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CSML 3: Climate Science Modelling Language - MetOcean DWG

76th OGC Technical Committee

Bonn, Germany

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CSML: Background

- Climate Science Modelling Language.
  - A set of GML-based 'Feature Types' to describe the types of geometric data objects used in Climate Sciences – Grids, profiles, point obs.
  - Originally Developed as part of the NERC DataGrid Project.
  - Jointly with British Atmospheric and Oceanographic Data Centres and others.
  - Developed in parallel with some ideas in O&M (e.g. sampling features).
  - Now in 3rd iteration as a profile of O&M – *a set of specialised Observation classes*.
  - Draft OGC Best Practice Paper (Pending docs: 11-021)

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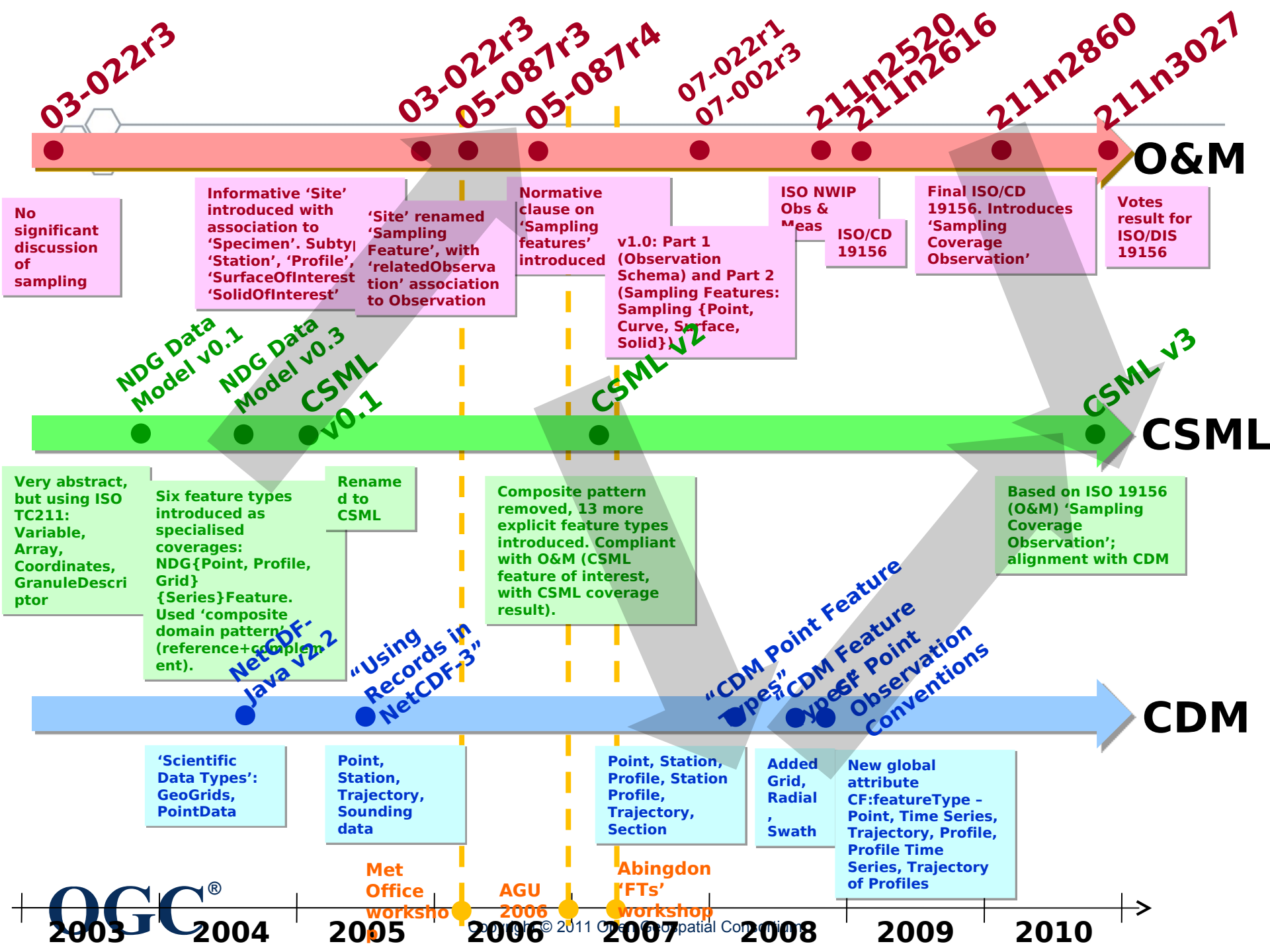

CSML = Reusable features.

