

Contents

OGC® EO Data Access Best Practice	2
License Agreement	3
Abstract	5
Keywords	6
Submitting organizations	7
Document Contributor Contact Points.....	8
Changes to the OGC ® Abstract Specification	9
Future Work.....	10
Foreword	11
Introduction.....	12
OGC® EO Data Access Best Practice	12
1. Scope	13
2. Normative references	14
3. Terms and definitions	16
3.1. Coverage	16
3.2. Dataset	16
3.3. Dataset Series	16
3.4. EO Coverage	16
3.5. EO Metadata	16
3.6. Stitched Mosaic	16
3.7. EO Product	16
3.8. EO Product Dataset	17
3.9. EO Product Quicklook	17
3.10. Lineage record.....	17
3.11. refers to	17
4. Conventions	18
4.1. UML notation	18
4.2. Data dictionary tables	18
4.3. Namespace prefix conventions	18
4.4. Multiple representations	19
5. Cross Service Interaction	20
5.1. Overview	20
6. Grouping of Associated Data	21

6.1. Overview	21
7. Collection and Product Registration	25
7.1. Overview	25
8. Condense Coverage Description Information	26
8.1. Overview	26
9. Uniform Coverage Grouping	27
9.1. Overview	27
10. WCS Masking Extension	28
10.1. Overview	28
11. rangeType Description Enhancements	29
11.1. Overview	29
11.2. Physical Properties	29
11.3. Data Types	30
11.4. Conversion from Data Types to Physical Properties	30
11.5. Hint for RGB Generation	31
11.6. Recommended definitions	32
11.6.1. <code>wcseo:dataSemantics</code> , <code>swe:Quantity/@definition</code> , and <code>swe:uom/@code</code>	32
11.6.2. <code>wcseo:dataType</code>	33
11.6.3. <code>wcseo:type</code> in <code>wcseo:dataType2dataSemantics</code> and <code>wcseo:RGBgenerationHint</code>	33
11.6.4. <code>wcseo:bandSequence</code>	33
11.6.5. <code>definition</code> attribute of <code>swe:DataRecord</code>	34
11.6.6. <code>swe:field/@name</code> vs. <code>swe:field/swe:Quantity/swe:identifier</code>	34
11.6.7. <code>swe:nilValue/@reason</code>	35
11.7. Examples	35
Bibliography	42
Annex A: Revision History	43

Open Geospatial Consortium

Submission Date: TBD

Publication Date: TBD

Approval Date: TBD

External identifier of this OGC® document:

<http://www.opengis.net/doc/BP/eo-data-access-bp>

Internal reference number of this OGC® Document: OGC 16-118

URL for this OGC® document: <https://eox-a.github.io/eo-data-access-bp/>

PDF version: <https://eox-a.github.io/eo-data-access-bp/index.pdf>

Version: 0.0.1draft

Category: OGC® Best Practice

Editor: Stephan Meißl

OGC® EO Data Access Best Practice

Copyright © 2016 Open Geospatial Consortium.

To obtain additional rights of use, visit <http://www.opengeospatial.org/legal/>

Warning

This document defines an OGC Best Practices on a particular technology or approach related to an OGC standard. This document is not an OGC Standard and may not be referred to as an OGC Standard. It is subject to change without notice. However, this document is an official position of the OGC membership on this particular technology topic.

Document type: OGC Best Practice
Document subtype: Profile
Document stage: Draft proposed version
Document language: English

License Agreement

Permission is hereby granted by the Open Geospatial Consortium, ("Licensor"), free of charge and subject to the terms set forth below, to any person obtaining a copy of this Intellectual Property and any associated documentation, to deal in the Intellectual Property without restriction (except as set forth below), including without limitation the rights to implement, use, copy, modify, merge, publish, distribute, and/or sublicense copies of the Intellectual Property, and to permit persons to whom the Intellectual Property is furnished to do so, provided that all copyright notices on the intellectual property are retained intact and that each person to whom the Intellectual Property is furnished agrees to the terms of this Agreement.

If you modify the Intellectual Property, all copies of the modified Intellectual Property must include, in addition to the above copyright notice, a notice that the Intellectual Property includes modifications that have not been approved or adopted by LICENSOR.

THIS LICENSE IS A COPYRIGHT LICENSE ONLY, AND DOES NOT CONVEY ANY RIGHTS UNDER ANY PATENTS THAT MAY BE IN FORCE ANYWHERE IN THE WORLD.

THE INTELLECTUAL PROPERTY IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NONINFRINGEMENT OF THIRD PARTY RIGHTS. THE COPYRIGHT HOLDER OR HOLDERS INCLUDED IN THIS NOTICE DO NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE INTELLECTUAL PROPERTY WILL MEET YOUR REQUIREMENTS OR THAT THE OPERATION OF THE INTELLECTUAL PROPERTY WILL BE UNINTERRUPTED OR ERROR FREE. ANY USE OF THE INTELLECTUAL PROPERTY SHALL BE MADE ENTIRELY AT THE USER'S OWN RISK. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR ANY CONTRIBUTOR OF INTELLECTUAL PROPERTY RIGHTS TO THE INTELLECTUAL PROPERTY BE LIABLE FOR ANY CLAIM, OR ANY DIRECT, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, OR ANY DAMAGES WHATSOEVER RESULTING FROM ANY ALLEGED INFRINGEMENT OR ANY LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR UNDER ANY OTHER LEGAL THEORY, ARISING OUT OF OR IN CONNECTION WITH THE IMPLEMENTATION, USE, COMMERCIALIZATION OR PERFORMANCE OF THIS INTELLECTUAL PROPERTY.

This license is effective until terminated. You may terminate it at any time by destroying the Intellectual Property together with all copies in any form. The license will also terminate if you fail to comply with any term or condition of this Agreement. Except as provided in the following sentence, no such termination of this license shall require the termination of any third party end-user sublicense to the Intellectual Property which is in force as of the date of notice of such termination. In addition, should the Intellectual Property, or the operation of the Intellectual Property, infringe, or in LICENSOR's sole opinion be likely to infringe, any patent, copyright, trademark or other right of a third party, you agree that LICENSOR, in its sole discretion, may terminate this license without any compensation or liability to you, your licensees or

any other party. You agree upon termination of any kind to destroy or cause to be destroyed the Intellectual Property together with all copies in any form, whether held by you or by any third party.

Except as contained in this notice, the name of LICENSOR or of any other holder of a copyright in all or part of the Intellectual Property shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Intellectual Property without prior written authorization of LICENSOR or such copyright holder. LICENSOR is and shall at all times be the sole entity that may authorize you or any third party to use certification marks, trademarks or other special designations to indicate compliance with any LICENSOR standards or specifications.

