Conceptual Modelling within The OGC MetOcean Domain Working Group

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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?
- Liaison with external initiatives
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


- 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.
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”.

The ISO TC211 standards framework + OGC
Feature Cataloguing - Methodology

1. Use Case Development
2. Identification of Spatial Object Types
3. As-is Analysis
4. Gap Analysis
5. Model development
6. Test and Validation

Figure 4 — From reality to geographic data

ISO 19109
Model-Driven-Approach: UML as primary source

- FullMoon, HollowWorld
- ShapeChange

UML to GML automated:
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
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).

<table>
<thead>
<tr>
<th>Information types</th>
<th>Future Aviation</th>
<th>Current Aviation</th>
<th>Severe Weather</th>
<th>Hurricane</th>
<th>Winter Highway</th>
<th>India Agri.</th>
<th>Sub Sahara</th>
<th>Emergency Response</th>
<th>Polar Year</th>
<th>Model Steering</th>
<th>Flood Forecast</th>
<th>Data Models...</th>
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<tbody>
<tr>
<td>Surface obestation, buoy, road sensor</td>
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<td>Radar Imagery</td>
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<td>Data Models...</td>
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CDM: Point, StationTimeSeries; CSML: WeatherForecast (with any grid Feature derived objects as collection members); WOML: AerialReport, same as CSML/coverages; WXXM: AreaForecast, same as CSML/coverages; AIXM: RadialSweep, ScanningRadar, same as CSML/coverages; CDM: Swath, Grid; CSML: Swath, Grid; WOML: Profile, Profile; WXXM: Grid, GridSeries; AIXM: Grid, GridSeries; CDM: ColdFront, WarmFront, OccuadedFront, Jet, UpperTrough; CSML: SurfacePrecipitationArea, TextForecastArea; WOML: 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...