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**A MetOcean NWP metadata profile for WCS2.0**

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1. Abstract

This document defines a MetOcean NWP profile consisting of an information model and an XML encoding for the following two WCS2.0 operations:

1. *GetCapabilities -* a WCS server describes the services and operations via a GetCapabilities document.
2. *DescribeCoverage* *-* a WCS server describes the contents of a specific coverage via a DescribeCoverage document.

Metadata and vocabularies are defined that provide interoperability of these operations and documents using common semantics. The information model proposed supports MetOcean specific concepts, but these may be useful in other communities.

1. Keywords

The following are keywords to be used by search engines and document catalogues.

WCS, coverage, collection, meteorology, oceanography, NWP, analysis, result mask, observation, measurement, O&M and MetOcean

1. Preface

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

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

1. Submitting organizations

The following organizations submitted this Document to the Open Geospatial Consortium Inc.

Met Office, UK

1. Submitters

All questions regarding this submission should be directed to the editor or the submitters:

|  |  |
| --- | --- |
| Name | Company |
| Peter Trevelyan | Met Office, UK |

1. Scope

The purpose of this Met Ocean profile of WCS2.0 is to define the metadata returned in the response documents resulting from the WCS2.0 operations: GetCapabilities, and DescribeCoverage; and for use within the meteorological and oceanographic communities.

This work has been done by members of the OGC MetOcean Domain Working Group.

1. Conformance

This standard defines:

* A MetOcean application profile that outlines the MetOcean specific metadata to be part of the DescribeCoverage response.
* An amended GetCapabilities operation whose response provides a means of grouping together coverages and coverage collections such that the response document can reflect a user defined hierarchy, a client application may request this information about Coveragecollection resources in a *GetCapabilities* response by specifying the token *offeredCollections* in the Sections element of the GetCapabilities request.

Requirements for two standardization target types are considered:

* Key –value pair (KVP) protocol binding
* XML/POST protocol binding

Conformance with this standard shall be checked using all the relevant tests specified in Annex A (normative) of this document. The framework, concepts, and methodology for testing, and the criteria to be achieved to claim conformance are specified in the OGC Compliance Testing Policies and Procedures and the OGC Compliance Testing web site[[1]](#footnote-1).

In order to conform to this OGC™interface standard, a software implementation shall choose to implement:

Any one of the conformance levels specified in Annex A (normative) .

All requirements-classes and conformance-classes described in this document are owned by the standard(s) identified.

This document establishes the following requirements and conformance classes:-

***metocean\_Nwp-Observation* of URI**

**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_NwpObservation** defining the metocean\_NwpObservation at a conceptual level in clause 8.1; the corresponding conformance class is metocean\_NwpObservation **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_NwpObservation**

***metocean\_NwpModel* of URI**

**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_NwpModel** defining the metocean\_NwpModel at a conceptual level in clause 8.2; the corresponding conformance class is metocean\_NwpModel **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_NwpModel**

***metocean\_NwpResultMask* of URI**

**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_NwpResultMask** defining the metocean\_NwpResultMask at a conceptual level in clause 8.3; the corresponding conformance class is metocean\_NwpResultMask **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_NwpResultMask**

***metocean\_GetCapabilities* of URI**

**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilitiesGroups**

defining the metocean\_GetCapabilites response in clause 8.4 the corresponding conformance class with URI

**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_GetCapabilitiesGroups**

***GetCapabilities-RelatedCoverageCollection of URI***

[**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilities**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_GetCapabilities)\_**RelatedCoverageCollection** defining the structure of the related coverage collection in clause 8.5 the corresponding conformance class with URI

[**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_GetCapabilities**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/conf/metocean/metocean_GetCapabilities)\_**RelatedCoverageCollection**

***GetCapabilities-RelatedCoverage of URI***

[**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilities**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_GetCapabilities)**\_RelatedCoverage** defining the structure of the related coverage in clause 8.6 the corresponding conformance class with URI

[**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_GetCapabilities**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/conf/metocean/metocean_GetCapabilities)**\_RelatedCoverage**

***metocean\_DescribeCoverage* of URI**

**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_DescribeCoverage** defining the metocean\_DescribeCoverage response in clause 8.7, the corresponding conformance class with URI

**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_DescribeCoverage**

1. References

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

OGC 08-131r3 – The Specification Model – A Standard for Modular Specification

ISO 19103:2005 – Geographic information - Conceptual schema language

ISO 8601:2004 - Data elements and interchange formats – Information interchange – Representation of dates and times

OGC Abstract Specification Topic 1 – Feature geometry (aka ISO 19107)

OGC Abstract Specification Topic 2 – Spatial Referencing by Coordinates (aka ISO 19111:2007)

OGC Abstract Specification Topic 6 – Schema for Coverage geometry and functions (aka ISO 19123:2005)

OGC Abstract Specification Topic 11 – Geographic information — Metadata (aka ISO 19115:2014)

OGC Abstract Specification Topic 20 – Observations and Measurements (aka ISO 19156:2011)

OGC 07-036 Geography Mark-up Language (aka ISO 19136:2007 or GML3.2.1)

OGC® Web Coverage Service 2.0 Interface Standard - Core OGC Document 09-110r4 <http://www.opengeospatial.org/standards/wcs>

OGC Observations and Measurements v2.0 XML OGC Document 10-025r1 <http://www.opengis.net/doc/IS/OMXML/2.0>

OGC SWE Common Data Model Encoding Standard v2.0 OGC Document 08-094r1 [http://www.opengis.net/doc/IS/SWECommon/2.0](http://www.opengis.net/doc/IS/SWECommon/2.0%20)

Unified Code for Units of Measure (UCUM) – Version 1.9, 2013

Unified Modelling Language (UML). Version 2.3. May 2010

Extensible Mark-up Language (XML) – Version 1.0 (Fourth Edition), August 2006

XML Schema – Version 1.0 (Second Edition), October 2004

Web Coverage Service Interface Standard - Coverage Collection Extension 15-044r2

1. Terms and Definitions

This document uses the terms defined in Sub-clause 5.3 of [OGC 06-121r8], which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word “shall” (not “must”) is the verb form used to indicate a requirement to be strictly followed to conform to this standard.

For the purposes of this document, the following additional terms and definitions apply. There is some variation in the specific use of some technical terms within the meteorological domain. We have attempted to follow common usage, referring where possible to the WMO No.306[*http://www.wmo.int/pages/prog/www/WMOCodes*](http://www.wmo.int/pages/prog/www/WMOCodes)*.*

* 1. numerical weather prediction model

[mathematical model](http://en.wikipedia.org/wiki/Mathematical_model) of the atmosphere and oceans used to [predict the weather](http://en.wikipedia.org/wiki/Weather_forecasting) based on current weather conditions and are normally run at set times each day.

Synonyms: forecast model, NWP Model.

EXAMPLE The ECMWF model that runs twice per day and creates a ten day prediction of the global atmosphere.

* 1. reference time

nominal start of a specific forecast model run.

Synonym: model run time.

NOTE: “reference time” will used in preference to “model run time” as it is more generic and includes services that may be continually updated.

* 1. verification time

time at which a forecast becomes verifiable.

Synonym: validity time.

NOTE: Forecast models running with different reference times will have, for some fields, the same verification time if the durations of the different model runs overlap.

* 1. data mask

a means to indicate which elevations and times are available for each parameter output from a forecast model as they may not be regular (see Section 7 and Figure 2).

NOTE: A data mask is described using a “referenceable Grid Coverage”.

* 1. GRIB

WMO (World Meteorological Organisation) format for gridded binary data exchanged between member countries, including a controlled vocabulary defined in tables.

* 1. [Web Coverage Service](http://www.opengeospatial.org/standards/wcs) 2.0 (WCS2.0)

standard created by the OGC that refers to the exchange of geospatial information as ‘coverages’: digital geospatial information representing space-varying phenomena.

* 1. GetCapabilities operation

request to a WCS server for a list of what operations and services (“capabilities”) are being offered by that server.

* 1. DescribeCoverage

request to a WCS server for additional information about a coverage that a client wants to query. It returns information about the CRS, the metadata, the domain, the range and the formats available. A client generally will need to issue a DescribeCoverage request before it can make the proper GetCoverage request.

* 1. DescribeCoverageCollection

request to the WCS server for additional information about a CoverageCollection that a client wants to query. It returns information about the metadata and the domain.

1. Conventions
   1. Abbreviated terms

GML Geography Mark-up Language

O&M Observations and Measurements

OGC Open Geospatial Consortium

MetOcean Meteorological/Oceanographic

NWP Numerical Weather Prediction

SWE OGC Sensor Web Enablement

UML Unified Modelling Language

WCS2.0 OGC Web Coverage Service version 2.0

WMO World Meteorological Organisation

XML W3C Extensible Markup Language

XSD W3C XML Schema Definition Language

* 1. Schema language

The XML implementation specified in this Standard is described using the XML Schema language (XSD) [XML Schema Part 1: Structures, XML Schema Part 2: Datatypes] and Schematron [ISO/IEC 19757-3, Information technology — Document Schema Definition

Languages (DSDL) — Part 3: Rule-based validation — Schematron].

* 1. UML notation

The diagrams that appear in this standard are presented using the Unified Modeling Language (UML) static structure diagram.

**Note:** Within the context of this standard, the following color scheme is used to identify the package in which the class exists. This is just for informative purposes.

 Tan: Defined within this standard

 Blue: WCS2.0 (Web Coverage Service v2.0)

 Red: ISO19156 – Observations & Measurements

 Green: ISO19115 – The MetOcean Metadata

1. Vocabularies

This standard defines a number of properties that require the use of codes or vocabulary items. In some cases a list of terms is provided. Where no codes are provided (the link to the WMO registry is in italics), it is expected that a list will be developed in the future, or a local code list may be used. A summary of the vocabularies is shown in Table 1. The WMO is responsible for managing the content of these vocabularies. Once agreement is reached for definitions, the MetOceanDWG should submit updates to the OGC Naming Authority. In the future the vocabularies may be extended to the climate community.