Set of Feature Types for the Climate Sciences developed at STFC/BADC

Weakly typed: e.g. Profiles, PointSeries, GridSeries.
Not:
"OceanSalinityDepthProfile"

UML model
GML
Application
Schema

csml:ProfileFeature
(e.g. CTD cast OR RadioSonde)

+ location
+ time
+ domain (*heights, pressure levels*)
+ rangeset (*measured values*)
+ phenomena (*salinity, temperature*)

+ operationExtractProfile(...)
+ operationExtractPoint(...)

Oceanography ⟷ **Atmospheric Science**

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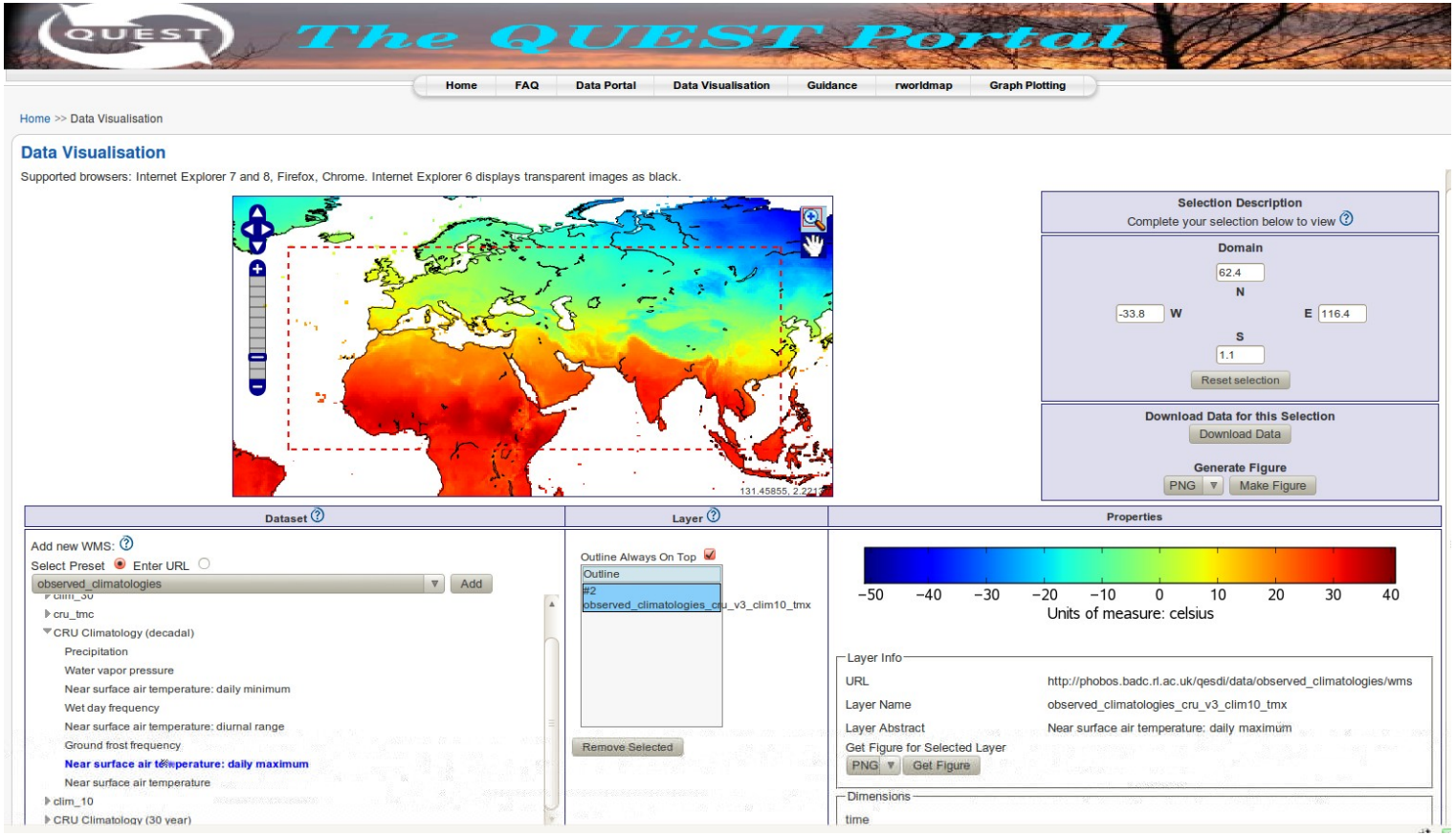
CSML 2 implementations



