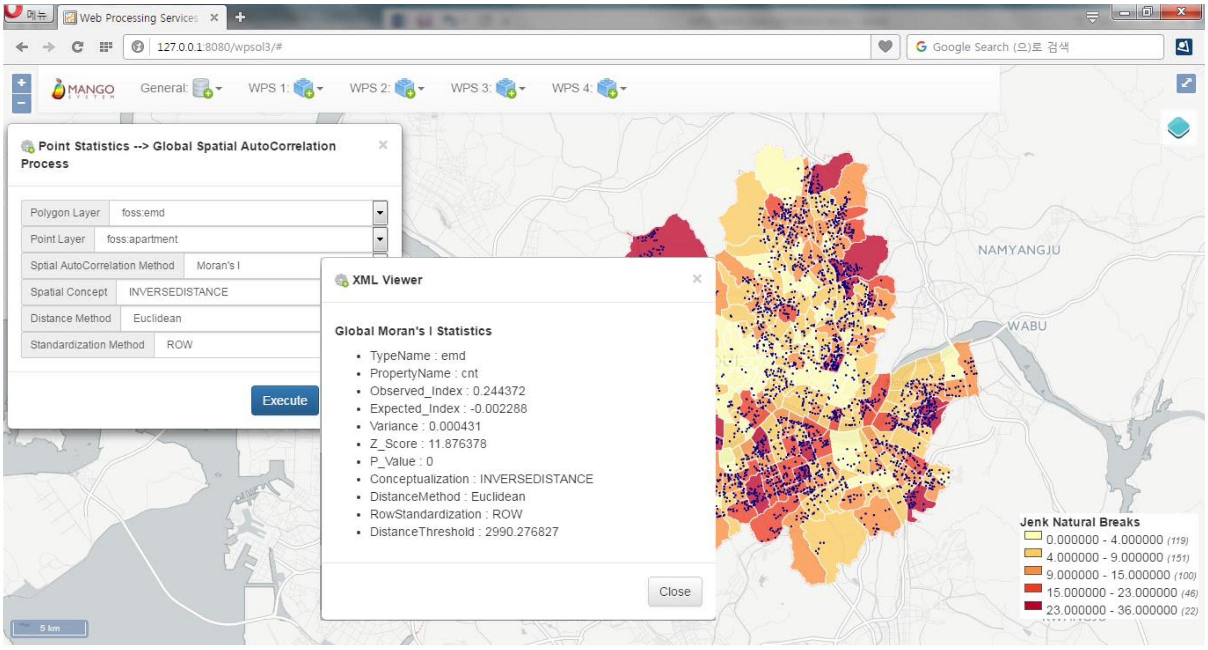


---

[12] ArcGIS, QGIS 등의 모델러 또는 모델 빌더와 같이 여러 프로세스를 순차적으로 연결하여 새로운 분석 프로세스를 구성할 수 있습니다.

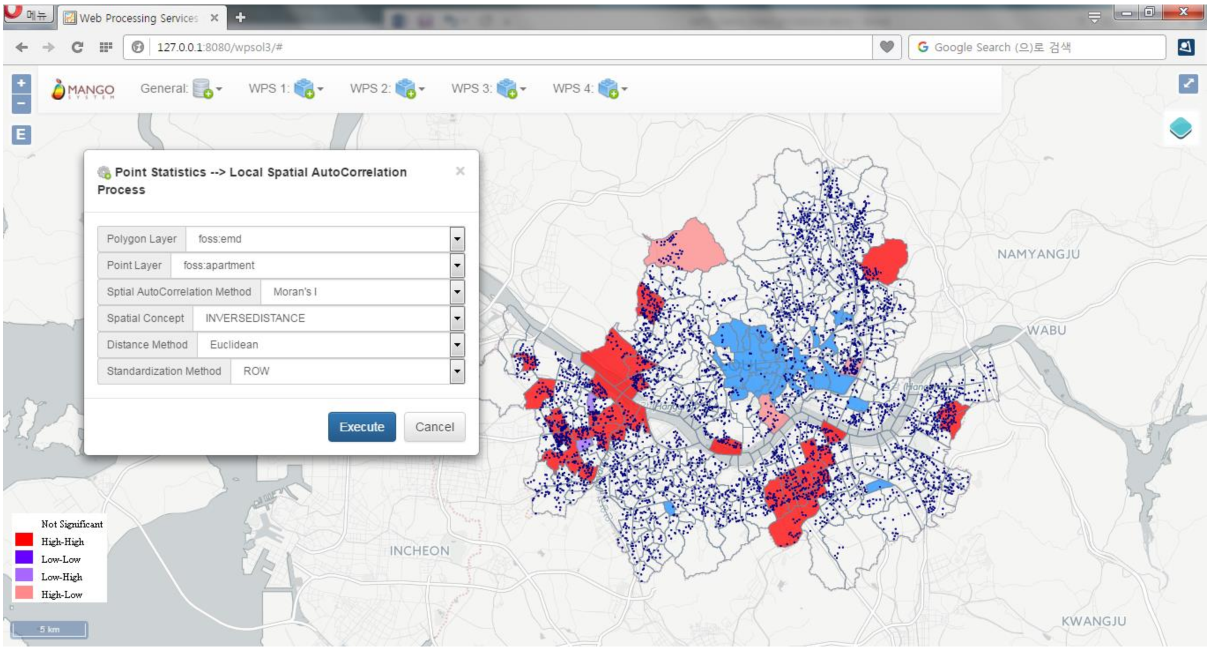
5.2.3.6. Point Aggregation -> Global Spatial AutoCorrelation

폴리곤 레이어의 각 피처에 포함되는 포인트 레이어의 피처 수를 계산하고, 폴리곤 레이어에 계산된 포인트 수를 이용하여 전역적 공간 자기상관을 분석하는 기능입니다.



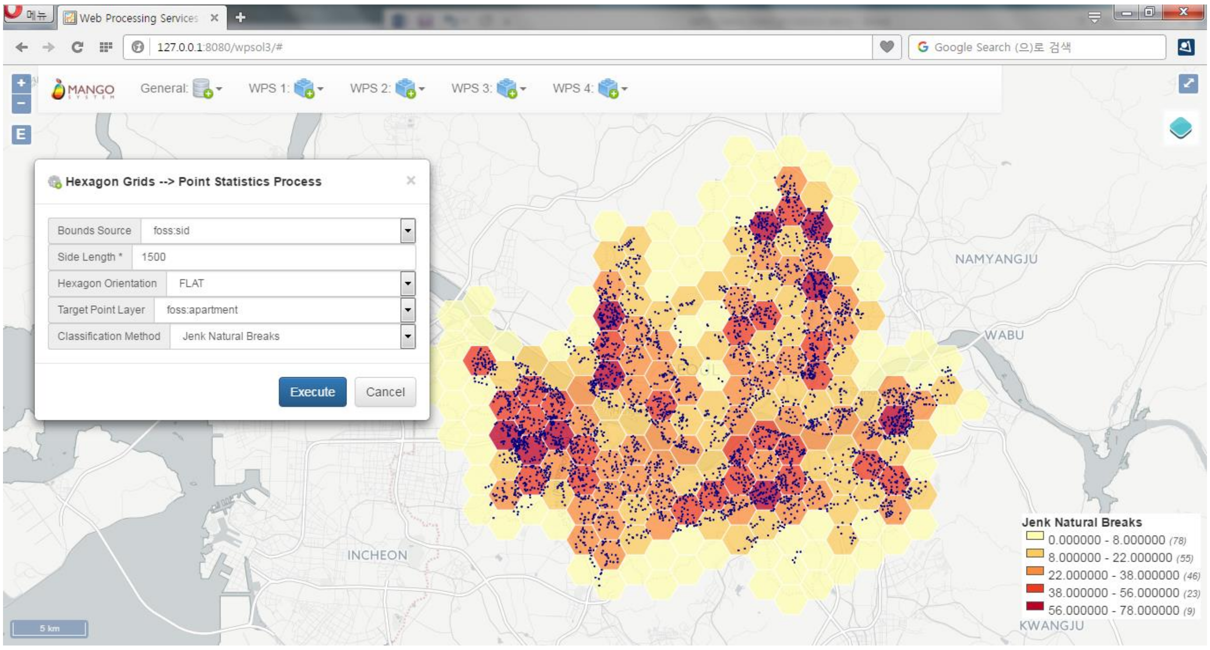
5.2.3.7. Point Aggregation -> Local Spatial AutoCorrelation

폴리곤 레이어의 각 피처에 포함되는 포인트 레이어의 피처 수를 계산하고, 그 포인트 수를 국지적 공간 자기상관 분석 후 LISA Map 으로 표현하는 기능입니다.



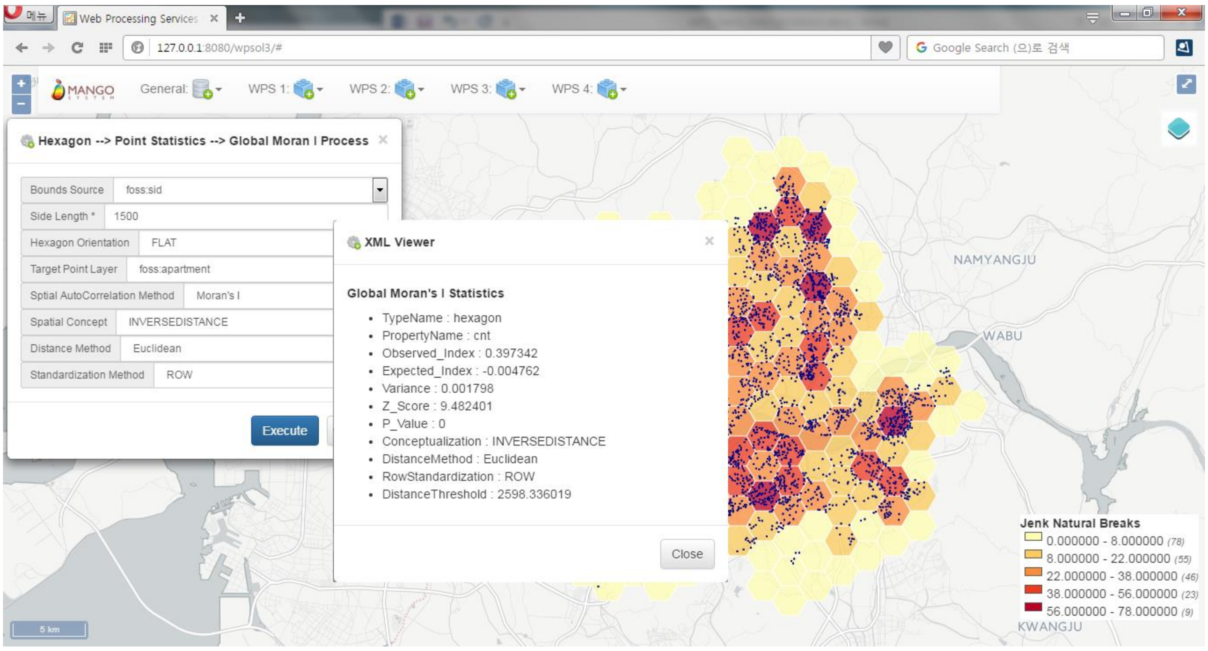
5.2.3.8. Hexagonal Grids -> Point Aggregation - Choropleth Map

특정 영역을 기준으로 Hexagonal 그리드를 생성하고, 그리드의 각 셀에 포인트 피처의 개수를 계산한 후 주제도를 작성하는 예입니다.



