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**A MetOcean Metadata profile for WCS2.1**

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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 WCS2.1 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.
3. *DescribeCoverageCollection*- a WCS server describes the contents of a specific coverage collection via a DescribeCoverageCollection 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, simulation, 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

National Weather Service (NOAA), US

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1. Revision History

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1. Scope

The purpose of this Met Ocean profile of WCS2.1 is to define the metadata returned in the response documents resulting from the WCS2.1 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,* and/or *MetOceanGroupCoverageCollection,* in the Sections element of the GetCapabilities request.

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.

Requirements and conformance test URIs defined in this document are relative to:-

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

This document establishes the following requirements and conformance classes:-

***metocean\_metOcean-observation* of URI http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean\_metOcean-observation** defining the metocean\_metOcean-observation at a conceptual level in clause ; the corresponding conformance class is metocean\_MetOceanObservation with URI **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/ metocean\_metOcean-observation** See (annex A1)

***metocean\_simulation-process-description* of URI http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/ metocean\_simulation-process-description** defining the metocean\_simulation-process-description at a conceptual level in clause ; the corresponding conformance class is metocean\_simulation-process-description **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/ metOcean\_simulation-process-description** See (annex A2)

***metocean\_result-mask* of URI http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/ metocean\_result-mask** defining the metocean\_result-mask at a conceptual level in clause ; the corresponding conformance class is metocean\_result-mask **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/ metocean\_result-mask** See (annex A3)

***metocean\_GetCapabilities* of URI http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/ metocean\_GetCapabilities** defining the metocean\_GetCapabilites-groups response in clause the corresponding conformance class with URI **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/ metocean\_getCapabilities** See (annex A4)

***metocean\_DescribeCoverage* of URI http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean\_ DescribeCoverage** defining the metocean\_DescribeCoverage response in clause , the corresponding conformance class with URI **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/ metocean\_DescribeCoverage** See (annex A5)

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 2.1 Interface Standard - Core OGC Document 09-110r5 <http://www.opengeospatial.org/standards/wcs>

OGC Best Practice for using Web Map Services (WMS) with time dependant or Elevation dependant data. Document 12-111 <https://portal.opengeospatial.org/files/?artifact_id=56394&version=2>

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 15-044r4

Coverage Implementation Schema OGC 09-146r5 <https://portal.opengeospatial.org/files/?artifact_id=65455&version=1>

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, simulation

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

* 1. reference time

temporal parameter used to represent a time axis that can be mapped to some relevant referent time other than validity time. The semantic meaning can differ for different types of data. For numerical weather forecasts it may be a nominal time where observations have been assimilated to initialize the calculation.

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. validity time

an attribute value specified by an instant in, or duration of, universal chronological time that identifies when information is valid or applicable. In [ISO 19156], the validity time has the semantics of phenomenonTime. Deciding if the data have a ‘validity time’ is an important step.

Synonym: verification 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 for a set of elevations and times the availability of specific parameters for a given output dataset. (see Section 7 and ). This mechanism is important as it allows the 2D coverages to be stacked together in time and elevation to form a 4D coverage,

NOTE: A data mask is described using a “cis:GeneralGridCoverage”.

* 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) 2.1 (WCS2.1)

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: CIS (Coverage Implementation Schema 1.1)

1.1

Orange: ISO19156 – Observations & Measurements

 Green: Defined within this standard

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 . 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 other disciplines, e.g. the climate community.

Table 1 Summary of vocabularies within this standard

| **Code list** | **Package(s)** | **Code items defined** |
| --- | --- | --- |
| disciplineCode | SimulationProcessMetadata | Yes |
| typeOfDataCode | SimulationProcessMetadata | Yes |
| significanceOfReferenceTimeCode | SimulationProcessMetadata | Yes |
| originatingCentreCode | SimulationProcessMetadata | Yes |
| productionStatusCode | SimulationProcessMetadata | Yes |
| typeOfCalendarCode | SimulationProcessMetadata | Yes |
| fixedSurfacetypeAndUnits | SimulationProcessMetadata | 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 be done more efficiently 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 WCS2.1 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. WCS2.1

The WCS2.1 files (see <https://portal.opengeospatial.org/files/?artifact_id=67116&version=1>) form the core standard and extensions (see below) defines the operations (specifically GetCapabilities, DescribeCoverage required by the MetOcean community, but the metadata (other than basic WCS) needs to be community specific and is added by using the wcs:Extension element. Currently, the only profile is for the Earth Observing community.

WCS Core Extensions

* 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

The main benefit of WCS2.1 is that it allows the description of a CIS 1.1 Coverage (see ). The is important as a CIS 1.1 supports multi-dimensional coverage and therefore supports the MetOcean profile.



Figure 1 WCS CoverageDescriptions UML class diagram

* 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; the nominal “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. Post Processing

It is becoming increasingly common for raw NWP model output to be “post processed” using a number of techniques raging from the application of statistical methods based on past model behaviour to adjustments made using ensemble forecasts. As we move away from simple deterministic models i.e. raw model output, the notion of reference time becomes less useful and terms such “simulated forecast” become more meaningful.

* + 1. Coverages

A coverage contains a domainSet component describing the coverage’s domain (the set of “direct positions”, i.e., the locations for which values are stored in the coverage) and a range­Set component containing these stored values of the coverage. Further, a coverage contains a rangeType element which describes the coverage's range set data structure. Such a type often consists of one or more fields (also referred to as parameters), however, much more general definitions are possible. For the description of the range value structure, SWE Common [OGC 08-094] Data­Record is used. The metadata component represents an extensible slot for metadata. For a UML description see



Figure 2 UML Diagram representing the coverage model (CIS 1.1).

* + 1. 4D Coverages

A typical NWP forecast may be expressed as a set of 2D 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 and the metadata returned by the GetCapabilites response soon becomes unmanageable. The problem can be simplified by identifying, where possible, “4D Coverages” this is made much easier with the OGC’s Coverage Implementation Schema (CIS 1.1).

A typical numerical simulation has a number of different vertical coordinates; for example: pressure, height above mean sea level, height above ground, surface, max wind level etc*.* 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, but the “GeneralGridCoverage Type” as described by GML Application Schema Coverage OGC 09-146r3 (See ) makes this possible.

* + 1. Time Dependant data (from WMS Best Practice OGC document:12-111r1)

Complex data sets can have temporal dependencies of many kinds. This document adopts the phrase 'validity time' in reference to this type of temporal dependency despite the potentially misleading natural language association of the root 'validity.' This concept is essentially identical to the concept of 'phenomenonTime' from the standard ISO 19156:2011, Geographic information -- Observations and measurements, which refers to the applicability of the data using the chronological Gregorian calendar.

Frequently, data are additionally temporally dependent relative to some reference time instant; observations may have an accession time into a data repository, numerical weather forecasts may have a nominal time where observations have been assimilated to initialize the calculation and alerts may have a time when they are issued or published.

The diversity of such references precludes defining a dimension type with explicit semantics though the need for a mechanism to distinguish data based on some temporal referent is widely shared. The definition of a generic dimension called referenceTimeAxis, may be used for such occasions. This supported in this standard.