*** Operational data portal at Centre for Environmental Archive.**

- **Reads CSML XML files and associated NetCDF at the backend**
- **Data Scientists can add datasets by using 'csmlscan' tool to create CSML Feature Types**

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Aims of CSML 3

- To provide a core, re-usable, data model for meteorology and oceanography (and more..?) which:
  - Reflects existing community practice – 'grids, points etc'
  - Is based on ISO 19156 (CSML 2 was only *aligned* with O&M*)*
  - Is aligned with binary CF NetCDF and associated CDM etc.
  - Has a primary implementation as a GML Application Schema (but not exclusive).
  - Extend to support requirements from existing CSML users – WXXM (Aviation)
  - Provide a candiate core model for MetOcean DWG
  - Provide candidate model for INSPIRE Ocean and Atmos/Met themes.

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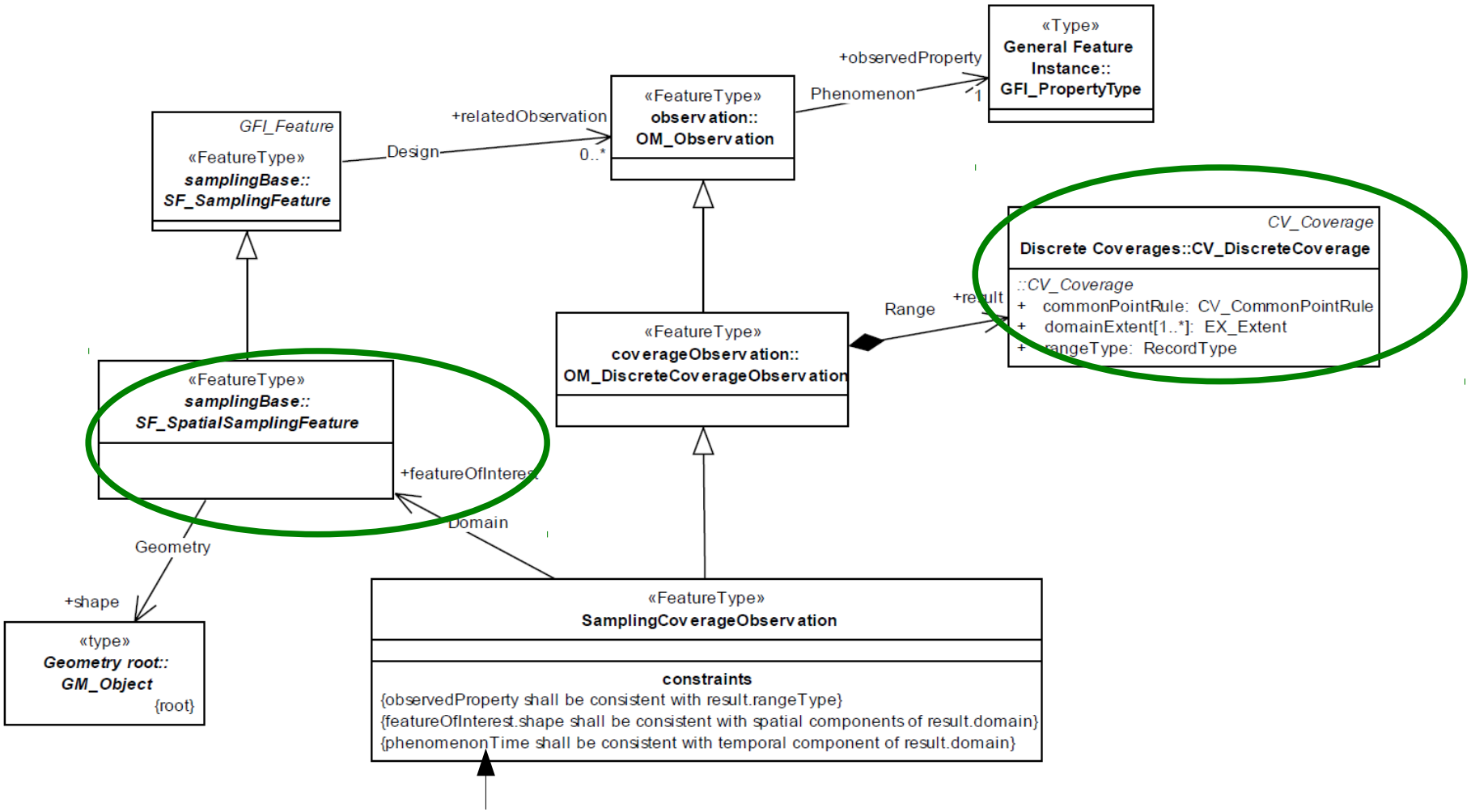
19156 Sampling Coverage Obs. (informative)



CSML 3 implements and specialises SamplingCoverageObservation.