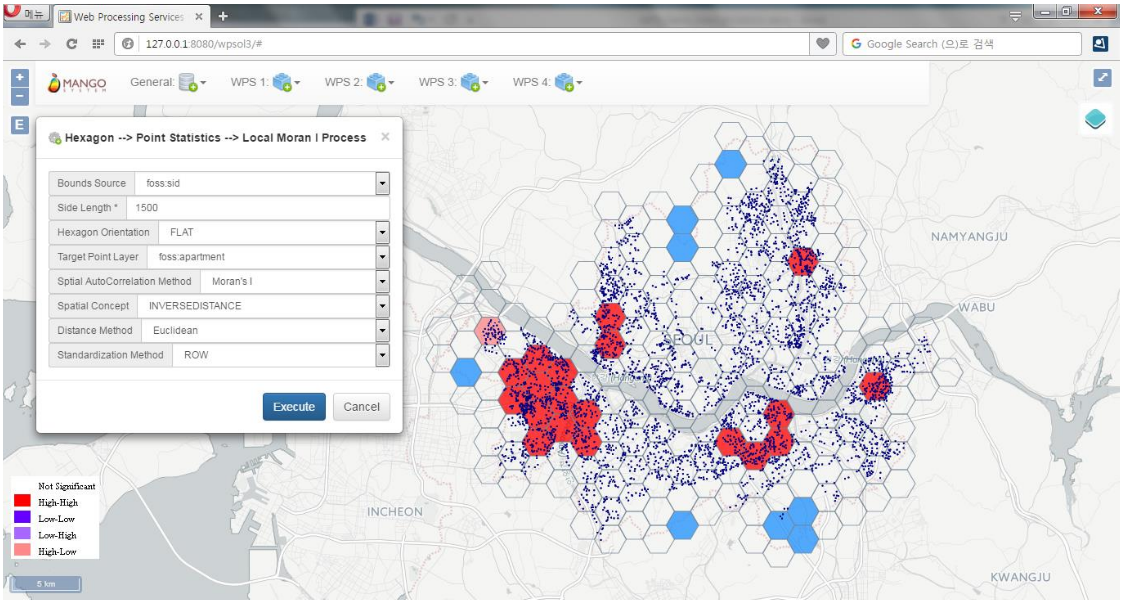
5.2.3.9. Hexagonal Grids -> Point Aggregation -> Global Spatial AutoCorrelation

특정 영역을 기준으로 Hexagonal 그리드를 생성하고, 그리드의 각 셀에 포인트 피처의 개수를 계산한 후 전역적 공간 자기상관을 분석하는 예입니다.



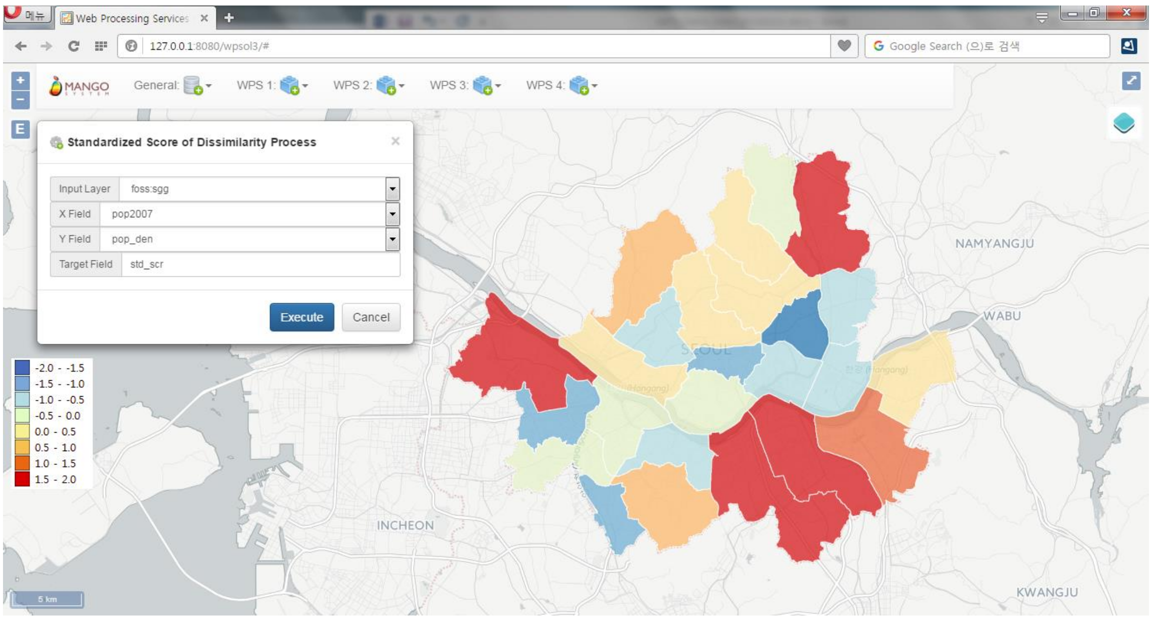
5.2.3.10. Hexagonal Grids -> Point Aggregation -> Local Spatial AutoCorrelation

특정 영역을 기준으로 Hexagonal 그리드를 생성하고, 그리드의 각 셀에 포인트 피처의 개수를 계산한 후 국지적 공간 자기상관을 분석 후 LISA Map 으로 표현하는 기능입니다.



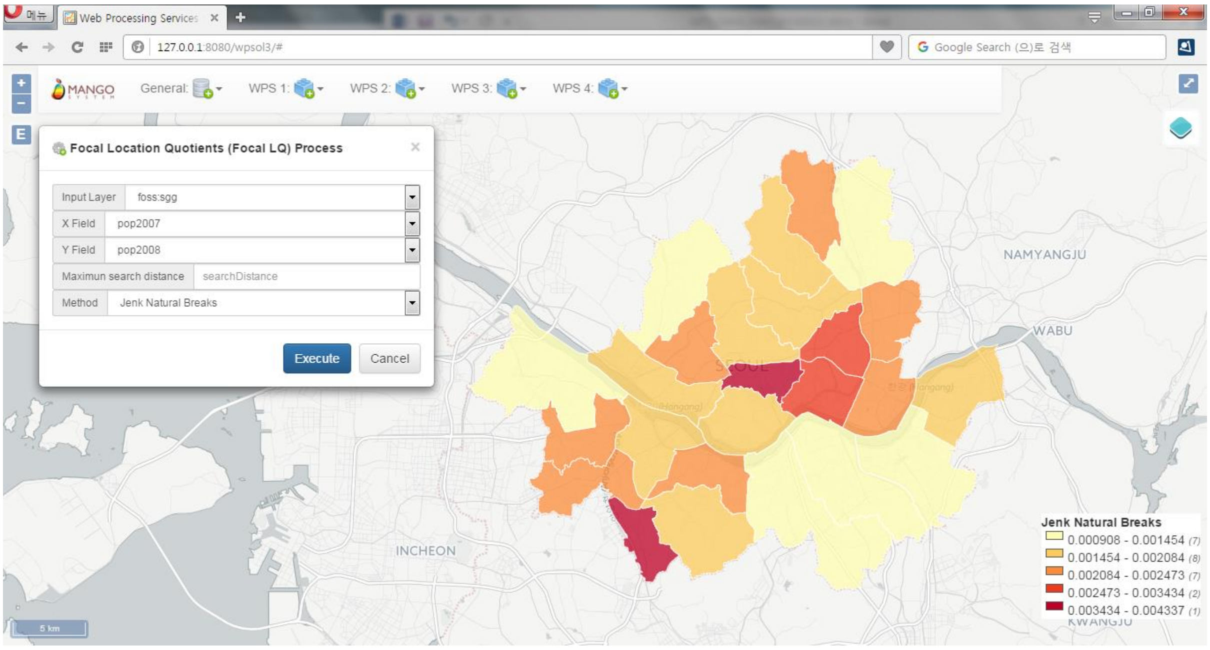
5.2.3.11. Standardized Score of Dissimilarity

서버의 단일 레이어에 대해 2 개의 필드(전체산업, 특정산업 등)를 이용하여 표준화 상이점수(집중도)를 계산하여 주제도로 표현하는 기능입니다.



5.2.3.12. Focal Location Quotients

서버의 단일 레이어에 대해 2 개의 필드(전체산업, 특정산업 등)를 이용하여 Focal Location Quotients(특화도) 계산하여 주제도로 표현하는 기능입니다.

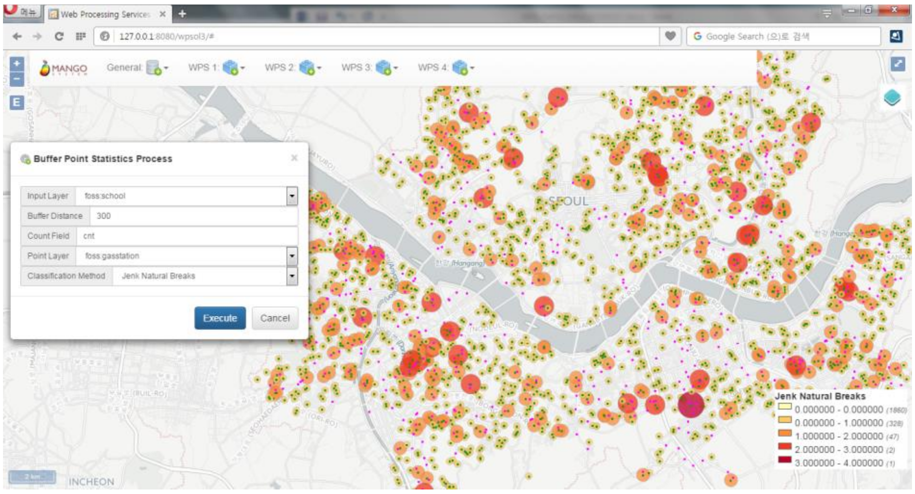


5.2.4. D3

5.2.4.1. Summarize Nearby -> Point Symbolizer

기준 포인트 레이어에서 버퍼 거리 내에 포함된 포인트 레이어의 피처 수를 계산 후 피처 수를 급간 구분하여 포인트 심볼로 표현하는 기능입니다.

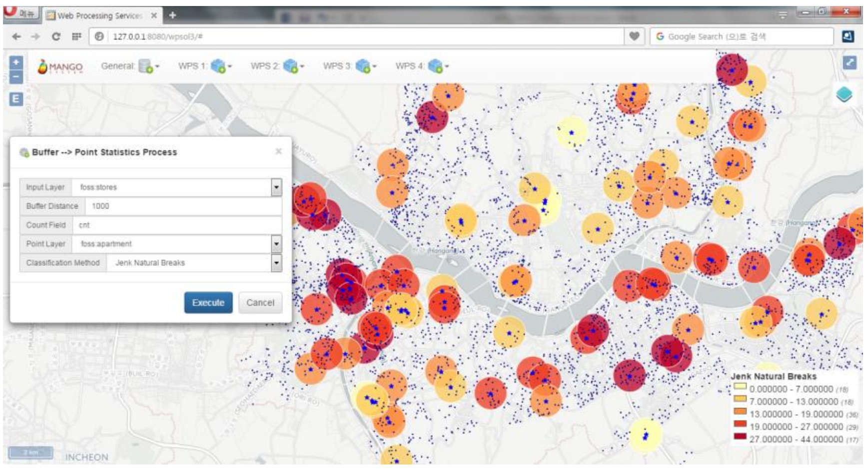
다음은 학교를 기준으로 300 미터 거리 내에 있는 주유소 개수를 구하고 주제도를 작성한 예입니다.



