

Defra Earth Observation Data Service Application Programming Interface (API) and Web Processing Service (WPS)

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Introduction

The Defra Earth Observation Data Service provides access to analysis-ready Sentinel-1 and Sentinel-2 data for England. View and download services are provided by the EO Data Service website (<https://earthobs.defra.gov.uk>), but analytical data users will find it more efficient to access the data via an Application Programming Interface (API).

The EO Data Service enables users to interact with the data using APIs, which provide an easy way of accessing and using data within a desktop or cloud-based processing environment. There are two sets of APIs offered by the EO Data Service:

GeoServer APIs deliver Open Geospatial Consortium (OGC) web services: Web Map Service, Web Coverage Service, Web Feature Service and Web Processing Service.

GeoNode APIs provide a REST style access to the data via simple HTTP GET requests. Data can be returned in a range of formats including JSON, CSV and html web pages.

This document covers the structure and use of the GeoNode API followed by an introduction to the Web Processing Service. Other OGC web services are covered in the EO Data Service User Guide and videos which are available here: <http://earthobs.defra.gov.uk/help/#getting-started>

The EO Data Service is currently at a beta release. We are going through a process of user engagement to improve the service and documentation.

This document provides information about the structure and function of the EO Data Service API and lists each of the endpoints with their query parameters. Further resources are available from <https://earthobs.defra.gov.uk/#using-the-api> comprising a webinar on using the API and a Jupyter Notebook and ancillary files providing a practical example of using the API with Web processing Services (WPS).

Datasets provided through the EO Data Service are published under the Open Government Licence (OGL) v3 unless otherwise stated. Terms and conditions of use for the EO Data Service can be found here:

<https://earthobs.defra.gov.uk/termsfuse/>

If you use data from the EO Data Service in a report, presentation or other publication, please acknowledge this with the following text:

"<Sentinel-1 / Sentinel-2> analysis-ready data supplied under the Open Government Licence v3 by the Defra Earth Observation Data Service [earthobs.defra.gov.uk]."

If you have questions about the APIs please contact GI-Office@defra.gov.uk

Using the GeoNode API

API Structure and GET Requests

The EO Data Service API consists of the root: <https://earthobs.defra.gov.uk/> and the following endpoints: **layers**, **categories**, **base**, **keywords**, **maps**, **owners**, **profiles**, **regions** and **styles**. These are documented in detail in the **API Endpoints** section of this document. Each endpoint will return a resource, i.e. a collection of data, in response to a HTTP GET request. A GET request has the following syntax:

GET request-URI HTTP-version

e.g: GET /layers version="1.0"

The API call can be modified as outlined in the following sections to determine which data are returned from the available resource.

Authentication

The EO Data Service API requires user credentials in the form of an authentication token to be sent with each request. You can find your authentication token by logging into the EO Data Service website and selecting Profile from the menu under your user name, as shown below. For further information on setting up user accounts and using the EO Data Service website see <http://earthobs.defra.gov.uk/help/#getting-started>

Guest Data User (guest_data_user)



Guest

Position	Data User
Organization	Not provided.
Location	GBR
Voice	Not provided.
Fax	Not provided.
Description	Not provided.
Keywords	Not provided
Authentication Token	e7Qxt1x9EtjNn29joEgnl6PVEZnAWl

[Message User](#)

[Edit profile](#)

[Connected social accounts](#)

[Associated e-mails](#)

[Set/Change password](#)

[Upload new layers](#)

[My Activities](#)

[Notifications](#)

[Invite Users](#)

Authentication tokens must be added to API requests using:

username=<username>

api_key=<authentication token>

Example:

https://earthobs.defra.gov.uk/api/base/?limit=9&offset=0&username=<username>&api_key=<authentication token>

This is an API call that returns all available layers, maps and layer groups in the EO Data Service

Please note that both user name and authentication token are case sensitive.

In contrast, authentication tokens must be added to requests made directly to Geoserver, e.g. via cURL commands or OGC web services, using:

access_token=<authentication token>

Example:

https://earthobs.defra.gov.uk/geoserver/geonode/S1B_20191120_81_desc_061336_061401_VVVH_G0_GB_OSGB_RTCK_SpkRL/wms?request=GetCapabilities&access_token=<authentication token>

This is a web map service (WMS) call that returns a single Sentinel-1 scene.

API Limit and Pagination

In all API calls:

limit= determines the maximum number of records to be returned. This defaults to 9.

offset= determines the value of the first record to be returned based on its position in the list, i.e. offset=9 will return the 10th record.

Query Parameters

Query parameters can be added to API endpoints, preceded by **?**, to influence the data returned. A query string consists of **?** followed by the parameters and their values. Multiple query parameters can be included in a query string, separated by **&**.

