



## DGIWG – 119

### Defence Profile of OGC's Web Coverage Service 2.0

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<b>Abstract:</b>	This document is a DGIWG profile of OGC's WCS 2.0 Interface Standard – Core. It specifies the mandatory, conditional, and optional criteria for implementation within the Defence community.
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## Executive Summary

This document specifies a core set of requirements that a DGIWG WCS Geo Profile implementation must fulfil. Specific WCS extension standards which address military capability requirements functionality are identified as mandatory, conditional or optional additions to the core to obtain a complete implementation. This document indicates which extensions, at a minimum, need to be considered in addition to core to allow for a complete DGIWG WCS Profile implementation. This document further defines WCS service metadata requirements needed for a compliant DGIWG WCS service. Additionally, this document identifies a requirement for support for JPIP Streaming that is currently outside the WCS Core and Extensions standards but which provides a significant enhancement to military capabilities.

OGC WCS 2.0 Core [OGC 09-110r4] defines a Web Coverage Service as:

*"The OGC Web Coverage Service (WCS) supports electronic retrieval of geospatial data as "coverages" – that is, digital geospatial information representing space/time-varying phenomena. A WCS provides access to coverage data in forms that are useful for client-side rendering, as input into scientific models, and for other clients."*

WCS, Core is defined by WCS 2.0.1 [OGC 09-110r4], GMLCOV [OGC 09-146r2], and OWS Common [OGC 06-121r9].

WCS, extensions described in the DGIWG Profile are:

- Protocol binding extensions: they describe client/server communication protocols and the encoding of parameters shipped using these protocols. [GET/KVP, POST/XML, POST/SOAP]
- Format encoding extensions: they describe encodings applicable for the transfer of coverages (not for the request encodings!); Data model extensions: they extend or refine coverage-related data structures. [Geotiff, JPEG2000]
- Service model extensions: they add further service capabilities. [CRS, Interpolation, Scaling, Range-Subsetting, Processing]

Usability extensions: they add means to better use the services. [not currently supported]

Annexes to this document provide an Abstract Test Suite, Uses Cases and XML Examples.

The implementation requirements for these extensions is defined within the body of this document. This Profile is intended to cover the basic use cases for geospatial data (including elevation/terrain data). A separate Profile is being submitted to the Open Geospatial Consortium to cover the meteorological and oceanographic (METOC) needs.

Software implementations that claim to be conformant with the DGIWG WCS Geo Profile **shall** support **all mandatory** operations, parameters and elements of the base standard and extensions as the specifically defined requirements in this document.

The DGIWG WCS profile **references** the different operations, parameters, **requirements** and **recommendations** for software implementations to foster **interoperability** and use in the **military domain**.

## i. Submitting organizations

For the Defence Geospatial Information Working Group (DGIWG):

Nation	Parent organization
France	Institut Géographique National (IGN)
Germany	Bundeswehr Geoinformation Centre (BGIC)
United States	National Geospatial-Intelligence Agency (NGA)
United Kingdom	Defence Science and Technology Laboratory (DSTL)

## ii. Revision history

This document is the first version of the DGIWG profile for WCS.

## iii. Future work

The DGIWG WCS Geo is based on version 2.0 of WCS, which references CIS 1.0 (previously GMLCOV 1.0).

WCS 2.1 (which aims at being an OGC standard in late 2017) is an emerging version. Version 2.1 requires use of CIS 1.1 which provides better description of irregular and N dimensions coverages. These two standards are an evolution to support some complex MetOcean use cases like getting coverages along a corridor.

DGIWG WCS profiles may then evolve to this 2.1 version of WCS in a compatible manner to support new use cases and requirements.

The DGIWG Web Service technical panel has determined a need for future works in these areas:

- MetOcean domain with support of multidimensional data an extensions developed by the OGC MetOcean community (i.e. Coverage Collection, MetOcean Metadata Profile, MetOcean GetCorridor Extension...).
- Asynchronous access, the ability to query coverage and either receive data with alternative methods (FTP, DVD...) or receive data when available.
- Publish / Subscribe capabilities tied to asynchronous access requests to notify a user when data becomes available.
- Stored queries, the ability to create, drop, list and described parameterized query expressions that are stored by the server and can be repeatedly invoked using different parameter values.
- WCS tiling service, the ability to disseminate geospatial data in tiles to lightweight devices.

*NOTE: this future work is supported by the use cases found in 0Annex B – Use Cases*

**(Normative)**

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# 1. Introduction

The OGC Web Coverage Service (WCS) supports electronic retrieval of geospatial data as "coverages" – that is, digital geospatial information representing space/time-varying phenomena.

A WCS provides access to coverage data in forms that are useful for client-side rendering, as input into scientific models, and for other clients. The WCS may be compared to the OGC Web Feature Service (WFS) and the Web Map Service (WMS). As WMS and WFS service instances, a WCS allows clients to choose portions of a server's information holdings based on spatial constraints and other query criteria.

Unlike WMS, which returns spatial data to be portrayed as static maps (rendered as pictures by the server), the Web Coverage Service provides available data together with their detailed descriptions; defines a rich syntax for requests against these data; and returns data with its original semantics (instead of pictures) which may be interpreted, extrapolated, etc., and not just portrayed.

Unlike WFS, which returns discrete geospatial features, the Web Coverage Service returns coverages representing space/time-varying phenomena that relate a spatio-temporal domain to a (possibly multidimensional) range of properties. As such, WCS focuses on coverages as a specialized class of features and, correspondingly, defines streamlined functionality.

WCS 2.0 uses the coverage model of the GML Application Schema for Coverages [OGC 09-146r1] which has been developed with the goal that coverages handled by a WCS can be more easily interchanged with other OGC services. WCS 2.0 supports all coverage types supported by said Application Schema; it is not constrained to quadrilateral grid coverages like previous WCS versions.

*Source: inspired from WCS 2.0 Core [OGC 09-110r4] - Introduction*



## 2. Scope

This document defines profiles of the OGC Web Coverage Service for use in a military environment.

## 3. Conformance

This document establishes two conformance classes:

- DGIWG WCS-Geo
- DGIWG WCS-MetOc (which will be addressed in a future version of the DGIWG profile)

Lists the conformance abstract tests which shall be exercised on any software artefact claiming to implement a DGIWG WCS profile.

### 3.1. WCS Geo

DGIWG WCS-Geo conformance class defines requirements for WCS servers allowing distribution of geographic data in a military environment.

Conformance class name	Operation or behavior	OGC WCS 2.0 Conformance Test	DGIWG WCS Conformance Test	Req.
<b>DGIWG WCS-Geo</b> (Annex A.1) <a href="http://www.dgiwg.org/std/wcs/1.0/conf/geo">http://www.dgiwg.org/std/wcs/1.0/conf/geo</a>	<b>OGC WCS 2.0 Core :</b> <a href="http://www.opengis.net/spec/WCS/2.0/conf/core">http://www.opengis.net/spec/WCS/2.0/conf/core</a>	OGC 09-110r4, A.1	A.1.1	Requirement 1
	<b>DGIWG WCS-Geo GetCapabilities</b>		A.1.2	Requirement 2
	<b>OGC WCS 2.0 get-kvp :</b> <a href="http://www.opengis.net/spec/WCS_protocol-binding_get-kvp/1.0/conf/get-kvp">http://www.opengis.net/spec/WCS_protocol-binding_get-kvp/1.0/conf/get-kvp</a>	OGC 09-147r1, A.1	A.1.3.a	Requirement 3
	<b>OGC WCS 2.0 post-xml :</b> <a href="http://www.opengis.net/spec/WCS_protocol-binding_post-xml/1.0/conf/post-xml">http://www.opengis.net/spec/WCS_protocol-binding_post-xml/1.0/conf/post-xml</a>	OGC 09-148r1, A.1	A.1.3.b	Requirement 4
	<b>OGC GMLCOV 1.0 special format</b> <a href="http://www.opengis.net/spec/GMLCOV/1.0/conf/special-format">http://www.opengis.net/spec/GMLCOV/1.0/conf/special-format</a>	OGC 09-146r2, A.4	A.1.4.a	Requirement 5
	<b>OGC GMLCOV 1.0 multipart</b> <a href="http://www.opengis.net/spec/GMLCOV/1.0/conf/multipart">http://www.opengis.net/spec/GMLCOV/1.0/conf/multipart</a>	OGC 09-146r2, A.3	A.1.4.b	Requirement 6
	<b>OGC GMLCOV 1.0 gml</b> <a href="http://www.opengis.net/spec/GMLCOV/1.0/conf/gml">http://www.opengis.net/spec/GMLCOV/1.0/conf/gml</a>	OGC 09-146r2, A.2	A.1.4.c	Requirement 7

Conformance class name	Operation or behavior	OGC WCS 2.0 Conformance Test	DGIWG WCS Conformance Test	Req.
	<b>OGC GMLCOV 1.0 geotiff-coverage</b> <a href="http://www.opengis.net/spec/GMLCOV_geotiff-coverages/1.0/conf/geotiff-coverage">http://www.opengis.net/spec/GMLCOV_geotiff-coverages/1.0/conf/geotiff-coverage</a>	OGC 12-100r1, A1	A.1.4.d	<i>Requirement 8</i>
	<b>DGIWG WCS-Geo - Geotiff</b>		A.1.4.d	<i>Requirement 9</i>
	<b>OGC GMLCOV 1.0 jpeg2000-coverage</b> <a href="http://www.opengis.net/spec/gmlcov_jpeg2000-coverages/1.0/conf/jpeg2000-coverage">http://www.opengis.net/spec/gmlcov_jpeg2000-coverages/1.0/conf/jpeg2000-coverage</a>	OGC 12-108, A1	A.1.4.e	<i>Requirement 10</i>
	<b>OGC GMLCOV 1.0 jpeg2000-access</b> <a href="http://www.opengis.net/spec/gmlcov_jpeg2000-coverages/1.0/conf/jpeg2000-access">http://www.opengis.net/spec/gmlcov_jpeg2000-coverages/1.0/conf/jpeg2000-access</a>	OGC 14-110r2, A1	A.1.4.e	<i>Requirement 11</i>
	<b>DGIWG WCS-Geo - JPEG2000</b>		A.1.4.e	<i>Requirement 12</i>
	<b>OGC GMLCOV 1.0 jpip-access</b> <a href="http://www.opengis.net/spec/WCS_jpeg2000-coverages/1.0/req/jpip-access">http://www.opengis.net/spec/WCS_jpeg2000-coverages/1.0/req/jpip-access</a>	OGC 14-110r2, A2	A.1.4.f	<i>Requirement 13</i>
	<b>OGC WCS 2.0 CRS 1.0</b> <a href="http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs">http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs</a>	OGC 11-053r1, A1	A.1.5.a	<i>Requirement 14</i>
	<b>DGIWG WCS-Geo - CRS</b>		A.1.5.b	<i>Requirement 15</i>
	<b>OGC WCS 2.0 Scaling 1.0</b> <a href="http://www.opengis.net/spec/WCS_service-extension_scaling/1.0/conf/scaling">http://www.opengis.net/spec/WCS_service-extension_scaling/1.0/conf/scaling</a>	OGC 12-039, A1	A.1.6.a	<i>Requirement 16</i>
	<b>OGC WCS 2.0 Range Subsetting 1.0</b> <a href="http://www.opengis.net/spec/WCS_service-extension_range-subsetting/1.0/conf/record-subsetting">http://www.opengis.net/spec/WCS_service-extension_range-subsetting/1.0/conf/record-subsetting</a>	OGC 12-040, A1	A.1.6.b	<i>Requirement 17</i>

### 3.2. WCS MetOc

DGIWG WCS-MetOc conformance class defines requirements for WCS servers allowing distribution of Meteorological and Oceanographic data in a military environment. This conformance class will be defined in an updated version of this standard.

## 4. References

### 4.1. Normative references

ID	Title	Reference	Version
[1]	OGC WCS 2.0 Interface Standard - Core Corrigendum	OGC 09-110r4	2.0.1
[2]	OGC WCS 2.0 Interface Standard - KVP Protocol Binding Extension	OGC 09-147r3	1.0.1
[3]	OGC WCS 2.0 Interface Standard - XML/POST Protocol Binding Extension	OGC 09-148r1	1.0
[5]	OGC Coverage Implementation Schema "CIS"	OGC 09-146r2	1.0.1
[6]	OGC GML Application Schema - Coverages - GeoTIFF Coverage Encoding Profile	OGC 12-100r1	1.0
[7]	OGC GML Application Schema - Coverages JPEG2000 Coverage Encoding Extension	OGC 12-108	1.0
[8]	OGC GML Application Schema - Coverages JPEG2000/JPIP Encoding extension Best Practices	OGC 14-110r2	1.0
[9]	OGC Web Coverage Service Interface Standard - CRS Extension	OGC 11-053r1	1.0
[10]	OGC Web Coverage Service Interface Standard - Scaling Extension	OGC 12-039	1.0
[11]	OGC Web Coverage Service Interface Standard - Range Subsetting Extension	OGC 12-040	1.0

### 4.2. Informative references

Title	Reference	Version
OGC WCS 2.0 Interface Standard - XML/SOAP Protocol Binding Extension	OGC 09-149r1	1.0
OGC Web Coverage Service Interface Standard - Interpolation Extension	OGC 12-049	1.0
OGC Web Coverage Service 2.0 Interface Standard - Coverage Collection Extension	OGC 15-044r4	Draft 1.0
DGIWG Profile of JPEG2000 for Georeferenced Imagery	DGIWG-104	1.0.0
DGIWG GeoTIFF Profile for Georeferenced Imagery	DGIWG-108	2.1.0
OGC Web Coverage Service 2.0 Interface Standard - Coverage Collection Extension	OGC 15-044r4	Draft 1.0

## 5. Terms, definitions, and abbreviations

### 5.1. Definitions

For the purposes of this document, terms and definitions found in (OGC®, WCS 2.0 Interface Standard- Core: Corrigendum (2.0.1) [09-110r4 ], 2012) apply.

### 5.2. Abbreviations

<b>CIS</b>	Coverage Implementation Schema
<b>CRS</b>	Coordinate Reference System
<b>DCP</b>	Distributed Computing Platform
<b>DGC</b>	Defence Geographic Centre
<b>DGIFC</b>	Defence Geospatial Intelligence Fusion Centre
<b>DGIWG</b>	Defence Geospatial Information Working Group
<b>EO</b>	Earth Observation
<b>EPSG</b>	European Petroleum Survey Group
<b>FES</b>	Filter Encoding Specification
<b>GML</b>	Geography Markup Language
<b>GMLCOV</b>	GML Application Schema for Coverages
<b>HTTP</b>	Hypertext Transfer Protocol
<b>HTTPS</b>	Secure Hypertext Transfer Protocol
<b>ISO</b>	International Organization for Standardization
<b>JPIP</b>	JPEG 2000 Interactive Protocol
<b>KVP</b>	Keyword-value pairs
<b>MIME</b>	Multipurpose Internet Mail Extension
<b>MO</b>	the Met Office
<b>OGC</b>	Open Geospatial Consortium
<b>OWS</b>	OGC Web Service
<b>REST</b>	Representational State Transfer
<b>RFI</b>	Request For Information
<b>SOAP</b>	Simple Object Access Protocol
<b>SWE</b>	Sensor Web Enablement
<b>UKHO</b>	UK Hydrographic Office
<b>URI</b>	Uniform Resource Identifier
<b>URL</b>	Uniform Resource Locator
<b>URN</b>	Uniform Resource Name
<b>UTM</b>	Universal Transverse Mercator
<b>WFS</b>	Web Feature Service
<b>WMS</b>	Web Map Service
<b>WCS</b>	Web Coverage Service
<b>WSDL</b>	Web Services Description Language
<b>XML</b>	Extensible Markup Language

## **6. OGC Web Coverage Service (informative)**

This section is **informative** and gives an overview of the Web Coverage Service Standard and its conformance classes that can be used to build profiles.

### **6.1. What is a Web Coverage Service**

*Source : "OGC 09-110r4 – WCS Core 2.0.1"*

The OGC Web Coverage Service (WCS) supports electronic retrieval of geospatial data as "coverages" – that is, digital geospatial information representing space/time-varying phenomena.

A WCS provides access to coverage data in forms that are useful for client-side rendering, as input into scientific models, and for other clients. The WCS may be compared to the OGC Web Feature Service (WFS) and the Web Map Service (WMS). As WMS and WFS service instances, a WCS allows clients to choose portions of a server's information holdings based on spatial constraints and other query criteria.

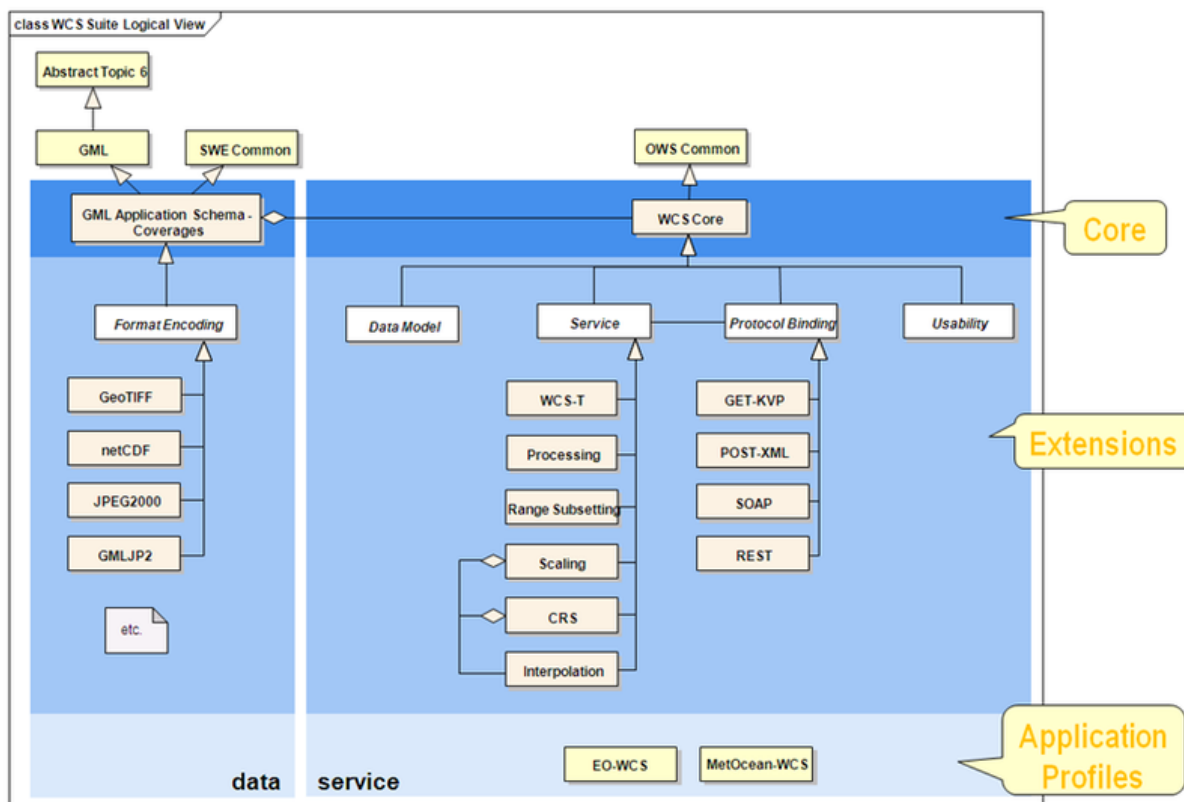
Unlike WMS, which portrays spatial data to return static maps (rendered as pictures by the server), the Web Coverage Service provides available data together with their detailed descriptions; defines a rich syntax for requests against these data; and returns data with its original semantics (instead of pictures) which may be interpreted, extrapolated, etc., and not just portrayed.