5.2.4.2. Buffer -> Point Aggregation -> Polygon Symbolizer

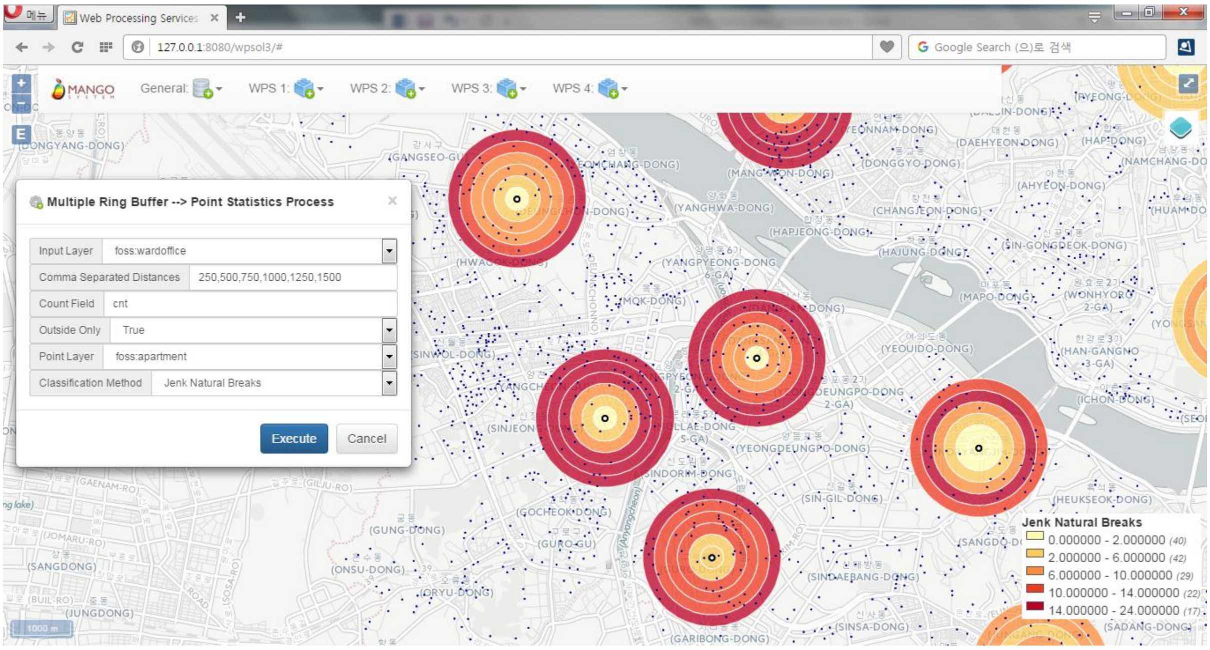
기준 포인트 레이어를 버퍼 후 버퍼 내에 포함된 포인트 수를 계산하고 급간 구분 후 주제도를 작성하는 기능입니다.

다음은 대형 매장을 기준으로 1km 내에 포함된 아파트의 수를 계산 후 주제도를 작성한 예입니다.



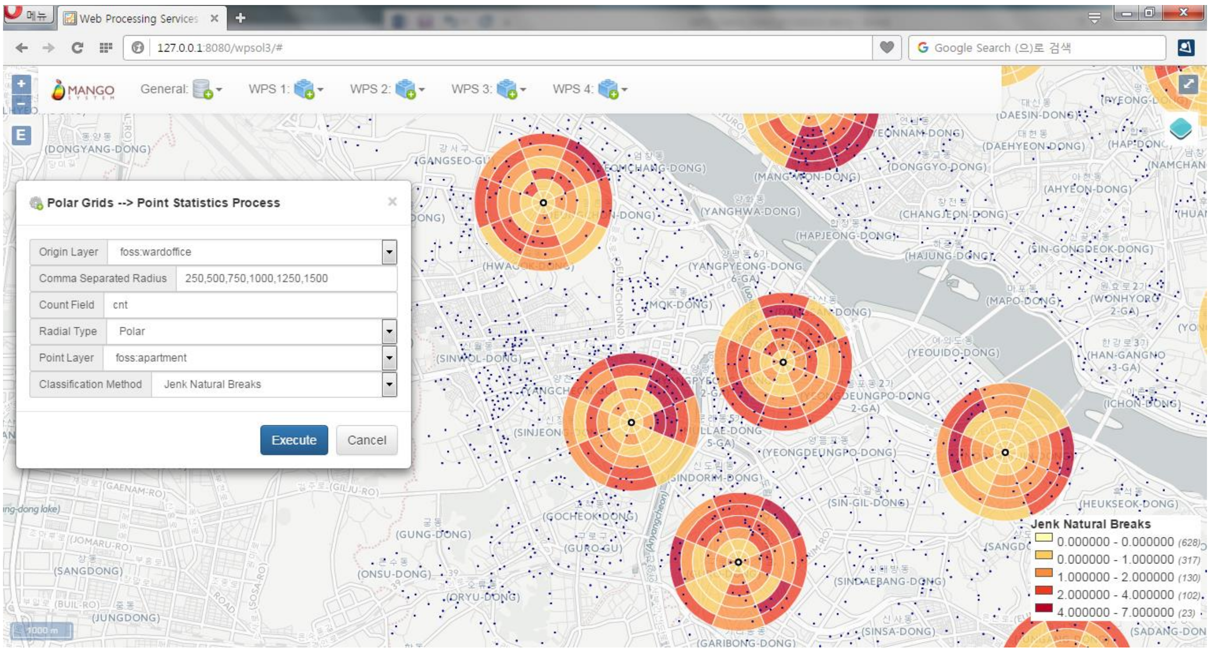
5.2.4.3. Multiple Ring Buffer -> Point Aggregation -> Polygon Symbolizer

포인트 레이어에서 콤마로 구분한 거리에 따라 버퍼 링을 생성하고 각 링에 포함된 포인트 수를 계산 후 주제도를 작성하는 기능입니다.



5.2.4.4. Polar Grids -> Point Aggregation -> Polygon Symbolizer

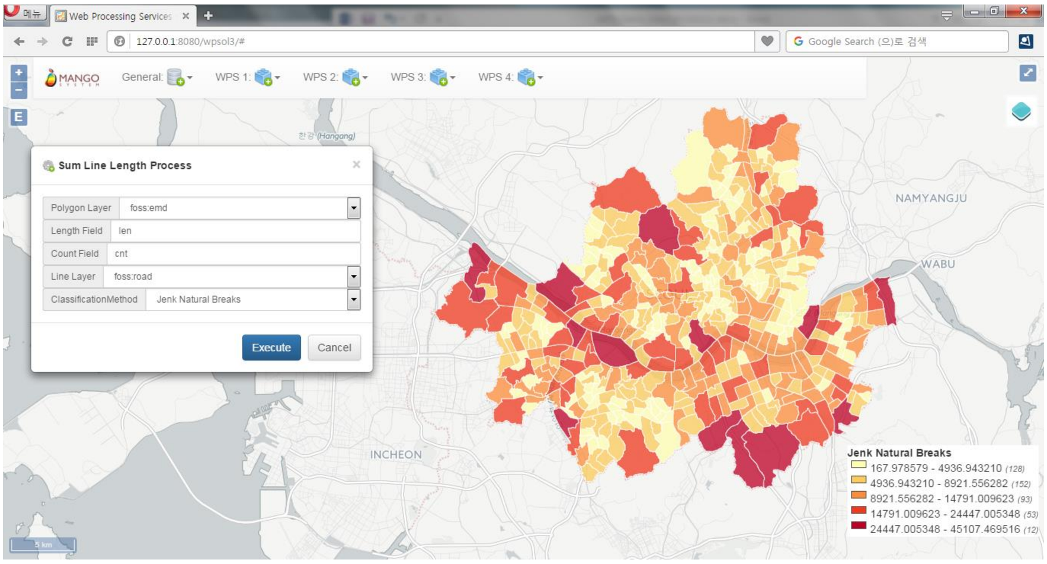
포인트 레이어에서 콤마로 구분한 거리에 따라 Polar 그리드를 생성하고 각 셀에 포함된 포인트 수를 계산 후 주제도화하는 기능이며, 방향성을 확인할 수 있습니다.



5.2.4.5. Sum Line Length -> Polygon Symbolizer

폴리곤 레이어와 라인 레이어를 이용하여 폴리곤 피처에 교차되는 라인 피처의 개수 및 거리 합(Clip 하여 계산)을 계산하는 기능입니다.

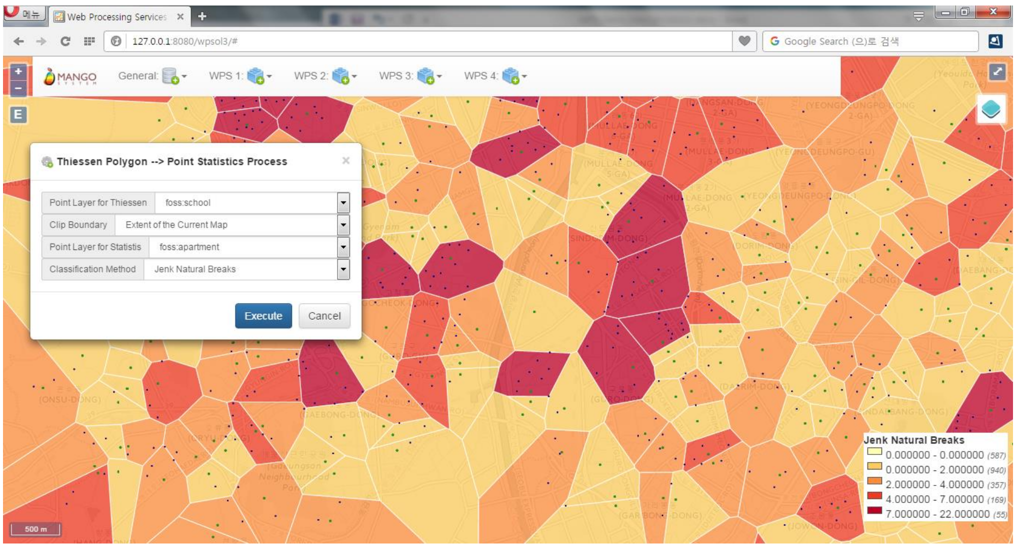
다음은 서울시 읍면동별 주요도로의 길이 계산 후 주제도를 작성한 예입니다.