GET {root}/endpoint/?query1=value&query2=value&query3=value

The order in which query parameters appear in a query string does not matter.

This is an example of adding a query parameter to the Keywords API endpoint:

https://earthobs.defra.gov.uk/api/keywords/?username=<username>&api_key=<authentication token>

Only the authentication parameters have been included.

	This therefore returns a list of <u>all</u> keywords used in the EO Data Service, with their name, identifier ("id"), resource URI, slug (human-readable unique identifier) and the number of datasets whose metadata contains each keyword.
<code>https://earthobs.defra.gov.uk/api/keywords/?slug=sentinel-2&username=<username>&api_key=<authentication_token></code>	<p>The query string ?slug=sentinel-2 has been added. This therefore returns information including name, identifier, resource URI etc for the keyword Sentinel-2:</p> <pre>{ "meta": { "limit": 9, "next": null, "offset": 0, "previous": null, "total_count": 1 }, "objects": [{ "count": 257, "depth": 1, "id": 8, "name": "Sentinel-2", "numchild": 0, "path": "000F", "resource_uri": "/api/keywords/8/", "slug": "sentinel-2" }], "requested_time": 1574509289.502798 }</pre>

The query parameters available for use with each endpoint are shown in the **API Endpoints** section of this document. You can also find them by querying the endpoint's schema and looking at the end of the string of JSON text returned, for example:

<code>https://earthobs.defra.gov.uk/api/keywords/schema/?username=<username>&api_key=<authentication_token></code>	<p>returns [...] "filtering": {"slug": 1}</p> <p>This shows that the only query parameter which can be used with the keywords endpoint is slug.</p>
<code>https://earthobs.defra.gov.uk/api/regions/schema/?username=<username>&api_key=<authentication_token></code>	<p>returns [...] "filtering": {"code": 1, "name": 1}</p> <p>This shows that two filtering parameters can be used with the regions endpoint, namely code and name.</p>
<code>https://earthobs.defra.gov.uk/api/styles/schema/?username=<username>&api_key=<authentication_token></code>	<p>returns [...] "filtering": {"id": 1, "layer": 2, "name": 1, "title": 1}}</p> <p>This shows that four query parameters can be used with the styles endpoint, namely id, layer, name and title.</p>

In the schema for the regions endpoint, note that the layer parameter is followed by the number 2 (`"layer": 2`). This means that the layer parameter can be used on its own (`?layer=value`) or modified by adding one of the query parameters associated with the layers endpoint separated by a double underscore `__` (e.g. `?layer__date=`). For example:

<a href="https://earthobs.defra.gov.uk/api/styles/?layer=3&username=<username>&api_key=<authentication_token>">https://earthobs.defra.gov.uk/api/styles/?layer=3&username=<username>&api_key=<authentication_token>	Returns information about the style applied to the layer whose ID number is 3. Layer 3 is a Sentinel-1 scene and the applied style is the S1_Polarisation_V1 style. The information includes a list of layers using this style, a description of the style (e.g. font, border, background colour) and the style's name and title.
<a href="https://earthobs.defra.gov.uk/api/styles/?layer__title=GB_boundaries&username=<username>&api_key=<authentication_token>">https://earthobs.defra.gov.uk/api/styles/?layer__title=GB_boundaries&username=<username>&api_key=<authentication_token>	Returns information about the style which is applied to the GB_boundaries layer, namely "A dark orange polygon style".
<a href="https://earthobs.defra.gov.uk/api/styles/?layer__date=2019-11-20T11:02:49&username=<username>&api_key=<authentication_token>">https://earthobs.defra.gov.uk/api/styles/?layer__date=2019-11-20T11:02:49&username=<username>&api_key=<authentication_token>	Returns information about the style which is applied to layers acquired on 20 th November 2019 at 11:02:49, namely the S2_True_Colour style.

Field Lookups

Field lookups can be added to query parameters to further modify them. Without them, the query parameter will return only records that are an exact match. Field lookups must be separated from the parameter by a double underscore `__`. Some field lookups are shown below:

Field Lookup	Description	Example
iexact	Case-insensitive exact match	<code>?username__iexact=guest_data_user</code> Returns records containing guest_data_user or any variation on capitalisation
contains	Case-sensitive containment test	<code>?username__contains=guest</code> Returns only records containing guest

icontains	Case-insensitive containment test	?username__icontains=GUEST Returns records containing GUEST, Guest, guest or any other variation on capitalisation
in	In a given list	?keywords__slug_in=Sentinel-1 Returns records containing the keyword Sentinel-1
max	Maximum value	?cc_max=50 Returns records with a maximum cloud cover value of 50% (Sentinel-2 only)
min	Minimum value	?cc_min=25 Returns records with a minimum cloud cover value of 25% (Sentinel-2 only)
range	Range of dates, numbers or characters	?date__range=2019-01-01%2000:00,2019-02-01%2000:00 Returns records with dates in January 2019

