Towards a WMS profile for Met Ocean products

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Second Workshop on the use of OGC standards in meteorology

24 November 2009

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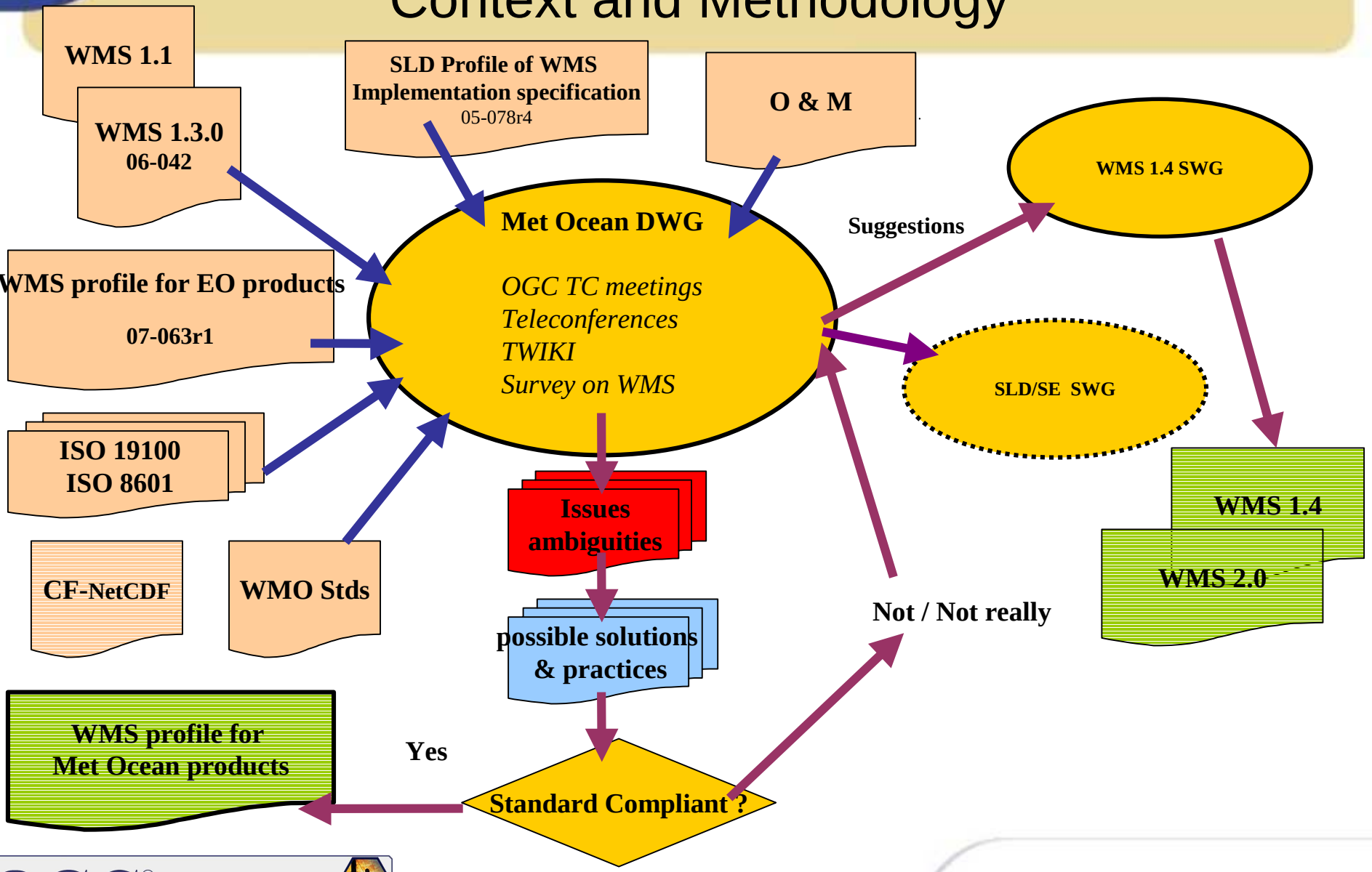
METEO FRANCE
Toujours un temps d'avance

Overview

- Context and methodology
- Progress on the time issue
- Other issues identified and possible solutions
  - Coordinates Reference Systems
  - Vertical coordinates
  - Styling
  - Layering, metadata search and filtering
  - Other (Cross sections …)
- Conclusion : Goals and way forward
  - OGC Best Practice (WMS profile for Met-Ocean products ?
  - Requirements for WMS 1.4 and WMS 2.0, SLD ?

