Conceptual Modelling within The OGC MetOcean Domain Working Group

21st EGOWS Mtg, 1st -4th June 2010, ECMWF

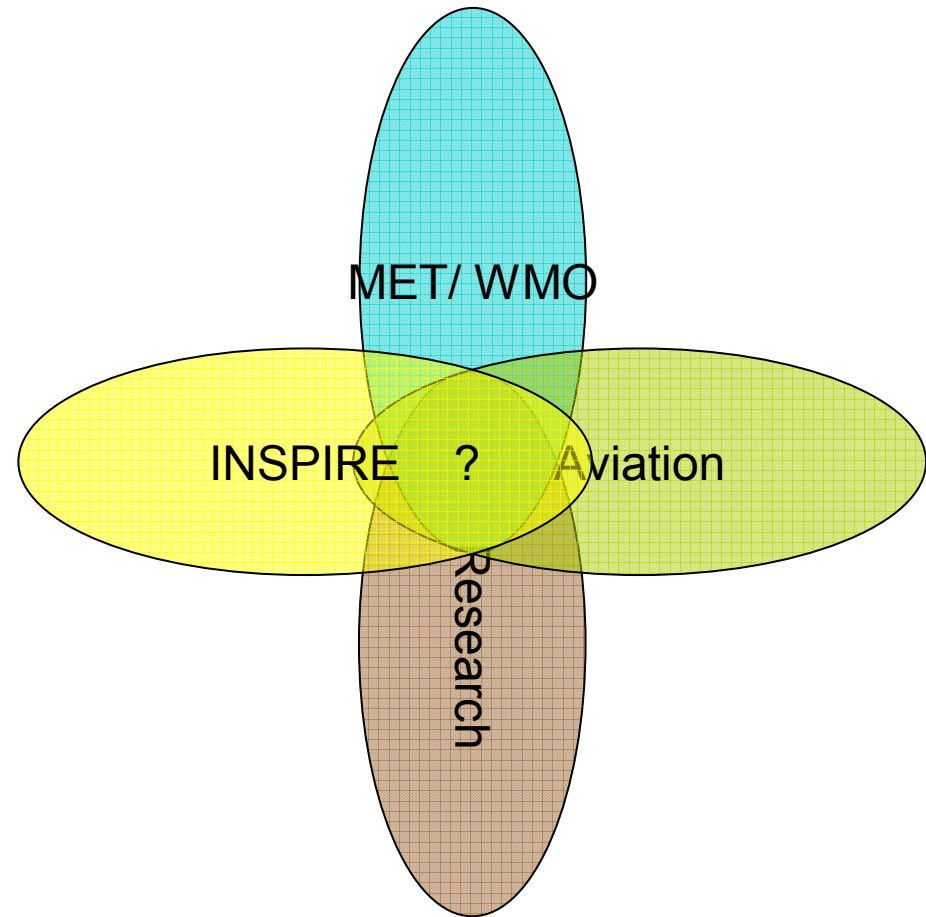Dominic Lowe, dominiclowe@stfc.ac.uk

British Atmospheric Data Centre, http://badc.nerc.ac.uk
Science & Technology Faclities Council, http://www.scitech.ac.uk

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OGC MetOcean Conceptual Modelling Working Group

Membership includes representatives from some significant initiatives, groups, with some common interest.

- OGC is a 'meeting point'

- Establishing a common Universe of Discourse?

- Leading to a common core conceptual model?

- Liason with external initiatives

MET/ WMO

INSPIRE   ?   Aviation

Research

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Conceptual Modelling group - Active participants

- British Atmospheric Data Centre, UK
- Met Office, UK
- Meteo France
- Met No, Norway
- NCAR (WXXM/AIXM), USA
- NOAA, USA
- Science & Technology Facilities Council, UK
- Unidata, USA

- **More input welcome, please join us.**
  https://lists.opengeospatial.org/mailman/listinfo/meteo.dwg

- **Fortnightly telecons and email discussion**

What is (the point of) Conceptual Modelling?

- Conceptual modelling is about modelling *'concepts'* within a *'Universe of Discourse'*

- In the MetOcean universe of discourse, example concepts might be: Fronts, Forecasts, Grids, Surface Obs, Currents..

- The modelling process is about formalising these concepts so that a community has a *well-documented, shared, stable and implementation-neutral model* that can be a basis for future applications and interoperability. It is the starting point!

- Within the **ISO TC211** framework for Geographic Information, this process really means defining 'Feature Types' - along with their *attributes, operations and relations* to other feature types.

- If we can agree upon and formalise all (or some..) of our concepts we develop a strong basis for implementations that support **interoperability and reuse**.

The ISO TC211 standards framework + OGC

- ISO TC211 suite of standards provide an extensive conceptual model for geographic information and services.