Geometry Queries

A geometry query parameter can be applied to return spatial data layers that intersect a supplied polygon or bounding box using **?geometry=POLYGON(<node_coordinates>)**. Geometry must be supplied as a list of nodes in well-known-text (WKT) format. The first and last node in the list must be the same. Data layers provided through the EO Data Service are projected to OSGB 1936/British National Grid (EPSG 27700).

Error Codes

The following standard HTTP error codes are used:

ERROR 401 (Unauthorised)	Authentication credentials were not supplied or are not correct. Check the user name and authentication token and remember that these are case sensitive.
ERROR 403 (Forbidden)	The request is formed correctly and contains authentication credentials, but the user does not have necessary permissions for the resource.

ERROR 404 (Not Found)	Connection has been made with the server, but the file or resource specified in the API call cannot be located. Check for errors in the API endpoint.
ERROR 405 (Method Not Allowed)	The API call included an HTTP method that is not allowed by the EO Data Service, for example PUT or DELETE.

Note that if the root and authentication credentials are supplied correctly but there is a mistake in the query string, the query will not be applied and all available data will be returned, but no error will be generated.

API Endpoints

The following GetCapabilities call generates a list of API endpoints offered by the EO Data Service:

https://earthobs.defra.gov.uk/api/?GetCapabilities&access_token=<authentication_token>

Some of these are out-of-the-box Geonode elements which are not relevant to the EO Data Service. Those which are relevant to the EO Data Service are summarised below.

{root} corresponds to <https://earthobs.defra.gov.uk>

Base

Function	End-point	API	Query parameters		
Returns all layers, maps and layer groups that meet the query parameters.	base	{root}/api/base/	category	Category number (see p.11)	integer
			category__identifier	Category identifier (see p.11)	text string
			date	Acquisition date of satellite imagery. Upload date of other layer types. Creation date of map or layer group.	date-time YYYY-MM-DD HH:MM
			id	Unique identifier of layer, map or layer group.	integer
			keywords	Keyword number (see p.12)	text string
			keywords__slug	Keyword slug (see p.12)	text string

			name	Layer name	text string
			owner	Unique identifier of user who uploaded the layer or who created the map or layer group (see p.15)	integer
			owner__username	Username of user who uploaded the layer or who created the map or layer group (see p.15)	text string
			regions	Region number (see p.16)	integer
			regions__code	Region code (see p.16)	text string (three upper case letters)
			regions__name	Region name (see p.16)	text string
			title	Layer title	text string

Examples:

https://earthobs.defra.gov.uk/api/base/?title__icontains=boundaries&username=<username>&api_key=<authentication_token>

Returns any map, layer group or data layer with 'boundaries' in the title (not case sensitive).

https://earthobs.defra.gov.uk/api/base/?category__identifier=imagerybasemapsearchcover&username=<username>&api_key=<authentication_token>

Returns any map, layer group or data layer belonging to the category 'imagerybasemapsearchcover'.

Categories

Function	End-point	API	Query parameters		
Returns the categories used to classify data layers in the EO Data Service and the number of	categories	{root}/api/categories/	identifier=	Category identifier e.g. "boundaries", "environment", "biota", "oceans", "conservation".	text string

layers assigned to each category					
<p>Example:</p> <p><a href="https://earthobs.defra.gov.uk/api/categories/?limit=100&username=<username>&api_key=<authentication_token>">https://earthobs.defra.gov.uk/api/categories/?limit=100&username=<username>&api_key=<authentication_token></p> <p>Returns a list of all categories used in the service, with their ID number, name, description, examples of the type of datasets covered, and the number of layers assigned to each category.</p> <p><a href="https://earthobs.defra.gov.uk/api/categories/?limit=21&identifier=imagerybasemapsearchcover&username=<username>&api_key=<authentication_token>">https://earthobs.defra.gov.uk/api/categories/?limit=21&identifier=imagerybasemapsearchcover&username=<username>&api_key=<authentication_token></p> <p>Returns ID number, name, description and examples of the types of dataset assigned this category (imagerybasemapsearchcover), as well as the number of layers in the EO Data Service assigned to this category.</p>					

Keywords

Function	End-point	API	Query parameters		
Returns information on the keywords used in the EO Data Service	keywords	{root}/api/keywords/	slug=	Human-readable identifier for each keyword. Examples of keyword slugs used in the EO Data Service are: sentinel-2; surface-reflectance; earth-observation; satellite-imagery; analysis-ready-data; sentinel-1; synthetic-aperture-radar; backscatter.	text string (lower case without spaces)
<p>Example:</p> <p><a href="https://earthobs.defra.gov.uk/api/keywords/?slug__in=sentinel-1&username=<username>&api_key=<authentication_token>">https://earthobs.defra.gov.uk/api/keywords/?slug__in=sentinel-1&username=<username>&api_key=<authentication_token></p>					

Returns information on the keyword 'sentinel-1' including id number, name and the number of objects in the database whose metadata contains this keyword.