5.2.4.6. Thiessen Polygon -> Point Statistics -> Polygon Symbolizer

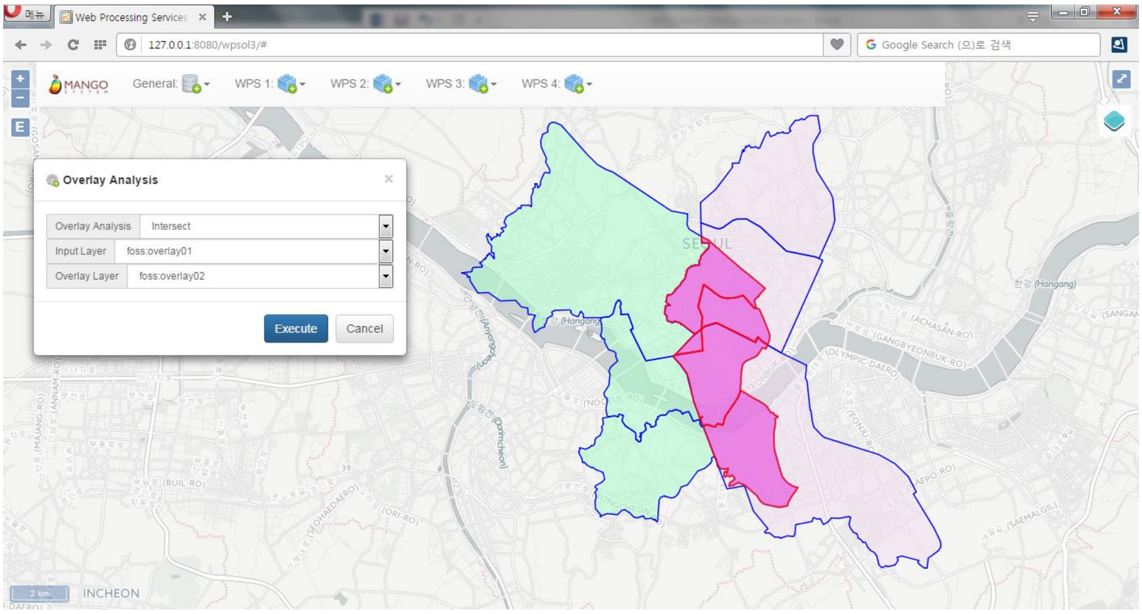
기준 포인트 레이어를 이용하여 Thiessen 폴리곤을 생성 후 각 폴리곤에 포함되는 포인트의 개수를 계산하고 주제도를 작성하는 기능입니다.

다음은 학교를 기준으로 Thiessen 폴리곤을 생성하고 폴리곤에 포함되는 아파트의 수를 계산 후 주제도를 작성한 예입니다.



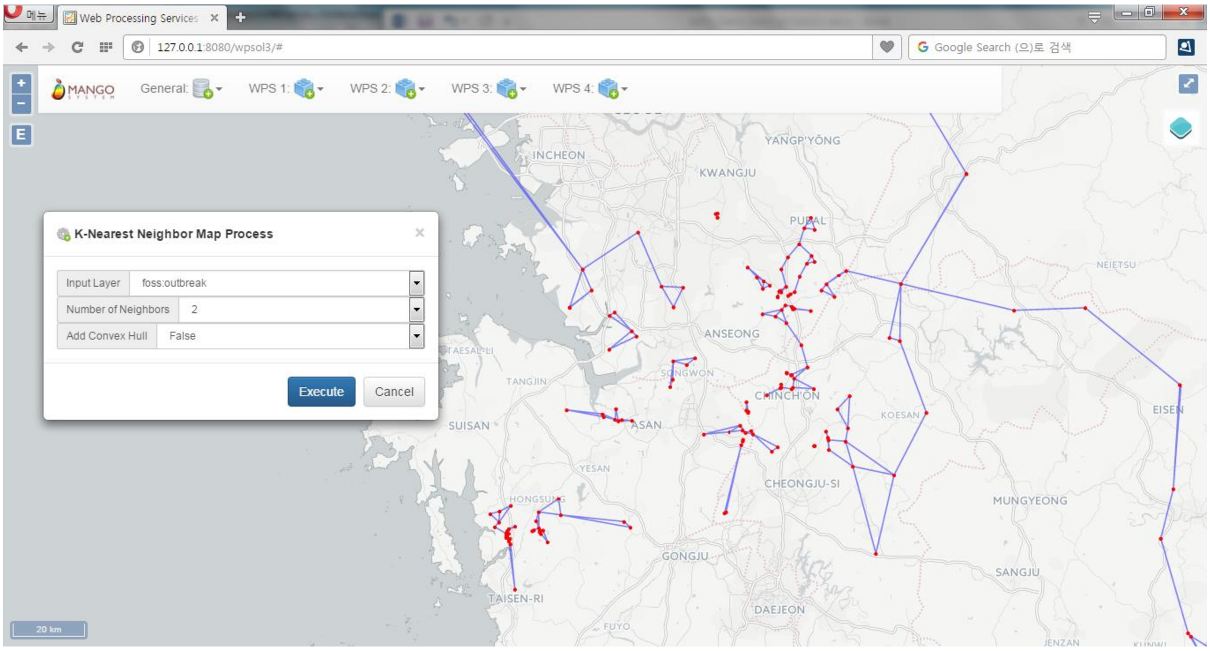
5.2.4.7. Vector Overlay Analysis

Union, Intersect, Difference, Symmetrical Difference, Identity, Update 등 레이어의 중첩분석 기능입니다.



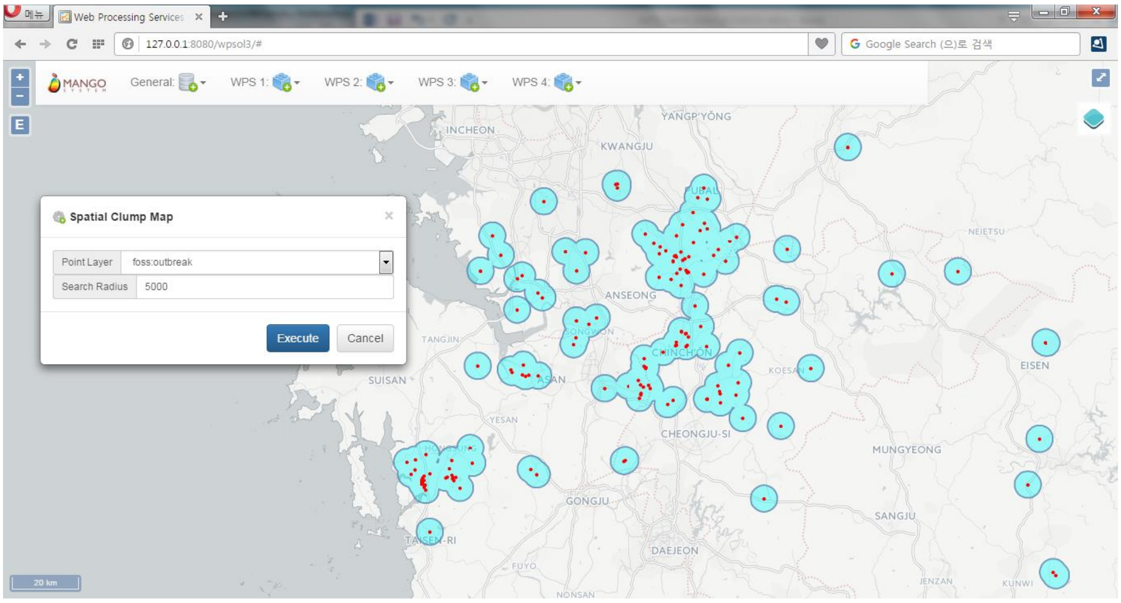
5.2.4.8. K-Nearest Neighbor Map

포인트 레이어의 각 피처별로 가장 가까운 피처를 연결하며, Neighbor 수를 1 ~ n 차까지 확장 가능하며, Cluster 여부를 시각적으로 판단이 가능합니다.



5.2.4.9. Spatial Clump Map

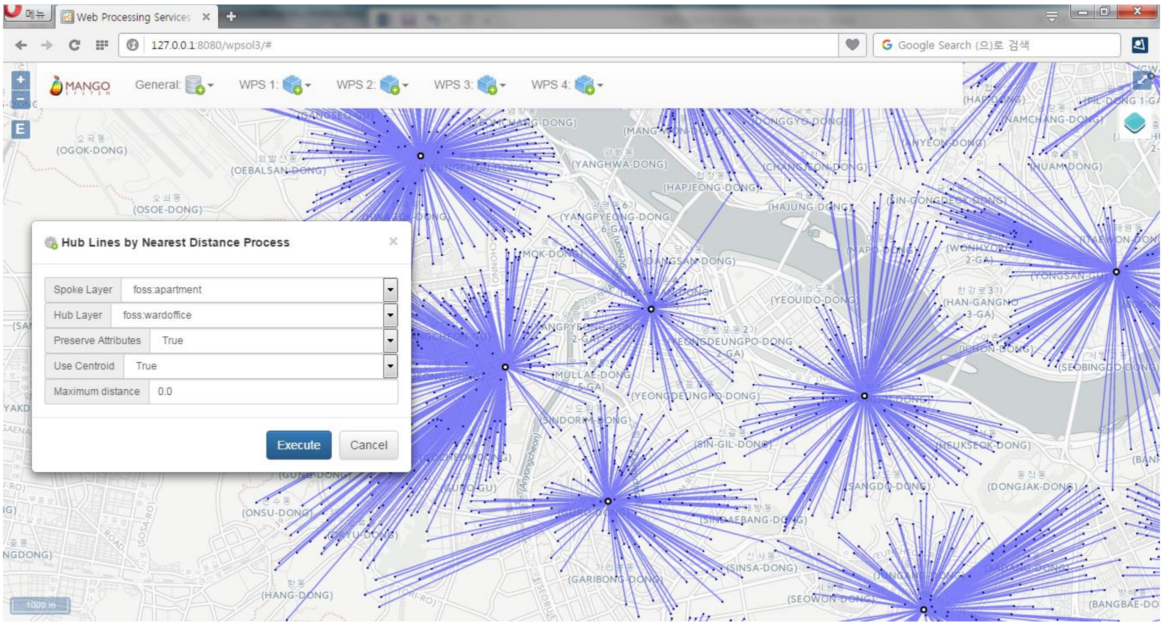
포인트 레이어와 반경을 기준으로 Spatial Clump Map 을 작성하는 기능이며, 포인트 레이어의 Cluster 여부를 확인할 수 있습니다.



5.2.4.10. Hub Lines by Nearest Distance

Hub 레이어의 각 피처와 가장 가까운 Spoke 레이어를 연결한 Hub Line 생성하는 기능입니다.

다음 예는 서울시의 아파트에서 가장 가까운 구청을 연결한 Hub Line 결과입니다.