This WCS2.1 profile uses a combination of time stamp, a list of time stamps or a start\_time/end\_time/time\_interval to enumerate time. The semantics of this string representation of a timestamp is built from the time components and specific separators. A full string representation has the following format:

“YYYY-MM-DDThh:mm:ss.SSSZ”

Where:

* YYYY indicates a 4-digit year
* MM indicates a month
* DD indicates a day of a month
* T is the separator between the date part and the time part
* hh indicates an hour
* mm indicates a minute
* ss indicates a second
* SSS indicates a millisecond
* Z is the time zone designator for the zero UTC offset

The precision of a timestamp t is determined by the last time component. Timestamps may be associated with a time zone. If no time zone is specified with a timestamp t, then t is assumed to be in local time.

A time interval is a triple tmin/tmax/r where tmin and tmax are timestamps that define the lower and upper bounds of the interval and r is the resolution. The interval contains all timestamps tmin + i \* r, i >= 0, that are lower or equal than tmax. A resolution r is represented by the format P [n1Y] [n2M] [n3D] [T [n4H] [n5M] [n6S]] where:-

* P is a starting character.
* Y is the year designator that follows the value n1 for the number of years.
* M is the month designator that follows the value n2 for the number of months.
* D is the day designator that follows the value n3 for the number of days.
* T is the time designator that precedes the time components of the representation.
* H is the hour designator that follows the value n4 for the number of hours.
* M is the minute designator that follows the value n5 for the number of minutes.

Some Examples:-

1. ***A Time stamp***

*2015-05-15T00:00:00Z*

1. ***A list of time stamps:-***

*2015-05-15T00:00:00Z, 2015-05-15T06:00:00Z etc.*

1. ***A start and end time***

*2015-05-15T00:00:00Z/2015-05-17T12:00:00Z*

1. ***Example of a start/end/interval :***

*2015-05-15T00:00:00Z/2015-05-17T00:00:00Z/PT12H*

***Example of a reference time axis a list of durations (Note thatA reference time must be specified)*** *PT0H,PT6H,PT12H*

Where a reference time is specified (using om:phenomenonTime) then time axis will be enumerated as a set of time using the time duration notation i.e. using the P [n1Y] [n2M] [n3D] [T [n4H] [n5M] [n6S]] notation. Thus PT12H denotes a time duration of 12 hours relative to the reference time.

Where no reference time is specified, but the times are relative to a starting and end point then a recurring time interval can be used for example:-

2015-05-15T00:00:00Z/2015-05-17T00:00:00Z/PT12H

Where no reference time is specified, a set of timestamps may be used e.g. 2015-05-15T00:00:00Z, 2015-05-15T12:00:00Z, 2015-05-15T18:00:00Z *Note where times are irregular then the form start/end/interval is not appropriate.*

* + 1. Data Masking

An added problem is possibility of the irregularity of the output data, 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 possible sparsity of the data (See ).

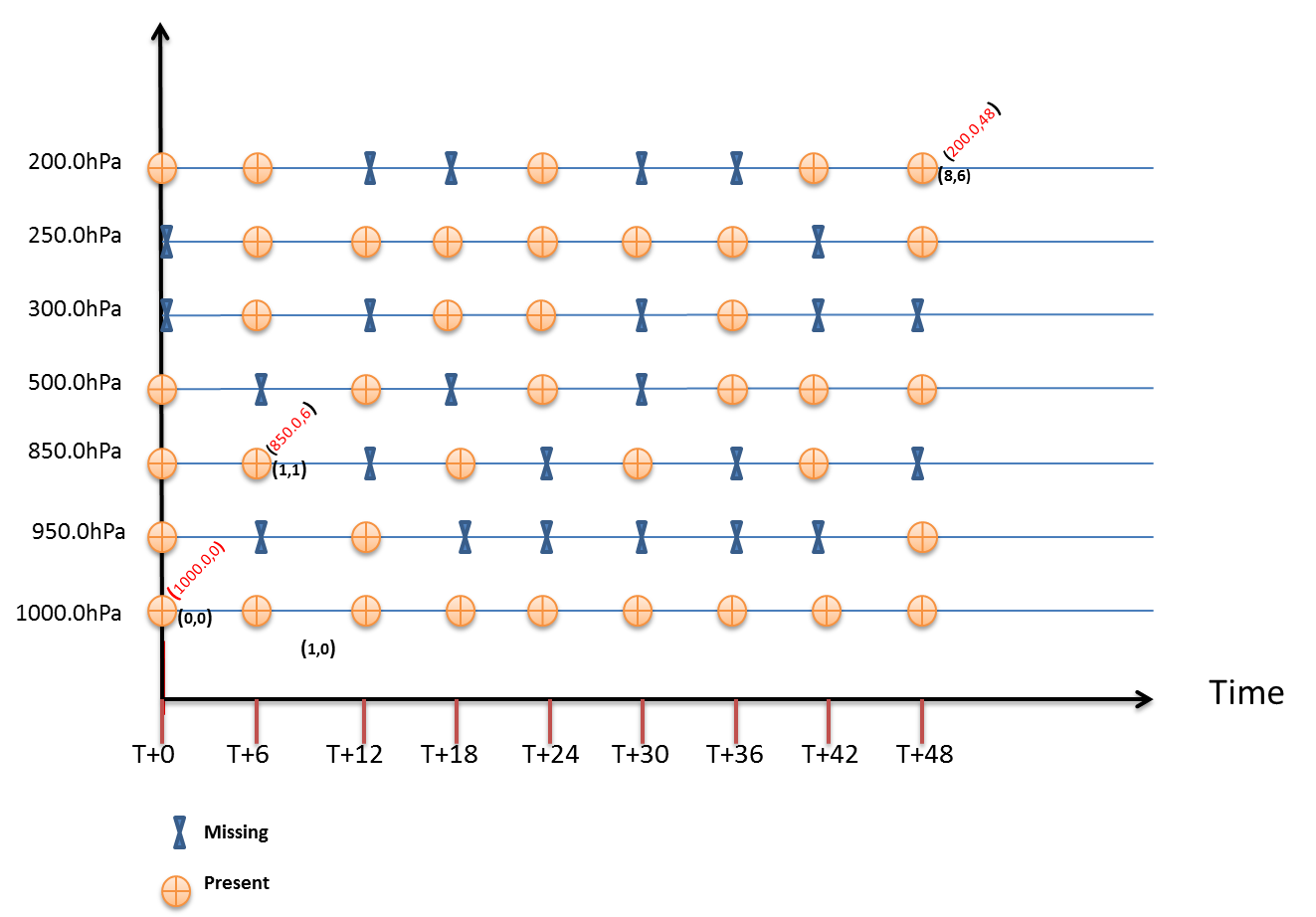


Figure 3 Diagram representing the irregularity of the time and vertical axes and the sparsity of the output in the coverage model

The data mask has a “GeneralGridCoverage” Type” as described by GML Application Schema Coverage OGC 09-146r3 (*Coverage Implementation Schema*). The element cis:domainSet is used to enumerate the temporal and vertical axes of the “coverage”. using either the element cis:irregularAxis or cis:regularAxis.

The vertical 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 “range set” part of the coverage is a tuple list used to indicate if data are present, i.e. a “1” if present and a “0” if not.

The server support of the mask should be indicated by the server in the GetCapabilities file. *<ows:Profile>*[*http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/mask-support</ows:Profile*](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/conf/mask-support%3c/ows:Profile)

* + 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 Numerical weather Prediction model the output (a set of coverages) may be grouped together, so allowing a specific model instance (aka model “run”) to be described by a unique identifier with an accompanying geospatial/temporal extent information linked to that identifier..