19156 Annex D – CSML-like pattern.

ISO/DIS 19156

Table D.1 — Examples of coverage results for different sampling regimes

Observation class	Example	Spatial sampling feature	Coverage result
Profile	Expendable bathythermograph observation of seawater temperature	SF_SamplingCurve	• one-dimensional grid at fixed (x,y,t) within four-dimensional (x-y-z-t) CRS • grid axis aligned with CRS z-axis
ProfileTimeSeries	Radar wind profiler measurement	SF_SamplingCurve	• two-dimensional grid at fixed (x,y) within four-dimensional (x,y,z,t) CRS • grid axes aligned with CRS z- and t-axes
Trajectory	Pollutant concentration from mobile air quality sensor	SF_SamplingCurve	• one-dimensional grid within four-dimensional (x-y-z-t) CRS
Section	Vertical profiles of water current measurements taken by an acoustic doppler current profiler towed along a ship's track	SF_SamplingSurface	• two-dimensional grid within four-dimensional (x-y-z-t) CRS • one grid axis aligned with CRS z-axis
GridTimeSeries	Time-series of 3-D velocity field from a finite-difference seismic model	SF_SamplingSolid	• four-dimensional grid within four-dimensional (x-y-z-t) CRS

CSML 3 implements specialised observation classes.

Constraints.

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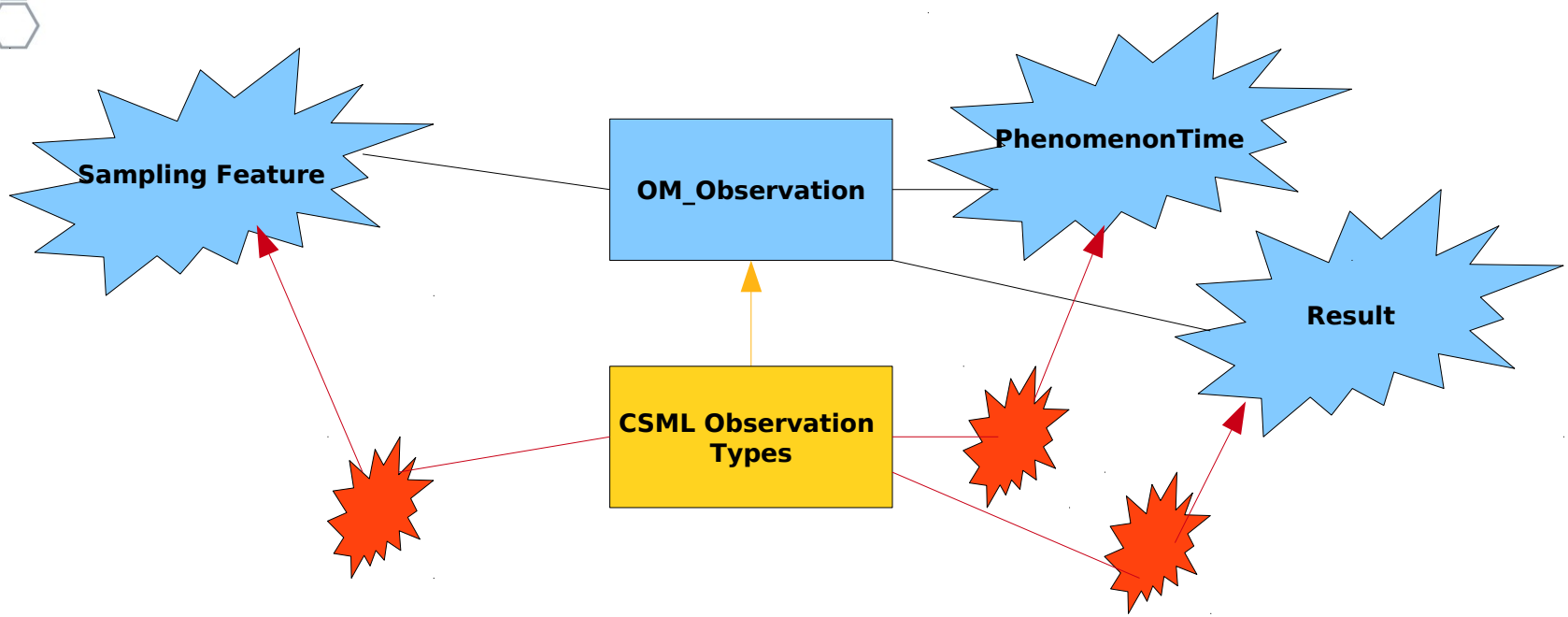
Application schema + Schematron to profile general O&M model