Context and Methodology

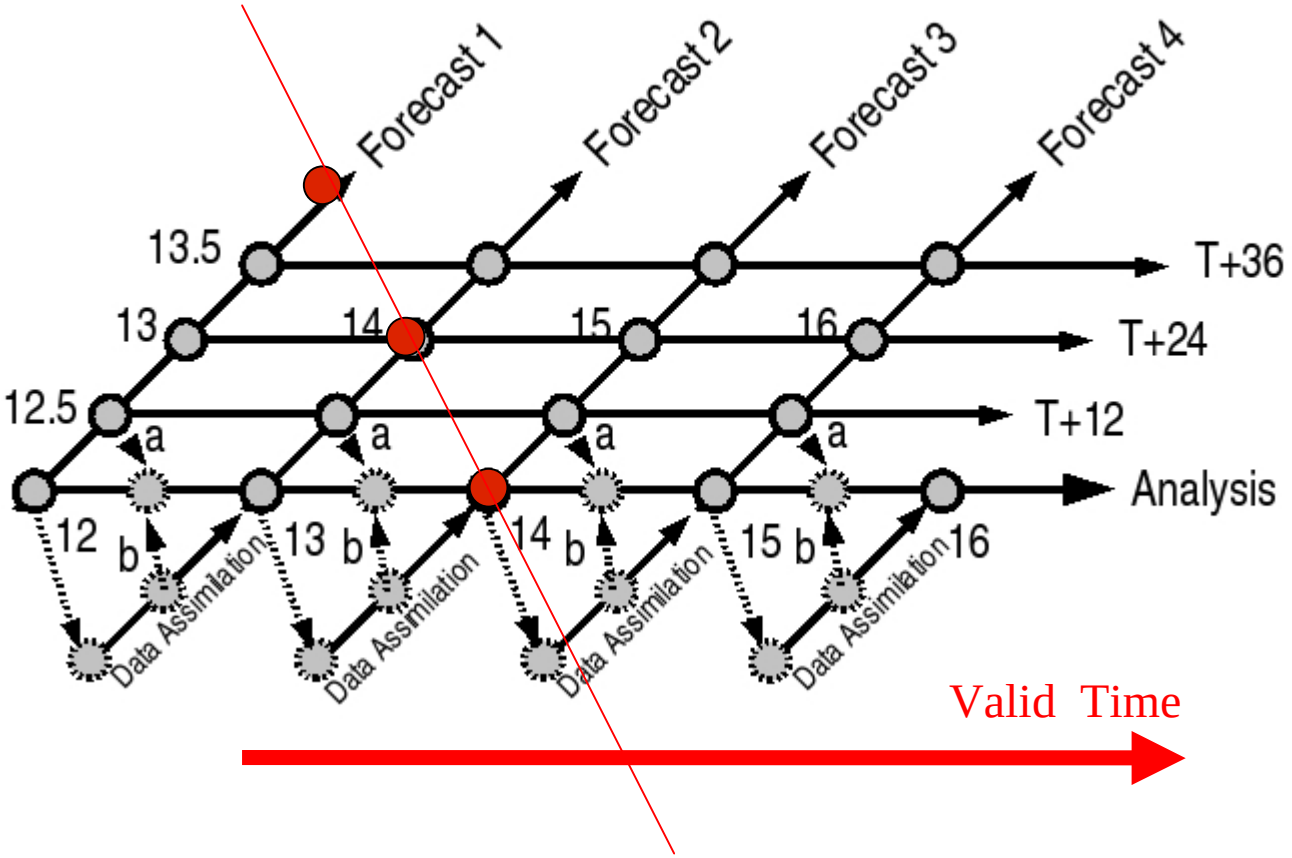


Met requirements in term of time handling : Forecasts and Simulations

- Many concepts, time properties and related semantics have been identified. The Met Office distinguished :
  - **Primary** time properties : data needed to **acquire** the dataset (the map)
  - **Secondary** time properties : treat as **metadata** on the dataset
- Primary time properties would be :
  - "**Reference Time", "Run", "Datum Time**"
    Time at which the simulation was initialised
  - **"Validity Time", "Verification Time", "Forecast Offset" (duration)**
    - Time which the result-set of the simulation is describing
  - "**Process Period**" (part of the phenomenon definition ?)
    - Time interval relative to validity time for accumulations, averages, max/min etc.
- Secondary time properties :
  - "**Creation Time", "Start Time**"
    - Time at which the simulation was executed or started
  - **"Issue Time**"
    - Time at results of the simulation were published / issued
  - "**Validity Period**"
    - Interval during which the results of the simulation should be used
  - **Data Cut-off, end of data assimilation**, …