* + 1. MetOcean Profile for GetCapabilities

The GetCapabilites MetOcean application profile has been designed to specifically allow the grouping together of coverages, coverageCollections and computational simulations. The first two use cases i.e coverages and coverageCollections are generic and therefore applicable to any community domain, but the third needs more explanation.

The third use case i.e. computational simulations, is specific to the Met Ocean application profile and developed around the NWP methodology (see section 7.2.1). What makes this “use case” different is that each simulation (aka a “model run”) is a collection of coverages. For a typical NWP model these would be based on the different vertical coordinate reference systems used, e.g. pressure, height, means sea level, surface, max wind level etc. The semantics are sufficiently important to warrant a specific class as it will make parsing by the client that much easier.

Simulations are typically updated at regular intervals and it useful to refer to a series of simulations as set of members, with each member referring to a specific instance of that simulation sequence. Each member of this series is in effect a grouping together of the related coverages (they typically share both a horizontal and temporal domains) and uniquely identified using an identifier (coverageCollectionId). This set of coverages may then be further described by either using a DescribeCoverageCollection operation (if available on the server) or by using the “SimulationCoverageSummary” class available in the GetCapabilites response.

Best data, analyses, forecasts, climate runs.

* 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 and is used to denote the “referenceTime”.
* **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. MetOcean Observation metadata mapping on Observations and Measurements

To represent MetOcean metadata, this profile extends the Observations and Measurements properties with MetOcean specific information. The relationship of MetOceanObservation to the O&M is shown in and in section 8.1 and table 2. The adaptation, in places, uses specialisation particularly with respect to the basic Observation Type. In the examples the object MetOceanObservation is an abstract type and has to be substituted by a concrete object of type ObservationType

1. MetOcean Application Profile UML & Requirements (normative)
   1. Requirements class: metOcean\_metOcean-Observation

|  |  |
| --- | --- |
| **Requirements Class** | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean\_metOcean-observation** | |
| **Dependency** | **http://www.opengis.net/spec/OMXML/2.0/req/observation** |
| **Requirement** | /**req/metocean\_metOcean-observation/structure**  A metocean: MetOceanObservation instance shall conform to , and |
| **Requirement** | /**req/metocean\_metOcean-observation/observed-property**  The observed property of the OM\_Observation type shall link the WMO code definitions of as GRIB2 table 0.0 “Discipline” e.g. for meteorology <http://codes.wmo.int/grib2/codeflag/0.0/_0> |
| **Requirement** | /**req/metocean\_metOcean-observation/result-quality**  The MetOceanObservation shall have a resultQuality property (from OM\_Observation) that references the ResultMask by substitution with AbstractDQ\_Element. |
| **Requirement** | /**req/metocean\_metOcean-observation/feature-of-interest**  The ‘featureOfInterest’ property of the MetOceanObservation element shall reference a SimulationProcessDescription element that is an instance of SF\_SpatialSamplingPoint (from ISO 19156:2011 Spatial Sampling Features). |
| **Requirement** | /**req/metocean\_metOcean-observation/phenomenon-time**  The specific use will depend on what time axes are used (See 7.2.4). Its uses shall conform to section 7.2.4 |
| **Requirement** | /**req/metocean\_metOcean-observation/valid-time**  An attribute value shall specify an instant in, or duration of, universal chronological time that identifies when information is valid or applicable by referencing gml:TimePeriod |
| **Requirement** | /**req/metocean\_metOcean-observation/observation-type**  A specialized observation (e.g. NWPObservation) shall be derived from OM\_Observation through the abstract type *MetOceanObservation* |
| **Requirement** | /**req/metocean\_metOcean-observation/procedure**  The om:procedure element shall contain an instance of “SimulationProcessMetadata” |



Figure 4 – MetOceanObservation UML

* + 1. Requirements class overview

The MetOceanObservation requirements class defines how metadata appropriate to the MetOcean community will be expressed as part of the responses to a WCS2.1 GetCapabilities and DescribeCoverage request.

* + 1. MetOceanObservation

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 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 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). For NWP models the most obvious real-world-entity is the domain over which the simulation was carried out by using the shape property.
* 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 **procedure** references the metadata that describes the procedure that was used by the simulation process. Note that this is done by reference to the WMO GRIB2 code tables.
* The **resultQuality** will point to the data mask used to indicate if 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 MetOceanObservation properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| om:phenomenonTime | The analysis time i.e. the start or “reference time” of the NWP process as outlined in section 7.2.4 | TM\_Object | One  (mandatory) |
| om:resultTime | issue time (e.g. result time) i.e. the time when the entire NWP model output was published | TM\_Instant | One  (mandatory) |
| om: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) |
| om:procedure | The procedure used in making the observation. A specialised type is provided to detail important aspects of the observation procedure. There is huge diversity in the available methods for gauging observations; the key aspects are captured here to provide useful metadata for result interpretation. | SimulationProcessMetadata | One  (mandatory) |
| om: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) |
| om:featureOfInterest | The feature of interest is the entity about which the observation is made, in this case it used describe the model used to create the assimilation/forecast. | SimulationProcessDescription. | One  (mandatory) |
| om: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) |

* + 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: SimulationProcessDescription

|  |  |
| --- | --- |
| **Requirements Class** | |
| [**http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean\_simulation-process-description**](http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean_simulation-process-description%20) | |
| **Dependency** | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean\_metOcean-observation** |
| **Dependency** | **http://www.opengis.net/spec/OMXML/2.0/req/observation** |
| **Requirement** | **/req/metocean\_simulation-process-description/structure**  A metocean: SimulationProcessDescription instance shall conform to , , , , , , , ,  and the XML schema being part of this standard. |
| **Requirement** | **/req/metocean\_simulation-process-description/metadata**  SimulationProcessMetadata shall have a set of properties each using gml:reference to link to the relevant controlled registers e.g. WMO. |
| **Requirement** | **/req/metocean\_simulation-process-description/fixedSurfaceType**  If the fixed surface type has no vertical dependency (e.g. Ground, Max Wind Level) then the cis:regularAxis element shall be used with the lowerBound and upperBound attributes set to the value of 1 and the resolution set to 0. |
| **Requirement** | **/req/metocean\_simulation-process-description/footprint**  The shape property of the sampledFeature shall contain the component Footprint that will define the horizontal domain of the simulation model. |



Figure 5 – Simulation Process UML

* + 1. Requirements class overview

Simulations of weather, climate and ocean forecasts are made using 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 describe the spatial/temporal domain of the model.

* + 1. SimulationProcessDescription

The metocean\_SimulationProcessDescription requirements class defines how metadata appropriate to the simulation 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 SimulationProcessDescription Properties

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

* + 1. SimulationProcessMetadata

The metadata for the NWP Model:

Table 5 SimulationProcessMetadata 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 and international originating centre’s (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. Footprint

A description of the horizontal domain of the NWP model:

Table 6 Footprint

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

* + 1. DisciplineCode

A type capturing the relevant scientific discipline:

Table 7 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 8 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 9 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 10 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 11 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\_result-mask** | |
| **Dependency** | [**http://www.opengis.net/spec/CIS/1.1/**](http://www.opengis.net/spec/CIS/1.1/) |
| **Requirement** | **req/metocean\_result-mask/structure**  A metocean:ResultMask instance shall conform to , , |
| **Requirement** | **/req/metocean\_result-mask/mask-extension**  The ResultMask shall through the specialisation of gmd:AbstractDQ\_Result (that has a property gmd:result), reference a ParameterMask that contains the property TimeHeight Mask of type cis:GeneralGridCoverageType |
| **Requirement** | **/req/metocean\_result-mask/metocean/getCapabilities-response-conformance-class-in-profile**  A WCS service implementing this extension shall include the following URI in a ows: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 6 – ResultMask UML

* + 1. Requirements class overview

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.

