

# MetOcean -WCS

*A Draft Proposal*

Version 0.1

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**Secretary: - Peter Trevelyan**

**Discussion document for the required in extensions for a WCS2.0 profile for Meteorological and Oceanographic Data**

***A MetOc profile for “The Describe Coverage Response”,***

***“GetCapabilities” and “GetCoverage”*.**

**V.8**

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**Author Peter Trevelyan**

**12*-148 for Met Ocean DWG Discussion paper on WCS2.0.***

# **The WCS 2.0Met-Ocean Profile:-**

This document describes draft proposals for the response and request documents for the Web Coverage Service 2.0 (WCS2.0) MetOcean Profile. These proposals address the existing operations; GetCapabilites, DescribeCoverage and a new operation entitled DescribeCoverageCollection. The GetCoverage use cases are also considered.

# **Coverages:**

The WCS delivers data in the form of coverage’s that can be described as “the digital representation of some spatio-temporal phenomenon”. A “coverage” is a special kind of [geographic feature](http://en.wikipedia.org/wiki/Feature_data), with the distinguishing characteristics that whilst other features have one particular value associated (such as a road number, which remains constant over all the road's extent) a coverage typically conveys different values at different locations. A “coverage” is represented by its "domain" (the universe of extent) and a range of values representing the Coverage's value at each defined location. A “coverage” can be multi-dimensional, such as a 4-D x/y/z/t for climate, weather and ocean data. Met-Ocean data can be extended to a 5-D coverages, showing that the profile goes beyond traditional spatio-temporal axes. The concepts defined within are actually applicable to any multidimensional coverage, not just Met-Ocean. It is also important to understand the range of coverage types for example; cross-sections, grids, profiles, trajectories etc., that are defined by the WCS2.0 interface.

# **Some Key Proposals for the MetOcean profile:-**

1. Each “coverage” has a “reference” time indicating a notional start time if referring to a NWP model run (see NWP primer). The forecast time (in the case of a model run) is relative to this time. The GetCapabilities response will list the reference times for each listed CoverageCollection. The response example XML document returned by the “DescribeCoverage” lists the forecast times as hours, but this may be changed if required. The “GetCoverage” examples do not use relative time i.e. actual time even if it is a forecast. These constraints are partly due to the use of floating point numbers in “GML” arrays such as poslist.
2. A “CoverageCollection” groups coverages by a common theme. The “CoverageCollection” identifier may have a meaningful name that indicates the common theme (see GetCapabilities response). This structure allows for CoverageCollections to have children such that it is only the leaf node that has an actual set of coverages.
3. A service called “DescribeCoverageCollection” retrieves the description (contents) of the “coverage collections” for a given “CollectionId” and lists the coverages. The number of coverages returned may be limited by using a filter e.g. reference time.
4. The concept of coverages collections allows the coverage collection identifiers to describe a “real world” data service. An example will help; an aviation service (itself a coverageCollectionId), contains two collections, e.g. icing service (coverageCollectionId “icing\_service”) and turbulence services (coverageCollectionId “turbulence\_services”). Each of these collections have two collections, i.e. (“UKregional\_Icing” and “Global\_Icing”) and for turbulence (“UKregional\_Turbulence, “Global\_Turbulence”). These “leaf node “collections can be “realised” (analogous to a concrete object). In practice this means that a coverageCollectionId can be used in a “DescribeCoverageCollection” to return a list of coverage identifiers that can in turn be used in a GetCoverage call.
5. The typical output of a NWP model run will have thousands of fields, each one a 2D “coverage” and therefore unmanageable. The main reason why these coverages are not presented as a multi-dimensional coverage is due to the problem of missing data; (see diagram in the NWP primer). By using a “DataMask” the missing data may be “mapped” out. This will reduce the number of coverage’s to a manageable level as they are now “four dimensional” rather than two dimensional (by use of a data mask).
6. All coverages will share, by definition, the same vertical coordinate. For the sake of clarification all coverage identifiers are given a name that reflects the type of vertical coordinate. Vertical coordinates are described within the metadata and belong to four main subtypes (see examples). The coverage identifier, although have semantic meaning should not be parsed, but used as a label.
7. Coverages that have disparate vertical coordinates cannot be mixed. Thus separate GetCoverage calls would have to made to extract data on isobaric and ICAO height.

# **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 and atmosphere. The name given to a specific model is often meaningful and may reflect the domain i.e. global, UK etc. Typically a model is run at a set time a number of times a day and this 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 know that “reference time” will used in preference to “model run time” as it is more generic and includes services that may be continually updated. In this case the reference time would be the time of the last update. It is also worth noting that the actual output from a model run is often irregular in time and as well as in the vertical. For example: - an output temperature may well not be present for every time or every level. It is therefore a challenge to present the output as a 4D coverage given the irregularity of the data. The following diagram illustrates this:-

T+0

T+18

T+ 6

T+12

1000.0hPa

950.0hPa

850.0hPa

500.0hPa

300.0hPa

250.0hPa

200.0hPa

T+24

T+30

T+36

T+42

T+48

**(1,1)**

**(**1000.0,0**)**

**(**850.0,6**)**

**(0,0)**

**(8,6)**

**Missing**

**Present**

**(1,0)**

# **The WCS 2.0Met-Ocean Profile of Services:-**

There are four service calls; three being part of the standard cores profile and one that has been specifically created to cover the special use cases that the met-Ocean community i.e. “DescribeCoverageCollection” require. Each of these service calls will be described in full with any extensions to the core profile clearly described.

# **GetCapabilities:-**

The GetCapabilities operation allows a WCS client to retrieve service metadata and Coverages metadata offered by a WCS server. The GetCapabilities response also advertises the offered operations i.e. the GetCapabilities, GetCoverage, DescribeCoverageCollection (specific to this profile and not part of core) and DescribeCoverage. Metadata maybe encoded within these response documents as there is an “extension point” provided by the core WCS2.0 standard.

The GetCapabilites “service end point” will normally be stable, but advertised services may be added/deleted and changes broadcast through the GetCapabilities response document. Service end points are referred to via a “href” reference that is encoded in the XML capabilities document. This approach enables “intelligent” client software to easily adapt to any changes in “Service end points”.

# **GetCapabilities Request:-**

This diagram shows the relationship between the classes for GetCapabilities request. The example below requests three sections i.e. OperationMetadata, service metadata and “CoverageCollectionSummary”.



A typical GetCapabilites request is straightforward and simple. This example is requesting both operations. The XML would be posted to a given service end point i.e. server.

# **An example of a GetCapabilities Request**:-

s<?xml version="1.0" encoding="UTF-8"?>  
<wcs:GetCapabilities  
 xmlns:ows='http://www.opengis.net/ows/2.0'  
 xmlns:wcs='http://www.opengis.net/wcs/2.0'  
 xmlns:wcseo="http://www.opengis.net/wcseo/1.0"  
 xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'  
 xsi:schemaLocation='http://www.opengis.net/wcs/2.0 <http://schemas.opengis.net/wcs/2.0/wcsAll.xsd>' service="WCS">  
 <ows:AcceptVersions>  
 <ows:Version>2.0.0</ows:Version>  
 </ows:AcceptVersions>  
 <ows:Sections>  
 <ows:Section>OperationsMetadata</ows:Section>  
 <ows:Section> CoverageCollectionSummary</ows:Section>  
 <ows:Section>serviceProperties</ows:Section>  
 </ows:Sections>  
</wcs:GetCapabilities>

Notice the use of “CoverageCollectionSummary” as an extra part of the response. This is a specific addition to enumerate the coverage collections, the reference times of the available collections and the collection identifiers. Any number of collections may be described and for multiple “reference times”

Notice that the schema location is WCS as the metocean profile uses a built as an extension to the WCS core profile. A specific met-ocean “Capabilities” schema for the response document will be used.



# **GetCapabilities Response:-**

The GetCapabilities response document consists of a service metadata section and an optional contents section. Service metadata are those defined in the s­er­vice­Metadata component of the server’s coverage offering. The contents section delivers information about the coverage offering of the server. This figure shows this structure.



The areas of real interest are the “OperationsMetadata” and the “ServiceMetadata” sections. The “OperationsMetadata” advertises the various operations that are supported and are really service endpoints. There are three mandatory operations i.e. GetCapabilities, GetCoverage and DescribeCoverage. The other operations are specific to the particular provider and support the tailoring of services. Note that these operations have been extended beyond those already defined in the WCS core, i.e. “DescribeCoverageCollection”. Additional future services will include “GetCorridorCoverage”, “GetPolygonCoverage” & “GetCrossSectionCoverage”.

The following listing is an example of a typical response to a GetCapabilities request. The only extension to the core standard is the inclusion of extra metadata after the “wcs:Extension” element. An extension element provides a hook that has type “any” so allowing extra content. This extra metadata could, and probably will be extended in the future. The identifier “coverageCollectionId” is used an argument passed into the “DescribeCoverageCollection” operation and should not be parsed.

<?xml version="1.0" encoding="ISO-8859-1"?>  
<wcs:Capabilities updateSequence="20120504T160000Z" version="2.0.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"  
 xmlns:ogc="http://www.opengis.net/ogc" xmlns:ows="http://www.opengis.net/ows/2.0"  
 xmlns:swe="http://www.opengis.net/swe/2.0" xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 xmlns:crs="http://www.opengis.net/wcs/service-extension/crs/1.0"  
 xsi:schemaLocation="http://www.metoffice.gov.uk/pete file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanGetCapabilities.xsd">  
 <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 2.0</ows:Keyword>  
 <ows:Keyword>WCS</ows:Keyword>  
 <ows:Keyword>UK\_PP4</ows:Keyword>  
 <ows:Keyword>UK\_GLOBAL</ows:Keyword>  
 <ows:Keyword>UK\_NAE</ows:Keyword>  
 <ows:Keyword>EURO\_PP</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">  
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 <ows:HTTP>  
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 </ows:Operation>  
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 <ows:HTTP>  
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 xlink:type="simple"/>  
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 xlink:type="simple">  
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 </ows:Post>  
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 </ows:Constraint>  
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 uomLabels="deg deg">  
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 </metocean:referenceTimeList>  
 </metocean:CoverageCollectionSummary>  
 </metocean:childCoverageCollections>  
 </metocean:CoverageCollectionSummary>  
 </metocean:childCoverageCollections>  
 <metocean:childCoverageCollections>  
 <metocean:CoverageCollectionSummary>  
 <metocean:coverageCollectionId>Aviation\_Turbulence\_Products</metocean:coverageCollectionId>  
 <gml:name>Aviation\_Turbulence\_Products</gml:name>  
 <metocean:childCoverageCollections>  
 <metocean:CoverageCollectionSummary>  
 <metocean:coverageCollectionId>UK\_Region\_Aviation\_Turbulence\_Products</metocean:coverageCollectionId>  
 <gml:name>UK\_Global\_Model</gml:name>  
 <gml:boundedBy>  
 <gml:Envelope axisLabels="lat long" srsDimension="2"  
 srsName="http://www.opengis.net/def/crs/EPSG/0/4326"  
 uomLabels="deg deg">  
 <gml:lowerCorner>45.0 -10.0</gml:lowerCorner>  
 <gml:upperCorner>60.0 10.0</gml:upperCorner>  
 </gml:Envelope>  
 </gml:boundedBy>  
 <metocean:referenceTimeList>  
 <metocean:ReferenceTime>  
 <gml:timePosition>2012-07-15T00:00:00Z</gml:timePosition>  
 <gml:timePosition>2012-07-15T00:00:00Z</gml:timePosition>  
 </metocean:ReferenceTime>  
 </metocean:referenceTimeList>  
 </metocean:CoverageCollectionSummary>  
 <metocean:CoverageCollectionSummary>  
 <metocean:coverageCollectionId>Atlantic\_Region\_Aviation\_Turbulence\_Products</metocean:coverageCollectionId>  
 <gml:name>Atlantic\_Region\_Aviation\_Turbulence\_Products</gml:name>  
 <gml:boundedBy>  
 <gml:Envelope axisLabels="lat long" srsDimension="2"  
 srsName="http://www.opengis.net/def/crs/EPSG/0/4326"  
 uomLabels="deg deg">  
 <gml:lowerCorner>30.0 -90.0</gml:lowerCorner>  
 <gml:upperCorner>80.0 60.0</gml:upperCorner>  
 </gml:Envelope>  
 </gml:boundedBy>  
 <metocean:referenceTimeList>  
 <metocean:ReferenceTime>  
 <gml:timePosition>2012-07-15T00:00:00Z</gml:timePosition>  
 <gml:timePosition>2012-07-15T00:00:00Z</gml:timePosition>  
 </metocean:ReferenceTime>  
 </metocean:referenceTimeList>  
 </metocean:CoverageCollectionSummary>  
 </metocean:childCoverageCollections>  
 </metocean:CoverageCollectionSummary>  
 </metocean:childCoverageCollections>  
 </metocean:CoverageCollectionSummary>  
 </wcs:Extension>  
 </wcs:Contents>  
</wcs:Capabilities>

Describe CoverageCollection”­­­ Request:-

For a given “coverageCollectionId” and reference time the “DescribeCoverageCollection” request returns a list of coverage identifiers (CoverageId’s) belonging to a given CoverageCollectionId.

In these examples of the “DescribeCoverageCollection” request the “ReferenceTime” is used to filter the response..

This example will obtain the list of “coverage’s”, contained within the collection and denoted by an identifier for a range of reference times.

<?xml version="1.0" encoding="UTF-8"?>  
<metocean:DescribeCoverageCollection  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 xsi:schemaLocation="http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanRequestDescribeCoverageCollection.xsd"  
 service="WCS" version="2.0.0">  
 <metocean:coverageCollectionId>UK\_GLOBAL</metocean:coverageCollectionId>  
 <wcs:DimensionTrim>  
 <wcs:Dimension>referenceTime</wcs:Dimension>  
 <wcs:TrimLow>2012-05-15T00:00:00Z</wcs:TrimLow>  
 <wcs:TrimHigh>2012-05-16T00:00:00Z</wcs:TrimHigh>  
 </wcs:DimensionTrim>  
</metocean:DescribeCoverageCollection>

This example will obtain the list of “coverage’s”, contained within the collection and denoted by an identifier for a specific reference time.

<?xml version="1.0" encoding="UTF-8"?>  
<metocean:DescribeCoverageCollection  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 xsi:schemaLocation="http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanRequestDescribeCoverageCollection.xsd"  
 service="WCS" version="2.0.0">  
 <metocean:coverageCollectionId>UK\_GLOBAL</metocean:coverageCollectionId>  
 <wcs:DimensionSlice>  
 <wcs:Dimension>referenceTime</wcs:Dimension>  
 <wcs:SlicePoint>2012-05-16T00:00:00Z</wcs:SlicePoint>  
 </wcs:DimensionSlice>  
</metocean:DescribeCoverageCollection>

# **Example DescribeCoverageCollection Response:-**

This diagram shows the relationship between the classes for a describe model run response.



The .UML diagram shows the relationships between the various classes.