Layers

Function	End-point	API	Query parameters		
Returns individual layers (not maps or layer groups) that meet the user's query parameters	Layers	{root}/api/base/search/?in__type=layer	category	Category number (see p.11)	integer
			category__identifier	Category identifier (see p.11)	text string
			date	Acquisition date of satellite imagery. Upload date of other layer types.	date-time YYYY-MM-DD HH:MM
			id	Unique identifier of layer	integer
			keywords	Keyword number (see p.12)	text string
			keywords__slug	Keyword slugs (see p.12)	text string
			name	Layer name	text string
			owner	Unique identifier of user who uploaded the layer (see p.15)	integer
			owner__username	Username of user who uploaded the layer (see p.15)	text string
			regions	Region number (see p.16)	integer
			regions__code	Region code (see p.16)	text string (three upper case letters)
			regions__name	Region name (see p.16)	text string
			title	Layer title	text string

Examples:

[https://earthobs.defra.gov.uk/api/base/search/?in__type=layer/?limit=9&offset=0&date__range=2019-06-01%2000:00,2019-07-01%2000:00&geometry=POLYGON\(\(-0.48 51.28,0.21 51.28,0.21 51.69,-0.48 51.69,-0.48 51.28\)\)&username=<username>&api_key=<authentication_token>](https://earthobs.defra.gov.uk/api/base/search/?in__type=layer/?limit=9&offset=0&date__range=2019-06-01%2000:00,2019-07-01%2000:00&geometry=POLYGON((-0.48 51.28,0.21 51.28,0.21 51.69,-0.48 51.69,-0.48 51.28))&username=<username>&api_key=<authentication_token>)

Returns data collected in June 2019 within a bounding box around Greater London.

[https://earthobs.defra.gov.uk/api/base/search/?in__type=layer/?limit=9&offset=0&date__range=2019-07-01%2000:00,2019-07-31%2023:59&title__icontains=s2a&&geometry=POLYGON\(\(-2.55 50.49,-2.35 50.49,-2.35 50.58,-2.55 50.58,-2.55 50.49\)\)&cc_max=50&username=<username>&api_key=authentication_token](https://earthobs.defra.gov.uk/api/base/search/?in__type=layer/?limit=9&offset=0&date__range=2019-07-01%2000:00,2019-07-31%2023:59&title__icontains=s2a&&geometry=POLYGON((-2.55 50.49,-2.35 50.49,-2.35 50.58,-2.55 50.58,-2.55 50.49))&cc_max=50&username=<username>&api_key=authentication_token)

Returns Sentinel 2a granules acquired in July 2019 with <50% cloud cover intersecting a bounding box over Portland in Dorset.

https://earthobs.defra.gov.uk/api/base/search/?in__type=layer/?owner__username__icontains=admin&keywords__slug__in=sentinel-1&username=<username>&api_key=<authentication_token>

Returns layers uploaded by users with 'admin' in their user name and sentinel-1 amongst the keywords in their metadata keywords

Maps

Function	End-point	API	Query parameters		
Returns maps that meet the user's query parameters.	maps	{root}/api/maps/	Category	Category id number (see p.11)	integer
			category__identifier	Category identifier (see p.11)	text string
			date	Date when map was created.	date-time YYYY-MM-DD HH:MM
			id	Unique identifier of map	integer
			keywords	Keyword number (see p.12)	text string
			keywords__slug	Keyword slug (see p.12)	text string
			name	Layer name	text string
			owner	Unique identifier of user who created the map (see p.15)	integer
			owner__username	Username of user who created the map (see p.15)	text string
			regions	Region id number (see p.16)	integer
			regions__code	Region code (see p.16)	text string (three upper case letters)

			regions__name	Region name (see p.16)	text string
			title	Map title	text string
Examples: <a href="https://earthobs.defra.gov.uk/api/maps/?title__contains=Yorkshire&owner__username__icontains=JNCC&username=<username>&api_key=<authentication_token>">https://earthobs.defra.gov.uk/api/maps/?title__contains=Yorkshire&owner__username__icontains=JNCC&username=<username>&api_key=<authentication_token> Returns maps whose title contains the word Yorkshire (case sensitive) created by users whose username includes JNCC (case-insensitive). The information returned includes map name, ID, bounding box, username of user who created the map, and the layers used in the map. <a href="https://earthobs.defra.gov.uk/api/maps/?date__range=2019-01-01%2000:00,2019-12-01%2000:00&username=<username>&api_key=<authentication_token>">https://earthobs.defra.gov.uk/api/maps/?date__range=2019-01-01%2000:00,2019-12-01%2000:00&username=<username>&api_key=<authentication_token> Returns maps created in November 2019					