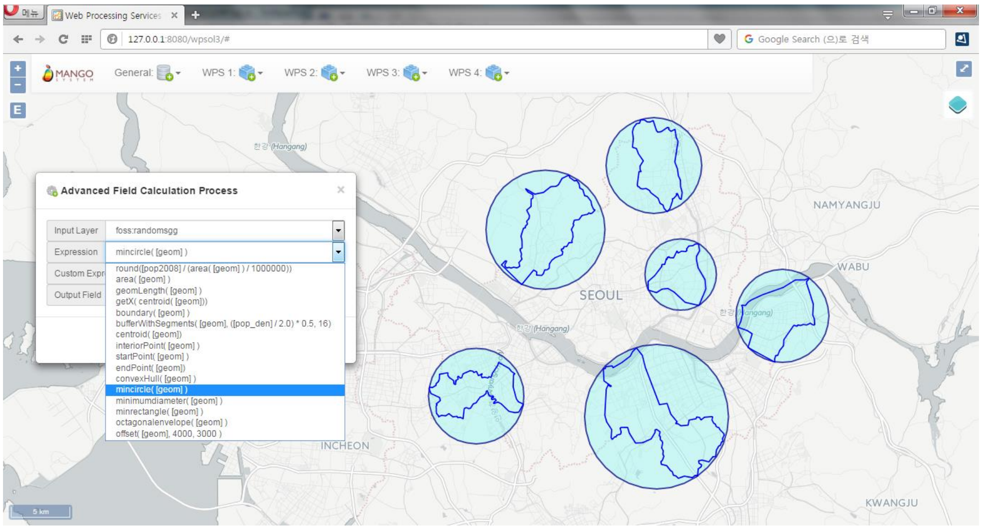


5.2.5. D4

5.2.5.1. Advanced Field Calculator

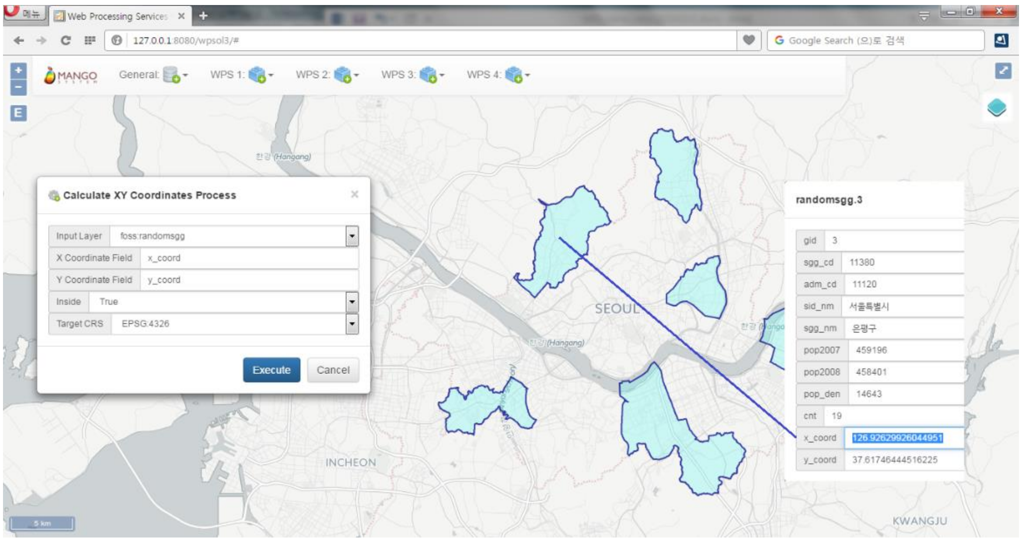
다양한 공간(지오메트리 변환) 및 속성정보(필드 연산)를 이용하여 필드에 새로운 값을 계산하는 기능입니다.

다음 예는 폴리곤 레이어의 각 피처를 둘러싸는 원을 계산하여 폴리곤 레이어로 추가한 예입니다. 이 외에도 포인트 변환, 버퍼 수행, 지오메트리의 속성정보나 필드 연산이 가능합니다.



5.2.5.2. Calculate XY Coordinates

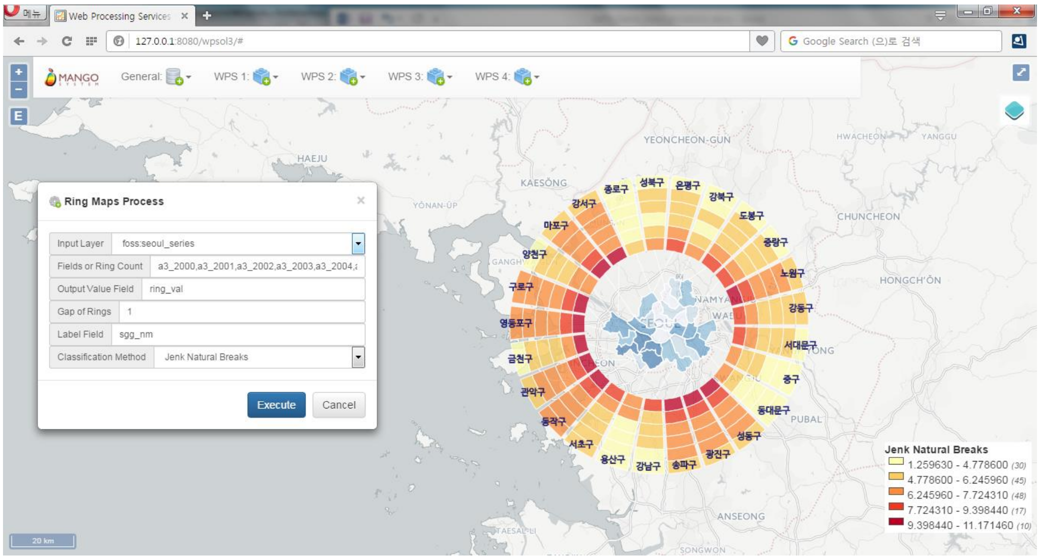
선택한 레이어의 각 피처 중심점의 X, Y 값을 설정한 좌표체계로 변환하여 계산하는 기능입니다.



5.2.5.3. Ring Maps - Choropleth Map

시계열 데이터의 필드값을 이용하여 Ring Map 생성 후 주제도를 작성하는 기능입니다.

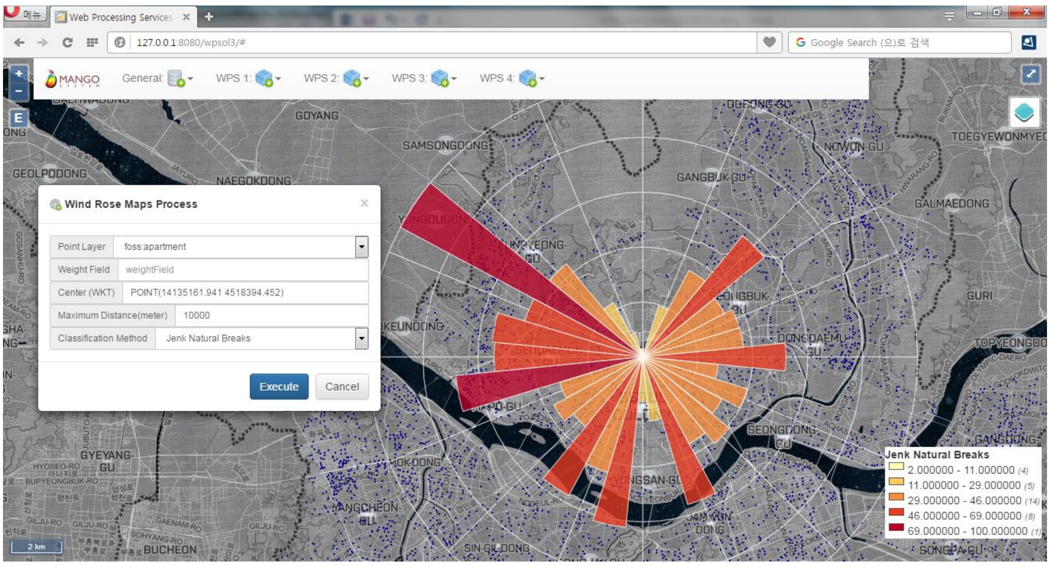
다음은 서울시 구별 2000 ~ 2005 년 인구 자연증가율을 Ring Map 으로 표현한 예입니다.



5.2.5.4. Wind Rose Maps - Choropleth Map

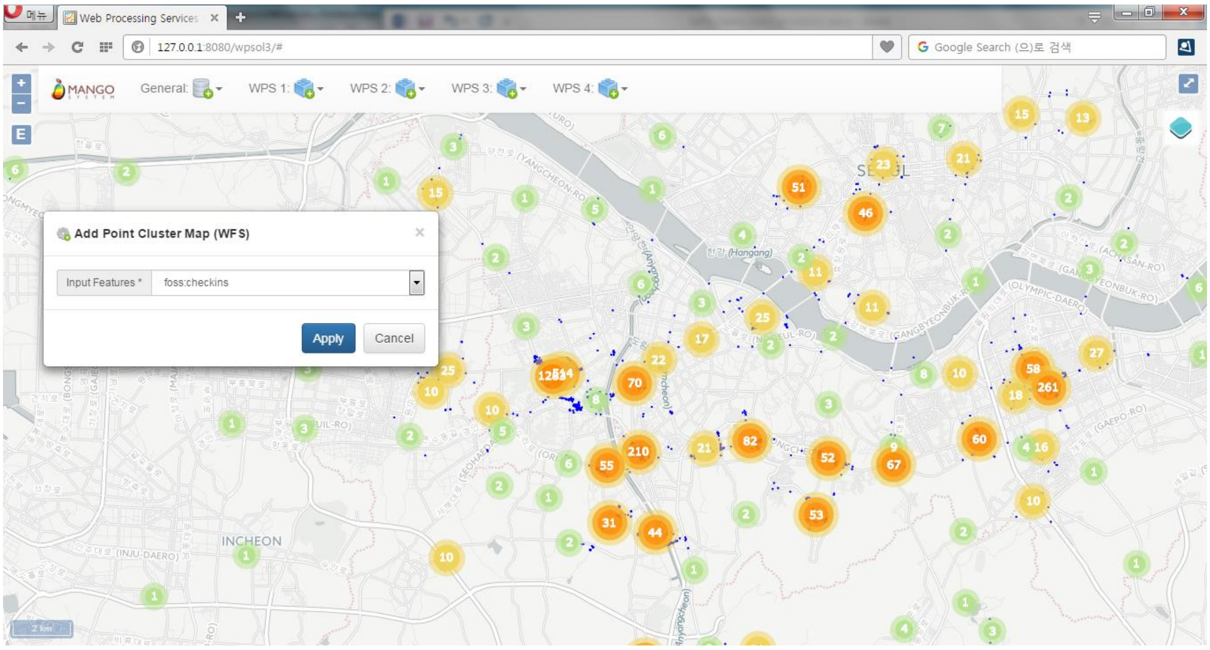
포인트 레이어를 중심점(임의 지정 또는 레이어의 중심점)을 기준으로 Wind Rose Map 을 생성하고 각 셀에 포함되는 포인트 레이어의 피처 수를 계산 후 주제도를 작성하는 기능입니다.

다음은 서울시청을 기준으로 서울시의 아파트 분포에 대한 Wind Rose Map 을 작성한 예입니다.