Different CSML Observation classes (point, grid, profile etc) have different constraints:

- **Type of 'result' (different coverage /dimensions)**
- **Type of 'phenomenonTime': TM_Period/TM_Instant**
- **Type of 'samplingFeature': SF_SamplingPoint, SF_SamplingCurve etc**

Classes: GML Application Schema
Constraints: Schematron

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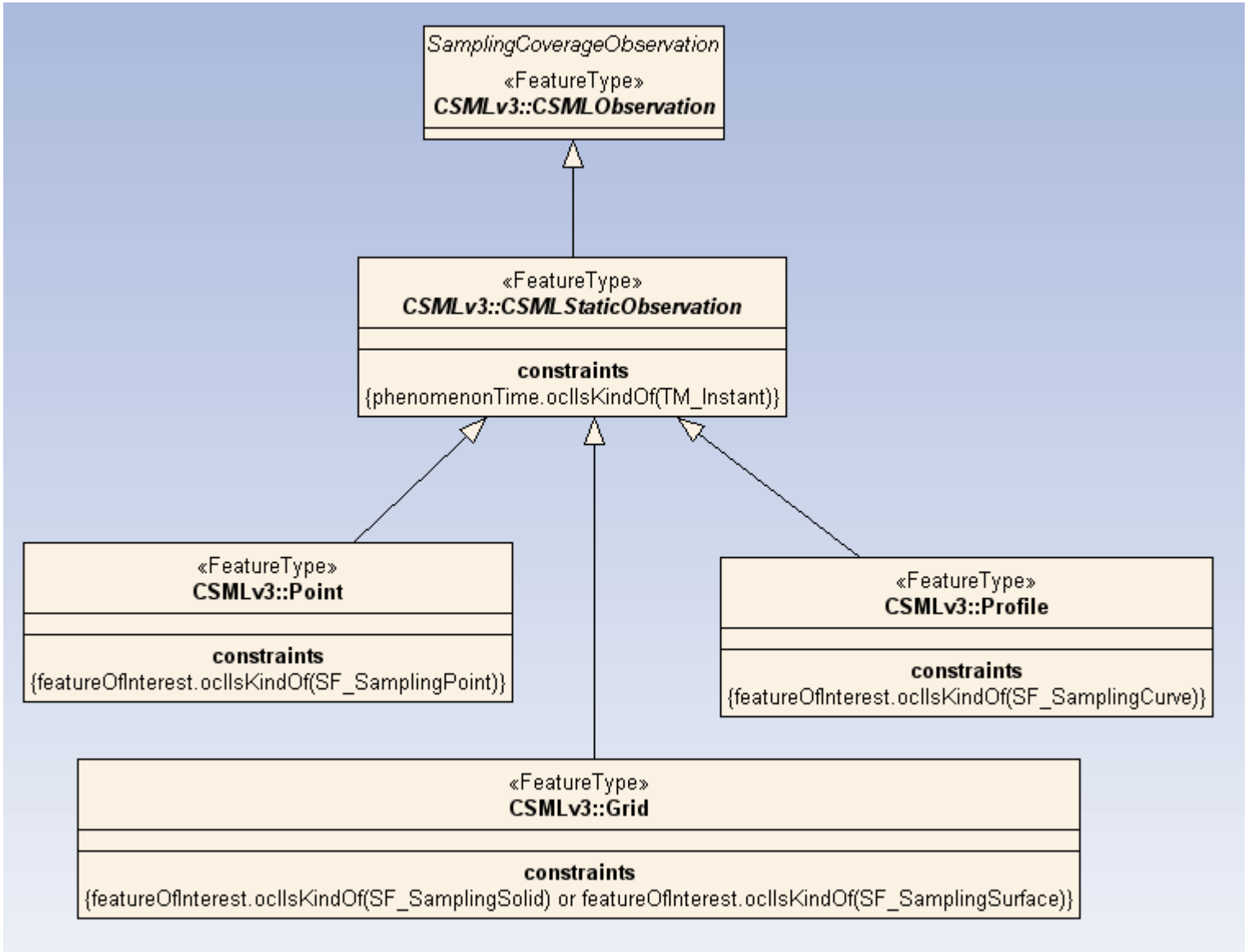
CSML 3: 'Static' Observation types