Owners

Function	End-point	API	Query parameters		
Returns user account information	owners	{root}/api/owners/	username=	Username of the registered user	text string
Example <a href="https://earthobs.defra.gov.uk/api/owners/?username=<username>&api_key=<authentication_token>">https://earthobs.defra.gov.uk/api/owners/?username=<username>&api_key=<authentication_token> Returns information about the user whose authentication credentials are used in the API call, including name, address, e-mail, phone, fax, id number, organisation and position.					

Profiles

Function	End-point	API	Query parameters		
Returns user profile information	profiles	{root}/api/profiles/	username=	Username of the registered user	text string

Example

https://earthobs.defra.gov.uk/api/profiles/?username=<username>&api_key=<authentication_token>

Returns information about the user whose authentication credentials are used in the API call, including name, address, e-mail, phone, fax, id number, organisation, position, date the account was created, profile detail URL, number of layers uploaded, number of maps created.

Regions

Function	End-point	API	Query parameters		
Returns a list of regions of the world	regions	{root}/api/regions/	code=	3-letter code for the region	text string (3 letters upper case)
			name=	Full name of the region	text string

Examples

https://earthobs.defra.gov.uk/api/regions/?code=GBR&username=<username>&api_key=<authentication token>

https://earthobs.defra.gov.uk/api/regions/?name=United%20Kingdom&username=<username>&api_key=<authentication_token>

Both of the above calls return information for the United Kingdom region. The information returned includes bounding box coordinates, projection system, id number and resource URI.

Styles

Function	End-point	API	Query parameters		
Returns information on the styles (SLD files) applied to raster and vector data layers in the	Styles	{root}/api/styles/	id=	Unique identifier of the style	integer
			layer=	Layer number	integer
			layer__category=	Category number of layer	integer
			layer__date=	Date of acquisition or upload of layer	date-time YYYY-MM-DD HH:MM
			layer__id=	Unique identifier of layer	integer

EO Data Service			layer__keywords=	Keyword number of layer	text string
			layer__name=	Name of layer	text string
			layer__owner=	Unique identifier of user who uploaded the layer or created the map or layer group	integer
			layer__regions=	Unique identifier of region	Integer
			layer__title=	Title of layer	text string
			name=	Style name	text string
			title=	Style title	text string

Examples

https://earthobs.defra.gov.uk/api/styles/?name=S2_False_Colour&username=<username>&api_key=<authentication_token>

Returns information on the S2_False_Colour style. The information includes a list of layers using this style, a description of the style and the style's name and title.

https://earthobs.defra.gov.uk/api/styles/?layer__keywords__slug=sentinel-1&username=<username>&api_key=<authentication_token>

Returns information about the style applied to layers whose metadata includes the keyword Sentinel 1

Web Processing Service

Web Processing Service (WPS) is an extension for GeoServer which enables users to carry out data processing and analysis via API without needing to export or download the data. It is integrated with other GeoServer services and the data catalogue, meaning that it can read data from the GeoServer catalogue, carry out processing and write the output to the catalogue as a new layer.

The EO Data Service API can be used in any coding environment, and there are a number of tools and libraries for making HTTP GET requests, such as Wget, cURL and Python Requests. WPS is just one of several options for interacting with EO Data Service data via the API. It has been included in this document because it provides a set of ready-made functions for manipulating and analysing spatial data that will be familiar to GIS-users, thereby offering a user-friendly environment for experimenting with the API.

Further information about WPS can be found on the GeoServer website: <https://docs.geoserver.org/stable/en/user/services/wps/index.html>

WPS operations fall into three main categories:

1. GetCapabilities

Returns details of the service offering as an XML document called the capabilities document.

Example:

https://earthobs.defra.gov.uk/geoserver/ows?service=WPS&version=1.0.0&request=GetCapabilities&access_token=<authentication_token>

2. DescribeProcess

Returns a description of one or several WPS processes available through the service as an XML document.