This Agreement is governed by the laws of the Commonwealth of Massachusetts. The application to this Agreement of the United Nations Convention on Contracts for the International Sale of Goods is hereby expressly excluded. In the event any provision of this Agreement shall be deemed unenforceable, void or invalid, such provision shall be modified so as to make it valid and enforceable, and as so modified the entire Agreement shall remain in full force and effect. No decision, action or inaction by LICENSOR shall be construed to be a waiver of any rights or remedies available to it. None of the Intellectual Property or underlying information or technology may be downloaded or otherwise exported or reexported in violation of U.S. export laws and regulations. In addition, you are responsible for complying with any local laws in your jurisdiction which may impact your right to import, export or use the Intellectual Property, and you represent that you have complied with any regulations or registration procedures required by applicable law to make this license enforceable

Abstract

This OGC Best Practice document details proposed configuration and instantiation conventions for access to Earth Observation (EO) data developed in the European Space Agency (ESA) funded project Evolution of EO Online Data Access Services (EVO-ODAS).

It defines how to utilize WCS with EO products including generic conventions and recommendations for data and metadata mapping and conversion which are to be used in concrete tailoring for specific missions. It further considers how to link to other services like CSW, WMS, and WPS.

Suggested additions, changes, and comments on this draft document are welcome and encouraged. Such suggestions may be submitted by email message, by creating an issue or a pull request at the [GitHub repository](#), or by making suggested changes in an edited copy of this document.

Keywords

ogcdoc, eo, earth observation, data access, wcs, eo-wcs

Submitting organizations

The following organizations have submitted this Best Practice to the Open GeoSpatial Consortium, Inc.:

- EOX IT Services GmbH
- German Aerospace Center (DLR)
- GeoSolutions S.A.S.
- European Space Agency (ESA)

Document Contributor Contact Points

All questions regarding this document should be directed to the editor or the contributors.

Name	Organization
Stephan Meißl < stephan.meissl@eox.at >	EOX IT Services GmbH

Changes to the OGC ® Abstract Specification

The OGC ® Abstract Specification does not require any changes to accommodate the technical contents of this (part of this) document.

Future Work

Please send any suggestions for future work to the document editor or contributors named above.

Foreword

This OGC Best Practice document details proposed configuration and instantiation conventions for access to Earth Observation (EO) data developed in the European Space Agency (ESA) funded project Evolution of EO Online Data Access Services (EVO-ODAS).

It defines how to utilize WCS with EO products including generic conventions and recommendations for data and metadata mapping and conversion which are to be used in concrete tailoring for specific missions. It further considers how to link to other services like CSW, WMS, and WPS.

Suggested additions, changes, and comments on this draft document are welcome and encouraged. Such suggestions may be submitted by email message, by creating an issue or a pull request at the [GitHub repository](#), or by making suggested changes in an edited copy of this document.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The Open Geospatial Consortium shall not be held responsible for identifying any or all such patent rights.

Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the standard set forth in this document, and to provide supporting documentation.

Introduction

TODO

OGC® EO Data Access Best Practice

Chapter 1. Scope

This OGC Best Practice document details configuration and instantiation conventions for access to Earth Observation (EO) data. It defines how to utilize WCS with EO products including generic conventions and recommendations for data and metadata mapping and conversion which are to be used in concrete tailoring for specific missions. It further considers how to link to other services like CSW, WMS, and WPS.

TODO

Chapter 2. Normative references

The following normative documents contain provisions that, through reference in this text, constitute provisions of this specification. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

OGC 06-121r9, *OGC Web Services Common Standard*, version 2.0

OGC 09-146r2, *OGC® Coverage Implementation Schema* (renamed from *OGC® GML Application Schema - Coverages*), version 1.0

Conformance classes used: *gml-coverage*, *gml*, *multipart*, *special-format*

OGC 09-110r4, *OGC® WCS 2.0 Interface Standard- Core: Corrigendum*, version 2.0

Conformance classes used: *core*

TBD OGC 10-140r1, *OGC® Web Coverage Service 2.0 Interface Standard - Earth Observation Application Profile*, version 1.1

Conformance classes used: *ewocs*, *ewocs_geteocoverageset*, *ewocs_get-kvp*, *ewocs_soap*,

OGC 11-053r1, *OGC® Web Coverage Service Interface Standard - CRS Extension*, version 1.0

Conformance classes used: *crs*, *crs-gridded-coverage*

OGC 12-039, *OGC® Web Coverage Service Interface Standard - Scaling Extension*, version 1.0

Conformance classes used: *scaling*

OGC 12-040, *OGC® Web Coverage Service Interface Standard - Range Subsetting Extension*, version 1.0

Conformance classes used: *record-subsetting*

OGC 12-049, *OGC® Web Coverage Service Interface Standard - Interpolation Extension*, version 1.0

Conformance classes used: *interpolation*

OGC 09-147r3, *OGC® Web Coverage Service 2.0 Interface Standard - KVP Protocol Binding Extension - Corrigendum*, version 1.0

Conformance classes used: *get-kvp*

OGC 09-149r1, *OGC® Web Coverage Service 2.0 Interface Standard - XML/SOAP Protocol Binding Extension*, version 1.0

Conformance classes used: *soap*

OGC 12-100r1, *OGC® GML Application Schema - Coverages - GeoTIFF Coverage Encoding Profile*, version 1.0

Conformance classes used: *geotiff-coverage*

OGC 14-100r2, *OGC® CF-netCDF 3.0 encoding using GML Coverage Application Schema*, version 2.0

Conformance classes used: *CF-netCDF-1.6 GML encoding*, *CF-netCDF-1.6 data format*, *CF-netCDF-1.6 multipart data encoding*

OGC 12-108, *OGC® GML Application Schema - Coverages JPEG2000 Coverage Encoding Extension*, version 1.0

Conformance classes used: *jpeg2000-coverage*

OGC 10-157r4, *OGC® Earth Observation Metadata profile of Observations & Measurements*, version 1.1

Conformance classes used: *eop*, *sar*, *opt*

Chapter 3. Terms and definitions

This document uses the standard terms defined in Subclause 5.3 of [OGC 06-121r9], which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word "shall" (not "must") is the verb form used to indicate a requirement to be strictly followed to conform to this standard.

For the purposes of this document, the terms and definitions given in the above references, particularly EO-WCS [10-140r1], apply. In addition, the following terms and definitions apply. An arrow "→" indicates that the following term is defined in this Clause.

3.1. Coverage

digital representation of a spatio-temporally varying phenomenon as defined in

3.2. Dataset

2-D → EO Coverage



A Dataset usually represents observations obtained by satellite instruments.