- OGC is developing implementations of many of these concepts
  - core geographic information objects (GML)
  - services (WMS, WFS, WCS etc)
  - catalogues (CSW)
  - ...

- TC211 also provides a model (and guidance) for developing domain specific conceptual models:
  - ISO 19101 – Geographic Information: Reference Model
  - ISO 19109 – Geographic Information: Rules for Application Schema
  - ISO 19110 – Geographic Information: Methodology for Feature Cataloguing

- It states that Conceptual Models should be formalised in UML

- Implementations - (GML Application schemas, documentation, code etc) are all derived from the model – "Model Driven Approach".

Feature Cataloguing - Methodology
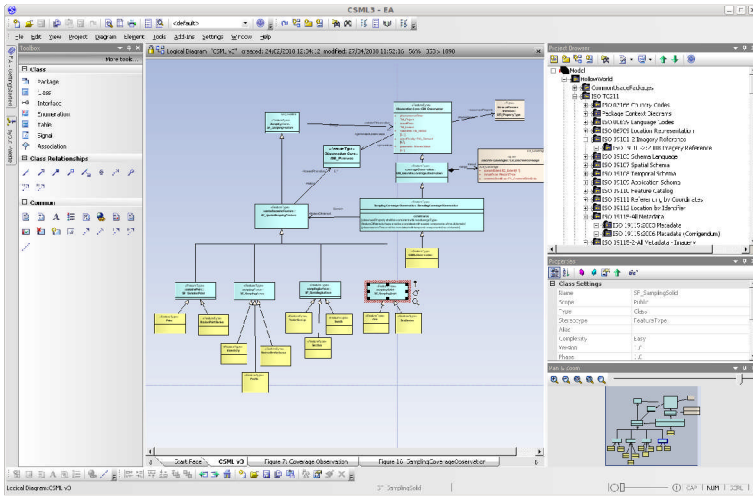
INSPIRE Methodology

Figure 4 — From reality to geographic data
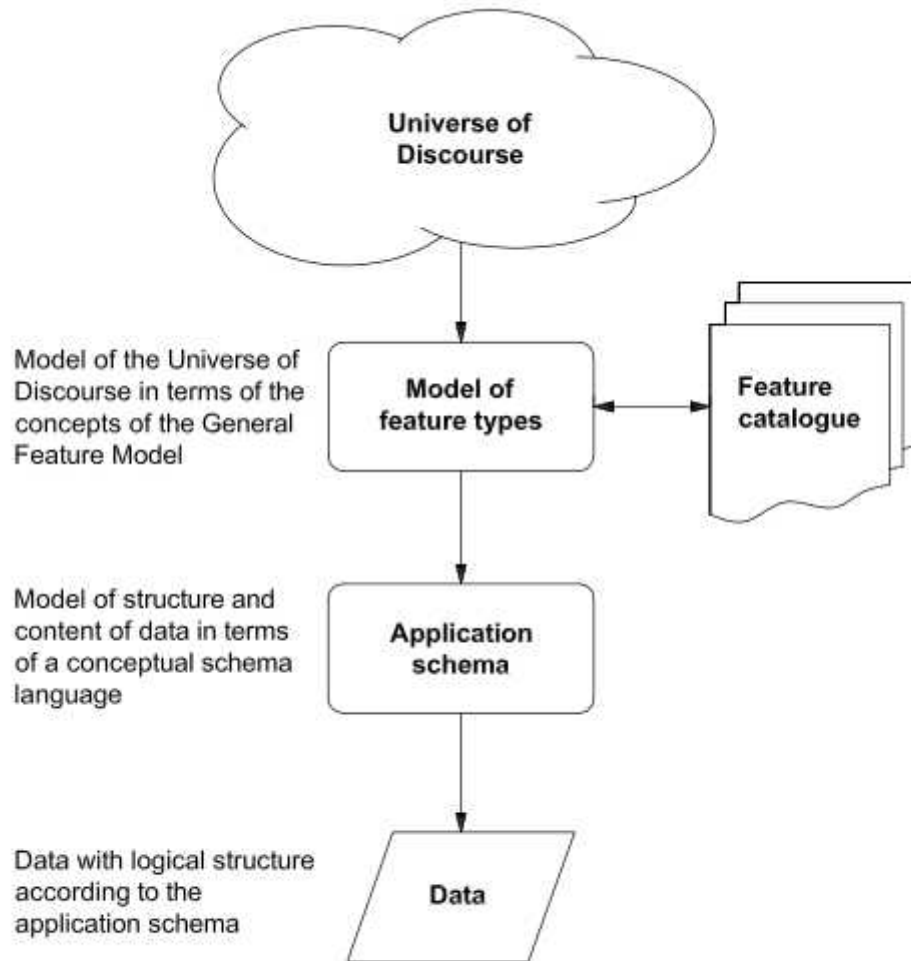
ISO 19109