Table 1 Summary of vocabularies within this standard

| **Code list** | **Package(s)** | **Code items defined** |
| --- | --- | --- |
| DisciplineCode | NwpModelMetadata | Yes |
| TypeOfDataCode | NwpModelMetadata | Yes |
| SignificanceOfReferenceTimeCode | NwpModelMetadata | Yes |
| ProductionStatusCode | NwpModelMetadata | Yes |
| TypeOfCalendarCode | NwpModelMetadata | Yes |
| FixedSurfacetypeAndUnits | NwpModelMetadata | Yes |

1. Non-Normative (Informative) Material

The MetOcean profile for WCS2.0 is an initiative of the MetOceanDWG to develop international standards and address interoperability of meteorological and oceanographic information systems.

The need for this work arises out of the need to transfer ever increasing amounts of data across networks. This can only be done by sub-setting the data on the server and transferring the relevant data to the client. The obvious candidate for this service is the OGC WCS2.0 that was designed to extract and subset coverages. It is therefore logical to extend this standard to accommodate MetOcean specific metadata, although this has some challenges due to the multi-dimensional nature of MetOcean data. Some of these extra dimensions are non-geodetic (e.g. vertical pressure) and are irregular (time).

* 1. WCS2.0

The WCS2.0 core standard and core extensions (see below) cover most of the operations (specifically GetCapabilities, DescribeCoverage and DescribeCoverageCollections) required by the MetOcean community, but the metadata (other than basic WCS) needs to be community specific. Currently, the only profile is for the Earth Observing community.

WCS Core Extensions

* WCS CoverageCollections, version 1.0.0, OGC 15-044
* WCS Range Subsetting Extension, version 1.0.0, OGC 12-040
* WCS Scaling Extension, version 1.0.0, OGC 12-039
* WCS Range Subsetting version 1.0 OGC 12-040
* WCS Interpolation Extension, version 1.0.0, OGC 12-049
* WCS CRS Extension version 1.0 OGC 11-053
* WCS Coverage Collection Extension 1.0 OGC 15-044
  1. Key Concepts
     1. A Short NWP (Numerical Weather Prediction) Primer

The term “NWP model” refers to a computer model used to forecast the future state of the ocean/ atmosphere. A NWP model is normally “run” at a set time and repeated at regular intervals during the day; this “start” time is known (amongst the MetOcean community), as the “model run time” i.e. a notional starting point. All forecast times for a specific model run are therefore relative to this “reference” time. It is important to note that term “reference time” will used in preference to “model run time” as it is more generic and includes services that may be continually updated.

* + 1. Coverages

Coverages represent digital geospatial information representing space/time-varying phenomena. OGC Abstract Topic 6 [OGC 07-011] – which is identical to ISO 19123 – defines an abstract model of coverages. This is concretized by the Geography Markup Language (GML) 3.2 [07-036], an XML grammar written in XML Schema for the description of application schema (see Figure 1). A typical NWP forecast model data may expressed as a set of coverages typically, but not exclusively rectified grid coverages, i.e. coverages whose horizontal domain is a rectified Grid. A typical model run contains literally thousands of 2D coverages each with a unique identifier. The metadata to describe this soon becomes unmanageable and the problem can be simplified by identifying, where possible, “4D Coverages”.

The concept of “coverage” is central to the representation of many common weather observations and forecasts. Weather datasets that fall into the category of coverages include point measurements, wind profiles, model grids, and time series measurements at a single point. Of particular interest to aviation are weather properties observed or forecast along a trajectory, which can also be represented as a “coverage”.

* + 1. 4D Coverages

A typical numerical model has a number of different vertical coordinates; for example: pressure, height above mean sea level, height above ground, surface, max wind level etc. By definition a coverage instance is defined, among other things, by the DomainSet (see diagram below). By forming a 4D coverage from all of the 2D coverages that share the same horizontal, vertical and temporal domains the number of coverages can be significantly reduced. This is a challenge as the vertical and temporal axes are not regular and need to be enumerated. Until compound axes are allowed (see future work) the result mask is the best way of doing this, by using a “Referenceable Grid Coverage” for the Result Mask.



Figure 1 UML Diagram representing the coverage model.

* + 1. Data Masking

Even when the coverage is to be extended to other dimensions, e.g. time and vertical, there is an added complication as the data coverage may well be irregular, i.e. not all the data are available for every time and level. For example; air temperature may not be present for every output time-step at every specified level. It is therefore a challenge to present the output as a 4D coverage given the irregularity of the data (See Figure 2).

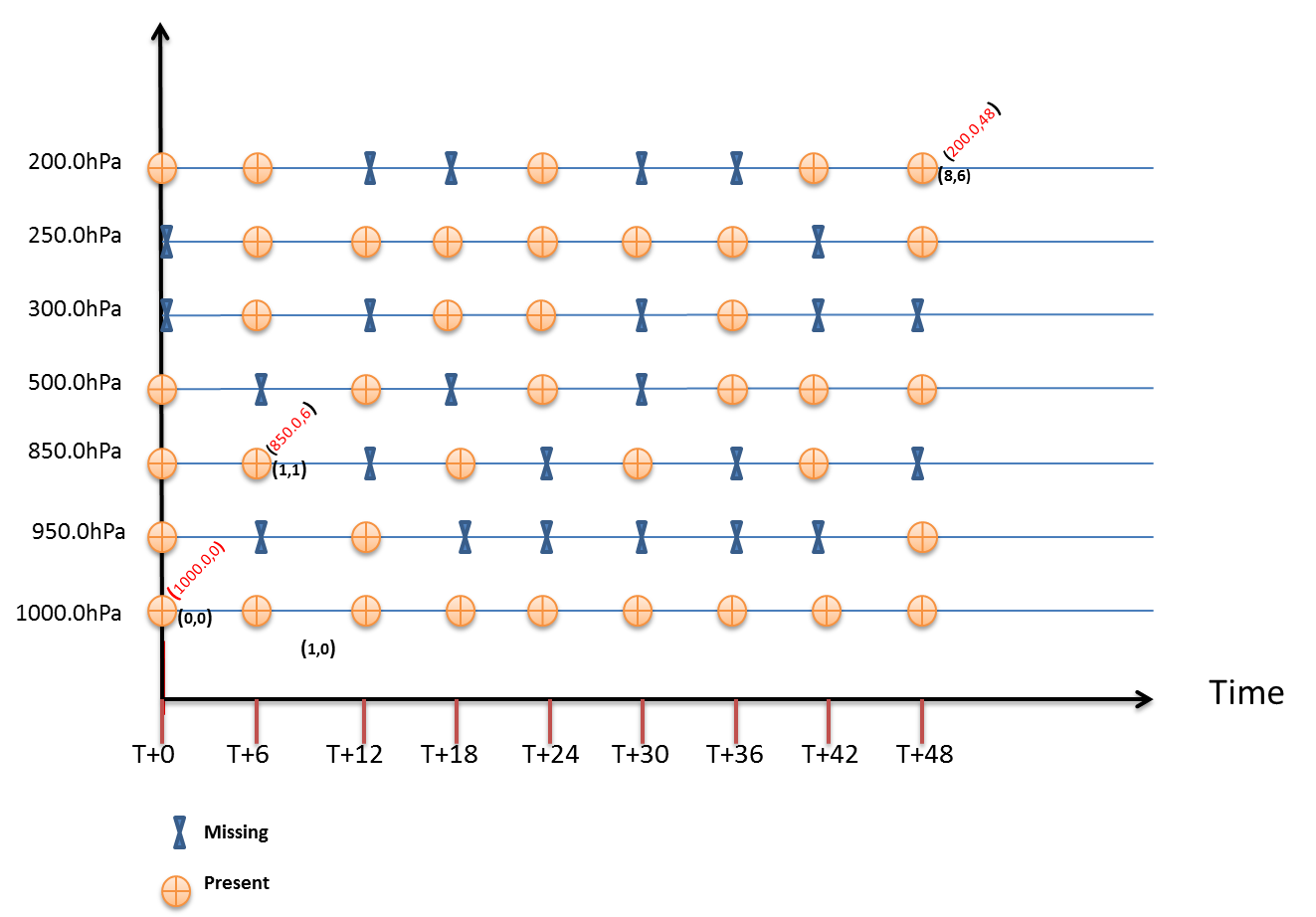


Figure 2 Diagram representing the irregularity of the time and vertical axes and the sparsity of the output in the coverage model

This diagram illustrates irregular nature of the time and vertical axis as well as the “Swiss Cheese” nature of the output. It is possible to enumerate the axes, but not all data will be available at each of the coordinates.

* + - 1. **Enumerating the axes**

The data mask has a “Referencable Grid Coverage Type” as described by GML Application Schema Coverage OGC 09-146r2 (*Referenceable Grid Coverages are coverages whose internal grid structure can be mapped to a coordinate reference system by some general transformation. They differ from rectified grid coverages in that the coordinate transformation is not necessarily affine*). The domain set is used to enumerate the temporal and vertical axes of the “coverage”. The coordinate reference system (CRS) is by reference see (<http://codes.wmo.int/grib2/codeflag/4.5>) and the units of measure are as specified in the WMO GRIB2 table 4.5.

The temporal CRS is also by by reference:- <http://codes.wmo.int/grib2/codeflag/1.2> (note this is the WMO registry to define type of time intervals), the units are in hours (as used in axis labels), but could be minutes/years etc and forecast periods are relative to the “Reference Time”>

* + - 1. **Data sparsity**

The second issue addresses the problem that data are not always present at each model level/forecast time. This is solved by using the “range set” part of the coverage using a tuple list to indicate if data are present, i.e. a “1” if present and a “0” if not.

* + 1. CoverageCollections

A coverage collection is a very useful mechanism for grouping together coverages into a collection, very similar to a feature collection. This mechanism for grouping coverages is very powerful and allows, for example, a description of an image mosaic in terms of the full mosaic (Coverage Collection) and the constituent images (Coverages). In the case of Numerical weather Prediction models the output (a set of coverages) may be grouped (or collected) together, so allowing a specific model instance (aka model “run”) to be described by a single identifier i.e. the CoverageCollection identifier.