Unlike WFS, which returns discrete geospatial features, the Web Coverage Service returns coverages representing space/time-varying phenomena that relate a spatio-temporal domain to a (possibly multidimensional) range of properties. As such, WCS focuses on coverages as a specialized class of features and, correspondingly, defines streamlined functionality

### **6.2. WCS 2.0**

#### **6.2.1. A modular standard**

WCS 2.0 has been developed according the new OGC policy for modular specifications.



**Figure 1 : WCS Specifications hierarchy**  
 (source: <http://www.opengeospatial.org/standards/wcs>)

It includes:

- **WCS Core**, defines only basic requirements (WCS operations requests and response, WCS Coverage model based on GML Application Schema for Coverages ...). It defines only one conformance class : Core
- **Protocol bindings** extensions (GET/KVP, POST/XML, SOAP, REST), defining encoding for WCS requests. For each binding, one conformance class is defined.
- **Service** extensions, defining additional capabilities to the Core. This set of extensions allows coverage data to be reprojected, resized, and extracted.

WCS 2.0 uses the coverage model defined by the GML Application Schema for Coverages which has been developed with the goal that coverages, handled by a WCS, can be more easily interchanged with other OGC services. Format Encodings (Geotiff, JPEG2000, NetCDF ...) are defined as GMLCOV extensions (see figure below).

### 6.2.2. WCS 2.0 – Core

The core specifies how a Web Coverage Service (WCS) offers multi-dimensional coverage data for access over the Internet. It specifies a core set of requirements that a WCS implementation must fulfil. WCS extension standards add further functionality to this core; some of these are required in addition to the core to obtain a complete implementation.

This core does not prescribe support for any particular coverage encoding format. This also holds for GML as a coverage delivery format: while GML constitutes the canonical format for the definition of WCS, it is not required by the core that a concrete instance of a WCS service implements the GML coverage format. WCS extensions specifying use of data encoding formats in the context of WCS are designed in a way that the GML coverage information contents specified in this core is consistent with the contents of an encoded coverage.

It defines a single conformance class, *core*, with URI <http://www.opengis.net/spec/WCS/2.0/conf/core>.

### 6.2.3. WCS 2.0 – Bindings extensions

The issue of bindings is an important one to consider. If the client and server do not use the same binding, they will not be interoperable. A service will define which binding it supports as part of its GetCapabilities document. If a client requests information from the server via a different binding than the server supports, the server typically returns an error message that would not necessarily be useful to the client. If a WCS server for example provides a HTTP POST binding and a client makes the request using a SOAP binding an interoperability issue exists. It is possible however, to require a developer to implement a "façade" on the server side which would be able to read a request and interpret it or translate it to a binding it does support to solve such interoperability problems. The other possibility would be to build clients that support more than one binding.

#### Get/KVP

It defines a single conformance class, *get-kvp*, of URI [http://www.opengis.net/spec/WCS\\_protocol-binding\\_get-kvp/1.0/conf/get-kvp](http://www.opengis.net/spec/WCS_protocol-binding_get-kvp/1.0/conf/get-kvp).

#### POST/XML

It defines a single conformance class, *post-xml*, of URI [http://www.opengis.net/spec/WCS\\_protocol-binding\\_post-xml/1.0/conf/post-xml](http://www.opengis.net/spec/WCS_protocol-binding_post-xml/1.0/conf/post-xml).

#### POST/SOAP

It defines a single conformance class, *soap*, of URI [http://www.opengis.net/spec/WCS\\_protocol-binding\\_soap/1.0/conf/soap](http://www.opengis.net/spec/WCS_protocol-binding_soap/1.0/conf/soap).

### 6.2.4. WCS 2.0 – Formats extensions

#### GeoTIFF

The OGC® GML Application Schema - Coverages - GeoTIFF Coverage Encoding Profile – henceforth abbreviated as “GMLCOV for GeoTIFF” specifies an encoding of coverages in the GeoTIFF data exchange format.

It defines a single conformance class, *geotiff-coverage*, of URI [http://www.opengis.net/spec/GMLCOV\\_geotiff-coverages/1.0/conf/geotiff-coverage](http://www.opengis.net/spec/GMLCOV_geotiff-coverages/1.0/conf/geotiff-coverage).

#### JPEG2000

The OGC® GML Application Schema - Coverages – JPEG2000 Coverage Encoding Profile – henceforth abbreviated as “GMLCOV for JPEG2000” specifies an encoding of coverages in the JPEG2000 data exchange format.

It defines a single conformance class, *jpeg2000-coverage*, of URI [http://www.opengis.net/spec/GMLCOV\\_jpeg2000-coverages/1.0/conf/jpeg2000-coverage](http://www.opengis.net/spec/GMLCOV_jpeg2000-coverages/1.0/conf/jpeg2000-coverage).

The use of JP2K/JPIP URL with WCS is defined in a separate document (OGC 14-110). It defines 2 conformance classes :

- *jpeg2000-access* of URI [http://www.opengis.net/spec/GMLCOV\\_jpeg2000-coverages/1.0/conf/jpeg2000-access](http://www.opengis.net/spec/GMLCOV_jpeg2000-coverages/1.0/conf/jpeg2000-access).
- *jpip-access* of URI [http://www.opengis.net/spec/GMLCOV\\_jpeg2000-coverages/1.0/conf/jpip-access](http://www.opengis.net/spec/GMLCOV_jpeg2000-coverages/1.0/conf/jpip-access).

## 6.2.5. WCS 2.0 – Service extensions

### CRS

Clients and servers supporting the CRS extension are CRS aware, that is: they can request and deliver coverages in CRSs (defining space and time) beyond the original stored coverage. A server advertises both CRS support and the concrete CRSs supported in the GetCapabilities document; a client can request delivery of a coverage obtained through a GetCoverage request in one of these CRSs advertised by the server.

The CRS extension adds the following to operations defined in the Core:

– The GetCapabilities response document is extended with a “crsSupported” element. This element lists all the CRSs supported by the server. Some CRS may not apply to all coverages (some CRS are 2D, other 3D, ...)

– The GetCoverage request is extended with “subsettingCRS” and “outputCRS”. The subsetting CRS is the one used for the request (i.e. the bounding box), whereas the outputCRS is the one in which the data is returned to the client.

It establishes the following conformance classes:

– *crs*, allows requesting and delivering coverages in CRSs other than only the one in which they are originally stored. Its URI is [http://www.opengis.net/spec/WCS\\_service-extension\\_crs/1.0/conf/crs](http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs).

– *crs-discrete-coverage*, defines how Web Coverage Services shall deal with CRSs when Discrete Coverages (in the definition of GML 3.2.1 [OGC 09-146r1]) are addressed. Its URI is [http://www.opengis.net/spec/WCS\\_service-extension\\_crs/1.0/conf/crs-discrete-coverage](http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs-discrete-coverage).

– *crs-gridded-coverage*, which defines how Web Coverage Services shall deal with CRSs when gridded Coverages are addressed. Its URI is [http://www.opengis.net/spec/WCS\\_service-extension\\_crs/1.0/conf/crs-gridded-coverage](http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs-gridded-coverage).

### Scaling

WCS 2.0 Core does not provide a mechanism to scale coverage data. An extension has been developed by OGC to support such a mechanism. It specifies parameters for the OGC Web Coverage Service (WCS) GetCoverage request which allow for the scaling of a coverage during server-side processing in a GetCoverage request.

The Scaling mechanism should be understood here as “linear transformation that enlarges (increases) or shrinks (diminishes) a coverage by a scale factor that may or may not be the



same in all directions”. It can be applied uniformly along all axes of the coverage or individually (one method per axis).

It defines a single conformance class `conformance class`, of URI [http://www.opengis.net/spec/WCS\\_service-extension\\_scaling/1.0/conf/scaling](http://www.opengis.net/spec/WCS_service-extension_scaling/1.0/conf/scaling).

## Interpolation

WCS 2.0 Core does not provide mechanism to interpolate coverage data along the axes. An extension has been developed by OGC to support this mechanism. It specifies parameters to the OGC Web Coverage Service (WCS) GetCoverage request which give control over interpolation of a coverage during its server-side processing.

Interpolation mechanism is used for reprojection (change of CRS) or/and for scaling down data.

Interpolation mechanism should be understood here as an “estimation of the range value of a coverage for an intermediate location”. The user is then able to define interpolation methods among a set of proposed methods (nearest-neighbor, linear, quadratic, cubic, lost-area or barycentric). They can be applied uniformly along all axes of the coverage or individually (one method per axis).

Extended capabilities are advertised in the GetCapabilities document when supported by the server (interpolation on all axes, interpolation per axis, and the type of interpolation supported).

It defines two set of conformance classes. The first set is composed of:

- *interpolation*, with URI [http://www.opengis.net/spec/WCS\\_service-extension\\_interpolation/1.0/conf/interpolation](http://www.opengis.net/spec/WCS_service-extension_interpolation/1.0/conf/interpolation). For this conformance class, the same interpolation method is used for all axes of the domain. This is the mandatory core conformance class of this extension.

- *interpolation-per-axis*, defines how to require different interpolation methods on each axis. Its URI is [http://www.opengis.net/spec/WCS\\_service-extension\\_interpolation/1.0/conf/interpolation-per-axis](http://www.opengis.net/spec/WCS_service-extension_interpolation/1.0/conf/interpolation-per-axis).

The second set of conformance classes are related to interpolation methods, defined in OGC Abstract Topic 6 / ISO 19123 :

- *nearest-neighbor-interpolation*, with URI [http://www.open-gis.net/spec/WCS\\_service-extension\\_interpolation/1.0/conf/nearest-neighbor](http://www.open-gis.net/spec/WCS_service-extension_interpolation/1.0/conf/nearest-neighbor).

- *linear-interpolation*, with URI [http://www.opengis.net/spec/WCS\\_service-extension\\_interpolation/1.0/conf/linear](http://www.opengis.net/spec/WCS_service-extension_interpolation/1.0/conf/linear).

- *quadratic-interpolation*, with URI [http://www.opengis.net/spec/WCS\\_service-extension\\_interpolation/1.0/conf/quadratic](http://www.opengis.net/spec/WCS_service-extension_interpolation/1.0/conf/quadratic).

- *cubic-interpolation*, with URI [http://www.opengis.net/spec/WCS\\_service-extension\\_interpolation/1.0/conf/cubic](http://www.opengis.net/spec/WCS_service-extension_interpolation/1.0/conf/cubic).

- *lost-area-interpolation*, with URI [http://www.opengis.net/spec/WCS\\_service-extension\\_interpolation/1.0/conf/lost-area](http://www.opengis.net/spec/WCS_service-extension_interpolation/1.0/conf/lost-area).

- *barycentric-interpolation*, with URI [http://www.opengis.net/spec/WCS\\_service-extension\\_interpolation/1.0/conf/barycentric](http://www.opengis.net/spec/WCS_service-extension_interpolation/1.0/conf/barycentric).

## Range subsetting

WCS 2.0 Core does not provide mechanism to subset data in the range set domain. A simple example is a multiband satellite image for which the user only wants one single band of it (or a selection of them but not all). Another example could be a grid coverage with information related to temperature, pressure and wind speed where the user only wants temperature information, or wind speed, or two of them but not all three. An extension has been developed by OGC to support this mechanism. It specifies parameters for the OGC Web Coverage Service (WCS) GetCoverage request which allows extraction of specific fields, according to the range type specification, from the range set of a coverage during server-side processing in a GetCoverage request. Within this extension the range of the coverage shall be described by a SWE (Sensor Web Enablement) data record (e.g. a coverage conformant with GML Application Schema for coverages).

This extended capability is advertised in the GetCapabilities document when supported by the server.

This extension defines the only conformance class.

– *record-subsetting*, with URI [http://www.opengis.net/spec/WCS\\_service-extension\\_range-subsetting/1.0/conf/record-subsetting](http://www.opengis.net/spec/WCS_service-extension_range-subsetting/1.0/conf/record-subsetting). This is the mandatory core conformance class of this extension.

## Processing

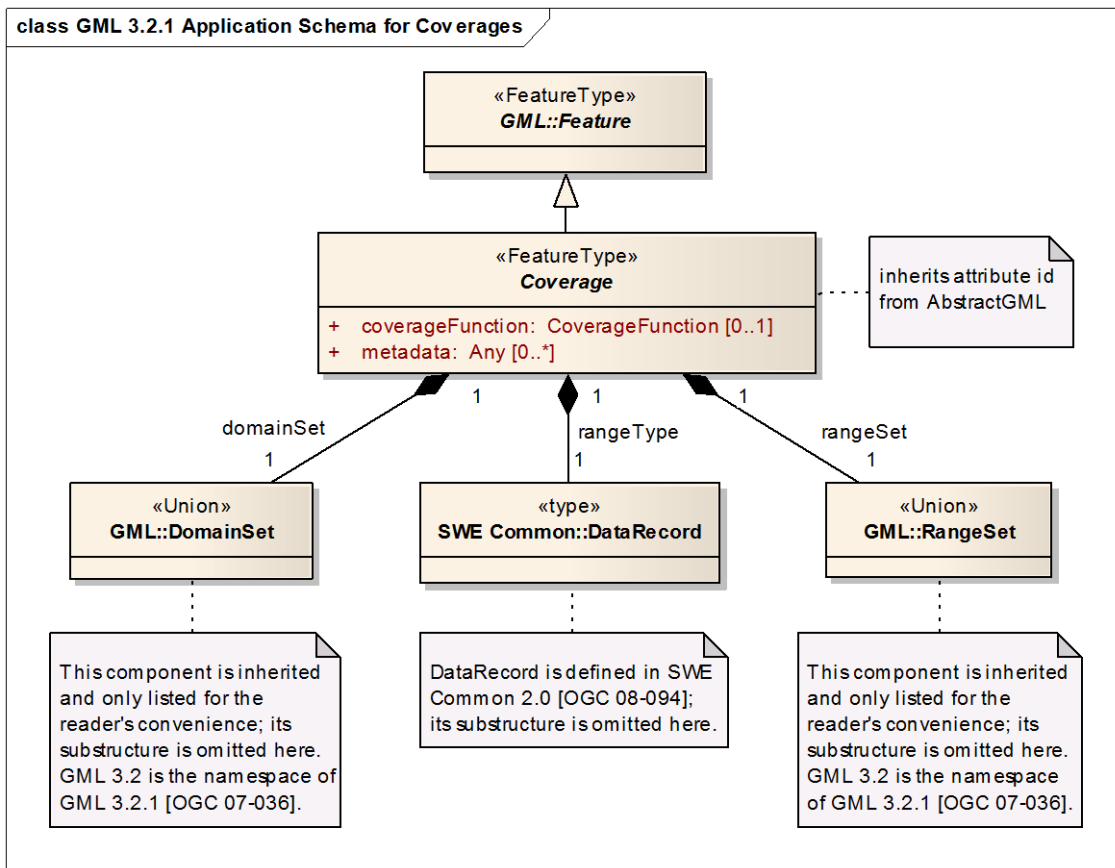
The OGC Web Coverage Service (WCS) – Processing Extension defines an extension to the WCS Core [OGC 09-110], the ProcessCoverages request type, which allows clients to initiate server-side processing and filtering of coverages and to download the resulting coverage or value sets based on the query language defined in the Web Coverage Processing Service (WCPS) interface standard [OGC 08-068].

This extension defines the only conformance class.

- *processing*, of URI [http://www.opengis.net/spec/WCS\\_serviceextension\\_processing/2.0/req/processing](http://www.opengis.net/spec/WCS_serviceextension_processing/2.0/req/processing); the corresponding conformance class is *processing*, with URI [http://www.opengis.net/spec/WCS\\_serviceextension\\_processing/2.0/conf/processing](http://www.opengis.net/spec/WCS_serviceextension_processing/2.0/conf/processing).

### 6.2.6. Coverage Implementation Schema ("CIS") formerly named GML application schema for coverages

This standard defines an implementation schema for coverage modelling. It is based on GML 3.2 coverages and adds a description for the range type (see Figure 2).



**Figure 2: Application schema for coverages model**

CIS defines several conformance classes:

- *gml-coverage* is abstract and applies to all other following subclasses. It establishes general requirements which apply to all coverages. Its URI is <http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-coverage>.

- *gml* is concrete and defines additional requirements for pure GML coverages. Its URI is <http://www.opengis.net/spec/GMLCOV/1.0/conf/gml>.

- *multipart* is concrete and establishes requirements for multipart coverages. A multipart coverage consists of a GML-encoded part containing the coverage data minus its range set followed by a second part containing an encoding of the coverage range set in some standard encoding format (Geotiff, JPEG 2000, NetCDF ...). Its URI is <http://www.opengis.net/spec/GMLCOV/1.0/conf/multipart>.

- *special-format* is concrete and establishes requirements for coverages encoded in formats other than GML. Its URI is <http://www.opengis.net/spec/GMLCOV/1.0/conf/special-format>.

Any implementation claiming conformance with this GMLCOV standard must conform to the abstract conformance class *gml-coverage* and, in addition, at least one of the concrete conformance classes *gml*, *multipart*, or *special-format*.

### **6.2.7. Coverage collection extension**

This extension specifies a mechanism that enables coverages to be grouped together as a collection in order that the amount of information within the *GetCapabilities* response document is not duplicated. Each collection is a group of coverages (with common properties) that can be described through the new *DescribeCoverageCollection* operation. Each coverage can be individually accessed with the *GetCoverage* request.

This extension is still being discussed within OGC and is then not used within this profile.

## **6.3. WCS existing profiles**

### **6.3.1. WCS Earth Observation profile**

The OGC Web Coverage Service (WCS) Application Profile – Earth Observation (EOWCS), defines a profile of WCS 2.0 [OGC 09-110r4] for use on Earth Observation data. An Application Profile bundles several specifications and possibly adds additional requirements on an implementation. Extra requirements can be additions (for example, Dataset Series are introduced by this specification) or constraints (for example, coverages offered are restricted to 2-D rasters).

It relies on WCS 2.0 (the Core [OGC 09-110r4] plus selected extensions), the GML Application Schema for Coverages [OGC 09-146r2], the Earth Observation Metadata Profile of Observations and Measurements [OGC 10-157r3], and GML 3.2.1 [OGC 07-036].

## 7. DGIWG Geo Profile (normative)

This section is **normative** and defines requirements for DGIWG WCS-Geo profile.

### 7.1. Normative requirements

Aim of this profile is to disseminate basic geospatial coverages:

- Elevation data (as DTM or bathymetric data)
- Imagery data (Ortho-imagery, raw imagery...)
- Point clouds
- Thematic classified data (land cover / land use coverages)
- ...