Constraints On :

Phenomenon Time
Sampling Feature
Result



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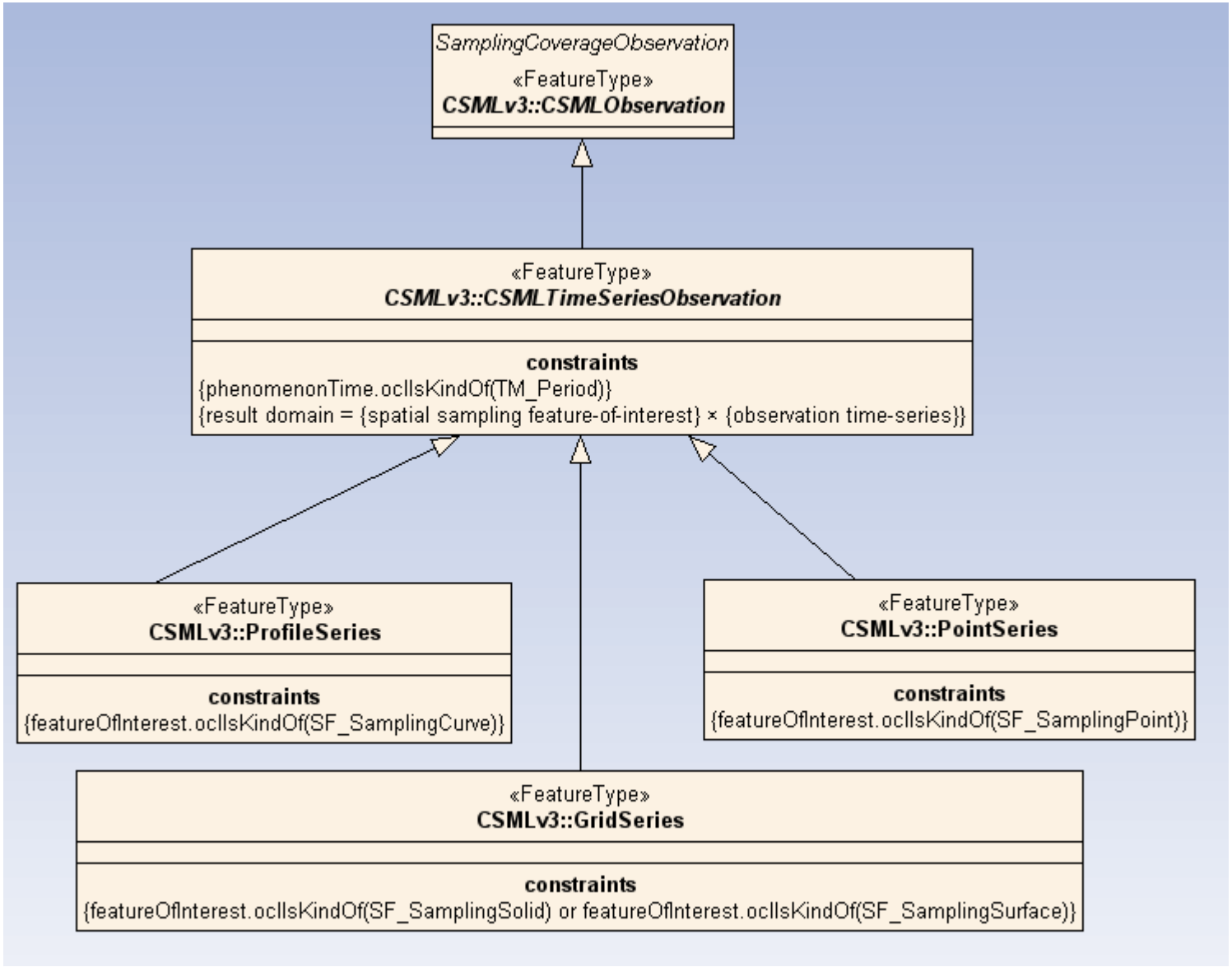
'Time Series' Observation types