* 1. The basic Observation type

The major elements of the model are indicated in bold and modelled through associations in the UML model. In addition, an observation has the following attributes and associations:

* **parameter** (optional): for arbitrary event-specific parameters, e.g. instrument settings
* **phenomenonTime** (mandatory): the time that the result applies to the feature of interest
* **resultQuality** (optional): the quality of the result
* **resultTime** (mandatory): the time when the result becomes available (e.g. if postprocessing or laboratory analysis is required, it might be different to the phenomenonTime)
* **validTime** (optional): the time period during which the result is intended to be used (e.g. if a meteorological forecast is modelled as an observation, then it is intended to be used during a specific period of time)
* **relatedObservation** (optional): related observations providing important context for understanding the result
* **metadata** (optional): descriptive metadata
* **featureOfInterest** (mandatory): The association Domain shall link the OM\_Observation to the GFI\_Feature that is the subject of the observation and carries the observed property. This feature has the role featureOfInterest with respect to the observation.
* **observedProperty** (mandatory): The association Phenomenon shall link the OM\_Observation to the GFI\_PropertyType for which the OM\_Observation:result provides an estimate of its value. The property type has the role observedProperty with respect to the observation.
* **result**: The association Range shall link the OM\_Observation to the value generated by the procedure. The value has the role result with respect to the observation.
* **procedure**: The association ProcessUsed shall link the OM\_Observation to the OM\_Process (6.2.3) used to generate the result. The process has the role procedure with respect to the observation.
  + 1. NWP Observation metadata mapping on Observations and Measurements

To represent MetOcean metadata, this profile extends the Observations and Measurements properties with MetOcean specific information. Figure 4 shows the relationship of NWPObservation to the O&M in sections 8.1, 8.2 and 8.3.

1. MetOcean Application Profile UML & Requirements (normative)
   1. Requirements class: NwpObservation

|  |  |
| --- | --- |
| **Requirements Class** | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_NwpObservation** | |
| **Dependency** | **http://www.opengis.net/spec/OMXML/2.0/req/observation** |
| **Requirement** | **/structure**  A metocean:NwpObservation instance shall conform to Figure 3, Table 2 and Table 3. |
| **Requirement** | **/observed-property**  The observed property of the OM\_Observation type shall be a link the WMO code definitions as described in the relevant GRIB2 table. |
| **Requirement** | **/result-quality**  The NwpObservation shall have a resultQuality property (from OM\_Observation) that references the ResultMask by substitution with AbstractDQ\_Element. |
| **Requirement** | **/feature-of-interest**  The ‘featureOfInterest’ property of the OM\_Observation element shall reference a NWPModel element that is an instance of SF\_SpatialSamplingPoint (from ISO 19156:2011 Spatial Sampling Features). |
| **Requirement** | **/phenomenon-time**  The analysis time i.e. the start or “reference time” of the NWP process. Note that many cases this is notional (e.g. continuous data assimilation), but is always the reference point for the forecast times. |
| **Requirement** | **/result-time**  The time of the arrival of data onto the system. For cases where the data arrives over a period of time (e.g. the generation of the data is in real time), then this time denotes the start time of the arrival of data. |
| **Requirement** | **/valid-time**  The time period over which the model forecast times span. |
| **Requirement** | **/observation-type**  A Metocean-Nwp-Observation shall be derived from OM\_Observation type. |
| **Requirement** | **/metadata**  The name element of the specific metadata element shall be encoded using gml:ReferenceType and have an xlink:href value of the form:-  example  xlink:href="http://codes.wmo.int/grib2/codeflag/0” xlink:title="originatingCentre" |
|  | **/metocean/getCapabilities-response-conformance-class-in-profile**  A WCS service implementing this extension shall include the following URI in a Profile element in the ServiceIdentification in a GetCapabilities response:http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_NwpObservation |



Figure 3 – NwpObservation UML

* + 1. Requirements class overview

The NwpObservation requirements class defines how metadata appropriate to the MetOcean community will be expressed as part of the responses to a WCS2.0 GetCapabilities and DescribeCoverage request.

* + 1. NwpObservation

NWP observations are defined as a specialised type OM\_Observation from ISO19156, with the following restrictions:

* The **feature of interest** is the entity about which the observation is made and Meteorological observations or forecasts clearly relate to the real world. For example, we may provide a weather forecast for the North Atlantic European area with the express intention of sampling the grid to provide a forecast for a specific location and time such as a town or airport. Thus the sampling regime is a proxy for the real entity of interest. Thus the observation or forecast is not directly related to real world entities and the Observations and Measurements model provides a conceptual model linking the these two concepts i.e. SamplingFetaures.
* The **sampling** feature is related to the real world via the property <sam:sampledFeature> and further specialisations are provided by the addition of the shape property via SF\_SpatialSamplingFeature and sub-types thereof). In all cases identified thus far in meteorology, it appears useful to describe an observation, measurement or forecast with respect to the sampling regime (e.g. the Sampling Feature) and indirectly refer to the real-world entity for which the Sampling Feature is a proxy. In this profile the property “sampled feature” will be a link to a reference to the numerical model used in the forecasting process.
* The **observedProperty** references WMO GRIB2 code tables that list, by “Product Discipline” ref <http://codes.wmo.int/grib2/codeflag/0.0>; the list of disciplines defines the domain of the environment being measured.
* The **process** is a simple description the will be a reference to an external document describing the model used in the forecast simulation.
* The **resultQuality** will point to the data mask used to enumerate the temporal and vertical axes as well as provide information on whether or not a parameter is available at a particular time/level.
* The **validTime** is the time period that spans the first and last validity times of the forecast.

Table 2 NwpObservation properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| phenomenon time | The analysis time i.e. the start or “reference time” of the NWP process. | TM\_Object | One  (mandatory) |
| result time | issue time (e.g. result time) i.e. the time when the entire NWP model output was published | TM\_Instant | One  (mandatory) |
| validTime | The time period denoting the whole time range for which the forecast is relevant. | TM\_Period  (Note the reference time as defined in http://codes.wmo.int/grib2/codeflag/1.2) | zero or one  (optional) |
| Procedure | Reference to supporting documentation (attribute "documentationRef"); e.g. online documentation describing the procedure in detail | PredictionProcess | One  (mandatory) |
| resultQuality | A reference to a pertaining TimeHeight mask is stored, together with the name of the physical parameter to which it corresponds. A Time-Height Mask is a 2-D ReferenceableGridCoverage with height/time axes and Boolean range values. Such a mask serves to indicate areas where all range values, across the whole horizontal extent, contain only nil values This serves as a hint to applications as to which regions contain “interesting” (i.e., non-nil) values. | ResultMask | zero or one  (optional) |
| feature-of-interest | The feature of interest is the entity about which the observation is made, in this case it used describe the NWP model used to create the assimilation/forecast. | NwpModel. | One  (mandatory) |
| observedProperty | the OM\_Observation model allows only a single instance of <om:observedProperty>. In the case of the NWP model, many individual physical properties may be measured that are associated with a particular environmental domain, e.g. Meteorological Products, Hydrological Products, Space Products, Oceanographic Products, etc.. Theses domains are defined in the WMO GRIB2 code table “Product Discipline” ref <http://codes.wmo.int/grib2/codeflag/0.0>. | ObservedProperties  (See <http://codes.wmo.int/grib2/codeflag/0.0>) | One  (mandatory) |
| Parameter | If present, the attributes parameter:NamedValue shall describe an arbitrary event-specific parameter. In this specification is the reference time of the nwp model run as specified in GRIB2, table 1.2 | OM:NamedValue | zero or more (optional) |

* + 1. MetOcean ObservedProperties

The properties relating to a NWP model as used in weather, climate and ocean forecast models:

Table 3 ObservedProperties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| observedParameters | The code used to indicate the discipline, i.e meteorology, oceanography, space etc. (this will reference WMO GRIB2 table 0.0) | DisciplineCode | One  (mandatory) |

* 1. Requirements class: NwpModel

|  |  |
| --- | --- |
| **Requirements Class** | |
| [**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_NwpModel**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_NwpModel) | |
| **Dependency** | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_NwpObservation** |
| **Requirement** | **/structure**  A metocean: NwpModel instance shall conform to  Figure 4, Table 4, Table 5, Table 6, Table 7, Table 8, Table 9, Table 10, Table 11, Table 12 and the XML schema being part of this standard. |
| **Requirement** | **/nwp-model-metadata**  MetOceanNwpModelMetadata shall reference be encoded using gml:reference and have a XLINK that references the associated GRIB2 tables using the WMO code register. |
| **Requirement** | **/model-footprint**  The shape property of the SF\_SpatialSamplingFeatureType shall contain the element ModelFootprint that will define the domain of the NWP model |



Figure 4 – NwpModel UML

* + 1. Requirements class overview

NWP models are mathematical models based on principles that are used to generate either short-term weather forecasts or longer-term climate predictions and as such have many properties that gives context to the spatial/temporal domain of the model.

* + 1. NwpModel

The metocean\_NwpModel requirements class defines how metadata appropriate to the NWP model will be defined. The main properties will be listed within a set of code tables that are based on the WMO GRIB2 code tables and are available via a WMO register. These links are explicitly listed in the code tables and are, in the main, resolvable.

