



# An Outline of a WCS2.0 MetOC Profile for discussion

ECMWF 2013



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# The aims of this discussion

- To Agree the basic principles i.e. Use cases using the Met Ocean dwg.
- Form a “working group” to look at creating a core Met Ocean profile and if necessary propose changes to the core definition and if required extend the core profile.
- Work within the OGC WCS swg (chaired by Peter Baumann);
- The Met Ocean dwg group to ensure any proposals are “fit for purpose”
- To work with the WCS swg to create an OGC standards document.



# Contents

This presentation covers the following areas

- Introduction to feature types:-
- An explanation of the WCS2.0 core profile:
- A brief description of each of the WCS2.0 operations:
- For each operation a proposal for either a profile (i.e. no change to the core profile) or an extension:
- A more detailed presentation is also available on the portal along with a word document:
- Questions and answers;



# Use cases the will define Feature Types:

- The MetOC community has made extensive use of a data model used by NetCDF (CDM) that is closely related to CSML (Climate Science Markup Language).
- The most common feature types are:-Point Collection, GRID, GRID series, Trajectories, Profiles and Time/Cross Sections.
- Many use cases are based on these feature types.
- The goal was to design a web interface (built on WCS2.0) to support these feature types i.e. GetCoverage operations need to support these feature types.



# What is The WCS2.0 Core:

- The WCS interface supports retrieval of geospatial coverage data – i.e. digital geospatial information representing a space/time-varying phenomena.
- The WCS interface specifies the following operations:
  - **GetCapabilities** – This operation allows a client to request information about the server's capabilities and coverage's offered.
  - **DescribeCoverage** – This operation allows a client to request detailed metadata on a selected coverage's offered by a server.
  - **GetCoverage** – This operation allows a client to request a coverage comprised of selected range properties at a selected set of spatio-temporal locations, expedited in some coverage encoding format.



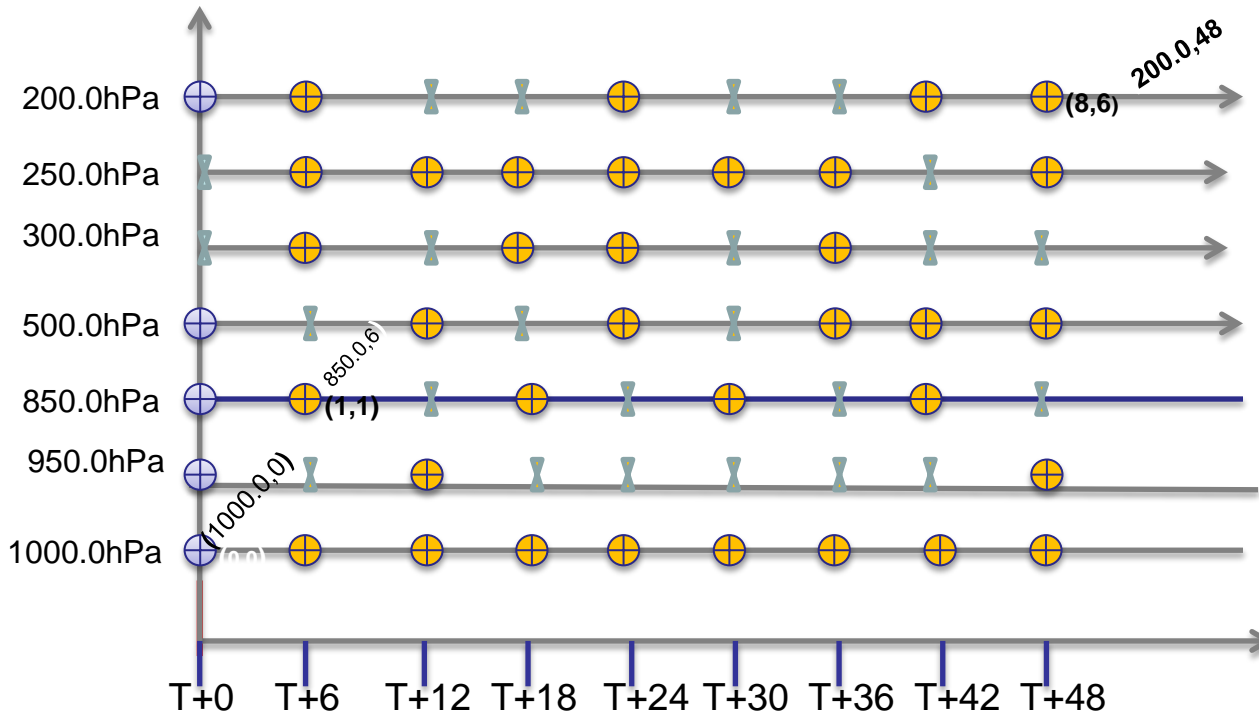
# Some Met Ocean house rules:

- The WCS has a key understanding of a coverage identifier, but what does this mean in the Met-Ocean world.
- A coverage could be the whole NWP model run:
  - Need to think about reference times (“run times”)
- A coverage could be a single dataset/file:
- A service e.g. aviation icing.
  - Update time
- Could be a combination:



# Referenceable grid by array

1000.0 0	1000.0 6	1000.0 12	1000.0 18	1000.0 24	1000.0 30	1000.0 36	1000.0 42	1000.0 48
950.0 0	950.0 NaN	950.0 12	950.0 NaN	950.0 NaN	950.0 NaN	950.0 NaN	950.0 NaN	950.0 48
850.0 0	850.0 6	850.0 NaN	850.0 18	850.0 NaN	850.0 30	850.0 NaN	850.0 42	850.0 NaN
500.0 0	500.0 NaN	500.0 12	500.0 NaN	500.0 24	500.0 NaN	500.0 36	500.0 42	500.0 48
300.0 NaN	300.0 6	300.0 NaN	300.0 18	300.0 24	300.0 NaN	300.0 36	300.0 NaN	300.0 NaN
250.0 NaN	250.0 6	250.0 12	250.0 18	250.0 24	250.0 30	250.0 36	250.0 NaN	250.0 48
200.0 0	200.0 6	200.0 NaN	200.0 NaN	200.0 24	200.0 NaN	200.0 NaN	200.0 42	200.0 48





# GetCapabilities:

- Service metadata section:-
  - Service metadata component of the server's coverage offering, this would include contact details, service availability and the providers name.
- OperationsMetadata:-
  - A list of the offered operations, normally GetCapabilities, DescribeCoverage & GetCoverage.
- A CoverageSummary:-
  - Lists the available "Coveragelds". In the examples the Coverageld equates either to model run e.g. UKGLOBAL or a service e.g. "Icing Service".
  - The CoverageSubType; e.g. rectifiedDataset.
- An Extension Point:-





# GetCapabilities **MetOC View:**

- OperationsMetadata:-
  - In addition to GetCoverage add custom operations e.g. GetTrajectory, plus others, see later.
- Use the Extension Point to include:-
  - A DataSummary that includes the bounding box and for each CoverageId a list of service (*model*) reference times.
  - Often refers to a NWP model run, but could equally be a service where the reference time refers to the update time of the service.



# An example of coveragids'

```
<wcs:CoverageSummary>
  <wcs:CoverageId>UKMOGLOBAL</wcs:CoverageId>
  <wcs:CoverageSubtype>ReferenceableDataset</wcs:CoverageSubtype>
</wcs:CoverageSummary>
<wcs:CoverageSummary>
  <wcs:CoverageId>UKPPESTDATA</wcs:CoverageId>
  <wcs:CoverageSubtype>RectifiedDataset</wcs:CoverageSubtype>
</wcs:CoverageSummary>
<wcs:CoverageSummary>
  <wcs:CoverageId>IcingService</wcs:CoverageId>
  <wcs:CoverageSubtype>RectifiedDataset</wcs:CoverageSubtype>
</wcs:CoverageSummary>
```



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# Describe Coverage:-

- DescribeCoverage--Returns a full description of one or more coverages;
  - Each Coverage has a unique identifier;
  - A Metadata Record;
    - A domain specific description of the coverage offerings, for example the forecast output data and the procedure used.
  - Service Parameters;
  - A DomainSet (In this example a rectified Grid);
  - A rangeType (Type SWE DataRecord);
    - This section defines the parameters and the allowed ranges.
  - Service Parameters;



# Describe Coverage Response:-

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- The description of the offered coverage's is illustrated in the following UML diagram:



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# Describe Coverage **MetOC View:**

- The Coverage identifier;
  - Identifier will normally be a model name or the type of service (e.g. Icing service).
- The Metadata Record;
  - This needs to contain the available parameters that will include the forecast times and vertical axes.
- The DomainSet will need to support a 4(5)D grid and this may mean a adaption to GRID
- The RangeType (Type SWE DataRecord);
  - The range type will define the parameters and their ranges;



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# Describe Coverage **MetOC View:**

- The element “MetOCMetadata” is used as the top level element to provide the Metadata content to be used with gmlcov:metadata i.e.

```
<gmlcov:metadata>
```

```
  <gml:Extension>
```

```
    <metocp:MetOCMetadata>
```

```
      <metocp:MetOCEnvironmentalDescription gml:id="ID001">
```

- The element MetOCMetadata has two parts i.e. the O&M2.0 and metadataProperty.
- O&M2.0 has been profiled for MetOC data, in particular: om:procedure is type “any” so the metadata is free form. om:featureOfInterest. Feature of interest is the model domain describe as a linear ring.