3.3. Dataset Series

collection of → EO Coverages

3.4. EO Coverage

Rectified Grid → Coverage or Referenceable Grid → Coverage having an → EO Metadata record and a WGS84 bounding box

3.5. EO Metadata

→ EO Coverage's metadata record

3.6. Stitched Mosaic

→ EO Coverage composed from subsets of one or more co-referenced → Datasets

3.7. EO Product

An EO Product contains one or more related → EO Product Datasets plus metadata and

optionally auxiliary data like → EO Product Quicklooks.

3.8. EO Product Dataset

One or more files each containing one or more → EO Coverages.

3.9. EO Product Quicklook

A visual representation of a usually reduced → EO Product Dataset encoded in an image format. The → EO Product Dataset may combine different bands.

3.10. Lineage record

Data structure documenting an operation that has been applied to the → coverage it is part of

3.11. refers to

contains, in its → EO Metadata element as defined in [OGC 10-157r4], the → EO Metadata element of

Chapter 4. Conventions

4.1. UML notation

Unified Modeling Language (UML) static structure diagrams appearing in this specification are used as described in Subclause 5.2 of OGC Web Services Common [OGC 06-121r9].

4.2. Data dictionary tables

The UML model data dictionary is specified herein in a series of tables. The contents of the columns in these tables are described in Subclause 5.5 of [OGC 06-121r9]. The contents of these data dictionary tables are normative, including any table footnotes.

4.3. Namespace prefix conventions

The following namespaces are used in this document. The prefix abbreviations used constitute conventions used here, but are **not** normative. The namespaces to which the prefixes refer are normative, however.

Table 1. Namespace mappings

Prefix	Namespace URI	Description
xsd	http://www.w3.org/2001/XMLSchema	XML Schema namespace
ows	http://www.opengis.net/ows/2.0	OWS Common 2.0
gml	http://www.opengis.net/gml/3.2	GML 3.2.1
gmlcov	http://www.opengis.net/gmlcov/1.0	Coverages Implementation Schema 1.0
wcs	http://www.opengis.net/wcs/2.0	WCS 2.0
eop	http://www.opengis.net/eop/2.1	Earth Observation Metadata Profile of Observations and Measurements
opt	http://www.opengis.net/opt/2.1	Optical Earth Observation Metadata Profile of Observations and Measurements (extension of eop)
sar	http://www.opengis.net/sar/2.1	SAR Earth Observation Metadata Profile of Observations and Measurements (extension of eop)
wcseo	http://www.opengis.net/wcs/wcseo/1.1	WCS Application Profile - Earth Observation 1.1

Prefix	Namespace URI	Description
scal	http://www.opengis.net/wcs/scaling/1.0 (schema uses http://www.opengis.net/WCS_service-extension_scaling/1.0)	WCS Scaling Extension
int	http://www.opengis.net/wcs/interpolation/1.0 (schema uses http://www.opengis.net/WCS_service-extension_interpolation/1.0)	WCS Interpolation Extension
crs	http://www.opengis.net/wcs/crs/1.0	WCS CRS Extension
gmd	http://www.isotc211.org/2005/gmd	ISO 19139 Metadata
gmi	http://standards.iso.org/iso/19115-2/gmi/1.0	ISO 19139-2 Metadata
mdb	http://standards.iso.org/iso/19115-3/mdb/1.0	ISO 19115-3 Metadata

4.4. Multiple representations

When multiple representations of the same information are given in a specification document these are consistent. Should this not be the case then this is considered an error, and the [XML Schema](#) shall take precedence.

Chapter 5. Cross Service Interaction

5.1. Overview

We propose to address the cross service interaction item by giving recommendations on how to structure the data offered in the various services as well as how to explicitly link between them. These explicit link recommendations include these services: OpenSearch, WMS, WMTS, WCS, and DS-EO.

An example for a data structuring recommendation is that for a collection there should be an EO-WMS layer and an EO-WCS DatasetSeries provided both reusing the ID of the collection. Thus clients know that a product viewed via a GetMap request with TIME parameter can be downloaded via a GetEOCoverageSet request using the same TIME parameter value.

First explicit linking recommendations are given in the "EVO-ODAS Recommendation on building a discovery interface using OpenSearch Technical Note" [RD49] by GeoSolutions. The recommendation there is to use `link` elements with a `rel` attribute of value `wms`, `wmts`, `wcs`, `wfs`, or `ds-eo` in Atom results to link to the EO Product in the respective service. Note that it also includes recommendations on how to structure these links in order to link to a single product. In short the recommendation is to link to a tailored Capabilities document like e.g., <http://u.rl?service=WMS&acceptVersions=1.3.0&request=GetCapabilities&time=2015-10-02T10:00:00Z&elevation=150>. This covers all links from OpenSearch to any other service.

In the same way recommendations will be given from (EO-)WMS, WMTS, (EO-)WCS, and DS-EO to the respective four other services using for example `wms:DataURL`, in the layer specification of the WMS Capabilities linking to the corresponding EO-WCS DatasetSeries.

TODO

Chapter 6. Grouping of Associated Data

6.1. Overview

Modeling the grouped data as coverage itself would directly allow GetCoverage requests but would require rather big changes to WCS. Thus we propose to follow and extend the approach already established in EO- WCS and reuse the concept of DatasetSeries.

As described in the section "Encoding of Multiple Coverages in One File" 3.1.2 above we propose to use **Reference** elements in **Metadata** elements also for associated data. Together with the GetEOCoverageRequest operation and a **mediaType** of **multipart/related** this could be suitable to be used for data access to whole EO Products.