Table 4 NwpModel Properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| sams:shape | NWPModel that specializes SF\_SpatialSamplingPoint using the “shape” element to reference metocean:modelFootprint. | ModelFootprint | One  (mandatory) |
| nwpModelMetadata | A slot for any MetOcean specific metadata | NwpModelMetadata | One  (mandatory) |

* + 1. NwpModelMetadata

The metadata for the NWP Model:

Table 5 NwpModelMetadata Properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| Discipline | This table is used to indicate the discipline of the processed data contained within a specified Coverage. (this will reference WMO GRIB2 table 0.0) | DisciplineCode | One  (mandatory) |
| typeOfData | A code to indicate the kind of NWP product, e.g. analysis, forecast, analysis and forecast etc.(this will reference WMO GRIB2 table 1.4) | TypeOfDataCode | One  (mandatory) |
| significanceOfReferenceTime | This defines the meaning of “Reference Time (this will reference WMO GRIB2 table 1.2) | SignificanceOfReferenceTimeCode | One  (mandatory) |
| originatingCentre | NATIONAL/INTERNATIONAL ORIGINATING CENTERS (this will reference WMO GRIB2 table 0) | OriginatingCentreCode | One  (mandatory) |
| productionStatusOfData | The code used to indicate the production status, e.g. operational, research etc. (this will reference WMO GRIB2 table 1.3) | ProductionStatusOfDataCode | One  (mandatory) |
| typeOfCalendar | The code used to indicate the type of calendar being used e.g. Gregorian, 360 day (often used by climate models), (this will reference WMO GRIB2 table 1.6) | Type OfCalendarCode | One  (mandatory) |
| fixedSurfaceTypesAndUnits | The code is used to indicate the surface type (cf vertical CRS) and the associated units. (this will reference WMO GRIB2 table 4.5) | FixedSurfaceTypesAndUnits | One  (mandatory) |

* + 1. ModelFootprint

A description of the horizontal domain of the NWP model:

Table 6 ModelFootprint

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| horizontalDomain | The horizontal domain (or its projection) on the ground i.e. the NWP footprint. | gml:Polygon | One  (mandatory) |

* + 1. PredictionProcess

The properties relating to a NWP model as used in weather and ocean forecast models:

Table 7 PredictionProcess

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| metce:Process | Reference to supporting documentation (attribute "documentationRef"); e.g. online documentation describing a well known document (e.g. using the element <gml:description> | gml:description | One  (mandatory) |

* + 1. DisciplineCode

A type capturing the relevant scientific discipline:

Table 8 DisciplineCode code items

| **Code item** | **Definition** | **URL** |
| --- | --- | --- |
| Meteorological Products | Meteorological products | <http://codes.wmo.int/grib2/codeflag/0.0/_1> |
| Hydrological Products | Hydrological Products | <http://codes.wmo.int/grib2/codeflag/0.0/_1> |
| Land Surface Products | Land Surface Products | <http://codes.wmo.int/grib2/codeflag/0.0/_2> |
| Space products | Space products | <http://codes.wmo.int/grib2/codeflag/0.0/_3> |
| Oceanographic products | Oceanographic products | <http://codes.wmo.int/grib2/codeflag/0.0/_10> |

* + 1. TypeOfDataCode

A type code capturing the type of products:

Table 9 TypeOfDataCode code items

| **Code item** | **Definition** | **URL** |
| --- | --- | --- |
| Analysis Products | Analysis Products | <http://codes.wmo.int/grib2/codeflag/1.4> |
| Forecast Products | Forecast Products | <http://codes.wmo.int/grib2/codeflag/1.4> |
| Analysis and Forecast Products | Analysis and Forecast Products | <http://codes.wmo.int/grib2/codeflag/1.4> |
| Control Forecast Products | Control Forecast Products | <http://codes.wmo.int/grib2/codeflag/1.4> |
| Perturbed Forecast Products | Perturbed Forecast Products | <http://codes.wmo.int/grib2/codeflag/1.4> |
| Control and Perturbed Forecast Products | Control and Perturbed Forecast Products | <http://codes.wmo.int/grib2/codeflag/1.4> |
| Processed Satellite Observations | Processed Satellite Observations | <http://codes.wmo.int/grib2/codeflag/1.4> |

* + 1. SignificanceOfReferenceTimeCode

A type code capturing the significance of the reference time:

Table 10 SignificanceOfReferenceTimeCode code Items

| **Code item** | **Definition** | **URL** |
| --- | --- | --- |
| Analysis | The reference time of the analysis | [*http://codes.wmo.int/grib2/codeflag/1.2*](http://codes.wmo.int/grib2/codeflag/1.2) |
| Start of Forecast | All forecast times are relative to this Reference time | [*http://codes.wmo.int/grib2/codeflag/1.2*](http://codes.wmo.int/grib2/codeflag/1.2) |
| Verifying Time of Forecast | The reference time is used to denote the validity time of the forecast | [*http://codes.wmo.int/grib2/codeflag/1.2*](http://codes.wmo.int/grib2/codeflag/1.2) |
| Observation Time | The Reference time is used to denote the time of observation. | [*http://codes.wmo.int/grib2/codeflag/1.2*](http://codes.wmo.int/grib2/codeflag/1.2) |

* + 1. OriginatingCentreCode

A code list to indicate the centre responsible for the product, this is referenced by [*http://codes.wmo.int/grib2/codeflag/0*](http://codes.wmo.int/grib2/codeflag/0)

* + 1. ProductionStatusCode

A type code capturing the significance of the reference time:

Table 11 ProductionStatusCode code Items

| **Code item** | **Definition** | **URL** |
| --- | --- | --- |
| Operational Products | Operational Products | [*http://codes.wmo.int/grib2/codeflag/1.3*](http://codes.wmo.int/grib2/codeflag/1.3) |
| Operational Test Products | Operational Test Products | [*http://codes.wmo.int/grib2/codeflag/1.3*](http://codes.wmo.int/grib2/codeflag/1.3) |
| Research Products | Research Products | [*http://codes.wmo.int/grib2/codeflag/1.3*](http://codes.wmo.int/grib2/codeflag/1.3) |
| Re-Analysis Products | Re-Analysis Products | [*http://codes.wmo.int/grib2/codeflag/1.3*](http://codes.wmo.int/grib2/codeflag/1.3) |

* + 1. TypeOfCalendarCode

A type code capturing the significance of the Calendar used:

Table 12 TypeOfCalendarCode code Items

| **Code item** | **Definition** | **URL** |
| --- | --- | --- |
| Gregorian | Gregorian | [*http://codes.wmo.int/grib2/codeflag/1.6*](http://codes.wmo.int/grib2/codeflag/1.6) |
| 360-day | 360-day | [*http://codes.wmo.int/grib2/codeflag/1.6*](http://codes.wmo.int/grib2/codeflag/1.6) |
| 365-day (see Note 1) | 365-day (Essentially a non-leap year) | [*http://codes.wmo.int/grib2/codeflag/1.6*](http://codes.wmo.int/grib2/codeflag/1.6) |
| Proleptic Gregorian | Proleptic Gregorian (Extends the Gregorian calendar indefinitely in the past) | [*http://codes.wmo.int/grib2/codeflag/1.6*](http://codes.wmo.int/grib2/codeflag/1.6) |

* + 1. FixedSurfaceTypesAndUnits

The code list is used to indicate the surface type (cf vertical CRS) and the associated units. <http://codes.wmo.int/grib2/codeflag/4.5>

* 1. Requirements class: ResultMask

|  |  |
| --- | --- |
| **Requirements Class** | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_ResultMask** | |
| **Requirement** | **/structure**  A metccean:ParameterMask instance shall conform to Figure 5 and Table 13 and Table 14. |
| **Requirement** | **/result-quality**  The NwpObservation shall have a resultQuality property, if present, (from OM\_Observation) that points to a ResultMask. |
| **Requirement** | **/resultmask**  The ResultMask shall through the specialisation of gmd:AbstractDQ\_Result that has a property gmd:result that reference a ParameterMask that contains the property TimeHeight Mask of type “ReferenceableGridCoverage” |
| **Requirement** | **/getCapabilities-response-conformance-class-in-profile**  A WCS service implementing this extension shall include the following URI in a Profile element in the ServiceIdentification in a GetCapabilities response:http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_ResultMask |
| **Requirement** | **/rangeComponent**  Each ResultMask shall have a rangeType that is a list the GRIB2 named parameters (separated by a / if more than one) for which the ResultMask applies. |
| **Requirement** | **/metocean/getCapabilities-response-conformance-class-in-profile**  A WCS service implementing this extension shall include the following URI in a Profile element in the ServiceIdentification in a GetCapabilities response:  http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_ResultMask |

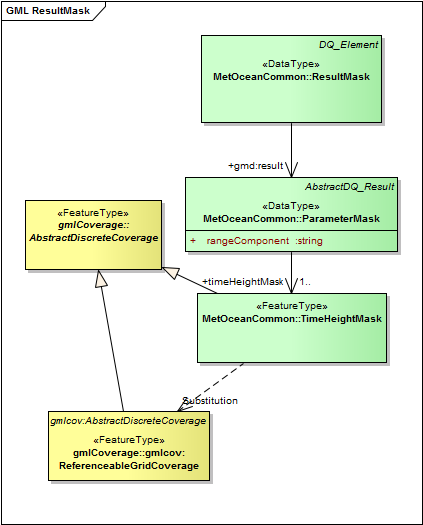


Figure 5 – ResultMask UML

* + 1. Requirements class overview

A common problem with NWP models is the large number of 2D coverage and the corresponding size of the GetCapabilities request. It is much more efficient to describe the multi-dimensional data as“nD” coverages, usually 3D or 4D, but there is a problem. Even when the coverages are extended to other dimensions, e.g. to include time and vertical, there is an added complication as the data coverage may well be irregular, i.e. not all the data are available for every time and level (see fig 2). It is therefore a challenge to present the output as a 4D coverage given the irregularity of the data as by definition; a “coverage” must have a result for every discrete point within that coverage. The solution presented here is to mask out all missing data. This ResultMask, itself a coverage, will have a set of Boolean values denoting, with a 1 (where data are present) and a 0.i.e false where data are missing. The ResultMask “Domain Set” will define the temporal axis and if present the vertical axis. This is important as these two axes are not defined the standard gml:domainSet element.