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# Describe Coverage MetOC View:

```
<metocmetadata:parameterDomainSet>
  <metocmetadata:TimeSlices>
    <metocmetadata:forecastTimesList>
      <metocmetadata:ForecastTimes>
        <metocmetadata:forecastTime>PT00H</metocmetadata:forecastTime>
        <metocmetadata:forecastTime>PT03H</metocmetadata:forecastTime>
      </metocmetadata:ForecastTimes>
    </metocmetadata:forecastTimesList>
    <metocmetadata:verticalAxisListProperty>
      <metocmetadata:VerticalAxis>
        <metocmetadata:verticalAxis
          srsName="http://www.metoffice.gov.uk/def/crs/mo/0/Isobaric_surface"
          srsDimension="1" axisLabels="Isobaric_surface" uomLabels="hPa">
            1000.0 850.0 500.0 300.0 250.0 200.0
          </metocmetadata:verticalAxis>
        <metocmetadata:verticalAxis
          srsName="http://www.metoffice.gov.uk/def/crs/mo/0/surface"
          srsDimension="1" axisLabels="Flight_level" uomLabels="Kft">
            15000.0 18000.0 20000.0 25000.0 30000.0 35000.0
          </metocmetadata:verticalAxis>
        </metocmetadata:VerticalAxis>
      </metocmetadata:verticalAxisListProperty>
    </metocmetadata:TimeSlices>
  </metocmetadata:parameterDomainSet>
```



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# Describe Coverage **MetOC View**

- ```
<metocmetadata:SpatialTemporalDomains>
  <gml:domainSet>
    <gmlrgrid:ReferenceableGridByArray gml:id="ex" dimension="2"
srsName="http://www.opengis.net/def/crs-compound?
1=http://www.opengis.net/def/crs/EPSSG/0/4326amp2=http://www.opengis.net/def/crs/ISO/2004/8601">
      <gml:limits>
        <gml:GridEnvelope>
          <gml:low>0 0</gml:low>
          <gml:high>8 6</gml:high>
        </gml:GridEnvelope>
      </gml:limits>
      <gml:axisLabels>Isobaric_surface forecast_time</gml:axisLabels>
      <gml:posList axisLabels="Isobaric_surface Time" uomLabels="hPA hours">
        1000.0 0 1000.0 6 1000.0 12 1000.0 18 1000.0 24 1000.0 30 1000.0 36
        950.0 0 950.0 NaN 950.0 12 950.0 NaN 950.0 NaN 950.0 NaN 950.0 NaN 950.0
        850.0 0 850.0 6 850.0 NaN 850.0 18 850.0 NaN 850.0 30 850.0 NaN
      </gml:posList>
      <gmlrgrid:sequenceRule axisOrder="+1 +2">Linear</gmlrgrid:sequenceRule>
    </gmlrgrid:ReferenceableGridByArray>
  </gml:domainSet>
</metocmetadata:SpatialTemporalDomains>
```



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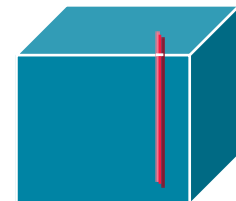
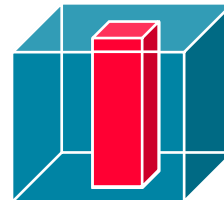
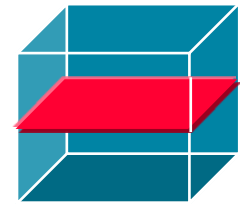
# GetCoverage:

- The GetCoverage request encodes the type of extraction based on a simple trim or slice; it consists of:-
  - The Coverage id (mandatory);
  - A Trim operation that requires a low and high trim point;
  - A Slice operation that reduces the dimension by one and requires the slice axis;
  - The dimension or axis name that is to be trimmed or sliced.
  - Service Parameters;



# GetCoverage:

- The basic Trim and Slice Operations





# GetCoverage **MetOC View:**

- The extensions are designed to
  - To extend the output feature types e.g.
    - Cross sections;
    - Vertical profiles;
    - 2/3/4D trajectories;
    - Time Series
  - To extend operations e.g.
    - Interpolation;
    - Re-projection;
    - Aggregation.
- It is not the intention to go thro each extension, but to outline the principles.



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# GetCoverage **MetOC View:**

- **Extending the simple slice and trim:-**
  - **Add a UOM attribute to SlicePoint.**
    - SlicePoint has type “string” which is not easy to validate:
  - **Introduce a new element OutputFeatureDefinition:-**
    - This allows the user to introduce extra output coverdges such as trajectory and cross sections that require a base line defines as a set of way points.
  - **Introduce a new element fieldSubset:-**
    - fieldSubset allows the extraction of a specific parameter name belonging to a Coverage identified by a unique Coverageld.