No.	Requirement	Compliance
1	A DGIWG WCS-Geo server shall implement the WCS 2.0 “core” conformance class.	M
2	A DGIWG WCS-Geo server shall provide a GetCapabilities response document according to requirements in Table 2, Table 3, Table 4, Table 5, Table 6 and Table 7.	M
3	A DGIWG WCS-Geo server shall implement get-kvp conformance class.	M
4	A DGIWG WCS-Geo server shall implement post-xml conformance class.	M
5	A DGIWG WCS-Geo server shall implement the “special-format” ( <a href="http://www.opengis.net/spec/GMLCOV/1.0/conf/special-format">http://www.opengis.net/spec/GMLCOV/1.0/conf/special-format</a> ) conformance class of GML application schema for coverages.	M
6	A DGIWG WCS Geo server shall implement the “multipart” ( <a href="http://www.opengis.net/spec/GMLCOV/1.0/conf/multipart">http://www.opengis.net/spec/GMLCOV/1.0/conf/multipart</a> ) conformance class of GML application schema for coverages.	M
7	If the purpose of the server implementation is to publish coverage data in GML format, then a DGIWG WCS-Geo server shall implement the “gml” conformance class ( <a href="http://www.opengis.net/spec/GMLCOV/1.0/conf/gml">http://www.opengis.net/spec/GMLCOV/1.0/conf/gml</a> ) as well.	C
8	If the purpose of the server implementation is to publish coverage data in GeoTIFF format, then a DGIWG WCS-Geo server shall implement the “geotiff-coverage” conformance class ( <a href="http://www.opengis.net/spec/GMLCOV_geotiff-coverages/1.0/conf/geotiff-coverage">http://www.opengis.net/spec/GMLCOV_geotiff-coverages/1.0/conf/geotiff-coverage</a> ).	C
9	If GeoTIFF is used as an output format, then the output file shall be compliant with the DGIWG GeoTIFF Profile (see Normative References).	C
10	If the purpose of a DGIWG WCS-Geo server is to publish coverage data in JPEG2000 format, then the “jpeg2000-coverage” ( <a href="http://www.opengis.net/spec/gmlcov_jpeg2000-coverages/1.0/conf/jpeg2000-coverage">http://www.opengis.net/spec/gmlcov_jpeg2000-coverages/1.0/conf/jpeg2000-coverage</a> ) shall be supported.	C
11	If the purpose of a DGIWG WCS-Geo server is to publish coverage data in JPEG2000 format, then the “jpeg2000-access” conformance class ( <a href="http://www.opengis.net/spec/gmlcov_jpeg2000-coverages/1.0/conf/jpeg2000-access">http://www.opengis.net/spec/gmlcov_jpeg2000-coverages/1.0/conf/jpeg2000-access</a> ) shall be supported.	C
12	If GMLJPEG2000 is used as an output format, then the output file shall be compliant with the DGIWG Profile of JPEG2000 for Georeferenced Imagery.	C

No.	Requirement	Compliance
13	If a DGIWG WCS-Geo server provides JPEG2000 stream URL (JPIP URL), it shall implement "jpip-access" conformance class ( <a href="http://www.opengis.net/spec/WCS_jpeg2000-coverages/1.0/req/jpip-access">http://www.opengis.net/spec/WCS_jpeg2000-coverages/1.0/req/jpip-access</a> ).	C
14	A DGIWG WCS-Geo server shall implement the extension "crs" conformance class ( <a href="http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs">http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs</a> ).	M
15	A DGIWG WCS-Geo server shall support at least CRSs EPSG:4326 and CRS:84. Optionally data may be provided in additional CRSs, depending on national requirements.	M
16	If a DGIWG-Geo server provides scaling capability, it shall implement "scaling" conformance class ( <a href="http://www.opengis.net/spec/WCS_service-extension_scaling/1.0/conf/scaling">http://www.opengis.net/spec/WCS_service-extension_scaling/1.0/conf/scaling</a> ).	C
17	A DGIWG WCS-Geo serverprofile shall implement "record-subsetting" conformance class ( <a href="http://www.opengis.net/spec/WCS_service-extension_range-subsetting/1.0/conf/record-subsetting">http://www.opengis.net/spec/WCS_service-extension_range-subsetting/1.0/conf/record-subsetting</a> ).	M

## 7.2. Non-normative recommendations for implementation

The non-normative requirements requested by this profile are summarized in Table 1.

**Table 1: DGIWG WCS Profile Non-normative Recommendations for DGIWG WCS Server Implementation**

No.	Recommendation	Compliance
1	When JPEG2000 format is used as an output format by a server claiming conformance to DGIWG WCS Geo profile implement, it is recommended to provide data as JPIP stream as well.	O
2	When another output format is additionally used by a WCS service, it is recommended to develop the corresponding format extension for WCS.	O
3	DGED should be used as an encoding option for gridded elevation data.	O
4	Lossless compression should be used for elevation thematic data (Land Cover ...), especially when color tables are used.	O
5	A DGIWG WCS-Geo server should also support followings CRSs: <ul style="list-style-type: none"> <li>– World Mercator projection, known as EPSG:3395</li> <li>– All projections for which validity zone overlaps data published by the service <ul style="list-style-type: none"> <li>○ UTM projections over WGS84 (north zones), EPSG:32601 to EPSG:32660</li> <li>○ UTM projections over WGS84 (south zones), EPSG:32701 to EPSG:32760</li> <li>○ UPS projection over WGS84 (north zone), EPSG:5041</li> <li>○ UPS projection over WGS84 (south zone), EPSG:5042</li> </ul> </li> </ul>	O
6	A DGIWG WCS-Geo server should support "interpolation" conformance class ( <a href="http://www.opengis.net/spec/WCS_serviceextension_interpolation/1.0/conf/interpolation">http://www.opengis.net/spec/WCS_serviceextension_interpolation/1.0/conf/interpolation</a> ).	O

### 7.3. General

The DGIWG WCS-Geo is based on the OGC WCS 2.0 – Core Standard.

**Requirement 1: A DGIWG WCS-Geo server shall implement the WCS 2.0 “core” conformance class.**

Relevant operations and parameters for the DGIWG WCS-Geo profile are discussed in the followings sections.

### 7.4. Supported operations

Based on the WCS 2.0 Core conformance class, the DGIWG WCS-Geo Profile supports the following operations: **GetCapabilities**, **DescribeCoverage**, and **GetCoverage**. The sections below provide additional information/requirements on operations supported.

#### 7.4.1. GetCapabilities

The *GetCapabilities* operation generates a service metadata document describing a WCS service provided by a server. This metadata document holds information about:

- Version and update sequence (from OWS-Common)  
*Service metadata document version*
- Service identification (from OWS-Common)  
*General metadata for this specific server.*
- Service provider (from OWS-Common)  
*Metadata about the organization that provides this specific service instance or server*
- Operation metadata (from OWS-Common)  
*Metadata about the operations and related abilities specified by this service and implemented by this server, including the URLs for operation requests.*
- Services metadata  
*Despite its name, this element should not be confuse with the OWS:ServiceMetadata. ServiceMetadata contains information describing the WCS service on hand (formats supported and an extension point to define extra individual service metadata). This is the entry point to describe WCS extension.*
- Contents (adapted from OWS-Common)  
*This element redefines the OWS:Content section with a CoverageSummary and an Extension element.*
- Languages  
*The list of languages that this service is able to fully support.*

**Requirement 2: A DGIWG WCS-Geo server shall provide a GetCapabilities response document according to requirements in Error! Reference source not found., Table 3, Table 4,**

**Table 5, Table 6 and Table 7.**

**NOTE:** In the tables below, the bold text represents additional requirements/recommendations for that element.

**Table 2: WCS GetCapabilities Response - Service Identification elements**

ServiceIdentification			
Element name	Definition	Cardinality in OGC standard (OWS-Common)	Cardinality in DGIWG WCS-Geo
From OWS-Common 2.0			
Title	Title of this resource, normally used for display to humans.	0..*	<b>1 (Mandatory)</b>
Abstract	Brief narrative description of this resource, normally used for display to humans.	0..*	<b>1 (Mandatory)</b> Abstract shall at least contain "This server implements the DGIWG WCS Geo Profile v1.0 of WCS 2.0".
Keywords	Unordered list of one or more commonly used or formalized word(s) or phrase(s) used to describe the subject.	0..*	<b>1..* (Mandatory)</b> This keyword list shall at least contain all keywords registered at the coverage level (see Table 7).
ServiceType	A service type name from a registry of services. This type name is normally used for machine-to-machine.	WCS	WCS
ServiceTypeVersion	Unordered list of one or more versions of this service type implemented by this server.	2.0.1	2.0.1
Profile	Unordered list of identifiers of Application Profiles that are implemented by this server.	0..*	<b>1..* (Mandatory)</b> The first mandatory element shall contain the following value: <a href="http://dgiwg.org/std/wcs/1.0/conf/geo">"http://dgiwg.org/std/wcs/1.0/conf/geo"</a> Other elements have to be filled in according to supported extensions (CRS, ...)..
Fees	Fees and terms for using this server.	0..*	0..*
AccessConstraints	Unordered list of access constraints applied to assure the protection of privacy or intellectual property, and any other restrictions on retrieving or	0..*	0..* <b>If a nation (or organization) does implement a security protocol for their WCS implementation they should advertise the protocol</b>



ServiceIdentification			
Element name	Definition	Cardinality in OGC standard (OWS-Common)	Cardinality in DGIWG WCS-Geo
	using data from or otherwise using this server.		implemented to enable interoperability (or some words to that effect).

*NOTE 1: the <ows:Abstract> element may include additional information.*

*NOTE 2: the DGIWG profile does not include <AccessConstraints> because DGIWG anticipates that nations implement their own security related protocols.*

**Table 3: WCS Service Provider elements**

ServiceProvider			
Element name	Definition	Multiplicity in OGC standard (OWS-Common or WCS Core)	Multiplicity in DGIWG WCS-Geo
From OWS-Common 2.0			
ProviderName	A unique identifier for the service provider organization.	1	1
ProviderSite	Reference to the most relevant web site of the service provider.	1	1
ServiceContact	Information for contacting the service provider.	1	1

**Table 4: WCS GetCapabilities Response Operation Metadata elements**

OperationMetadata			
Element name	Definition	Multiplicity in OGC standard (OWS-Common or WCS Core)	Multiplicity in DGIWG WCS-Geo
From OWS-Common 2.0			
Operation	Metadata for one operation that this server interface implements.	3..*	3..* (GetCapabilities, DescribeCoverage, GetCoverage)
Parameter	Parameter valid domain that applies to one or more operations which this server implements.	0..*	0..*
Constraint	Constraint on valid domain of a non parameter quantity that applies to this server.	0..*	0..*

ExtentedCapabilities	Metadata about server and software additional abilities	0..*	<b>Should only be used for OGC extensions (not vendor specific extensions).</b>
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**Table 5: WCS GetCapabilities Response - Service Metadata elements**

ServiceMetadata			
Element name	Definition	Multiplicity in OGC standard (OWS-Common or WCS Core)	Multiplicity in DGIWG WCS-Geo
formatSupported	Coverage encoding formats supported by this server	1..*	1..*
extension	Any kind of ancillary information about the service	0..*	0..* This profile does not require any type/structure of metadata for this element. For example, EO metadata profile may be used here.

**Table 6: WCS GetCapabilities Response - Operation Metadata elements**

Language			
Element name	Definition	Multiplicity in OGC standard (OWS-Common or WCS Core)	Multiplicity in DGIWG WCS-Geo
From OWS-Common 2.0			
Language	Identifier of a language supported by the server.	1	1 The server shall at least support English.

**Table 7: WCS GetCapabilities Response - CoverageSummary elements**

Contents			
Element name	Definition	Multiplicity in OGC standard (OWS-Common or WCS Core)	Multiplicity in DGIWG WCS-Geo
<b>CoverageSummary</b>	A CoverageSummary contains information essential for accessing a coverage served by a WCS.	0..*	
Inherited from OWS-Common 2.0			
Title	Title of this resource normally used for display to humans.	0..*	<b>1..* (mandatory)</b> One human readable title in English is mandatory. Additional titles in other languages like Esperanto are optional.

Contents			
Element name	Definition	Multiplicity in OGC standard (OWS-Common or WCS Core)	Multiplicity in DGIWG WCS-Geo
Abstract	Brief narrative description of this resource, normally used for display to humans.	0..*	<b>1..* (mandatory)</b> One abstract in English is mandatory. Additional abstracts in other languages are optional. This element shall contain at least "This server implements the DGIWG WCS Geo Profile v1.0 of WCS 2.0."
Keywords		0..*	<b>1..* (mandatory)</b> At least one keyword is required for each Coverage to facilitate data discovery in catalogues. Keywords can be duplicated in multiple languages. Using elements from following list is recommended : elevation, bathymetry, Imagery, scanned maps, fused image, lidar/sonar
From WCS 2.0 Core			
coverageld	Identifier of a coverage offered by the service on hand	1 (mandatory)	1 (mandatory)
coverage-Subtype	Type name of the coverage on hand	1 (mandatory)	<b>1 (mandatory)</b> Coverage Subtype structure should follow GMLCOV model (Cf. Figure 2 - The Coverage type hierarchy of OGC 09-146r2]
coverage-Subtype-Parent	Recursive list of the coverage's supertypes		
extension	Further metadata	0..1 (optional)	0..1 (optional)
wgs84-BoundingBox	Minimum bounding rectangle surrounding dataset, using WGS 84 CRS with decimal degrees and longitude before latitude.	0..* (optional)	<b>1 (mandatory)</b> The WGS84 Bounding Box shall be provided.
boundingBox	Minimum bounding rectangle surrounding dataset, in available CRS	0..* (optional)	<b>Mandatory</b> If additional CRSs are supported (besides WGS84), then a bounding box shall be provided for each CRS. This shall be done according to the

Contents			
Element name	Definition	Multiplicity in OGC standard (OWS-Common or WCS Core)	Multiplicity in DGIWG WCS-Geo
			list of supported CRS advertised in the <i>crsSupported</i> element (see CRS extension).
metadata	Reference to more metadata about this dataset	0..1 (optional)	<b>1 (Recommended)</b> When metadata element is used, the xlink:href attribute with type anyURI should include a URL from which this metadata can be electronically retrieved. In an SDI like architecture, a link to the metadata resource available on a CSW server should be provided.
<b>Extension</b>	Extension element used to hook in additional content e.g. in WCS extensions or application profiles.	0..*	

### 7.4.2. DescribeCoverage

The *DescribeCoverage* operation generates a description document of the coverages requested. One or more coverage identifier can be provided in a single *DescribeCoverage* request.

This description document provides at least following information on each coverage:

- Identifier of the coverage
- Envelope of the coverage
- domainset, i.e. a 2D rectified grid question for spatiotemporal domains
- rangeType, i.e. elevation values on 16 bits , RGB values between 0-255 for orhtoimagery, ..
- serviceParameters as type of the coverage (GridCoverage, ..), native format of the coverage and other additional information.

This profile does not add any further requirement than the one in WCS 2.0 Core.

### 7.4.3. GetCoverage

There is no extra requirement on GetCoverage operation that the ones defined by OGC WCS standard.

## 7.5. Bindings

Conformance classes *get-kvp* and *post-xml* require the support of requests according to these two bindings.

**Requirement 3: A DGIWG WCS-Geo server shall implement get-kvp conformance class.**

**Requirement 4: A DGIWG WCS-Geo server shall implement post-xml conformance class.**

According to these two previous requirements a WCS server implementing the DGIWG WCS Geo profile then implements both GET/KVP and POST/XML bindings.

## **7.6. Formats**

### **7.6.1. Coverage encoding**

This profile requires support of special-format (the coverage is directly provided in GML, Geotiff, JPEG2000 ...) or multipart meaning the coverage is provided with a CIS wrapper.

**Requirement 5: A DGIWG WCS-Geo server shall implement the “special-format” (<http://www.opengis.net/spec/GMLCOV/1.0/conf/special-format>) conformance class of GML application schema for coverages.**

**Requirement 6: A DGIWG WCS Geo server shall implement the “multipart” (<http://www.opengis.net/spec/GMLCOV/1.0/conf/multipart>) conformance class of GML application schema for coverages.**

*NOTE: more information on what these two conformance classes mean in section 6.2.6.*

### **7.6.2. Coverage formats**

#### **7.6.2.1. GML**

According to CIS (GMLCOV implementation schema), coverages may also be retrieved in GML.

**Requirement 7: If the purpose of the server implementation is to publish coverage data in GML format, then a DGIWG WCS-Geo server shall implement the “gml” conformance class (<http://www.opengis.net/spec/GMLCOV/1.0/conf/gml>) as well.**

The following figure is an example of coverage that can be directly accessed as a mutli-surface coverage in GML.

# Corine land cover classes

## 1. Artificial surfaces

### 1.1 Urban fabric

- 1.1.1. Continuous urban fabric
- 1.1.2. Discontinuous urban fabric

### 1.2 Industrial, commercial and transport units

- 1.2.1. Industrial or commercial units
- 1.2.2. Road and rail networks and associated land
- 1.2.3. Port areas
- 1.2.4. Airports

### 1.3 Mine, dump and construction sites

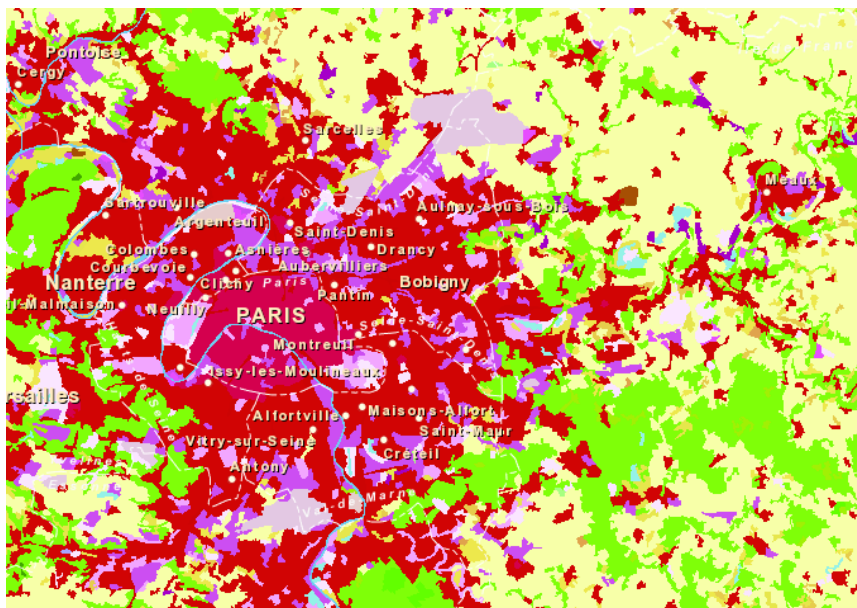
## 3. Forests and semi-natural areas

### 3.1 Forests

- 3.1.1. Broad-leaved forest
- 3.1.2. Coniferous forest
- 3.1.3. Mixed forest

### 3.2 Shrub and/or herbaceous vegetation associations

- 3.2.1. Natural grassland
- 3.2.2. Moors and heathland
- 3.2.3. Sclerophyllous vegetation
- 3.2.4. Transitional woodland shrub



Land Cover data can be modeled as coverage data (MultiSurface Coverage or Raster). In case of representing the data as multisurface coverages, land cover data can be retrieved through the WCS interface in GML format. For example, each GML:MultiSurface element supports the geometry and a Land Cover Code as it is done for Corine Land Cover.