Simulations and forecasts

Valid Time = 2009-11-14T00:00:00Z



Source : Bryan Lawrence (British Atmospheric Data Centre)

Met Ocean DWG proposals regarding forecasts and simulations

- WMS TIME and DIMENSIONS would be used for **primary time** properties.
- Other time properties belong to LAYER **metadata**
- Native **TIME** would be used for **validity time**.
- If native **TIME** not specified, the default data (map) returned would be the “most up do date forecast for current time” – to be defined (especially when all the last run is not yet available)
- For skilled clients, a server would support at least 2 orthogonal dimensions (names under validation) :
  - **DIM_RUN_START_TIME**
  - **DIM _FORECAST_OFFSET** (a duration)
- Precedence's should be defined to handle inconsistent requests

  e.g : TIME != DIM_START_RUN + DIM_FORECAST_OFFSET
- Rules to be defined when TIME specified, but not corresponds to a valid forecast run + offset

  e.g : To overlay satellite or radar data.

Met requirements in term of time handling : Climatology

- 3 variables (axis) can be introduced (according **CF NetCDF** conventions 1.4) :
  - "**Cell Method**" or "**Statistical Process**" : accumulations, averages, max/min, …)
  - **"Climatological bounds"** : statistics are computed over a time interval
  - Climatological statistics may also be derived from corresponding portions of a "**range"** of year (seasons), month, day, and therefore need a specific "**climatological**" axis

e.g :

- **Average** temperature for each climatological **seasons** over **1970-1999**
- **Decadal max/min** temperatures for **January** over **1970-1999**
- **Hourly average** temperatures are given for **April 1997**.
- …

New issues raising out of the current works regarding climatology

- The “statistical process” is not directly linked to the time issue, but can be handled with a specific dimension :
  - **DIM_CELL_METHOD**
- Handle the climatological process period (or bounds) with the native **TIME** parameter (ISO8601 encoding)
- The rules for the “climatological axis” (dimension) are still to be discussed :
  - Name of the dimension : **DIM_CLIMATOLOGICAL_TIME ?**
  - Grammar for values :
    - Abbreviated or partial date time (hyphen in place of omitted date elements), but not currently used :
      - E.g DIM_CLIMATOLOGICAL_TIME=-11- for November encoding YYYYMMDD
    - Compliant ISO 8601:2000 but not ISO 8601:2004 ? (Provision removed)

Met Ocean requirements regarding Observations

- As for simulations, we distinguish primary and secondary time variables (metadata)

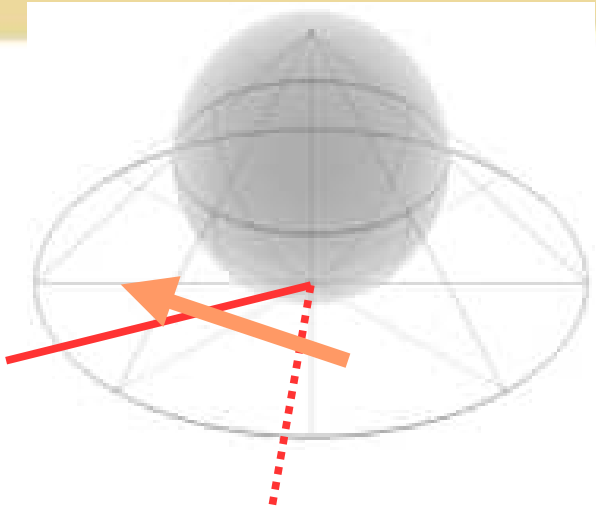
- Primary time properties would be :
  - **"Sampling Time"** (from OGC Observations & Measurements 07-022r1) –
    - the time that the result applies to the feature-of-interest".
  - "**Collection period**"
    - the time interval bounding all discrete observations within the collection
  - "**Process Period**" (part of the phenomenon definition ?)
    - Time interval relative to validity time for accumulations, averages, max/min etc.
    - Similar to the climatological bounds
    - E.G rain accumulation over 3 hours

- Secondary time properties would be :
  - "**Issue Time"** (from OGC Observations & Measurements) –
    - "the time when the procedure associated with the observation act was applied"
    - Can be a time range for instance satellite originating data

