



Powered by standards – new data tools for the climate sciences

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STFC Rutherford Appleton Lab, UK

Geogle

temperature

ERA40

The ECMWF ERA-40 Re-Analysis Project consists of a number of climate datasets spanning the period mid-1957 to August 2002 using a consistent model. The data overlaps with the earlier ECMWF ERA-15 Re-analysis project (1979-1993). The broad objectives and partner organisations are presented in the ERA-40 background information.

badc.nerc.ac.uk

[air_potential_temperature](#)

[GridSeries \(xypt\)](#)

1957-2002



European Synoptic stations

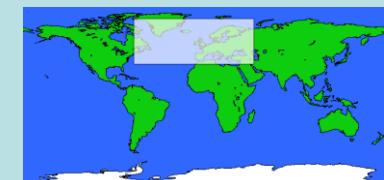
Hourly Surface data from 141 European stations for the period 1990-1996. Parameters include temperature, wind, rainfall, cloud cover etc.

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[air_temperature](#)

[PointSeries \(xyzt\)](#)

1990-1996



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ISO 19115 EX Extent

[1957-2002](#)



European Synoptic stations

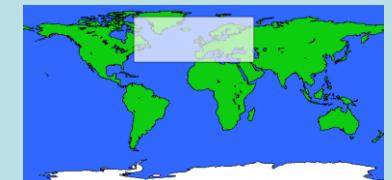
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[GridSeries \(xypt\)](#)

ISO 19115 EX Extent

[1957-2002](#)



ISO 19115 MD_Keywords

European Synoptic stations

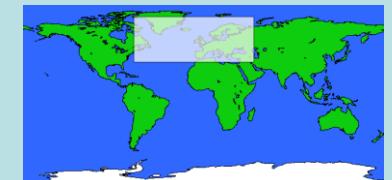
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[1990-1996](#)



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thesaurusName: CF definition

Re-analysis Project consists of a number of datasets spanning the period mid-1957 to August 2002 using a consistent set of methods. The data overlaps with the earlier ECMWF ERA-15 and ERA-40 datasets (1979-1993). The broad objectives and partner organisations are presented in the ERA-40 background information.

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[air_potential_temperature](#)

[GridSeries \(xypt\)](#)

ISO 19115 EX_Extent

[1957-2002](#)



ISO 19115 MD_Keywords

European Synoptic stations

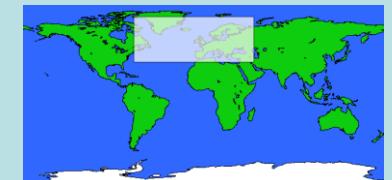
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thesaurusName: **CF**
definition

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Re-analysis project (1979-1993). The broad objectives and partner organisations are presented in the ERA-40 background information.
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[GridSeries \(xypt\)](#)

ISO 19126 ("Feature concept dictionary and registers")
ISO 19135 ("Procedures for item registration")

O 19115 EX Extent

[1957-2002](#)



ISO 19115 MD_Keywords

European Synoptic stations

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[PointSeries \(xyzt\)](#)



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European Commission Joint Research Centre Institute for Environment and Sustainability

INSPIRE Registry - Version 1.00 Search Contact Legal notice English (en) ▾

INSPIRE registry 

Europa > European Commission > JRC > INSPIRE Registry

Tuesday, 21 April 2009 Not logged in

Registry Home Registers Feature Concept Dictionary [View Register Items](#)

Valid Superseded Retired

Item Identifier	Item Class	Name	Status	Date Accepted	Date Amended
1	theme	Coordinate reference systems	Valid	05-Dec-08	
2	theme	Geographical grid systems	Valid	05-Dec-08	
10	theme	Elevation	Valid	05-Dec-08	
11	theme	Land cover	Valid	05-Dec-08	
12	theme	Orthoimagery	Valid	05-Dec-08	
13	theme	Geology	Valid	05-Dec-08	
14	theme	Statistical units	Valid	05-Dec-08	
15	theme	Buildings	Valid	05-Dec-08	
16	theme	Soil	Valid	05-Dec-08	
17	theme	Land use	Valid	05-Dec-08	
18	theme	Human health and safety	Valid	05-Dec-08	
19	theme	Utility and governmental services	Valid	05-Dec-08	
20	theme	Environmental monitoring facilities	Valid	05-Dec-08	
21	theme	Production and industrial facilities	Valid	05-Dec-08	
22	theme	Agricultural and aquaculture facilities	Valid	05-Dec-08	
23	theme	Population distribution — demography	Valid	05-Dec-08	
24	theme	Area management/restriction/regulation zones and reporting units	Valid	05-Dec-08	
25	theme	Natural risk zones	Valid	05-Dec-08	
26	theme	Atmospheric conditions	Valid	05-Dec-08	
27	theme	Meteorological geographical features	Valid	05-Dec-08	
28	theme	Oceanographic geographical features	Valid	05-Dec-08	
29	theme	Sea regions	Valid	05-Dec-08	
30	theme	Bio-geographical regions	Valid	05-Dec-08	
31	theme	Habitats and biotopes	Valid	05-Dec-08	
32	theme	Species distribution	Valid	05-Dec-08	
33	theme	Energy resources	Valid	05-Dec-08	
34	theme	Mineral resources	Valid	05-Dec-08	
38	spatial object type	Administrative unit upper level	Valid	05-Dec-08	
42	spatial object type	Administrative unit lower level	Valid	05-Dec-08	

x Find: Next Previous Match case



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[air_potential_temperature](#)

[GridSeries \(xypt\)](#)

1957-2002



ISO 19115 MD_ReferenceSystem

European Synoptic stations

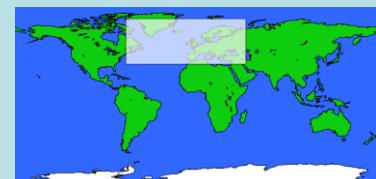
Hourly Surface data from 141 European stations for the period 1990-1996. Parameters include temperature, wind, rainfall, cloud cover etc.

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authority: **BADC**
definition

[air_potential_temperature](#)

of a number of
August 2002 using a
ECMWF ERA-15



1957-2002

[GridSeries \(xypt\)](#)

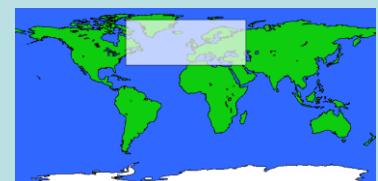
ISO 19115 MD_ReferenceSystem

European Synoptic stations

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authority: **BADC**
definition

[air_potential_temperature](#)

ISO 19111-2 (“Spatial referencing by coordinates – Part 2: Extension for parametric values”)

ECMWF ERA-15

[GridSeries \(xypt\)](#)



ISO 19115 MD_ReferenceSystem

European Synoptic stations

Hourly Surface data from 141 European stations for the period 1990-1996. Parameters include temperature, wind, rainfall, cloud cover etc.

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[air_temperature](#)