### Example 1: dissemination of Land Cover data in GML

#### 7.6.2.2. GeoTIFF

**Requirement 8:** *If the purpose of the server implementation is to publish coverage data in GeoTIFF format, then a DGIWG WCS-Geo server shall implement the “geotiff-coverage” conformance class ([http://www.opengis.net/spec/GMLCOV\\_geotiff-coverages/1.0/conf/geotiff-coverage](http://www.opengis.net/spec/GMLCOV_geotiff-coverages/1.0/conf/geotiff-coverage)).*

DGIWG developed a specific profile for GeoTIFF; this profile is more restrictive than requirements defined by CIS. The WCS Geo Profile requires output conformant to DGIWG GeoTIFF file.

**Requirement 9: If GeoTIFF is used as an output format, then the output file shall be compliant with the DGIWG GeoTIFF Profile (see Normative References).**

#### 7.6.2.3. JPEG2000

**Requirement 10: If the purpose of a DGIWG WCS-Geo server is to publish coverage data in JPEG2000 format, then the “jpeg2000-coverage” ([http://www.opengis.net/spec/gmlcov\\_jpeg2000-coverages/1.0/conf/jpeg2000-coverage](http://www.opengis.net/spec/gmlcov_jpeg2000-coverages/1.0/conf/jpeg2000-coverage)) shall be supported.**

*NOTE:* this first requirement describes how to use JPEG2000 with GMLCOV application schema.

**Requirement 11: If the purpose of a DGIWG WCS-Geo server is to publish coverage data in JPEG2000 format, then the “jpeg2000-access” conformance class ([http://www.opengis.net/spec/gmlcov\\_jpeg2000-coverages/1.0/conf/jpeg2000-access](http://www.opengis.net/spec/gmlcov_jpeg2000-coverages/1.0/conf/jpeg2000-access)) shall be supported.**

*NOTE:* this second requirement describes how to use JPEG2000 with a service.

**Requirement 12: If GMLJPEG2000 is used as an output format, then the output file shall be compliant with the DGIWG Profile of JPEG2000 for Georeferenced Imagery.**

*NOTE 1:* GMLJPEG2000 files are jpx files

*NOTE 2:* DGIWG GMLJP2 profile is under revision, based on the new 2.0 version of the GMLJP2 OGC standard.

#### 7.6.2.4. JPIP stream

JPEG2000 allows for providing huge datasets within a single file. A JPEG2000 file can be directly retrieved when requesting JPEG2000 as output format in a GetCoverage request.

Another possibility is to stream the JPEG2000 content within the JPIP protocol (described by ISO 15444-9). This allows getting back an URL for navigating and downloading JPEG2000 piece by piece. Every piece of coverage can be seen without the full download; each piece can be self-interpreted.

*NOTE:* The WCS server only returns the JPIP URL. This URL can then be used with an ISO 15444-9 compliant client to stream data.

**Recommendation 1 : When JPEG2000 format is used as an output format by a server claiming conformance to DGIWG WCS Geo profile implement, it is recommended to provide data as JPIP stream as well.**

**Requirement 13: If a DGIWG WCS-Geo server provides JPEG2000 stream URL (JPIP URL), it shall implement “jpip-access” conformance class ([http://www.opengis.net/spec/WCS\\_jpeg2000-coverages/1.0/req/jpip-access](http://www.opengis.net/spec/WCS_jpeg2000-coverages/1.0/req/jpip-access)).**

#### 7.6.2.5. Other formats

Other output format may be used for serving data on a WCS service.

**Recommendation 2 : When another output format is additionally used by a WCS service, it is recommended to develop the corresponding format extension for WCS.**



*NOTE: this recommendation aims at standardization use of other with a WCS service. It is necessary to define standard names and parameters to allow interoperability between clients and servers.*

#### **7.6.2.6. Which format for which coverage type?**

Geotiff format is adapted to provide elevation, imagery and more generally raster data. It can provide lossless or lossy compression. GeoTIFF is also a suitable format to provide elevation information in Geopackage.

JPEG2000 format is well adapted for imagery and more generally raster maps. Lossy compression is far more powerful than GeoTIFF for the same visual quality result. It also may be used for elevation or thematic data (land cover).

GeoTIFF and JPEG2000 are only suitable for gridded data and then other format has to be used for point cloud data (LAS for example with developing the corresponding extension according to Recommendation 2).

Coverage as GML may also be transmitted with as WCS service. GML is more adapted to small coverage/amount of data or vector like coverage (Multi points, Multi surfaces ...). For example, point clouds or thematic data may be distributed in GML. These can also be transmitted via a WFS service.

***Recommendation 3: DGED should be used as an encoding option for gridded elevation data.***

***Recommendation 4: Lossless compression should be used for elevation thematic data (Land Cover ...), especially when color tables are used.***

### **7.7. Other capabilities**

#### **7.7.1. Coordinate Reference Systems**

A WCS service implementing the Core conformance class is required to only provide data in the CRS of the data as stored in the database. To allow the client to get coverage in other CRS a CRS extension has been developed.

***Requirement 14: A DGIWG WCS-Geo server shall implement the extension "crs" conformance class ([http://www.opengis.net/spec/WCS\\_service-extension\\_crs/1.0/conf/crs](http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs)).***

The "crs" conformance class ([http://www.opengis.net/spec/WCS\\_service-extension\\_crs/1.0/conf/crs](http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs)) is abstract. Depending on the type of coverage provided by the server, it may also require support for the "crs-discrete-coverage" conformance class ([http://www.opengis.net/spec/WCS\\_service-extension\\_crs/1.0/conf/crs-discrete-coverage](http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs-discrete-coverage)) and/or for the "crs-gridded-coverage" conformance class ([http://www.opengis.net/spec/WCS\\_service-extension\\_crs/1.0/conf/crs-gridded-coverage](http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs-gridded-coverage)).

***Requirement 15: A DGIWG WCS-Geo server shall support at least CRSs EPSG:4326 and CRS:84. Optionally data may be provided in additional CRSs, depending on national requirements.***

NOTE 1: According to OGC 09-048r3, corresponding URLs for EPSG:4326 and CRS:84 are respectively <http://www.opengis.net/def/crs/EPSSG/0/4326> and <http://www.opengis.net/def/crs/OGC/1.3/CRS84>.

NOTE 2: The CRSs above are mandatory in the DGWIG WMS 1.3 profile

If the internal storage CRS is different from EPSG:4326 and CRS:84, then the WCS shall support a transformation between the internal storage CRS and EPSG:4326 + CRS:84. The effects of such a transformation shall be considered when determining and declaring the guaranteed data accuracy.

**Recommendation 5: A DGIWG WCS-Geo server should also support followings CRSs:**

- **World Mercator projection, known as EPSG:3395**
- **All projections for which validity zone overlaps data published by the service**
  - **UTM projections over WGS84 (north zones), EPSG:32601 to EPSG:32660**
  - **UTM projections over WGS84 (south zones), EPSG:32701 to EPSG:32760**
  - **UPS projection over WGS84 (north zone), EPSG:5041**
  - **UPS projection over WGS84 (south zone), EPSG:5042**

### 7.7.2. Scaling

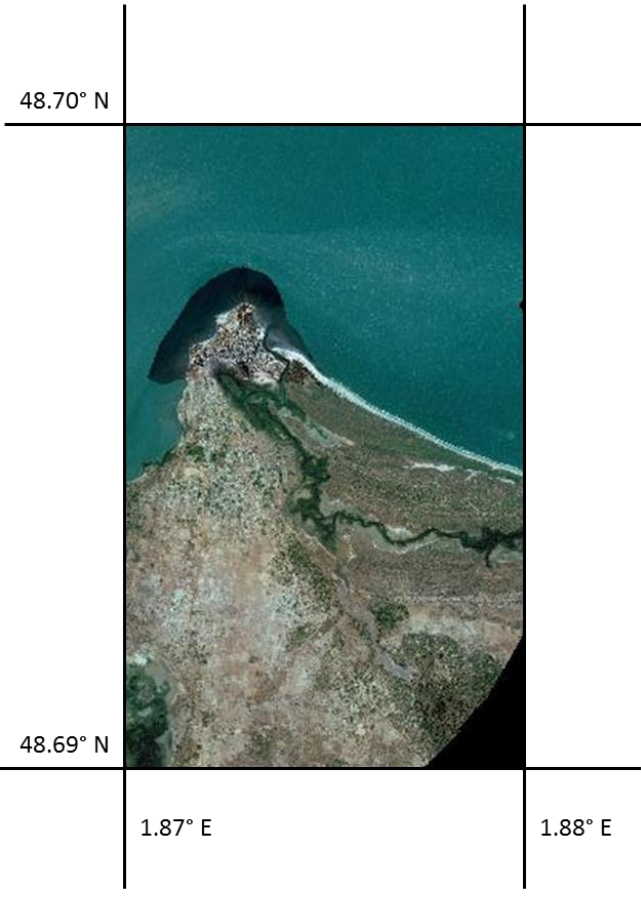
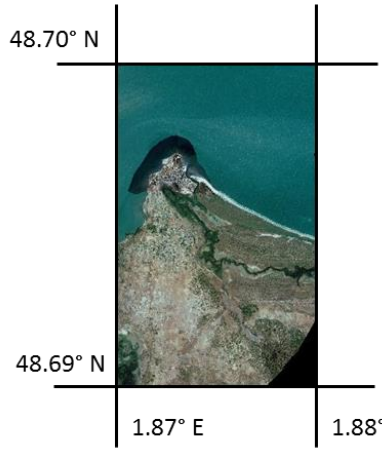
The Scaling mechanism should be understood here as “linear transformation that enlarges (increases) or shrinks (diminishes) a coverage by a scale factor that may or may not be the same in all directions”. It can be applied uniformly along all axes of the coverage or individually (one method per axis).

It allows users to get only the amount of data needed for a specific use and then limit the bandwidth needed on the network (a user may not want the full resolution of an image but only a reduced resolution of the image). For example, why downloading an image with a 0.5m pixel if 2.5m is enough ?

**Requirement 16: If a DGIWG-Geo server provides scaling capability, it shall implement “scaling” conformance class ([http://www.opengis.net/spec/WCS\\_service-extension\\_scaling/1.0/conf/scaling](http://www.opengis.net/spec/WCS_service-extension_scaling/1.0/conf/scaling)).**

If the server provides scaling capability, then it has to support WCS 2.0 scaling conformance class. Scaling can be done through three mechanisms:

- Scale factor allows scaling of coverages by a common factor applied to all axes. This can be used, for example, to scale down a 2D raster image, from a 1m resolution to a 2m resolution. In this case, the scale factor would be equal to 2.

	Native coverage	Coverage with scale factor =2
		
Coverage size	400 x 640 pixels	200 x 320 pixels
Pixel size	$1.56 \cdot 10^{-5} \text{ }^\circ(\text{lat}) \times 2.5 \cdot 10^{-5} \text{ }^\circ(\text{long})$	$3.12 \cdot 10^{-5} \text{ }^\circ(\text{lat}) \times 5 \cdot 10^{-5} \text{ }^\circ(\text{long})$

**Table 8 : Native and scaled down coverage by 2**

- Scale axes allows scaling of coverages by a factor applied to each axis (potentially different on each axis). This can be used, for example, to scale a 3D coverage (latitude, longitude, time), keeping the same spatial resolution (on latitude and longitude axes) and reducing the temporal resolution (time axis) from 1 hour to 1 day (24h). In this case, the scale factor would be equal to 1 for both latitude and longitude and would be equal to 24 for time axis.
- Scale domain allows scaling of coverages by providing the target domain of the desired coverage.

Please note that a server is free to employ any interpolation method during scaling, and information about the interpolation applied may not be accessible to the client.

### 7.7.3. Interpolation

When the CRS and/or Scaling extension is being used by the user, the Interpolation extension allows the client to choose one interpolation method among the ones advertised by the server (otherwise one default interpolation method is used).

**Recommendation 6:** A DGIWG WCS-Geo server should support “interpolation” conformance class ([http://www.opengis.net/spec/WCS\\_serviceextension\\_interpolation/1.0/conf/interpolation](http://www.opengis.net/spec/WCS_serviceextension_interpolation/1.0/conf/interpolation)).

### 7.7.4. Range subsetting

The range subsetting extension defines only one conformance class “record-subsetting” which allows clients to subset the range type described by a <swe:DataRecord> element as modelled by GMLCOV application schema.

**Requirement 17:** A DGIWG WCS-Geo serverprofile shall implement “record-subsetting” conformance class ([http://www.opengis.net/spec/WCS\\_service-extension\\_range-subsetting/1.0/conf/record-subsetting](http://www.opengis.net/spec/WCS_service-extension_range-subsetting/1.0/conf/record-subsetting)).

Within a DescribeCoverage response, the following XML fragment shows the description of a RGB 24bits coverage with a <swe:DataRecord> element. Each of the three bands red, green and blue is advertised.

*NOTE:* This XML fragment is extracted from a full DescribeCoverage response.

```
<gmlcov:rangeType>
  <swe:DataRecord>
    <swe:field name="red">
      <swe:Quantity
definition="http://www.opengis.net/def/property/OGC/0/Radiance">
        <swe:description>Red Channel</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"/>
        <swe:constraint>
          <swe:AllowedValues>
            <swe:interval>0 255</swe:interval>
          </swe:AllowedValues>
        </swe:constraint>
      </swe:Quantity>
    </swe:field>
    <swe:field name="green">
      <swe:Quantity
definition="http://www.opengis.net/def/property/OGC/0/Radiance">
```

```

        <swe:description>Green Channel</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"/>
        <swe:constraint>
            <swe:AllowedValues>
                <swe:interval>0 255</swe:interval>

        <swe:significantFigures>3</swe:significantFigures>
            </swe:AllowedValues>
        </swe:constraint>
        </swe:Quantity>
    </swe:field>
    <swe:field name="blue">
        <swe:Quantity
definition="http://www.opengis.net/def/property/OGC/0/Radiance">
            <swe:description>Blue Channel</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"/>
            <swe:constraint>
                <swe:AllowedValues>
                    <swe:interval>0 255</swe:interval>

            <swe:significantFigures>3</swe:significantFigures>
                </swe:AllowedValues>
            </swe:constraint>
        </swe:Quantity>
    </swe:field>
</swe:DataRecord>
</gmlcov:rangeType>

```

**Example 2: DataRecord describing a RGB 24 bits coverage**

With the range-subsetting extension, the client can request only one band, a selection of bands among these declared in the DataRecord. Bands can also simply be reordered. This will allow the user to select only the data he needs (for example from a satellite image).

In a GetCoverage request (KVP encoding)

- Extraction of the red band,  
...&RANGESUBSET=red&...
- Extraction of the green and blue bands,  
...&RANGESUBSET=green,blue&...
- Reordering of the bands  
...&RANGESUBSET=green,red,blue&...

**Example 3: range-subsetting parameter in a GetCoverage request (Get/KVP)**

```
<?xml version="1.0" encoding="UTF-8"?>
<wcs:GetCoverage xmlns:wcs="http://www.opengis.net/wcs/2.0"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"
  xsi:schemaLocation="http://www.opengis.net/wcs/range-subsetting/1.0
  http://schemas.opengis.net/wcs/range-subsetting/1.0/wcsRsub.xsd"
  service="WCS" version="2.0.1">
  <wcs:Extension>
    <rsub:RangeSubset>
      <rsub:RangeItem>
        <rsub:RangeComponent>red</rsub:RangeComponent>
      </rsub:RangeItem>
    </rsub:RangeSubset>
  </wcs:Extension>
  <wcs:CoverageId>C0001</wcs:CoverageId>
</wcs:GetCoverage>
```

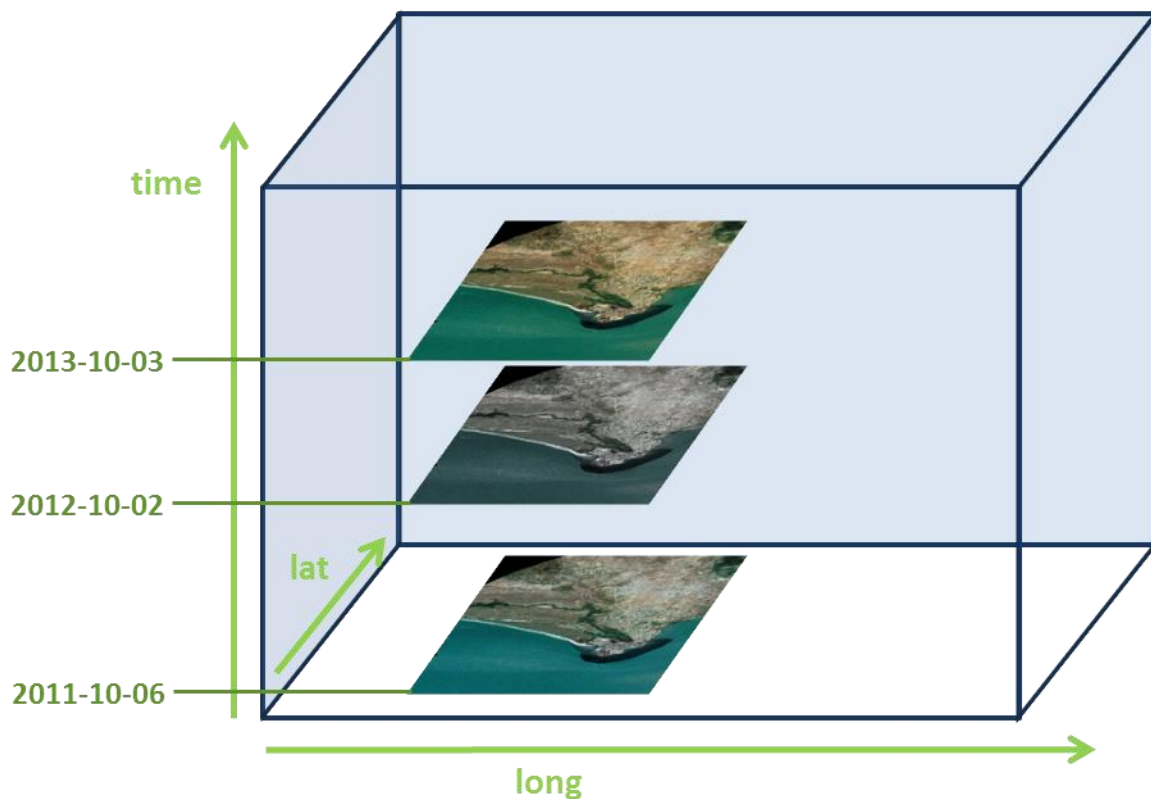
**Example 4: range-subsetting parameter in a GetCoverage request (POST/XML)**

## 8. Future capabilities

### 8.1. Time series

Time series mechanism is not actually supported by WCS 2.0 Core. The WCS Coverage collection extension which is being developed by OGC should allow the support of this use case. This extension would provide mechanisms to group coverage and request them.

As this document is not finalized, it is not referenced here and time series are then not supported. For more information, refer to the draft document "OGC® Web Coverage Service Interface Standard - Coverage Collection Extension (15-044r2)".



*Figure 3: Example of time series for coverages*

### 8.2. WCS-Tiling

OGC has initiated work for providing tiles through a WCS service. The aim is to apply the tiling mechanism used by WMTS to WCS.

Tiling mechanism allows caching, fast serving and display of the data.

WMTS and Geopackage standards already provide tiling mechanisms, so consistency with WCS would be required.