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# GetCoverage **MetOC:**

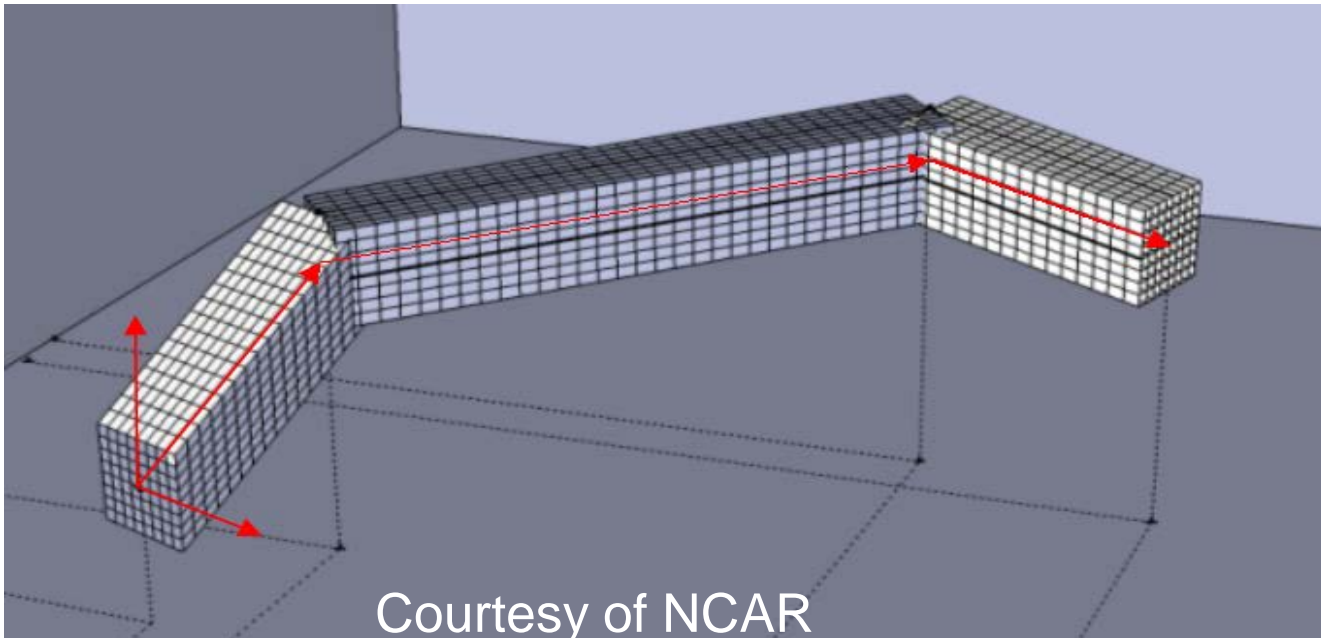
- Interpolation and re-projection:
  - **Use the existing work from the image community to define a subsetting CRS and output CRS.**
    - The subsetting CRS defines the CRS on which the subsetting parameters are based. If it is omitted then the original CRS is used.
    - The subsetting CRS may be compound e.g. Map CRS (54004) combined with another axis e.g. a vertical CRS (isobaric)
    - An output CRS that defines the re-projection CRS.
  - **New Element: TrimGridOffset:- Interpolation interval**
    - This is used to define the interpolation interval:
    - `<wcsmo:TrimGridOffset uomLabels=" Deg ">1.0</wcsmo:TrimGridOffset>`

# GetCoverage MetOC:



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- An example:- This trajectory has three dimensions i.e. a width, a height and a specified number of sample points along the direction of travel.
- The way points of the trajectory are defined (in this example) in latitude, longitude, height and time. The sample points are equally spaced in time i.e. Using the time of the first and last points.



Courtesy of NCAR



# GetCoverage **MetOC**:

- The **fieldSubset** is used to specify the parameters e.g. temperature and wind
- The **subsetting CRS** is used to specify the CRS of the Trim bounds e.g. epsg 4326 and Geographic height.
- The **Trim bounds** are used to specify the depth and lateral extents, in this example the axis names are Corridor lateral (UOM Km), Corridor vertical (UOM Km) and Corridor\_Axis\_Sample\_Size i.e. the number of sample points.
- The **gridOffsets** represent the resolution of the resulting corridor grid in each of the three dimensions, in this example 0.5Km in the vertical and 5Km in the horizontal.
- The **OutputFeatureDefinition** that is used to specify the way points specified in the subsetting CRS.



# Questions & answers