1990-1996



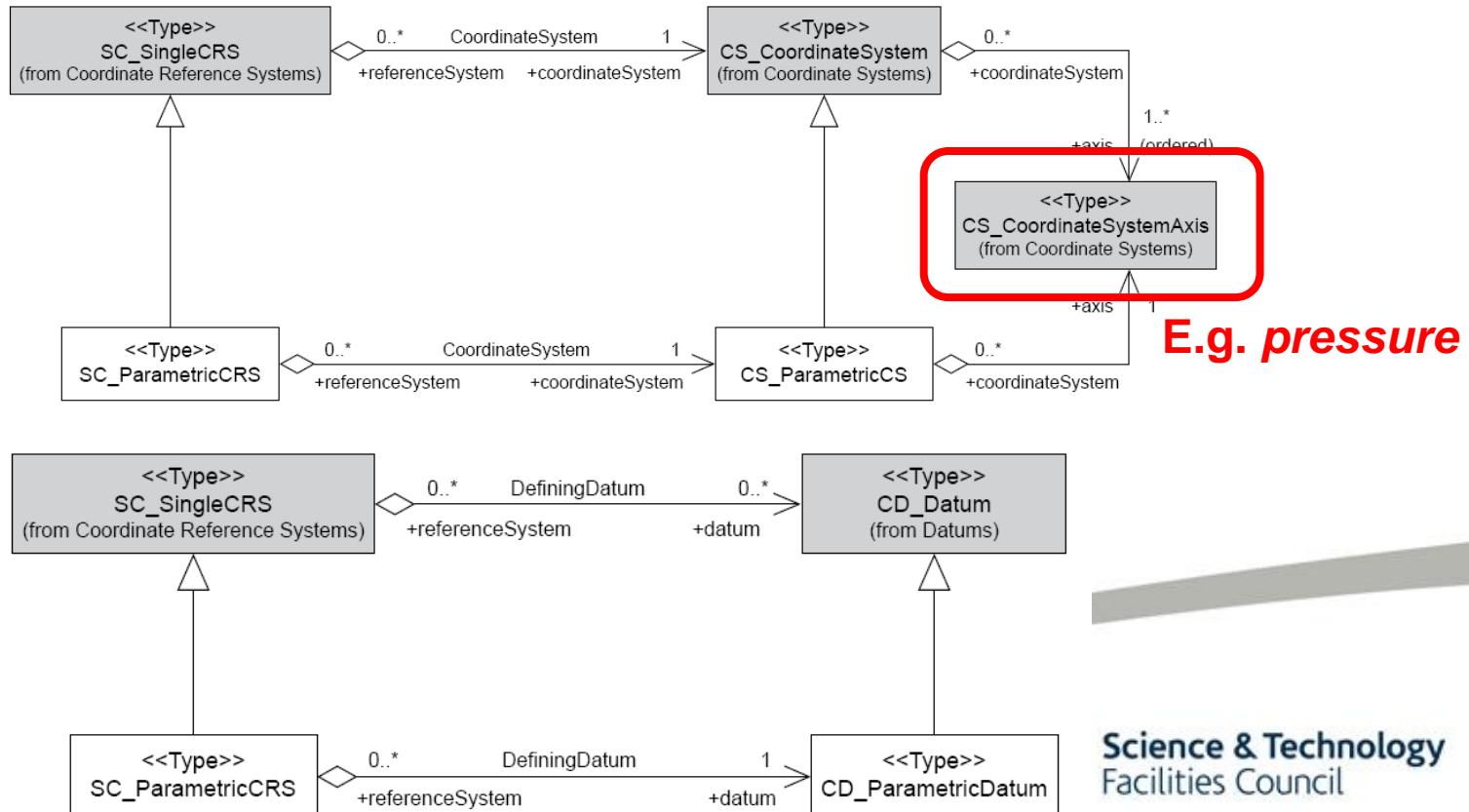
[PointSeries \(xyzt\)](#)



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ISO 19111-2

- Proposed by UK as NWIP late 2006
- DIS voted for publication this year!



ISO 19111-2

- *datum*: parameter or set of parameters that define the position of the origin, the scale, and the orientation of a coordinate system (ISO 19111)
- *parametric datum*: datum describing the relationship of a parametric coordinate system to an object.
NOTE: The object is normally the Earth. (ISO 19111-2)
- Could have been more imaginative with parametric datum!
 - e.g. full atmospheric density field...



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European Synoptic stations

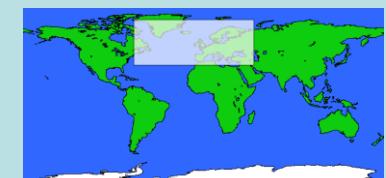
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[air_temperature](#)

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1990-1996



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featureCatalogue: **CSML** featureType

Re-analysis project (1979-1993). The objectives and partner organisations are presented in the ERA-40 background information.

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[air_potential_temperature](#)

of a number of
August 2002 using a
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1957-2002



[GridSeries \(xypt\)](#)

ISO 19115 MD_ContentInformation

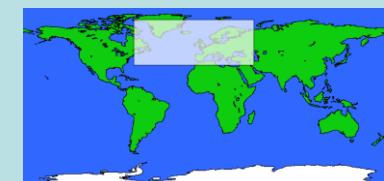
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[ERA40](#)

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[**featureType**](#)

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organisations are presented in the ERA-40 background information.

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[air_potential_temperature](#)

[1957-2002](#)

of a number of
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**ISO 19110 ("Methodology
for feature cataloguing")**



[GridSeries \(xypt\)](#)

ISO 19115 MD_ContentInformation

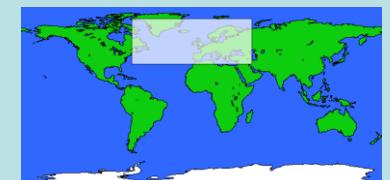
[European Synoptic stations](#)

Hourly Surface data from 141 European stations for the period 1990-1996. Parameters include temperature, wind, rainfall, cloud cover etc.

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[1990-1996](#)

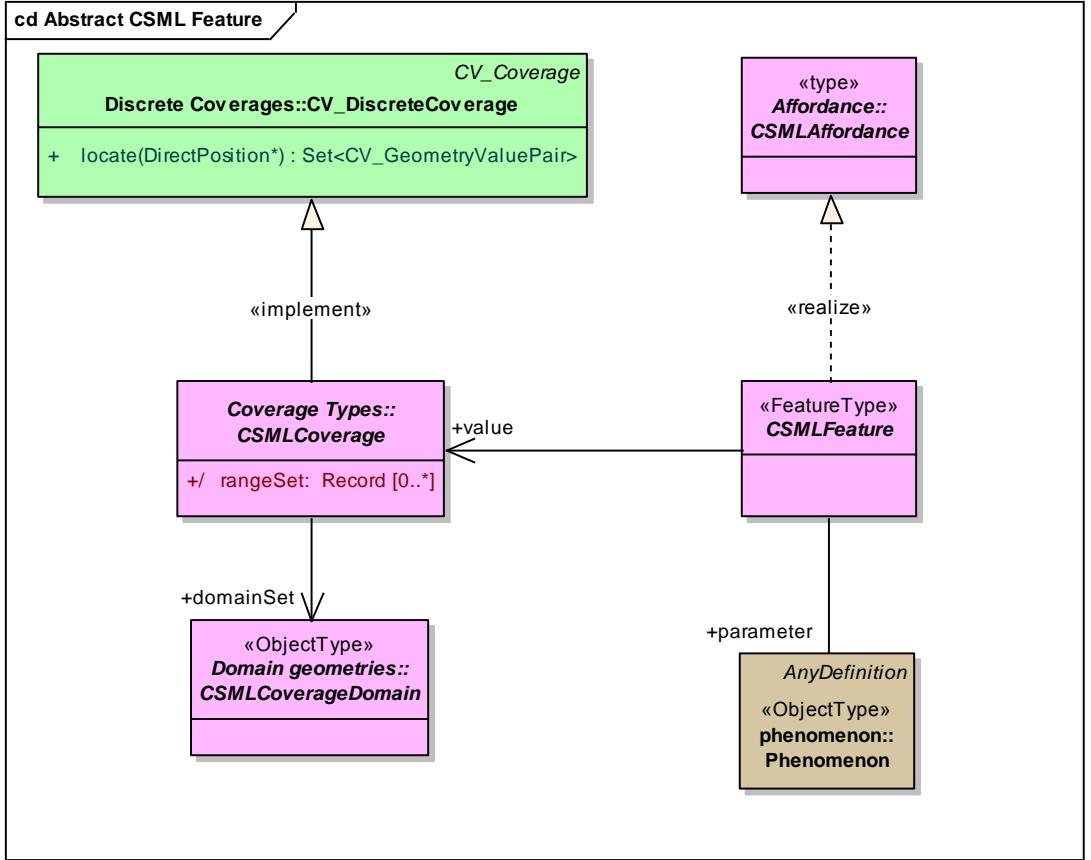


[PointSeries \(xyzt\)](#)

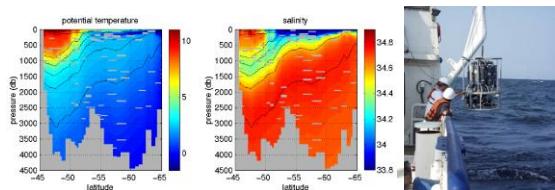


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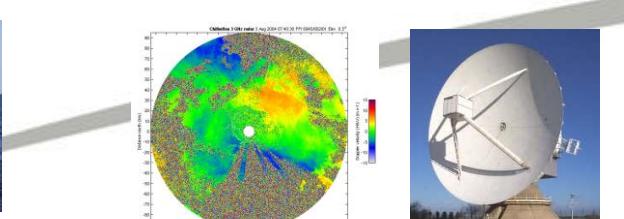
Climate Science Modelling Language (CSML)