* + 1. ResultMask

Model as used in weather and ocean forecast models:

Table 12 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 13 Parameter Mask

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| timeHeightMask | A Time-Height Mask is a ”GeneralGridCoverage” (using the Coverage Implementation Schema v1.1) with height/time axes and Boolean range values. Such a mask serves to indicate areas where parameters (range values) contain only nil values This serves as a hint to applications as to which regions contain “interesting” (i.e., non-nil) values. | TimeHeightMask | zero or one  (optional) |
| rangeComponent | The list of parameters for which the ResultMask applies.  Multiple parameters are separated by a /. | string | One  (mandatory) |

* 1. Requirements class: GetCapabilities

|  |  |
| --- | --- |
| **Requirements Class** | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/ metocean\_GetCapabilities** | |
| Dependency | **http://www.opengis.net/doc/IS/WCS/2.1#clause:8.2** |
| Dependency | **http:/www.opengis.net/spec/WCS/2.1/conf/core/getCapabilities** |
| Dependency | **http:/www.opengis.net/spec/WCS/2.1/conf/core/wcsServiceMetadata-structure** |
| Dependency | **http:/www.opengis.net/spec/WCS/2.1/conf/core/wcsServiceMetadata-contents** |
| Dependency | [**http://www.opengis.net/spec/WCS\_application-profile\_coverage\_collections/1.0/conf/covcoll\_offering**](http://www.opengis.net/spec/conf/covcoll_offering) |
| Dependency | **http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/conf/covcoll\_collection-summary** |
| **Requirement** | **/req/metocean\_GetCapabilities/structure**  A metocean:MetoceanGroup instance shall conform to , , , ,, ,, and |
| **Requirement** | **req/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 |
| **Requirement** | **/req/covcoll\_getCapabilities/response-CoverageCollection-List**  All CoverageCollection resources shall be listed, irrespective of their position within a hierarchy of nested collections within the Extension element of the Contents: |

v

Figure 7 MetOcean GetCapabilities UML

* + 1. Requirements class overview

The WCSGetCapabilitiesMetOceanProfile requirements class is dependent on the CoverageCollection operation that is itself a WCS extension class and DescribeCoverageCollection operations being supported by the WCS server.

This MetOcean profile provides a method of grouping together coverages (see ), 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 14 wcs:Extension properties

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

* + 1. CoverageCollectionMetadata

The CoverageCollectionMetadata is a high level object that forms the core part of the MetOcean GetCapabilities response.

Table 15 wcs: CoverageCollectionMetadata properties

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Definition | Data types and values | Multiplicity |
| Name | A meaningful name that gives identity to the group | NCName | zero or one (optional) |
| serviceInstant | The service address of the server that will serve the coverages/coverageCollections. | anyURI | zero or one  (optional) |
| ows:metadata | An extension point for any additional metadata | ows:abstractMetadata | zero or one  (optional) |
| coverageSummary | The summary of the coverages listed in the GetCapabilities response. | metocean:CoverageSummary | zero or more |
| covcoll:coverageCollectionSummary | The summary of the coverage collections listed in the GetCapabilities response. | covcoll:CoverageCollectionSummary | zero or more |

* + 1. MetOceanGroup

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

Table 16 MetOceanGroup properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| simulationCollection | A simulation is the construction of a mathematical model to reproduce the characteristics of a forecast based on a computer simulation of the atmosphere-ocean. A common example would be a NWP model run collection. | SimulationCollection | zero or more |

* + 1. SimulationCollection

The development and use of computer models for the study of actual or postulated dynamic systems is common in the field of environment science. It is commonplace to “run” simulations at regular intervals and it is convenient to group together these simulations and list each instance (or member) of that series with each member having a unique identifier.

Table 17 SimulationCollection properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| simulationMember | An individual member of the series of simulation (aka Model Run) | SimulationMember | one or more  (mandatory) |
| cis:envelope | The envelope around a coverage is defined by the lower and upper bound of each axis, respectively; an asterisk "\*" in lower/upper bound denotes a null value. | cis:axisExtent | zero or one |

* + 1. SimulationMember

The development and use of computer models for the study of actual or postulated dynamic systems is common in the field of environment science. It is commonplace to “run” simulations at regular intervals and it is convenient to group together these simulations and list each instance (or member) of that series with each member having a unique identifier.

Table 18 SimulationMember properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| covcoll:coverageCollectionId | Identifier of a CoverageCollection offered by this service aka the identifier of each member (e.g. model run) of the simulation. | NCName | one  (mandatory) |
| cis:envelope | The envelope around a coverage is defined by the lower and upper bound of each axis, respectively; an asterisk "\*" in lower/upper bound denotes a null value. | cis:axisExtent | zero or one |
| ows:metadata | An extension point for any additional metadata | ows:abstractMetadata | zero or one |
| simulationCoverageSummary | The summary information for each coverage contained in each member (e.g. model run) of the simulation. | SimulationCoverageSummary | zero or more |

* + 1. CoverageCollectionSummary

The metadata that are required to describe a listed coverage. collection

Table 19 metocean:CoverageCollectionSummary properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| covcoll:coverageCollectionId | Identifier of a CoverageCollection offered by this service | NCName | one |
| cis:envelope | The envelope around a coverage is defined by the lower and upper bound of each axis, respectively; an asterisk "\*" in lower/upper bound denotes a null value. | cis:axisExtent | zero or one |
| ows:metadata | An extension point for any additional metadata | ows:abstractMetadata | zero or one |

* + 1. CoverageSummary

The metadata that are required to describe a listed coverage

Table 20 metocean:CoverageSummary properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| wcs:coverageId | Identifier of a coverage offered by the service on hand | NCName | one |
| cis:envelope | The envelope around a coverage is defined by the lower and upper bound of each axis, respectively; an asterisk "\*" in lower/upper bound denotes a null value. | cis:axisExtent | zero or one |
| ows:metadata | An extension point for any additional metadata | ows:abstractMetadata | zero or one |

* + 1. Additional Metadata

Any required ancillary data.