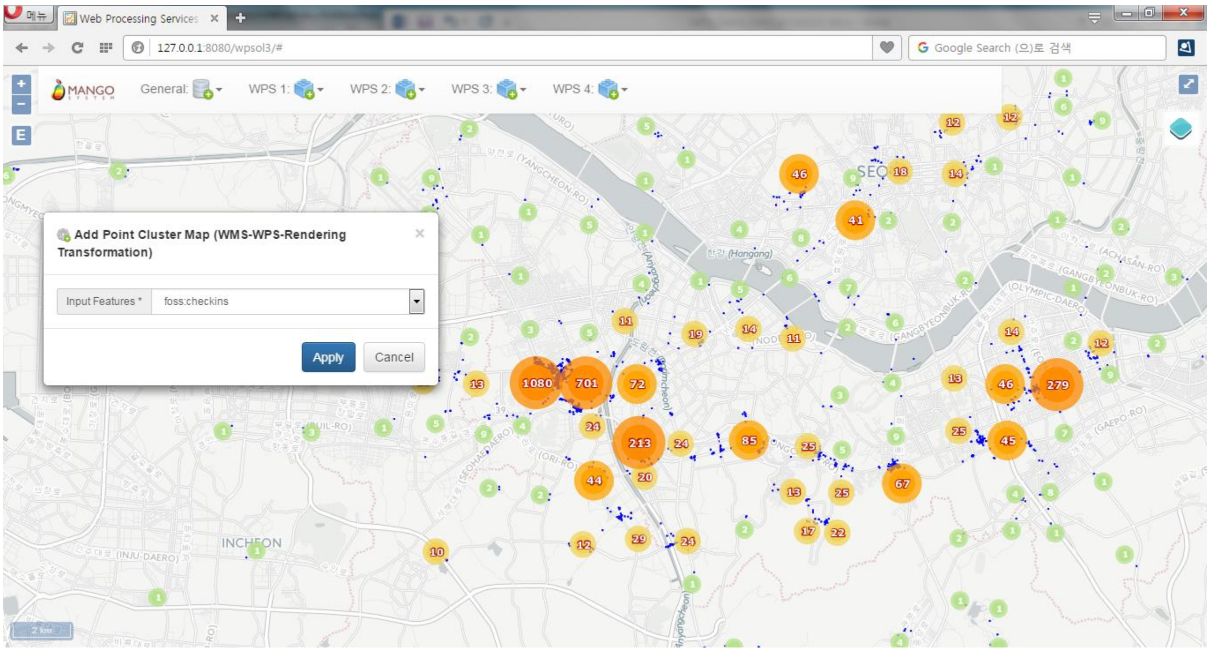
5.2.5.5. Point Cluster Map (WFS)

포인트 레이어에 대한 Point Cluster 레이어 작성, 벡터 데이터를 불러와서 클라이언트에서 직접 지도를 구성하므로 대용량 데이터는 처리가 불가능할 수 있습니다.



5.2.5.6. Point Cluster Map (WMS-WPS-Rendering Transformation)

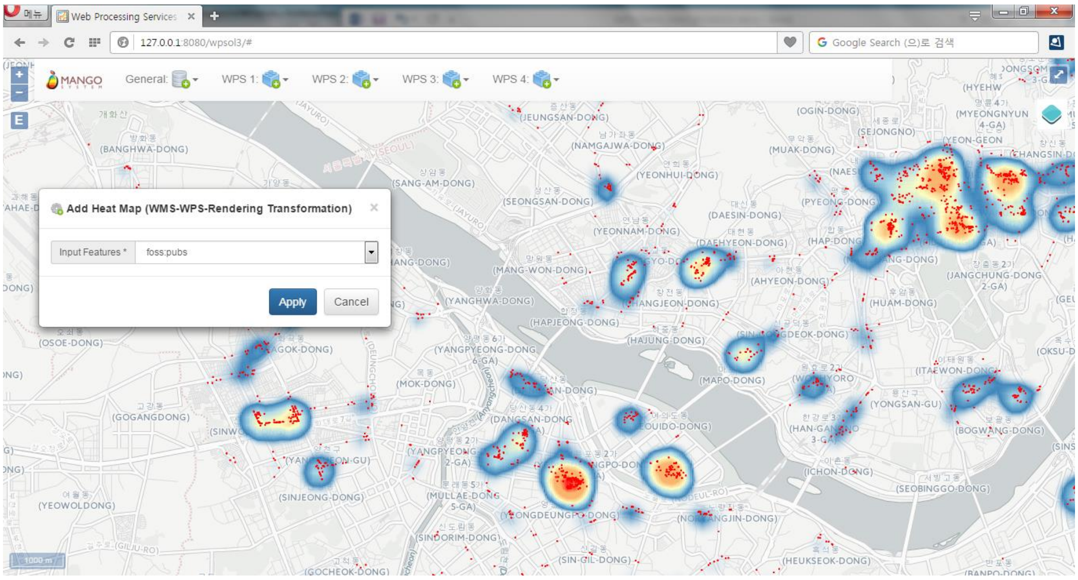
포인트 레이어에 대한 Point Cluster 레이어 작성, 서버에서 Point Cluster 지도 작성 후 이미지를 반환하므로 대용량 데이터 처리도 가능합니다.



5.2.5.7. Heat Map (WMS-WPS-Rendering Transformation)

포인트 레이어에 대한 Heat Map 생성하는 기능입니다.

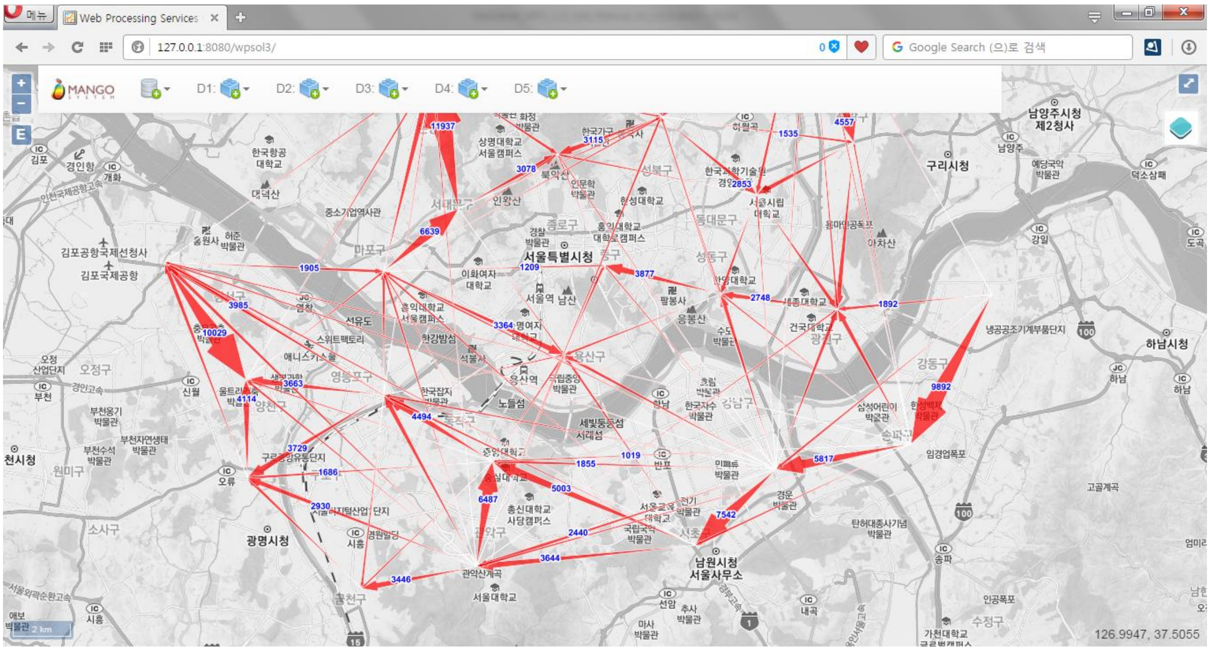
서버에서 Heat Map 을 생성하여 표준 WMS 를 이용하여 이미지를 생성 후 반환하므로 대용량 데이터 처리도 가능합니다.



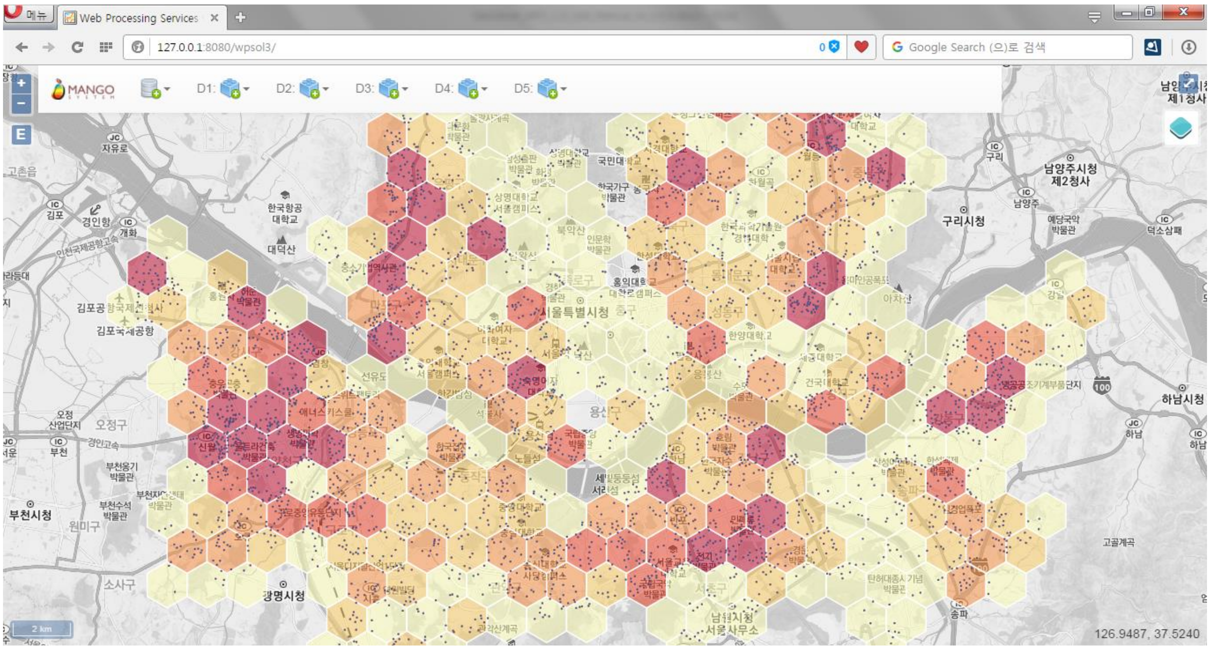
5.2.5.8. WMS-WPS-Rendering Transformation

WMS Rendering Transformation 을 이용하여 SLD 를 통해 시각화하는 기능입니다.