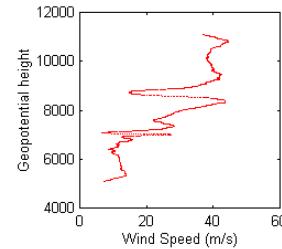
RaggedSectionFeature



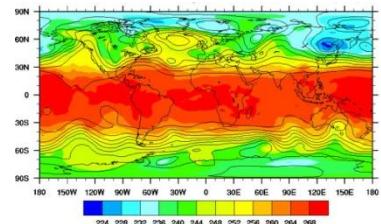
ScanningRadarFeature



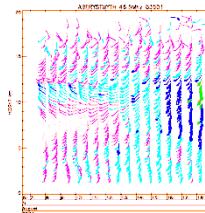
ProfileFeature



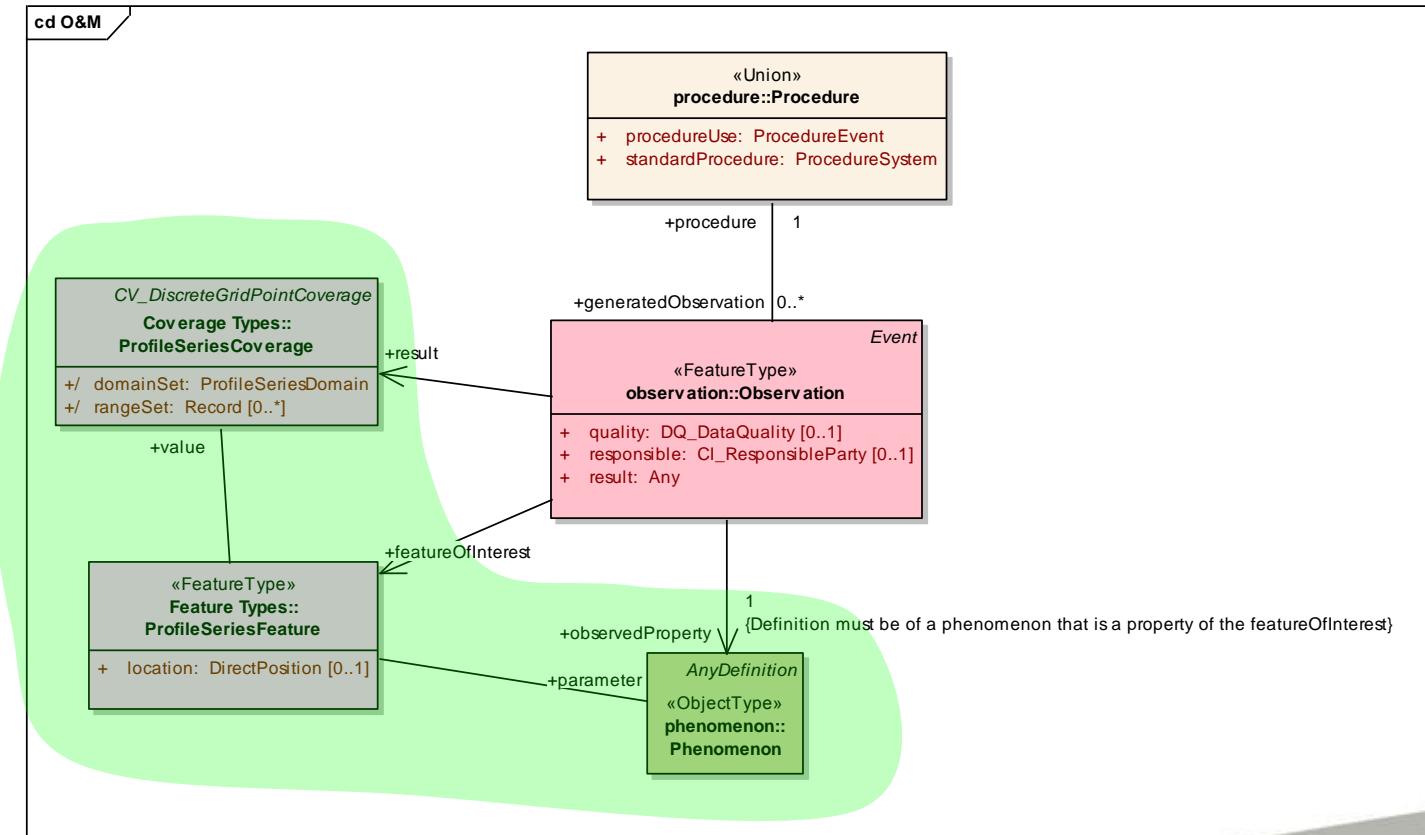
GridFeature



ProfileSeriesFeature



Climate Science Modelling Language (CSML)



An **Observation** is an Event whose **result** is an estimate of the **value** of some **Property** of the **Feature-of-interest**, obtained using a specified **Procedure**

- O&M
‘Sampling Features’ informed by CSML
- CSML v3 will specialise SF
- SF-coverage pattern documented in ISO 19156?

ISO 19110 Feature Catalogue

- EU FP6 project ‘MOTIIVE’
 - developed ebRIM-based Feature Catalogue

OGC 07-172,
‘Feature Type
Catalogue
Extension
package’ [link](#)



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ISO 19110 Feature Catalogue

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 - developed ebRIM-based Feature Catalogue

The screenshot shows a Mozilla Firefox browser window displaying the Motiive Feature Type Catalogue Browser. The title bar reads "Motiive Catalogue Browser Mock Up - Mozilla Firefox". The main content area is titled "Motiive Feature Type Catalogue Browser". On the left, there is a tree view of feature types under "AbstractFeature": AbstractFeature, Observation, Process, SamplingFeature, and SurveyProcedure. The "SamplingFeature" node is selected. To the right of the tree, detailed information about the "SamplingFeature" is provided:

FeatureType Name: SamplingFeature
FeatureType ID: urn:motive:ftc:OM.SamplingFeature.20071017
FeatureType Description: Sampling features are frequently related to each other, as parts of networks, through sub-sampling, etc. This is supported by the relatedSamplingFeature association with a generic SamplingFeatureRelation association class, which carries a source, target and role. A common requirement for sampling features is an indication of the SurveyProcedure that provides the surveyDetails related to determination of its location and shape.
Registry Package: SamplingFeature

Attributes:

Name	Cardinality	Data Type	Description
description	0..*	sa:SamplingFeatureRelation	Sampling features are frequently related to each other, as parts of complexes, networks, through sub-sampling, etc. This is supported by the relatedSamplingFeature association with a SamplingFeatureRelation association class, which carries a source, target and role.

Inherited Attributes:

Inherited From: AbstractFeature

Name	Cardinality	Data Type	Description
descriptionReference	0..1	gml:Reference	The value of this property is a remote text description of the object. The xlink:href attribute of the gml:descriptionReference property references the external description.
description	0..1	gml:StringOrRef	The value of this property is a text description of the object. The attribute eml:id supports provision of a handle for the XML

OGC 07-172,
‘Feature Type
Catalogue
Extension
package’ [link](#)

ISO 19110 Feature Catalogue

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The screenshot shows a Microsoft Internet Explorer window titled "Motive Catalogue Browser Mock Up - Microsoft Internet Explorer provided by HRW - Default IE GPO". The address bar shows the path "D:\Work\dataprods\DGXIII\motiive\V3_Project\FTC_Browser\mockup\index.html". The main content area is titled "Motiive Feature Type Catalogue Browser". On the left, there is a tree view of feature types:

- Grid Series Coverage
 - Tidal Times Series
 - Motive Grid Series Coverage
 - Sea Surface Temperature
 - Sea Surface Temperature
 - Ocean Climatology
 - Sea Surface Temperatur
 - Point Series

On the right, detailed information is provided for the selected "Tidal Times Series" node:

- Feature**: TidalTimesSeries
- Type**: TidalTimesSeries
- Package**: Motiive
- Properties**:
 - location: DirectPosition (0..1), inherited from PointSeriesType
 - value... (valueAffectedBy: serviceName)
 - deploymentDate
 - instrument (valueObservedBy: serviceName)
 - managingAuthority
 - monitoringStationName
 - qualityChecked
- Operations**:
 - ReturnTidalLevel (inherited from ...)
- Linked Services**:
 - [WFS/GetFeature](#)
 - [WMS/GetFeatureIn](#)

OGC 07-172,
‘Feature Type
Catalogue
Extension
package’ [link](#)

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ERA40 ISO 19115 CI_OnlineResource

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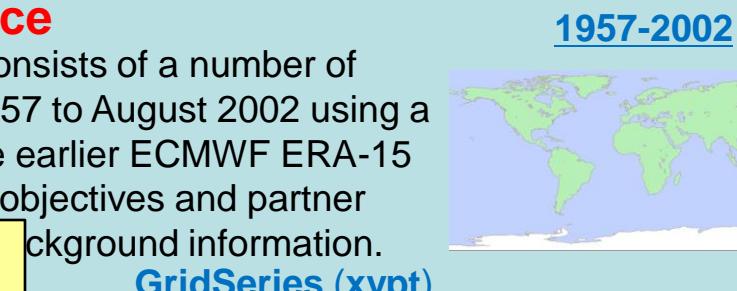
Google

temperature

ERA40 ISO 19115 CI_OnlineResource

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applicationProfile: WFS
linkage: [right click/copy](#)



[GridSeries \(xypt\)](#)

