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# Powered by standards – new data tools for the climate sciences

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STFC Rutherford Appleton Lab, UK

EGU General Assmebly, Vienna, Splinter Session SPM23, 22-Apr-2009

Geogle

temperature

**ERA40**

**1957-2002**

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.

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ISO 19115 EX_Extent

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ISO 19115 MD_Keywords

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thesaurusName: **CF**
**definition**

**ISO 19115 EX_Extent**

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thesaurusName: **CF definition**

**ISO 19126 (“Feature concept dictionary and registers”)**
**ISO 19135 (“Procedures for item registration”)**

**O 19115 EX_Extent**

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Re-
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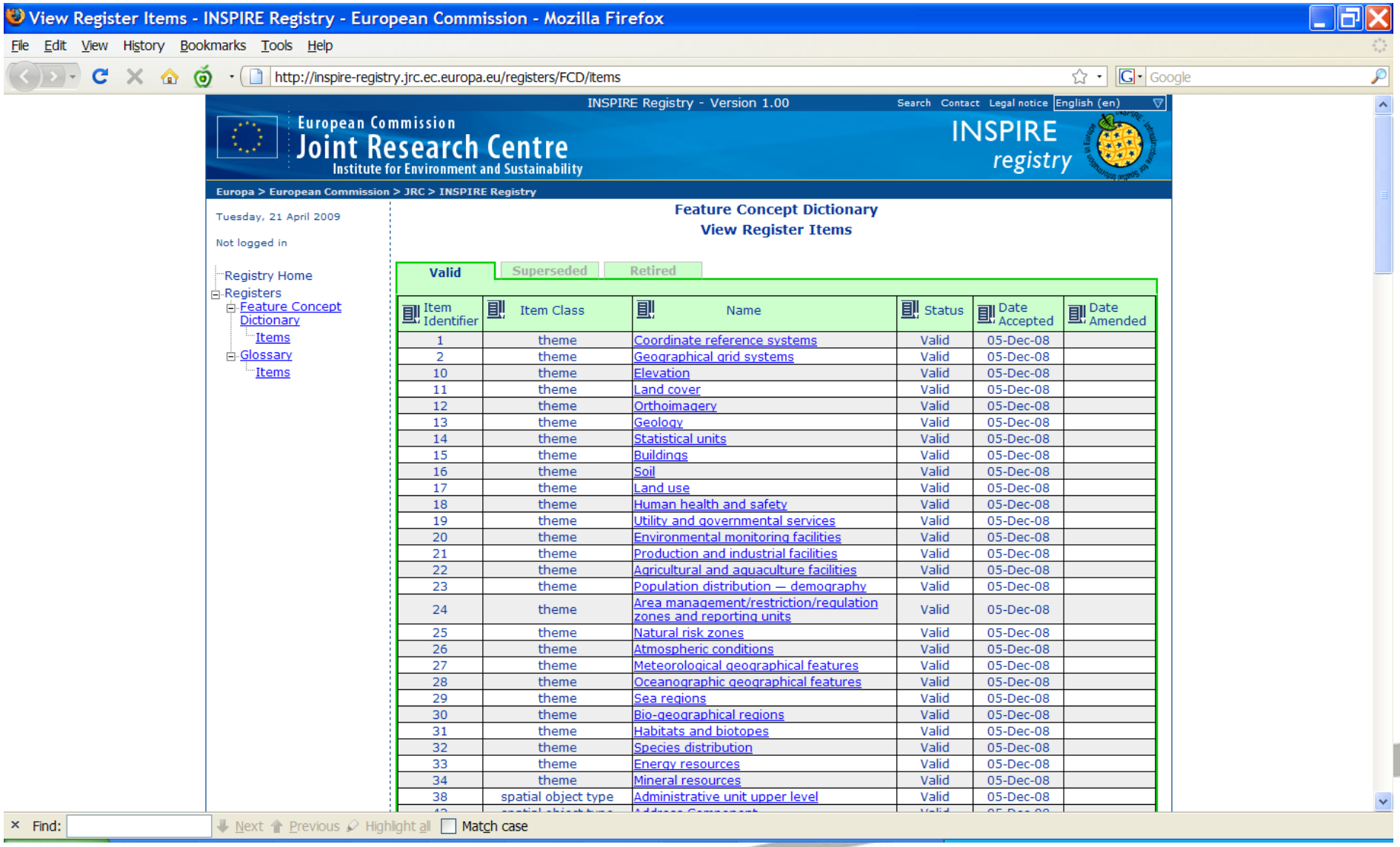


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badc.nerc.ac.uk air_potential_temperature GridSeries (xypt)

**ISO 19115 MD_ReferenceSystem**

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authority: **BADC**

**definition**

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temperature

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

authority: **BADC definition**

**ERA40**

The ECMWF ERA-4 … o climate datasets spa … u consistent model. Th … ECMWF ERA-15 Re-analysis project (1979-1993). The broad … tives and partner organisations are presented in the ERA-40 background information.

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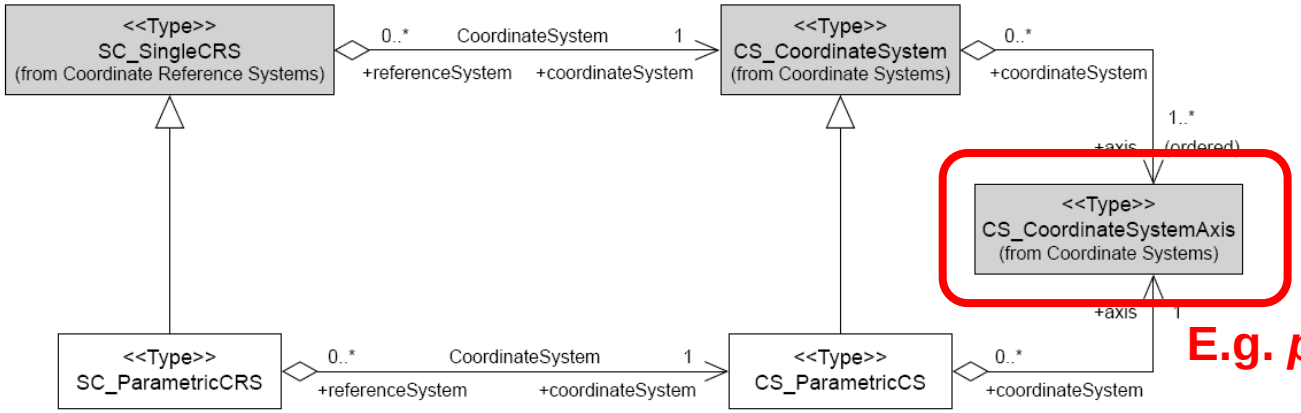
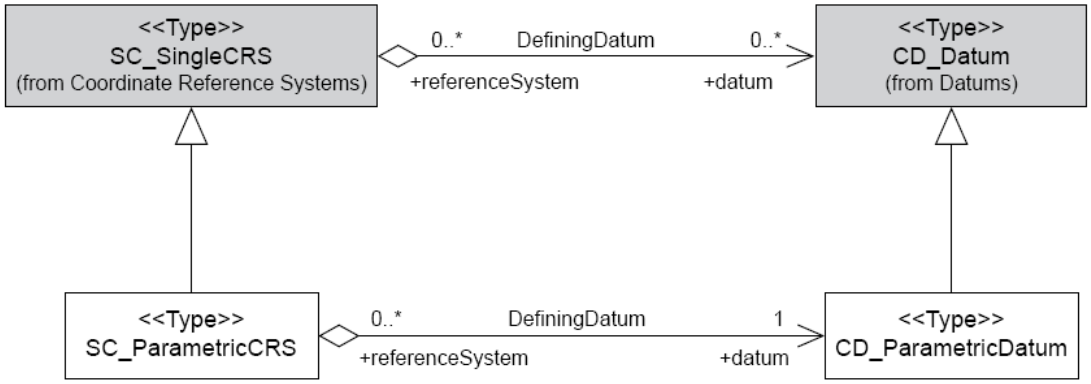
# ISO 19111-2

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




**E.g. *pressure***

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# 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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**ISO 19115 MD_ContentInformation**

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featureCatalogue: **CSML**

**featureType**

**ERA40** **1957-2002**

The ... of a number of clim... ugust 2002 using a con... ECMWF ERA-15 Re-analysis project (1979-1993). The ... objectives and partner organisations are presented in the ERA-40 ba... ground information.