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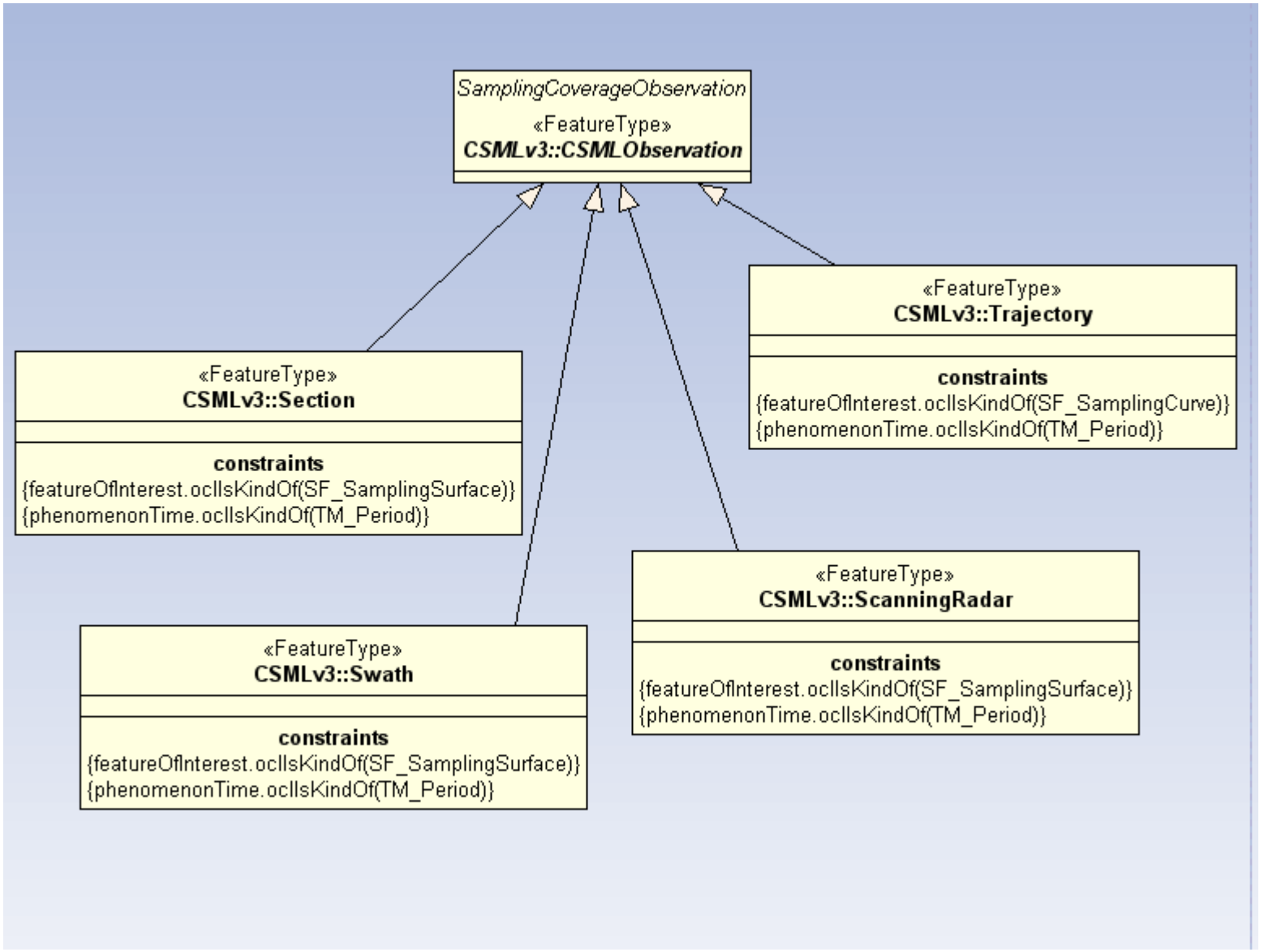
Other Observation types



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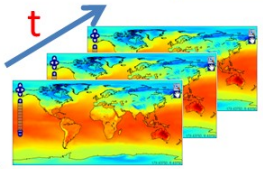
CSML 3 Feature Types – Unidata CDM

CSML	CF/CDM
Point	Point
PointSeries	StationTimeSeries
Trajectory	Trajectory
Profile	Profile
ProfileSeries	StationProfile

CSML	CF/CDM
Swath	Swath
ScanningRadar	StationaryRadialSweep
Section	Collection of Profiles
Grid	Grid (single time)
GridSeries	Grid

GridSeries		
based on	*SF_SamplingSolid*	
phenomenonTime	*TM_Period*	
coverage result	CV_DiscreteGridPointCoverage	
	grid dimension	*four*
	external CRS	*four (x-y-z-t)*
	alignment	-