The first part of the multipart response would look like the example below but additionally include **Reference** elements to the associated data inside **Metadata** elements of the **DatasetSeries** element. Of course the second part of the multipart response needs to include all the referenced files.

```
<?xml version="1.0" encoding="UTF-8"?>
<wcseo:EOCoverageSet numberMatched="3" numberReturned="3" xmlns:ows=
"http://www.opengis.net/ows/2.0" xmlns:gml="http://www.opengis.net/gml/3.2"
xmlns:gmlcov="http://www.opengis.net/mlcov/1.0" xmlns:swe=
"http://www.opengis.net/swe/2.0" xmlns:wcs="http://www.opengis.net/wcs/2.0"
xmlns:wcseo="http://www.opengis.net/wcs/wcseo/1.1" xmlns:eop=
"http://www.opengis.net/eop/2.1" xmlns:om="http://www.opengis.net/om/2.0"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:xsi=
"http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation=
"http://www.opengis.net/wcs/wcseo/1.1
http://schemas.opengis.net/wcs/wcseo/1.1/wcsEOAll.xsd">
  <wcseo:RectifiedDataset gml:id="someEOCoverage1">
    <gml:boundedBy>
      ...
    </gml:boundedBy>
    <gml:domainSet>
      ...
    </gml:domainSet>
    <gml:rangeSet>
      <gml:File>
        <gml:rangeParameters xlink:arcrole="fileReference" xlink:href=
"cid:coverage.meta4;someEOCoverage1.tif" xlink:role=
"http://www.opengis.net/spec/GMLCOV_geotiff-coverages/1.0/conf/geotiff-
coverage" />
        <gml:fileReference>
```

```

cid:coverage.meta4;someE0Coverage1.tif</gml:fileReference>
  <gml:fileStructure />
  <gml:mimeType>image/tiff</gml:mimeType>
</gml:File>
</gml:rangeSet>
<gmlcov:rangeType>
...
</gmlcov:rangeType>
<gmlcov:metadata>
  <gmlcov:Extension>
    <wcseo:E0Metadata>
      <eop:EarthObservation gml:id="eop_someE0Coverage1">
        ...
      </eop:EarthObservation>
      <wcseo:lineage>
        <wcseo:referenceGetE0CoverageSet>
          <ows:Reference xlink:href="
http://www.someWCS.org?SERVICE=WCS&VERSION=2.0.1&REQUEST=GetE0CoverageS
et&E0ID=someDatasetSeries1&PACKAGEFORMAT=application/metalink4+xml&
MEDIATYPE=multipart/related" />
        </wcseo:referenceGetE0CoverageSet>
        <gml:timePosition>2016-05-17T12:25:40Z</gml:timePosition>
      </wcseo:lineage>
    </wcseo:E0Metadata>
  </gmlcov:Extension>
</gmlcov:metadata>
</wcseo:RectifiedDataset>
<wcseo:RectifiedDataset gml:id="someE0Coverage2">
  <gml:boundedBy>
    ...
  </gml:boundedBy>
  <gml:domainSet>
    ...
  </gml:domainSet>
  <gml:rangeSet>
    <gml:File>
      <gml:rangeParameters xlink:arcrole="fileReference" xlink:href=
"cid:coverage.meta4;someE0Coverage2.tif" xlink:role=
"http://www.opengis.net/spec/GMLCOV_geotiff-coverages/1.0/conf/geotiff-
coverage" />
    </gml:fileReference>
  </gml:rangeParameters>
  </gml:File>
</gml:rangeSet>
<gmlcov:rangeType>

```



```

...
</gmlcov:rangeType>
<gmlcov:metadata>
  <gmlcov:Extension>
    <wcseo:EOMetadata>
      <eop:EarthObservation gml:id="eop_someE0Coverage2">
        ...
        </eop:EarthObservation>
        <wcseo:lineage>
          <wcseo:referenceGetE0CoverageSet>
            <ows:Reference xlink:href="
http://www.someWCS.org?SERVICE=WCS&VERSION=2.0.1&REQUEST=GetE0CoverageS
et&E0ID=someDatasetSeries1&PACKAGEFORMAT=application/metalink4+xml&
MEDIATYPE=multipart/related" />
          </wcseo:referenceGetE0CoverageSet>
          <gml:timePosition>2016-05-17T12:25:40Z</gml:timePosition>
        </wcseo:lineage>
      </wcseo:EOMetadata>
    </gmlcov:Extension>
  </gmlcov:metadata>
</wcseo:RectifiedDataset>
<wcseo:DatasetSeries>
  <wcseo:DatasetSeriesId>someDatasetSeries1</wcseo:DatasetSeriesId>
  <eop:Footprint gml:id="footprint_someDatasetSeries1">
    ...
  </eop:Footprint>
  <gml:TimePeriod gml:id="someDatasetSeries1_timeperiod">
    ...
  </gml:TimePeriod>
  <ows:Metadata>
    <wcseo:EOMetadata>
      <ows:Reference xlink:href="http://www.someCatalogue.org/eop-
metadatafrom-someDatasetSeries1" xlink:role=
"http://standards.iso.org/iso/19115/-3/mdb/1.0" xlink:title="ISO 19115-3
Metadata" />
    <wcseo:lineage>
      <wcseo:referenceGetE0CoverageSet>
        <ows:Reference xlink:href="http://www.someWCS.org?SERVICE=WCS
&VERSION=2.0.1&REQUEST=GetE0CoverageSet&E0ID=someDatasetSeries1&
PACKAGEFORMAT=application/metalink4+xml&MEDIATYPE=multipart/related"/>
      </wcseo:referenceGetE0CoverageSet>
      <gml:timePosition>2016-05-17T12:25:40Z</gml:timePosition>
    </wcseo:lineage>
  </wcseo:EOMetadata>
</ows:Metadata>
<wcseo:rectifiedDataset>
  <wcs:CoverageId>someE0Coverage1</wcs:CoverageId>

```

```
</wcseo:rectifiedDataset>  
<wcseo:rectifiedDataset>  
  <wcs:CoverageId>someEOCoverage2</wcs:CoverageId>  
</wcseo:rectifiedDataset>  
</wcseo:DatasetSeries>  
</wcseo:EOCoverageSet>
```

An additional consideration is to harmonize this proposal with EO-O&M as adopted by EO-WCS. EO-O&M is designed to define a catalog record for one EO product including links to various raster or vector features like measurements, browses, masks, etc.

TODO

Chapter 7. Collection and Product Registration

7.1. Overview

We propose to include a high level description of a HTTP REST API to programmatic register collections and products in ODA Systems.

The API needs to specify the request and response structure as well as the payloads. Both, particularly the payload, depend heavily on the functionality available in concrete implementations. Thus we propose to evaluate the suitability to specify collection and product registration including suitability to specify a minimal set of services an ODA System has to support.

The GeoServer REST API 20 serves as basis for our proposal.

TODO

Chapter 8. Condense Coverage

Description Information

8.1. Overview

OpenSearch is the designated EVO-ODAS endorsed search service. Thus we propose to extend OpenSearch in a way to allow clients to specify the verbosity of the answer using a new parameter named `view`. Several allowed values are defined in that proposal ranging from `full` for everything to `geotime` for a very limited view only including id, name, bbox, start, and end.

Additionally, there is the idea of adding histogram like functionality i.e., requesting summary information for defined buckets like months.

It has also been suggested to evaluate XPath as mechanism to retrieve only subsets of XML documents. Although this looks like a promising approach there are some difficulties from an implementation point of view. In general, an XML document can be queried using XPath once it has been generated. This approach wouldn't scale well on server implementations and is thus discarded, at least in EVO-ODAS.

TODO

Chapter 9. Uniform Coverage Grouping

9.1. Overview

We propose to carefully review to which extent the forthcoming CIS 1.1 is prepared for this.