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**ISO 19110 (“Methodology for feature cataloguing”)**

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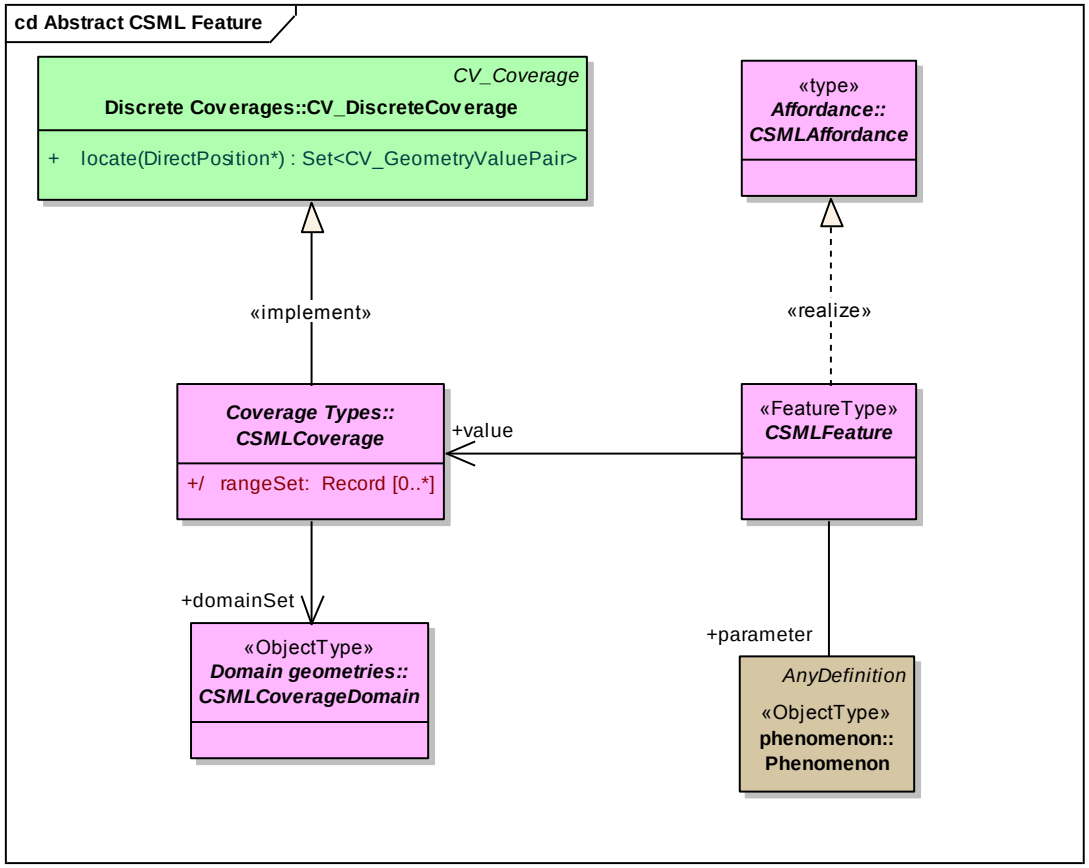
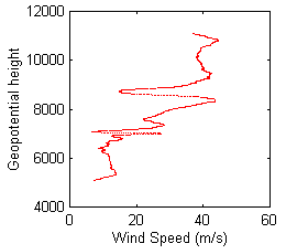
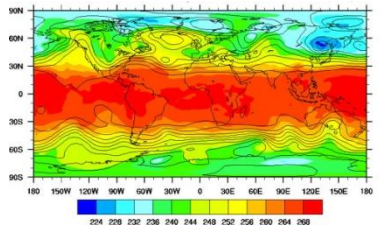
# Climate Science Modelling Language (CSML)



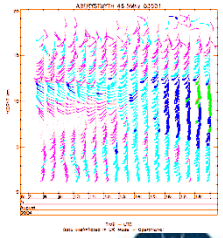

**ProfileFeature**



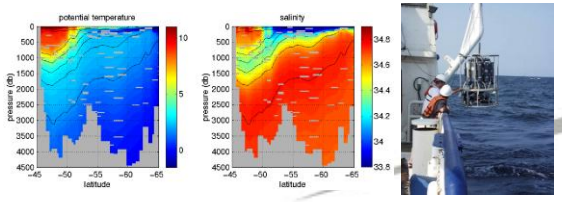

**GridFeature**



**ProfileSeriesFeature**

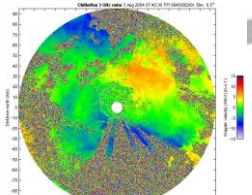


**RaggedSectionFeature**






**ScanningRadarFeature**



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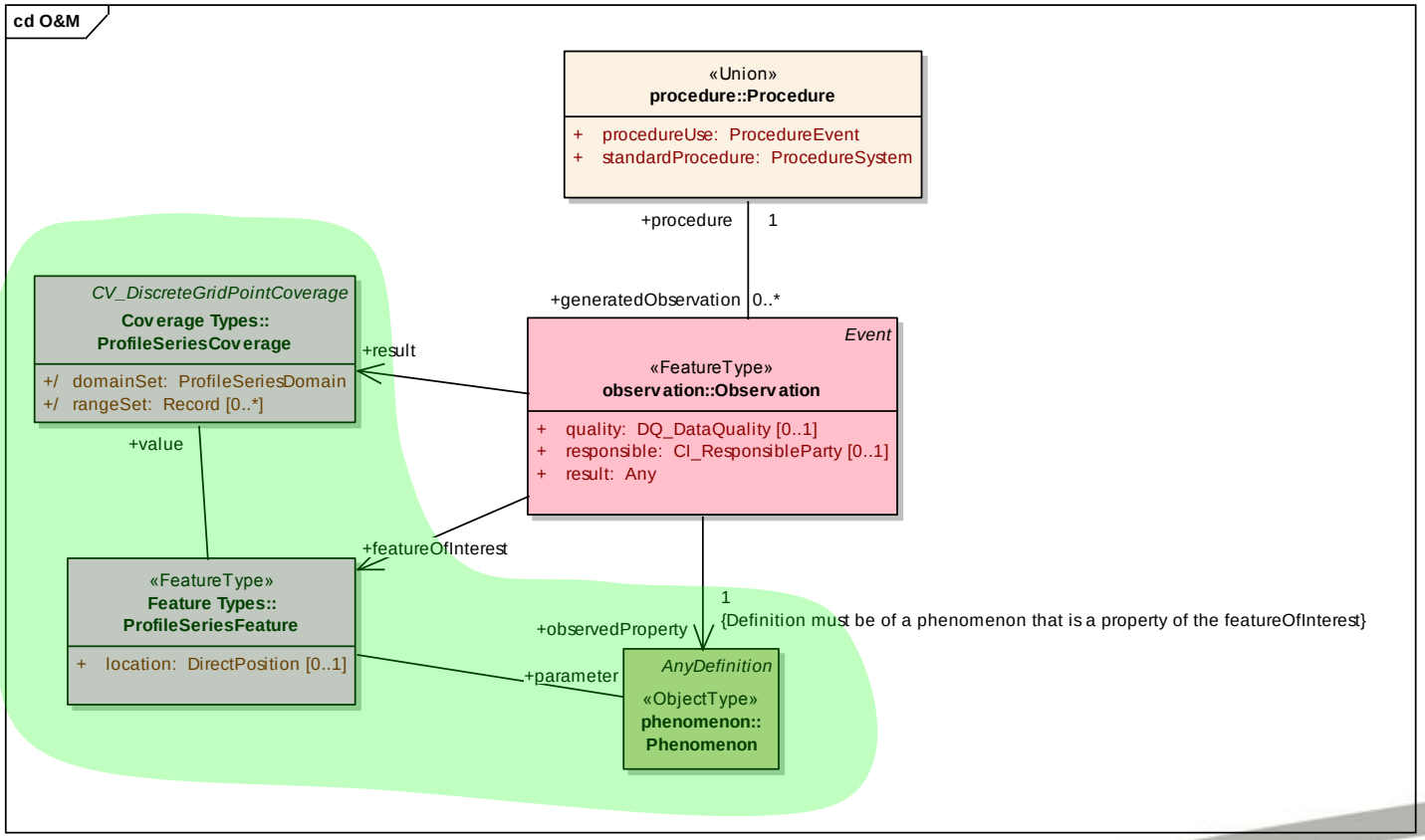