Example:

https://earthobs.defra.gov.uk/geoserver/ows?service=WPS&version=1.0.0&request=DescribeProcess&identifier=ras:RasterZonalStatistics&access_token=<authentication_token>

Returns information about the WPS tool ras:RasterZonalStatistics which generates zonal statistics for supplied raster and polygon datasets.

3. Execute

Performs the process with the specified input data and processing parameters. The example below re-projects a vector dataset (GB_boundaries.shp) from OSGB36 British National Grid to WGS84 UTM zone 30N):

```
<?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>vec:Reproject</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:geonode="http://www.geonode.org/">
          <wfs:Query typeName="geonode:GB_boundaries"/>
        </wfs:GetFeature>
      </wps:Body>
    </wps:Reference>
  </wps:Input>
  <wps:Input>
    <ows:Identifier>forcedCRS</ows:Identifier>
    <wps:Data>
      <wps:LiteralData>EPSG:27700</wps:LiteralData>
    </wps:Data>
  </wps:Input>
  <wps:Input>
    <ows:Identifier>targetCRS</ows:Identifier>
    <wps:Data>
      <wps:LiteralData>EPSG:32630</wps:LiteralData>
    </wps:Data>
  </wps:Input>
</wps:DataInputs>
  <wps:ResponseForm>
    <wps:ResponseDocument storeExecuteResponse="true" status="true">
      <wps:Output asReference="true" mimeType="text/xml; subtype=wfs-collection/1.0">
        <ows:Identifier>result</ows:Identifier>
      </wps:Output>
    </wps:ResponseDocument>
  </wps:ResponseForm>
</wps:Execute>

```

Information on the full range of WPS operations can be found in the WPS capabilities document. A few examples are shown below with the XML for their execution, with user input parameters highlighted. For a practical example of using the EO Data Service API with WPS, download the Jupyter Notebook from <https://earthobs.defra.gov.uk/#using-the-api>

Selected examples of WPS

ras:BandSelect	Returns a raster generated by the selection of some bands from the input raster.
	The example below selects band 1 (Blue) from a Sentinel-2 granule collected on 14 th July 2019 over grid tile T30UWA. The band to be selected must be provided as an integer: 0 will return band 1, 1 will return band 2 etc.
<pre> <?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"> </pre>	

```

<ows:Identifier>ras:BandSelect</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>geonode:S2A_20190714_lat50lon223_T30UWA_ORB037_utm30n_osgb_vmsk_sharp_rad_srefdem_stdsref</ows:Identifier>
          <wcs:DomainSubset>
            <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#27700">
              <ows:LowerCorner>329230.0 -38280.0</ows:LowerCorner>
              <ows:UpperCorner>437560.0 72990.0</ows:UpperCorner>
            </ows:BoundingBox>
          </wcs:DomainSubset>
          <wcs:Output format="image/tiff"/>
        </wcs:GetCoverage>
      </wps:Body>
    </wps:Reference>
  </wps:Input>
  <wps:Input>
    <ows:Identifier>SampleDimensions</ows:Identifier>
    <wps>Data>
      <wps:LiteralData>0</wps:LiteralData>
    </wps>Data>
  </wps:Input>
  <wps:Input>
    <ows:Identifier>VisibleSampleDimension</ows:Identifier>
    <wps>Data>
      <wps:LiteralData>0</wps:LiteralData>
    </wps>Data>
  </wps:Input>
</wps>DataInputs>
<wps:ResponseForm>
  <wps:ResponseDocument storeExecuteResponse="true" status="true">
    <wps:Output asReference="true" mimeType="image/tiff">
      <ows:Identifier>result</ows:Identifier>
    </wps:Output>
  </wps:ResponseDocument>
</wps:ResponseForm>
</wps:Execute>

```

ras:RasterZonalStatistics

Computes statistics for the distribution of a certain quantity in a set of polygonal zones.

Zones must be provided in both vector and raster format. The source band from which statistics will be generated must be provided as an integer: 0 will return band 1, 1 will return band 2 etc.

```

<?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>ras:RasterZonalStatistics</ows:Identifier>
  <wps>DataInputs>
    <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>geonode:S2B_20191116_lat53lon071_T30UXD_ORB037_utm30n_osgb_vmsk_sharp_rad_srefdem_stdref</ows:Identifier>
            <wcs:DomainSubset>
              <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#27700">
                <ows:LowerCorner>433360.0 260280.0</ows:LowerCorner>
                <ows:UpperCorner>541610.0 371590.0</ows:UpperCorner>
              </ows:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>band</ows:Identifier>
      <wps>Data>
        <wps:LiteralData>0</wps:LiteralData>
      </wps>Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>zones</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:geonode="http://www.geonode.org/">
            <wfs:Query typeName="geonode:SSSI_boundaries_class"/>
          </wfs:GetFeature>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>classification</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>geonode:SSSI_boundaries_classif</ows:Identifier>
            <wcs:DomainSubset>
              <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#27700">
                <ows:LowerCorner>408655.92 90181.3576</ows:LowerCorner>
                <ows:UpperCorner>418405.92 112321.3576</ows:UpperCorner>
              </ows:BoundingBox>
            </wcs:DomainSubset>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
  </wps>DataInputs>