# Annex A – Abstract Test Suite

## (Normative)

### A.1 Conformance test class : DGIWG WCS-Geo

#### A.1.1 DGIWG WCS-Geo - General

- a) Requirement: Requirement 1
- b) Test Purpose: Verify that the server implements the WCS 2.0 Core.
- c) Test Method: Execute the tests for the OGC WCS 2.0 "core" (<http://www.opengis.net/spec/WCS/2.0/conf/core>) conformance class.
- d) References: section **Error! Reference source not found.**

#### A.1.2 DGIWG WCS-Geo – GetCapabilities

- a) Requirement: Requirement 2
- b) Test Purpose: Verify that the GetCapabilities response document contains required elements.
- c) Test Method: Check the GetCapabilities response document of a valid GetCapabilities request to verify if required elements are present and if the content is correct.
- d) References: section 7.4.1

#### A.1.3 DGIWG WCS-Geo – Bindings

##### A.1.3.a DGIWG WCS-Geo - GetKVP

- a) Requirement: Requirement 3
- b) Test Purpose: Verify the support of Get/KVP.
- c) Test Method: Execute the tests for the OGC WCS 2.0 "get-kvp" ([http://www.opengis.net/spec/WCS\\_protocol-binding\\_get-kvp/1.0/conf/get-kvp](http://www.opengis.net/spec/WCS_protocol-binding_get-kvp/1.0/conf/get-kvp)) conformance class.
- d) References: section 7.5

##### A.1.3.b DGIWG WCS-Geo - POSTXML

- a) Requirement: Requirement 4
- b) Test Purpose: Verify the support of POST/XML.
- c) Test Method: Execute the tests for the OGC WCS 2.0 post-xml conformance class ([http://www.opengis.net/spec/WCS\\_protocol-binding\\_post-xml/1.0/conf/post-xml](http://www.opengis.net/spec/WCS_protocol-binding_post-xml/1.0/conf/post-xml)[http://www.opengis.net/spec/WCS\\_protocol-binding\\_post-xml/1.0/req/post-xml](http://www.opengis.net/spec/WCS_protocol-binding_post-xml/1.0/req/post-xml)).
- d) References: section 7.5



### A.1.4 DGIWG WCS-Geo – formats

DGIWG Geo profile does not require any specific format, so tests A.1.4.c to A.1.4.f are conditional.

#### A.1.4.a DGIWG WCS-Geo – special format

- a) Requirement: Requirement 5
- b) Test Purpose: Verify the support of CIS 1.0 special-format conformance class.
- c) Test Method: Execute the tests for the OGC CIS 1.0 "*special format*" (<http://www.opengis.net/spec/GMLCOV/1.0/conf/special-format>) conformance classe.
- d) References: section 7.6.1

#### A.1.4.b DGIWG WCS-Geo - multipart

- e) Requirement: Requirement 6
- f) Test Purpose: Verify the support of CIS 1.0 multipart conformance classes.
- g) Test Method: Execute the tests for the OGC CIS 1.0 "multipart" (<http://www.opengis.net/spec/GMLCOV/1.0/conf/multipart>) conformance class.

References: section 7.6.1

#### A.1.4.c DGIWG WCS-Geo - GML

- a) Requirement: Requirement 7
- b) Test Purpose: Verify the support of CIS 1.0 gml conformance class.
- c) Test Method: Execute the tests for the OGC CIS 1.0 "*gml*" (<http://www.opengis.net/spec/GMLCOV/1.0/conf/gml>) conformance class.
- d) References: section 7.6.2

#### A.1.4.d DGIWG WCS-Geo - Geotiff

- a) Requirement: Requirement 8
- b) Test Purpose: Verify the support of GMLCOV 1.0 geotiff-coverage conformance class.
- c) Test Method: Execute the tests for the OGC GMLCOV 1.0 "*geotiff-coverage*" ([http://www.opengis.net/spec/GMLCOV\\_geotiff-coverages/1.0/conf/geotiff-coverage](http://www.opengis.net/spec/GMLCOV_geotiff-coverages/1.0/conf/geotiff-coverage)) conformance class.
- d) References: section 7.6.2.2

- a) Requirement: Requirement 9
- b) Test Purpose: Verify the support of the Geotiff DGIWG profile.
- c) Test Method: Send a valid request and verify that output satisfies tests of the DGIWG Geotiff profile (Class B: Profile Baseline).
- d) References: section 7.6.2.2

#### A.1.4.e DGIWG WCS-Geo – JPEG2000

- a) Requirement: Requirement 10
- b) Test Purpose: Verify the support of GMLCOV 1.0 jpeg2000-coverage and jpeg2000-access conformance classes.
- c) Test Method: Execute the tests for the OGC GMLCOV 1.0 "*jpeg2000-coverage*" ([http://www.opengis.net/spec/gmlcov\\_jpeg2000-coverages/1.0/conf/jpeg2000-coverage](http://www.opengis.net/spec/gmlcov_jpeg2000-coverages/1.0/conf/jpeg2000-coverage)) conformance class.
- d) References: section 7.6.2.3

- a) Requirement: Requirement 11
- b) Test Purpose: Verify the support of GMLCOV 1.0 jpeg2000-access conformance class.
- c) Test Method: Execute the tests for the OGC GMLCOV 1.0 "*jpeg2000-access*" ([http://www.opengis.net/spec/gmlcov\\_jpeg2000-coverages/1.0/conf/jpeg2000-access](http://www.opengis.net/spec/gmlcov_jpeg2000-coverages/1.0/conf/jpeg2000-access)) conformance class.
- d) References: section 7.6.2.3

- a) Requirement: Requirement 12
- b) Test Purpose: Verify the support of the GMLJP2 DGIWG profile.
- c) Test Method: Send a valid request and verify that output satisfies tests of the DGIWG GMLJP2 profile (Class B: Baseline profile).
- d) References: section 7.6.2.3

#### A.1.4.f DGIWG WCS-Geo - JPIP

- a) Requirement: Requirement 13
- b) Test Purpose: Verify the support of GMLCOV 1.0 jpip-access conformance classes.
- c) Test Method: Execute the tests for the OGC GMLCOV 1.0 "*jpip-access*" ([http://www.opengis.net/spec/WCS\\_jpeg2000-coverages/1.0/req/jpip-access](http://www.opengis.net/spec/WCS_jpeg2000-coverages/1.0/req/jpip-access)) conformance class.
- d) References: section 7.6.2.3

### **A.1.5 DGIWG WCS-Geo – CRS**

#### A.1.5.a DGIWG WCS-Geo - CRS

- a) Requirement: Requirement 14
- b) Test Purpose: Verify the support of WCS 2.0 CRS 1.0 extension.
- c) Test Method: Execute the tests for the OGC CRS 1.0 "*crs*" ([http://www.opengis.net/spec/WCS\\_service-extension\\_crs/1.0/conf/crs](http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs)) conformance.
- d) References: section 7.7.1

A.1.5.b DGIWG WCS-Geo – EPSG:4326/CRS:84

- a) Requirement: Requirement 15
- b) Test Purpose: Verify the support of CRS EPSG:4326 and CRS:84.
- c) Test Method: Verify the support of EPSG:4326 and CRS:84 according to the CRS extension.
- d) References: section 7.7.1

**A.1.6 DGIWG WCS-Geo – other**

A.1.6.a DGIWG WCS-Geo – scaling

- a) Requirement: Requirement 16:
- b) Test Purpose: Verify the support of the scaling extension.
- c) Test Method: Execute the tests for the OGC Scaling 1.0 "*scaling*" ([http://www.opengis.net/spec/WCS\\_service-extension\\_scaling/1.0/conf/scaling](http://www.opengis.net/spec/WCS_service-extension_scaling/1.0/conf/scaling)).
- d) References: section 7.7.2

A.1.6.b References: section 7.7.1 DGIWG WCS-Geo – range subsetting

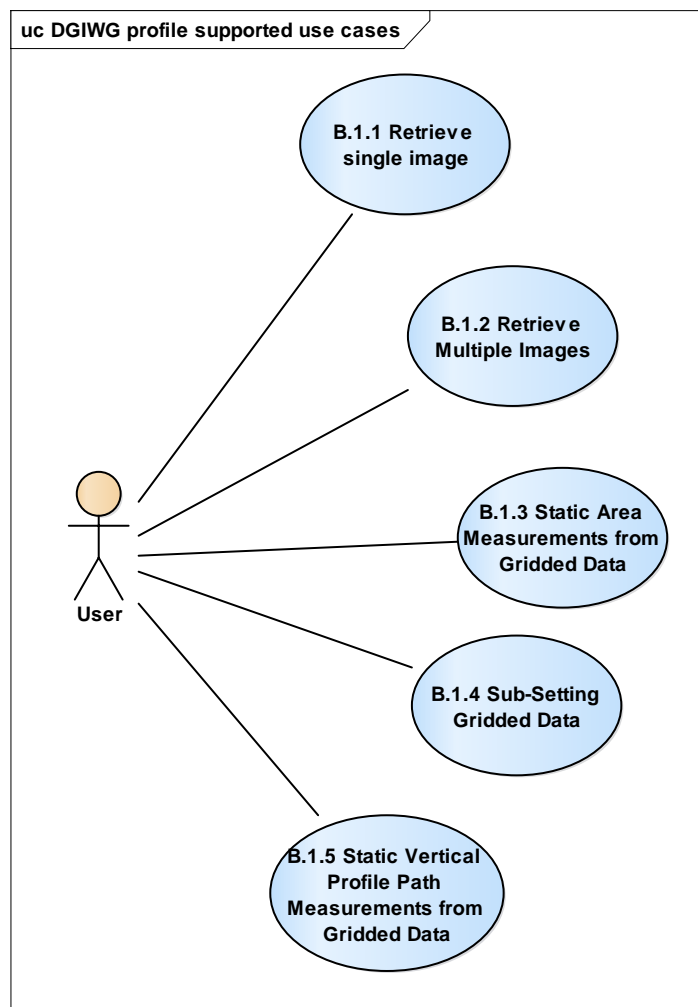
- a) Requirement: Requirement 17
- b) Test Purpose: Verify the support of the range-subsetting extension.
- c) Test Method: Execute the tests for the OGC Range Subsetting 1.0 "*record-subsetting*" ([http://www.opengis.net/spec/WCS\\_service-extension\\_range-subsetting/1.0/conf/record-subsetting](http://www.opengis.net/spec/WCS_service-extension_range-subsetting/1.0/conf/record-subsetting)).
- d) References: section 7.7.4

## Annex B – Use Cases (Normative)

Following use cases reflect requirements of multiple specialist geospatial centres such as the Met Office (MO), the UK Hydrographic Office (UKHO), the Defence Geospatial Intelligence Fusion Centre (DGIFC), and the Defence Geographic Centre (DGC). This document presents example use cases for WCS that can be used by Dstl as the starting point in seeking feedback from the relevant stakeholders.

The DGIWG WCS-Geo profile covers 5 (Annex B - ) over these 9 use cases. The 4 other use cases (B.2) rely on the "time" dimension for which the GMLCOV model is not suitable for. It needs specific extensions which will be integrated into the DGIWG WCS-Metoc profile.

### B.1 Supported use cases



*Figure 4 : WCS use cases supported by this profile*

## B.1.1 Retrieve single image

<b>Title</b>	Retrieve single image
<b>Overview</b>	This use case describes how a client retrieves a specified image from a WCS. This image can be trimmed based on spatial properties. For multispectral images the desired spectral bands can also be user selected.
<b>Example Usage</b>	<ol style="list-style-type: none"> <li>1. [DGIFC] In response to a RFI an analyst requires a panchromatic image from a sensor (e.g. Worldview I) from a specific image. The data needs to be encoded in a number of output formats to include GEOTIFF, JPEG and PNG.</li> <li>2. [DGIFC] In response to a RFI an analyst requires a colour image formed from the first three spectral bands of a multispectral sensor (e.g. Quickbird) from a specific image. The data needs to be encoded in a number of output formats to include GEOTIFF, JPEG and PNG.</li> <li>3. [DGIFC] In order to perform MASINT analysis an analyst requires all eight bands from a multispectral sensor (e.g. Worldview II) from a specific image. The data needs to be encoded in a number of output formats to include GEOTIFF and JPEG2000.</li> <li>4. [DGIFC] To perform line of sight analysis to assess potential sniper positions an analyst requires a DEM (stored as an image) across an area defined by <math>52\pm 0.1N</math> <math>0\pm 0.1E</math>.</li> <li>5. [DGC] In order to calculate vegetation cover (via NDVI) across an area an analyst requires the red and near-infrared bands from Landsat imagery over the area defined by <math>52\pm 0.1N</math> <math>0\pm 0.1E</math>. The data needs to be encoded in a number of output formats to include GEOTIFF and JPEG2000.</li> </ol>
<b>Actors</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> User</li> <li><input type="checkbox"/> Client application</li> <li><input type="checkbox"/> WCS</li> </ul>
<b>Preconditions</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> User has determined that the WCS offers the desired through the DescribeCoverage and GetCapabilities operations.</li> <li><input type="checkbox"/> User has determined the required image contains the appropriate spectral bands.</li> <li><input type="checkbox"/> It is assumed that images and/or mosaics covering large extents are available.</li> </ul>
<b>Main Flow</b>	<p>STEP 1: User sets the following input specification on the Client application [Service Name, Coverage ID, Location (inc. CRS), Bands].</p> <p>STEP 2: User submits a GetCoverage request to the WCS, through the Client application based on the input specification.</p> <p>STEP 3: If required, the output image is trimmed based on spatial and spectral properties.</p> <p>STEP 4: WCS returns a response to the Client application.</p> <p>STEP 5: The User receives the response from the WCS through the Client application.</p>
<b>Post-condition</b>	The coverage retrieved from the Client application is presented to the user.
<b>Standards/Extensions required</b>	<p>OGC Core</p> <p>At least 1 binding (get/KVP, POST/XML, SOAP)</p> <p>At least one format (Geotiff/JPEG2000)</p>

## B.1.2 Retrieve Multiple Images

<b>Title</b>	Retrieve multiple images
<b>Overview</b>	This use case describes how a client retrieves all images collected over a specified location within a certain time from a WCS. For multispectral images the desired spectral bands can also be user selected.
<b>Example Usage</b>	<p>1. [DGIFC] In response to an RFI an analyst requires all images collected over 52N 0E from 2013-01-01 till 2013-06-01. The data needs to be encoded in a number of output formats to include GEOTIFF, JPEG and PNG.</p> <p>2. [DGIFC] In order to assess a potential route for potential IED attack an analyst requires all images collected along a route corridor (defined by a polygon) from 2013-01-01 till 2013-06-01. The data needs to be encoded in a number of output formats to include GEOTIFF, JPEG and PNG</p> <p>3. [DGIFC] In response to reports of hostile activity in an area an analyst requires all reconnaissance images collected over an area defined by 52±0.1N 0±0.1E from 2013-05-01 till 2013-06-01.</p> <p>4. [DGIFC] To provide Military Aid to the Civil Authorities after a natural disaster an analyst requires two images over 52N 0E collected before and after 2013-06-01T06:00:00Z in order to perform a damage assessment.</p>
<b>Actors</b>	<input type="checkbox"/> User <input type="checkbox"/> Client application <input type="checkbox"/> WCS <input type="checkbox"/> WFS
<b>Preconditions</b>	<input type="checkbox"/> User has determined that the WCS offers the desired image through the DescribeCoverage and GetCapabilities operations.
<b>Main Flow</b>	<p>STEP 1: User sets the following input specification on the Client application [Service Name, Coverage ID, Location (inc. CRS), Bands].</p> <p>STEP 2: User submits a GetCoverage request to the WCS, through the Client application based on the input specification.</p> <p>STEP 3: The Client filters the coverage metadata to determine which coverages meet the user's spatial and temporal requirements.</p> <p>STEP 4: If suitable coverages are available the Client submits multiple GetCoverage requests to the server based on the input specification (including appropriate spectral bands for that sensor).</p> <p>STEP 5: WCS collates the coverages into a suitable format for delivery.</p> <p>STEP 6: WCS returns a response to the Client application.</p> <p>STEP 7: The User receives the response from the WCS through the Client application.</p>
<b>Post-condition</b>	The coverage retrieved from the Client application is presented to the user.
<b>Note</b>	As described STEP 3 involves passing the entire list of coverages to the client for filtering. For bandwidth, processing and security reasons, this operation would be better performed on the server. This would require either an extension to the WCS standard or the use of a WPS.

### B.1.3 Static Area Measurements from Gridded Data

<b>Title</b>	Static area measurements from gridded data
<b>Overview</b>	This use case describes how a client retrieves measurements across an area for a fixed time from a gridded data set served through a WCS. An interpolation method may be selected to allow measurements to be returned from an exact coordinate instead of the nearest grid point.
<b>Example Usage</b>	<ol style="list-style-type: none"> <li>1. [MO] A user needs to have an estimate of the forecast rainfall for a given catchment area at time 2012-05-15T06:00:00Z. The area is irregular and is defined as a closed polygon. The data needs to be encoded in a number of formats to include JSON, KML, and GML.</li> <li>2. [MO] As per UC4.1, but the rainfall estimate for each ensemble member is required so that a probability can be calculated.</li> <li>3. [UKHO] Extract depth values from a bathymetric chart for an area defined by <math>50\pm 0.5N</math> <math>0\pm 0.5E</math>. The data needs to be encoded in a number of formats to include JSON, KML, and GML.</li> <li>4. [DGC] Produce a terrain elevation map of an area by interpolating a lidar point cloud.</li> </ol>
<b>Actors</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> User</li> <li><input type="checkbox"/> Client application</li> <li><input type="checkbox"/> WCS</li> <li><input type="checkbox"/> WFS</li> </ul>
<b>Preconditions</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> User has determined that the WCS offers the desired parameter(s) through the DescribeCoverage and GetCapabilities operations.</li> <li><input type="checkbox"/> User has determined the required location and time.</li> </ul>
<b>Main Flow</b>	<p>STEP 1: User sets the following input specification on the Client application [Service Name, Coverage ID, Area (inc. CRS), Time, Field Name(s), Interpolation Method(s), Ensemble Number(s)].</p> <p>STEP 2: User submits a GetCoverage request to the WCS, through the Client application based on the input parameters.</p> <p>STEP 3: If the area is defined by a name, a WFS is used to retrieve the location definition.</p> <p>STEP 4: WCS determines the grid point(s) that fall within the specified area.</p> <p>STEP 5: WCS compiles the requested data set by slicing and trimming the coverage according to the area and field name(s).</p> <p>STEP 5: WCS returns a response to the Client application.</p> <p>STEP 6: The User receives the response from the WCS through the Client application.</p>
<b>Post-condition</b>	The coverage retrieved from the Client application is presented to the user.
<b>Note</b>	This use case is derived from version 0.4 of the Met Office WCS use cases. The ensemble parameter is specific to the Met Office.