The new partitioning functionality of CIS 1.1 requires all partitions to share the same range type partitions which is exactly what is ask for in this item. On the other side it requires partitions to not overlap which would require to use real 3D coverages in order to group 2D EO coverages.

This needs to be further reviewed in order to harmonize with the concepts of EO-WCS. In any case this might be best suited to be integrated and documented in the solution to the "General Coverage Grouping" item detailed in section 3.3.1 below.

TODO

Chapter 10. WCS Masking Extension

10.1. Overview

We propose to extend the GetCoverage request with parameters to request a masking via a mask coverage or polygons e.g. given as GeoJSON or shapefile. The coverage of polygons can be given by reference or, if small enough, included directly in the request in case of polygons as WKT.

The response shall use a defined NoData value for areas outside of the mask.

In the frame of EVO-ODAS this will be described in the EO Data Access Best Practice. Later on this might be promoted to an actual WCS extension.

TODO

Chapter 11. rangeType Description Enhancements

11.1. Overview

EO-WCS 1.1 extends the range type description of WCS 2.0 which is inherited from the Coverage Implementation Schema (CIS) 1.0 (formerly known as GML Application Schema - Coverages (GMLCOV)).

The extension includes elements to specify the measured physical properties (`wcseo:dataSemantics`), the data types of stored numbers (`wcseo:dataType`), the conversion from stored numbers to physical properties (`wcseo:dataType2dataSemantics`), as well as a hint for how to generate a RGB version (`wcseo:RGBgenerationHint`).

The additional range type information is provided via the `wcseo:rangeTypeExtension` element which is either included once for the whole range type under the `swe:DataRecord` element or separately for each channel, often referred to as band, under each `swe:DataRecord/swe:field/swe:Quantity` element. It may also be included in both locations for example when there is one common RGB generation hint but the data conversion is specific for each band.

The new elements are introduced one by one in the following sections and extensive examples are given [below](#).

11.2. Physical Properties

The `wcseo:rangeTypeExtension` element first includes the `wcseo:dataSemantics` element of type `anyURI`. This element holds an URI preferably resolving to a description of the observed physical property like <http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Visible>.

This element needs to be synchronized with the `definition` attribute of each `swe:Quantity` element as well as the unit of measure defined via the `code` attribute of the `swe:uom` element again of each `swe:Quantity` element.

XML instance examples included with the OGC schemas make use of <http://www.opengis.net/def/property/OGC/0/Radiance> for the `definition` attribute which doesn't resolve to something useful as expected. Another URI used in OGC examples is <http://sweet.jpl.nasa.gov/2.0/physRadiation.owl#Radiance>. The latest version of this at the time of writing is <http://sweet.jpl.nasa.gov/2.3/propEnergyFlux.owl#Radiance>.

It is suspected that the ESA funded projects RARE, SMAAD, OBEOS, and/or PRODTREES define URIs to describe physical properties as well. However, a web research didn't bring up anything useful in this direction. Thus, for the time being, the examples given use the SWEET ontologies defined by the NASA Jet Propulsion Laboratory

(<http://sweet.jpl.nasa.gov>).

An example for a unit of measure code is `W.m-2.sr-1` as defined by <http://sweet.jpl.nasa.gov/2.3/reprSciUnits.owl#wattPerMeterSquaredPerSteradian> for radiance as used above.

SWE Common mandates the usage of units as defined by <http://aurora.regenstrief.org/UCUM>. However, this server is not accessible anymore and seems to be moved to <http://unitsofmeasure.org/ucum.html>.

Another physical property example is spectral radiance with URI <http://sweet.jpl.nasa.gov/2.3/propEnergyFlux.owl#SpectralRadiance> and unit of measure code `W.m-2.sr-1.nm-1` as defined by <http://sweet.jpl.nasa.gov/2.3/reprSciUnits.owl#wattPerMeterSquaredPerSteradianPerWavelength>.

11.3. Data Types

The `wcseo:rangeTypeExtension` element further includes the `wcseo:dataType` element, again of type `anyURI`. This element again holds an URI preferably resolving to a description of the data type. Examples of such URIs are <http://www.opengis.net/def/dataType/OGC/1.1/nonNegativeInteger>, <http://www.opengis.net/def/dataType/OGC/0/unsignedInt>, or <http://www.opengis.net/def/property/netcdf/1.0/unsignedShort>.

The data type is also implicitly provided via the actual coverage encoding. However, to describe it explicitly in the `wcseo:rangeTypeExtension` element allows clients to retrieve it also in coverage descriptions and without need to understand and parse the actual coverage encoding format.

11.4. Conversion from Data Types to Physical Properties

In order to be able to convert the stored numbers to the value of the actual measured physical property the `wcseo:dataType2dataSemantics` element is added to the `wcseo:rangeTypeExtension`. It describes the conversion via two real number intervals and a type.

`wcseo:intervalFrom` gives the interval of values stored in the coverage, `wcseo:intervalTo` specifies the interval the stored values are converted to, and `wcseo:type` defines which conversion method to use. Both intervals are given via two real numbers and the type via anyURI.

The example below describes a linear transformation, as typically used for optical data, from [1,4095] to [390.0000,780.0000] i.e. for a value x between 1 and 4095 the actual measured value y is calculated as: $y = 390 + (x-1) * (780-390) / (4095-1)$


```

<wcseo:dataType2dataSemantics>
  <wcseo:intervalFrom>1 4095</wcseo:intervalFrom>
  <wcseo:intervalTo>390.0000 780.0000</wcseo:intervalTo>
  <wcseo:type>
http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#Linear</wcseo:type>
</wcseo:dataType2dataSemantics>

```

Another example, given below, describes the inverse to a logarithmic transformation as for example sometimes used for radar data. The transformation of stored values x in the interval $[1,65535]$ to observed values y in the interval $[2,1000000000]$ is given by $y = 2 * e^{(((x-1)*(\ln(1000000000)-\ln(2)))/(65535-1))}$.

```

<wcseo:dataType2dataSemantics>
  <wcseo:intervalFrom>1 65535</wcseo:intervalFrom>
  <wcseo:intervalTo>2 1000000000</wcseo:intervalTo>

  <wcseo:type>http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#ExponentialFunction</wcseo:type>
</wcseo:dataType2dataSemantics>

```

11.5. Hint for RGB Generation

The last element in the `wcseo:rangeTypeExtension` element is the `wcseo:RGBgenerationHint` element. It is meant to provide a hint for clients wanting to visualize the data. It includes the elements `wcseo:bandSequence`, `wcseo:intervalFrom`, `wcseo:intervalTo`, and `wcseo:type`. The first is a list of three band names or band arithmetic instructions delimited by spaces used for the three bands to generate the RGB version. The names used shall be equal to `name` attributes of the respective `swe:field` element. The other three elements are comparable to the ones used in the data conversion above.