# **DescribeCoverageCollection Response:-**

<?xml version="1.0" encoding="UTF-8"?>  
<metocean:CoverageCollectionDescriptions  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:ows="http://www.opengis.net/ows/2.0"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:sam="http://www.opengis.net/sampling/2.0"  
 xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"  
 xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 xmlns:om="http://www.opengis.net/om/2.0"  
 xmlns:metce="http://www.wmo.int/metce"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanDescribeCoverageCollection.xsd">  
 <metocean:CoverageCollectionDescription gml:id="ModelRunColletion1">  
 <metocean:coverageCollectionId>UK\_GLOBAL</metocean:coverageCollectionId>  
 <gml:name>The UK operational Global Model</gml:name>  
 <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>  
 <metocean:referenceTime>  
 <gml:TimeInstant gml:id="NotionalStartTime1">  
 <gml:timePosition>2012-05-15T00:00:00Z </gml:timePosition>  
 </gml:TimeInstant>  
 </metocean:referenceTime>  
 <metocean:sourceObservationProperty>  
 <metocean:SourceObservation gml:id="NWP1">  
 <om:phenomenonTime>  
 <gml:TimePeriod gml:id="ForecastTimeRange1">  
 <gml:beginPosition>2012-05-15T00:00:00Z </gml:beginPosition>  
 <gml:endPosition>2012-05-20T00:00:00Z </gml:endPosition>  
 </gml:TimePeriod>  
 </om:phenomenonTime>  
 <om:resultTime>  
 <gml:TimeInstant gml:id="Arrival\_Start\_time\_on\_System1">  
 <gml:timePosition>2012-05-15T03:30:00Z </gml:timePosition>  
 </gml:TimeInstant>  
 </om:resultTime>   
 <om:procedure>  
 <metce:Process>  
 <gml:description>UK Met Office Global Unified Model</gml:description>  
 </metce:Process>  
 </om:procedure>  
 <om:parameter>  
 <om:NamedValue>  
 <om:name xlink:href=" www.codes.wmo.int/GRIB2/table1.2/referenceTime"/>  
 <om:value>  
 <gml:TimeInstant gml:id="referencetime1">  
 <gml:timePosition>2012-05-15T00:00:00</gml:timePosition>  
 </gml:TimeInstant>  
 </om:value>  
 </om:NamedValue>  
 </om:parameter>  
 <om:observedProperty xlink:href="http://codes.wmo.int/common/observation-type/METCE/2013/NWP\_Model"/>  
 <om:featureOfInterest>  
 <sams:SF\_SpatialSamplingFeature gml:id="UK\_GLOBAL\_NWP\_MODEL\_GRID1">  
 <sam:type xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF\_SamplingSurface"/>  
 <sam:sampledFeature>  
 <metocean:CoverageCollectionProperties gml:id="uuid.37a7f1d0-b731-11e3-9e96-0800200c9a66">  
 <gml:identifier codeSpace="urn:uuid:">37a7f1d0-b731-11e2-9e96-0800200c9a66</gml:identifier>  
 <metocean:geometryComponent>  
 <metocean:CoverageCollectionDomain>  
 <metocean:horizontalProjection>  
 <gml:Polygon gml:id="UK\_GLOBAL\_NWP\_MODEL\_GRID\_Boundary\_Geometry1" uomLabels="deg deg"  
 axisLabels="lat long"   
 srsDimension="2"  
 srsName="http://www.opengis.net/def/crs/EPSG/0/4326">  
 <gml:exterior>  
 <gml:LinearRing>  
 <gml:posList>  
 -90.0 -180.0   
 90.0 -180.0   
 90.0 180.0   
 -90.0 180.0  
 -90.0 -180.0   
 </gml:posList>  
 </gml:LinearRing>  
 </gml:exterior>  
 </gml:Polygon>  
 </metocean:horizontalProjection>  
 </metocean:CoverageCollectionDomain>  
 </metocean:geometryComponent>  
 </metocean:CoverageCollectionProperties>  
 </sam:sampledFeature>  
 <sams:shape xlink:href="UK\_GLOBAL\_NWP\_MODEL\_GRID"/>  
 </sams:SF\_SpatialSamplingFeature>  
 </om:featureOfInterest>  
 <om:result/>  
 </metocean:SourceObservation>  
 </metocean:sourceObservationProperty>  
 <metocean:coverageIdList>  
 <wcs:CoverageSummary>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL</wcs:CoverageId>  
 <wcs:CoverageSubtype>VerticalDependency</wcs:CoverageSubtype>  
 <ows:Metadata xlink:href="www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface">  
 <metocean:coverageDescription coverageDescription="Isobaric Surface"/>  
 </ows:Metadata>  
 </wcs:CoverageSummary>  
 <wcs:CoverageSummary>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_Max\_Wind</wcs:CoverageId>  
 <wcs:CoverageSubtype>ComputedSurface</wcs:CoverageSubtype>  
 <ows:Metadata xlink:href="www.codes.wmo.int/GRIB2/table4.5/MaximumWindLevel">  
 <metocean:coverageDescription coverageDescription="Maximum Wind Level"/>  
 </ows:Metadata>  
 </wcs:CoverageSummary>  
 <wcs:CoverageSummary>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_Ground</wcs:CoverageId>  
 <wcs:CoverageSubtype>NoVerticalDependency</wcs:CoverageSubtype>  
 <ows:Metadata xlink:href="www.codes.wmo.int/GRIB2/table4.5/Ground">  
 <metocean:coverageDescription coverageDescription="Ground"/>  
 </ows:Metadata>  
 </wcs:CoverageSummary>  
 <wcs:CoverageSummary>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_Thickness</wcs:CoverageId>  
 <wcs:CoverageSubtype>NamedRange</wcs:CoverageSubtype>  
 <ows:Metadata xlink:href="www.codes.wmo.int/GRIB2/table4.5/Thickness">  
 <metocean:coverageDescription coverageDescription="Thickness"/>  
 </ows:Metadata>  
 </wcs:CoverageSummary>  
 <wcs:CoverageSummary>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_Specific\_Altitude\_Above\_Mean\_Sea\_Level</wcs:CoverageId>  
 <wcs:CoverageSubtype>VerticalDependency</wcs:CoverageSubtype>  
 <ows:Metadata xlink:href="www.codes.wmo.int/GRIB2/table4.5/Specific Altitude Above Mean Sea Level">  
 <metocean:coverageDescription coverageDescription="Specific Altitude Above Mean Sea Level"/>  
 </ows:Metadata>  
 </wcs:CoverageSummary>  
 </metocean:coverageIdList>  
 </metocean:CoverageCollectionDescription>  
 <metocean:CoverageCollectionDescription gml:id="ModelRunColletion2">  
 <metocean:coverageCollectionId>UK\_GLOBAL</metocean:coverageCollectionId>  
 <gml:name>The UK operational Global Model</gml:name>  
 <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>  
 <metocean:referenceTime>  
 <gml:TimeInstant gml:id="NotionalStartTime2">  
 <gml:timePosition>2012-05-15T12:00:00Z </gml:timePosition>  
 </gml:TimeInstant>  
 </metocean:referenceTime>  
 <metocean:sourceObservationProperty>  
 <metocean:SourceObservation gml:id="NWP2">  
 <om:phenomenonTime>  
 <gml:TimePeriod gml:id="ForecastTimeRange2">  
 <gml:beginPosition>2012-05-15T12:00:00Z </gml:beginPosition>  
 <gml:endPosition>2012-05-20T12:00:00Z </gml:endPosition>  
 </gml:TimePeriod>  
 </om:phenomenonTime>  
 <om:resultTime>  
 <gml:TimeInstant gml:id="Arrival\_Start\_time\_on\_System2">  
 <gml:timePosition>2012-05-15T15:30:00Z </gml:timePosition>  
 </gml:TimeInstant>  
 </om:resultTime>   
 <om:procedure>  
 <metce:Process>  
 <gml:description>UK Met Office Global Unified Model</gml:description>  
 </metce:Process>  
 </om:procedure>  
 <om:parameter>  
 <om:NamedValue>  
 <om:name xlink:href=" www.codes.wmo.int/GRIB2/table1.2/referenceTime"/>  
 <om:value>  
 <gml:TimeInstant gml:id="referencetime2">  
 <gml:timePosition>2012-05-15T12:00:00</gml:timePosition>  
 </gml:TimeInstant>  
 </om:value>  
 </om:NamedValue>  
 </om:parameter>  
 <om:observedProperty xlink:href="http://codes.wmo.int/common/observation-type/METCE/2013/NWP\_Model"/>  
 <om:featureOfInterest>  
 <sams:SF\_SpatialSamplingFeature gml:id="UK\_GLOBAL\_NWP\_MODEL\_GRID2">  
 <sam:type xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF\_SamplingSurface"/>  
 <sam:sampledFeature>  
 <metocean:CoverageCollectionProperties gml:id="uuid.37a7f1d0-b731-11e3-9e96-0800200c9a76">  
 <gml:identifier codeSpace="urn:uuid:">37a7f1d0-b731-11e2-9e96-0800200c9a66</gml:identifier>  
 <metocean:originatingcentre>EGRR</metocean:originatingcentre>  
 <metocean:modeltype>atmospheric</metocean:modeltype>  
 <metocean:modelidentifier>UK\_GLOBAL\_NWP\_MODEL\_GRID</metocean:modelidentifier>  
 <metocean:geometryComponent>  
 <metocean:CoverageCollectionDomain>  
 <metocean:horizontalProjection>  
 <gml:Polygon gml:id="UK\_GLOBAL\_NWP\_MODEL\_GRID\_Boundary\_Geometry2" uomLabels="deg deg"  
 axisLabels="lat long"   
 srsDimension="2"  
 srsName="http://www.opengis.net/def/crs/EPSG/0/4326">  
 <gml:exterior>  
 <gml:LinearRing>  
 <gml:posList>  
 -90.0 -180.0   
 90.0 -180.0   
 90.0 180.0   
 -90.0 180.0  
 -90.0 -180.0   
 </gml:posList>  
 </gml:LinearRing>  
 </gml:exterior>  
 </gml:Polygon>  
 </metocean:horizontalProjection>  
 </metocean:CoverageCollectionDomain>  
 </metocean:geometryComponent>  
 </metocean:CoverageCollectionProperties>  
 </sam:sampledFeature>  
 <sams:shape xlink:href="UK\_GLOBAL\_NWP\_MODEL\_GRID"/>  
 </sams:SF\_SpatialSamplingFeature>  
 </om:featureOfInterest>  
 <om:result/>  
 </metocean:SourceObservation>  
 </metocean:sourceObservationProperty>  
 <metocean:coverageIdList>  
 <wcs:CoverageSummary>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T12.00.00Z\_ISBL</wcs:CoverageId>  
 <wcs:CoverageSubtype>VerticalDependency</wcs:CoverageSubtype>  
 <ows:Metadata xlink:href="www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface">  
 <metocean:coverageDescription coverageDescription="Isobaric Surface"/>  
 </ows:Metadata>  
 </wcs:CoverageSummary>  
 <wcs:CoverageSummary>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T12.00.00Z\_Max\_Wind</wcs:CoverageId>  
 <wcs:CoverageSubtype>ComputedSurface</wcs:CoverageSubtype>  
 <ows:Metadata xlink:href="www.codes.wmo.int/GRIB2/table4.5/MaximumWindLevel">  
 <metocean:coverageDescription coverageDescription="Maximum Wind Level"/>  
 </ows:Metadata>  
 </wcs:CoverageSummary>  
 <wcs:CoverageSummary>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T12.00.00Z\_Ground</wcs:CoverageId>  
 <wcs:CoverageSubtype>NoVerticalDependency</wcs:CoverageSubtype>  
 <ows:Metadata xlink:href="www.codes.wmo.int/GRIB2/table4.5/Ground">  
 <metocean:coverageDescription coverageDescription="Ground"/>  
 </ows:Metadata>  
 </wcs:CoverageSummary>  
 <wcs:CoverageSummary>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T12.00.00Z\_Thickness</wcs:CoverageId>  
 <wcs:CoverageSubtype>NamedRange</wcs:CoverageSubtype>  
 <ows:Metadata xlink:href="www.codes.wmo.int/GRIB2/table4.5/Thickness">  
 <metocean:coverageDescription coverageDescription="Thickness"/>  
 </ows:Metadata>  
 </wcs:CoverageSummary>  
 <wcs:CoverageSummary>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T12.00.00Z\_Specific\_Altitude\_Above\_Mean\_Sea\_Level</wcs:CoverageId>  
 <wcs:CoverageSubtype>VerticalDependency</wcs:CoverageSubtype>  
 <ows:Metadata xlink:href="www.codes.wmo.int/GRIB2/table4.5/Specific Altitude Above Mean Sea Level">  
 <metocean:coverageDescription coverageDescription="Specific Altitude Above Mean Sea Level"/>  
 </ows:Metadata>  
 </wcs:CoverageSummary>  
 </metocean:coverageIdList>  
 </metocean:CoverageCollectionDescription>  
</metocean:CoverageCollectionDescriptions>

DescribeCoverage:-

The “DescribeCoverage” request returns, for a given coverage identifier, a description of that coverage. The response will be specific to a coverage that will be multi-dimensional.

The purpose of the DescribeCoverageRequest is to create a response document that details the contents of each “coverage”. A “data mask” is used to mask out any missing fields and parameters may, if so desired, share a data mask e.g. U, V. The coverage identifiers do have a semantic meaning, but they are not intended to be parsed simply used as references.

Some examples:-

The call will describe coverages that have a vertical coordinate on an isobaric surface.

http://metofficeserver.gov.uk/demo/ows?

service=wcs&

version=2.0.0&

request= DescribeCoverage &

CoverageId= UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL

The second call will describe all fields with a coordinate of Ground contained within this coverage.

http://metofficeserver.gov.uk/demo/ows?

http://metofficeserver.gov.uk/demo/ows?

service=wcs&

version=2.0.0&

request= DescribeCoverage &

CoverageId= UK\_GLOBAL\_2012-05-15T00.00.00Z\_GROUND

Example of a Describe Coverage Response:-

This diagram shows the relationship between the classes for a describe coverage response. Note that metadata is shown as an attribute in Coverage Description that provides an extension point for community specific metadata.

This diagram is the UML diagram for the DescribeCoverage response.



By referring to the UML diagrams above it can be seen that the DescribeCoverage response document is divided up into sections i.e.

* <boundedBy>
* <CoverageId>
* <metadata>
* <domainSet>
* <rangeType>
* <ServiceParameters>

The Met-Ocean extension will be part of the metadata section that is itself an extension of the O&M Observation class. The O&M observation provides frame work for time, feature of interest as well as the observation procedure, in this case a numerical weather prediction model. Typically for NWP data not all forecast times are offered for all levels. This problem is addressed by providing a mask that will indicate, for each parameter, what is omitted and what is included.

This UML diagram shows how the gmlcov:extension is used to include MetOcean metadata.