## B.1.4 Sub-Setting Gridded Data

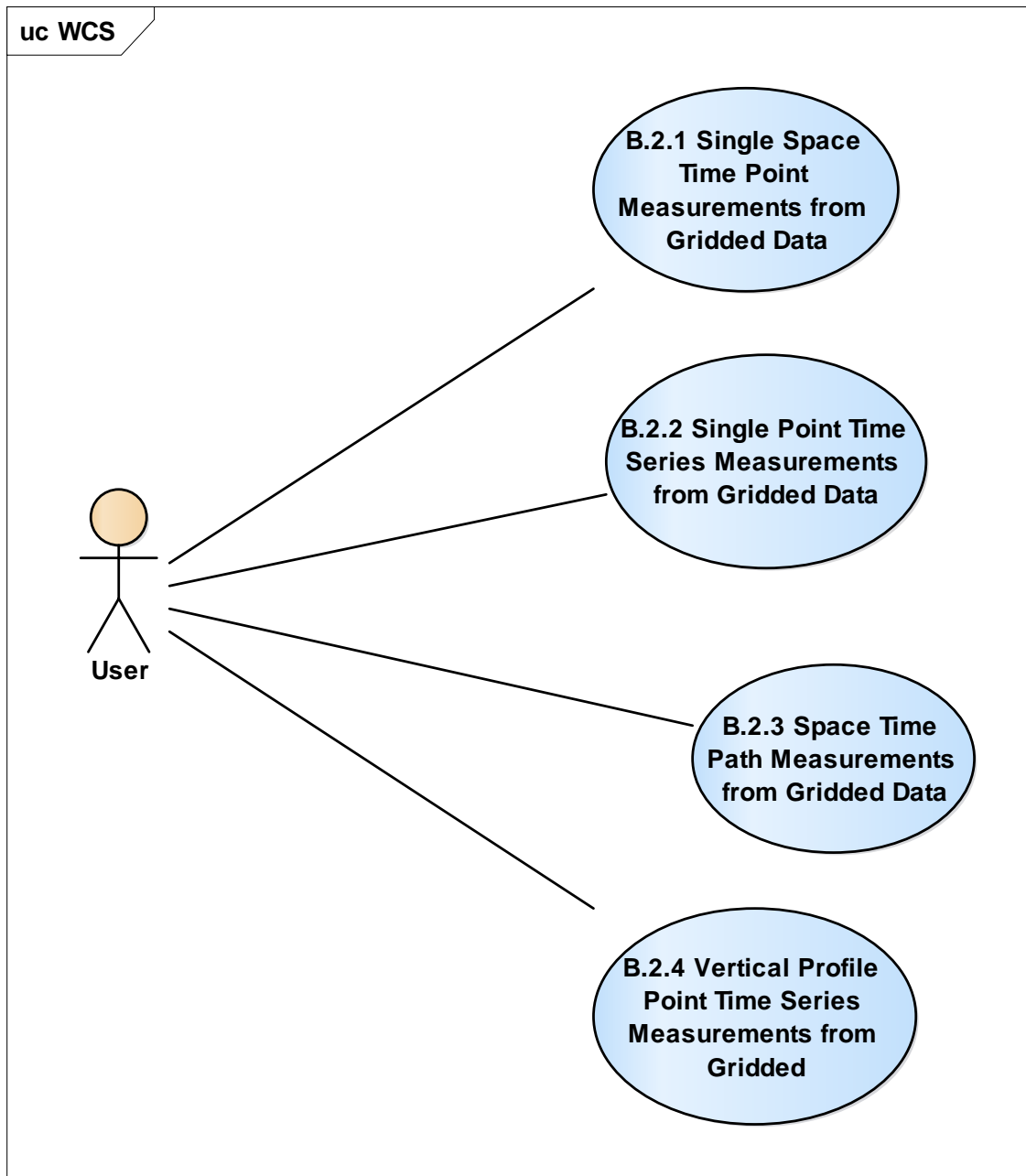
<b>Title</b>	Sub-setting gridded data
<b>Overview</b>	This use case describes how a client retrieves a sub-set of the original data defined over a specific space and/or time from a gridded data set served through a WCS. An interpolation method may be selected to allow measurements to be returned from an exact coordinate instead of the nearest grid point.
<b>Example Usage</b>	<p>1. [MO] A decision support system needs high resolution gridded data for a given volume, at a specific time to provide an air traffic controller with local forecast for wind and rainfall within the vicinity of the airport; the area of interest is a 100 km box centred at a specific airport. The data is to stay on the original grid and at the same resolution i.e. there will be no change in resolution or projection, thus no interpolation will take place.</p> <p>2. [ALL] A dataset is required that is created from “sampling” the parent grid. In order to achieve this, data will need to be sampled e.g. every other grid point, with no interpolation taking place, and missing data will not be “filled” in.</p> <p>3. [ALL] A dataset is required that is regularly spaced in space and time. Most output streams from NWP models have data that is missing, either in time or space and the missing data will have to be “created” using the data that are present. There will normally be a number of interpolation methods and these will have to be advertised by the service provider.</p> <p>4. [ALL] The user requires the data on a different resolution from that of the parent grid. The data may be re-projected, both in the horizontal and vertical. The resolution of the data will be changed and therefore the new grid resolution will be required.</p>
<b>Actors</b>	<input type="checkbox"/> User <input type="checkbox"/> Client application <input type="checkbox"/> WCS
<b>Preconditions</b>	<input type="checkbox"/> User has determined that the WCS offers the desired parameter(s) through the DescribeCoverage and GetCapabilities operations. <input type="checkbox"/> User has determined the required location and times.
<b>Main Flow</b>	<p>STEP 1: User sets the following input specification on the Client application [Service Name, Coverage ID, Location (inc. CRS), Times, Field Name(s), Interpolation Method(s)].</p> <p>STEP 2: User submits a GetCoverage request to the WCS, through the Client application based on the input parameters.</p> <p>STEP 3: WCS determines the nearest grid point(s) to the specified location and times.</p> <p>STEP 4: WCS compiles the requested data set by slicing, trimming, and interpolating (if required) the coverage according to the space/time coordinates and field name(s).</p> <p>STEP 5: WCS returns a response to the Client application.</p> <p>STEP 6: The User receives the response from the WCS through the Client application.</p>
<b>Post-condition</b>	The coverage retrieved from the Client application is presented to the user.
<b>Note</b>	This use case is derived from version 0.4 of the Met Office WCS use cases.



## B.1.5 Static Vertical Profile Path Measurements from Gridded Data

<b>Title</b>	Static vertical profile path measurements from gridded data
<b>Overview</b>	This use case describes how a client retrieves vertical profile measurements along a path in space for a fixed time from a gridded data set served through a WCS. An interpolation method may be selected to allow measurements to be returned from an exact coordinate instead of the nearest grid point.
<b>Example Usage</b>	<p>1. [MO] In order to perform threshold analysis and locate the position of a weather front a weather forecaster needs to know the vertical profile of temperature and wind along a baseline. The data should not be interpolated in the vertical or along the baseline as this may smear the fine detailed temperature and humidity gradients.</p> <p>2. [MO] For presentation purposes a user desires to plot parameters along a cross section and display on an aviation chart, as the plotting software can only cope with data at regular intervals the data will need to be interpolated in the vertical and horizontal.</p> <p>3. [UKHO] A survey ship sails along a given route and needs forecasts of the currents (at various depths).</p>
<b>Actors</b>	<input type="checkbox"/> User <input type="checkbox"/> Client application <input type="checkbox"/> WCS <input type="checkbox"/> WFS
<b>Preconditions</b>	<input type="checkbox"/> User has determined that the WCS offers the desired parameter(s) through the DescribeCoverage and GetCapabilities operations. <input type="checkbox"/> User has determined the required location and times.
<b>Main Flow</b>	<p>STEP 1: User sets the following input specification on the Client application [Service Name, Coverage ID, Path (route name or space/time way points), Field Name(s), Interpolation Method(s)].</p> <p>STEP 2: User submits a GetCoverage request to the WCS, through the Client application based on the input parameters.</p> <p>STEP 3: If the path is defined by a name, a WFS is used to retrieve the way points.</p> <p>STEP 4: WCS determines the nearest grid point(s) to the specified path.</p> <p>STEP 5: WCS compiles the requested data set by slicing, trimming, and interpolating (if required) the coverage according to the path and field name(s).</p> <p>STEP 6: WCS returns a response to the Client application.</p> <p>STEP 7: The User receives the response from the WCS through the Client application.</p>
<b>Post-condition</b>	The coverage retrieved from the Client application is presented to the user.
<b>Note</b>	This use case is derived from version 0.4 of the Met Office WCS use cases.

## B.2 Not yet supported use cases



*Figure 5 : WCS use cases not supported by this profile*

## B.2.1 Single Space Time Point Measurements from Gridded Data

<b>Title</b>	Single space time point measurements from gridded data
<b>Overview</b>	This use case describes how a client retrieves measurements at a single point fixed in time and space from a gridded data set served through a WCS. An interpolation method may be selected to allow measurements to be returned from an exact coordinate instead of the nearest grid point.
<b>Example Usage</b>	<ol style="list-style-type: none"> <li>1. [MO] Extract a temperature value for a point located at 50N, 10.0E, level 500hPa and for a time 2012-05-15T06:00:00Z from the parent grid. The data needs to be encoded in a number of formats to include JSON and GML. The data is to be extracted from the nearest grid point, i.e. no interpolation to take place either in time or space.</li> <li>2. [MO] As UC1.1 except both temperature and humidity values are required.</li> <li>3. [MO] As UC1.2 except the data is to be extracted for the exact location i.e. interpolation to take place either in time or space. Note that there may be a choice in the interpolation method used.</li> <li>4. [MO] As UC1.3 except measurements from all ensemble members are required.</li> <li>5. [UKHO] Extract a depth value for a point located at 50N 0E from the parent grid. The data is to be extracted from the nearest grid point, i.e. no interpolation to take place either in time or space.</li> </ol>
<b>Actors</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> User</li> <li><input type="checkbox"/> Client application</li> <li><input type="checkbox"/> WCS</li> </ul>
<b>Preconditions</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> User has determined that the WCS offers the desired parameter(s) through the DescribeCoverage and GetCapabilities operations.</li> <li><input type="checkbox"/> User has determined the required location (space and/or pressure) and time.</li> </ul>
<b>Main Flow</b>	<p>STEP 1: User sets the following input specification on the Client application [Service Name, Coverage ID, Location (inc. CRS), Time, Field Name(s), Interpolation Method(s), Ensemble Number].</p> <p>STEP 2: User submits a GetCoverage request to the WCS, through the Client application based on the input parameters.</p> <p>STEP 3: WCS determines the nearest grid point(s) to the specified location and time.</p> <p>STEP 4: WCS compiles the requested data set by slicing and interpolating (if required) the coverage according to the space/time (and ensemble) coordinates and field name(s).</p> <p>STEP 5: WCS returns a response to the Client application.</p> <p>STEP 6: The User receives the response from the WCS through the Client application.</p>
<b>Post-condition</b>	The coverage retrieved from the Client application is presented to the user.
<b>Note</b>	This use case is derived from version 0.4 of the Met Office WCS use cases. The ensemble parameter is specific to the Met Office NWP models.

## B.2.2 Single Point Time Series Measurements from Gridded Data

<b>Title</b>	Single point time series measurements from gridded data
<b>Overview</b>	This use case describes how a client retrieves time series measurements at a single point fixed in space from a gridded data set served through a WCS. An interpolation method may be selected to allow measurements to be returned from an exact coordinate instead of the nearest grid point.
<b>Example Usage</b>	<ol style="list-style-type: none"> <li>1. [MO DGC] A user wishes to plot rainfall rate over time for a given 3D fixed point so that threshold analysis can be performed to find a weather window (e.g. rainfall rate less than 16.0mm per hour). The data needs to be encoded in a number of formats to include JSON and GML. The data is to be extracted from the nearest grid point, i.e. no interpolation to take place either in time or space.</li> <li>2. [MO DGC] As UC2.1 except both rainfall rate and temperature values are required.</li> <li>3. [MO DGC] As UC2.2 except the data is to be extracted for the exact location and time intervals, i.e. interpolation to take place either in time or space. Note that there may be a choice in the interpolation method used.</li> <li>4. [UKHO] A user wishes to inspect the sea level at a specific location over a 24 hour period on a specific day to reveal the high and low tides. Interpolation may be required in both space and time.</li> </ol>
<b>Actors</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> User</li> <li><input type="checkbox"/> Client application</li> <li><input type="checkbox"/> WCS</li> </ul>
<b>Preconditions</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> User has determined that the WCS offers the desired parameter(s) through the DescribeCoverage and GetCapabilities operations.</li> <li><input type="checkbox"/> User has determined the required location (space and/or pressure) and time.</li> </ul>
<b>Main Flow</b>	<p>STEP 1: User sets the following input specification on the Client application [Service Name, Coverage ID, Location (inc. CRS), Time, Field Name(s), Interpolation Method(s), Ensemble Number].</p> <p>STEP 2: User submits a GetCoverage request to the WCS, through the Client application based on the input parameters.</p> <p>STEP 3: WCS determines the nearest grid point(s) to the specified location and times.</p> <p>STEP 4: WCS compiles the requested data set by slicing, trimming, and interpolating (if required) the coverage according to the space/time coordinates and field name(s).</p> <p>STEP 5: WCS returns a response to the Client application.</p> <p>STEP 6: The User receives the response from the WCS through the Client application.</p>
<b>Post-condition</b>	The coverage retrieved from the Client application is presented to the user.
<b>Note</b>	This use case is derived from version 0.4 of the Met Office WCS use cases.

### B.2.3 Space Time Path Measurements from Gridded Data

<b>Title</b>	Space time path measurements from gridded data
<b>Overview</b>	This use case describes how a client retrieves measurements along a path in space and time from a gridded data set served through a WCS. An interpolation method may be selected to allow measurements to be returned from an exact coordinate instead of the nearest grid point.
<b>Example Usage</b>	<ol style="list-style-type: none"> <li>1. [MO DGC] A client wishes to extract the forecast for surface wind along a major route i.e. a snap shot at a specific point in time. The route will be defined by either a route name, or if the route is not named, a series of way points defined in space. The data needs to be encoded in a number of formats to include JSON and GML. The data is to be interpolated for each segment from the grid for a specific time.</li> <li>2. [MO DGC] As UC3.1 except the route is defined in both space and time for a specific journey. The output data may be interpolated in both space and time.</li> <li>3. [MO] As UC3.2 except an aircraft controller wishes to extract forecast winds for a flight corridor.</li> </ol>
<b>Actors</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> User</li> <li><input type="checkbox"/> Client application</li> <li><input type="checkbox"/> WCS</li> <li><input type="checkbox"/> WFS</li> </ul>
<b>Preconditions</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> User has determined that the WCS offers the desired parameter(s) through the DescribeCoverage and GetCapabilities operations.</li> <li><input type="checkbox"/> User has determined the required location (space and/or pressure) and time.</li> </ul>
<b>Main Flow</b>	<p>STEP 1: User sets the following input specification on the Client application [Service Name, Coverage ID, Path (route name or space/time way points), Field Name(s), Interpolation Method(s)].</p> <p>STEP 2: User submits a GetCoverage request to the WCS, through the Client application based on the input parameters.</p> <p>STEP 3: If the path is defined by a name, a WFS is used to retrieve the way points.</p> <p>STEP 4: WCS determines the nearest grid point(s) to the specified path.</p> <p>STEP 5: WCS compiles the requested data set by slicing, trimming, and interpolating (if required) the coverage according to the path and field name(s).</p> <p>STEP 6: WCS returns a response to the Client application.</p> <p>STEP 7: The User receives the response from the WCS through the Client application.</p>
<b>Post-condition</b>	The coverage retrieved from the Client application is presented to the user.
<b>Note</b>	This use case is derived from version 0.4 of the Met Office WCS use cases.

## B.2.4 Vertical Profile Point Time Series Measurements from Gridded

<b>Title</b>	Vertical profile point time series measurements from gridded data
<b>Overview</b>	This use case describes how a client retrieves vertical profile time series measurements at a fixed location from a gridded data set served through a WCS. An interpolation method may be selected to allow measurements to be returned from an exact coordinate instead of the nearest grid point.
<b>Example Usage</b>	<p>1. [MO] A user wishes to know when fog is likely to clear. This requires knowledge of when the boundary layer inversion is likely to break down and this can be ascertained from a time series profile for temperature at the specific location. The data needs to be encoded in a number of formats to include JSON and GML. The data is to be extracted from the nearest grid point, i.e. no interpolation to take place either in time or space as the integrity of the data is paramount.</p> <p>2. [MO] As per UC5.1, but in order to make a probabilistic forecast all the model ensemble members are required.</p> <p>3. [MO] A user wishes to know when a cold front is likely to pass through as this will cause an increase in wind gust and a sharp veering of the wind. The time series of a vertical profile of wind speed and direction will help in pin pointing the exact time. The data needs to be encoded in a number of formats to include JSON and GML. The data is to be extracted from the exact location and at every 10 minutes. Interpolation both in time and space will be required.</p> <p>4. [UKHO] In order to investigate underwater sound propagation a user requires the vertical temperature and salinity profile as a function of time. The data is to be extracted from the nearest grid point and at every 10 minutes. Interpolation in time will be required.</p>
<b>Actors</b>	<input type="checkbox"/> User <input type="checkbox"/> Client application <input type="checkbox"/> WCS
<b>Preconditions</b>	<input type="checkbox"/> User has determined that the WCS offers the desired parameter(s) through the DescribeCoverage and GetCapabilities operations. <input type="checkbox"/> User has determined the required location and times.
<b>Main Flow</b>	<p>STEP 1: User sets the following input specification on the Client application [Service Name, Coverage ID, Location (inc. CRS), Times, Field Name(s), Interpolation Method(s), Ensemble Number(s)].</p> <p>STEP 2: User submits a GetCoverage request to the WCS, through the Client application based on the input parameters.</p> <p>STEP 3: WCS determines the nearest grid point(s) to the specified location and times.</p> <p>STEP 4: WCS compiles the requested data set by slicing, trimming, and interpolating (if required) the coverage according to the space/time (and ensemble) coordinates and field name(s).</p> <p>STEP 5: WCS returns a response to the Client application.</p> <p>STEP 6: The User receives the response from the WCS through the Client application.</p>
<b>Post-condition</b>	The coverage retrieved from the Client application is presented to the user.
<b>Note</b>	This use case is derived from version 0.4 of the Met Office WCS use cases.