The example below describes the RGB generation from a single band product by reusing the single band three times and logarithmically stretching the interval $[100,100000000]$ to $[1,255]$ i.e. value x is converted to y using $y = ((\ln(x)-\ln(100))*(255-1))/(\ln(100000000)-\ln(100))+1$.

```

<wcseo:RGBgenerationHint>
  <wcseo:bandSequence>gray gray gray</wcseo:bandSequence>
  <wcseo:intervalFrom>100 100000000</wcseo:intervalFrom>
  <wcseo:intervalTo>1 255</wcseo:intervalTo>
  <wcseo:type>
http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#Logarithmic</wcseo:type>
</wcseo:RGBgenerationHint>

```

11.6. Recommended definitions

This section details our recommendations for the most commonly used data as well as for data not covered here. Of course data providers are free to choose any definitions, it's just highly recommended to use resolvable URIs providing meaningful descriptions ideally machine as well as human readable.

11.6.1. `wcseo:dataSemantics`, `swe:Quantity/@definition`, and `swe:uom/@code`

The non-exhaustive list below provides recommendations for the values of the three items `wcseo:dataSemantics`, `definition` attribute of `swe:Quantity`, and `code` attribute of `swe:Quantity/swe:uom` for the most common use cases.

- Panchromatic
 - `wcseo:dataSemantics`
 - <http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Visible>
 - `definition`
 - <http://sweet.jpl.nasa.gov/2.3/propEnergyFlux.owl#SpectralRadiance>
 - `code`
 - `W.m-2.sr-1.nm-1`
- RGB
 - `wcseo:dataSemantics`
 - <http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Red>
 - <http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Green>
 - <http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Blue>
 - `definition`
 - <http://sweet.jpl.nasa.gov/2.3/propEnergyFlux.owl#SpectralRadiance>
 - `code`
 - `W.m-2.sr-1.nm-1`
- SAR
 - `wcseo:dataSemantics`
 - <http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#CBand>
 - `definition`
 - <http://sweet.jpl.nasa.gov/2.3/propSpaceMultidimensional.owl#RadarCrossSection>
 - `code`
 - `dB`
- Further URIs

- **wcseo:dataSemantics**
 - Most concepts in <http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl>
- **definition**
 - <http://sweet.jpl.nasa.gov/2.3/propEnergyFlux.owl#Radiance>
 - <http://sweet.jpl.nasa.gov/2.3/propEnergyFlux.owl#Intensity>
- **code**
 - **W.m-2.sr-1**
 - **W.m-2**

11.6.2. **wcseo:dataType**

The **wcseo:dataType** needs to match the data type actually used in the coverage encoding like GeoTIFF. The non-exhaustive list below provides recommendations for URIs to use. Further definitions can be retrieved using the base URIs from the examples given below.

- <http://www.opengis.net/def/dataType/OGC/0/unsignedByte>
- <http://www.opengis.net/def/dataType/OGC/0/unsignedShort>
- <http://www.opengis.net/def/dataType/OGC/0/unsignedInt>
- <http://www.opengis.net/def/dataType/OGC/0/unsignedLong>
- <http://www.w3.org/2001/XMLSchema#unsignedByte>
- <http://www.w3.org/2001/XMLSchema#unsignedShort>
- <http://www.w3.org/2001/XMLSchema#integer>
- <http://www.w3.org/2001/XMLSchema#nonNegativeInteger>
- <http://www.w3.org/2001/XMLSchema#double>

Other possible but not recommended values are provided in the list below.

- <http://www.opengis.net/def/dataType/OGC/1.1/nonNegativeInteger>
- <http://www.opengis.net/def/property/netcdf/1.0/unsignedShort>

11.6.3. **wcseo:type** in **wcseo:dataType2dataSemantics** and **wcseo:RGBgenerationHint**

Recommendations for possible values for the **wcseo:type** element used to define data conversions are provided below.

- <http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#Linear>
- <http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#Logarithmic>
- <http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#ExponentialFunction>

11.6.4. **wcseo:bandSequence**

The **wcseo:bandSequence** element used in the **wcseo:RGBgenerationHint** is defined as type **NameTriple** which is a space delimited list of three elements of type **anyURI**. Typically

these three elements each reference a `name` attribute of a `swe:field` element. An additional option is to define three arithmetic expression like "band1"*1/3+"band2"*2/3. Note that the arithmetic expressions themselves need to be URL-encoded and particularly must not include spaces. A valid example would be `band1%2F3%2Bband2%2A2%2F3 band1%2A2%2F3%2Bband2%2F3 %28band1%2Bband3%29%2F2`.

11.6.5. definition attribute of `swe:DataRecord`

The non-exhaustive list below provides recommendations for the value of the `definition`` attribute of `swe:DataRecord`.

- <http://www.opengis.net/def/property/OGC-E0/0/opt/SpectralMode/PANCHROMATIC>
- <http://www.opengis.net/def/property/OGC-E0/0/opt/SpectralMode/COLOR>
- <http://www.opengis.net/def/property/OGC-E0/0/opt/SpectralMode/MULTISPECTRAL>
- <http://www.opengis.net/def/property/OGC-E0/0/sar/PolarizationMode/HH>
- <http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Monochromatic>
- <http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Polychromatic>

The list below shows other possible but not recommended URIs.

- <http://www.opengis.net/def/ogc-eo/opt/SpectralMode/PANCHROMATIC>
- <http://www.opengis.net/def/ogc-eo/opt/SpectralMode/COLOR>
- <http://www.opengis.net/def/order/OGC-E0/0/SpectralBandColorComposition>
- <http://www.opengis.net/def/order/OGC-E0/0/SpectralBandComposition>

11.6.6. `swe:field/@name` vs. `swe:field/swe:Quantity/swe:identifier`

The `name` attribute of `swe:field` is defined as type `NCName`. This mainly means that it must not include characters like `:` (colon), `@`, `$`, `%`, `&`, `/`, `+`, `,`, `;`, or any whitespace characters. It further must not start with a number, minus, or dot.

The range subsetting extension of WCS [OGC 12-040] uses this `name` attribute in its `RangeComponent` element to select bands for retrieval.

Coverages, however, may use not `NCName` compliant IDs for their bands. It is, for example, quite common to identify variables within a netCDF file with strings including blanks or colons.

The `swe:field` element includes in its `swe:Quantity` element a `swe:identifier` element which is of type `anyURI` and can potentially hold any complex ID given it is URL-encoded.