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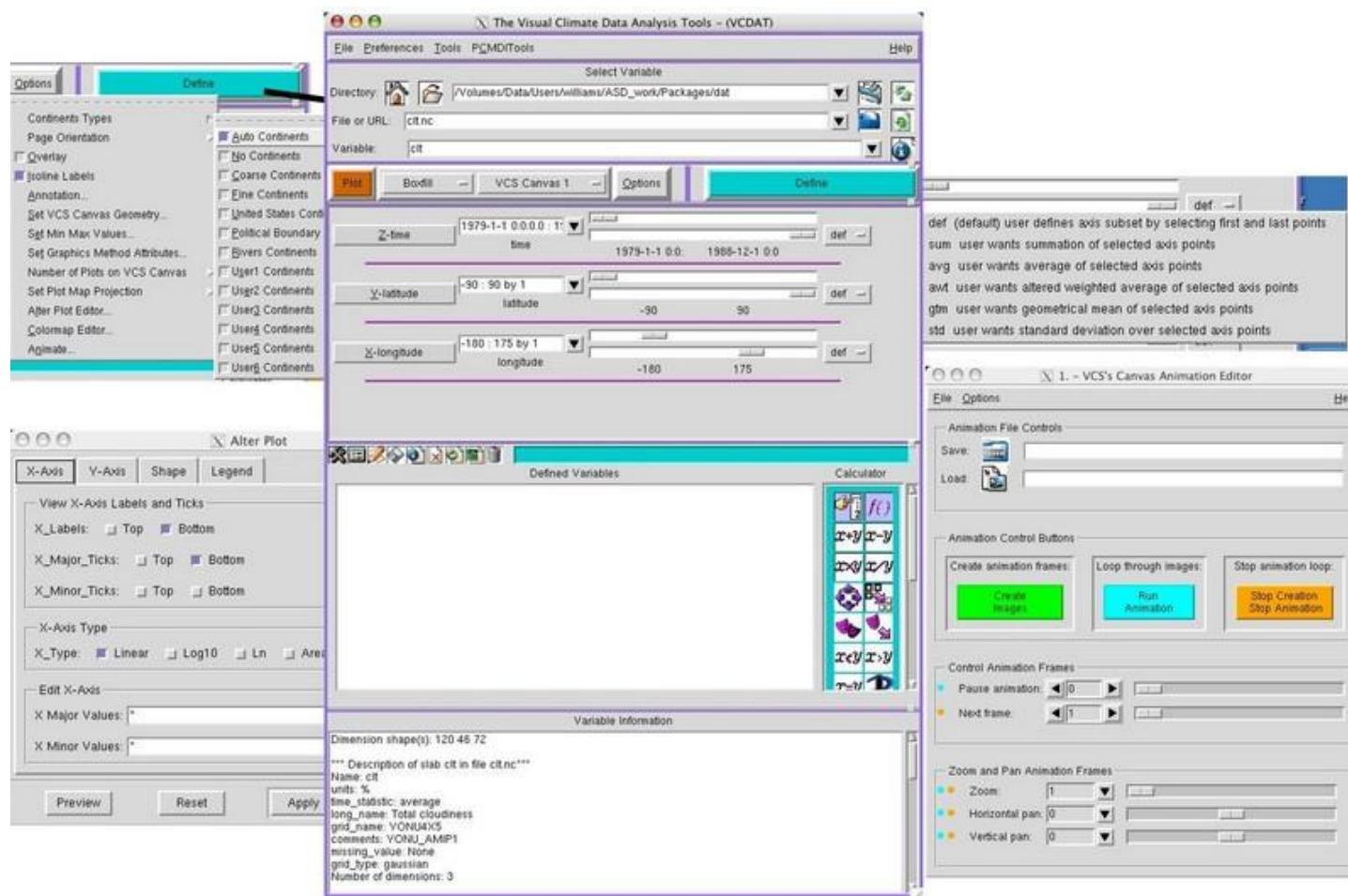
[air_temperature](#)

[PointSeries \(xyzt\)](#)



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Open tool xxx

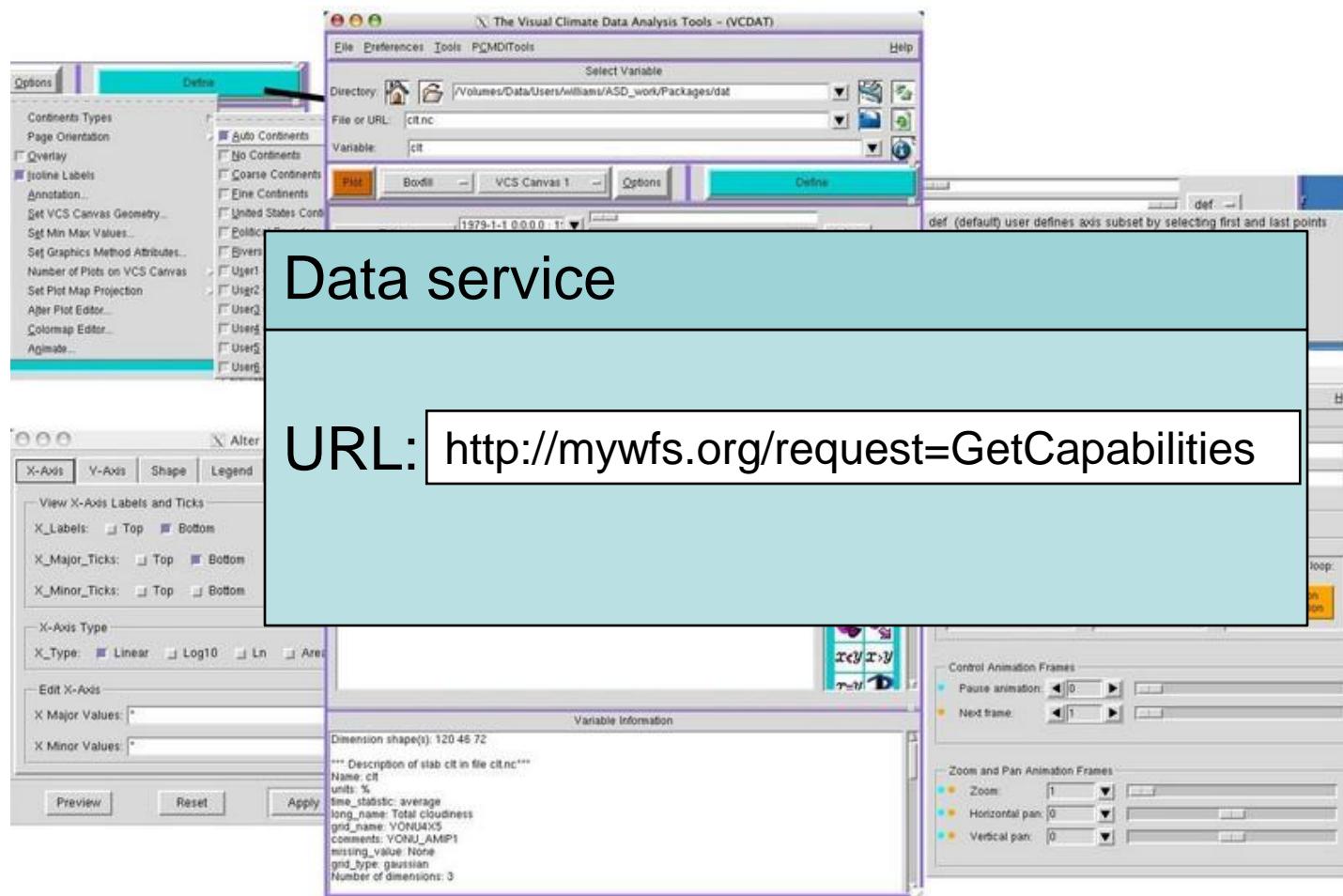


- http://portal.opengeospatial.org/files/?artifact_id=31487
- Lowe & Woolf: EGU2009-10927, 18:30 Thursday