- O&M 'Sampling Features' informed by CSML
- CSML v3 will specialise SF
- SF-coverage pattern documented in ISO 19156?

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**

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# 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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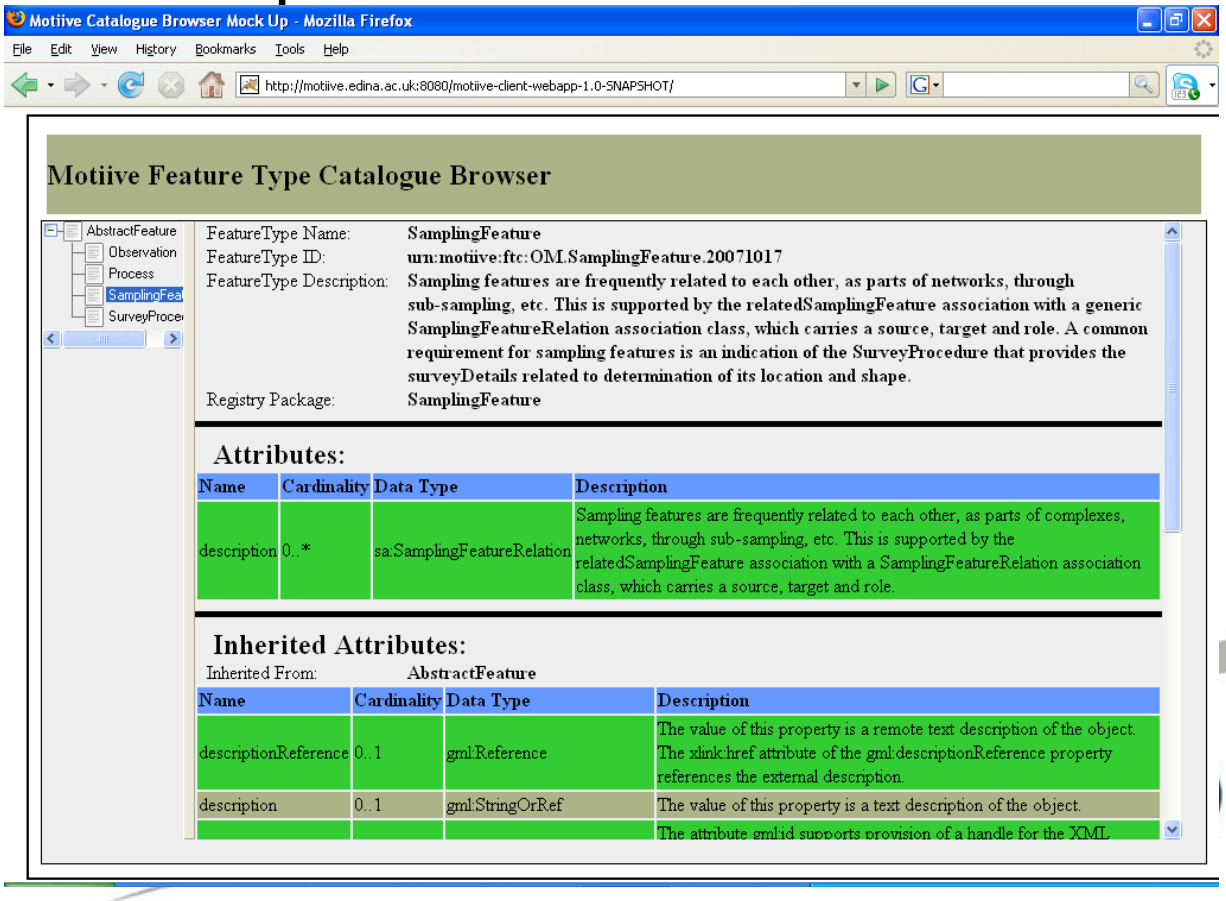


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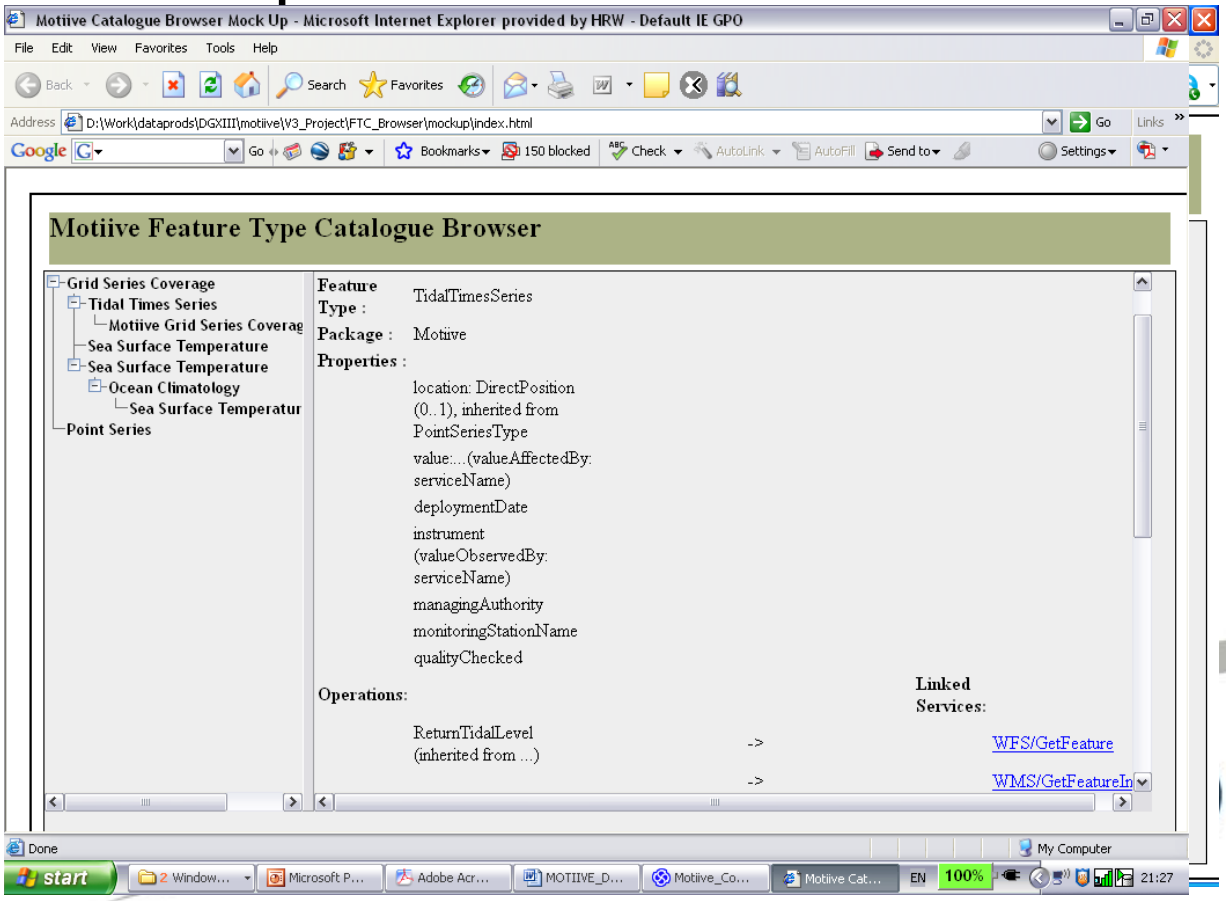