Table 21 metocean:CoverageSummary properties

| **Name** | **Definition** | **Data types and values** | **Multiplicity** |
| --- | --- | --- | --- |
| ows;abstractMetadata | The extension point in ows:metadata |  |  |
| referenceTime | The analysis time i.e. the start or “reference time” of the simulation process. | gml:timePosition | zero or one (optional) |
| referenceTimeAxis | The analysis axis time i.e. a list of reference times that constitute an axis | Choice  cis:regularAxis  cis:irregularAxis | zero or one (optional) |

* 1. Requirements class: MetOceanDescribeCoverage

|  |  |
| --- | --- |
| **Requirements Class** | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean\_ DescribeCoverage** | |
| Dependency | **[OGC06-121r9] (**[**http://www.opengis.net/doc/OWS/2.0/clause/8**](http://www.opengis.net/doc/OWS/2.0/clause/8)**)** |
| Dependency | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean\_metOcean-observation** |
| Dependency | **http:/www.opengis.net/spec/WCS/2.1/conf/core/wcsServiceMetadata-contents** |
| Dependency | [**http://www.opengis.net/spec/WCS/2.1/**](http://www.opengis.net/spec/WCS/2.1/)**./conf/core/coverageSummary** |
| Dependency | **[OGC09-1110r5] (**[**http://www.opengis.net/doc/wcs/2.1/clause/8.3**](http://www.opengis.net/doc/wcs/2.1/clause/8.3)**)** |
| Requirement | **/req/metocean\_DescribeCoverage/structure**  The metocean:DescribeCoverage instance shall conform to , and |
| Requirement | **/req/metocean\_DescribeCoverage/metocean-coverage-metadata-property**  A MetOceanMetadata instance shall have a specialised observation derived from OM:Observation through the abstract class *MetOceanObservation* |



Figure 8 MetOceanDescribeCoverage response UML

* + 1. Requirements class overview

The additional metadata uses the cis:Extension hook to link, via the CoverageMetadata entity to the MetOceanObservation. The DescribeCoverage response encodes the MetOceanObservation to provide metadata that is based on the WMO (World Meteorological Organisation) GRIB2 coding. The MetOceanObservation is specialised by community specific types, e.g. NWPObservation, SimulatedObservation and others yet to be defined.

* + 1. cis:Extension

The extension point that links MetOcean specific metadata to the DescribeCoverage response:

Table 22 Extension properties

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

* + 1. MetOceanCoverageMetadata

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

Table 23 MetOceanCoverageMetadata properties

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

1. UML Conformance Class Abstract Test Suite (normative)
   1. Conformance class: MetOcean-Observation

|  |  |  |
| --- | --- | --- |
| **Conformance Class** | | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean\_metOcean-observation** | | |
| Requirements | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_ MetOceanObservation** | |
| Dependency | http://www.opengis.net/spec/OMXML/2.0/req/observation | |
| Test | /**conf/metocean\_metOcean-observation/structure** | |
| Requirement | /**req/metocean\_metOcean-observation/structure** |
| Test purpose | A metocean: MetOceanObservation instance shall conform to , and |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the NWPObservation component and ensure it conforms to , and |
| Test | /**conf/metocean\_metOcean-observation/observed-property** | |
|  | Requirement | /**req/metocean\_metOcean-observation/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 | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the NWPObservation component and ensure the observedProperty component links to a valid WMO definition as described in GRIB2 table 0.0 |
| Test | /**conf/metocean\_metOcean-observation/result-quality** | |
|  | Requirement | /**req/metocean\_metOcean-observation/result-quality** |
|  | Test purpose | To ensure that the MetOceanObservation component has a resultQuality property (from OM\_Observation) that references the ResultMask by substitution with AbstractDQ\_Element. |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the MetOceanObservation component and validate that the element “om:resultQuality” (if not null) property contains the element metocean:ResultMask. |
| Test | /**conf/metocean\_metOcean-observation/feature-of-interest** | |
|  | Requirement | /**req/metocean\_metOcean-observation/feature-of-interest** |
|  | Test purpose | To ensure that the ‘featureOfInterest’ component of the MetOceanObservation component contains a SimulationProcessDescription element that is an instance of SF\_SpatialSamplingPoint (from ISO 19156:2011 Spatial Sampling Features). |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the MetOceanObservation component and validate that the featureOfInterest’ component contains a SimulationProcessDescription element that is an instance of SF\_SpatialSamplingPoint (from ISO 19156:2011 Spatial Sampling Features). |
| Test | /**conf/metocean\_metOcean-observation/phenomenon-time** | |
|  | Requirement | **/req/metocean/metocean\_MetOceanObservation/phenomenon-time** |
|  | Test purpose | The specific use will depend on what time axes are used (See 7.2.4). Its uses shall conform to section 7.2.4 |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation and check that the use of the property om:phenomenonTime conforms to section 7.2.4 |
| Test | /**conf/metocean\_metOcean-observation/valid-time** | |
|  | Requirement | /**req/metocean\_metOcean-observation/valid-time** |
|  | Test purpose | To ensure that the validTime element is encoded as a gml:TimePeriod |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the om:validTime component and check that it has a property of gml:TimePeriod. |
| Test | /**conf/metocean\_metOcean-observation/observation-type** | |
|  | Requirement | /**req/metocean\_metOcean-observation/observation-type** |
|  | Test purpose | A specialized observation (e.g. NWPObservation) shall be derived from OM\_Observation through the abstract type *MetOceanObservation* |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the document to ensure the specialised observation is of type om:OM\_ObservationType. |
| Test | /**req/metocean\_metOcean-observation/procedure** | |
|  | Requirement | /**conf/metocean\_metOcean-observation/procedure** |
|  | Test purpose | The om:procedure element shall contain the element of “SimulationProcessMetadata” |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the document to ensure that the om:procedure component contains the metocean:SimulationProcessMetadata component. |

* 1. Conformance class: SimulationProcessDescription

|  |  |  |
| --- | --- | --- |
| **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-observation** | |
| Dependency | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean\_metOcean-observation** | |
| Dependency | **http://www.opengis.net/spec/OMXML/2.0/req/observation** | |
| Test | **conf/metocean\_simulation-process-description/structure** | |
| Requirement | **req/metocean\_simulation-process-description/structure** |
| Test purpose | To ensure that metocean: SimulationProcessDescription component shall conform to , , , , , , , , and the XML schema being part of this standard. |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the SimulationProcessDescription component and ensure it conforms to , , , , , , , , and the XML schema being part of this standard. |
| Test | **/conf/metocean\_simulation-process-description/metadata** | |
|  | Requirement | **req/metocean\_simulation-process-description/metadata** |
|  | Test purpose | SimulationProcessMetadata shall have a set of properties each using gml:reference to link to the relevant controlled registers e.g. WMO. |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the document to ensure that the SimulationProcessMetadata component contains links via gml:reference to a set of controlled registers. |
| Test | **/conf/metocean\_simulation-process-description/fixedSurfaceType** | |
|  | Requirement | **/req/metocean\_simulation-process-description/fixedSurfaceType** |
| Test purpose | If the fixed surface type has no vertical dependency (e.g. Ground, Max Wind Level) then the cis:regularAxis element shall be used with the lowerBound and upperBound attributes set to the value of 1 and the resolution set to 0. |
| Test purpose | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the document to ensure that any fixed surface type that has not vertical dependency has the lowerBound and upperBound attributes set to the value of 1 and the resolution set to 0 |
| Test | **/conf/metocean\_simulation-process-description/footprint** | |
|  | Requirement | **req/metocean\_simulation-process-description/footprint** |
|  | Test purpose | The shape property of the sampledFeature shall contain the component Footprint that will define the horizontal domain of the simulation model. |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the document to ensure that the sams:shape component contains a Footprint component (see ) that describes the domain of the simulation. |