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Open tool xxx

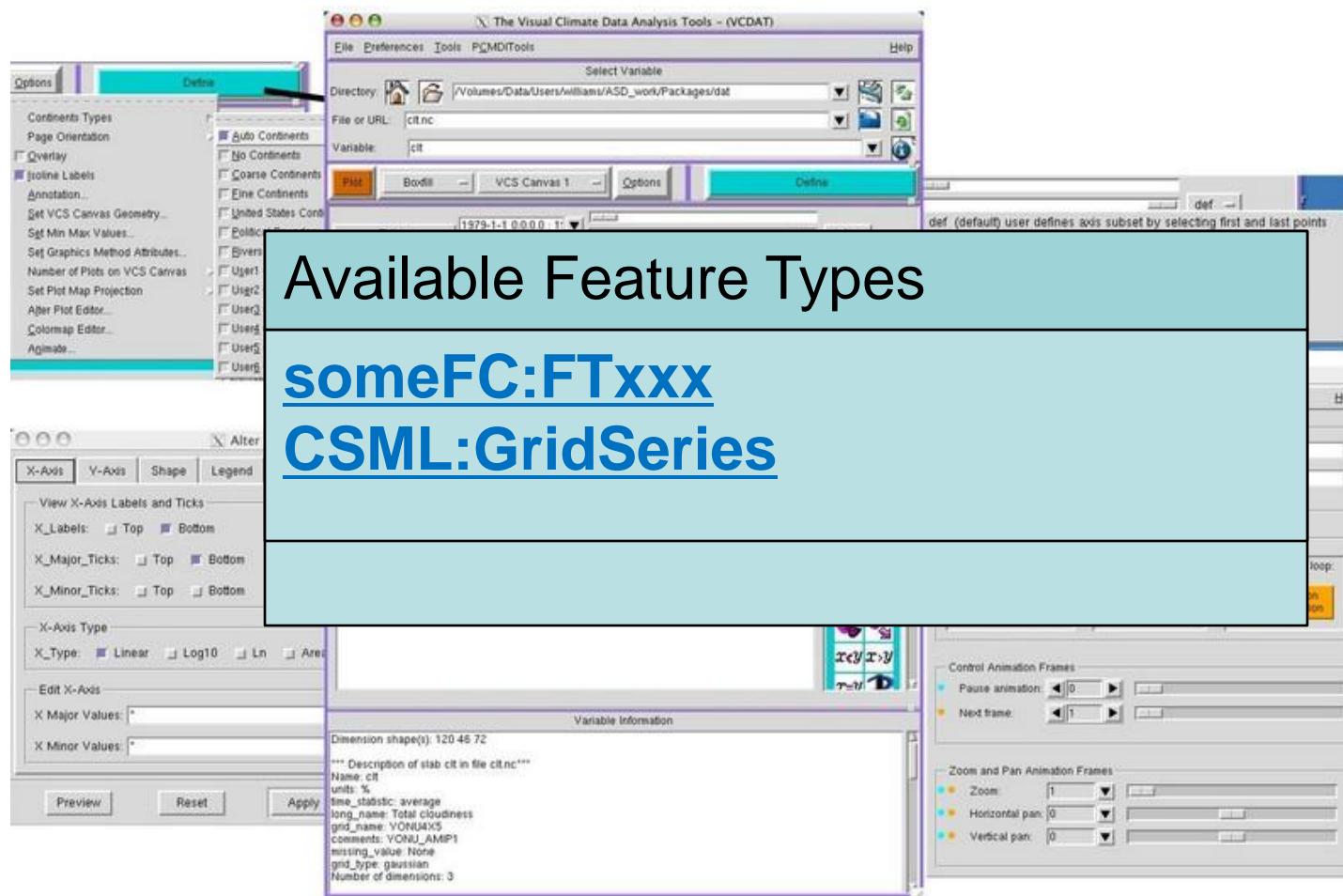


- http://portal.opengeospatial.org/files/?artifact_id=31487
- **Lowe & Woolf: EGU2009-10927, 18:30 Thursday**



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Open tool xxx

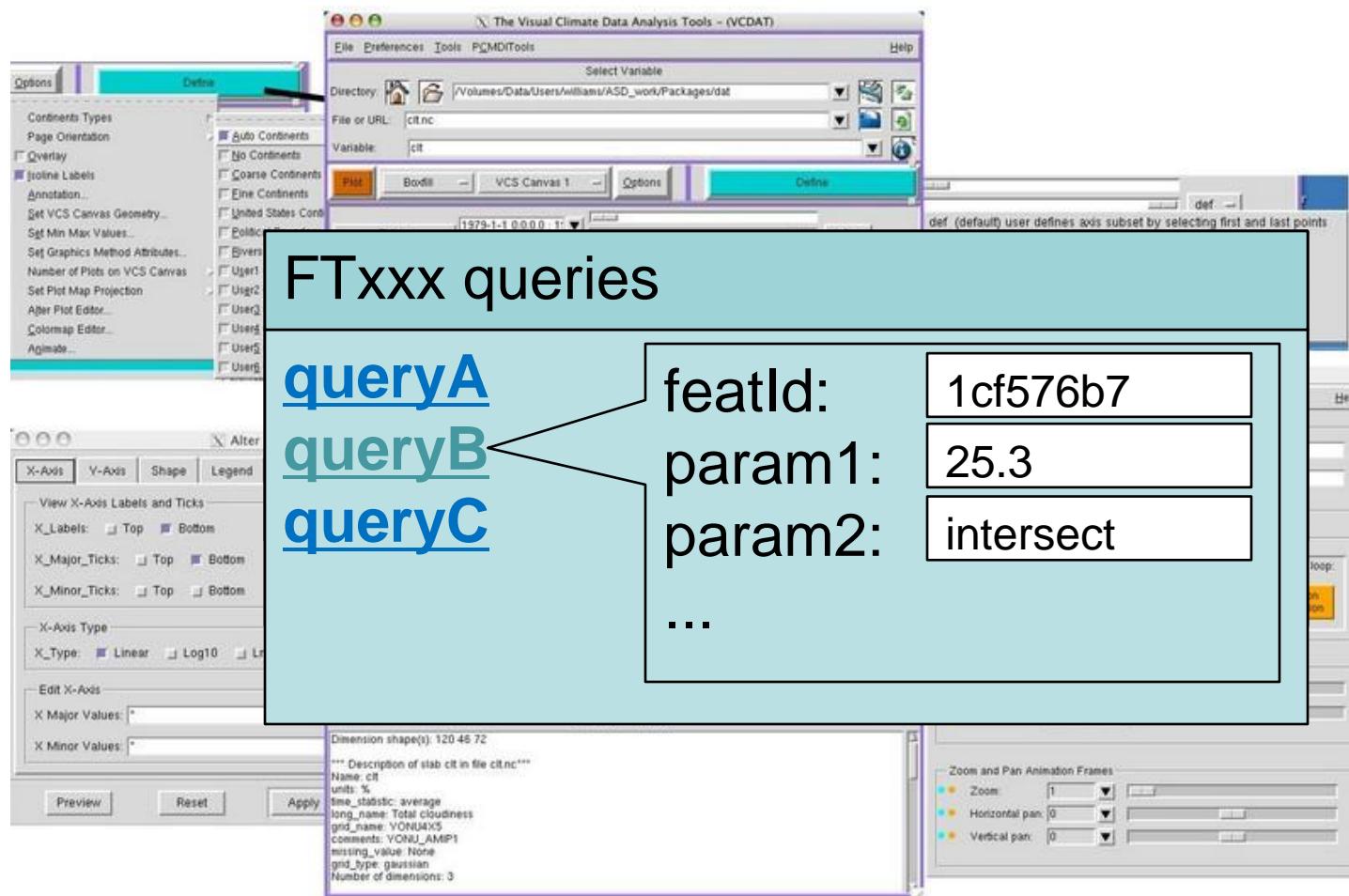


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Open tool xxx

The screenshot shows the VCDAT application window. The title bar reads "The Visual Climate Data Analysis Tools - (VCDAT)". The menu bar includes File, Preferences, Tools, PCMDITools, Help, and a "Select Variable" dropdown. The toolbar contains icons for Open, Save, Print, and Options. The main area has tabs for "Define" (highlighted in blue), Plot, Boxfill, and VCS Canvas 1. The "Define" tab shows a "Directory" set to "/Volumes/Data/Users/williams/ASD_work/Packages/dat" and a "File or URL" set to "clt.nc". The "Variable" dropdown is set to "clt". Below these are checkboxes for "Auto Continents", "No Continents", "Coarse Continents", "Fine Continents", and "United States Cont". A status bar at the bottom shows "1979-1-1 0.0 0.0 1".

CSML:GridSeries queries

subsetProfile atLocOf: 12ace5b9

subsetPointSeries

subsetProfileSeries

The interface includes a left sidebar with "Options" and "Define" tabs, and sections for "Continents Types", "Page Orientation", "Overlay", "Inline Labels", "Annotation...", "Set VCS Canvas Geometry...", "Set Min Max Val...", "Set Graphics M...", "Number of Plots", "Set Plot Map Pr...", "After Plot Editor", "Colormap Editor", and "Agimate...". Below this is a "X-Axis" panel with "View X-Axis", "X_Labels", "X_Major_Ticks", "X_Minor_Ticks", "X-Type", "X_Type", "Edit X-Axis", and "X Major Value". At the bottom are "Preview", "Reset", and "Apply" buttons.