# Annex C – Examples

## (Informative)

### C.1 Example 1 : GetCapabilities

<http://www.dgiwg.ign.fr?service=wcs&version=2.0.1&request=getcapabilities>

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<wcs:Capabilities updateSequence="20150604T120000Z" version="2.0.1"
xmlns:wcs="http://www.opengis.net/wcs/2.0" xmlns:ows="http://www.opengis.net/ows/2.0"
xmlns:crs="http://www.opengis.net/wcs/service-extension/crs/1.0"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xsi:schemaLocation="http://www.opengis.net/wcs/2.0
http://schemas.opengis.net/wcs/2.0/wcsAll.xsd">
  <ows:ServiceIdentification>
    <ows:Title>DGIWG minimal WCS 2.0 Geo profile instance</ows:Title>
    <ows:Abstract>This server implements the DGIWG WCS Geo Profile v0.4.8 (draft) of
WCS 2.0. It implements minimum requirements and recommendations.</ows:Abstract>
    <ows:Keywords>
      <!-- Keywor list to be updated according to IGD input-->
      <ows:Keyword>elevation</ows:Keyword>
      <ows:Keyword>orthoimagery</ows:Keyword>
      <ows:Keyword>thematicClassification</ows:Keyword>
      <ows:Keyword>physicalMeasurement</ows:Keyword>
      <ows:Keyword>mixed</ows:Keyword>
    </ows:Keywords>
    <ows:ServiceType codeSpace="OGC">WCS</ows:ServiceType>
    <ows:ServiceTypeVersion>2.0.1</ows:ServiceTypeVersion>
    <!--Conformance to DGIWG WCS Geo Profile v 0.5.0-->
    <ows:Profile>urn:dgiwg:service:DGIWG_XXX_WCS_2.0_GeoProfile</ows:Profile>
    <!--WCS Core support-->
    <ows:Profile>http://www.opengis.net/spec/WCS/2.0/conf/core</ows:Profile>
    <!--GMLCOV support-->
    <ows:Profile>http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-
coverage</ows:Profile>
    <ows:Profile>http://www.opengis.net/spec/GMLCOV/1.0/conf/multipart</ows:Profile>
    <ows:Profile>http://www.opengis.net/spec/GMLCOV/1.0/conf/special-
format</ows:Profile>
    <ows:Profile>http://www.opengis.net/spec/GMLCOV_geotiff-
coverages/1.0/conf/geotiff-coverage</ows:Profile>
    <!--binding support-->
    <ows:Profile>http://www.opengis.net/spec/WCS_protocol-binding_get-
kvp/1.0/conf/get-kvp</ows:Profile>
    <ows:Profile>http://www.opengis.net/spec/WCS_protocol-binding_post-
xml/1.0/conf/post-xml</ows:Profile>
    <!--extensions support-->
    <ows:Profile>http://www.opengis.net/spec/WCS_service-
extension_crs/1.0/conf/crs</ows:Profile>
    <ows:Profile>http://www.opengis.net/spec/WCS_service-extension_crs/1.0/conf/crs-
gridded-coverage</ows:Profile>
```

```

<ows:Profile>http://www.opengis.net/spec/WCS_service-
extension_interpolation/1.0/conf/interpolation</ows:Profile>
<ows:Profile>http://www.opengis.net/spec/WCS_service-
extension_scaling/1.0/conf/scaling</ows:Profile>
<ows:Profile>http://www.opengis.net/spec/WCS_service-extension_range-
subsetting/1.0/conf/record-subsetting</ows:Profile>
<ows:Fees>None</ows:Fees>
<ows:AccessConstraints>None</ows:AccessConstraints>
</ows:ServiceIdentification>
<ows:ServiceProvider>
<ows:ProviderName>IGN</ows:ProviderName>
<ows:ProviderSite xlink:href="http://www.ign.fr" xlink:type="simple"/>
<ows:ServiceContact>
<ows:IndividualName>Dimitri Sarafinof</ows:IndividualName>
<ows:PositionName>Standardization Manager</ows:PositionName>
<ows:ContactInfo>
<ows:Phone>
<ows:Voice>Provided on request</ows:Voice>
<ows:Facsimile>None</ows:Facsimile>
</ows:Phone>
<ows:Address>
<ows:DeliveryPoint>73 avenue de Paris</ows:DeliveryPoint>
<ows:City>SAINT MANDE</ows:City>
<ows:AdministrativeArea>ILE DE
FRANCE</ows:AdministrativeArea>
<ows:PostalCode>94165</ows:PostalCode>
<ows:Country>FRANCE</ows:Country>

<ows:ElectronicMailAddress>support@ign.fr</ows:ElectronicMailAddress>
</ows:Address>
<ows:OnlineResource xlink:href="http://www.ign.fr" xlink:type="simple"/>
<ows:HoursOfService>Mon - Fri 8:30 - 17:00 CET and CEST
respectively excl. French holidays</ows:HoursOfService>
<ows:ContactInstructions>E-mails are usually answered within 3 working
days.</ows:ContactInstructions>
</ows:ContactInfo>
<ows:Role>Service provider</ows:Role>
</ows:ServiceContact>
</ows:ServiceProvider>
<ows:OperationsMetadata>
<ows:Operation name="GetCapabilities">
<ows:DCP>
<ows:HTTP>
<ows:Get xlink:href="http://dgiwg.ign.fr/wcs?" xlink:type="simple"/>
<ows:Post xlink:href="http://dgiwg.ign.fr/wcs?" xlink:type="simple">
<ows:Constraint name="PostEncoding">
<ows:AllowedValues>
<ows:Value>XML</ows:Value>
</ows:AllowedValues>
</ows:Constraint>
</ows:Post>
</ows:HTTP>

```



```

        </ows:DCP>
    </ows:Operation>
    <ows:Operation name="DescribeCoverage">
        <ows:DCP>
            <ows:HTTP>
                <ows:Get xlink:href="http://dgiwg.ign.fr/wcs?" xlink:type="simple"/>
                <ows:Post xlink:href="http://dgiwg.ign.fr/wcs??"
xlink:type="simple">
                    <ows:Constraint name="PostEncoding">
                        <ows:AllowedValues>
                            <ows:Value>XML</ows:Value>
                        </ows:AllowedValues>
                    </ows:Constraint>
                </ows:Post>
            </ows:HTTP>
        </ows:DCP>
    </ows:Operation>
    <ows:Operation name="GetCoverage">
        <ows:DCP>
            <ows:HTTP>
                <ows:Get xlink:href="http://dgiwg.ign.fr/wcs?" xlink:type="simple"/>
                <ows:Post xlink:href="http://dgiwg.ign.fr/wcs?" xlink:type="simple">
                    <ows:Constraint name="PostEncoding">
                        <ows:AllowedValues>
                            <ows:Value>XML</ows:Value>
                        </ows:AllowedValues>
                    </ows:Constraint>
                </ows:Post>
            </ows:HTTP>
        </ows:DCP>
    </ows:Operation>
    <ows:Constraint name="CountDefault">
        <ows:NoValues/>
        <ows:DefaultValue>10</ows:DefaultValue>
    </ows:Constraint>
</ows:OperationsMetadata>
<wcs:ServiceMetadata>
    <wcs:formatSupported>image/tiff</wcs:formatSupported>
    <wcs:formatSupported>image/jp2</wcs:formatSupported>
    <wcs:Extension>
        <!-- WGS84 lat/long-->

    <crs:crsSupported>http://www.opengis.net/def/crs/EPSG/0/4326</crs:crsSupported>
        <!-- WGS84 long/lat-->

    <crs:crsSupported>http://www.opengis.net/def/crs/OGC/1.3/CRS84</crs:crsSupported>
        <!--WGS 84 / World Mercator-->

    <crs:crsSupported>http://www.opengis.net/def/crs/EPSG/0/3395</crs:crsSupported>
        <!--WGS 84 / UTM zones 30N, 31N and 32N -->

    <crs:crsSupported>http://www.opengis.net/def/crs/EPSG/0/32630</crs:crsSupported>

```

```

<crs:crsSupported>http://www.opengis.net/def/crs/EPSG/0/32631</crs:crsSupported>
<crs:crsSupported>http://www.opengis.net/def/crs/EPSG/0/32632</crs:crsSupported>
  </wcs:Extension>
</wcs:ServiceMetadata>
<wcs:Contents>
  <wcs:CoverageSummary>
    <wcs:CoverageId>Coverage1</wcs:CoverageId>
    <wcs:CoverageSubtype>RectifiedDataset</wcs:CoverageSubtype>
  </wcs:CoverageSummary>
  <wcs:CoverageSummary>
    <wcs:CoverageId>Coverage2</wcs:CoverageId>
    <wcs:CoverageSubtype>RectifiedDataset</wcs:CoverageSubtype>
  </wcs:CoverageSummary>
  <wcs:CoverageSummary>
    <wcs:CoverageId>Coverage3</wcs:CoverageId>
    <wcs:CoverageSubtype>RectifiedDataset</wcs:CoverageSubtype>
  </wcs:CoverageSummary>
  <wcs:Extension>
  </wcs:Extension>
</wcs:Contents>
</wcs:Capabilities>

```

These are a DescribeCoverage request and the corresponding response.

### DescribeCoverage request (Get/KVP)

<http://myWCSserver?service=WCS&version=2.0.0&request=DescribeCoverage&coverageid=myCoverage>

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<wcs:CoverageDescriptions
  xmlns:eop="http://www.opengis.net/eop/2.0"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"
  xmlns:swe="http://www.opengis.net/swe/2.0"
  xmlns:wcs="http://www.opengis.net/wcs/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/2.0
  http://schemas.opengis.net/wcs/2.0/wcsDescribeCoverage.xsd">
  <wcs:CoverageDescription
    gml:id="MER_FRS_1PNPDK20110521_182542_000001913102_00372_48231_6517_RGB">
    <gml:boundedBy>
      <gml:Envelope axisLabels="lat long" srsDimension="2"
        srsName="http://www.opengis.net/def/crs/EPSG/0/4326" uomLabels="deg deg">
        <gml:lowerCorner>31.85719298 -126.69448090</gml:lowerCorner>
        <gml:upperCorner>45.61040878 -110.01309995</gml:upperCorner>
      </gml:Envelope>
    </gml:boundedBy>

```

```

<wcs:CoverageId>myCoverage</wcs:CoverageId>
<gml:domainSet>
  <gml:RectifiedGrid dimension="2" gml:id="myCoverage_RGB_grid">
    <gml:limits>
      <gml:GridEnvelope>
        <gml:low>0 0</gml:low>
        <gml:high>5280 4353</gml:high>
      </gml:GridEnvelope>
    </gml:limits>
    <gml:axisLabels>lat long</gml:axisLabels>
    <gml:origin>
      <gml:Point gml:id="myCoverage_RGB_grid_origin"
srsName="http://www.opengis.net/def/crs/EPSSG/0/4326">
        <gml:pos>45.61040878 -126.69448090</gml:pos>
      </gml:Point>
    </gml:origin>
    <gml:offsetVector
srsName="http://www.opengis.net/def/crs/EPSSG/0/4326">0.00000000
0.00315875</gml:offsetVector>
    <gml:offsetVector
srsName="http://www.opengis.net/def/crs/EPSSG/0/4326">-0.00315875
0.00000000</gml:offsetVector>
  </gml:RectifiedGrid>
</gml:domainSet>
<gmlcov:rangeType>
  <swe:DataRecord>
    <swe:field name="red">
      <swe:Quantity
definition="http://www.opengis.net/def/property/OGC/0/Radiance">
        <swe:description>Red Channel</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"/>
        <swe:constraint>
          <swe:AllowedValues>
            <swe:interval>0 255</swe:interval>
          </swe:AllowedValues>
        </swe:constraint>
      </swe:Quantity>
    </swe:field>
    <swe:field name="green">
      <swe:Quantity
definition="http://www.opengis.net/def/property/OGC/0/Radiance">
        <swe:description>Green Channel</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"/>
                                <swe:constraint>
                                <swe:AllowedValues>
                                <swe:interval>0 255</swe:interval>

                                <swe:significantFigures>3</swe:significantFigures>
                                </swe:AllowedValues>
                                </swe:constraint>
                                </swe:Quantity>
                                </swe:field>
                                <swe:field name="blue">
                                <swe:Quantity
definition="http://www.opengis.net/def/property/OGC/0/Radiance">
                                <swe:description>Blue Channel</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"/>
                                <swe:constraint>
                                <swe:AllowedValues>
                                <swe:interval>0 255</swe:interval>

                                <swe:significantFigures>3</swe:significantFigures>
                                </swe:AllowedValues>
                                </swe:constraint>
                                </swe:Quantity>
                                </swe:field>
                                </swe:DataRecord>
                                </gmlcov:rangeType>
                                <wcs:ServiceParameters>
                                <wcs:CoverageSubtype>RectifiedDataset</wcs:CoverageSubtype>
                                <wcs:nativeFormat>image/tiff</wcs:nativeFormat>
                                </wcs:ServiceParameters>
                                </wcs:CoverageDescription>
                                </wcs:CoverageDescriptions>

```

**Example 5: GetCapabilities response**

## C.2 Example 2 : DescribeCoverage 2D

These are a DescribeCoverage request and the corresponding response.

DescribeCoverage request (Get/KVP)

<http://myWCSserver?service=WCS&version=2.0.0&request=DescribeCoverage&coverageid=myCoverage>

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<wcs:CoverageDescriptions
  xmlns:eop="http://www.opengis.net/eop/2.0"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"
  xmlns:swe="http://www.opengis.net/swe/2.0"
  xmlns:wcs="http://www.opengis.net/wcs/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/2.0
http://schemas.opengis.net/wcs/2.0/wcsDescribeCoverage.xsd">
  <wcs:CoverageDescription
    gml:id="MER_FRS_1PNPDK20110521_182542_000001913102_00372_48231_6517_RGB">
    <gml:boundedBy>
      <gml:Envelope axisLabels="lat long" srsDimension="2"
srsName="http://www.opengis.net/def/crs/EPSSG/0/4326" uomLabels="deg deg">
        <gml:lowerCorner>31.85719298 -126.69448090</gml:lowerCorner>
        <gml:upperCorner>45.61040878 -110.01309995</gml:upperCorner>
      </gml:Envelope>
    </gml:boundedBy>
    <wcs:CoverageId>myCoverage</wcs:CoverageId>
    <gml:domainSet>
      <gml:RectifiedGrid dimension="2" gml:id="myCoverage_RGB_grid">
        <gml:limits>
          <gml:GridEnvelope>
            <gml:low>0 0</gml:low>
            <gml:high>5280 4353</gml:high>
          </gml:GridEnvelope>
        </gml:limits>
        <gml:axisLabels>lat long</gml:axisLabels>
        <gml:origin>
          <gml:Point gml:id="myCoverage_RGB_grid_origin"
srsName="http://www.opengis.net/def/crs/EPSSG/0/4326">
            <gml:pos>45.61040878 -126.69448090</gml:pos>
          </gml:Point>
        </gml:origin>
        <gml:offsetVector
srsName="http://www.opengis.net/def/crs/EPSSG/0/4326">0.00000000
0.00315875</gml:offsetVector>
      </gml:RectifiedGrid>
    </gml:domainSet>
  </wcs:CoverageDescription>
</wcs:CoverageDescriptions>
```

```

        <gml:offsetVector
srsName="http://www.opengis.net/def/crs/EPSG/0/4326">-0.00315875
0.00000000</gml:offsetVector>
    </gml:RectifiedGrid>
</gml:domainSet>
<gml:cov:rangeType>
    <swe:DataRecord>
        <swe:field name="red">
            <swe:Quantity
definition="http://www.opengis.net/def/property/OGC/0/Radiance">
                <swe:description>Red Channel</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"/>
                    <swe:constraint>
                        <swe:AllowedValues>
                            <swe:interval>0 255</swe:interval>

                <swe:significantFigures>3</swe:significantFigures>
                    </swe:AllowedValues>
                </swe:constraint>
            </swe:Quantity>
        </swe:field>
        <swe:field name="green">
            <swe:Quantity
definition="http://www.opengis.net/def/property/OGC/0/Radiance">
                <swe:description>Green Channel</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"/>
                    <swe:constraint>
                        <swe:AllowedValues>
                            <swe:interval>0 255</swe:interval>

                <swe:significantFigures>3</swe:significantFigures>
                    </swe:AllowedValues>
                </swe:constraint>
            </swe:Quantity>
        </swe:field>
        <swe:field name="blue">
            <swe:Quantity
definition="http://www.opengis.net/def/property/OGC/0/Radiance">
                <swe:description>Blue Channel</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"/>
                                <swe:constraint>
                                    <swe:AllowedValues>
                                        <swe:interval>0 255</swe:interval>

                                <swe:significantFigures>3</swe:significantFigures>
                                    </swe:AllowedValues>
                                    </swe:constraint>
                                </swe:Quantity>
                                </swe:field>
                                </swe:DataRecord>
                                </gmlcov:rangeType>
                                <wcs:ServiceParameters>
                                    <wcs:CoverageSubtype>RectifiedDataset</wcs:CoverageSubtype>
                                    <wcs:nativeFormat>image/tiff</wcs:nativeFormat>
                                </wcs:ServiceParameters>
                                </wcs:CoverageDescription>
                                </wcs:CoverageDescriptions>

```

**Example 6: DescribeCoverage response describing a RGB 24 bits coverage**

### C.3 Example 3 : GetCoverage

[http://myWCsserver?service=wcs&version=2.0.1&request=GetCoverage&coverageid=myCoverage&size=long\(669\)&size=lat\(1165\)&format=image/tiff&mediatype=multipart/mixed](http://myWCsserver?service=wcs&version=2.0.1&request=GetCoverage&coverageid=myCoverage&size=long(669)&size=lat(1165)&format=image/tiff&mediatype=multipart/mixed)

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<gmlcov:GridCoverage
  gml:id="MER_FRS_1PNUPA20090701_124435_000005122080_00224_38354_6861_RGB"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"
  xmlns:ows="http://www.opengis.net/ows/2.0"
  xmlns:swe="http://www.opengis.net/swe/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/gmlcov/1.0
http://schemas.opengis.net/gmlcov/1.0/coverage.xsd">
  <gml:boundedBy>
    <gml:Envelope axisLabels="lat long" srsDimension="2"
srsName="http://www.opengis.net/def/crs/EPSG/0/4326" uomLabels="deg deg">
      <gml:lowerCorner>-36.11142057 -55.39807892</gml:lowerCorner>
      <gml:upperCorner>-3.600661039 -36.7188349</gml:upperCorner>
    </gml:Envelope>
  </gml:boundedBy>
  <gml:domainSet>
    <gml:RectifiedGrid dimension="2" gml:id="myCoverage_RGB_grid">
      <gml:limits>
        <gml:GridEnvelope>
          <gml:low>0 0</gml:low>
          <gml:high>668 1164</gml:high>
        </gml:GridEnvelope>
      </gml:limits>
      <gml:axisLabels>lat long</gml:axisLabels>
      <gml:origin>
        <gml:Point gml:id="myCoverage_RGB_grid_origin"
srsName="http://www.opengis.net/def/crs/EPSG/0/4326">
          <gml:pos>-3.600661 -55.398079</gml:pos>
        </gml:Point>
      </gml:origin>
      <gml:offsetVector srsName="http://www.opengis.net/def/crs/EPSG/0/4326">
        0 0.027921</gml:offsetVector>
      <gml:offsetVector srsName="http://www.opengis.net/def/crs/EPSG/0/4326">
        -0.027906 0</gml:offsetVector>
      </gml:RectifiedGrid>
    </gml:domainSet>
    <gml:rangeSet>
      <gml:File>
        <gml:rangeParameters xlink:arcrole="fileReference" xlink:href="myCoverage.tif"
xlink:role="http://www.opengis.net/spec/GMLCOV_geotiff-coverages/1.0/conf/geotiff-coverage"/>
        <gml:fileReference>myCoverage.tif</gml:fileReference>
        <gml:fileStructure/>
        <gml:mimeType>image/tiff</gml:mimeType>
      </gml:File>
    </gml:rangeSet>
  </gmlcov:rangeType>
  <swe:DataRecord>
    <swe:field name="red">
      <swe:Quantity
definition="http://www.opengis.net/def/property/OGC/0/Radiance">
        <swe:description>Red Channel</swe:description>
      </swe:Quantity>
    </swe:field>
  </swe:DataRecord>

```

Lat/long coordinates of the left upper corner

Long and lat spacing

Link to the geotiff coverage



```

        <swe:nilValues/>
        <swe:uom code="W.m-2.Sr-1"/>
        <swe:constraint>
            <swe:AllowedValues>
                <swe:interval>0 255</swe:interval>
                <swe:significantFigures>3</swe:significantFigures>
            </swe:AllowedValues>
        </swe:constraint>
    </swe:Quantity>
</swe:field>
<swe:field name="green">
    <swe:Quantity
definition="http://www.opengis.net/def/property/OGC/0/Radiance">
        <swe:description>Green Channel</swe:description>
        <swe:nilValues/>
        <swe:uom code="W.m-2.Sr-1"/>
        <swe:constraint>
            <swe:AllowedValues>
                <swe:interval>0 255</swe:interval>
                <swe:significantFigures>3</swe:significantFigures>
            </swe:AllowedValues>
        </swe:constraint>
    </swe:Quantity>
</swe:field>
<swe:field name="blue">
    <swe:Quantity
definition="http://www.opengis.net/def/property/OGC/0/Radiance">
        <swe:description>Blue Channel</swe:description>
        <swe:nilValues/>
        <swe:uom code="W.m-2.Sr-1"/>
        <swe:constraint>
            <swe:AllowedValues>
                <swe:interval>0 255</swe:interval>
                <swe:significantFigures>3</swe:significantFigures>
            </swe:AllowedValues>
        </swe:constraint>
    </swe:Quantity>
</swe:field>
</swe:DataRecord>
</gmlcov:rangeType>
</gmlcov:GridCoverage>

```

**Example 7: GetCoverage response (with Multipart description)**

## Annex D – Extended capabilities (Informative)

This annex is based on extensions defined by NGA for WCS 1.0. Same principles may be applied to support same functionalities over a WCS 2.0 implementation.