* 1. Conformance class: ResultMask

|  |  |  |
| --- | --- | --- |
| **Conformance Class** | | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/ metocean\_result-mask** | | |
| Requirements | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/rew/ metocean\_result-mask** | |
| **Dependency** | [**http://www.opengis.net/spec/CIS/1.1/**](http://www.opengis.net/spec/CIS/1.1/) | |
| Test | **/conf/metocean\_result-mask/structure** | |
| Requirement | **/req/metocean\_result-mask/structure** |
| Test purpose | Ensure a metocean:ParameterMask instance shall conform to , and . |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation Inspect the NWPObservation component and ensure it conforms to , and . |
| Test | **/conf/metocean\_result-mask/mask-extension** | |
|  | Requirement | **/req/metocean\_result-mask/mask-extension** |
|  | Test purpose | The ResultMask shall through the specialisation of gmd:AbstractDQ\_Result (that has a property gmd:result), reference a ParameterMask that contains the property TimeHeight Mask of type cis:GeneralGridCoverageType |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the document to ensure that the component ParameterMask is of type cis:GeneralGridCoverageType |
| Test | **/conf/metocean\_result-mask/metocean/getCapabilities-response-conformance-class-in-profile** | |
|  | Requirement | **/req/metocean\_result-mask/metocean/getCapabilities-response-conformance-class-in-profile** |
|  | Test purpose | 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 |
|  | Test method | Retrieve a GetCapabilities document via a GetCapabilities operation. Inspect the document to ensure a server that supports a ResultMask has a n ows:profile element of  http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean/metocean\_ResultMask |

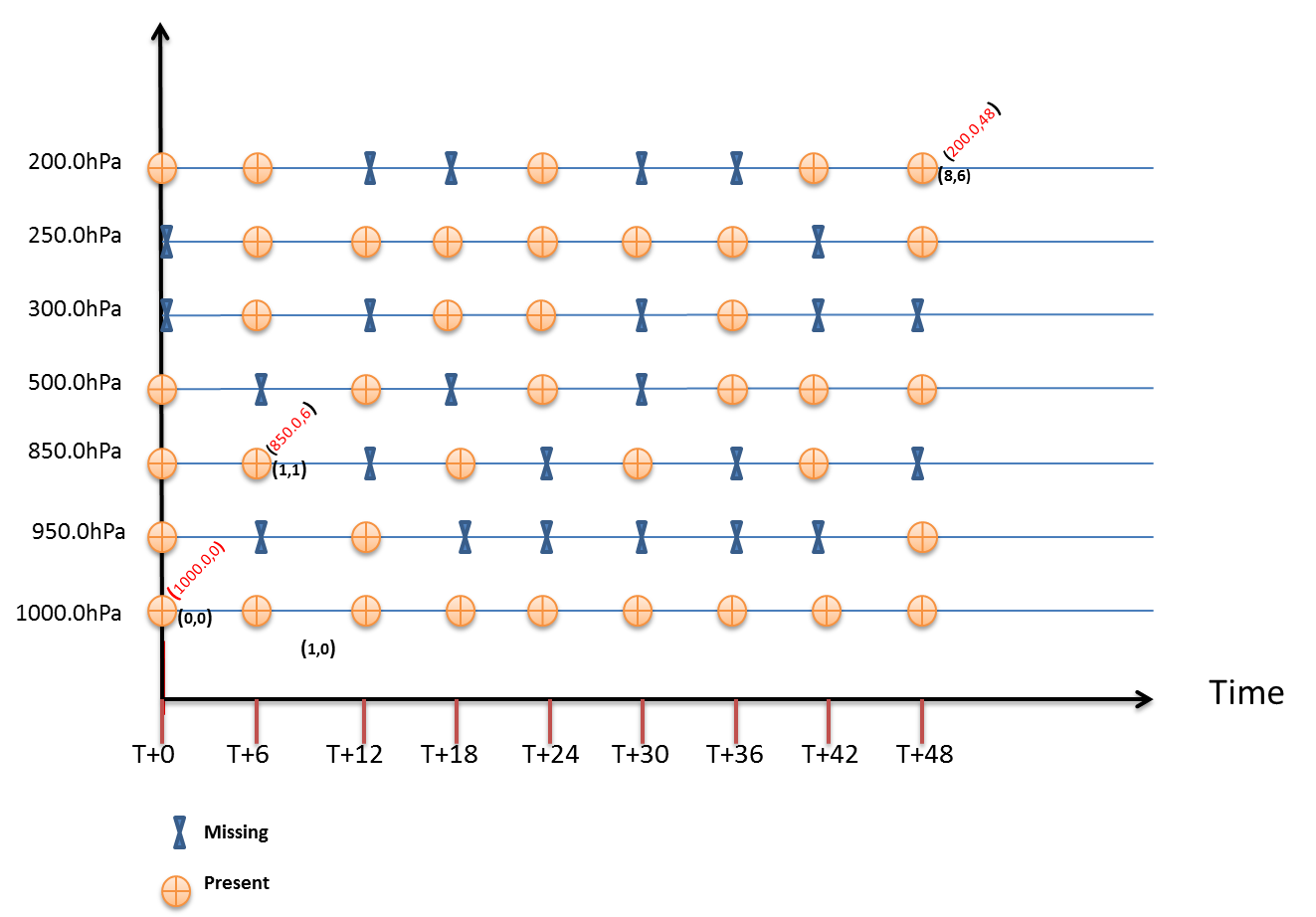
* 1. Conformance class: GetCapabilities

|  |  |  |
| --- | --- | --- |
| **Conformance Class** | | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/ metocean\_GetCapabilities** | | |
| Requirements | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/ metocean\_GetCapabilities** | | |
| Dependency | **http://www.opengis.net/doc/IS/WCS/2.1#clause:8.2** | | |
| Dependency | **http:/www.opengis.net/spec/WCS/2.1/conf/core/getCapabilities** | | |
| Dependency | **http:/www.opengis.net/spec/WCS/2.0/req/core/wcsServiceMetadata-structure** | | |
| Dependency | **http:/www.opengis.net/spec/WCS/2.1/conf/core/wcsServiceMetadata-contents** | | |
| Dependency | [**http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/conf/covcoll\_offering**](http://www.opengis.net/spec/WCS_service-extension_coveragecollection/1.0/conf/covcoll_offering) | | |
| Dependency | **http://www.opengis.net/spec/WCS\_service-extension\_coveragecollection/1.0/conf/covcoll\_collection-summary** | | |
| Test | **/conf/metocean/metocean\_GetCapabilitiesGroups/structure** | | |
|  | Requirement | **/req/metocean\_GetCapabilities/structure** | |
|  | Test purpose | A metocean:MetoceanGroup instance shall conform to , , , ,, ,, and | |
|  | Test method | Retrieve a GetCapabilities document via a GetCapabilities operation. Inspect the document to ensure to ensure the MetoceanGroup conforms to :-  , , , ,, ,, and | |
| 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\_MetOceanObservation | |
|  | Test method | Retrieve a GetCapabilities document via a GetCapabilities operation. Inspect the document to ensure a server that supports a this extension i.e. groups has a an ows:profile element of  <http://www.opengis.net/spec/WCS_application-profile_metocean/1.0/req/metocean/metocean_GetCapabilities>-groups | |