The bottom right panel shows "Zoom and Pan Animation Frames" with "Zoom" set to 1, "Horizontal pan" to 0, and "Vertical pan" to 0. The bottom center panel displays a world map with a red asterisk marking a location in the North Atlantic.

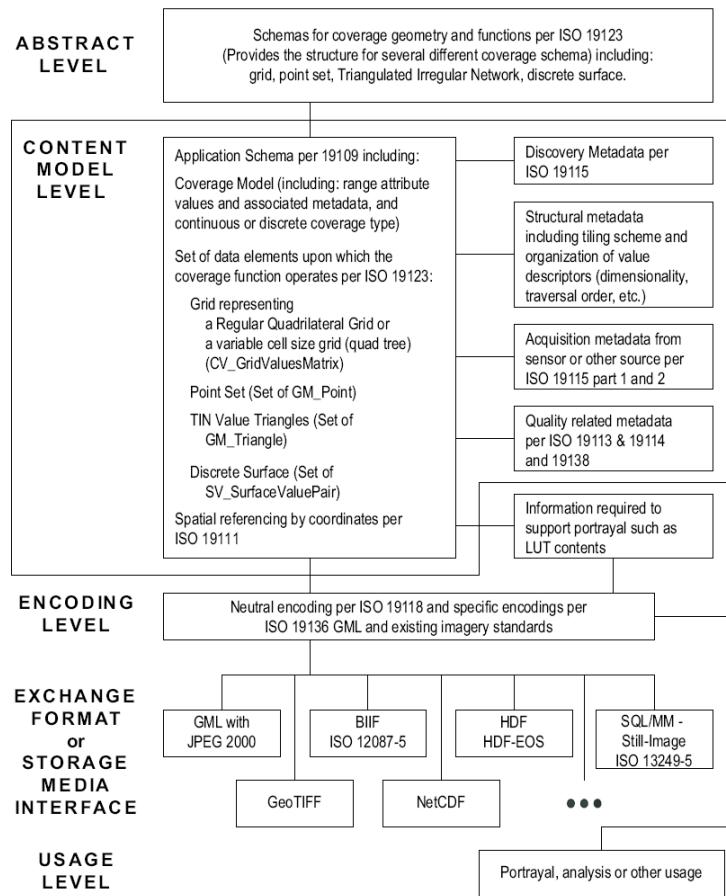
- http://portal.opengeospatial.org/files/?artifact_id=31487
- **Lowe & Woolf: EGU2009-10927, 18:30 Thursday**



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WFS - encoding

- ISO/TS 19129 “Imagery, gridded and coverage data framework”



- Distinguishes ***logical content*** from ***exchange format*** and ***mappings*** between them (**GML** can mediate)
- ***Application schema*** also for coverage-based data



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Encoding

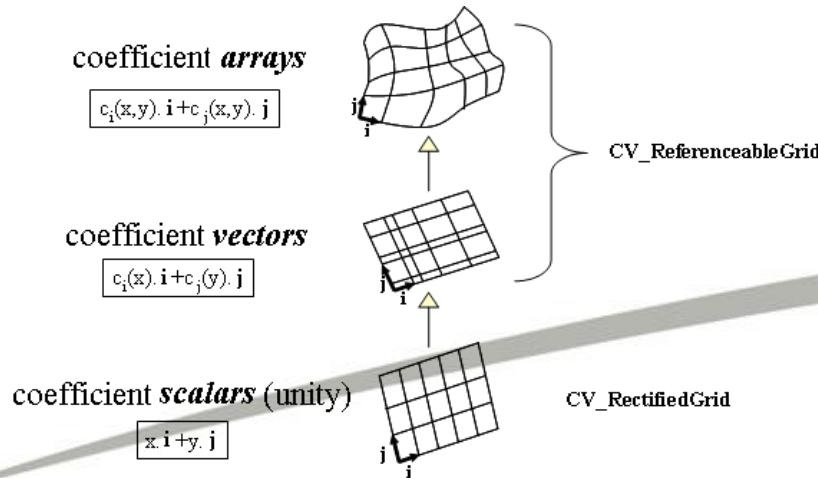
- Model ('GML wrapper'):
 - GML feature 'skeleton' (e.g. CSML)
 - Binary file 'flesh' (e.g. netCDF)
 - xlink for mappings
 - xlink:href = file resource
 - xlink:role = nature of resource ('CF-netCDF')
 - xlink:arcrole = nature of xlink ('embed content')
- OGC 07-083: "Use of xlink in GML – Profile for file-based data content" [link](#)
- INSPIRE D2.7: "Guidelines for the encoding of spatial data", Annex C (Encoding of file-based data) [link](#)



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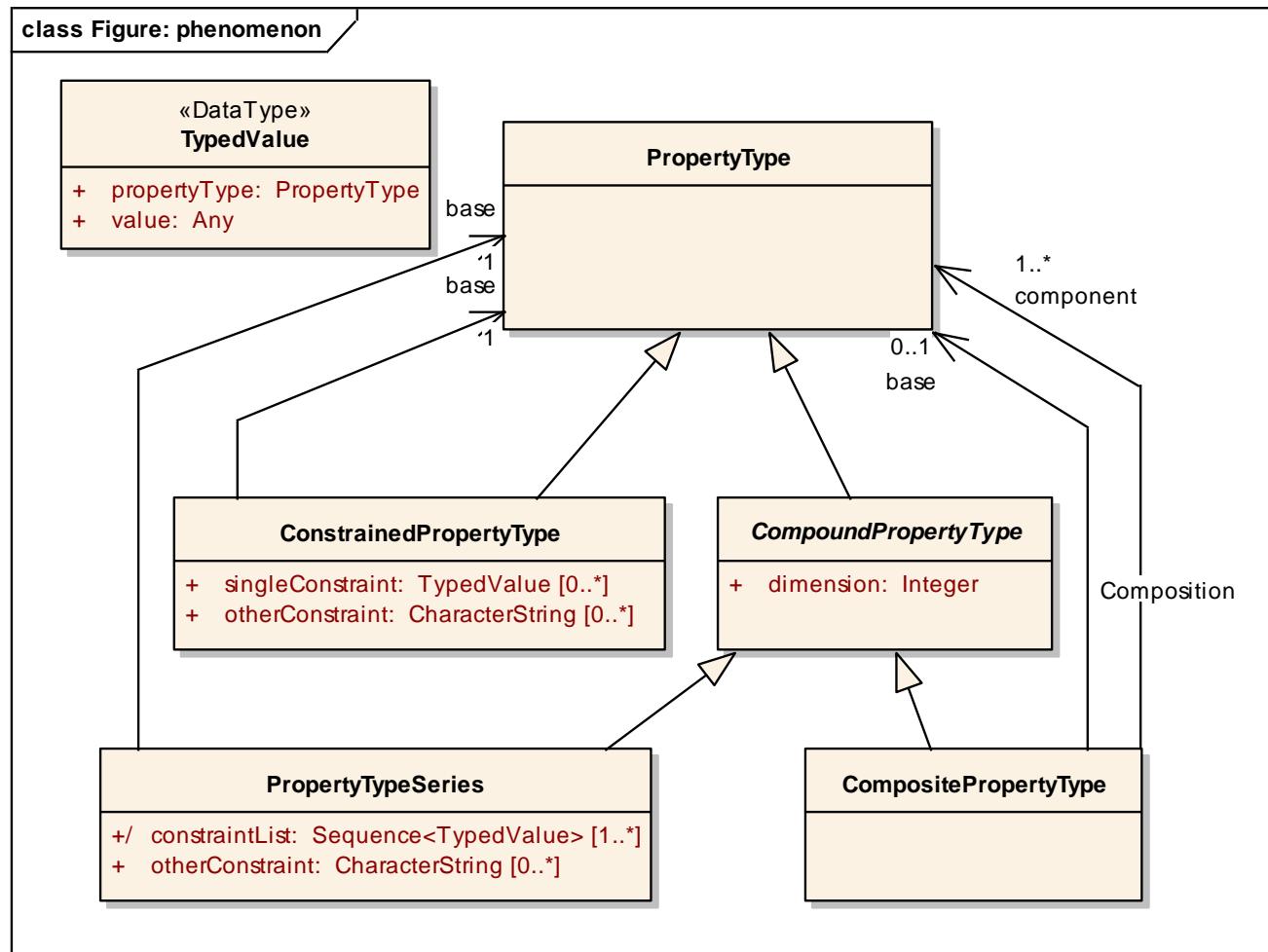
Encoding

- What about irregular grids?
 - Need GML implementation of ISO 19123 CV_ReferenceableGrid
 - OGC 06-160: our original proposal
 - OGC 07-040: Galdos alternative
 - **OGC 07-112: combined proposal [link](#)**
 - Compatible with CF-netCDF ‘coordinate variables’
 - Currently being considered by GML SWG