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badc.r[illegible] **GridSeries** (**xypt**)

applicationProfile: **WFS**
linkage: ***right click/copy***

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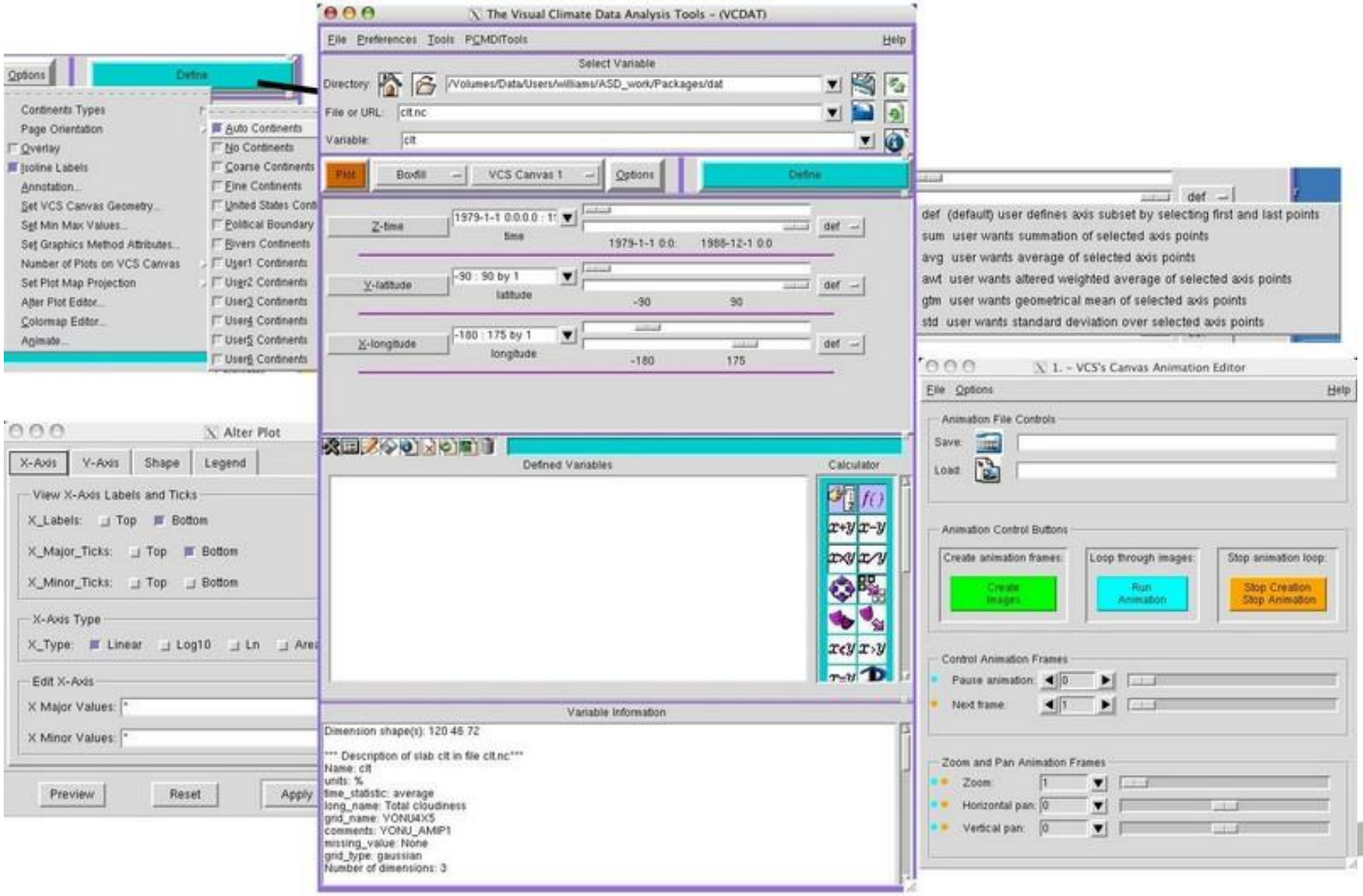
# Open tool xxx




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

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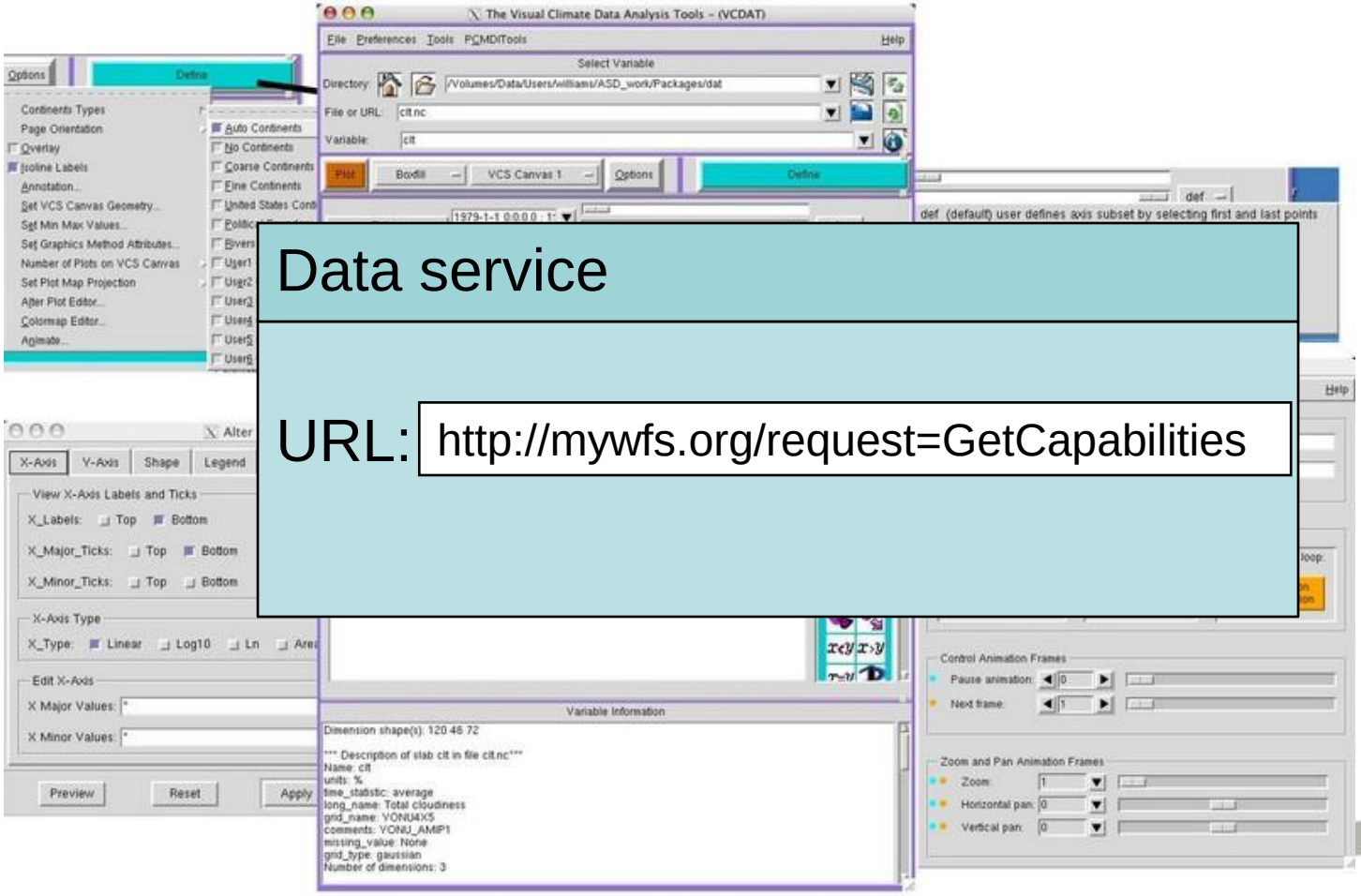
# Open tool xxx