****

Example of a DescribeCoverage Response (1):-

<?xml version="1.0" encoding="UTF-8"?>  
<wcs:CoverageDescriptions  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:ows="http://www.opengis.net/ows/2.0"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:swe="http://www.opengis.net/swe/2.0"  
 xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 xmlns:om="http://www.opengis.net/om/2.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:metce="http://def.wmo.int/metce/2013"  
 xmlns:sam="http://www.opengis.net/sampling/2.0"  
 xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 file:/C:/Users/PTrevelyan/WCS/MOWCS3/schemas/wcsMetOceanDescribeCoverage.xsd">  
 <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:sourceObservationProperty>  
 <metocean:SourceObservation gml:id="AT">  
 <om:phenomenonTime>  
 <gml:TimePeriod gml:id="TimeRange">  
 <gml:beginPosition>2012-05-15T00:00:00Z </gml:beginPosition>  
 <gml:endPosition> 2012-05-20T00:00:00Z </gml:endPosition>  
 </gml:TimePeriod>  
 </om:phenomenonTime>  
 <om:resultTime>  
 <gml:TimeInstant gml:id="arrival\_time\_on\_system">  
 <gml:timePosition>2012-05-15T03:30:00Z </gml:timePosition>  
 </gml:TimeInstant>  
 </om:resultTime>   
 <om:procedure>  
 <metce:Process>  
 <gml:description> UKMO Unified Model </gml:description>  
 </metce:Process>  
 </om:procedure>  
 <om:parameter>  
 <om:NamedValue>  
 <om:name xlink:href="http://www.codes.wmo.int/GRIB2/table1.2/referenceTime"/>  
 <om:value>  
 <gml:TimeInstant gml:id="referencetime">  
 <gml:timePosition>2012-05-15T00:00:00Z</gml:timePosition>  
 </gml:TimeInstant>  
 </om:value>  
 </om:NamedValue>  
 </om:parameter>  
 <om:observedProperty xlink:href="http://codes.wmo.int/common/observation-type/METCE/2013/NWP\_Model"/>  
 <om:featureOfInterest>  
 <sams:SF\_SpatialSamplingFeature gml:id="NWP\_MODEL\_GRID">  
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 2=http://http://codes.wmo.int/grib2/codeflag/4.11"  
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 2=http://http://codes.wmo.int/grib2/codeflag/4.11"  
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Example of a DescribeCoverage Response (2):-

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 xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:ows="http://www.opengis.net/ows/2.0"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:swe="http://www.opengis.net/swe/2.0"  
 xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 xmlns:om="http://www.opengis.net/om/2.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:metce="http://def.wmo.int/metce/2013"  
 xmlns:sam="http://www.opengis.net/sampling/2.0"  
 xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
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 <swe:AllowedValues>  
 <swe:interval>0 1000</swe:interval>  
 <swe:significantFigures>5</swe:significantFigures>  
 </swe:AllowedValues>  
 </swe:constraint>  
 </swe:Quantity>  
 </swe:field>  
 <swe:field name="SnowPrecipitationRate">  
 <swe:Quantity  
 definition="http://test.wmocodes.info/common/c-15/me/RelativeHumidity">  
 <swe:description>relative\_humidity</swe:description>  
 <swe:nilValues/>  
 <swe:uom code="mm/hr"/>  
 <swe:constraint>  
 <swe:AllowedValues>  
 <swe:interval>0 100</swe:interval>  
 <swe:significantFigures>4</swe:significantFigures>  
 </swe:AllowedValues>  
 </swe:constraint>  
 </swe:Quantity>  
 </swe:field>  
 <swe:field name="SkinTemperature">  
 <swe:Quantity  
 definition="http://test.wmocodes.info/common/c-15/me/SkinTemperature">  
 <swe:description>Dewpoint Temperature</swe:description>  
 <swe:nilValues/>  
 <swe:uom code="C"/>  
 <swe:constraint>  
 <swe:AllowedValues>  
 <swe:interval>-273 100</swe:interval>  
 <swe:significantFigures>4</swe:significantFigures>  
 </swe:AllowedValues>  
 </swe:constraint>  
 </swe:Quantity>  
 </swe:field>  
 </swe:DataRecord>  
 </gmlcov:rangeType>  
 <wcs:ServiceParameters>  
 <wcs:CoverageSubtype>RectifiedDataset</wcs:CoverageSubtype>  
 <wcs:nativeFormat>image/tiff</wcs:nativeFormat>  
 </wcs:ServiceParameters>  
 </wcs:CoverageDescription>  
</wcs:CoverageDescriptions>

**Example GetCoverage Requests:-**

This section sets out to present a number of possible use cases that range from simple data extraction to complex data sub-setting based on geometries such as lines, polygons, trajectories etc. in order to provide planning tools with optimally sub-setted data. The data extraction operations are therefore aligned with the exploitation i.e. projected use, of the data. For example, finding extremes of weather over an area is dependent on extracting all the grid points contained within a polygon. This optimization of data extraction at source has the great advantage over traditional “bulk transfer” methods by cutting down the amount of data that needs to be transferred to the client as well as reducing the complexity of the client. By serving data through services it is easy to define a service e.g. “turbulence forecast” and encode the required business rules on the data server.

****

The use cases are grouped together by the shape of the coverage as this will dictate the functionality of the WCS API. These shapes are already recognized by the Met-Ocean community and therefore have encoding support e.g. the NetCDF common data model and the “Climate Science Markup Language” (CSML). These “shapes” are hereafter referred to as features and will map onto the GML coverage types. Some of the use cases are outwardly very similar, but the delivered Coverages are modeled differently.

**Data Access Query Type 1:-**

**Generic Use Case: - Feature type, Point Collection:**

**Feature description**:-Point in time and space; this involves the extraction from the NWP grid of one parameter for a fixed location and time:

**Use cases:**

**1.1: Single point measurement:**

Extract a temperature field for a point at 50N, 10.0E, level 500hPa & time:- 2012-07-15T00:00:00Z 15T00:00:00Z from the parent grid. The data needs to be encoded in a number of formats to include JSON and GML. The data is to be extracted from along a native model axis. If no interpolation axis is present then the nearest axis will be used. This could also be explicitly stated by having an interpolation method of nearest neighbour.

**1.2: Single point measurement:**

For a set of parameters fixed in time and space from the nearest grid point:

As for example 1.2, but for more than one parameter:

**1.3: Single point measurement:**

Extract a temperature and dew point temperature field for a point located at 50.0N, 10.0E, level 600hPa and for a time 2012-07-15T00:00:00Z from the parent grid. The data needs to be encoded in a number of formats to include JSON and GML. The data is to be extracted for the exact location i.e. interpolation will be required both in time and space, including the vertical. Note that there may be a choice in the interpolation method used dependant on the axis.

**Use Case 1.1: GetCoverage:-** A Single point measurement, for a one parameter fixed in time and space from the nearest grid point GetCoverage Request.

This request is quite simple and uses the Slice parameter to reduce the dimension to one i.e. a single point. The attribute UOM has been added to SlicePoint; the main reason, as can be seen from the example, is to ensure that the server can ensure they match the original grid, if not an exception should occur.

There is a request to change the core profile to include an attribute of UOM to DimensionSlice would help the Met-Ocean community.

<?xml version="1.0" encoding="UTF-8"?>  
<wcs:GetCoverage xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:wcsCRS="http://www.opengis.net/wcs/crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 service="WCS" version="2.0.0"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/range-subsetting/1.0/rsub.xsd">  
 <!-- ==============================================================================================-->  
 <!--TThis example illustrates how a simple Slice operation works, no interpolation is used -->  
 <!--In this sample code a slice is made along 50N, 10W for 500hPA and for a specific time -->  
 <!--The output would be a single grid point for the given parameter i.e airtemperature -->  
 <!--================================================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>airTemperature</rsub:rangeComponent>   
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL</wcs:CoverageId>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>Lat</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="Deg">50.0</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>Long</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="Deg">10.0</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>IsobaricSurface</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="hPa">500.0</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="ISO8601">2012-07-15T00:00:00Z</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <wcs:format>GRIB2</wcs:format>  
 <wcs:mediaType></wcs:mediaType>  
</wcs:GetCoverage>

**Use Case 1.2: GetCoverage** for a Single point measurement, for a multiple parameters fixed in time and space from the nearest grid point GetCoverage Request.

<rsub:rangeSubset>  
 <rsub:rangeComponent>airTemperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>dewPointTemperature</rsub:rangeComponent>  
 </rsub:rangeSubset>

**Use Case 1.3: GetCoverage:** Single point measurement, for a set of parameters fixed in time and space for an exact location and exact level, but nearest time:

<?xml version="1.0" encoding="UTF-8"?>  
<wcs:GetCoverage xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 service="WCS" version="2.0.0"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/WCS\_service-extension\_interpolation/1.0 file:/C:/Users/Rocky/WCS/MOWCS3/schemas/int.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/range-subsetting/1.0/rsub.xsd">  
 <!-- ===============================================================================================-->  
 <!--This example illustrates how a simple Slice operation works, In this sample -->  
 <!-- code a slice is made along 50N, 10W for 600hPA and sliced along a specific forecaast time -->  
 <!--The output would be a single grid point for the given parameters. If required interpolation -->  
 <!-- will be done i.e if the model and slice axes are different. -->  
 <!--================================================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>airTemperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>dewPointTemperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs> http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface&amp;  
 3=http://www.opengis.net/def/temporal/ISO8601</wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 <int:Interpolation>  
 <int:InterpolationAxes>  
 <int:InterpolationAxis axis="http://www.opengis.net/def/axis/OGC/1/latitude"  
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/Cubic"/>  
 <int:InterpolationAxis axis="http://www.opengis.net/def/axis/OGC/1/longitude"  
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/Cubic"/>  
 <int:InterpolationAxis  
 axis="http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface"  
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/barycentric"/>  
 <int:InterpolationAxis axis="http://www.codes.wmo.int/GRIB2/table4.5/Time"  
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/nearest-neighbor"/>  
 </int:InterpolationAxes>  
 </int:Interpolation>  
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL</wcs:CoverageId>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>Lat</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="Deg">50.0</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>Long</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="Deg">10.0</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>IsobaricSurface</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="hPa">600.0</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="ISO8601">2012-07-15T00:00:00Z</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <wcs:format>GRIB2</wcs:format>  
 <wcs:mediaType></wcs:mediaType>  
</wcs:GetCoverage>

**Data Access Query Type 2:-**

**Generic Use Case: - Feature type, Point Series Feature**

**Feature description:-** A time series of a point value; i.e. obtaining a parameter for a grid a NWP for each time-step at a fixed location:

**Use cases:**

**2.1 Time Series of a set of parameters at a fixed location in space:**

A user wishes to plot a time series for a number of parameters for a given fixed point and for all available model forecast times (between the selected start and end points) to find a weather window e.g. rainfall rate less than 16.0mm per hour. The data needs to be encoded in a number of formats to include JSON and GML. The data is to be extracted from the nearest grid point, i.e. no interpolation to take place either in time or space i.e. only available data to be extracted.

**2.2 Time series of set parameters as a fixed location in space:**

As 2.1, but the data needs to be extracted for the exact location and at time intervals (every hour) that are not in the original output stream i.e. interpolation to take place either in time or space; note that there may be a choice in the interpolation method used and note the use of sample size within the interpolation axis URL.

**Use Case 2.1: GetCoverage:-** Time Series of a set parameter at a fixed location in space.

<?xml version="1.0" encoding="UTF-8"?>  
<wcs:GetCoverage xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/range-subsetting/1.0/rsub.xsd">  
 <!-- ================================================================================= -->  
 <!--This example illustrates how a Slice operation works mixed with a trim -->  
 <!--In this sample a time series for a point is generated for snow and rain rate -->  
 <!--The output is a times series at a point for the model forecast times -->  
 <!--it is not assumed that the model and slice axes match and if not, then interpolation-->  
 <!--will be used. It would be possible to know what forecast times would be used by -->  
 <!--referring to the DescribeCovereage response and using the datamask -->  
 <!--=================================================================================== -->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>rainfall\_rate</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>   
 <rsub:rangeComponent>snowfall\_rate</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=www.codes.wmo.int/GRIB2/table4.5/Ground  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 <int:Interpolation>  
 <int:InterpolationAxes>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/axis/OGC/1/latitude"  
 axis="http://www.opengis.net/def/interpolation/OGC/1/nearest-neighbor"/>  
 <int:InterpolationAxis interpolationMethod=  
 "http://www.opengis.net/def/interpolation/OGC/1/nearest-neighbor"  
 axis="http://www.opengis.net/def/axis/OGC/1/longitude"/>  
 </int:InterpolationAxes>  
 </int:Interpolation>   
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_Ground</wcs:CoverageId>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>Lat</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="Deg">51.2</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>Long</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="Deg">-3.5</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:TrimLow uomLabels="ISO8601">2012-05-15T00:00:00Z</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="ISO8601">2012-05-15T12:00:00Z</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <wcs:format>GRIB2</wcs:format>  
 <wcs:mediaType></wcs:mediaType>  
</wcs:GetCoverage>

**Use Case 2.2: GetCoverage: -** Time Series of a set parameter at a fixed location in space.

<?xml version="1.0" encoding="UTF-8"?>  
<wcs:GetCoverage xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/range-subsetting/1.0/rsub.xsd">  
 <!-- ======================================================= -->  
 <!--This example illustrates how a Slice operation works mixed with a trim -->  
 <!--In this sample a time series for a point is generated for snow and rain rate -->  
 <!--The output is a times series at a point at model at 13 regular time intervals. -->  
 <!--Given the start and end times are 12 hours apart and the sample size is 13 then -->   
 <!--the time series would be at hourly intervals. -->  
 <!--it is not assumed that the model and slice axes match and if not then interpolation -->  
 <!--will be used Note in this example the output will be at hourly intervals -->  
 <!--======================================================= -->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>rainfall\_rate</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>   
 <rsub:rangeComponent>snowfall\_rate</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=www.codes.wmo.int/GRIB2/table4.5/Ground  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 <int:Interpolation>  
 <int:InterpolationAxes>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/cubic"  
 axis="http://www.opengis.net/def/axis/OGC/1/latitude"/>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/cubic"  
 axis="http://www.opengis.net/def/axis/OGC/1/longitude"/>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/linear"  
 axis="http://www.opengis.net/def/axis/OGC/1/Time"  
 samplesize="http://www.opengis.net/def/axis/OGC/1/samplesize/13"/>  
 </int:InterpolationAxes>  
 </int:Interpolation>  
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_Ground</wcs:CoverageId>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>Lat</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="Deg">50.6</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>Long</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="Deg">-3.5</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:TrimLow uomLabels="ISO8601">2012-05-15T00:00:00Z</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="ISO8601">2012-05-15T12:00:00Z</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <wcs:format>GRIB2</wcs:format>  
 <wcs:mediaType></wcs:mediaType>  
</wcs:GetCoverage>

**Data Access Query Type 3:-**

**Generic Use Case: - Feature type, Corridor Feature**

**Feature description:-** The corridor may be:

1. A simple extraction of data from a grid mapped onto a poly-line.
2. Same as 1, but time varies i.e. X1,Y1,T1 to Xn,Yn,Tn
3. Same as 1 and 2, but in 3D i.e. X1,Y1,Z1,T1

**Use cases:**

**3.1 Forecast of weather conditions along a surface route:**

A client wishes to extract the forecast for surface wind along a major route for a snap shot in time. The route will be defined by either a route name, or if the route is not named, a series of way points defined in space (aka way points).The data needs to be encoded in a number of formats to include JSON and NetCDF. The data is to be interpolated for each segment from the grid for the specific time. The road will be divided up by dividing the total length of the road by the sample size. In this example the road is 5 Km wide and divided into 1Km segments whilst the length is divided into 500 segments (the route is 500Km long). The sample size is 501 and encoded in the interpolation URL.