1. Use Case Development

2. Identification of Spatial Object Types

3. As-is Analysis

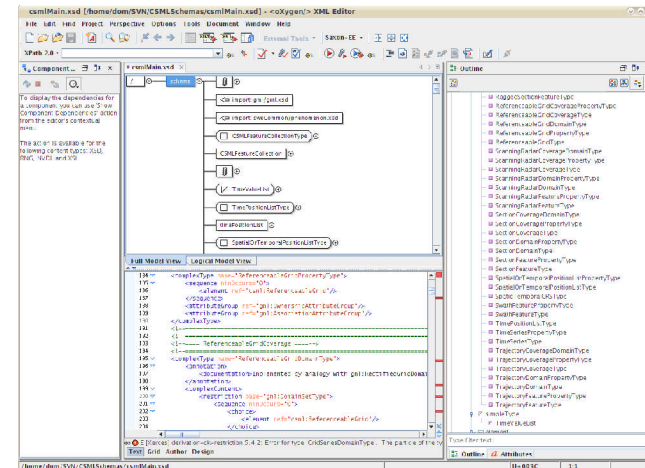4. Gap Analysis

5. Model development

6. Test and Validation

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Model-Driven-Approach: UML as primary source

UML to GML automated:
- FullMoon, HollowWorld
- ShapeChange

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Progress in OGC MetOcean DWG – 11 Use cases

- Future aviation scenarios derived from NextGen Net Enabled Weather (NNEW) and Single European Sky (SESAR)

- Current aviation operational meteorology services

- Routine operational forecasting activity at national weather service in support of severe weather warning service

- Multi-model ensemble forecasting to reduce or mitigate impacts of landfalling hurricane

- Winter maintenance of highways infrastructure - decision support for de-icing

- Seasonal forecasting for agriculture in India

- Climate impact assessment for economic development in sub-saharan Africa

- Use of meteorology in support of Emergency Response

- Sustained environmental science campaign - e.g. International Polar Year

- Automated Steering of High-resolution Local Weather Forecast Models

- Riverine Flood Forecasting using Meteorological Ensemble Forecasts

UC5: winter maintenance of highways infrastructure - decision support for de-icing

Current Owner: BruceWright

Summary

De-icing decision support service to highway maintenance organizations during a winter season to optimise use of resource, whilst ensuring safety

User communities/actors

Commercial Road Sensor Operator, Local Government Organizations Responsible for Highway Maintenance, Forecasting Centre, Road User

Information types

Road sensors observations, surface (synoptic) observations, radar imagery (precipitation), satellite imagery, gridded forecasts (high-resolution, including ensembles, downscaling, nowcasts), site-specific forecasts (including intelligent interpolation, specialist road surface modelling, statistical correction, forecaster modification), forecaster guidance (text), alerts (of threshold exceedence), road surface thermal mapping (from vehicle-mounted sensors), routes (road segment geometries), verification statistics, licencing conditions on sensor observations

Query types

Retrieve data by geographic area, retrieve data by route, retrieve data for set of points, retrieve time series (for any of the previous 3), retrieve route or site metadata, retrieve go / no go response (to 'grit' road) based on agreed business rules, subscribe to alerting service, speak to

Extracting Information types, comparing to existing data models (As-is Analysis).

Information types	Future Aviation	Current Aviation	Severe Weather	Hurricane	Winter Highway	India Agri.	Sub Sahara	Emergency Response	Polar Year	Model Steering	Flood Forecast	Data Models ...				
	1	2	3	4	5	6	7	8	9	10	11	CDM	CSML	WOML	WXXM	AIXM
Surface obs:station, buoy, road sensor	x	x	x		x			x				Point StationTimeSeries	Point PointSeries		Point PointSeries SurfaceReport	
Area forecasts (e.g.AIRMETs, SIGMETs)	x	x												WeatherForecast (with any gml:Feature derived objects as collection members)	AreaForecast	
Aerial Observations	x	x	x												AerialReport, same as CSML/coverages	
Radar Imagery	x	x	x	x	x			x				RadialSweep	ScanningRadar		same as CSML/coverages	
Satellite Data	x	x	x					x				Swath, Grid	Swath, Grid		same as CSML/coverages	
Dropsondes			x									Profile	Profile		same as CSML/coverages	
Model data(wind, temp, RH etc)	x	x			x							Grid	GridSeries		same as CSML/coverages	
Other Gridded products*	x	x	x	x	x			x				Grid	Grid, GridSeries		same as CSML/coverages	
Alerts & reports	x	x	x		x										none	
Sensible Weather Objects (dynamic)			x											ColdFront WarmFront OccludedFront Jet Trough UpperTrough CloudArea SurfacePrecipitationArea TextForecastArea	Contour	

Next Steps

- Finish As-Is Analysis

- Perform Gap analysis

- Decide which information types to focus modelling efforts on

- Decide how best to interact with INSPIRE met/atmos theme...

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