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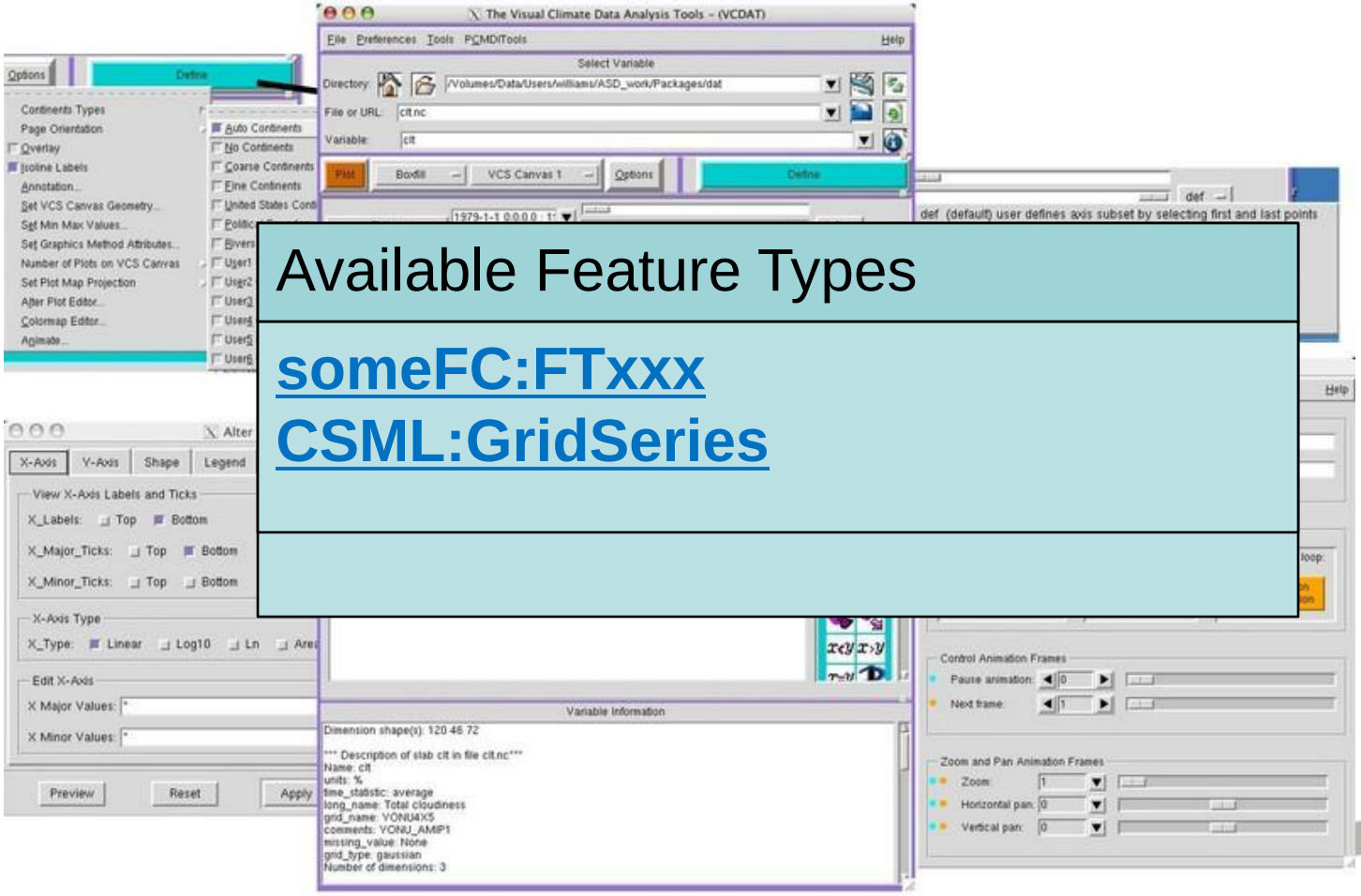


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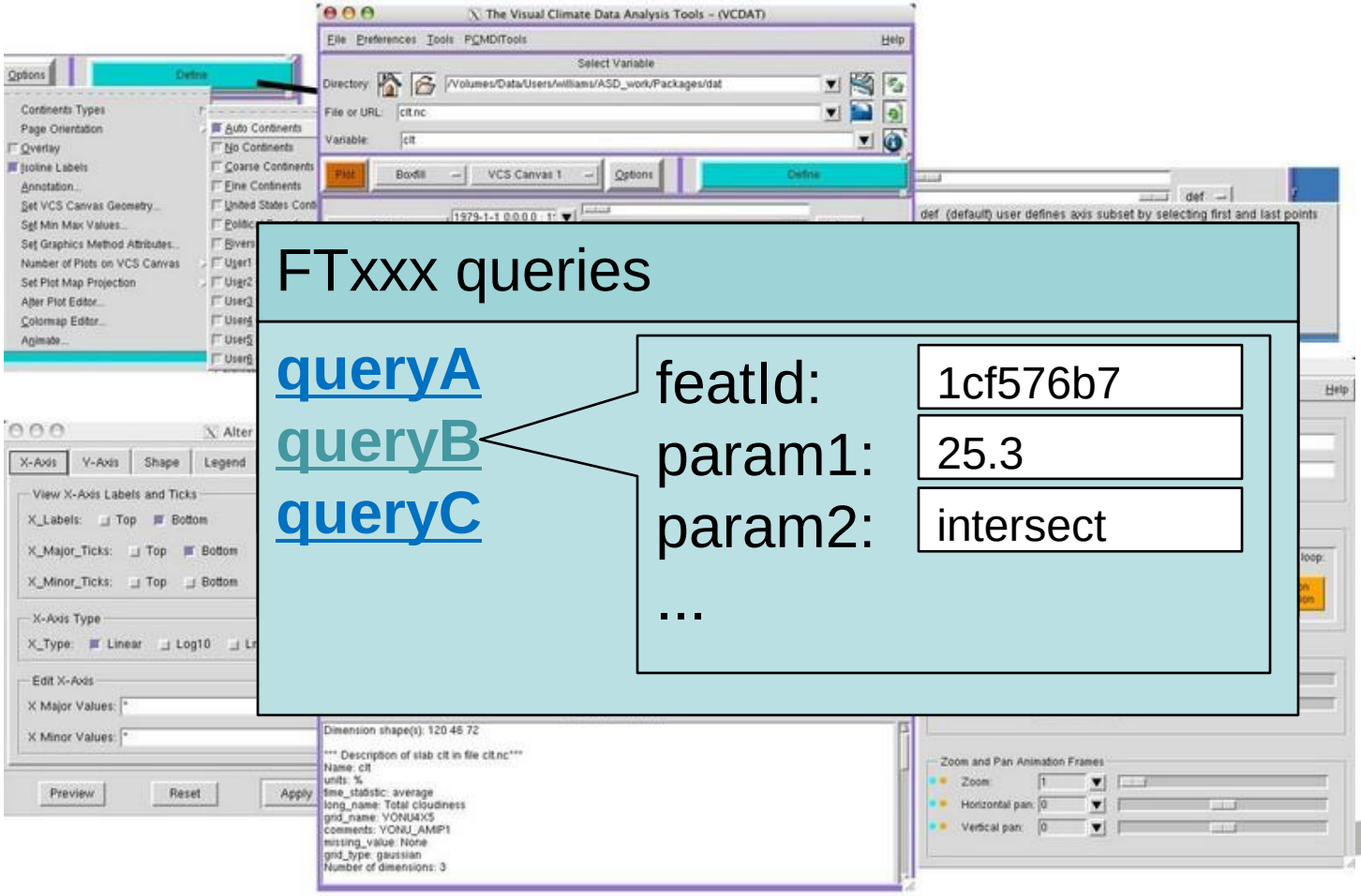