The *GetCoverage* operation defined by the OGC is very basic. The WCS client initiates an HTTP session and requests a specific coverage. In response, the WCS server streams the coverage to the client in the HTTP session. For large files, alternative dissemination methods by providing the following additional operations may be defined :

- *GetCoverageWithHandler* (Annex D - ) allows clients to have a specific coverage delivered to one or more destinations via FTP/FTPS
- *GetMultipleCoveragesWithHandler* (D.2) allows clients to have one or more specific coverages written to media for physical delivery (or delivered to one or more destinations via FTP/FTPS).

*GetCoverageWithHandler* and *GetMultipleCoveragesWithHandler* operations are asynchronous. In this mode, the *ResponseHandler* parameter in the operation request (1) allows clients to specify information to support the requested dissemination method. After validating the operation request, the service sends an Acknowledgement (2) to the client. At this point, the client is free to terminate the HTTP/HTTPS session. The service processes the operation request and disseminates the coverage(s) as requested by the client (3). In the case of *GetMultipleCoveragesWithHandler*, the service publishes final status to a WNS (4) (eNotification Service, having provided the location from which this status can be obtained in the prior Acknowledgement. Client send *GetMessages* request to the WNS Pullpoint (5). The WNS send *GetMessages* response (containing final status of operation) to client (6).

Actions (5) can be ran as soon as (2) is done but the Final Status (6) will be only transmitted when Response send to FTP/Media (3).

After this, the WCS client know that coverages are available at the provided FTP address/Media

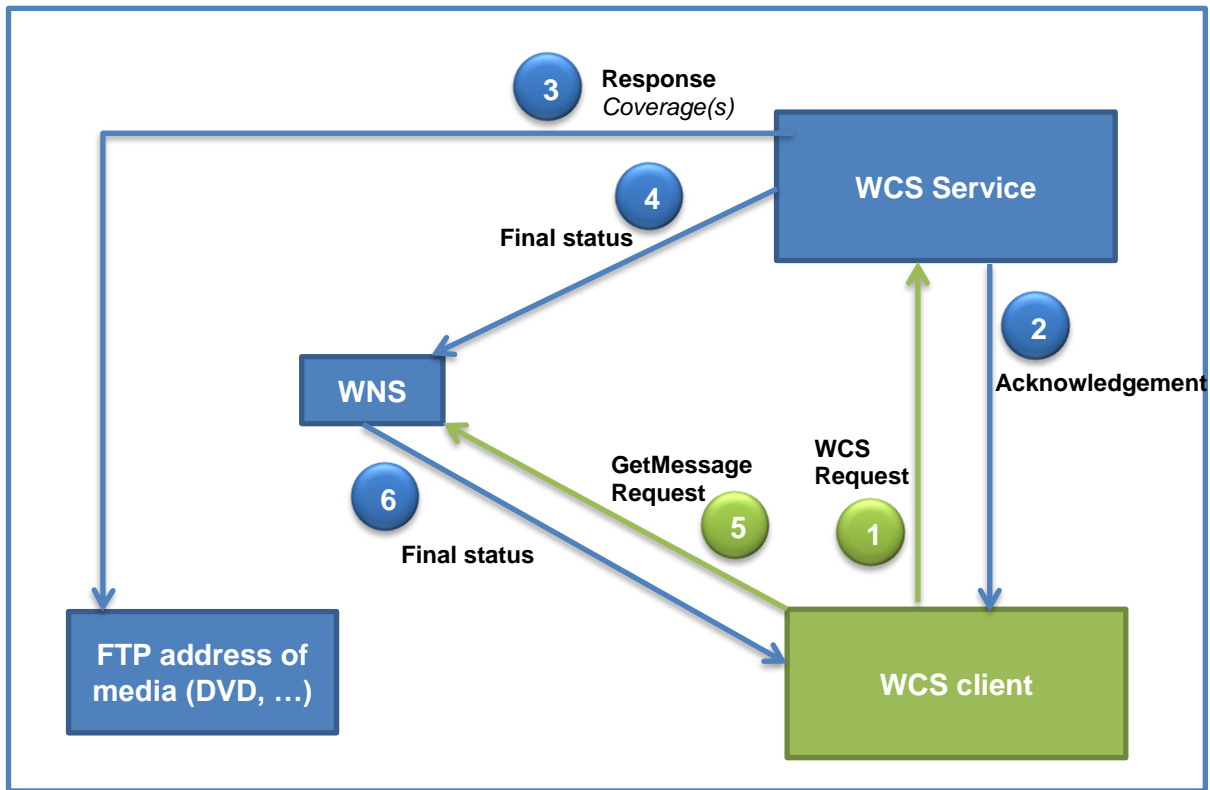


Figure 6 : WCS asynchronous access with a WNS service

## D.1 GetCoverageWithHandler Operation

The GetCoverage operation defined by OGC allows only synchronous delivery of a coverage via the HTTP stream to only one recipient. The asynchronous concept of operation has a use case for a coverage to be disseminated, in a manner that is asynchronous from the request itself, to one or more recipients via FTP/FTPS. As streaming large data (>500MB) is impractical via HTTP/HTTPS, the GetCoverage request is extended with the ResponseHandler parameter. The ResponseHandler parameter is not defined in the OGC WCS 1.0.0; however, it extends the CSW GetRecords ResponseHandler parameter (defined in the OGC CSW 2.0.1) to request asynchronous delivery of the operation response. The ResponseHandler parameter applies only to requests submitted via POST XML or SOAP.

The GetCoverageWithHandler operation allows a WCS client to request asynchronous delivery of a coverage to one or more recipients via FTP/FTPS. The client includes a ResponseHandler parameter in the GetCoverage request for each intended recipient. Each ResponseHandler parameter consists of two parts, the ReceiverProfileName (an extension to the CSW ResponseHandler) and the FTP URL. The WCS service uses the ResponseHandler parameter to perform releasability and binned data checks and to determine the appropriate protocol to use (FTP or FTPS) when disseminating the coverage.

If the GetCoverageWithHandler request is valid, the service returns a GetCoverage Acknowledgement to the client. In parallel, the service performs any required processing on the requested coverage. The coverage is then sent (via FTP or FTPS) to the FTP URL of recipients to which it is releasable.

## D.1.1 GetCoverageWithHandler Request

The GetCoverageWithHandler request extends the WCS GetCoverage request by adding one or more ResponseHandler parameters. Each ResponseHandler parameter consists of two parts, the ReceiverProfileName and the FTP URL. Table 9 describes the structure and content of the ResponseHandler parameter. The Service supports only POST XML and SOAP/WSDL encodings of the GetCoverageWithHandler request.

**Table 9: ResponseHandler**

M+U*	Name	Description	WCS Server Profile
1..∞ if using this parameter; 0 if not using this parameter	ResponseHandler	ResponseHandler data structure	Recognize one or more ResponseHandler data structures
	1 ReceiverProfile Name (See Note)	username of the receiver; the receiver must have a account	Recognize one ReceiverProfileName; use it to perform releasability and binned data checks
	1 FTP URL	Destination for coverage in standard FTP URL format	Recognize one FTP URL; use username:password to send coverage via FTP or FTPS
<p>Note: In the xsd, ReceiverProfileName is optional. This allows requests using Distinguished Name (DN), which do not populate the field, to pass the schema validation. For these requests, the service populates the ReceiverProfileName with the DN taken from the SAML token. Requests that don't use DN and do not supply this information fail after schema validation and receive a "NoApplicableCode" exception.</p>			
<p><b>*Multiplicity and Use:</b> "1" = one (mandatory); "1..∞" = one or more; "0..1" = zero or one (optional); "0..∞" = zero or more</p>			
<p><b>Example with additional details:</b></p> <pre>&lt;wcs:ResponseHandler ReceiverProfileName="LibraryUser"&gt;   URL:ftp://username:password@IP address//url-path &lt;/wcs:ResponseHandler&gt;</pre> <ul style="list-style-type: none"> <li>• <b>LibraryUser</b> is the username for the account user to whom the coverage is to be delivered.</li> <li>• <b>username:password</b> is the ftp username and password for the address to which to deliver the coverage; this username does not necessarily correspond to the LibraryUser</li> <li>• <b>url-path</b> is optional but, if supplied, must not contain a filename. WCS does not support the renaming of coverages by the client. If a filename is supplied it is treated as part of the path and causes the FTP to fail, or possibly end up in an unintended directory.</li> <li>• <b>port</b> is not supported, since the NSG Libraries are configured to use the default FTP port for security reasons. If a port is supplied, it is ignored; this could possibly cause the FTP to fail.</li> </ul>			

Each ReceiverProfileName contains the username of the receiver; this is needed for the service to perform releasability and binned data checks against the receiver's user profile. For example: A client requests a coverage and specifies five ResponseHandlers: one for himself (Receiver 1) and one for each of four others (Receiver 2, Receiver 3, Receiver 4, and Receiver 5). The service checks the user profiles of all five receivers. If the client fails the checks, the entire order is failed. If the client passes the checks, the coverage is sent to him and to any

other receivers who pass the checks, but it is not sent to any receivers who fail the checks. For this example, let's say that the coverage is releasable to the client (Receiver 1) and to Receiver 3 and Receiver 5, but not to Receiver 2 and Receiver 4. In this case, the coverage is sent to Receiver 1, Receiver 3, and Receiver 5, but not to Receiver 2 and Receiver 4.

Each FTP URL contains the information required to allow an FTP or FTPS connection to the receiver. For clients that utilize an FTPS connection to receive coverages, the ResponseHandler is used exactly as shown in Table 9 (i.e. "ftps" is not substituted for "ftp"). The Service user profile for the Library User contains the appropriate protocol to use (FTP vs. FTPS). Continuing the example from above, if the client (Receiver 1) and Receiver 3 uses FTP and Receiver 5 uses FTPS, the service sends the coverage to Receiver 1 via FTP, to Receiver 3 via FTP, and to Receiver 5 via FTPS.

### D.1.2 GetCoverageWithHandler Exception

If the service determines that the GetCoverageWithHandler request is invalid, one of the exceptions defined for the WCS GetCoverage operation is returned in an XML document.

### D.1.3 GetCoverageWithHandler Acknowledgement

If the service determines that the GetCoverageWithHandler request is valid, it returns an Acknowledgement message to the client. The client can consider receipt of the Acknowledgement as confirmation that the request was valid and has been accepted for processing. At this point, the requesting client is free to terminate the HTTPS session. Table 10 describes the structure and content of the Acknowledgement message.

**Table 10: GetCoverageWithHandler Acknowledgement**

M+U*	Name	Description	WCS Server Profile	
1	Acknowledgement	Acknowledgement data structure	Include one Acknowledgement data structure	
	1	TimeStamp	Date and time created	Include TimeStamp
	1	EchoedRequest	An copy of the request message body	Include copy of request message body
	0..1	RequestId	Identifier for polling purposes	Not useful for ConOps
* <b>Multiplicity and Use:</b> "1" = one (mandatory); "1..∞" = one or more; "0..1" = zero or one (optional); "0..∞" = zero or more				

### D.1.4 GetCoverageWithHandler Processing

In parallel with sending the acknowledgement, the service processes the order as it would for a GetCoverage request. (If an unexpected error occur within the CORBA domain, an error file containing the exception is sent, via FTP or FTPS, to the FTP URL specified in each ResponseHandler parameter.) After successful processing, the service delivers the coverage to the requested receivers to which the coverage is releasable via FTP or FTPS (depending on information in each receiver's user profile). The service sends a ".done" file to the destination(s) as final notification. The requesting client does not know if the coverage was successfully delivered to other destinations.

## D.2 GetMultipleCoveragesWithHandler Operation

The GetCoverage operation defined by OGC allows only synchronous delivery of a coverage via the HTTP stream. This operation support the use case for multiple coverages to be disseminated in a manner that is asynchronous from the request itself. Present GIAS capability allows electronic and media orders to contain requests for multiple products. To provide similar WCS functionality, the service provides a *GetMultipleCoveragesWithHandler* operation that allows clients to have one or more specific coverages written to media for physical delivery (or delivered to one or more destinations via FTP/FTPS).

As there may be up to 24 hours before a media order is actually processed, only asynchronous operation mode is supported for WCS media orders.

As with the *GetCoverageWithHandler* operation, the *GetMultipleCoveragesWithHandler* operation uses an Acknowledgement and disseminates coverages in a manner that is asynchronous from the request itself. *GetMultipleCoveragesWithHandler* goes one step further than *GetCoverageWithHandler* and publishes the final status to the Web Notification Service (WNS).

### D.2.1 GetMultipleCoveragesWithHandler Request

The *GetMultipleCoveragesWithHandler* request builds on the GetCoverage request by allowing multiple coverages to be specified. For media orders, the MediaResponseHandler allows the media type, quantity, and receiver information to be specified. [For electronic orders, it allows FTP redirection as in *GetCoverageWithHandler* (Annex D - ) . Table 11 describes the structure and content of the *GetMultipleCoveragesWithHandler* request. The service supports only SOAP/WSDL encodings of the *GetMultipleCoveragesWithHandler* request.

**Table 11: GetMultipleCoveragesWithHandler Request**

M+U*	Name	Description	WCS Server Profile
1	Service	Service type identifier	Recognize "WCSX"
1	Version	Specification version	Recognize "1.0.0"
1..∞	GetCoverage	GetCoverage data structure	Recognize one or more GetCoverage data structures
0..1 (See Note)	MediaResponseHandler	MediaResponseHandler data structure	Recognize zero or one MediaResponseHandler data structure
	1    MediaType	Type of media to write coverage(s) to; presently only single-layer DVD and double-layer DVD (DVD-DL) are supported	Recognize "DVD" or "DVD-DL"
	1    Quantity	Number of copies of the media; presently only one copy supported	Recognize "1"
	1    Receiver	Receiver of media	Verify that receiver has a valid user account and is authorized at least one of the requested coverages

M+U*	Name	Description	WCS Server Profile	
1	ShippingInfo	ShippingInfo data structure	Recognize one ShippingInfo data structure	
	1	CustomerName	Name of customer	Use for shipping manifest; return exception if not provided (See Note)
	1	Organization	Organization of customer	Use for shipping manifest; return exception if not provided (See Note)
	1	Address1	First line of customer address	Use for shipping manifest; return exception if not provided (See Note)
	0..1	Address2	Second line of customer address	Use for shipping manifest if provided
	0..1	Address3	Third line of customer address	Use for shipping manifest if provided
	1	City	City part of customer address	Use for shipping manifest; return exception if not provided (See Note)
	1	State	State part of customer address	Use for shipping manifest; return exception if not provided (See Note)
	1	ZipCode	ZipCode part of customer address	Use for shipping manifest; return exception if not provided (See Note)
	1	Country	Country part of customer address	Use for shipping manifest; return exception if not provided (See Note)
	1	PhoneNumber	PhoneNumber of customer	Use for shipping manifest; return exception if not provided (See Note)
	1	EmailAddress	EmailAddress of customer	Use for shipping manifest; return exception if not provided (See Note)
Note: Although the xsd shows this field as optional (for future flexibility), the implementation presently requires this field and returns a generic BAE exception if the field is not provided.				
Note: MediaResponseHandler data structure is only needed if a media order is intended.				
0..1 (See Note)	FtpResponseHandler	FtpResponseHandler data structure	Recognize one FTPResponseHandler data structures	
	1..∞	ResponseHandler	ResponseHandler data structure (See Table 9)	Recognize one or more ResponseHandler data structures
Note: The FtpResponseHandler data structure is only needed if an electronic order is intended (TBD-001).				
<b>*Multiplicity and Use:</b> "1" = one (mandatory); "1..∞" = one or more; "0..1" = zero or one (optional); "0..∞" = zero or more				

## D.2.2 GetMultipleCoveragesWithHandler Exception

If the service determines that the *GetMultipleCoveragesWithHandler* request is invalid, one of the exceptions defined for the WCS GetCoverage operation is returned in an XML document.

### D.2.3 GetMultipleCoveragesWithHandler Acknowledgement

If the service determines that the *GetMultipleCoveragesWithHandler* request is valid, it returns an Acknowledgement message to the client. The client can consider receipt of the Acknowledgement as confirmation that the request was valid and has been accepted for processing. At this point, the requesting client is free to terminate the HTTPS session. The Acknowledgment contains a RequestId to uniquely identify the order and the URI of the WNS ExportPullPoint from which the client can later obtain final status. Table 12 describes the structure and content of the Acknowledgement message.

**Table 12: GetMultipleCoveragesWithHandler Acknowledgement**

M+U*	Name	Description	WCS Server Profile
1	Acknowledgement	Acknowledgement data structure	Include one Acknowledgement data structure
1	TimeStamp	Date and time created	Include TimeStamp
1	EchoedRequest	An copy of the request message body	Include copy of request message body
1	RequestId	Identifier for polling purposes	Include export job identifier
1	ExportPullPoint	WNS URI to access for final status	Include URI to WNS ExportPullPoint
*Multiplicity and Use: "1" = one (mandatory); "1..∞" = one or more; "0..1" = zero or one (optional); "0..∞" = zero or more			

### D.2.4 GetMultipleCoveragesWithHandler Processing and Final Status

In parallel with sending the acknowledgement, the service performs any required processing on the requested coverage. For media orders, the service copies the releasable coverage(s) to the specified media, and the operator prints the receiver and shipping information in preparation for delivery of the media. [For electronic orders, the Service delivers the coverage(s) to the requested receivers to which the coverages are releasable via FTP or FTPS.] At this point, the operation is complete.

The final status of the *GetMultipleCoveragesWithHandler* operation is sent to the WNS, where it is published to the ExportPullPoint. Note that the WNS status does not divulge information about products to which the requester is not authorized. If a request is made for such products, the status is silent with respect to those products (i.e., their existence is not acknowledged.) At some point in time, the client sends a GetMessages request to the WNS ExportPullPoint. After authenticating the client and validating the request, the WNS sends the GetMessages response (containing the final status of the *GetMultipleCoveragesWithHandler* operation) to the client. The client then correlates the final status to the previous *GetMultipleCoveragesWithHandler* request. The GetMessages operation is described in the WNS Implementation Profile.