**3.2 Forecast of weather conditions along a surface route, in time and space:-**

As per 3.1, the data is extracted along a route, but in three dimensions. The road therefore, instead of being divided into equal length segments, will be divided in equally in time. Each way point has a time associated with it and length of the segments for this section will be different to the next set of way points as the average time between each way point will vary. An example will best illustrate this: - a route has 7 sectors (8 way points), and the length of the first sector is 24 Km. If the start time is 00:00 GMT and the end time 12:00 and the sample size is 145 then the time interval is 5 minutes across the whole journey. The start time of the first sector is, 00:00:00 GMT and the end time is 02:00 i.e. it is two hours long. Thus the first sector would have an implied sample size of 1Km. The second sector may well be different given the “way point” time interval will often be different. The time is given in epoch seconds (i.e. not of seconds since 1970) as ISO8601 time cannot be encoded in the array.

**3.3 Forecast of weather conditions along an aircraft flight path, in time and space:-**

An aircraft controller wishes to extract forecast winds for a flight corridor. The corridor will be defined by either a route name, or if the route is not named, a series of way points defined in space (aka way points that includes time).The data needs to be encoded in a number of formats to include JSON and NetCDF. The width and height of the corridor will have to be specified.

**OutputFeatureDefinition:-**

* The definition of the corridor is specified as a set of “way points” that defined in the “output CRS” and will either be static in time or time varying i.e. 4 dimensional.
  + Corridor width wrt to the output CRS;
  + Corridor height wrt to the output CRS;
  + Sample size i.e. the resolution of the corridor along the corridor axis. For static trajectories the sample size will be number of points, equally divided, from the start to finish. For dynamic trajectories e.g. 3/4D, then the sample size will determine the time interval into which the corridor is divided.
  + Grid Origin i.e. the origin coordinates of the corridor specified with respect to the output CRS.

**This diagram is courtesy of NCAR**



**Use Case 3.1:** GetCoverage: - Forecast weather conditions along a surface route:

<?xml version="1.0" encoding="UTF-8"?>  
<metocean:GetCorridorCoverage xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://www.opengis.net/WCS\_service-extension\_interpolation/1.0 file:/C:/Users/Rocky/WCS/MOWCS3/schemas/int.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 file:/C:/Users/Rocky/WCS/MOWCS3/schemas/rsub.xsd">  
 <!-- =================================================================================-->  
 <!--This example 3.1 illustrates how a simple 2D trajectory can be described e.g. a road,-->  
 <!--The road will have a width (in this case lateral extent of 5Km) and a centreline. -->  
 <!--In this example the corridor is divided into 500 segments of equal length from -->   
 <!--start to finish. The centre line is defined by the output feature with the way -->  
 <!--points being a set of latitudes and longitudes. The two axes are defined with one -->   
 <!--axis as being along the corridor path and the other perpendicular to it -->  
 <!--==================================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>rainfall\_rate</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>snowfall\_rate</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>surface\_temperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>  
 http://www.opengis.net/def/crs/EPSG/0/4326  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 <int:Interpolation>  
 <int:InterpolationAxes>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/linear/samplesize=501"  
 axis="http://www.opengis.net/def/axis/OGC/1/Corridor\_Length"/>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/linear/samplesize=5"  
 axis="http://www.opengis.net/def/axis/OGC/1/Corridor\_Width"/>  
 </int:InterpolationAxes>  
 </int:Interpolation>  
 <metocean:OutputFeatureDefinition>  
 <!-- The origin is centre of the road i.e. the lateral extent is relative to this -->  
 <!-- The road is divided up into 500 segments which is easier to define rather than the length -->  
 <metocean:Origin  
 srsDimension="2" uomLabels="Km SamplePoint">  
 0.0 0.0  
 </metocean:Origin>  
 <gmlrgrid:ReferenceableGridByArray gml:id="ey" dimension="2"  
 srsName="http://www.opengis.net/def/crs/EPSG/0/4326"  
 axisLabels="lat long" uomLabels="deg deg">  
 <gml:limits>  
 <gml:GridEnvelope>  
 <gml:low>0 0</gml:low>  
 <gml:high>2 7</gml:high>  
 </gml:GridEnvelope>  
 </gml:limits>  
 <gml:axisLabels>lat long</gml:axisLabels>  
 <gml:posList>  
 50.0 -2.5  
 51.0 -2.0  
 51.2 -1.1  
 51.6 -0.5  
 52.5 1.5  
 52.9 2.5  
 53.6 3.5   
 </gml:posList>  
 <gmlrgrid:sequenceRule axisOrder="+1 +2">Linear</gmlrgrid:sequenceRule>  
 </gmlrgrid:ReferenceableGridByArray>  
 </metocean:OutputFeatureDefinition>   
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_Ground</wcs:CoverageId>  
 <!-- The origin is centre of the road i.e. the lateral extent - 2.5 to 2.5 is relative to this -->  
 <!-- The road is divided up into 500 segments which is easier to define rather than the length -->  
 <!-- The trajectory is a snap shot in time i.e. it is sliced at 2012-05-15T00:00:00Z -->  
 <metocean:DimensionTrim>  
 <wcs:Dimension>Corridor\_Width</wcs:Dimension>  
 <metocean:TrimLow uomLabels="Km">-2.5</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="Km">2.5</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="ISO8601">2012-05-15T00:00:00Z</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <wcs:format>GRIB2</wcs:format>  
 <wcs:mediaType></wcs:mediaType>  
</metocean:GetCorridorCoverage>

**3.2 Use Case GetCoverage:-** Forecast of weather conditions along a surface route, in time and space:-

<?xml version="1.0" encoding="UTF-8"?>  
<metocean:GetCorridorCoverage xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://www.opengis.net/WCS\_service-extension\_interpolation/1.0 file:/C:/Users/Rocky/WCS/MOWCS3/schemas/int.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/range-subsetting/1.0/rsub.xsd">  
 <!-- =================================================================================-->  
 <!--This example illustrates how a simple 3D trajectory can be described e.g. a road, -->  
 <!--The road will have a width (in this case lateral extent of 5Km) and a centreline. -->  
 <!--In this example the corridor is divided into 500 segments of equal time length from -->   
 <!--start to finish. The centre line is defined by the output feature with the way -->  
 <!--points being a set of latitues and longitudes. The two axes are defined with one -->   
 <!--axis as being along the time axis and the other across the path. -->  
 <!--==================================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>rainfall\_rate</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>snowfall\_rate</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>surface\_temperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>  
 http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.opengis.net/def/temporal/ISO8601  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 <int:Interpolation>  
 <int:InterpolationAxes>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/linear/samplesize=145"  
 axis="http://www.opengis.net/def/axis/OGC/1/Corridor\_Time"/>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/linear/samplesize=11"   
 axis="http://www.opengis.net/def/axis/OGC/1/Corridor\_Width"/>  
 </int:InterpolationAxes>  
 </int:Interpolation>  
 <metocean:OutputFeatureDefinition>  
 <!-- The origin is centre of the road i.e. the lateral extent is relative to this -->  
 <!-- The road is divided up timewise into hourly intervals and the length of each -->  
 <!-- segment will depend on the average speed for each segment. -->  
 <metocean:Origin  
 srsDimension="3" uomLabels="Km SamplePoint">  
 0.0 0.0 0.0  
 </metocean:Origin>  
 <gmlrgrid:ReferenceableGridByArray gml:id="ex" dimension="3"  
 srsName="http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.opengis.net/def/temporal/ISO8601"  
 axisLabels="lat long time" uomLabels="deg deg epoch\_seconds">  
 <gml:limits>  
 <gml:GridEnvelope>  
 <gml:low>0 0 1337040000</gml:low>  
 <gml:high>7 7 1337083200</gml:high>  
 </gml:GridEnvelope>  
 </gml:limits>  
 <gml:axisLabels>lat long time</gml:axisLabels>  
 <gml:posList>  
 50.0 -2.5 1337040000  
 51.0 -2.0 1337047200  
 51.2 -1.1 1337054400  
 51.6 -0.5 1337061600  
 52.5 1.5 1337068800  
 52.9 2.5 1337074200  
 53.6 3.5 1337077800  
 53.8 3.8 1337083200  
 </gml:posList>  
 <gmlrgrid:sequenceRule axisOrder="+1 +2 +3">Linear</gmlrgrid:sequenceRule>  
 </gmlrgrid:ReferenceableGridByArray>  
 </metocean:OutputFeatureDefinition>   
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_Ground</wcs:CoverageId>  
 <!-- The origin is centre of the road i.e. the lateral extent - 2.5 to 2.5 is relative to this -->  
 <!-- The road is divided up into 500 segments which is easier to define rather than the length -->  
 <!-- The trajectory is sampled every hour from 2012-05-15T00:00:00Z to 2012-05-15T12:00:00Z -->  
 <metocean:DimensionTrim>  
 <wcs:Dimension>Corridor\_Width</wcs:Dimension>  
 <metocean:TrimLow uomLabels="Km">-2.5</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="Km">2.5</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:TrimLow uomLabels="ISO8601">2012-05-15T00:00:00Z</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="ISO8601">2012-05-15T12:00:00Z</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <wcs:format>GRIB2</wcs:format>  
 <wcs:mediaType></wcs:mediaType>  
</metocean:GetCorridorCoverage>  
  
  
  
  
  
**3.3 Use Case GetCoverage:-** Forecast of weather conditions along an aircraft flight path, in time and space i.e. a 4D trajectory

<?xml version="1.0" encoding="UTF-8"?>  
<metocean:GetCorridorCoverage xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://www.opengis.net/WCS\_service-extension\_interpolation/1.0 file:/C:/Users/Rocky/WCS/MOWCS3/schemas/int.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 file:/C:/Users/Rocky/WCS/MOWCS3/schemas/rsub.xsd">  
 <!-- =================================================================================-->  
 <!--This example illustrates how a 4D trajectory can be described e.g. a road, -->  
 <!--The road will have a width (in this case lateral extent of 5Km) and a centreline. -->  
 <!--In this example the corridor is divided into 500 segments of equal length from -->   
 <!--start to finish. The centre line is defined by the output feature with the way -->  
 <!--points being a set of latitues and longitudes. The two axes are defined with one -->   
 <!--axis as being along the corridor path and the other perpendicular to it -->  
 <!--==================================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>Wind\_Speed</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>Wind\_Direction</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>Temperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>  
 http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.opengis.net/def/crs/EPSG/0/5701&amp;  
 3=http://www.opengis.net/def/temporal/ISO8601  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 <int:Interpolation>  
 <int:InterpolationAxes>  
 <int:InterpolationAxis interpolationMethod=  
 "http://www.opengis.net/def/interpolation/OGC/1/linear/samplesize=500" axis="http://www.opengis.net/def/axis/OGC/1/Corridor\_Time"/>  
 <int:InterpolationAxis interpolationMethod=  
 "http://www.opengis.net/def/interpolation/OGC/1/linear/samplesize=11" axis="http://www.opengis.net/def/axis/OGC/1/Corridor\_Width"/>  
 <int:InterpolationAxis axis="http://www.opengis.net/def/axis/OGC/1/Corridor\_Height"   
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/barycentric/samplesize=5"/>  
 </int:InterpolationAxes>  
 </int:Interpolation>  
 <metocean:OutputFeatureDefinition>  
 <!-- Define the corridor width, height and resolution, notice that the grid origin is -->  
 <!-- The road is divided up timewise into hourly intervals and the length of each -->  
 <!-- segment will depend on the average speed for each segment. -->  
 <metocean:Origin  
 srsDimension="4" uomLabels="Km SamplePoint">  
 0.0 0.0 0.0 0.0  
 </metocean:Origin>  
 <gmlrgrid:ReferenceableGridByArray gml:id="ex" dimension="4"  
 srsName="http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.opengis.net/def/crs/EPSG/0/5701&amp;  
 3=http://www.opengis.net/def/temporal/ISO8601"  
 axisLabels="lat long height time" uomLabels="deg deg m epoch\_seconds">  
 <gml:limits>  
 <gml:GridEnvelope>  
 <gml:low>0 0 0 0</gml:low>  
 <gml:high>8 8 8 8</gml:high>  
 </gml:GridEnvelope>  
 </gml:limits>  
 <gml:axisLabels>lat long height time</gml:axisLabels>  
 <gml:posList>  
 50.0 -2.5 0.0 1337040000  
 51.0 -2.0 500 1337047200  
 51.2 -1.1 1000 1337054400  
 51.6 -0.5 3000 1337061600  
 52.5 1.5 3000 1337068800  
 52.9 2.5 2500 1337074200  
 53.6 3.5 1000 1337077800  
 53.8 3.8 0.0 1337083200  
 </gml:posList>  
 <gmlrgrid:sequenceRule axisOrder="+1 +2 +3 +4">Linear</gmlrgrid:sequenceRule>  
 </gmlrgrid:ReferenceableGridByArray>  
 </metocean:OutputFeatureDefinition>   
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL</wcs:CoverageId>  
 <!-- The origin is centre of the road i.e. the lateral extent - 2.5 to 2.5 is relative to this -->  
 <!-- The road is divided up into 500 segments which is easier to define rather than the length -->  
 <!-- The trajectory is sampled every hour as from 2012-05-15T00:00:00Z to 2012-05-15T12:00:00Z -->  
 <metocean:DimensionTrim>  
 <wcs:Dimension>Corridor\_Width</wcs:Dimension>  
 <metocean:TrimLow uomLabels="Km">-2.5</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="Km">2.5</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>Corridor\_Height</wcs:Dimension>  
 <metocean:TrimLow uomLabels="Km">-1.0</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="Km">1.0</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:TrimLow uomLabels="ISO8601">2012-05-15T00:00:00Z</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="ISO8601">2012-05-15T12:00:00Z</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <wcs:format>GRIB2</wcs:format>  
 <wcs:mediaType></wcs:mediaType>  
</metocean:GetCorridorCoverage>

**Data Access Query Type 4:-**

**Generic Use Case: - Feature type,** [**PointCollectionFeature**](file:///\\desktop.frd.metoffice.com\UserDFS$\peter.trevelyan\MyDocuments\Architect\Sprint\Sprint04\Use%20case%20by%20feature%20type(Point%20Feature).docx)

**Feature description:-** This is a collection of point values for a given time, level and contained within a polygon for a specific parameter from a 4D grid.

**Use cases:**

**4.1 Forecast of weather conditions within a given area:**

An environment agency needs to have an estimate of the forecast rainfall accumulation for a given catchment area. The area is irregular and is defined as a closed polygon. No interpolation to take place either in time or space. The data needs to be encoded in a number of formats to include JSON, KML and GML. A set of polygons will be created, one for each available forecast time.