```

```

        <wcs:Output format="image/tiff"/>
      </wcs:GetCoverage>
    </wps:Body>
  </wps:Reference>
</wps:Input>
</wps>DataInputs>
  <wps:ResponseForm>
    <wps:ResponseDocument storeExecuteResponse="true" status="true">
      <wps:Output asReference="true" mimeType="text/csv">
        <ows:Identifier>statistics</ows:Identifier>
      </wps:Output>
    </wps:ResponseDocument>
  </wps:ResponseForm>
</wps:Execute>

```

ras:RasterAsPointCollection

Returns a collection of point features for the pixels of a raster. The band values are provided as attributes.

The example below generates points for every pixel of a Sentinel-1 dataset collected on the 25th July 2019 and creates an output shapefile in OSGB36 British National Grid

```

<?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>ras:RasterAsPointCollection</ows:Identifier>
  <wps>DataInputs>
    <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>geonode:S1A_20190725_30_asc_175733_175758_VVH_G0_GB_OSGB_RTCK_SpkRL</ows:Identifier>
            <wcs:DomainSubset>
              <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#27700">
                <ows:LowerCorner>242223.95495566077 -25598.720147908083</ows:LowerCorner>
                <ows:UpperCorner>538313.9549556607 193711.27985209192</ows:UpperCorner>
              </ows:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>
        </wps:Body>
      </wps:Reference>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>targetCRS</ows:Identifier>

```

```

    <wps:Data>
      <wps:LiteralData>EPSG:27700</wps:LiteralData>
    </wps:Data>
  </wps:Input>
</wps:Input>
  <ows:Identifier>scale</ows:Identifier>
  <wps:Data>
    <wps:LiteralData>1</wps:LiteralData>
  </wps:Data>
</wps:Input>
</wps:DataInputs>
  <wps:ResponseForm>
    <wps:ResponseDocument storeExecuteResponse="true" status="true">
      <wps:Output asReference="true" mimeType="text/csv">
        <ows:Identifier>statistics</ows:Identifier>
      </wps:Output>
    </wps:ResponseDocument>
  </wps:ResponseForm>
</wps:Execute>

```

ras:CoverageClassStats

Calculates statistics from coverage values classified into bins/classes.

The example below calculates the mean values of the 4th band of a Sentinel-2 granule for 10 classes, or bins, created using the Natural Breaks method.

```

<?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>ras:CoverageClassStats</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>geonode:S2B_20190226_1at501on084_T30UXA_ORB137_utm30n_osgb_vmsk_sharp_rad_srefdem_stdsref</ows:Identifier>
            <wcs:DomainSubset>
              <ows:BoundingBox crs="http://www.opengis.net/gml/srs/epsg.xml#27700">
                <ows:LowerCorner>429240.0 -39610.0</ows:LowerCorner>
                <ows:UpperCorner>537550.0 71640.0</ows:UpperCorner>
              </ows:BoundingBox>
            </wcs:DomainSubset>
            <wcs:Output format="image/tiff"/>
          </wcs:GetCoverage>

```

```

    </wps:Body>
  </wps:Reference>
</wps:Input>
<wps:Input>
  <ows:Identifier>stats</ows:Identifier>
  <wps:Data>
    <wps:LiteralData>mean</wps:LiteralData>
  </wps:Data>
</wps:Input>
<wps:Input>
  <ows:Identifier>band</ows:Identifier>
  <wps:Data>
    <wps:LiteralData>3</wps:LiteralData>
  </wps:Data>
</wps:Input>
<wps:Input>
  <ows:Identifier>classes</ows:Identifier>
  <wps:Data>
    <wps:LiteralData>10</wps:LiteralData>
  </wps:Data>
</wps:Input>
<wps:Input>
  <ows:Identifier>method</ows:Identifier>
  <wps:Data>
    <wps:LiteralData>NATURAL_BREAKS</wps:LiteralData>
  </wps:Data>
</wps:Input>
</wps>DataInputs>
<wps:ResponseForm>
  <wps:ResponseDocument storeExecuteResponse="true" status="true">
    <wps:Output asReference="true" mimeType="text/xml">
      <ows:Identifier>results</ows:Identifier>
    </wps:Output>
  </wps:ResponseDocument>
</wps:ResponseForm>
</wps:Execute>