For coverages using non `NCName` IDs for their bands it is recommended to provide the full IDs, potentially URL-encoded, in the `swe:identifier` element. It is further recommended to use the respective first word (`NCNAME` type substring i.e. starting from it's first character up to and excluding the first character which is not allowed in an `NCName`) of the IDs for the `name` attributes.

For example an ID of `gray band` should use `gray` for the `name` attribute and `gray%20band` for the `swe:identifier` element.

11.6.7. `swe:nilValue/@reason`

The recommendations for the value of the `reason` attribute of `swe:nilValue` are given below.

- <http://www.opengis.net/def/nil/OGC/0/unknown>
- <http://www.opengis.net/def/nil/OGC/0/BelowDetectionRange>
- <http://www.opengis.net/def/nil/OGC/0/AboveDetectionRange>
- <http://www.opengis.net/def/nil/OGC/0/inapplicable>
- <http://www.opengis.net/def/nil/OGC/0/missing>
- <http://www.opengis.net/def/nil/OGC/0/template>
- <http://www.opengis.net/def/nil/OGC/0/withheld>

11.7. Examples

The following provides an example `gmlcov:rangeType` element including additional range type information for RGB generation on `swe:DataRecord` level as well as data conversion information on `swe:Quantity` level.

```
<gmlcov:rangeType>
  <swe:DataRecord definition="http://www.opengis.net/def/property/OGC-
EO/0/opt/SpectralMode/PANCHROMATIC">
    <swe:extension>
      <wcseo:rangeTypeExtension>
        <wcseo:RGBgenerationHint>
          <wcseo:bandSequence>gray gray gray</wcseo:bandSequence>
          <wcseo:intervalFrom>1 4095</wcseo:intervalFrom>
          <wcseo:intervalTo>1 255</wcseo:intervalTo>

        <wcseo:type>http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#Logarithmic</wcseo:type>
      </wcseo:RGBgenerationHint>
    </wcseo:rangeTypeExtension>
  </swe:extension>
  <swe:label>Gray Channel/Band</swe:label>
  <swe:field name="gray">
    <swe:Quantity definition=
"http://sweet.jpl.nasa.gov/2.3/propEnergyFlux.owl#SpectralRadiance">
      <swe:extension>
        <wcseo:rangeTypeExtension>

        <wcseo:dataSemantics>http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Visible</wcseo:dataSemantics>
```

```

<wcseo:dataType>http://www.opengis.net/def/dataType/OGC/0/unsignedShort</wcseo:
dataType>
  <wcseo:dataType2dataSemantics>
    <wcseo:intervalFrom>1 4095</wcseo:intervalFrom>
    <wcseo:intervalTo>390.0000 780.0000</wcseo:intervalTo>

<wcseo:type>http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#Linear</wcseo:ty
pe>
  </wcseo:dataType2dataSemantics>
  </wcseo:rangeTypeExtension>
</swe:extension>
<swe:identifier>gray</swe:identifier>
<swe:label>Gray Channel/Band</swe:label>
<swe:description>Gray Channel/Band</swe:description>
<swe:nilValues>
  <swe:nilValues>
    <swe:nilValue reason="http://www.opengis.net/def/nil/OGC/0/unknown
">0</swe:nilValue>
  </swe:nilValues>
</swe:nilValues>
<swe:uom code="W.m-2.sr-1.nm-1"/>
<swe:constraint>
  <swe:AllowedValues>
    <swe:interval>0 4095</swe:interval>
    <swe:significantFigures>4</swe:significantFigures>
  </swe:AllowedValues>
</swe:constraint>
</swe:Quantity>
</swe:field>
</swe>DataRecord>
</gmlcov:rangeType>

```

The following is an example of a multispectral range type.

```

<gmlcov:rangeType>
  <swe>DataRecord definition="http://www.opengis.net/def/property/OGC-
EO/0/opt/SpectralMode/MULTISPECTRAL">
    <swe:extension>
      <wcseo:rangeTypeExtension>
        <wcseo:RGBgenerationHint>
          <wcseo:bandSequence>red green blue</wcseo:bandSequence>
          <wcseo:intervalFrom>1 65535</wcseo:intervalFrom>
          <wcseo:intervalTo>1 255</wcseo:intervalTo>

        <wcseo:type>http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#Logarithmic</wcs

```

```

eo:type>
  </wcseo:RGBgenerationHint>
  </wcseo:rangeTypeExtension>
</swe:extension>
<swe:label>Multispectral product</swe:label>
<swe:field name="blue">
  <swe:Quantity definition=
"http://sweet.jpl.nasa.gov/2.3/propEnergyFlux.owl#SpectralRadiance">
    <swe:extension>
      <wcseo:rangeTypeExtension>

<wcseo:dataSemantics>http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Blue</
wcseo:dataSemantics>

<wcseo:dataType>http://www.opengis.net/def/dataType/OGC/0/unsignedShort</wcseo:
dataType>
  <wcseo:dataType2dataSemantics>
    <wcseo:intervalFrom>1 65535</wcseo:intervalFrom>
    <wcseo:intervalTo>455.0 492.0</wcseo:intervalTo>

<wcseo:type>http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#Linear</wcseo:ty
pe>
  </wcseo:dataType2dataSemantics>
  </wcseo:rangeTypeExtension>
</swe:extension>
<swe:identifier>blue</swe:identifier>
<swe:label>Blue Channel/Band</swe:label>
<swe:description>Blue Channel/Band</swe:description>
<swe:nilValues>
  <swe:nilValues>
    <swe:nilValue reason="http://www.opengis.net/def/nil/OGC/0/unknown
">0</swe:nilValue>
  </swe:nilValues>
</swe:nilValues>
<swe:uom code="W.m-2.sr-1.nm-1"/>
<swe:constraint>
  <swe:AllowedValues>
    <swe:interval>0 65535</swe:interval>
    <swe:significantFigures>5</swe:significantFigures>
  </swe:AllowedValues>
</swe:constraint>
</swe:Quantity>
</swe:field>
<swe:field name="green">
  <swe:Quantity definition=
"http://sweet.jpl.nasa.gov/2.3/propEnergyFlux.owl#SpectralRadiance">
    <swe:extension>