**4.1 Use Case GetCoverage:-** [PointCollectionFeature](file:///\\desktop.frd.metoffice.com\UserDFS$\peter.trevelyan\MyDocuments\Architect\Sprint\Sprint04\Use%20case%20by%20feature%20type(Point%20Feature).docx):

<?xml version="1.0" encoding="UTF-8"?>  
<metocean:GetPolygonCoverage xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 file:/C:/Users/Rocky/WCS/MOWCS3/schemas/rsub.xsd">  
 <!-- =================================================================================-->  
 <!--This examples illustrates how a set of grid points , that lie within a polygon -->  
 <!--points are extracted. The points are extracted for a set of available forecast -->  
 <!--Times. If the request was for times that were not available then time -->   
 <!-- interpolation would be required and the interpolation would have a sample size -->  
 <!-- See example 2.2 -->   
 <!-- -->  
 <!--==================================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>rainfall\_rate</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>snowfall\_rate</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>surface\_temperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>  
 http://www.opengis.net/def/crs/EPSG/0/4326  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 <metocean:OutputFeatureDefinition>  
 <metocean:Origin  
 srsDimension="2" uomLabels="deg deg">  
 50.0 -2.5  
 </metocean:Origin>  
 <!-- This example illustrates how a simple Polygon can be encoded & used to define an area -->  
 <gmlrgrid:ReferenceableGridByArray gml:id="ey" dimension="2"  
 srsName="http://www.opengis.net/def/crs/EPSG/0/4326"  
 axisLabels="lat long" uomLabels="deg deg">  
 <gml:limits>  
 <gml:GridEnvelope>  
 <gml:low>0 0</gml:low>  
 <gml:high>7 7</gml:high>  
 </gml:GridEnvelope>  
 </gml:limits>  
 <gml:axisLabels>lat long</gml:axisLabels>  
 <gml:posList>  
 50.0 -2.5  
 51.0 -2.0  
 51.2 -1.1  
 51.6 -0.5  
 52.5 1.5  
 52.0 1.0  
 51.6 -0.5  
 50.0 -2.5  
 </gml:posList>  
 <gmlrgrid:sequenceRule axisOrder="+1 +2">Linear</gmlrgrid:sequenceRule>  
 </gmlrgrid:ReferenceableGridByArray>  
 </metocean:OutputFeatureDefinition>   
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_Ground</wcs:CoverageId>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:TrimLow uomLabels="ISO8601">2012-07-15T00:00:00Z</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="ISO8601">2012-07-15T12:00:00Z</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <wcs:format>GRIB2</wcs:format>  
 <wcs:mediaType></wcs:mediaType>  
</metocean:GetPolygonCoverage>

**Data Access Query Type 5:-**

**Generic Use Case: - Feature type,** [**Profile**](file:///\\desktop.frd.metoffice.com\UserDFS$\peter.trevelyan\MyDocuments\Architect\Sprint\Sprint04\Use%20case%20by%20feature%20type(Point%20Feature).docx) **Time Series Feature:**

**Feature description:-** For a fixed location and time range create a profile for fixed level at time T1, another at timeT2 etc. The profiles are connected by time. Note all levels have the same vertical coordinate.

**Use cases:**

**5.1 Forecast of weather conditions over a vertical profile for a time period:**

A user wishes to know when fog is likely to clear. This requires knowledge of when the boundary layer inversion is likely to break down and this can be ascertained from a time series profile for temperature at the specific location. The data needs to be encoded in a number of formats to include JSON and GML. The data is to be extracted from the nearest grid point, i.e. no interpolation to take place either in time or space as the integrity of the data is paramount.

**5.2 Forecast of weather conditions along a vertical profile at a specific location and at specified time intervals:**

A user wishes to know when a cold front is likely to pass through as this will cause an increase in wind gust and a sharp veering of the wind. The time series of a vertical profile of wind speed and direction will help in pin pointing the exact time of the arrival of the cold front. The data is to be extracted from exact location and at every hour and at 50hPa intervals. Interpolation both in time and space will therefore be required. The data needs to be encoded in a number of formats to include JSON and GML.

**Use Case 5.1: GetCoverage**: Forecast of weather conditions over a vertical profile for a time period:

<?xml version="1.0" encoding="UTF-8"?>  
<wcs:GetCoverage xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/WCS\_service-extension\_interpolation/1.0 file:/C:/Users/Rocky/WCS/MOWCS3/schemas/int.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/range-subsetting/1.0/rsub.xsd">  
 <!-- ===============================================================================================-->  
 <!-- Forecast of weather conditions for a time series of a vertical profile for temperature and -->  
 <!-- humidity profile. A slice is made along 50N, 10W & for all available levels between -->  
 <!-- 1000 hPa to 200hPa and for all available forecast times between 2012-07-15T00:00:00Z and -->  
 <!-- 2012-07-16T00:00:12Z; No interpolation will take place -->  
 <!--================================================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>air\_temperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>relative\_humidity</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>  
 http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface&amp;  
 3=http://www.opengis.net/def/temporal/ISO8601  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL</wcs:CoverageId>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>Lat</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="Deg">50.0</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>Long</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="Deg">-3.5</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>IsobaricSurface</wcs:Dimension>  
 <metocean:TrimLow uomLabels="hPa">1000.0</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="hPa">200.0</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:TrimLow>2012-07-15T00:00:00Z</metocean:TrimLow>  
 <metocean:TrimHigh>2012-07-16T00:00:12Z</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <wcs:format>GRIB2</wcs:format>  
 <wcs:mediaType></wcs:mediaType>  
</wcs:GetCoverage>

**Use Case 5.2: GetCoverage:-** Forecast of weather conditions along a vertical profile at a specific location, at specified time and pressure intervals.

<?xml version="1.0" encoding="UTF-8"?>  
<wcs:GetCoverage xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/WCS\_service-extension\_interpolation/1.0 file:/C:/Users/Rocky/WCS/MOWCS3/schemas/int.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/range-subsetting/1.0/rsub.xsd">  
 <!-- ===============================================================================================-->  
 <!-- Forecast of weather conditions for a time series of a vertical profile for temperature and -->  
 <!-- humidity profile. A slice is made along 50N, 10W & for all interpolated levels between -->  
 <!-- 1000 hPa to 200hPa at 50hPA intervals (interpolated) and forecaast times between -->  
 <!-- 2012-07-15T00:00:00Z and 2012-07-15T00:00:12Z at 30 minute intervals (Interpolated). -->  
 <!-- Interpolation along each axis will take place -->  
 <!--================================================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>air\_temperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>relative\_humidity</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>  
 http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface&amp;  
 3=http://www.opengis.net/def/temporal/ISO8601  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 <int:Interpolation>  
 <int:InterpolationAxes>  
 <int:InterpolationAxis axis="http://www.opengis.net/def/axis/OGC/1/longitude"   
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/Cubic"/>  
 <int:InterpolationAxis axis="http://www.opengis.net/def/axis/OGC/1/latitude"   
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/Cubic"/>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/barycentric"  
 axis="http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface"/>  
 <int:InterpolationAxis axis="http://www.opengis.net/def/axis/OGC/1/Time"   
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/Cubic/samplesize=13"/>  
 </int:InterpolationAxes>  
 </int:Interpolation>  
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL</wcs:CoverageId>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>Lat</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="Deg">50.4</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>Long</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="Deg">-3.5</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>IsobaricSurface</wcs:Dimension>  
 <metocean:TrimLow uomLabels="hPa">1000.0</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="hPa">200.0</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:TrimLow uomLabels="ISO8601">2012-07-15T00:00:00Z</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="ISO8601">2012-07-15T12:00:00Z</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <wcs:format>GRIB2</wcs:format>  
 <wcs:mediaType></wcs:mediaType>  
</wcs:GetCoverage>

**Data Access Query Type 6:-**

**Generic Use Case: - Feature type, Section Feature:**

**Feature description:-** (Series of vertical profiles from positions along a trajectory in time and space)

This is the basic cross section formed by creating a baseline (aka trajectory) and extracting a parameter from the grid in the vertical (the levels are fixed). Each profile is for a specific time T. For a set of profiles (that form the cross section) the time may vary or it could be for the same time.

**Use cases:-**

**6.1 Presentation:**

Plot parameters along a cross section and display on an aviation chart, as the plotting software can only cope with data at regular intervals the data will need to be interpolated in the vertical and horizontal; all profiles on the cross section will be for the same time.

**6.2 Threshold analysis:**

An air traffic planner has a number of flight plans and wishes to know the conditions along the flight path for a number of sampled levels.

**6.3 Routeing:**

A survey ship sails along a given route and needs forecasts of the currents (at various depths).

**Use Case 6.1: GetCoverage:-** Section Feature i.e. Plot parameters along a cross section:

<?xml version="1.0" encoding="UTF-8"?>  
<metocean:GetCrossSectionCoverage xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/WCS\_service-extension\_interpolation/1.0 file:/C:/Users/Rocky/WCS/MOWCS3/schemas/int.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/range-subsetting/1.0/rsub.xsd">  
 <!-- =================================================================================-->  
 <!--The Cross Section has two main specifications i.e. baseline i.e -->  
 <!--OutputFeatureDefinition and the size and resolution of the cross section i.e. the -->  
 <!--ITRIM elements In this example the cross section has a baseline (in lat,long) -->   
 <!--and a lower and upper bound of 1000hPa and 200hPa respectively -->  
 <!--==================================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>air\_temperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>relative\_humidity</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>  
 http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface&amp;  
 3=http://www.opengis.net/def/temporal/ISO8601  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 <int:Interpolation>  
 <int:InterpolationAxes>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/linear/samplesize=7"  
 axis="http://www.opengis.net/def/axis/OGC/1/Cross\_Section\_Length"/>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/barycentric/samplesize=11"   
 axis="http://www.opengis.net/def/axis/OGC/1/Cross\_Section\_Height"/>  
 </int:InterpolationAxes>  
 </int:Interpolation>  
 <metocean:OutputFeatureDefinition>  
 <metocean:Origin  
 srsDimension="2" uomLabels="Km SamplePoint">  
 0.0 0.0  
 </metocean:Origin>  
 <gmlrgrid:ReferenceableGridByArray gml:id="ey" dimension="2"  
 srsName="http://www.opengis.net/def/crs/EPSG/0/4326"  
 axisLabels="Latitude Longitude" uomLabels="deg deg">  
 <gml:limits>  
 <gml:GridEnvelope>  
 <gml:low>0 0</gml:low>  
 <gml:high>2 8</gml:high>  
 </gml:GridEnvelope>  
 </gml:limits>  
 <gml:axisLabels>latitude longitude</gml:axisLabels>  
 <gml:posList>  
 50.0 -2.5   
 51.0 -2.0  
 51.2 -1.1  
 51.6 -0.5  
 52.5 1.5  
 52.9 2.5  
 53.6 3.5  
 53.8 3.8  
 </gml:posList>  
 <gmlrgrid:sequenceRule axisOrder="+1 +2">Linear</gmlrgrid:sequenceRule>  
 </gmlrgrid:ReferenceableGridByArray>  
 </metocean:OutputFeatureDefinition>   
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL</wcs:CoverageId>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>IsobaricSurface</wcs:Dimension>  
 <metocean:TrimLow uomLabels="hPa">1000.0</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="hPa">200.0</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="ISO8601">2012-07-15T00:00:00Z</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <wcs:format>GRIB2</wcs:format>  
 <wcs:mediaType></wcs:mediaType>  
</metocean:GetCrossSectionCoverage>

**Use Case 6.2: GetCoverage Example:- Section Feature i.e. Plot parameters along a cross section interpolating between way points in time:**

<?xml version="1.0" encoding="UTF-8"?>  
<metocean:GetCrossSectionCoverage xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0"  
 xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://www.opengis.net/WCS\_service-extension\_interpolation/1.0 file:/C:/Users/Rocky/WCS/MOWCS3/schemas/int.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/range-subsetting/1.0/rsub.xsd">  
 <!-- =================================================================================-->  
 <!--The Cross Section has two main specifications i.e. baseline i.e -->  
 <!--OutputFeatureDefinition and the size and resolution of the cross section i.e. the -->  
 <!-- TRIM elements. In this example the cross section has a baseline (in lat,long) -->   
 <!--and a lower and upper bound of 1000hPa and 200hPa respectively -->  
 <!--==================================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>air\_temperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>relative\_humidity</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>  
 http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface&amp;  
 3=http://www.opengis.net/def/temporal/ISO8601  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 <int:Interpolation>  
 <int:InterpolationAxes>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/linear/samplesize=11"  
 axis="http://www.opengis.net/def/axis/OGC/1/Cross\_Section\_Time"/>  
 <int:InterpolationAxis interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/barycentric/samplesize=11"   
 axis="http://www.opengis.net/def/axis/OGC/1/Cross\_Section\_Height"/>  
 </int:InterpolationAxes>  
 </int:Interpolation>  
 <metocean:OutputFeatureDefinition>  
 <gmlrgrid:ReferenceableGridByArray gml:id="ey" dimension="2"  
 srsName="http://www.opengis.net/def/crs/EPSG/0/4326"  
 axisLabels="lat long" uomLabels="deg deg">  
 <gml:limits>  
 <gml:GridEnvelope>  
 <gml:low>0 0</gml:low>  
 <gml:high>2 8</gml:high>  
 </gml:GridEnvelope>  
 </gml:limits>  
 <gml:axisLabels>lat long</gml:axisLabels>  
 <gml:posList>  
 50.0 -2.5 1337040000  
 51.0 -2.0 1337047200  
 51.2 -1.1 1337054400  
 51.6 -0.5 1337061600  
 52.5 1.5 1337068800  
 52.9 2.5 1337074200  
 53.6 3.5 1337077800  
 53.8 3.8 1337083200  
 </gml:posList>  
 <gmlrgrid:sequenceRule axisOrder="+1 +2">Linear</gmlrgrid:sequenceRule>  
 </gmlrgrid:ReferenceableGridByArray>  
 </metocean:OutputFeatureDefinition>   
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL</wcs:CoverageId>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>IsobaricSurface</wcs:Dimension>  
 <metocean:TrimLow uomLabels="hPa">1000.0</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="hPa">200.0</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:TrimLow uomLabels="ISO8601">2012-05-15T00:00:00Z</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="ISO8601">2012-05-15T12:00:00Z</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <wcs:format>GRIB2</wcs:format>  
 <wcs:mediaType></wcs:mediaType>  
</metocean:GetCrossSectionCoverage>

**Data Access Query Type 7:-**

**Generic Use Case: - Feature type, GRID Feature**

**Feature description:- (**Single time-snapshot of a gridded field.)

**Use cases:**

**7.1 Sub-setting the grid:-**

A decision support system needs high resolution gridded data for a given volume, at a specific time to provide an air traffic controller with local forecast for wind and rainfall within the vicinity of the airport; the area of interest is a 100Km (approx. 1.5Deg) box cantered at a specific airport. The data is to stay on the original grid and at the same resolution i.e. there will be no change in resolution or projection, thus no interpolation will take place. Given that the bounding box may not “snap” exactly onto the model grid (horizontally and vertically) the nearest grid point to the bounding box will be used.

**7.2 Creating a regular grid from an irregular grid:**

A dataset is required that is homogenous i.e. all data are regularly spaced either in space. Most output streams from NWP models have data that is missing, either in time or space and the missing data will have to be “created” using the data that are present. In the example the data is required for every 1/2degree (irrespective of the model grid) and at every 50hPa and at hourly intervals. Given that most NWP output will already be a regular horizontal grid then “sample size” would be omitted from the interpolation so allowing the data to stay on the parent grid.