* 1. Conformance class: MetOceanDescribeCoverage

|  |  |  |
| --- | --- | --- |
| **Conformance Class** | | |
| **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/conf/metocean\_ DescribeCoverage** | | |
| Requirements | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean\_DescribeCoverage** | |
| Dependency | **[OGC06-121r9] (**[**http://www.opengis.net/doc/OWS/2.0/clause/8**](http://www.opengis.net/doc/OWS/2.0/clause/8)**)** | |
| Dependency | **http://www.opengis.net/spec/WCS\_application-profile\_metocean/1.0/req/metocean\_metOcean-observation** | |
| Dependency | **http:/www.opengis.net/spec/WCS/2.1/conf/core/wcsServiceMetadata-contents** | |
| Dependency | [**http://www.opengis.net/spec/WCS/2.1/**](http://www.opengis.net/spec/WCS/2.1/)**./conf/core/coverageSummary** | |
| Dependency | **[OGC09-1110r5] (**[**http://www.opengis.net/doc/wcs/2.1/clause/8.3**](http://www.opengis.net/doc/wcs/2.1/clause/8.3)**)** | |
| Test | **/conf/metocean\_DescribeCoverage/structure** | |
|  | Requirement | **/req/metocean\_DescribeCoverage/structure** |
|  | Test purpose | The metocean:DescribeCoverage instance shall conform to , and |
|  | Test method | Retrieve a DecribeCoverage document via a DescribeCoverage operation. Inspect the document to ensure to ensure the MetoceanGroup conforms to , and |
| Test | **/conf/metocean\_DescribeCoverage /metocean-coverage-metadata-property** | |
|  | Requirement | **/req/metocean\_DescribeCoverage/metocean-coverage-metadata-property** |
|  | Test purpose | A MetOceanMetadata instance shall have a specialised observation derived from OM:Observation through the abstract class MetOceanObservation |
|  | Test method | Retrieve a CoverageDescriptions document via a DescribeCoverage operation. Inspect the document to ensure the specialised observation is of type om:OM\_ObservationType. |

1. Example of a MetOceanDescribeCoverage response



This example illustrates how this mask would be encoded:-

<metocean:ResultMask>  
 <gmd:result>  
 <metocean:ParameterMask>  
 <metocean:rangeComponent>Temperature/Relative Humidity/Dewpoint Temperature</metocean:rangeComponent>  
 <metocean:timeHeightMask>  
 <metocean:TimeHeightMask gml:id="ID000">  
 <cis:envelope srsName="http://www.opengis.net/def/crs-compound?  
 1=http://http://www.opengis.net/def/crs/OGC/0/AnsiDate&amp;  
 2=http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface"   
 axisLabels="Time pressure" srsDimension="2">  
 <cis:axisExtent axisLabel="Time" uomLabel="ISO8601" lowerBound="PT0H" upperBound="PT48H" />   
 <cis:axisExtent axisLabel="pressure" uomLabel="hPa" lowerBound="1000.0" upperBound="200.00" />  
 </cis:envelope>  
 <cis:domainSet>  
 <cis:generalGrid srsName="http://www.opengis.net/def/crs-compound?  
 1=http://http://www.opengis.net/def/crs/OGC/0/AnsiDate&amp;  
 2=http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface"   
 axisLabels="Time pressure">  
 <cis:irregularAxis uomLabel=" ISO8601" axisLabel=" Time ">  
 <cis:c>PT0H</cis:c>  
 <cis:c>PT6H</cis:c>  
 <cis:c>PT12H</cis:c>  
 <cis:c>PT18H</cis:c>  
 <cis:c>PT24H</cis:c>  
 <cis:c>PT30H</cis:c>  
 <cis:c>PT36H</cis:c>  
 <cis:c>PT42H</cis:c>  
 <cis:c>PT48H</cis:c>  
 </cis:irregularAxis>  
   
 <cis:irregularAxis uomLabel="hPa" axisLabel="pressure">  
 <cis:c>1000.0</cis:c>  
 <cis:c>950.0</cis:c>  
 <cis:c>850.0</cis:c>  
 <cis:c>500.0</cis:c>  
 <cis:c>300.0</cis:c>  
 <cis:c>250.0</cis:c>  
 <cis:c>200.0</cis:c>  
 </cis:irregularAxis>  
  
 <cis:gridLimits srsName="http://www.codes.wmo.int/def/crs/OGC/0/Index4D" axisLabels="k l" >  
 <cis:indexAxis axisLabel="k" lowerBound="0" upperBound="8"/>  
 <cis:indexAxis axisLabel="l" lowerBound="0" upperBound="6"/>  
 </cis:gridLimits>  
 </cis:generalGrid>  
 </cis:domainSet>  
 <cis:rangeSet>  
 <cis:dataBlock>  
 <!-- The mask is arranged such that the levels are listed in rows  
 for each time-step   
 Thus for timee PY0H the levels 300.0 and 250.0 are missing>-->  
 <cis:v>1 1 1 1 0 0 1</cis:v>  
 <cis:v>1 0 1 0 1 1 1</cis:v>  
 <cis:v>1 1 0 1 0 1 0</cis:v>  
 <cis:v>1 0 1 0 1 1 0</cis:v>  
 <cis:v>1 0 0 1 1 1 1</cis:v>  
 <cis:v>1 0 1 0 0 1 0</cis:v>  
 <cis:v>1 0 0 1 1 1 0</cis:v>  
 <cis:v>1 0 1 1 0 0 1</cis:v>  
 <cis:v>1 1 0 1 0 1 1</cis:v>  
 </cis:dataBlock>  
 </cis:rangeSet>  
 <cis:rangeType>  
 <swe:DataRecord>  
 <swe:field name="datacompletenessomission">  
 <swe:Boolean>  
 <swe:quality>  
 <swe:Quantity>  
 <swe:uom/>  
 <swe:constraint/>  
 <swe:value>1.0</swe:value>  
 </swe:Quantity>  
 </swe:quality>  
 <swe:nilValues>  
 <swe:NilValues>  
 <swe:nilValue reason="field missing"/>  
 </swe:NilValues>  
 </swe:nilValues>  
 <swe:value>0</swe:value>  
 </swe:Boolean>  
 </swe:field>  
 </swe:DataRecord>  
 </cis:rangeType>  
 </metocean:TimeHeightMask>  
 </metocean:timeHeightMask>  
 </metocean:ParameterMask>  
 </gmd:result>  
 </metocean:ResultMask>