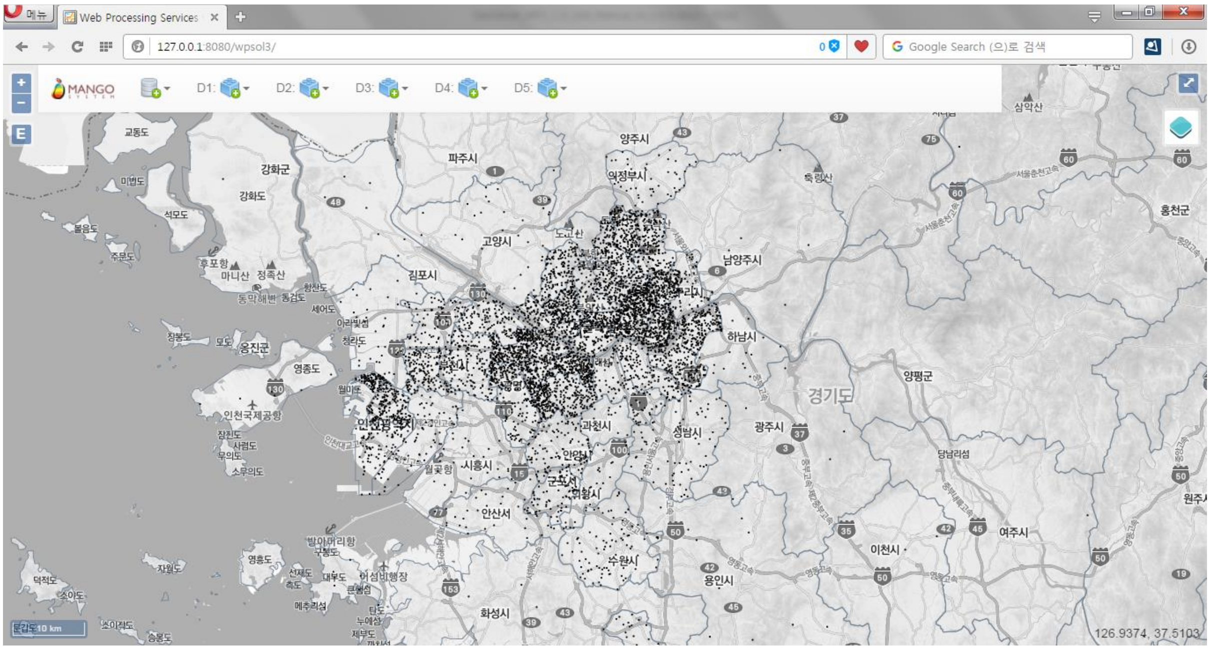
■ O-D Flow Map



■ Hexagonal Binning

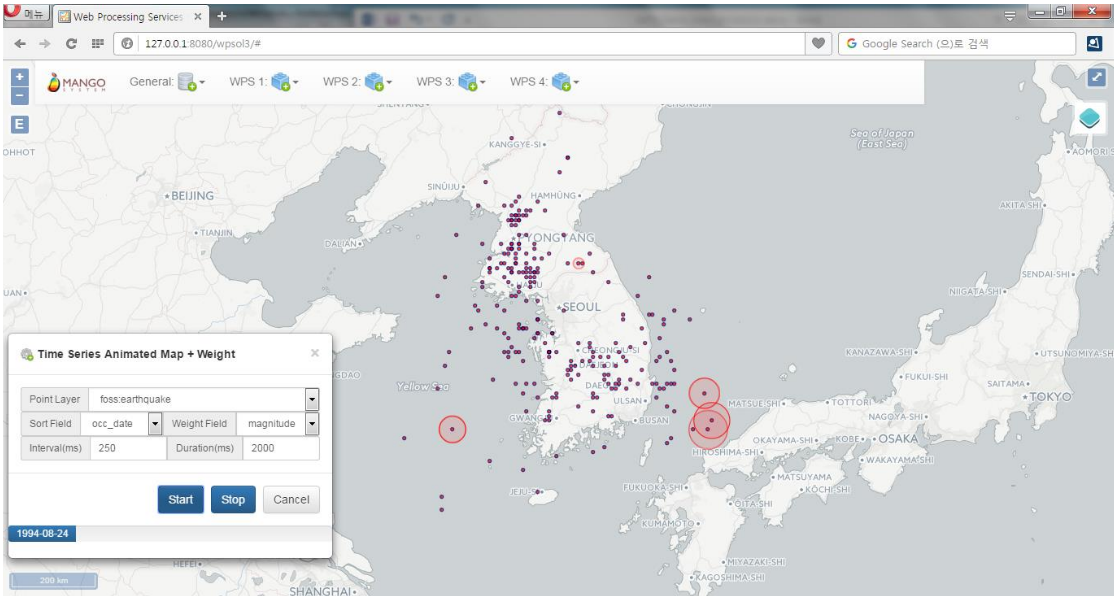


■ Dot Density Map



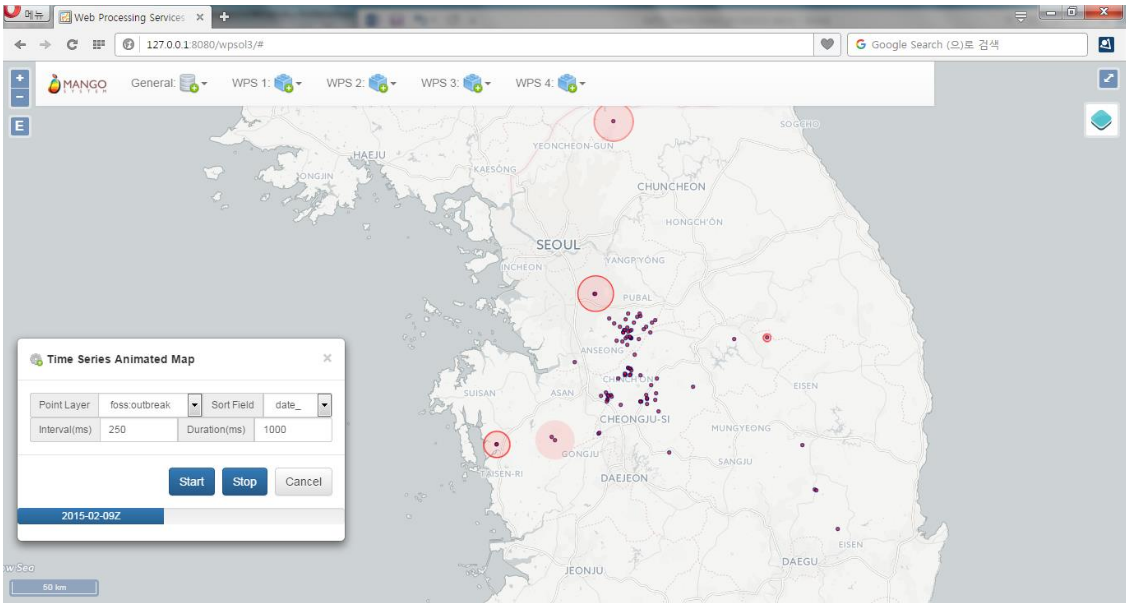
5.2.5.9. Time Series Animated Map + Weight

지진, 발병지역 등 시간 속성이 포함된 포인트 레이어를 동적 애니메이션으로 표시하며, 지진의 크기값 등 속성값을 가중치로 설정하여 애니메이션 원의 반경을 표시합니다.



5.2.5.10. Time Series Animated Map

지진, 발병지역 등 시간 속성이 포함된 포인트 레이어를 동적 애니메이션으로 확인할 수 있는 기능입니다.

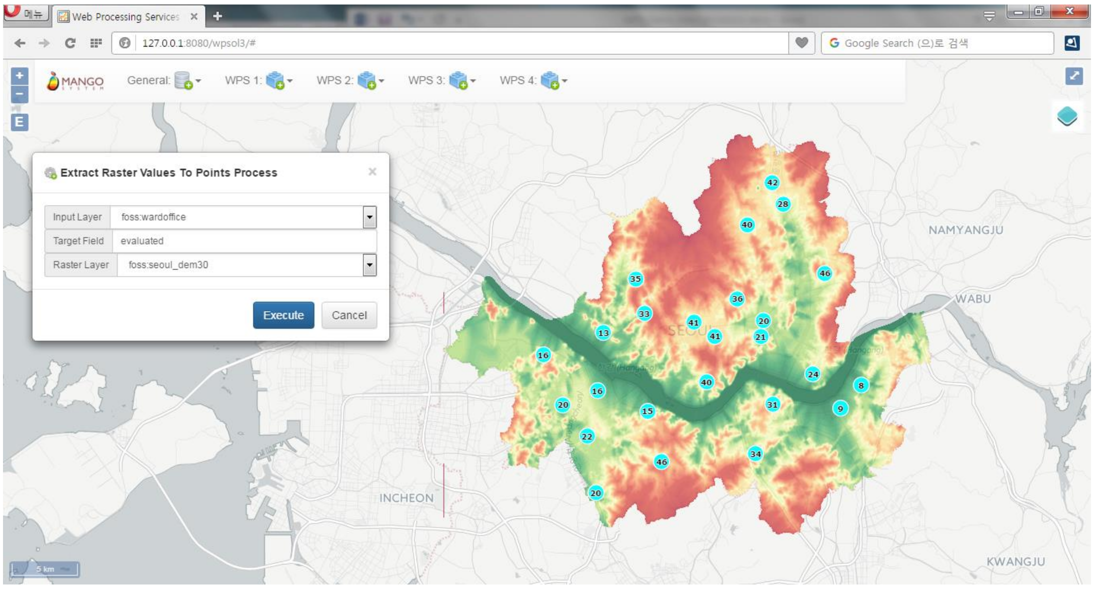


5.2.6. D5

5.2.6.1. Extract Raster Values to Points

포인트 레이어의 각 피처와 중첩되는 래스터 레이어의 셀값을 계산하는 기능입니다.

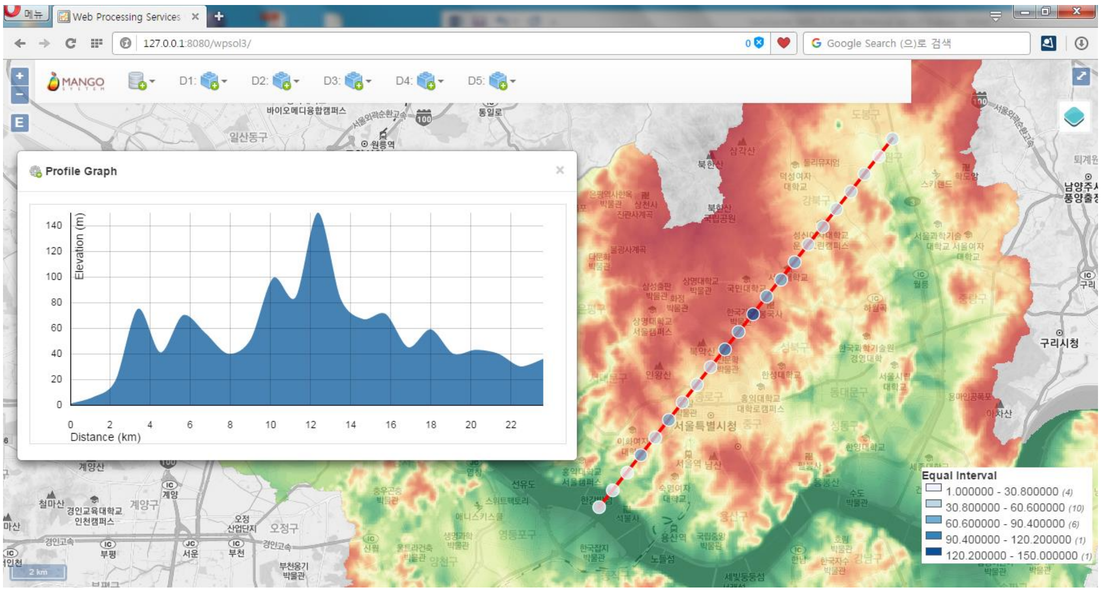
다음 예는 서울시 구청별로 DEM 데이터를 이용하여 표고값을 계산한 결과입니다.