```

Gs:download

Downloads a single layer

Please note that this only downloads the main S1 or S2 ARD GeoTiff file. Metadata files and ancillary files e.g. Sentinel-2 cloud masks are not downloaded. This will only download one layer. To download multiple layers, a separate POST request and .xml file would be needed for each file. File names are changed during download – the downloaded GeoTiff file will be named with the unique identifier of the original data.

```

<?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>gs:Download</ows:Identifier>
  <wps>DataInputs>
    <wps:Input>
      <ows:Identifier>layerName</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>geonode:S2B_20200217_lat50lon363_T30UVA_ORB080_utm30n_osgb_vmsk_sharp_rad_srefdem_stdref</wps:LiteralData>
      </wps:Data>
    </wps:Input>
    <wps:Input>
      <ows:Identifier>outputFormat</ows:Identifier>
      <wps:Data>
        <wps:LiteralData>image/tiff</wps:LiteralData>
      </wps:Data>
    </wps:Input>
  </wps>DataInputs>
  <wps:ResponseForm>
    <wps:ResponseDocument storeExecuteResponse="true" status="true">
      <wps:Output asReference="true" mimeType="application/zip">
        <ows:Identifier>result</ows:Identifier>
      </wps:Output>
    </wps:ResponseDocument>
  </wps:ResponseForm>
</wps:Execute>

```

Accessing the EO Data Service via cloud computing

The EO Data Service uses IP address whitelisting as a security feature. IP addresses have been whitelisted for the following organisations, enabling their staff to access the service from any laptop or PC on their organisation's network:

Defra and Agencies	Arm's Length Bodies (ALB)
Animal and Plant Health Agency	Centre for Environment, Fisheries and Aquaculture Science
Defra	Forest Research
Environment Agency	Forest Services
Natural England	Forestry England
Rural Payments Agency	Joint Nature Conservation Committee

However, analytical users may wish to use cloud-based computing rather than accessing the service via their laptop or PC, as this offers a more efficient and powerful way of processing large volumes of data. The following information is intended to help users understand the protocols involved in accessing the EO Data Service via cloud computing.

Defra and Agencies

Defra Cloud Services Centre may provision cloud-based computing to enable staff at Defra or the Agencies to access the EO Data Service. Staff wishing to pursue this option should contact EO Data Service support on GI-Office@defra.gov.uk to outline their requirements. The cost of provisioning must be met by the unit within Defra/the Agencies that is making the request. If you are seeking funding for a project that requires access to the EO Data Service from a cloud environment, we strongly recommend that you contact EO Data Service support at the earliest opportunity to get an estimate of costs for your budget.

Arm's Length Bodies

It is assumed that the ALB has access to their own cloud tenancy, e.g. [Azure](#), [JASMIN](#) or [Amazon Web Services](#), and that they (not Defra) are responsible for their cloud environment's security, infrastructure and associated costs. If the ALB wishes to access the EO Data Service from their cloud environment, they need to contact EO Data Service support on GI-Office@defra.gov.uk in order to:

- Provide the external IP address of their cloud environment for whitelisting. This must be a permanent, static IP address.
- Request a shared access signature (SAS) token.

The EO Data Service is hosted on Defra's Azure tenancy. Transfer of data to another Azure tenancy in the North Europe region does not incur egress charges. However, transfer of data from the EO Data Service to another cloud environment or to a user's PC or laptop will incur egress charges; these will be the responsibility of the EO Data Service owner.

It may be possible for Defra Cloud Services Centre to provision cloud-based computing for staff in Arm's Length Bodies, provided that the full cost of provisioning is met by the ALB.

EO expertise in the Defra network

Several organisations in the Defra network have teams or individuals with expertise in using EO data for environmental applications. If you are interested in using EO in your work area, please seek advice from the relevant people in your organisation:

Defra

'Earth Observation – Drones to Satellites' on Yammer

Earth Observation Centre of Excellence: earth-obs@defra.gov.uk

<https://defradigital.blog.gov.uk/2017/04/07/why-defra-has-an-earth-observation-centre-of-excellence/>

Cefas

'Marine Earth Observation Interest Group' on Yammer

Environment Agency

Geomatics

survey@environment-agency.gov.uk

Joint Nature Conservation Committee

Ecosystems Analysis Team

earthobs@jncc.gov.uk

<https://jncc.gov.uk/our-work/earth-observation/>

Natural England

Evidence Earth Observation Service

earth.observation@naturalengland.org.uk

Rural Payments Agency

GI_Services_Technica@rpa.gov.uk