* + 1. ResultMask

Model as used in weather and ocean forecast models:

Table 13 ResultMask

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| gmd:result | The ResultMask specialises AbstractDQ\_Element that has a the property gmd:result that is used to point to ParameterMask, by ParameterMask specialising gmd:AbstractDQ\_Result | ParameterMask | One  (mandatory) |

* + 1. ParameterMask

The properties relating to a Parameter Mask:

Table 14 Parameter Mask

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| timeHeightMask | A Time-Height Mask is a 2-D ReferenceableGridCoverage with height/time axes and Boolean range values. Such a mask serves to indicate areas where all range values, across the whole horizontal extent, contain only nil values This serves as a hint to applications as to which regions contain “interesting” (i.e., non-nil) values. | TimeHeightMask | One  (mandatory) |
| rangeComponent | The list of parameters for which the ResultMask applies.  Multiple parameters are separated by a /. | String | One  (mandatory) |

* 1. Requirements class: GetCapabilitiesGroups

|  |  |
| --- | --- |
| **Requirements Class** | |
| [**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilities**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_GetCapabilities)**Groups** | |
| **Dependency** | **http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/req/covcoll\_getCapabilities** |
| **Dependency** | **http:/www.opengis.net/spec/WCS/2.0/req/core/getCapabilities** |
| **Dependency** | **http:/www.opengis.net/spec/WCS/2.0/req/core/wcsServiceMetadata-structure** |
| **Dependency** | **http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/req/covcoll\_offering** |
| **Dependency** | **http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/conf/req/covcoll\_collection-summary** |
| **Requirement** | **/structure**  a metocean:MetoceanGroup instance shall conform to Figure 6 and Table 14, Table 15 and Table 16. |
| **Requirement** | **/metocean-group**  A MetOceanGroup instance shall contain at least one element of type metocean:metocean-subgroup |
| **Requirement** | **/metocean-subgroup**  A MetOceanSubGroup instance shall not be empty. |
| **Requirement** | **/metocean/getCapabilities-response-conformance-class-in-profile**  A WCS service implementing this extension shall include the following URI in a Profile element in the ServiceIdentification in a GetCapabilities response:  <http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_GetCapabilities>Groups |



Figure 6 MetOcean GetCapabilities UML

* + 1. Requirements class overview

The WCSGetCapabilitiesMetOceanProfile requirements class is closely associated with the CoverageCollection operation that is itself a WCS extension class. This application profile is therefore dependent on the GetCoverageCollection and DescribeCoverageCollection operations being supported by the WCS server.

This MetOcean profile provides a method of grouping together coverages (see Figure 6), the intended benefit being the reduction in the size of GetCapabilities response. The grouping structure may be freely interpreted and reflect the convenience that is suitable for the particular usage.

* + 1. wcs:Extension

Even though this is not part of the MetOcean profile it is show the relationship between this extension point and the MetOcean specific metadata:

Table 15 wcs:Extension properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| metoceanGroup | Extends the metadata in the GetCapabilities response to include MetOcean specific detail. (this is done because wcs:Extension is type “any” | MetOceanGroup | one or more  (mandatory) |

* + 1. MetOceanGroup

Meteorological and oceanographic data is by nature hierarchical and the ability to group entities together is important. Thus a set of NWP model runs may be clustered together to form a logical group (see example).

Table 16 MetOceanGroup properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| metoceanGroupName | The name given to any grouping that has a significant meaning.” | NCName | One  (mandatory) |
| metOceanSubGroup | A grouping that provides a convenient container for a related coverageCollection | MetOceanSubGroup | One  (mandatory) |

* + 1. MetOceanSubGroup

A hierarchical structure can be further broken down into subgroups that are grouped together into one group. Each subgroup has a related coverage collection.

Table 17 MetOceanSubGroup properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| subGroupName | The identifier of a subgroup | NCName | One  (mandatory) |
| serviceInstant | The service address of the server that will serve the coverages/coverageCollections. | anyURI | One  (mandatory) |
| relatedCoverageCollections | The coverageCollections contained within the MetOceanSubGroup. | RelatedCoverageCollection | Zero or more (Optional) |
| relatedCoverages | The coverages contained within the MetOceanSubGroup. | RelatedCoverage | Zero or more (Optional) |

* 1. Requirements class: GetCapabilities-RelatedCoverageCollection

|  |  |
| --- | --- |
| **Requirements Class** | |
| [**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilities**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_GetCapabilities)\_**RelatedCoverageCollection** | |
| **Dependency** | **http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/req/covcoll\_getCapabilities** |
| **Dependency** | **http:/www.opengis.net/spec/WCS/2.0/req/core/getCapabilities** |
| **Dependency** | **http:/www.opengis.net/spec/WCS/2.0/req/core/wcsServiceMetadata-structure** |
| **Dependency** | **http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/req/covcoll\_offering** |
| **Dependency** | **http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/conf/req/covcoll\_collection-summary** |
| **Requirement** | **/structure**  a metocean:MetoceanGroup instance shall conform to Figure 6 and Table 18 |
| **Requirement** | **/metocean-related-coveragecollection**  A RelatedCoverageCollection instance shall contain at least one element of type covcoll:CoverageCollectionSummary |
| **Requirement** | **/metocean\_getCapabilities/request-sections-group-collection**  A WCS server implementing this extension shall accept the token *MetOceanGroupCoverageCollection* within the sections element of the GetCapabilities request in addition to those specified in OWS Common [OGC 06-121r9] subclause 7.3.3. |
| **Requirement** | **/covcoll\_getCapabilities/response-extension-identification**  If the WCS service supports this extension  [*http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilities*](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_GetCapabilities)*\_RelatedCoverageCollection*  Then the following URI shall be in a Profile element in the ServiceIdentification in a GetCapabilities response:  [*http://www.opengis.net/spec/WCS\_service-*](http://www.opengis.net/spec/WCS_service-)*extension\_coveragecollection/1.0/conf/coverageCollection* |
| **Requirement** | **/metocean/getCapabilities-response-conformance-class-in-profile**  A WCS service implementing this extension shall include the following URI in a Profile element in the ServiceIdentification in a GetCapabilities response:  [*http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilities*](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_GetCapabilities)*\_RelatedCoverageCollection* |

* + 1. Requirements class overview

Each subgroup may contain a set of related coverage collections that in themselves a grouping together of a set of coverages (much like a feature collection. Note the dependency on the WCS server supporting the WCS2.0 extension “CoverageCollections”

* + 1. RelatedCoverageCollection

A “top level” description of each of the “CoverageCollections” contained within the each subgroup.

Table 18 RelatedCoverageCollection properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| collectionName | The identifier of a specific collection (identifier may be used as an input argument to a DescribeMetOceanCollection) | NCName | one  (Mandatory) |
| metOceanReferenceTime | The reference time of the collection. | gml:timePosition | zero or one  (Optional) |
| covcoll:coverageCollectionSummary | A summary of each coverage contained within the collection. | Covcoll:CoverageCollectionSummary | zero or one  (Optional) |

NOTE As RelatedCoverageCollection derives from GML::AbstractFeature, it inherits all properties from its parent class: gml:id, gml:metaDataProperty, gml:description, gml:descriptionReference, gml:identifier, gml:name and gml:boundedBy. Thus information about the spatial extent that the member coverages of the Coveragecollection occupy can be provided using GML::Envelope. In the situation that the Coveragecollection has spatiotemporal extent, the subtype GML::EnvelopeWithTimePeriod may be used.

* 1. Requirements class: GetCapabilities-RelatedCoverage

|  |  |
| --- | --- |
| **Requirements Class** | |
| [**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilities**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_GetCapabilities)**\_RelatedCoverage** | |
| **Dependency** | **http:/www.opengis.net/spec/WCS/2.0/req/core/getCapabilities** |
| **Dependency** | **http:/www.opengis.net/spec/WCS/2.0/req/core/wcsServiceMetadata-structure** |
| **Requirement** | **/structure**  a metocean:MetoceanGroup instance shall conform to Figure 6 and Table 19. |
| **Requirement** | **/metocean-related-coverage**  A RelatedCoverage instance shall contain at least one element of type wcs:CoverageSummary |
| **Requirement** | **/metocean\_getCapabilities/request-sections-group-coverage**  A WCS server implementing this extension shall accept the token *MetOceanGroupCoverage* within the sections element of the GetCapabilities request in addition to those specified in OWS Common [OGC 06-121r9] subclause 7.3.3. |
| **Requirement** | **/metocean/getCapabilities-response-conformance-class-in-profile**  A WCS service implementing this extension shall include the following URI in a Profile element in the ServiceIdentification in a GetCapabilities response:  [*http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilities*](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_GetCapabilities)*\_RelatedCoverage* |

* + 1. Requirements class overview

Each subgroup may contain a set of related coverages.

* + 1. RelatedCoverage

A “top level” description of each of the “Coverages” contained within the each subgroup.

Table 19 RelatedCoverage properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| coverageName | The identifier of a specific coverage. (this identifier may be used as an input argument to a GetCoverage) | NCName | one  (Mandatory) |
| metOceanReferenceTime | The reference time of the coverage. | gml:timePosition | zero or one  (Optional) |
| wcs:coverageSummary | Coverage offered within this Coveragecollection | wcs:CoverageSummary | zero or one  (Optional) |

NOTE As RelatedCoverage derives from GML::AbstractFeature, it inherits all properties from its parent class: gml:id, gml:metaDataProperty, gml:description, gml:descriptionReference, gml:identifier, gml:name and gml:boundedBy. Thus information about the spatial extent relating to the coverages within the sub-group can be provided using GML::Envelope. In the situation that the Coverage has spatiotemporal extent, the subtype GML::EnvelopeWithTimePeriod may be used.

Example of Grouping:-

<wcs:Extension>  
 <metocean:metOceanGroup>  
 <metocean:MetOceanGroup>  
 <metocean:metOceanGroupName>UK\_Atmospheric\_Models