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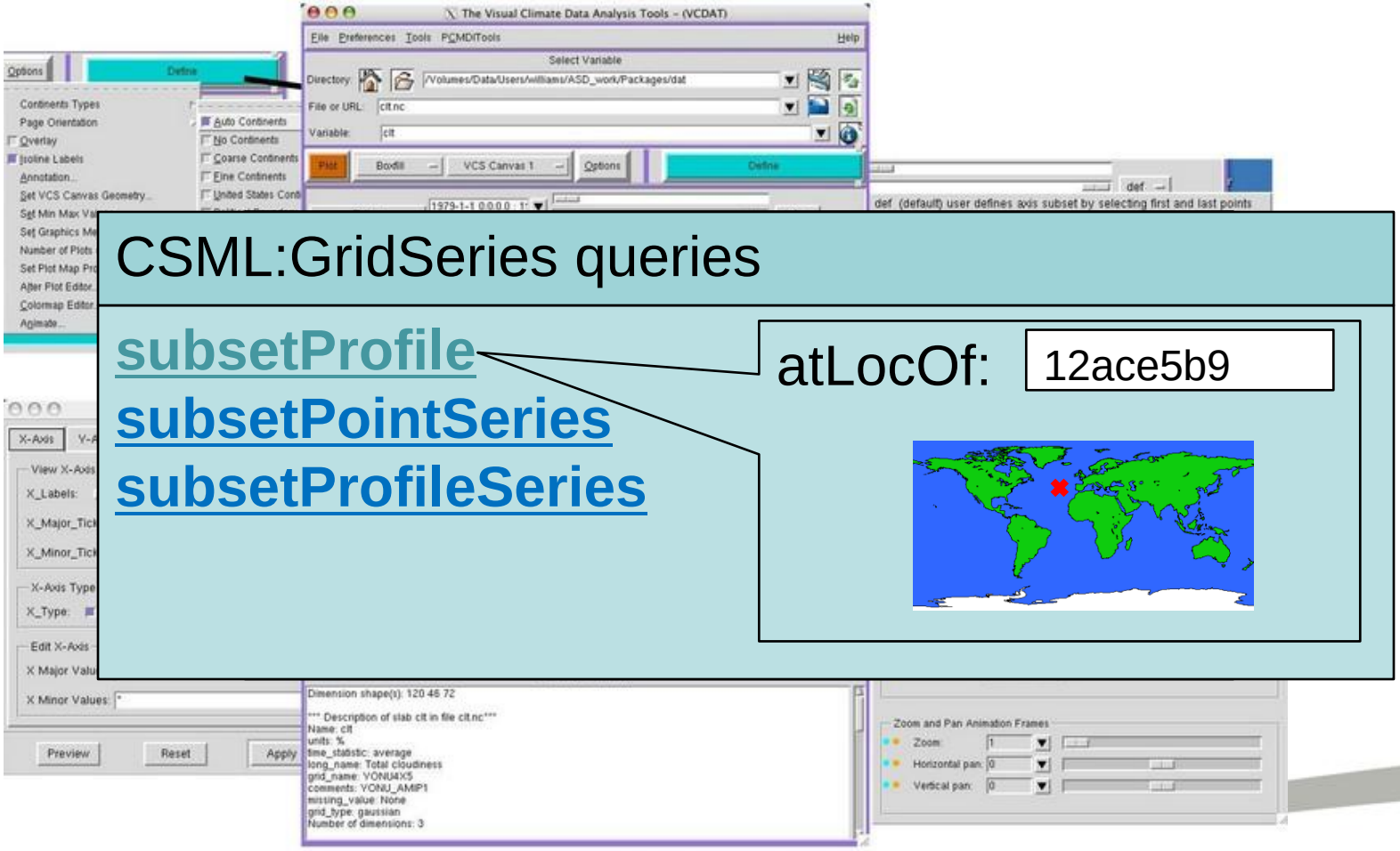


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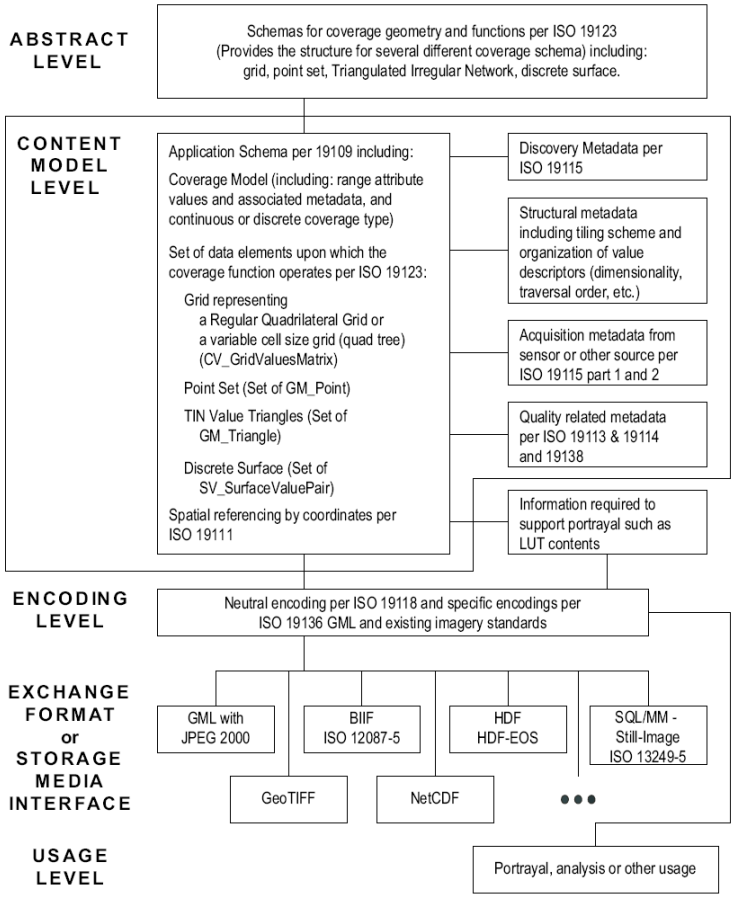
# WFS - encoding