```

```

<wcseo:rangeTypeExtension>

<wcseo:dataSemantics>http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Green<
/wcseo:dataSemantics>

<wcseo:dataType>http://www.opengis.net/def/dataType/OGC/0/unsignedShort</wcseo:
dataType>
    <wcseo:dataType2dataSemantics>
        <wcseo:intervalFrom>1 65535</wcseo:intervalFrom>
        <wcseo:intervalTo>492.0 557.0</wcseo:intervalTo>

<wcseo:type>http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#Linear</wcseo:ty
pe>
    </wcseo:dataType2dataSemantics>
    </wcseo:rangeTypeExtension>
</swe:extension>
<swe:identifier>green</swe:identifier>
<swe:label>Green Channel/Band</swe:label>
<swe:description>Green Channel/Band</swe:description>
<swe:nilValues>
    <swe:nilValues>
        <swe:nilValue reason="http://www.opengis.net/def/nil/OGC/0/unknown
">0</swe:nilValue>
    </swe:nilValues>
</swe:nilValues>
<swe:uom code="W.m-2.sr-1.nm-1"/>
<swe:constraint>
    <swe:AllowedValues>
        <swe:interval>0 65535</swe:interval>
        <swe:significantFigures>5</swe:significantFigures>
    </swe:AllowedValues>
</swe:constraint>
</swe:Quantity>
</swe:field>
<swe:field name="yellow">
    <swe:Quantity definition=
"http://sweet.jpl.nasa.gov/2.3/propEnergyFlux.owl#SpectralRadiance">
        <swe:extension>
            <wcseo:rangeTypeExtension>

<wcseo:dataSemantics>http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Yellow
</wcseo:dataSemantics>

<wcseo:dataType>http://www.opengis.net/def/dataType/OGC/0/unsignedShort</wcseo:
dataType>
    <wcseo:dataType2dataSemantics>
        <wcseo:intervalFrom>1 65535</wcseo:intervalFrom>

```



```

        <wcseo:intervalTo>557.0 597.0</wcseo:intervalTo>

<wcseo:type>http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#Linear</wcseo:ty
pe>
    </wcseo:dataType2dataSemantics>
    </wcseo:rangeTypeExtension>
</swe:extension>
<swe:identifier>yellow</swe:identifier>
<swe:label>Yellow Channel/Band</swe:label>
<swe:description>Yellow Channel/Band</swe:description>
<swe:nilValues>
    <swe:nilValues>
        <swe:nilValue reason="http://www.opengis.net/def/nil/OGC/0/unknown
">0</swe:nilValue>
    </swe:nilValues>
</swe:nilValues>
<swe:uom code="W.m-2.sr-1.nm-1"/>
<swe:constraint>
    <swe:AllowedValues>
        <swe:interval>0 65535</swe:interval>
        <swe:significantFigures>5</swe:significantFigures>
    </swe:AllowedValues>
</swe:constraint>
</swe:Quantity>
</swe:field>
<swe:field name="orange">
    <swe:Quantity definition=
"http://sweet.jpl.nasa.gov/2.3/propEnergyFlux.owl#SpectralRadiance">
        <swe:extension>
            <wcseo:rangeTypeExtension>

<wcseo:dataSemantics>http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Orange
</wcseo:dataSemantics>

<wcseo:dataType>http://www.opengis.net/def/dataType/OGC/0/unsignedShort</wcseo:
dataType>
    <wcseo:dataType2dataSemantics>
        <wcseo:intervalFrom>1 65535</wcseo:intervalFrom>
        <wcseo:intervalTo>597.0 622.0</wcseo:intervalTo>

<wcseo:type>http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#Linear</wcseo:ty
pe>
    </wcseo:dataType2dataSemantics>
    </wcseo:rangeTypeExtension>
</swe:extension>
<swe:identifier>orange</swe:identifier>
<swe:label>Orange Channel/Band</swe:label>

```

```

<swe:description>Orange Channel/Band</swe:description>
<swe:nilValues>
  <swe:nilValues>
    <swe:nilValue reason="http://www.opengis.net/def/nil/OGC/0/unknown
">0</swe:nilValue>
  </swe:nilValues>
</swe:nilValues>
<swe:uom code="W.m-2.sr-1.nm-1"/>
<swe:constraint>
  <swe:AllowedValues>
    <swe:interval>0 65535</swe:interval>
    <swe:significantFigures>5</swe:significantFigures>
  </swe:AllowedValues>
</swe:constraint>
</swe:Quantity>
</swe:field>
<swe:field name="red">
  <swe:Quantity definition=
"http://sweet.jpl.nasa.gov/2.3/propEnergyFlux.owl#SpectralRadiance">
    <swe:extension>
      <wcseo:rangeTypeExtension>

<wcseo:dataSemantics>http://sweet.jpl.nasa.gov/2.3/stateSpectralBand.owl#Red</w
cseo:dataSemantics>

<wcseo:dataType>http://www.opengis.net/def/dataType/OGC/0/unsignedShort</wcseo:
dataType>
  <wcseo:dataType2dataSemantics>
    <wcseo:intervalFrom>1 65535</wcseo:intervalFrom>
    <wcseo:intervalTo>622.0 780.0</wcseo:intervalTo>

<wcseo:type>http://sweet.jpl.nasa.gov/2.3/reprMathFunction.owl#Linear</wcseo:ty
pe>
  </wcseo:dataType2dataSemantics>
  </wcseo:rangeTypeExtension>
</swe:extension>
<swe:identifier>red</swe:identifier>
<swe:label>Red Channel/Band</swe:label>
<swe:description>Red Channel/Band</swe:description>
<swe:nilValues>
  <swe:nilValues>
    <swe:nilValue reason="http://www.opengis.net/def/nil/OGC/0/unknown
">0</swe:nilValue>
  </swe:nilValues>
</swe:nilValues>
<swe:uom code="W.m-2.sr-1.nm-1"/>
<swe:constraint>

```

```
    <swe:AllowedValues>
      <swe:interval>0 65535</swe:interval>
      <swe:significantFigures>5</swe:significantFigures>
    </swe:AllowedValues>
  </swe:constraint>
</swe:Quantity>
</swe:field>
</swe:DataRecord>
</gmlcov:rangeType>
```

Bibliography

- [1] OGC 09-153, WCS 2.0 Overview: Core and Extensions, version 1.0.0
- [2] ISO 8601:2004(E) Data elements and interchange formats - Information interchange - Representation of dates and time
- [3] IETF RFC 2616, Hypertext Transfer Protocol — HTTP/1.1. IETF, 1999
- [4] www.epsg.org
- [5] W3C Note 11, SOAP Messages with Attachments. W3C Note 11, 2000
- [6] XML Schema Part 2: Datatypes Second Edition, W3C Recommendation, 2004
- [7] OpenSearch Specification, 1.1, Draft 5
- [8] OGC 09-025r2, OpenGIS Web Feature Service 2.0 Interface Standard - With Corrigendum, version 2.0.2

Annex A: Revision History

Date	Release	Author	Paragraph modified	Description
TBD	0.0.1	Stephan Meißl	All	Draft proposal from ESA project EVO-ODAS