</metocean:metOceanGroupName>  
 <metocean:metOceanSubGroup>  
 <metocean:MetOceanSubGroup>  
 <metocean:subGroupName>UKPP</metocean:subGroupName>  
 <metocean:serviceInstance>http:operational/server</metocean:serviceInstance>  
 <metocean:relatedCoverageCollections >  
 <metocean:RelatedCoverageCollection gml:id="UK\_GLOBAL\_2012-05-  
 15T12.00.00Z">  
 <gml:boundedBy>  
 <gml:EnvelopeWithTimePeriod axisLabels="lat long" srsDimension="2"  
 srsName="http://www.opengis.net/def/crs/EPSG/0/4326" uomLabels="deg   
 deg" frame="#ISO-8601">  
 <gml:lowerCorner>-90 -180.0</gml:lowerCorner>  
 <gml:upperCorner>90.0 180.0</gml:upperCorner>  
 <gml:beginPosition>2015-05-15T00.00.12Z</gml:beginPosition>  
 <gml:endPosition>2015-05-16T12.00.12Z</gml:endPosition>   
 </gml:EnvelopeWithTimePeriod>  
 </gml:boundedBy>  
 <metocean:collectionName>UKPP4\_2012-05-15-00Z</metocean:collectionName>  
 <covcoll:coverageCollectionSummary>  
 <covcoll:CoverageCollectionSummary>  
 <ows:WGS84BoundingBox>  
 <ows:LowerCorner>-90 -180.0</ows:LowerCorner>  
 <ows:UpperCorner>90.0 180.0</ows:UpperCorner>  
 </ows:WGS84BoundingBox>  
 <covcoll:coverageCollectionId>UKPP4-2015-05-15-00Z  
 </covcoll:coverageCollectionId>  
 <covcoll:coverageCollectionProfile>  
 http://www.opengis.net/spec/WCS\_service-  
 extension\_coveragecollection/1.0/conf/coveragecollection  
 </covcoll:coverageCollectionProfile>  
 </covcoll:CoverageCollectionSummary>  
 </covcoll:coverageCollectionSummary>  
 </metocean:RelatedCoverageCollection>  
 </metocean:relatedCoverageCollections>  
 <metocean:relatedCoverages>  
 <metocean:RelatedCoverage gml:id="UK2\_GLOBAL">  
 <metocean:coverageName>UKPP4\_2012-05-15-00Z\_ISBL  
 </metocean:coverageName>  
 <metocean:metOceanReferenceTime>  
 <gml:timePosition>2012-05-15T12:00:00Z</gml:timePosition>  
 </metocean:metOceanReferenceTime>  
 <wcs:CoverageSummary>  
 <wcs:CoverageId>UKPP4\_2012-05-15-00Z\_ISBL</wcs:CoverageId>  
 <wcs:CoverageSubtype>RectifiedGrid</wcs:CoverageSubtype>  
 </wcs:CoverageSummary>  
 </metocean:RelatedCoverage>  
 </metocean:relatedCoverages>  
 </metocean:MetOceanSubGroup>  
 </metocean:metOceanSubGroup>  
 </metocean:MetOceanGroup>  
 </metocean:metOceanGroup>  
 </wcs:Extension>

Example The following list is the Capabilities request document of a server supporting coverage Collections

<wcs:GetCapabilities  
 xmlns:ows='http://www.opengis.net/ows/2.0'  
 xmlns:wcs='http://www.opengis.net/wcs/2.0'  
 xmlns:covcoll="http://www.opengis.net/covcoll/1.0"  
 xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'  
 xsi:schemaLocation='http://www.opengis.net/wcs/2.0http://schemas.opengis.net/wcs/2.0/wcsAll.xsd'  
 service="WCS">  
 <ows:AcceptVersions>  
 <ows:Version>2.0.0</ows:Version>  
 </ows:AcceptVersions>  
 <ows:Sections>  
 <ows:Section>OperationsMetadata</ows:Section>  
 <ows:Section>CoverageSummary</ows:Section>  
 <ows:Section>OfferedCollections</ows:Section>  
 </ows:Sections>  
</wcs:GetCapabilities>

* 1. Requirements class: MetOceanDescribeCoverage

|  |  |
| --- | --- |
| **Requirements Class** | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_DescribeCoverage** | |
| **Dependency** | [**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_nwp-observation**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_nwp-observation) |
| **Requirement** | **/structure**  the metocean:DescribeCoverage instance shall conform to Figure 7 and Table 20, and Table 21 |
| **Requirement** | **/metocean-coverage-metadata-property**  A MetOceanMetadata instance shall contain the element metocean:NwpObservation. |
|  |  |



Figure 7 MetOceanDescribeCoverage response UML

* + 1. Requirements class overview

The additional metadata uses the wcs:Extension hook to link, via the MetOceanCoverageMetadata entity to the MetOceanNwpObservation. The DescribeCoverage response encodes the MetOceanNwpObservation to provide metadata that is based on the WMO (World Meteorological Organisation) GRIB2 coding. The metadata links to the WMO code tables where possible so providing an authoritative source. A full description of the encoding is given in sections 8.1, 8.2 and 8.3.

The data mask performs two roles, see section 8.4, but until there is a way of using compound axes (see future work) it is the only way to enumerate the temporal and vertical axes.

* + 1. gmlcov:Extension

Even though this is not part of the MetOcean profile it is show the relationship between this extension point and the MetOcean specific metadata:

Table 20 Extension properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| extensionProperty | References the Metadata section. | MetOceanCoverageMetadata | Zero or one  (optional) |

* + 1. MetOceanCoverageMetadata

A NwpObservation is a more specialised Observation (as defined by O&M) that adds specific metadata and is used by MetOceanCoverageDescription:

Table 21 MetOceanCoverageMetadata properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| metOceanCoverageMetadataProperty | The metadata is contained within the NwpObservation class  (see section 8.1) | NwpObservation | one  (mandatory) |

1. UML Conformance Class Abstract Test Suite (normative)
   1. Conformance class: NwpObservation

|  |  |  |
| --- | --- | --- |
| **Conformance Class** | | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_nwp-observation** | | |
| Requirements | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_Nwp-Observation** | |
| Dependency | http://www.opengis.net/spec/OMXML/2.0/req/observation | |
| Test | **/structure** | |
| Requirement | **/req/metocean/metocean\_Nwp-Observation/structure** |
| Test purpose | Verify that the XML instance is valid |
|  | Test method | Validate the XML instance document using the XML Schema document: |
| Test | **/observed-property** | |
|  | Requirement | **/req/metocean/metocean\_NwpObservation /observed-property** |
|  | Test purpose | To ensure that the observed-property element of the OM\_Observation provides a link to the WMO code definition as described in GRIB2 table 0.0 |
|  | Test method | Inspect the XML to validate the link to the GRIB2 table 0.0 definition. |
| Test | **/result-quality** | |
|  | Requirement | **/req/metocean/metocean\_NwpObservation/result-quality** |
|  | Test purpose | To ensure the NwpObservation shall have a resultQuality property (from OM\_Observation) that references the ResultMask by substitution with AbstractDQ\_Element. |
|  | Test method | Inspect the XML to validate that the element “resultQuality” property points to the element ResultMask |
| Test | **/feature-of-interest** | |
|  | Requirement | **/req/metocean/metocean\_NwpObservation/feature-of-interest** |
|  | Test purpose | to ensure the “featureOfInterest” property of the NwpObservation shall contain the element MetOceanNWPModel that specialises SF\_SpatialSamplingPoint (from ISO 19156:2011 Spatial Sampling Features) using the “shape” element to reference metocean:modelFootprint. |
|  | Test method | Inspect the XML to ensure that the featureOfInterest” property contains the element ModelFootprint. |
| Test | **/phenomenon-time** | |
|  | Requirement | **/req/metocean/metocean\_NwpObservation/phenomenon-time** |
|  | Test purpose | to ensure that the NwpObservation shall have a phenomenon time, i.e. reference time of the validity times of the forecast is encoded as a gml:TimeInstance |
|  | Test method | inspect the NwpObservation to ensure that the phenomenon time is restricted to a time instant denoting the reference time of the forecast. |
| Test | **/result-time** | |
|  | Requirement | **/req/metocean/metocean\_NwpObservation/result-Time** |
|  | Test purpose | to ensure that the NwpObservation shall have a resultTime that is a gml:TimeInstance. |
|  | Test method | inspect the NwpObservation to ensure that the resultTime is restricted to a time instant denoting start time of the arrival of the data and is encoded as a gml:TimeInstance |
| Test | **/valid-time** | |
|  | Requirement | **/req/metocean/metocean\_NwpObservation/valid-time** |
|  | Test purpose | To ensure that the validTime element is encoded as a gml:TimePeriod |
|  | Test method | inspect the NwpObservation to ensure that the validTime is restricted to gml:TimePeriod denoting the time period for which the data is valid. |
| Test | **/observation-type** | |
|  | Requirement | **/req/metocean/metocean\_NwpObservation/observation-type**. |
|  | Test purpose | to ensure that the NwpObservation is a specialization of OM:Observation |
|  | Test method | Validate the XML schema to validate that NwpObservation is a specialization of OM\_Observation http://schemas.opengis.net/metocean/1.0/wcsMetOceanCommon.xsd |
| Test | **/metadata** | |
|  | Requirement | **/req/metocean/metocean\_NwpObservation/metadata**. |
|  | Test purpose | to validate that the element of the specific metadata element MetOceanNwpModelMetadata shall be encoded using gml:ReferenceType and have an xlink:href value of the form:-  xlink:href="http://codes.wmo.int/grib2/codeflag/0” xlink:title="originatingCentre" |
|  | Test method | inspect XML document MetOceanNwpModelMetadata to validate that the metadata element is correctly formed. |
| Test | **/metocean/getCapabilities-response-conformance-class-in-profile** | |
|  | Requirement | **/req/metocean/metocean\_NwpObservation/ metocean/getCapabilities-response-conformance-class-in-profile** |
|  | Test purpose | To ensure that a WCS service implementing this extension includes the following URI in a Profile element in the ServiceIdentification in a GetCapabilities response:http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_NwpObservation |
|  | Test method | inspect the XML response document to check that the ows:profile has been correctly coded in the ows:ServiceIdentification section. |

* 1. Conformance class: NwpModel

|  |  |  |
| --- | --- | --- |
| **Conformance Class** | | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_NwpModel** | | |
| Requirements | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_NwpModel** | |
| Dependency | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_NwpObservation** | |
| Test | **/structure** | |
| Requirement | **/req/metocean/metocean\_NwpModel/structure** |
| Test purpose | To ensure that an instance of NwpModel conforms to Figure 4, Table 4, Table 5, Table 6, Table 7, Table 8, Table 9, Table 10, Table 11, Table 12 and the XML schema being part of this standard. |
|  | Test method | Validate the XML instance document using the XML Schema document: |
| Test | **/nwp-model-metadata** | |
|  | Requirement | **/req/metocean/metocean\_Nwp\_Model/nwp-model-metadata** |
|  | Test purpose | To ensure metocean: MetOceanNwpModelMetadata instance shall conform to Table 5. and the XML schema being part of this standard |
|  | Test method | Validate the XML instance document using the XML Schema document: http://schemas.opengis.net/metocean/1.0/wcsMetOceanCommon.xsd |
| Test | **/model-footprint** | |
|  | Requirement | **/req/metocean/metocean\_Nwp\_Model/model-footprint** |
|  | Test purpose | To ensure the shape property of the SF\_SpatialSamplingFeatureType shall contain the element ModelFootprint that will define the domain of the NWP model |
|  | Test method | Inspect XML document model-footprint to validate that the metadata element is correctly formed. |