**7.3 Re-projection:**

The user requires the data on a different resolution from that of the parent grid. The data may be re-projected, both in the horizontal and vertical. The resolution of the data will be changed and therefore the new grid resolution will be required. In the example the new projection will be Mercator (54004) from 45W 30N to 45E to 70N with a grid of 100X100.

**Use Case 7.1: GetCoverage: -** GRID Feature i.e. Sub-setting the grid:-

<?xml version="1.0" encoding="UTF-8"?>  
<wcs:GetCoverage   
 xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:metocean="http://def.wmo.int/metocean/2013"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0">  
 <!--====================================================================-->  
 <!--This example illustrates how a simple Trim operation works, -->  
 <!--In this sample code a "cut out" from 50.0N to 60.0N and 1.5W to 1.5E is made -->   
 <!--The output grid is not interpolated and only available data will be accessed -->  
 <!--There is onyl in time extracted i.e. 2012-07-15T00:00:00Z -->  
 <!--=====================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeItem>  
 <rsub:rangeComponent>Temperature</rsub:rangeComponent>  
 </rsub:rangeItem>   
 <rsub:rangeItem>  
 <rsub:rangeComponent>Dew Point Temperature</rsub:rangeComponent>  
 </rsub:rangeItem>   
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>  
 http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface&amp;  
 3=http://www.opengis.net/def/temporal/ISO8601  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL</wcs:CoverageId>  
 <wcs:DimensionTrim>  
 <wcs:Dimension>lat</wcs:Dimension>  
 <wcs:TrimLow uomLabels="Deg">50.0</wcs:TrimLow>   
 <wcs:TrimHigh uomLabels="Deg">60.0</wcs:TrimHigh>  
 </wcs:DimensionTrim>  
 <wcs:DimensionTrim>  
 <wcs:Dimension>long</wcs:Dimension>  
 <wcs:TrimLow uomLabels="Deg">-1.5</wcs:TrimLow>   
 <wcs:TrimHigh uomLabels="Deg">1.5</wcs:TrimHigh>  
 </wcs:DimensionTrim>  
 <wcs:DimensionTrim>  
 <wcs:Dimension>Isobaric Surface</wcs:Dimension>  
 <wcs:TrimLow uomLabels="hPa">1000.0</wcs:TrimLow>  
 <wcs:TrimHigh uomLabels="hPa">250.0</wcs:TrimHigh>  
 </wcs:DimensionTrim>  
 <wcs:DimensionSlice>  
 <wcs:Dimension>Verifying Time of Forecast</wcs:Dimension>  
 <wcs:SlicePoint>2012-05-15T00:00:00Z</wcs:SlicePoint>  
 </wcs:DimensionSlice>  
 <wcs:format>GRIB2/</wcs:format>  
 <wcs:mediaType>/</wcs:mediaType>  
</wcs:GetCoverage>

**Use Case 7.2: GetCoverage Example: - Feature type, GRID Feature i.e. Creating a regular grid from an irregular grid:**

<?xml version="1.0" encoding="UTF-8"?>  
<wcs:GetCoverage   
 xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0" xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/PTrevelyan/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/WCS\_service-extension\_interpolation/1.0 file:/C:/Users/PTrevelyan/WCS/MOWCS3/schemas/int.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/range-subsetting/1.0/rsub.xsd">  
 <!--====================================================================-->  
 <!--This example illustrates how a simple Trim operation works, -->  
 <!--Creating a regular grid from an irregular grid -->   
 <!--=====================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>air\_temperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>relative\_humidity</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>  
 http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface&amp;  
 3=http://www.opengis.net/def/temporal/ISO8601  
 </wcsCRS:subsettingCrs>  
 </wcsCRS:GetCoverageCrs>  
 <int:Interpolation>  
 <int:InterpolationAxes>  
 <int:InterpolationAxis axis="http://www.opengis.net/def/axis/OGC/1/latitude"  
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/Cubics/amplesize=21"/>  
 <int:InterpolationAxis axis="http://www.opengis.net/def/axis/OGC/1/longitude"  
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/Cubic/samplesize=21"/>  
 <int:InterpolationAxis  
 axis="http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface"  
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/barycentric/samplesize=17"/>  
 <int:InterpolationAxis axis="http://www.opengis.net/def/axis/OGC/1/Time"   
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/linear/samplesize=13"/>  
 </int:InterpolationAxes>  
 </int:Interpolation>  
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL</wcs:CoverageId>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>Lat</wcs:Dimension>  
 <metocean:TrimLow uomLabels="Deg">50.0</metocean:TrimLow>   
 <metocean:TrimHigh uomLabels="Deg">60.0</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>Long</wcs:Dimension>  
 <metocean:TrimLow uomLabels="Deg">-10.0</metocean:TrimLow>   
 <metocean:TrimHigh uomLabels="Deg">10.0</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>IsobaricSurface</wcs:Dimension>  
 <metocean:TrimLow uomLabels="hPa">1000.0</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="hPa">200.0</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:TrimLow uomLabels="ISO8601">2012-05-15T00:00:00Z</metocean:TrimLow>  
 <metocean:TrimHigh uomLabels="ISO8601">2012-05-15T12:00:00Z</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <wcs:format>GRIB2/</wcs:format>  
 <wcs:mediaType>/</wcs:mediaType>  
</wcs:GetCoverage>

**Use Case 7.3: GetCoverage Example: - Feature type, GRID Feature i.e. re-projection.**

<?xml version="1.0" encoding="UTF-8"?>  
<wcs:GetCoverage   
 xmlns:xlink="http://www.w3.org/1999/xlink"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:wcsCRS="http://www.opengis.net/wcs\_service-extension\_crs/1.0"  
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 service="WCS" version="2.0.0" xsi:schemaLocation="http://www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd  
 http://www.opengis.net/wcs/crs/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/crs/1.0/wcsCrs.xsd  
 http://def.wmo.int/metce/2013/metocean file:/C:/Users/PTrevelyan/WCS/MOWCS3/schemas/wcsMetOceanCommon.xsd  
 http://www.opengis.net/WCS\_service-extension\_interpolation/1.0 file:/C:/Users/PTrevelyan/WCS/MOWCS3/schemas/int.xsd  
 http://www.opengis.net/wcs/range-subsetting/1.0 https://raw.github.com/EOxServer/schemas/master/wcs/range-subsetting/1.0/rsub.xsd">  
 <!--====================================================================-->  
 <!--This example illustrates how a simple re-projection works, -->  
 <!—The area of interest is specified in lat/long and re-projection to a Mercator -->

<!—The sample size defines the output grid size -->  
 <!--=====================================================================-->  
 <wcs:Extension>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>air\_temperature</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <rsub:rangeSubset>  
 <rsub:rangeComponent>relative\_humidity</rsub:rangeComponent>  
 </rsub:rangeSubset>  
 <wcsCRS:GetCoverageCrs>  
 <wcsCRS:subsettingCrs>http://www.opengis.net/def/crs-combine?  
 1=http://www.opengis.net/def/crs/EPSG/0/4326&amp;  
 2=http://www.codes.wmo.int/GRIB2/table4.5/IsobaricSurface&amp;  
 3=http://www.opengis.net/def/temporal/ISO8601</wcsCRS:subsettingCrs>  
 <wcsCRS:outputCrs>  
 http://www.opengis.net/def/crs/EPSG/0/54004   
 </wcsCRS:outputCrs>  
 </wcsCRS:GetCoverageCrs>  
 <int:Interpolation>  
 <int:InterpolationAxes>  
 <int:InterpolationAxis axis="http://www.opengis.net/def/axis/OGC/1/latitude"  
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/Cubics/amplesize=21"/>  
 <int:InterpolationAxis axis="http://www.opengis.net/def/axis/OGC/1/longitude"  
 interpolationMethod="http://www.opengis.net/def/interpolation/OGC/1/Cubic/samplesize=21"/>  
 </int:InterpolationAxes>  
 </int:Interpolation>  
 </wcs:Extension>  
 <wcs:CoverageId>UK\_GLOBAL\_2012-05-15T00.00.00Z\_ISBL</wcs:CoverageId>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>Lat</wcs:Dimension>  
 <metocean:TrimLow uomLabels="Deg">50.0</metocean:TrimLow>   
 <metocean:TrimHigh uomLabels="Deg">60.0</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionTrim>  
 <wcs:Dimension>Long</wcs:Dimension>  
 <metocean:TrimLow uomLabels="Deg">-10.0</metocean:TrimLow>   
 <metocean:TrimHigh uomLabels="Deg">10.0</metocean:TrimHigh>  
 </metocean:DimensionTrim>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>IsobaricSurface</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="hPa">500.0</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <metocean:DimensionSlice>  
 <wcs:Dimension>ValidityTime</wcs:Dimension>  
 <metocean:SlicePoint uomLabels="ISO8601">2012-07-15T00:00:00Z</metocean:SlicePoint>  
 </metocean:DimensionSlice>  
 <wcs:format>GRIB2/</wcs:format>  
 <wcs:mediaType>/</wcs:mediaType>  
</wcs:GetCoverage>

**Annexe Schemas:-**

**int.xsd**

<?xml version="1.0" encoding="UTF-8"?>  
<schema targetNamespace="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"   
 xmlns:int="http://www.opengis.net/WCS\_service-extension\_interpolation/1.0"  
 xmlns="http://www.w3.org/2001/XMLSchema"   
 elementFormDefault="qualified" version="1.0.0" xml:lang="en">  
 <annotation>  
 <appinfo>int.xsd</appinfo>  
 <documentation>This XML Schema Document is part of the WCS Interpolation Extension [OGC 12-049]. It encodes the elements and types that allow expressing Range Subsetting in WCS client/server communication.  
 Last updated: 2012-Dec-03  
 Copyright (c) 2012 Open Geospatial Consortium, Inc. All Rights Reserved.  
 To obtain additional rights of use, visit http://www.opengeospatial.org/legal/.  
 </documentation>  
 </annotation>  
 <!-- ============================================================== -->  
 <!-- includes and imports -->  
 <!-- ============================================================== -->  
  
 <!-- ============================================================== -->  
 <!-- elements and types -->  
 <!-- ============================================================== -->  
 <element name="extensionInterpolation" type="int:extensionInterpolationType"/>  
 <complexType name="extensionInterpolationType">  
 <annotation>  
 <documentation> WCS interpolation metadata.</documentation>  
 </annotation>  
 <sequence>  
 <element name="interpolationMetadata" type="int:interpolationMetadataType"/>  
 </sequence>  
 </complexType>  
 <!-- ============================================================== -->  
 <complexType name="interpolationMetadataType">  
 <annotation>  
 <documentation> supported interpolations for the interpolationMetadata.</documentation>  
 </annotation>  
 <sequence>  
 <element name="interpolationSupported" type="anyURI" minOccurs="0"/>  
 </sequence>  
 </complexType>   
 <!-- ============================================================== -->   
 <element name="Interpolation" type="int:InterpolationType"/>   
 <complexType name="InterpolationType">  
 <annotation>  
 <documentation> Interpolation for the GetCoverage request.</documentation>  
 </annotation>  
 <choice>  
 <element name="InterpolationMethod" type="int:InterpolationMethodType"/>  
 <element name="InterpolationAxes" type="int:InterpolationAxesType"/>  
 </choice>  
 </complexType>  
 <!-- ============================================================== -->   
 <complexType name="InterpolationMethodType">  
 <attribute name="interpolationMethod" type="anyURI" use="required"/>  
 </complexType>   
 <!-- ============================================================== -->   
 <complexType name="InterpolationAxesType">  
 <sequence>  
 <element name="InterpolationAxis" type="int:InterpolationAxisType" maxOccurs="unbounded"/>   
 </sequence>  
 </complexType>  
 <!-- ============================================================== -->   
 <complexType name="InterpolationAxisType">  
 <attribute name="axis" type="anyURI" use="required"/>   
 <attribute name="interpolationMethod" type="anyURI" use="required"/>   
 </complexType>   
</schema>

**range-subsetting.xsd**

<?xml version="1.0" encoding="UTF-8"?>  
<schema targetNamespace="http://www.opengis.net/wcs/range-subsetting/1.0"   
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns="http://www.w3.org/2001/XMLSchema"   
 elementFormDefault="qualified" version="1.0.0" xml:lang="en">  
 <annotation>  
 <appinfo>rsub.xsd</appinfo>  
 <documentation>This XML Schema Document is part of the WCS Range   
 Subsetting Extension [OGC 12-040]. It encodes the elements and   
 types that allow expressing Range Subsetting in WCS client/server   
 communication.  
 Last updated: 2012-September-13  
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 </documentation>  
 </annotation>  
 <!-- ============================================================== -->  
 <!-- includes and imports -->  
 <!-- ============================================================== -->  
 <import namespace="http://www.opengis.net/wcs/2.0" schemaLocation="http://schemas.opengis.net/wcs/2.0/wcsAll.xsd"/>  
 <!-- ============================================================== -->  
 <!-- elements and types -->  
 <!-- ============================================================== -->  
 <element name="rangeSubset" type="rsub:rangeSubsetType"/>  
 <complexType name="rangeSubsetType">  
 <annotation>  
 <documentation>rangeSubset parameter for GetCoverage requests.</documentation>  
 </annotation>  
 <choice>  
 <element name="rangeComponent" type="NCName"/>  
 <element name="rangeInterval" type="rsub:rangeIntervalType"/>  
 </choice>  
 </complexType>   
 <!-- ============================================================== -->  
 <complexType name="rangeIntervalType">  
 <annotation>  
 <documentation>Lower and upper bounds of a range interval (i.e., names of first and last range type component to be considered, following the component order given by the coverage's range type). </documentation>  
 </annotation>  
 <sequence>  
 <element name="startComponent" type="NCName"/>  
 <element name="endComponent" type="NCName"/>  
 </sequence>  
 </complexType>  
</schema>

**record\_components.xsd**

<schema xmlns="http://www.w3.org/2001/XMLSchema" xmlns:swe="http://www.opengis.net/swe/2.0" targetNamespace="http://www.opengis.net/swe/2.0" elementFormDefault="qualified" attributeFormDefault="unqualified" version="2.0.0">  
 <annotation>  
 <documentation>SWE Common Data Model schema for record data components. See requirements class http://www.opengis.net/spec/SWE/2.0/req/xsd-record-components/  
   