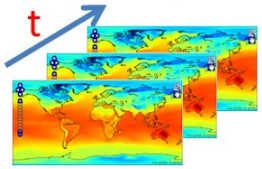


Time-series of gridded parameter fields. E.g. Numerical weather prediction model

ProfileSeries		
based on	*SF_SamplingCurve*	
phenomenonTime	*TM_Period*	
coverage result	CV_DiscreteGridPointCoverage	
	grid dimension	*two*
	external CRS	*four (x-y-z-t)*
	alignment	*z-, t- axes*

Time-series of profiles on fixed vertical levels at a fixed location. E.g. vertical radar timeseries

GridSeries		
based on	*SF_SamplingSolid*	
phenomenonTime	*TM_Period*	
coverage result	CV_DiscreteGridPointCoverage	
	grid dimension	*four*
	external CRS	*four (x-y-z-t)*
	alignment	-



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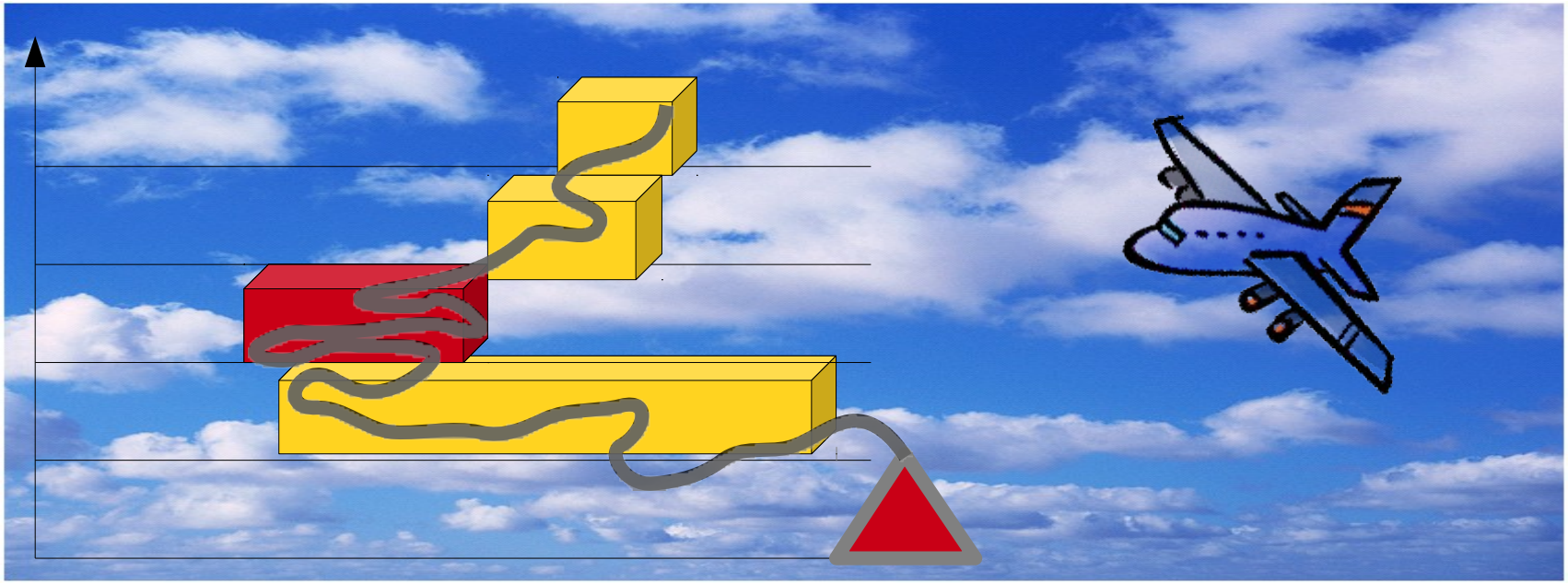
CSML 3: New requirements.

- Exeter 2010 3rd workshop on OGC/GIS in Meterology
- Requirement for 'volume' and 'surface' coverage-based feature types from Aviation (WXXM) community.
  - e.g. Regions with dangerous concentration of volcanic ash, mapped onto flight levels.



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Current Status of CSML 3

- Public SVN repository
  - http://proj.badc.rl.ac.uk/svn/csml/CSML3
    - UML
    - Auto-generated XML Schemas
- OGC Draft Best Practice Paper (Woolf, Lowe)
    - 11-021 CSML: Sampling Coverage Observations for the Met/Ocean Domain. *Please read and comment.*
    - Currently all coverage types use ReferenceableGrid – should simplify for simple types – e.g point/pointseries (as in CSML 2)
- New Feature types:
  - To do – specifically WXXM requirements
- Schematron:
  - To do next!

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