- 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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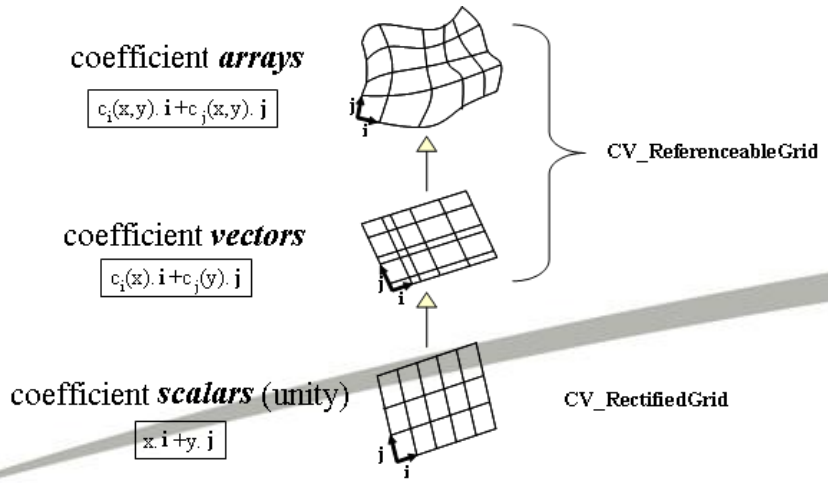
# Encoding

- 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

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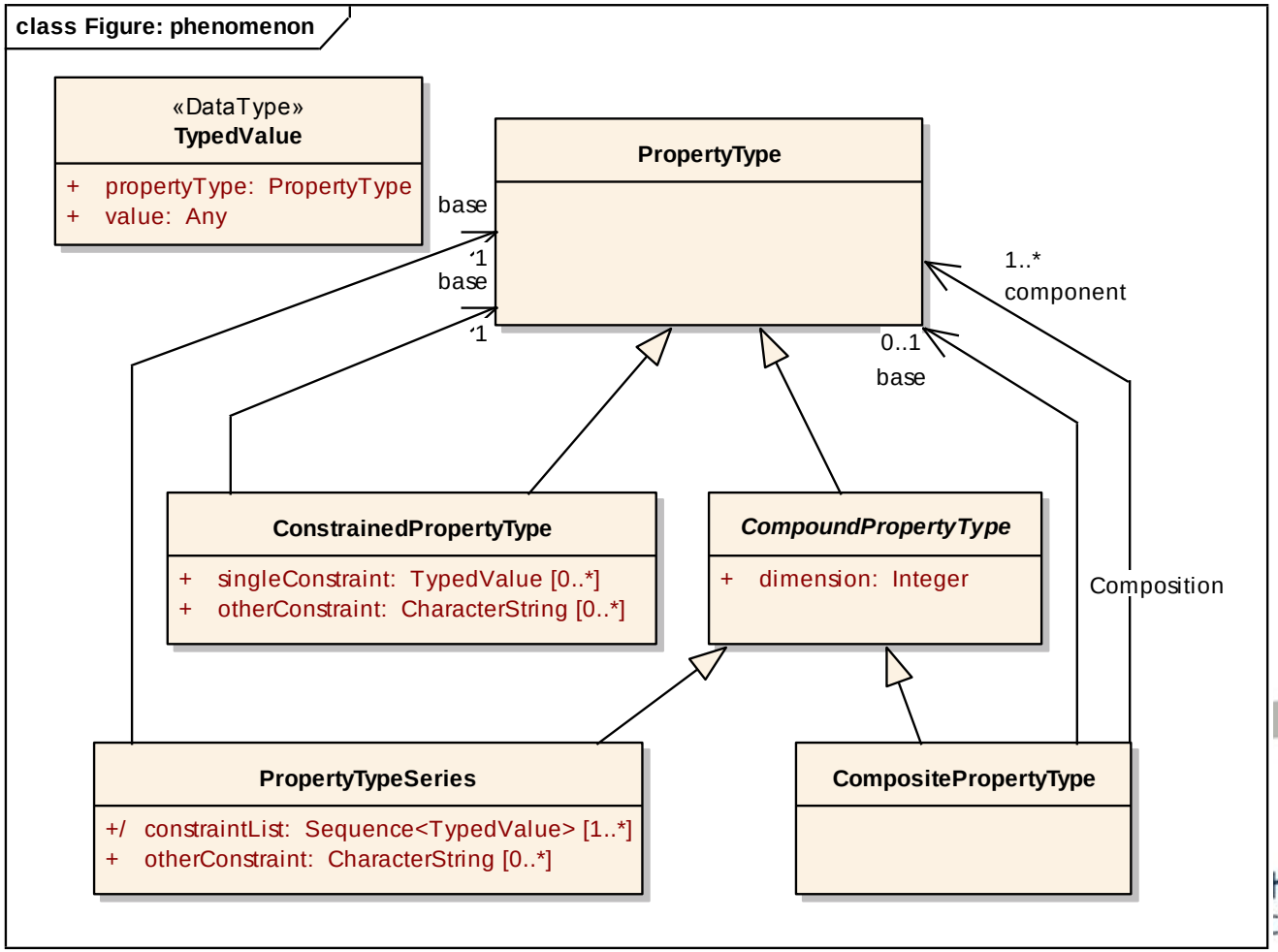
# Climatological parameters?

- SWE Common ‘Property model’



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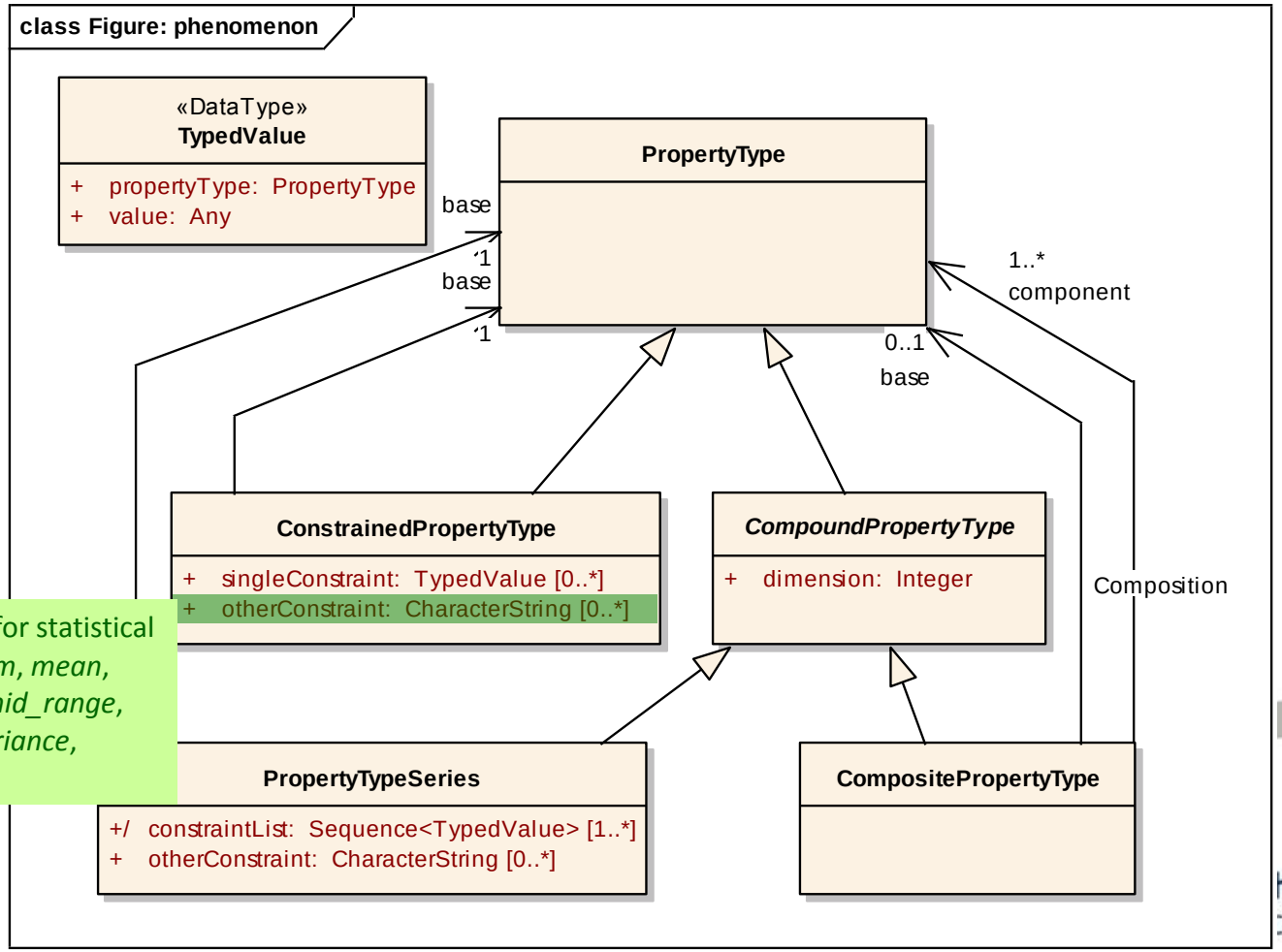