 SWE Common is an OGC Standard.  
 Copyright (c) 2010 Open Geospatial Consortium, Inc. All Rights Reserved.   
 To obtain additional rights of use, visit http://www.opengeospatial.org/legal/ .  
 </documentation>  
 </annotation>  
 <include schemaLocation="simple\_components.xsd"/>  
 <!-- ================================================= -->  
 <element name="DataRecord" substitutionGroup="swe:AbstractDataComponent" type="swe:DataRecordType">  
 <annotation>  
 <documentation>Implementation of ISO-11404 Record datatype. This allows grouping (sequence) of data components which can themselves be simple types, records, arrays or choices</documentation>  
 </annotation>  
 </element>  
 <complexType name="DataRecordType">  
 <complexContent>  
 <extension base="swe:AbstractDataComponentType">  
 <sequence>  
 <element maxOccurs="unbounded" minOccurs="1" name="field">  
 <annotation>  
 <documentation>Definition of the field provided as a nested data component. The field can be scalar or can itself be an aggregate such as a record, choice or array</documentation>  
 </annotation>  
 <complexType>  
 <complexContent>  
 <extension base="swe:AbstractDataComponentPropertyType">  
 <attribute name="name" type="NCName" use="required"/>  
 </extension>  
 </complexContent>  
 </complexType>  
 </element>  
 </sequence>  
 </extension>  
 </complexContent>  
 </complexType>  
 <complexType name="DataRecordPropertyType">  
 <sequence minOccurs="0">  
 <element ref="swe:DataRecord"/>  
 </sequence>  
 <attributeGroup ref="swe:AssociationAttributeGroup"/>  
 </complexType>  
 <complexType name="DataRecordPropertyByValueType">  
 <sequence>  
 <element ref="swe:DataRecord"/>  
 </sequence>  
 </complexType><!-- ================================================= -->  
 <element name="Vector" substitutionGroup="swe:AbstractDataComponent" type="swe:VectorType">  
 <annotation>  
 <documentation>Implementation of a mathematical vector composed of a list of scalar coordinates expressed in the mandatory reference frame.</documentation>  
 </annotation>  
 </element>  
 <complexType name="VectorType">  
 <complexContent>  
 <extension base="swe:AbstractDataComponentType">  
 <sequence>  
 <element maxOccurs="unbounded" minOccurs="1" name="coordinate">  
 <annotation>  
 <documentation>Definition of the coordinate provided as a data component with a numerical representation</documentation>  
 </annotation>  
 <complexType>  
 <complexContent>  
 <extension base="swe:AnyNumericalPropertyType">  
 <attribute name="name" type="NCName" use="required"/>  
 </extension>  
 </complexContent>  
 </complexType>  
 </element>  
 </sequence>  
 <attribute name="referenceFrame" type="anyURI" use="required">  
 <annotation>  
 <documentation>Frame of reference (usually spatial) with respect to which the coordinates of this vector are expressed. A reference frame anchors a vector value to a real world datum.</documentation>  
 </annotation>  
 </attribute>  
 <attribute name="localFrame" type="anyURI" use="optional">  
 <annotation>  
 <documentation>Frame of reference whose origin is located by the coordinates of this vector</documentation>  
 </annotation>  
 </attribute>  
 </extension>  
 </complexContent>  
 </complexType>  
 <complexType name="VectorPropertyType">  
 <sequence minOccurs="0">  
 <element ref="swe:Vector"/>  
 </sequence>  
 <attributeGroup ref="swe:AssociationAttributeGroup"/>  
 </complexType>  
 <complexType name="VectorPropertyByValueType">  
 <sequence>  
 <element ref="swe:Vector"/>  
 </sequence>  
 </complexType>  
</schema>

**rsub.xsd**

<?xml version="1.0" encoding="UTF-8"?>  
<schema targetNamespace="http://www.opengis.net/wcs/range-subsetting/1.0"   
 xmlns:rsub="http://www.opengis.net/wcs/range-subsetting/1.0"  
 xmlns="http://www.w3.org/2001/XMLSchema"   
 elementFormDefault="qualified" version="1.0.0" xml:lang="en">  
 <annotation>  
 <appinfo>rsub.xsd</appinfo>  
 <documentation>This XML Schema Document is part of the WCS Range   
 Subsetting Extension [OGC 12-040]. It encodes the elements and   
 types that allow expressing Range Sub-setting in WCS client/server   
 communication.  
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 </documentation>  
 </annotation>  
 <!-- ============================================================== -->  
 <!-- includes and imports -->  
 <!-- ============================================================== -->  
 <import namespace="http://www.opengis.net/wcs/2.0" schemaLocation="http://schemas.opengis.net/wcs/2.0/wcsAll.xsd"/>  
 <!-- ============================================================== -->  
 <!-- elements and types -->  
 <!-- ============================================================== -->  
 <element name="rangeSubset" type="rsub:rangeSubsetType"/>  
 <complexType name="rangeSubsetType">  
 <annotation>  
 <documentation>rangeSubset parameter for GetCoverage requests.</documentation>  
 </annotation>  
 <choice>  
 <element name="rangeComponent" type="NCName"/>  
 <element name="rangeInterval" type="rsub:rangeIntervalType"/>  
 </choice>  
 </complexType>   
 <!-- ============================================================== -->  
 <complexType name="rangeIntervalType">  
 <annotation>  
 <documentation>Lower and upper bounds of a range interval (i.e., names of first and last range type component to be considered, following the component order given by the coverage's range type). </documentation>  
 </annotation>  
 <sequence>  
 <element name="startComponent" type="NCName"/>  
 <element name="endComponent" type="NCName"/>  
 </sequence>  
 </complexType>  
</schema>

**wcsMetOceanCommon.xsd**

<?xml version="1.0" encoding="UTF-8"?>  
<xs:schema targetNamespace="http://def.wmo.int/metce/2013/metocean"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:xs="http://www.w3.org/2001/XMLSchema"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:om="http://www.opengis.net/om/2.0"  
 xmlns:sam="http://www.opengis.net/sampling/2.0"  
 xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"  
 xmlns:ows="http://www.opengis.net/ows/2.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xmlns="http://www.w3.org/2001/XMLSchema"   
 elementFormDefault="qualified" version="1.0.0" xml:lang="en">  
 <annotation>  
 <appinfo>wcsEOAll.xsd</appinfo>  
 <documentation>This XML Schema Document includes, directly and indirectly, all the XML Schema Documents defined by the OGC Web Coverage Service (WCS) - Earth Observation Application Profile (EO-AP).  
 Last updated: 2011-feb-04  
 Copyright (c) 2011 Open Geospatial Consortium, Inc. All Rights Reserved.  
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 </documentation>  
 </annotation>  
 <!-- =========================================================== -->  
 <!-- includes and imports -->  
 <!-- =========================================================== -->  
 <xs:import namespace="http://www.opengis.net/wcs/2.0" schemaLocation="http://schemas.opengis.net/wcs/2.0/wcsDescribeCoverage.xsd"/>  
 <xs:import namespace="http://www.opengis.net/wcs/2.0" schemaLocation="http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd"/>  
 <xs:import namespace="http://www.opengis.net/gmlcov/1.0" schemaLocation="http://schemas.opengis.net/gmlcov/1.0/gmlcovAll.xsd"/>  
 <xs:import namespace="http://www.opengis.net/gml/3.2" schemaLocation="http://schemas.opengis.net/gml/3.2.1/gml.xsd"/>  
 <xs:import namespace="http://www.opengis.net/om/2.0" schemaLocation="http://schemas.opengis.net/om/2.0/observation.xsd"/>  
 <xs:import namespace="http://www.opengis.net/samplingSpatial/2.0" schemaLocation="http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd"/>  
 <xs:import namespace="http://www.opengis.net/sampling/2.0" schemaLocation="http://schemas.opengis.net/sampling/2.0/samplingFeature.xsd"/>  
 <xs:import namespace="http://www.opengis.net/gml/3.3/rgrid" schemaLocation="http://schemas.opengis.net/gml/3.3/referenceableGrid.xsd"/>  
 <xs:import namespace="http://www.opengis.net/ows/2.0" schemaLocation="http://schemas.opengis.net/ows/2.0/owsAll.xsd"/>  
   
 <xs:element name="OutputFeatureDefinition" type="metocean:OutputFeatureDefinitionType">  
 <annotation>  
 <documentation>Response from a WCS DescribeCoverage operation, containing one or more coverage descriptions. </documentation>  
 </annotation>  
 </xs:element>  
 <xs:complexType name="OutputFeatureDefinitionType">  
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 <xs:sequence>  
 <xs:element name="Origin" type="gml:DirectPositionType" minOccurs="0" maxOccurs="unbounded"/>  
 <xs:element ref="gmlrgrid:ReferenceableGridByArray" minOccurs="1" maxOccurs="unbounded"/>  
 </xs:sequence>  
 </xs:sequence>  
 </xs:complexType>  
 <xs:element name="GetCorridorCoverage" type="wcs:GetCoverageType">  
 <annotation>  
 <documentation>Response from a WCS DescribeCoverage operation, containing one or more coverage descriptions. </documentation>  
 </annotation>  
 </xs:element>  
   
   
   
 <xs:element name="GetCrossSectionCoverage" type="wcs:GetCoverageType">  
 <annotation>  
 <documentation>Response from a WCS DescribeCoverage operation, containing one or more coverage descriptions. </documentation>  
 </annotation>  
 </xs:element>  
   
 <xs:element name="GetPolygonCoverage" type="wcs:GetCoverageType">  
 <annotation>  
 <documentation>Response from a WCS DescribeCoverage operation, containing one or more coverage descriptions. </documentation>  
 </annotation>  
 </xs:element>  
   
 <element name="DimensionTrim" type="metocean:DimensionTrimType" substitutionGroup="wcs:DimensionSubset">  
 <annotation>  
 <documentation>Describes the trimming of a coverage's domain axis, between two values.</documentation>  
 </annotation>  
 </element>  
 <complexType name="DimensionTrimType">  
 <complexContent>  
 <extension base="wcs:DimensionSubsetType">  
 <sequence>  
 <element ref="metocean:TrimLow" minOccurs="0"/>  
 <element ref="metocean:TrimHigh" minOccurs="0"/>  
 </sequence>  
 </extension>  
 </complexContent>  
 </complexType>  
   
   
 <xs:element name="TrimLow">  
 <xs:complexType>  
 <xs:simpleContent>  
 <xs:extension base="xs:string">  
 <attributeGroup ref="gml:SRSInformationGroup"/>  
 </xs:extension>  
 </xs:simpleContent>  
 </xs:complexType>  
 </xs:element>  
 <xs:element name="TrimHigh">  
 <xs:complexType>  
 <xs:simpleContent>  
 <xs:extension base="xs:string">  
 <attributeGroup ref="gml:SRSInformationGroup"/>  
 </xs:extension>  
 </xs:simpleContent>  
 </xs:complexType>  
 </xs:element>  
 <element name="DimensionSlice" type="metocean:DimensionSliceType" substitutionGroup="wcs:DimensionSubset">  
 <annotation>  
 <documentation>Describes the slicing of a coverage's domain axis at a particular point.</documentation>  
 </annotation>  
 </element>  
 <complexType name="DimensionSliceType">  
 <complexContent>  
 <extension base="wcs:DimensionSubsetType">  
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 <element ref="metocean:SlicePoint"/>  
 </sequence>  
 </extension>  
 </complexContent>  
 </complexType>  
  
 <xs:element name="SlicePoint">  
 <xs:complexType>  
 <xs:simpleContent>  
 <xs:extension base="xs:string">  
 <attributeGroup ref="gml:SRSInformationGroup"/>  
 </xs:extension>  
 </xs:simpleContent>  
 </xs:complexType>  
 </xs:element>  
</xs:schema>

**wcsMetOceanDescribeCoverage.xsd**

<?xml version="1.0" encoding="UTF-8"?>  
<schema targetNamespace="http://def.wmo.int/metce/2013/metocean"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:xs="http://www.w3.org/2001/XMLSchema"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:om="http://www.opengis.net/om/2.0"  
 xmlns:sam="http://www.opengis.net/sampling/2.0"  
 xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xmlns="http://www.w3.org/2001/XMLSchema"   
 elementFormDefault="qualified" version="1.0.0" xml:lang="en">  
 <annotation>  
 <appinfo>wcsEOAll.xsd</appinfo>  
 <documentation>This XML Schema Document includes, directly and indirectly, all the XML Schema Documents defined by the OGC Web Coverage Service (WCS) - Earth Observation Application Profile (EO-AP).  
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 </documentation>  
 </annotation>  
 <!-- =========================================================== -->  
 <!-- includes and imports -->  
 <!-- =========================================================== -->  
 <import namespace="http://www.opengis.net/wcs/2.0" schemaLocation="http://schemas.opengis.net/wcs/2.0/wcsDescribeCoverage.xsd"/>  
 <import namespace="http://www.opengis.net/gmlcov/1.0" schemaLocation="http://schemas.opengis.net/gmlcov/1.0/gmlcovAll.xsd"/>  
 <xs:import namespace="http://www.opengis.net/gml/3.2" schemaLocation="http://schemas.opengis.net/gml/3.2.1/gml.xsd"/>  
 <xs:import namespace="http://www.opengis.net/om/2.0" schemaLocation="http://schemas.opengis.net/om/2.0/observation.xsd"/>  
 <import namespace="http://www.opengis.net/samplingSpatial/2.0" schemaLocation="http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd"/>  
 <import namespace="http://www.opengis.net/sampling/2.0" schemaLocation="http://schemas.opengis.net/sampling/2.0/samplingFeature.xsd"/>  
 <import namespace="http://www.opengis.net/gml/3.3/rgrid" schemaLocation="http://schemas.opengis.net/gml/3.3/referenceableGrid.xsd"/>  
 <xs:element name="extensionProperty">  
 <xs:complexType>  
 <xs:sequence>  
 <xs:element ref="metocean:MetOceanCoverageMetadata"/>  
 </xs:sequence>  
 </xs:complexType>  
 </xs:element>  
 <xs:element name="MetOceanCoverageMetadata" type="metocean:MetOceanCoverageMetadataType" substitutionGroup="gml:AbstractObject"/>  
 <xs:complexType name="MetOceanCoverageMetadataType">  
 <xs:sequence>  
 <xs:element name="sourceObservationProperty">  
 <xs:complexType>  
 <xs:sequence>  
 <xs:element ref="metocean:SourceObservation"/>  
 </xs:sequence>  
 <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>  
 </xs:complexType>  
 </xs:element>  
 <xs:element name="dataMaskReferenceProperty">  
 <xs:complexType>  
 <xs:complexContent>  
 <xs:extension base="gml:AbstractMemberType">  
 <xs:sequence>  
 <xs:element ref="metocean:DataMaskReferenceMemberList"/>  
 </xs:sequence>  
 </xs:extension>  
 </xs:complexContent>  
 </xs:complexType>  
 </xs:element>  
 <xs:element name="dataMaskProperty">  
 <xs:complexType>  
 <xs:complexContent>  
 <xs:extension base="gml:AbstractMemberType">  
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 </xs:sequence>  
 </xs:extension>  
 </xs:complexContent>  
 </xs:complexType>  
 </xs:element>  
 </xs:sequence>  
 </xs:complexType>  
 <xs:element name="DataMaskMemberList" type="metocean:DataMaskmemberListType" substitutionGroup="gml:AbstractObject"/>  
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 <xs:element name="dataMask" type="metocean:maskNameType" minOccurs="1" maxOccurs="unbounded"/>  
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 <xs:sequence>  
 <xs:element ref="gmlcov:ReferenceableGridCoverage"/>  
 </xs:sequence>  
 <attribute name="maskName" type="string" use="required"/>  
 <attributeGroup ref="gml:AssociationAttributeGroup"/>  
 <attribute ref="gml:id" use="required"/>  
 </xs:complexType>  
   