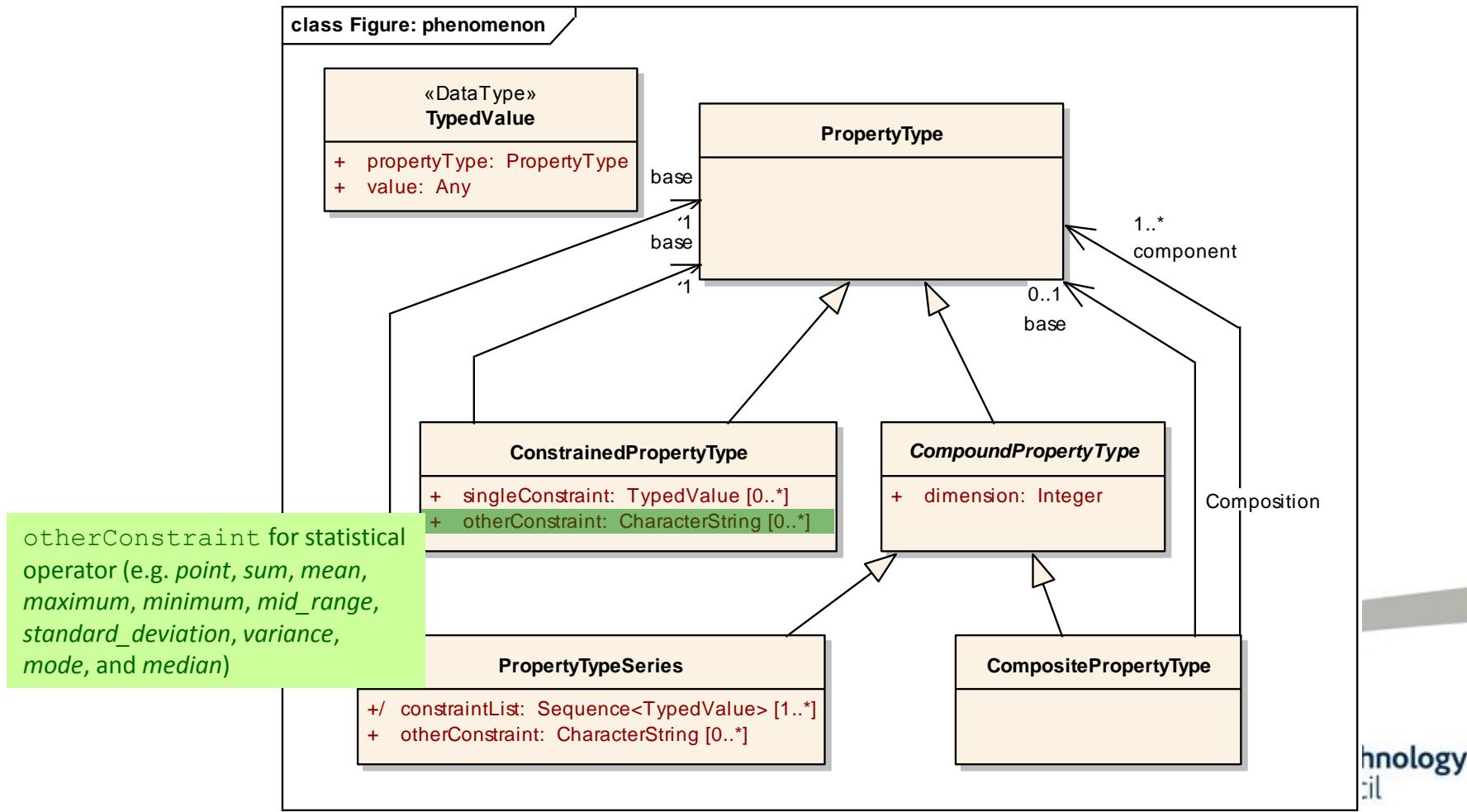
Climatological parameters?

- SWE Common ‘Property model’



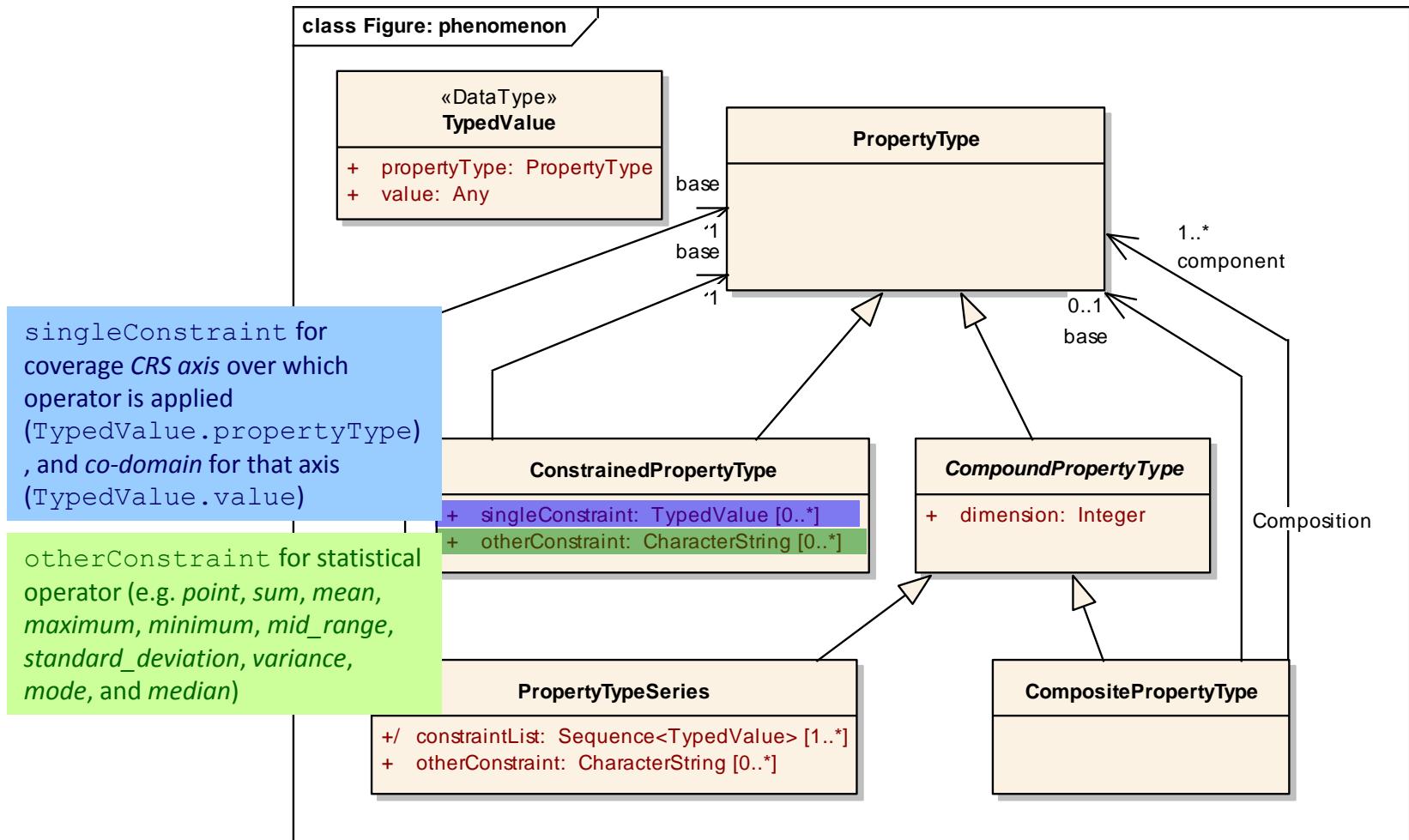
Climatological parameters?

- SWE Common ‘Property model’



Climatological parameters?

- SWE Common ‘Property model’



Climatological parameters?

- E.g. January 2007 maximum temperature

```
<swe:ConstrainedPhenomenon gml:id="Jan2007MaxTemp">
  <gml:identifier codeSpace="http://ndg.nerc.ac.uk">January 2007 maximum temperature</gml:identifier>
  <swe:base xlink:href="urn:ndg:cf:air_temperature"/>
  <swe:otherConstraint>maximum</swe:otherConstraint>
  <swe:singleConstraint>
    <swe:TypedValue>
      <swe:property codeSpace="http://ndg.nerc.ac.uk">time</swe:property>
      <swe:value>2007-01-01/2007-01-31</swe:value>
    </swe:TypedValue>
  </swe:singleConstraint>
</swe:ConstrainedPhenomenon>
```



Climatological parameters?