* 1. Conformance class: NwpResultMask

|  |  |  |
| --- | --- | --- |
| **Conformance Class** | | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_ResultMask** | | |
| Requirements | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_ResultMask** | |
| Dependency |  | |
| Test | **/structure** | |
| Requirement | **/req/metocean/metocean\_ResultMask/structure** |
| Test purpose | To ensure a metccean:ParameterMask instance shall conform to Figure 5 and Table 13 and Table 14. |
|  | Test method | Validate the XML instance document using the XML Schema document: |
| Test | **/result-quality** | |
|  | Requirement | **/req/metocean/metocean\_ResultMask/result-quality** |
|  | Test purpose | To ensure that the NwpObservation resultQuality property (if present) (from OM\_Observation) contains a ResultMask |
|  | Test method | Inspect the XML instance document to ensure the ResultMask is contained within resultQuality |
| Test | **/resultmask** | |
|  | Requirement | **/req/metocean/metocean\_ResultMask/resultmask** |
|  | Test purpose | Ensure that the instance of ResultMask is a specialisation of gmd:AbstractDQ\_Result that has a property gmd:result that reference a ParameterMask that contains the property TimeHeight Mask of type “ReferenceableGridCoverage” |
|  | Test method | Validate the XML instance document using the XML Schema document: |
| Test | **/getCapabilities-response-conformance-class-in-profile** | |
|  | Requirement | **/req/metocean/metocean\_ResultMask/getCapabilities-response-conformance-class-in-profile** |
|  | Test purpose | To ensure that the following URI is in the Profile element in the ServiceIdentification in a GetCapabilities response:*http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_ResultMask* |
|  | Test method | Inspect the response document to ensure that profile element contains *http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_ResultMask* |
| Test | **/rangeComponent** | |
|  | Requirement | **/req/metocean/metocean\_ResultMask//rangeComponent** |
|  | Test purpose | To ensure that the rangeType element only contains parameters that are GRIB2 compliant (see code tables) |
|  | Test method | Inspect the XML to validate that the rangeType parameters are a valid instance of a GRIB2 code table. |

* 1. Conformance class: metocean\_GetCapabilitiesGroups

|  |  |  |
| --- | --- | --- |
| **Conformance Class** | | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_GetCapabilitiesGroups** | | |
| Requirements | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilitiesGroups** | | |
| Dependency | **http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/req/covcoll\_getCapabilities** | | |
| Dependency | **http:/www.opengis.net/spec/WCS/2.0/req/core/getCapabilities** | | |
| Dependency | **http:/www.opengis.net/spec/WCS/2.0/req/core/wcsServiceMetadata-structure** | | |
| Dependency | [**http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/req/covcoll\_offering**](http://www.opengis.net/spec/WCS_service-extension_coveragecollection/1.0/req/covcoll_offering) | | |
| Dependency | **http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/req/covcoll\_collection-summary** | | |
| Test | **/structure** | | |
|  | Requirement | **/req/metocean/metocean\_GetCapabilitiesGroups/structure** | |
|  | Test purpose | to ensure that the MetOcean Group instance conforms to a metocean:MetoceanGroup instance shall conform to Figure 6 and Table 14, Table 15 and Table 16 | |
|  | Test method | Inspect the structure of the MetOcean instance conforms to Figure 4 and Table 14, Table 15, Table 16 and Table 17 | |
| Test | **/metocean-group** | | |
|  | Requirement | **/req/metocean/metocean\_GetCapabilitiesGroups//metocean-group** | |
|  | Test purpose | Ensure a metOceanGroup instance contains at least one element of type metocean: MetOceanSubGroup | |
|  | Test method | Inspect the XML response to ensure compliance | |
| Test | **/metocean-subgroup** | | |
|  | Requirement | /**req/metocean/metocean\_GetCapabilities/metocean-subgroup** | |
|  | Test purpose | A MetOceanSubGroup instance shall not be empty. | |
|  | Test method | To ensure a MetOceanSubGroup shall contains at least one element of type metocean:RelatedCoverageCollection or RelatedCoverage | |
| Test | **/metocean-getCapabilities-response-conformance-class-in-profile** | | |
|  | Requirement | /**req/metocean/metocean\_GetCapabilities/metocean-getCapabilities-response-conformance-class-in-profile** | |
|  | Test purpose | Ensure a WCS service implementing this extension shall include the following URI in a Profile element in the ServiceIdentification in a GetCapabilities response:  http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_NwpObservation | |
|  | Test method | Inspect the XML response document to ensure that the profile element is present. | |

* 1. Conformance class: metocean\_GetCapabilities\_RelatedCoverageCollection

|  |  |  |
| --- | --- | --- |
| **Conformance Class** | | |
| [**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_GetCapabilities**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/conf/metocean/metocean_GetCapabilities)**\_RelatedCoverageCollection** | | |
| Requirements | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilities\_RelatedCoverageCollection** | |
| Dependency | **http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/req/covcoll\_getCapabilities** | |
| Dependency | **http:/www.opengis.net/spec/WCS/2.0/req/core/getCapabilities** | |
| Dependency | **http:/www.opengis.net/spec/WCS/2.0/req/core/wcsServiceMetadata-structure** | |
| Dependency | [**http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/req/covcoll\_offering**](http://www.opengis.net/spec/WCS_service-extension_coveragecollection/1.0/req/covcoll_offering) | |
| Dependency | **http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/req/covcoll\_collection-summary** | |
| Test | **/structure** | |
|  | Requirement | **req/metocean/metocean\_GetCapabilities\_RelatedCoverageCollection/structure** |
|  | Test purpose | to ensure that the RelatedCoverageCollection instance conforms to a metocean:MetoceanGroup instance shall conform to Figure 6 and Table 18 |
|  | Test method | Inspect the structure of the MetOcean instance conforms to Figure 6 and Table 18 |
| Test | **/metocean-RelatedCoverageCollection** | |
|  | Requirement | **req/metocean/metocean\_GetCapabilities\_RelatedCoverageCollection/metocean-RelatedCoverageCollection** |
|  | Test purpose | To ensure that a RelatedCoverageCollection instance shall contain at least one element of type covcoll:CoverageCollectionSummary |
|  | Test method | Inspect the MetOceanSubGroup element and ensure there is at least one reference to element CoverageCollectionSummary |
| Test | **/metocean\_getCapabilities/request-sections-group-collection** | |
|  | Requirement | **req/metocean/metocean\_GetCapabilities\_RelatedCoverageCollection/request-sections-group-collection** |
|  | Test purpose | To ensure that WCS server the implements this extension accepts the token MetOceanGroupCoverageCollection within the sections element of the GetCapabilities request in addition to those specified in OWS Common [OGC 06-121r9] subclause 7.3.3. |
|  | Test method | Execute a GetCapabilites request and test for the successful operation with the token. |
|  | **/covcoll\_getCapabilities/response-extension-identification** | |
|  | Requirement | **req/metocean/metocean\_GetCapabilities\_RelatedCoverageCollection/ covcoll\_getCapabilities/response-extension-identification** |
|  | Test purpose | To ensure the URI:- *http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/conf/coverageCollection* is present in the service identification profile of the response document. |
|  | Test method | Inspect the response document to ensure the profile element is correct |
|  | **/getCapabilities-response-conformance-class-in-profile** | |
|  | Requirement | **req/metocean/metocean\_GetCapabilities\_RelatedCoverageCollection/ getCapabilities-response-conformance-class-in-profile** |
|  | Test purpose | To ensure the URI:  *http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilities\_RelatedCoverageCollection* is present in the service identification profile of the response document. |
|  | Test method | Inspect the response document to ensure the profile element is correct |

* 1. Conformance class: metocean\_GetCapabilities\_RelatedCoverage

|  |  |  |
| --- | --- | --- |
| **Conformance Class** | | |
| [**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_GetCapabilities**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/conf/metocean/metocean_GetCapabilities)**\_RelatedCoverage** | | |
| Requirements | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilities\_RelatedCoverage** | |
| Dependency | **http:/www.opengis.net/spec/WCS/2.0/req/core/getCapabilities** | |
| Dependency | **http:/www.opengis.net/spec/WCS/2.0/req/core/wcsServiceMetadata-structure** | |
| Test | **/structure** | |
|  | Requirement | **req/metocean/metocean\_GetCapabilities\_RelatedCoverage/structure** |
|  | Test purpose | to ensure that the MetOcean Group instance conforms to a metocean:MetoceanGroup instance shall conform to Figure 6 and Table 19 |
|  | Test method | Inspect the structure of the MetOcean instance conforms to Figure 6 and Table 19 |
| Test | **/metocean-related-coverage** | |
|  | Requirement | **req/metocean/metocean\_GetCapabilities\_RelatedCoverage/metocean-RelatedCoverage** |
|  | Test purpose | To ensure that a RelatedCoverage instance shall contain at least one element of type wcs:CoverageSummary |
|  | Test method | Inspect the RelatedCoverage element and ensure there is at least one reference to element wcs:CoverageSummary |
| Test | **/metocean\_getCapabilities/request-sections-group-coverage** | |
|  | Requirement | **req/metocean/metocean\_GetCapabilities\_RelatedCoverage/request-sections-group** |
|  | Test purpose | To ensure that WCS server the implements this extension accepts the token MetOceanGroupCoverage within the sections element of the GetCapabilities request in addition to those specified in OWS Common [OGC 06-121r9] subclause 7.3.3. |
|  | Test method | Execute a GetCapabilites request and test for the successful operation with the token. |
| Test | **/getCapabilities-response-conformance-class-in-profile** | |
|  | Requirement | **req/metocean/metocean\_GetCapabilities\_RelatedCoverage/getCapabilities-response-conformance-class-in-profile** |
|  | Test purpose | To ensure the URI:  *http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_GetCapabilities\_RelatedCoverage* is present in the service identification profile of the response document. |
|  | Test method | Inspect the response document to ensure the profile element is correct |