5.2.6.2. Raster Profile Graph

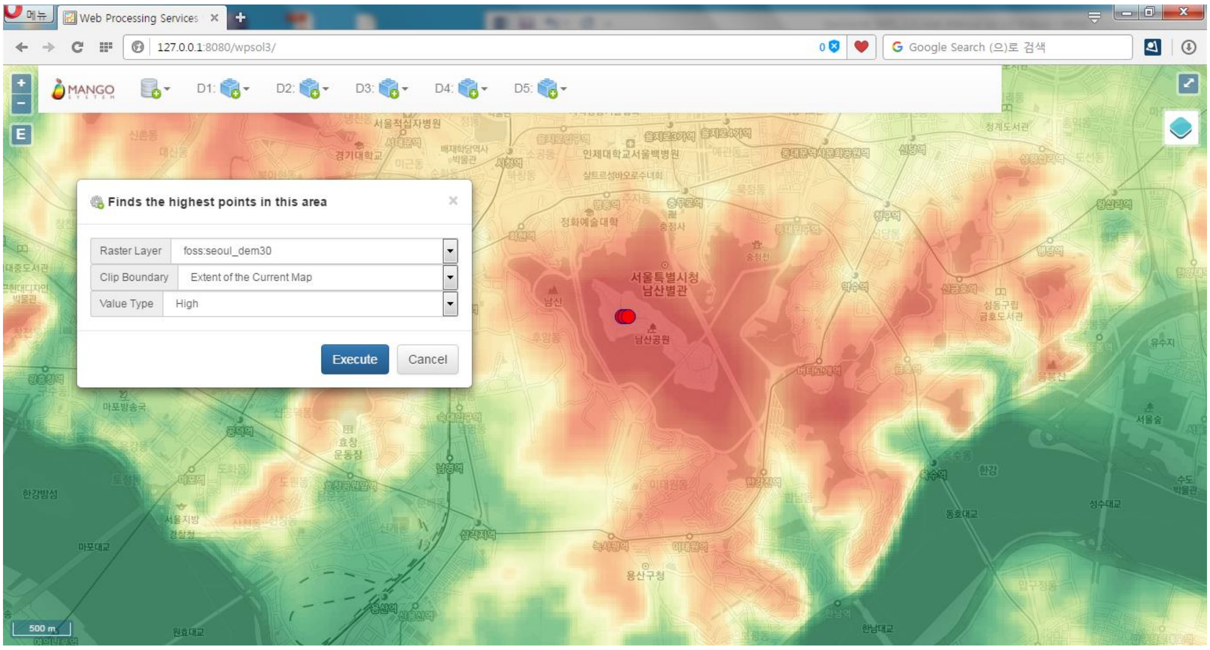
사용자가 지정한 라인을 이용하여 Profile 을 분석하는 기능입니다.

서울시 DEM 을 이용하여 두 지점간의 Profile(종단면) 분석 후 포인트 및 그래프로 시각화한 결과입니다.



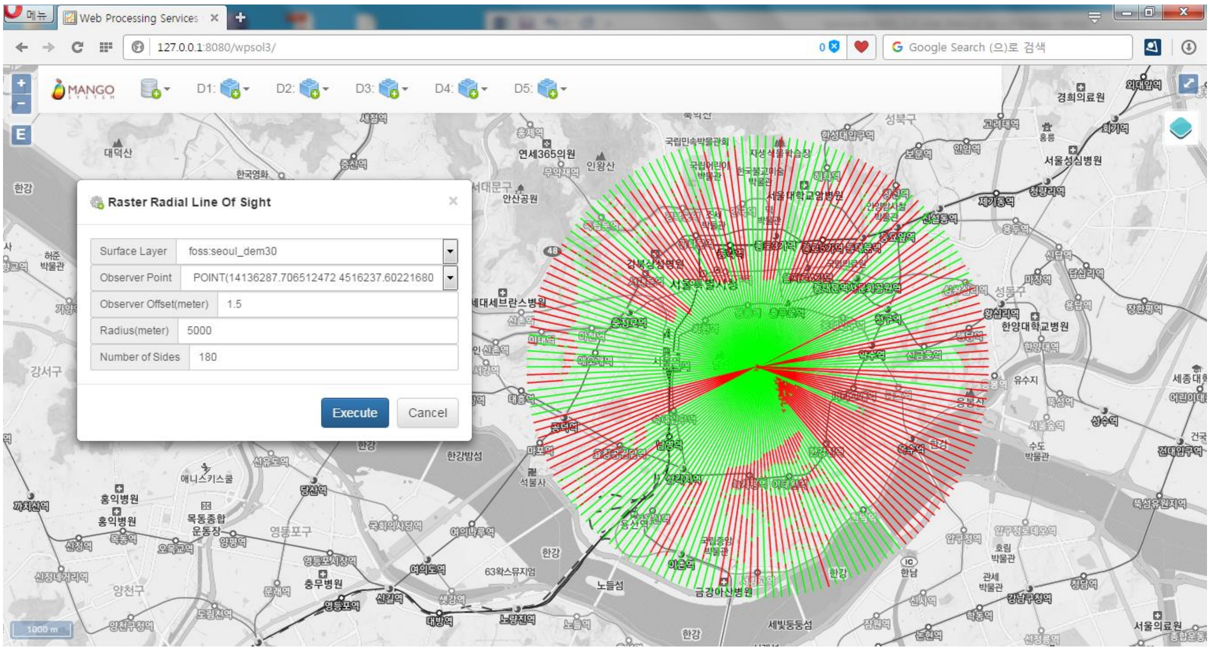
5.2.6.3. Finds the highest points in this area

사용자가 설정한 영역을 기준으로 래스터 셀의 최고값, 최저값을 포인트로 변환하는 기능입니다. 다음은 현재 지도영역을 기준으로 가장 높은 지점을 추출한 결과입니다.



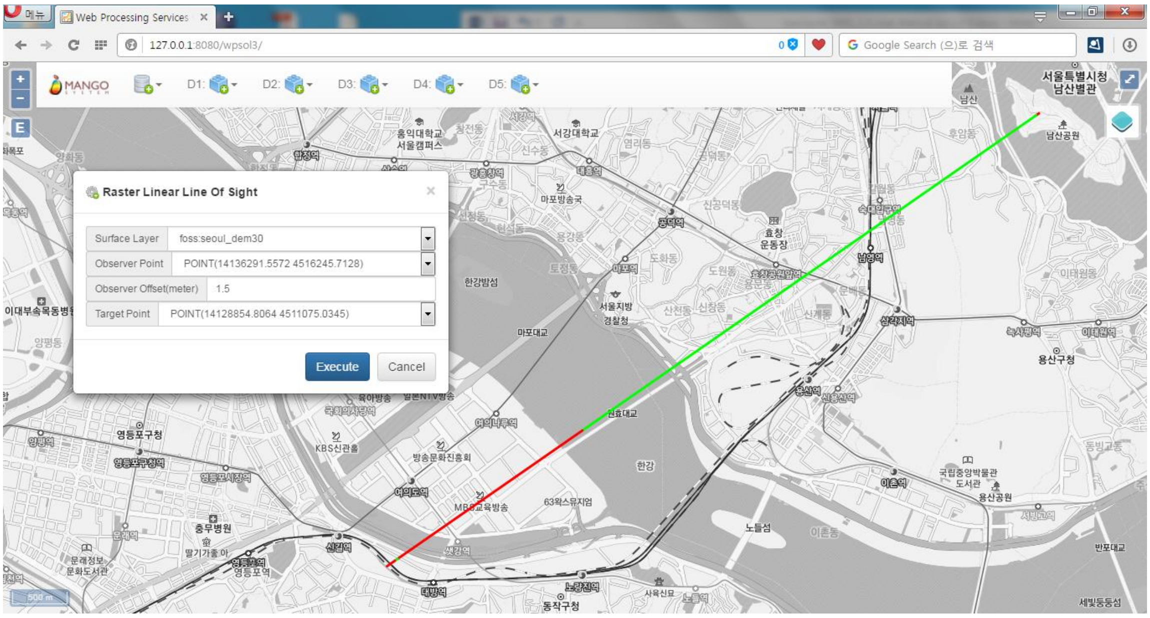
5.2.6.4. Raster Radial Line of Sight

DEM 을 이용하여 사용자가 설정한 지점에 대한 Radial Line of Sight 를 분석하는 기능입니다. 다음 예에서 녹색은 가시권역, 빨강색은 비가시권역을 표시합니다.



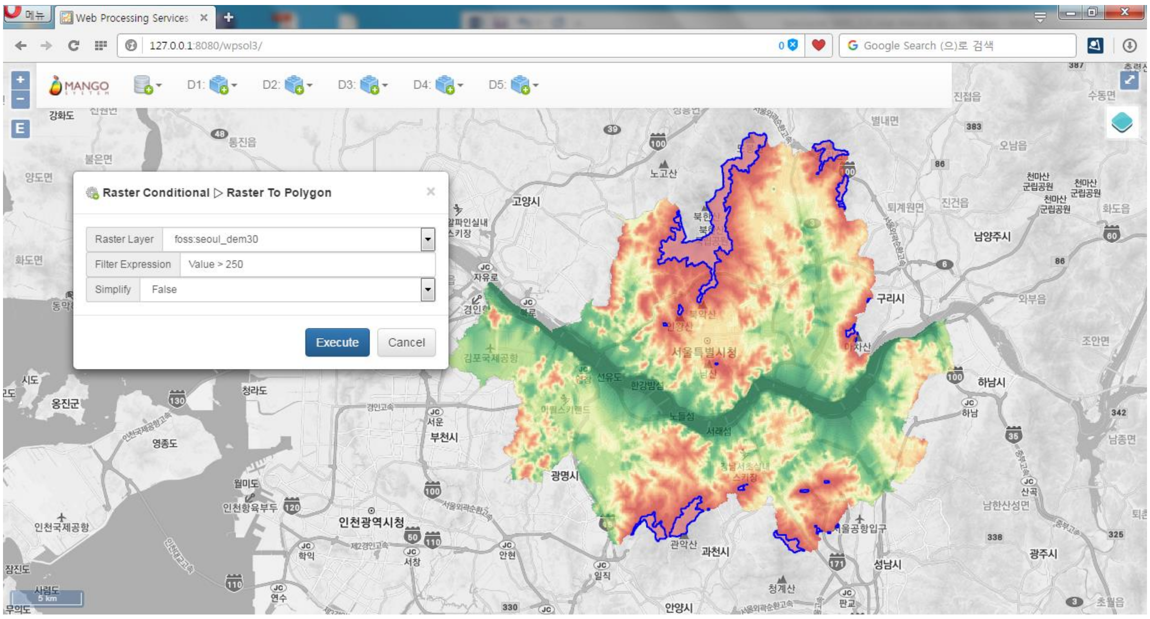
5.2.6.5. Raster Linear Line of Sight

사용자가 설정한 두 지점간의 가시선을 분석하는 기능입니다. 다음 예에서 녹색은 가시권, 빨강색은 비가시권을 표시합니다.



5.2.6.6. Raster Conditional → Raster to Polygon

Filter Expression 을 이용하여 기준을 만족하는 래스터를 추출 후 폴리곤으로 변환하는 기능입니다. 다음 예는 서울시 250 미터 이상의 영역을 추출한 결과입니다.



6 References

6.1. How to Contribute

Spatial Extension for GeoServer WPS 개발에 참여하는 방법은

- GitHub 를 이용하여 직접 개발에 참여
- Transifex 를 이용하여 지역화(한국어 등)에 참여하는 방법이 있습니다.

다음 URL 을 참고하십시오.

■ ***GitHub***

- https://github.com/mapplus/spatial_statistics_for_geotools_udig

■ ***Transifex***

- https://www.transifex.com/mangosystem/ss-rd

6.2. Reference

■ http://www.opengeospatial.org/standards/wps

■ http://docs.geoserver.org/stable/en/user/extensions/wps/index.html

■ https://github.com/mapplus/spatial_statistics_for_geotools_udig

[문서의 끝]

MANGO
SYSTEM

Spatial Extension for GeoServer WPS v1.0

USER MANUAL