 <xs:element name="DataMaskReferenceMemberList" type="metocean:DataMaskReferenceMemberListType" substitutionGroup="gml:AbstractObject"/>  
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 <xs:sequence>  
 <xs:element name="dataMaskReference" minOccurs="1" maxOccurs="unbounded">  
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 <xs:attribute name="fieldName" type="xs:string" />  
 <attributeGroup ref="gml:AssociationAttributeGroup"/>  
 </xs:extension>  
 </xs:simpleContent>  
 </xs:complexType>  
 </xs:element>  
 </xs:sequence>  
 </xs:complexType>  
   
 <xs:element name="SourceObservation" type="metocean:SourceObservationType" substitutionGroup="om:OM\_Observation"/>  
 <xs:complexType name="SourceObservationType">  
 <xs:complexContent>  
 <xs:extension base="om:OM\_ObservationType">  
 <xs:sequence>  
 </xs:sequence>  
 </xs:extension>  
 </xs:complexContent>  
 </xs:complexType>  
 <xs:element name="ModelDescription" type="metocean:ModelDescriptionType" substitutionGroup="gml:AbstractFeature"/>  
 <xs:complexType name="ModelDescriptionType">  
 <xs:complexContent>  
 <xs:extension base="gml:AbstractFeatureType">  
 <xs:sequence>  
 <xs:element name="originatingcentre" type="xs:string"/>  
 <xs:element name="modeltype" type="metocean:modeldomainType"/>  
 <xs:element name="modelidentifier" type="xs:string"/>  
 <xs:element name="geometryComponent">  
 <xs:complexType>  
 <xs:complexContent>  
 <xs:extension base="gml:AbstractMemberType">  
 <xs:sequence>  
 <xs:element ref="metocean:ModelDomain"/>  
 </xs:sequence>  
 </xs:extension>  
 </xs:complexContent>  
 </xs:complexType>  
 </xs:element>  
 </xs:sequence>  
 </xs:extension>  
 </xs:complexContent>  
 </xs:complexType>  
 <xs:simpleType name="modeldomainType">  
 <xs:restriction base="xs:string">  
 <xs:enumeration value="ocean"/>  
 <xs:enumeration value="atmospheric"/>  
 </xs:restriction>  
 </xs:simpleType>  
 <xs:element name="ModelDomain" type="metocean:ModelDomainType" substitutionGroup="gml:AbstractObject"/>  
 <xs:complexType name="ModelDomainType">  
 <xs:sequence>  
 <xs:element name="horizontalProjection">  
 <xs:complexType>  
 <xs:complexContent>  
 <xs:extension base="gml:AbstractMemberType">  
 <xs:sequence>  
 <xs:element ref="gml:Polygon"/>  
 </xs:sequence>  
 </xs:extension>  
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 </xs:complexType>  
</schema>

**wcsMetOceanDescribeCoverageCollection.xsd**

<?xml version="1.0" encoding="UTF-8"?>  
<schema targetNamespace="http://def.wmo.int/metce/2013/metocean"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:xs="http://www.w3.org/2001/XMLSchema"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:om="http://www.opengis.net/om/2.0"  
 xmlns:sam="http://www.opengis.net/sampling/2.0"  
 xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"  
 xmlns:ows="http://www.opengis.net/ows/2.0"  
 xmlns:gmlrgrid="http://www.opengis.net/gml/3.3/rgrid"  
 xmlns="http://www.w3.org/2001/XMLSchema"   
 elementFormDefault="qualified" version="1.0.0" xml:lang="en">  
 <annotation>  
 <appinfo>wcsEOAll.xsd</appinfo>  
 <documentation>This XML Schema Document includes, directly and indirectly, all the XML Schema Documents defined by the OGC Web Coverage Service (WCS) - Earth Observation Application Profile (EO-AP).  
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 </documentation>  
 </annotation>  
 <!-- =========================================================== -->  
 <!-- includes and imports -->  
 <!-- =========================================================== -->  
 <import namespace="http://www.opengis.net/wcs/2.0" schemaLocation="http://schemas.opengis.net/wcs/2.0/wcsDescribeCoverage.xsd"/>  
 <import namespace="http://www.opengis.net/gmlcov/1.0" schemaLocation="http://schemas.opengis.net/gmlcov/1.0/gmlcovAll.xsd"/>  
 <xs:import namespace="http://www.opengis.net/gml/3.2" schemaLocation="http://schemas.opengis.net/gml/3.2.1/gml.xsd"/>  
 <xs:import namespace="http://www.opengis.net/om/2.0" schemaLocation="http://schemas.opengis.net/om/2.0/observation.xsd"/>  
 <import namespace="http://www.opengis.net/samplingSpatial/2.0" schemaLocation="http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd"/>  
 <import namespace="http://www.opengis.net/sampling/2.0" schemaLocation="http://schemas.opengis.net/sampling/2.0/samplingFeature.xsd"/>  
 <import namespace="http://www.opengis.net/gml/3.3/rgrid" schemaLocation="http://schemas.opengis.net/gml/3.3/referenceableGrid.xsd"/>  
 <import namespace="http://www.opengis.net/ows/2.0" schemaLocation="http://schemas.opengis.net/ows/2.0/owsAll.xsd"/>  
 <element name="CoverageCollectionDescriptions" type="metocean:CoverageCollectionDescriptionsType">  
 <annotation>  
 <documentation>Response from a WCS DescribeCoverage operation, containing one or more coverage descriptions. </documentation>  
 </annotation>  
 </element>  
 <complexType name="CoverageCollectionDescriptionsType">  
 <sequence>  
 <element ref="metocean:CoverageCollectionDescription" minOccurs="0" maxOccurs="unbounded"/>  
 </sequence>  
 </complexType>  
 <xs:element name="coverageCollectionId" type="xs:NCName"/>  
 <xs:element name="CoverageCollectionDescription" type="metocean:CoverageCollectionDescriptionType" substitutionGroup="gml:AbstractFeature"/>  
 <xs:complexType name="CoverageCollectionDescriptionType">  
 <xs:complexContent>  
 <xs:extension base="gml:AbstractFeatureType">  
 <xs:sequence>  
 <xs:element ref="metocean:coverageCollectionId"/>  
 <xs:element ref="gml:name"/>  
 <xs:element ref="gml:boundedBy"/>  
  
 <xs:element name="referenceTime">  
 <xs:complexType>  
 <xs:complexContent>  
 <xs:extension base="gml:AbstractMemberType">  
 <xs:sequence>  
 <xs:element ref="gml:TimeInstant"/>  
 </xs:sequence>  
 </xs:extension>  
 </xs:complexContent>  
 </xs:complexType>  
 </xs:element>  
 <xs:element name="sourceObservationProperty">  
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 <xs:sequence>  
 <xs:element ref="metocean:SourceObservation"/>  
 </xs:sequence>  
 <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>  
 </xs:complexType>  
 </xs:element>  
 <xs:element name="coverageIdList" minOccurs="1" maxOccurs="unbounded">  
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 <xs:sequence>  
 <xs:element ref="wcs:CoverageSummary" maxOccurs="unbounded"/>  
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 <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>  
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 </xs:element>  
 </xs:sequence>  
 </xs:extension>  
 </xs:complexContent>  
 </xs:complexType>  
 <xs:element name="coverageDescription" substitutionGroup="ows:AbstractMetaData">  
 <xs:complexType>  
 <xs:simpleContent>  
 <xs:extension base="xs:string">  
 <xs:attribute name="coverageDescription" type="xs:string" />  
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 </xs:extension>  
 </xs:simpleContent>  
 </xs:complexType>  
 </xs:element>  
 <xs:complexType name="CoverageCollectionDescriptionPropertyType">  
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 <xs:element ref="metocean:CoverageCollectionDescription"/>  
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 <xs:attributeGroup ref="gml:AssociationAttributeGroup"/>  
 <xs:attributeGroup ref="gml:OwnershipAttributeGroup"/>  
 </xs:complexType>  
 <xs:element name="SourceObservation" type="metocean:SourceObservationType" substitutionGroup="om:OM\_Observation"/>  
 <xs:complexType name="SourceObservationType">  
 <xs:complexContent>  
 <xs:extension base="om:OM\_ObservationType">  
 <xs:sequence>  
 </xs:sequence>  
 </xs:extension>  
 </xs:complexContent>  
 </xs:complexType>  
 <xs:element name="CoverageCollectionProperties" type="metocean:CoverageCollectionPropertiesType" substitutionGroup="gml:AbstractFeature"/>  
 <xs:complexType name="CoverageCollectionPropertiesType">  
 <xs:complexContent>  
 <xs:extension base="gml:AbstractFeatureType">  
 <xs:sequence>  
 <xs:element name="originatingcentre" minOccurs="0" type="xs:string"/>  
 <xs:element name="modeltype" minOccurs="0" type="metocean:modeldomainType"/>  
 <xs:element name="modelidentifier" minOccurs="0" type="xs:string"/>  
 <xs:element name="geometryComponent">  
 <xs:complexType>  
 <xs:complexContent>  
 <xs:extension base="gml:AbstractMemberType">  
 <xs:sequence>  
 <xs:element ref="metocean:CoverageCollectionDomain"/>  
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 </xs:extension>  
 </xs:complexContent>  
 </xs:complexType>  
 </xs:element>  
 </xs:sequence>  
 </xs:extension>  
 </xs:complexContent>  
 </xs:complexType>  
 <xs:simpleType name="modeldomainType">  
 <xs:restriction base="xs:string">  
 <xs:enumeration value="ocean"/>  
 <xs:enumeration value="atmospheric"/>  
 </xs:restriction>  
 </xs:simpleType>  
 <xs:element name="CoverageCollectionDomain" type="metocean:CoverageCollectionDomainType" substitutionGroup="gml:AbstractObject"/>  
 <xs:complexType name="CoverageCollectionDomainType">  
 <xs:sequence>  
 <xs:element name="horizontalProjection">  
 <xs:complexType>  
 <xs:complexContent>  
 <xs:extension base="gml:AbstractMemberType">  
 <xs:sequence>  
 <xs:element ref="gml:Polygon"/>  
 </xs:sequence>  
 </xs:extension>  
 </xs:complexContent>  
 </xs:complexType>  
 </xs:element>  
 </xs:sequence>  
 </xs:complexType>  
</schema>

**wcsMetOceanGetCapabilities.xsd**

<?xml version="1.0" encoding="UTF-8"?>  
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"   
 targetNamespace="http://def.wmo.int/metce/2013/metocean"   
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns:gml="http://www.opengis.net/gml/3.2">  
 <xs:import namespace="http://www.opengis.net/gml/3.2" schemaLocation="http://schemas.opengis.net/gml/3.2.1/gml.xsd"/>  
 <xs:import namespace="http://www.opengis.net/gml/3.2" schemaLocation="http://schemas.opengis.net/gml/3.3/referenceableGrid.xsd"/>  
 <xs:import namespace="http://www.opengis.net/wcs/2.0" schemaLocation="http://schemas.opengis.net/wcs/2.0/wcsAll.xsd"/>  
 <xs:import namespace="http://www.opengis.net/ows/2.0" schemaLocation="http://schemas.opengis.net/ows/2.0/owsAll.xsd"/>  
   
 <xs:element name="CoverageCollectionSummary" type="metocean:CoverageCollectionSummaryType" substitutionGroup="gml:AbstractObject"/>  
 <xs:complexType name="CoverageCollectionSummaryType">  
 <xs:sequence>  
 <xs:element name="coverageCollectionId" minOccurs="0" maxOccurs="unbounded" type="xs:string"/>  
 <xs:element ref="gml:name" minOccurs="0" maxOccurs="unbounded"/>  
 <xs:element ref="metocean:childCoverageCollections" minOccurs="0" maxOccurs="unbounded"/>  
 <xs:element ref="gml:boundedBy" minOccurs="0" maxOccurs="unbounded"/>  
 <xs:element ref="metocean:referenceTimeList" minOccurs="0" maxOccurs="unbounded"/>  
 </xs:sequence>  
 </xs:complexType>  
   
 <xs:element name="childCoverageCollections">  
 <xs:complexType>  
 <xs:complexContent>  
 <xs:extension base="metocean:CoverageCollectionSummaryType">  
 <xs:sequence>  
 <xs:element ref="metocean:CoverageCollectionSummary" minOccurs="0" maxOccurs="unbounded"/>  
 </xs:sequence>  
 </xs:extension>  
 </xs:complexContent>  
 </xs:complexType>  
 </xs:element>  
 <xs:element name="referenceTimeList">  
 <xs:complexType>  
 <xs:sequence>  
 <xs:element name="ReferenceTime" type="metocean:referenceTimeListType" minOccurs="0" maxOccurs="unbounded"/>  
 </xs:sequence>  
 </xs:complexType>  
 </xs:element>   
 <xs:complexType name="referenceTimeListType">  
 <xs:sequence>  
 <xs:element ref="gml:timePosition" minOccurs="0" maxOccurs="unbounded"/>  
 </xs:sequence>  
 </xs:complexType>  
</xs:schema>

**wcsMetOceanRequestDescribeCoverageCollection.xsd**

<?xml version="1.0" encoding="UTF-8"?>  
<schema targetNamespace="http://def.wmo.int/metce/2013/metocean"  
 xmlns:wcseo="http://www.opengis.net/wcseo/1.0"  
 xmlns:wcs="http://www.opengis.net/wcs/2.0"  
 xmlns:gml="http://www.opengis.net/gml/3.2"  
 xmlns:metocean="http://def.wmo.int/metce/2013/metocean"  
 xmlns="http://www.w3.org/2001/XMLSchema"   
 elementFormDefault="qualified" version="1.0.0" xml:lang="en">  
 <annotation>  
 <appinfo>DescribeCoverageCollection</appinfo>  
 <documentation>This XML Schema Document defines the DescribeEOCoverageSet operation request and response XML elements and types, used by the OGC Web Coverage Service (WCS) Earth Observation Application Profile (EO-WCS).  
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 </documentation>  
 </annotation>  
  
 <!-- =========================================================== -->  
 <!-- includes and imports -->  
 <!-- =========================================================== -->  
 <import namespace="http://www.opengis.net/gml/3.2" schemaLocation="http://schemas.opengis.net/gml/3.2.1/gml.xsd"/>  
 <include schemaLocation="file:/C:/Users/Rocky/WCS/MOWCS3/schemas/wcsMetOceanDescribeCoverageCollection.xsd"/>  
 <import namespace="http://www.opengis.net/wcs/2.0" schemaLocation="http://schemas.opengis.net/wcs/2.0/wcsAll.xsd"/>  
  
 <!-- =========================================================== -->  
 <!-- elements and types -->  
 <!-- =========================================================== -->  
 <element name="DescribeCoverageCollection" type="metocean:DescribeCoverageCollectionType">  
 <annotation>  
 <documentation>Request to a WCS to perform the DescribeCoverage operation. This operation allows a client to retrieve descriptions of one or more coverages. In this XML encoding, no "request" parameter is included, since the element name specifies the specific operation. </documentation>  
 </annotation>  
 </element>  
 <complexType name="DescribeCoverageCollectionType">  
 <complexContent>  
 <extension base="wcs:RequestBaseType">  
 <sequence>  
 <element ref="metocean:collectionId" maxOccurs="unbounded"/>  
 <element ref="wcs:DimensionSubset" minOccurs="0" maxOccurs="3"/>  
 </sequence>  
 </extension>  
 </complexContent>  
 </complexType>  
</schema>