* 1. Conformance class: MetOceanDescribeCoverage

|  |  |  |
| --- | --- | --- |
| **Conformance Class** | | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_Describe-Coverage** | | |
| Requirements | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_Describe-Coverage** | | |
| Dependency | [**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean/metocean\_nwp-observation**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_nwp-observation) | | |
| Test | **/structure** | | |
|  | Requirement | **/req/metocean/metocean\_Describe-Coverage/structure** | |
|  | Test purpose | the ensure that metocean:DescribeCoverage instance shall conform to Figure 7 and Table 20, and Table 21 | |
|  | Test method | Inspect the structure of the MetOcean instance conforms to Figure 7 and Table 20, and Table 21 | |
| Test | **/metocean-coverage-metadata-property** | | |
|  | Requirement | **/req/metocean/metocean\_Describe-Coverage/structure/metocean-coverage-metadata-property** | |
|  | Test purpose | Ensure the MetOceanMetadata instance shall contain the element metocean:NwpObservation. | |
|  | Test method | Inspect the XML response to ensure that the element MetOceanMetadata conforms to Table 21 | |
| Test | **/metocean-MetOceanGroup** | | |
|  | Requirement | /**req/metocean/metocean\_GetCapabilities/structure/metocean-MetOceanGroup** | |
|  | Test purpose | to ensure that a MetOceanGroup element contains at least one element of the type MetOceanSubGroup. | |
|  | Test method | Inspect the structure of the MetOceanGroup elements contains at least element of the type MetOceanSubGroup | |

1. Example of a MetOceanDescribeCoverage response

<?xml version="1.0" encoding="UTF-8"?>  
<wcs:CoverageDescriptions >  
 <wcs:CoverageDescription gml:id="UK">  
 <gml:boundedBy>  
 <gml:Envelope axisLabels="lat long" srsDimension="2"  
 srsName="http://www.opengis.net/def/crs/EPSG/0/4326" uomLabels="deg deg">  
 <gml:lowerCorner>-90.0 0.0</gml:lowerCorner>  
 <gml:upperCorner>90.0 360.0</gml:upperCorner>  
 </gml:Envelope>  
 </gml:boundedBy>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL</wcs:CoverageId>  
 <gmlcov:metadata>  
 <gmlcov:Extension>  
 <metocean:extensionProperty>  
 <metocean:MetOceanCoverageMetadata>  
 <metocean:metOceanCoverageProperty>  
 <metocean:MetOceanNwpObservation gml:id="NwpObservation">  
 <om:phenomenonTime>  
 <gml:TimeInstant gml:id="referenceTime">  
 <gml:timePosition>2015-05-15T00:00:00Z</gml:timePosition>  
 </gml:TimeInstant>  
 </om:phenomenonTime>  
 <om:resultTime>  
 <gml:TimeInstant gml:id="arrival\_time\_on\_system">  
 <gml:timePosition>2015-05-15T03:30:00Z</gml:timePosition>  
 </gml:TimeInstant>  
 </om:resultTime>  
 <om:validTime>  
 <gml:TimePeriod gml:id="TimeRange2">  
 <gml:beginPosition>2015-05-15T00:00:00Z</gml:beginPosition>  
 <gml:endPosition>2015-05-20T00:00:00Z</gml:endPosition>  
 </gml:TimePeriod>  
 </om:validTime>  
 <om:procedure>  
 <metce:Process>  
 <gml:description>A description relating to the Model creating the  
 forecast</gml:description>  
 </metce:Process>  
 </om:procedure>  
 <om:parameter>  
 <om:NamedValue>  
 <om:name  
 xlink:href="http://www.codes.wmo.int/GRIB2/table1.2/Start of Forecast"/>  
 <om:value>  
 <gml:TimeInstant gml:id="referenceTime2">  
 <gml:timePosition>2015-05-15T00:00:00Z</gml:timePosition>  
 </gml:TimeInstant>  
 </om:value>  
 </om:NamedValue>  
 </om:parameter>  
 <om:observedProperty  
 xlink:href="http://codes.wmo.int/grib2/codeflag/0.0"  
 xlink:title="ParametrCategoryByDiscipline"/>  
 <om:featureOfInterest>  
 <metocean:NwpModel gml:id="NWP">  
 <sam:type  
 xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC  
 -OM/2.0/SF\_SamplingSurface"/>  
 <sam:sampledFeature  
 xlink:href="http://ukmetoffice.gov.uk/NwpModel/UkGlobal/Version  
 6.1/Exeter"  
 xlink:title="Model Used"/>  
 <sams:shape>  
 <metocean:ModelFootprint  
 gml:id="Model\_Boundary-Geometry2">  
 <metocean:horizontalDomain>  
 <gml:Polygon gml:id="Model\_Boundary-Geometry" uomLabels="deg  
 deg" axisLabels="lat long"   
 srsDimension="2" srsName="http://www.opengis.net/def/crs/EPSG/0/4326">  
 <gml:exterior>  
 <gml:LinearRing>  
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 </gml:exterior>  
 </gml:Polygon>  
 </metocean:horizontalDomain>  
 </metocean:ModelFootprint>  
 </sams:shape>  
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 <metocean:NwpModelMetadata>  
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 xlink:title="Meteorological Products"/>  
 <metocean:typeOfData  
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 xlink:title="Forecast Products"/>  
 <metocean:signifcanceOfReferenceTime  
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 xlink:title="Start of Forecast"/>  
 <metocean:originatingCentre  
 xlink:href="http://codes.wmo.int/grib2/codeflag/0/originatingCentre"  
 xlink:title="Uk Met Office Exeter"/>  
 <metocean:productionStatusOfData  
xlink:href="http://codes.wmo.int/grib2/codeflag/1.3/productionStatusOfData"  
 xlink:title="Operational Products"/>  
 <metocean:typeOfCalendarUsed  
 xlink:href="http://codes.wmo.int/grib2/codeflag/1.6/typeOfCalendarUsed"  
 xlink:title="Gregorian"/>  
 <metocean:fixedSurfacetypesAndUnits  
 xlink:href="http://codes.wmo.int/grib2/codeflag/4.5/Fixd surface types and units"  
 xlink:title="Isobaric Surface"/>  
 </metocean:NwpModelMetadata>  
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 </metocean:NwpModel>  
 </om:featureOfInterest>  
 <om:resultQuality>  
 <metocean:ResultMask>  
 <gmd:result>  
 <metocean:ParameterMask>  
 <metocean:rangeComponent>Temperature/Relative Humidity/Dewpoint Temperature</metocean:rangeComponent>  
 <metocean:timeHeightMask>  
 <metocean:TimeHeightMask gml:id="ID000">  
 <gml:boundedBy>  
 <gml:Envelope axisLabels="lat long"  
 srsDimension="2"  
 srsName="http://www.opengis.net/def/crs/EPSG/0/4326"  
 uomLabels="deg deg">  
 <gml:lowerCorner>-90.0 0.0</gml:lowerCorner>  
 <gml:upperCorner>90.0 360.0</gml:upperCorner>  
 </gml:Envelope>  
 </gml:boundedBy>  
 <gml:domainSet>  
 <gmlrgrid:ReferenceableGridByArray gml:id="ex"  
 dimension="2"  
 srsName="http://www.opengis.net/def/crs-combine?  
 1=http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface&amp;  
 2=http://http://codes.wmo.int/grib2/codeflag/4.11"  
 axisLabels="pressurealtitude forecast\_time"  
 uomLabels="hPa hours">  
 <gml:limits>  
 <gml:GridEnvelope>  
 <gml:low>1000 0</gml:low>  
 <gml:high>200 144</gml:high>  
 </gml:GridEnvelope>  
 </gml:limits>  
 <gml:axisLabels>pressurealtitude  
 forecast\_time</gml:axisLabels>  
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 200 0 1000 3 850 3 700 3 500 3 300 3 250 3 200 3  
 1000 6 850 6 700 6 500 6 300 6 250 6 200 6 1000 12  
 850 12 700 12 500 12 300 12 250 12 200 12 1000 24  
 850 24 700 24 500 24 300 24 250 24 200 24 1000 48  
 850 48 700 48 500 48 300 48 250 48 200 48 1000 72  
 850 72 700 72 500 72 300 72 250 72 200 72 1000 96  
 850 96 700 96 500 96 300 12 250 96 200 96 1000 120  
 850 120 700 120 500 120 300 120 250 120 200 120  
 1000 144 850 144 700 144 500 144 300 144 250 144  
 200 144 </gml:posList>  
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 </gmlrgrid:ReferenceableGridByArray>  
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 <gml:tupleList>  
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 </gml:rangeSet>  
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 </metocean:ParameterMask>  
 </gmd:result>  
 </metocean:ResultMask>  
 </om:resultQuality>  
 <om:result/>  
 </metocean:MetOceanNwpObservation>  
 </metocean:metOceanCoverageProperty>  
 </metocean:MetOceanCoverageMetadata>  
 </metocean:extensionProperty>  
 </gmlcov:Extension>  
 </gmlcov:metadata>  
 <gml:domainSet>  
 <gml:RectifiedGrid dimension="2" gml:id="UK\_NWP\_Global\_MODEL\_GRID">  
 <gml:limits>  
 <gml:GridEnvelope>  
 <gml:low>0 0</gml:low>  
 <gml:high>538 447</gml:high>  
 </gml:GridEnvelope>  
 </gml:limits>  
 <gml:axisLabels>lat long</gml:axisLabels>  
 <gml:origin>  
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 <gml:pos>-180 -90</gml:pos>  
 </gml:Point>  
 </gml:origin>  
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 0.0</gml:offsetVector>  
 </gml:RectifiedGrid>  
 </gml:domainSet>  
 <gmlcov:rangeType>  
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 <swe:description>air\_temperature</swe:description>  
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 <swe:uom code="C"/>  
 <swe:constraint>  
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 <swe:constraint>  
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 <swe:description>Dewpoint Temperature</swe:description>  
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 <swe:uom code="C"/>  
 <swe:constraint>  
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 <swe:interval>-273 100</swe:interval>  
 <swe:significantFigures>4</swe:significantFigures>  
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 </swe:Quantity>  
 </swe:field>  
 </swe:DataRecord>  
 </gmlcov:rangeType>  
 <wcs:ServiceParameters>  
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 <wcs:nativeFormat>image/tiff</wcs:nativeFormat>  
 </wcs:ServiceParameters>  
 </wcs:CoverageDescription>  
</wcs:CoverageDescriptions>

1. <http://cite.opengeospatial.org/> [↑](#footnote-ref-1)