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

Example of a GetCapabilities response

<?xml version="1.0" encoding="UTF-8"?>  
<wcs:Capabilities ">  
 <ows:ServiceIdentification>  
 <ows:Title>Test configuration of Met data server</ows:Title>  
 <ows:Abstract> Copyright (C) The Met Office - UK </ows:Abstract>  
 <ows:Keywords>  
 <ows:Keyword>MO-WCS</ows:Keyword>  
 <ows:Keyword>WCS MO-AP</ows:Keyword>  
 <ows:Keyword>WCS 2.1</ows:Keyword>  
 <ows:Keyword>WCS</ows:Keyword>  
 <ows:Keyword>Meteorological Products</ows:Keyword>  
 <ows:Keyword>Hydrological Products</ows:Keyword>  
 <ows:Keyword>Land Surface Products</ows:Keyword>  
 <ows:Keyword>Space Weather Products</ows:Keyword>  
 <ows:Keyword>Oceanographic Products</ows:Keyword>  
 <ows:Keyword>Aviation</ows:Keyword>  
 </ows:Keywords>  
 <ows:ServiceType codeSpace="OGC">OGC WCS</ows:ServiceType>  
 <ows:ServiceTypeVersion>2.0.0</ows:ServiceTypeVersion>  
 <ows:Profile>http://www.opengis.net/spec/WCS\_application-profile\_metoc/1.0/conf/mowcs</ows:Profile>  
 <ows:Profile>http://www.opengis.net/spec/WCS\_application-profile\_metoc/1.0/conf/mowcs\_get-kvp</ows:Profile>  
 <ows:Profile>http://www.opengis.net/spec/WCS/2.0/conf/core</ows:Profile>  
 <ows:Profile>http://www.opengis.net/spec/WCS\_protocol-binding\_get-kvp/2.0/conf/get-kvp</ows:Profile>  
 <ows:Profile>http://www.opengis.net/spec/WCS\_protocol-binding\_post-xml/2.0/conf/post-xml</ows:Profile>  
 <ows:Profile>http://www.opengis.net/spec/WCS\_service-model\_crs-predefined/1.0/conf/crs-  
 predefined</ows:Profile>  
 <ows:Profile>http://www.opengis.net/spec/WCS\_encoding\_geotiff/1.0/conf/geotiff</ows:Profile>  
 <ows:Profile>http://www.placeholder.com/GML\_and\_GeoTIFF</ows:Profile>  
 <ows:Profile>http://www.opengis.net/spec/WCS\_service-  
 model\_scaling+interpolation/1.0/conf/scaling+interpolation</ows:Profile>  
 <ows:Fees>None</ows:Fees>  
 <ows:AccessConstraints>None</ows:AccessConstraints>  
 </ows:ServiceIdentification>  
 <ows:ServiceProvider>  
 <ows:ProviderName>The Met Office Fitzroy Road Exeter UK EX13PB</ows:ProviderName>  
 <ows:ProviderSite xlink:href="http://metocserver.metoffice.gov.uk" xlink:type="simple"/>  
 <ows:ServiceContact>  
 <ows:IndividualName>William Shatner</ows:IndividualName>  
 <ows:PositionName>Author</ows:PositionName>  
 <ows:ContactInfo>  
 <ows:Phone>  
 <ows:Voice>Provided on request</ows:Voice>  
 <ows:Facsimile>None</ows:Facsimile>  
 </ows:Phone>  
 <ows:Address>  
 <ows:DeliveryPoint>Fitzroy Road</ows:DeliveryPoint>  
 <ows:City>Exeter</ows:City>  
 <ows:AdministrativeArea>Exeter City</ows:AdministrativeArea>  
 <ows:PostalCode>EX13PB</ows:PostalCode>  
 <ows:Country>UK</ows:Country>  
 <ows:ElectronicMailAddress>office@metoffice.gov.uk</ows:ElectronicMailAddress>  
 </ows:Address>  
 <ows:OnlineResource xlink:href="http://metoceanserver.metoffice.gov.uk"  
 xlink:type="simple"/>  
 <ows:HoursOfService>Mon - Fri 08:30 - 17:00 UT and CEST+1</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://metoceanserver.metoffice.gov.uk/wcs"  
 xlink:type="simple"/>  
 <ows:Post xlink:href="http://metoceanserver.metoffice.gov.uk/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://metoceanserver.metoffice.gov.uk/wcs"  
 xlink:type="simple"/>  
 <ows:Post xlink:href="http://metoceanserver.metoffice.gov.uk/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://metoceanserver.metoffice.gov.uk/wcs"  
 xlink:type="simple"/>  
 <ows:Post xlink:href="http://metoceanserver.metoffice.gov.uk/wcs"  
 xlink:type="simple">  
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 <ows:AllowedValues>  
 <ows:Value>XML</ows:Value>  
 </ows:AllowedValues>  
 </ows:Constraint>  
 </ows:Post>  
 </ows:HTTP>  
 </ows:DCP>  
 </ows:Operation>  
 <ows:Operation name="DescribeCoverageCollection">  
 <ows:DCP>  
 <ows:HTTP>  
 <ows:Get xlink:href="http://metoceanserver.metoffice.gov.uk/wcs"  
 xlink:type="simple"/>  
 <ows:Post xlink:href="http://metoceanserver.metoffice.gov.uk/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>100</ows:DefaultValue>  
 </ows:Constraint>  
 </ows:OperationsMetadata>  
 <wcs:ServiceMetadata>  
 <wcs:formatSupported>image/tiff</wcs:formatSupported>  
 <wcs:formatSupported>image/jp2</wcs:formatSupported>  
 <wcs:formatSupported>application/x-netcdf</wcs:formatSupported>  
 <wcs:formatSupported>application/x-hdf</wcs:formatSupported>  
 <wcs:formatSupported>application/GRIB1</wcs:formatSupported>  
 <wcs:formatSupported>application/GRIB2</wcs:formatSupported>  
 <wcs:formatSupported>application/NetCDF3</wcs:formatSupported>  
 <wcs:Extension>  
 <crs:crsSupported>http://www.opengis.net/def/crs/EPSG/0/4326</crs:crsSupported>  
 <crs:crsSupported>http://www.opengis.net/def/crs/EPSG/0/3857</crs:crsSupported>  
 <crs:crsSupported>http://www.opengis.net/def/crs/EPSG/0/900913</crs:crsSupported>  
 <crs:crsSupported>http://www.opengis.net/def/crs/EPSG/0/3035</crs:crsSupported>  
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 </wcs:CoverageSummary>  
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 <metocean:CoverageCollectionMetadata>  
 <metocean:name>ModelRuns</metocean:name>  
 <metocean:group>  
 <metocean:Group>  
 <metocean:simulationCollection>  
 <metocean:SimulationCollection>  
 <metocean:simulationMember>  
 <metocean:SimulationMember>  
 <covcoll:coverageCollectionId>UK\_Global\_2015-05-  
 15T00.00.00Z</covcoll:coverageCollectionId>  
 <cis:envelope srsName="http://www.opengis.net/def/crs-compound?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326;  
 2=http://http://www.opengis.net/def/crs/OGC/0/AnsiDate "   
 axisLabels="Lat Lon Time" srsDimension="3">  
 <cis:axisExtent axisLabel="Lat" uomLabel="deg" lowerBound="-90" upperBound="90" />   
 <cis:axisExtent axisLabel="lon" uomLabel="deg" lowerBound="-180" upperBound="180" />  
 <cis:axisExtent axisLabel="Time" uomLabel="ISO8601" lowerBound="2015-05-15T00.00.00Z" upperBound="2015-05-20T00.00.00Z" />   
 </cis:envelope>  
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 <gml:timePosition>2015-05-15T00.00.00Z</gml:timePosition>  
 </covcoll:referenceTime>  
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 1=http://www.opengis.net/def/crs/EPSG/0/4326;  
 2=http://http://www.opengis.net/def/crs/OGC/0/AnsiDate"   
 axisLabels="Lat Lon ansiDate" srsDimension="3">  
 <cis:axisExtent axisLabel="lat" uomLabel="deg" lowerBound="-90" upperBound="90" />   
 <cis:axisExtent axisLabel="Lon" uomLabel="deg" lowerBound="-180" upperBound="180" />  
 <cis:axisExtent axisLabel="Time" uomLabel="ISO8601" lowerBound="2015-05-15T12.00.00Z" upperBound="2015-05-20T12.00.00Z" />   
 </cis:envelope>  
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 <metocean:simulationCoverageSummary>  
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 </metocean:SimulationCoverageSummary>  
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 </metocean:Group>  
 </metocean:group>  
 </metocean:CoverageCollectionMetadata>  
 </wcs:Extension>  
 </wcs:Contents>  
</wcs:Capabilities>

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