- E.g. January 2007 maximum temperature

```
<swe:ConstrainedPhenomenon gml:id="Jan2007MaxTemp">
  <gml:identifier codeSpace="http://ndg.nerc.ac.uk">January 2007 maximum temperature</gml:identifier>
  <swe:base xlink:href="urn:ndg:cf:air_temperature"/>←
  <swe:otherConstraint>maximum</swe:otherConstraint>
  <swe:singleConstraint>
    <swe:TypedValue>
      <swe:property codeSpace="http://ndg.nerc.ac.uk">time</swe:property>
      <swe:value>2007-01-01/2007-01-31</swe:value>
    </swe:TypedValue>
  </swe:singleConstraint>
</swe:ConstrainedPhenomenon>
```



Climatological parameters?

- E.g. January 2007 maximum temperature

```
<swe:ConstrainedPhenomenon gml:id="Jan2007MaxTemp">
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      <swe:value>2007-01-01/2007-01-31</swe:value>
    </swe:TypedValue>
  </swe:singleConstraint>
</swe:ConstrainedPhenomenon>
```

The diagram illustrates the XML structure of a constrained phenomenon. It highlights two specific elements: 'air temperature' (in a red box) and 'maximum' (in a green box). Red arrows point from these highlighted elements to a pink box labeled 'air temperature'. A green arrow points from the 'maximum' element to a green box labeled 'constrained by maximum operator'.



Climatological parameters?

- E.g. January 2007 maximum temperature

```
<swe:ConstrainedPhenomenon gml:id="Jan2007MaxTemp">
  <gml:identifier codeSpace="http://ndg.nerc.ac.uk">January 2007 maximum temperature</gml:identifier>
  <swe:base xlink:href="urn:ndg:cf:air_temperature"/>
  <swe:otherConstraint>maximum</swe:otherConstraint>
  <swe:singleConstraint>
    <swe:TypedValue>
      <swe:property codeSpace="http://ndg.nerc.ac.uk">time</swe:property>
      <swe:value>2007-01-01/2007-01-31</swe:value>
    </swe:TypedValue>
  </swe:singleConstraint>
</swe:ConstrainedPhenomenon>
```

air temperature

constrained by
maximum operator

over January
2007



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Climatological parameters?

- What about ‘climatological calendars’ ?
 - induce a ‘multi-component’ range
 - summer (DJF), autumn (MAM), winter (JJA), spring (SON)
 - Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec
 - 00:00, 01:00, 02:00, 03:00, ..., 21:00, 22:00, 23:00
 - how to model them?
 - TM_OrdinalReferenceSystem with set of component TM_OrdinalEras for climatological intervals
 - TM_OrdinalEras topologically connected



Geogle

temperature

ERA40

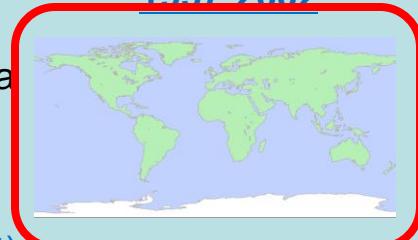
The ECMWF ERA-40 Re-Analysis Project consists of a number of climate datasets spanning the period mid-1957 to August 2002 using a consistent model. The data overlaps with the earlier ECMWF ERA-15 Re-analysis project (1979-1993). The broad objectives and partner organisations are presented in the ERA-40 background information.

badc.nerc.ac.uk

[air_potential_temperature](#)

[GridSeries \(xypt\)](#)

1957-2002



European Synoptic stations

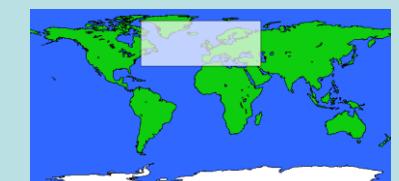
Hourly Surface data from 141 European stations for the period 1990-1996. Parameters include temperature, wind, rainfall, cloud cover etc.

badc.nerc.ac.uk

[air_temperature](#)

[PointSeries \(xyzt\)](#)

1990-1996



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Geogle

temperature

ERA40

The ECMWF ERA-40 Re-Analysis Project consists of a number of climate datasets spanning the period mid-1957 to August 2002 using a consistent methodology. The datasets include the ECMWF ERA-15 Re-analysis and a number of additional datasets from partner organisations. The datasets are available via the applicationProfile: WMS linkage: [right click/copy](#)

1957-2002



European Synoptic stations

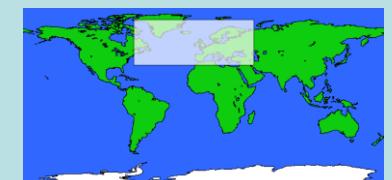
Hourly Surface data from 141 European stations for the period 1990-1996. Parameters include temperature, wind, rainfall, cloud cover etc.

badc.nerc.ac.uk

[air_temperature](#)

[PointSeries \(xyzt\)](#)

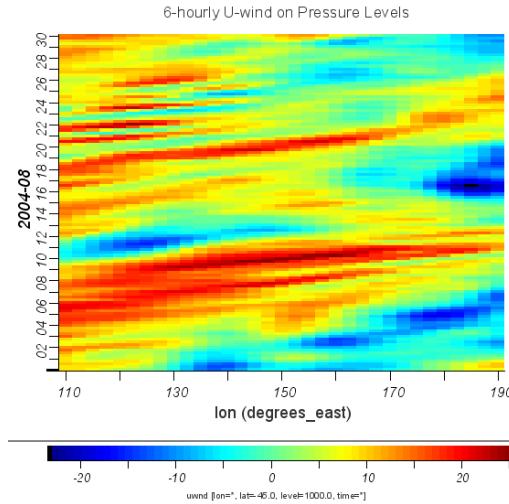
1990-1996



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View services

- Non-standard slices:
 - vertical
 - `BBOX=110,-45,190,-45,1000,1000&ELEVATION=100/950`
 - Hovmöller
 - `BBOX=110,-45,190,-45,1000,1000&TIME=2004-08-01/2004-08-31`



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3. GET MAP OPERATION

3.1. Get Map Request

3.1.1. Get Map request parameters

The Get Map request parameters listed in Table 5 shall be provided

INSPIRE IR

Table 5

Parameter	Description
Layers	List of layer names to be included in the map.
Styles	List of style to be used for each layer.
Coordinate Reference System	Coordinate Reference System of the map.
Bounding box	The 4 corner Coordinate of the two dimensional map for the selected Dimension pair and in the selected Coordinate Reference System
Image width	The map width in pixels
Image height	The map height in pixels
Image format	The output image format.
Language	language to be used for the response
Dimension Pair	The two dimensional axis to be used for the map For example a geographical dimension and time

Draft COMMISSION REGULATION implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the network services [link](#)



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View services

- INSPIRE draft IR

Our comments on v2:

Suggest adding the following text: “For three-dimensional and/or temporally-varying data, the view service shall support geometry selection over a vertical or temporal axis. NOTE: The WMS interface allows such geometry selection. E.g. a vertical slice can be generated using the ELEVATION parameter and a BBOX such as BBOX=X,y0,X,y1 (for a y-z slice); an x-t slice could be generated, for instance, using TIME=t1/t2 and BBOX=x0,Y,x1,Y.”

INSPIRE	Reference: D3.7.2 Draft Implementing Rule View Service v3.0
	2008-10-29 Page 9 of 14

2.3.3 Temporal data dimension

Following Article 8.2.d of the directive, the View Service shall address the temporal aspect of the data. Therefore for data themes with a temporal component the View Service shall allow visualizing the temporal dimension. Different ways of supporting are possible (using the time line to browse through temporal snapshots of 2-D representations of the data theme, allowing time slices along the x-t, y-t or the z-t axis and presenting the result as a 2-D representation...).

2.3.4 Other dimensions selection and display

For three-dimensional data, the View Service shall support selection over a third dimension axis.



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Summary

- Powerful new functionality becoming available through standards
 - metadata interoperability
 - data interoperability
 - common data model
 - common query model
 - standardised encodings
 - service interoperability





Questions?

- A. Woolf et. al., “Standards-based data interoperability for the climate sciences”, *Met. Apps.* **12**(1), 9-22 (2005)
- D Lowe et. al., “Standards Challenges in the Climate Sciences”, AGU Fall Meeting, San Diego, Dec 2006., *Eos Trans. AGU*, **87**(52), Fall Meet. Suppl., Abstract IN43C-0916
- A Woolf et. al., “Data integration with the Climate Science Modelling Language”, *Adv. in Geosci.* **8**(1), 83-90 (2006)
- K Millard et. al., “Developing feature types and related catalogues for the marine community: lessons from the MOTIIVE project”, *Int. J. Spatial Data Infrastructures Res.* **2**, 132-162
- A Woolf et. al., “Feature types as an integration bridge in the climate sciences”, AGU Fall Meeting, San Diego, December 2006, *Eos Trans. AGU*, **87**(52), Fall Meet. Suppl., Abstract IN53C-02