`otherConstraint` for statistical operator (e.g. *point*, *sum*, *mean*, *maximum*, *minimum*, *mid_range*, *standard_deviation*, *variance*, *mode*, and *median*)

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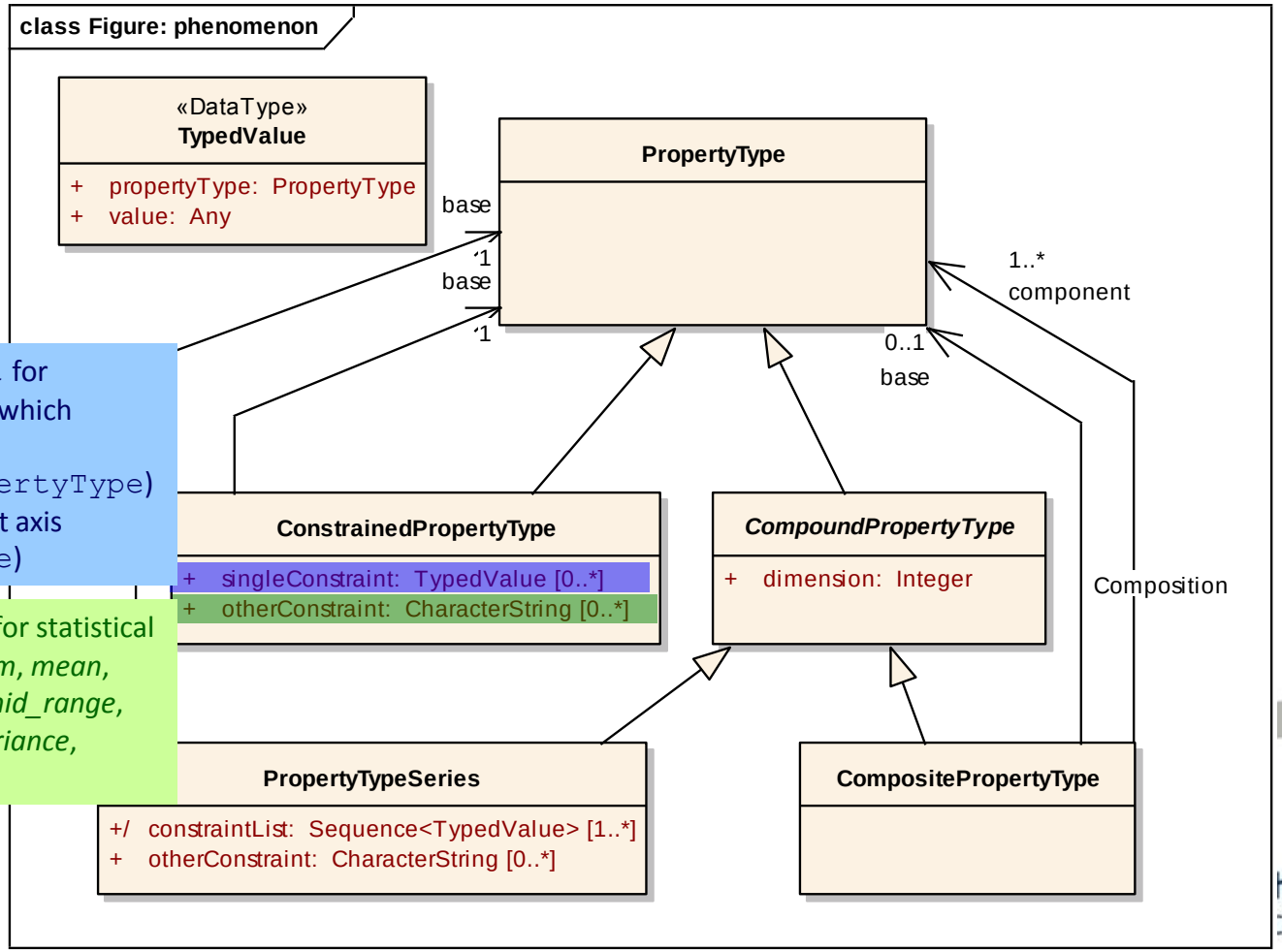


`singleConstraint` for coverage *CRS axis* over which operator is applied (`TypedValue.propertyType`), and *co-domain* for that axis (`TypedValue.value`)

`otherConstraint` for statistical operator (e.g. *point*, *sum*, *mean*, *maximum*, *minimum*, *mid_range*, *standard_deviation*, *variance*, *mode*, and *median*)

# 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>
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**air temperature**

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**air temperature**

constrained by **maximum** operator

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    </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


http://portal.opengeospatial.org/files/?artifact_id=25716

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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**)

**European Synoptic stations**

1990-1996

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**)

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Geogle

temperature

**ERA40** 1957-2002

The ECMWF ERA-40 Re-Analysis Project consists of a number of climate datasets spanning the period mid-1957 to August 2002 using a consiste… ECMWF ERA-15 Re-ana… partner organis… nd information.

badc.nerc.ac… GridSeries (xypt)

applicationProfile: **WMS**

linkage: ***right click/copy***

**European Synoptic stations** 1990-1996

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)

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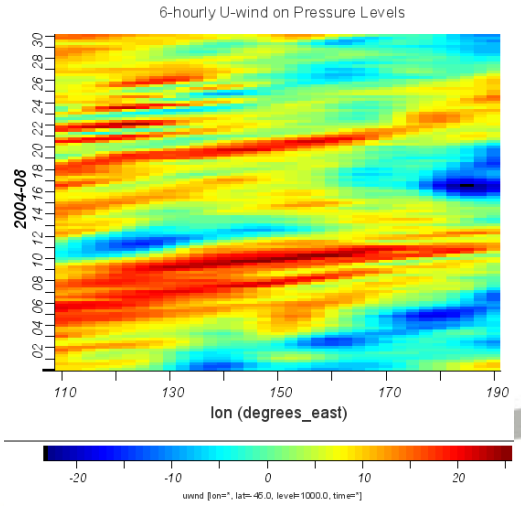
# View services

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

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# View services

**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

**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<br><br>For example a geographical dimension and time |

**INSPIRE IR**

*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."*



### 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

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# 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