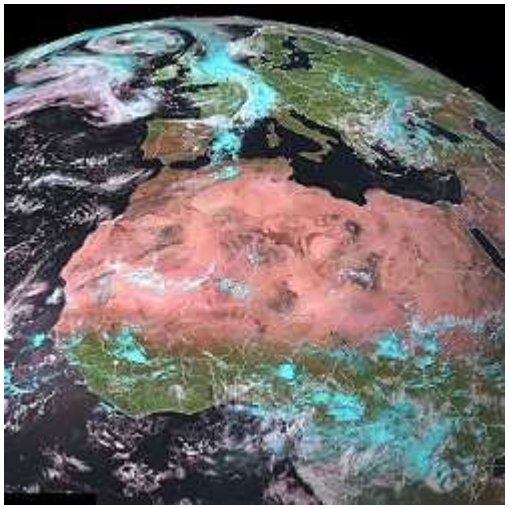
Proposals and possible solutions regarding the time issue for observations

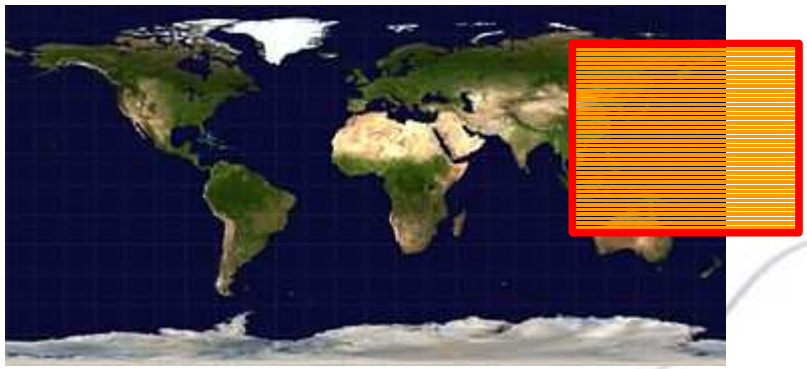
- Need to map time properties onto the **Observations & Measurements model** (OGC 07-022r1)
- Need to map time properties onto native WMS **TIME** parameter, DIMENSIONS or LAYER metadata
- Native **TIME** would be used for **SamplingTime or CollectionPeriod**
- Possible DIMENSION for "**ProcessPeriod**"

Met requirements in term of CRS



- Suitable projected CRS for polar areas and south hemisphere
  - Polar stereographic “North” and “South”
    - EPSG:32661, EPSG:32771
    - Specify the origin meridian would be useful
  - Others ?
- Vertical perspective :
  - “Space view” (geo-stationary satellite originating data) : Show the globe as it appears from space.
- Equirectangular CRS over the Anti-Meridian :
  - E.g : EPSG:4326 BBOX



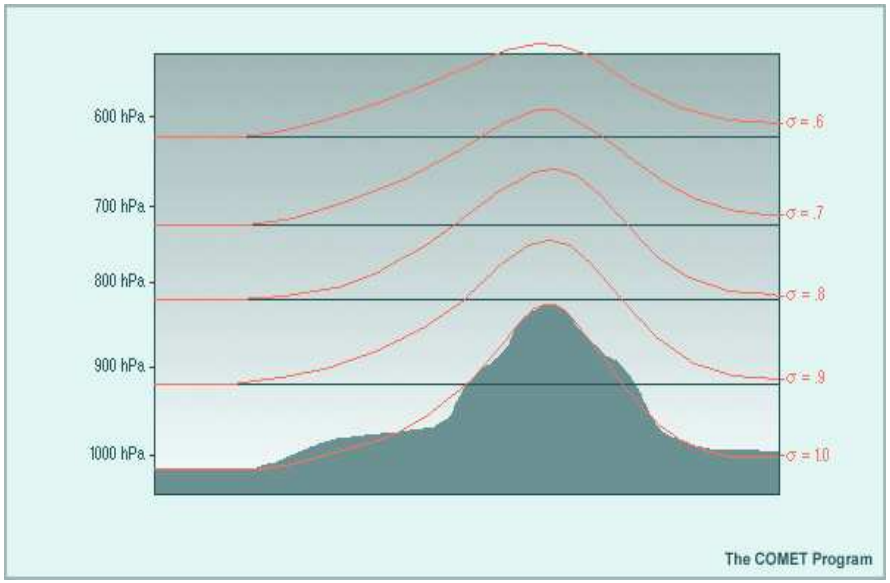


New issues raising out of the current works regarding CRS

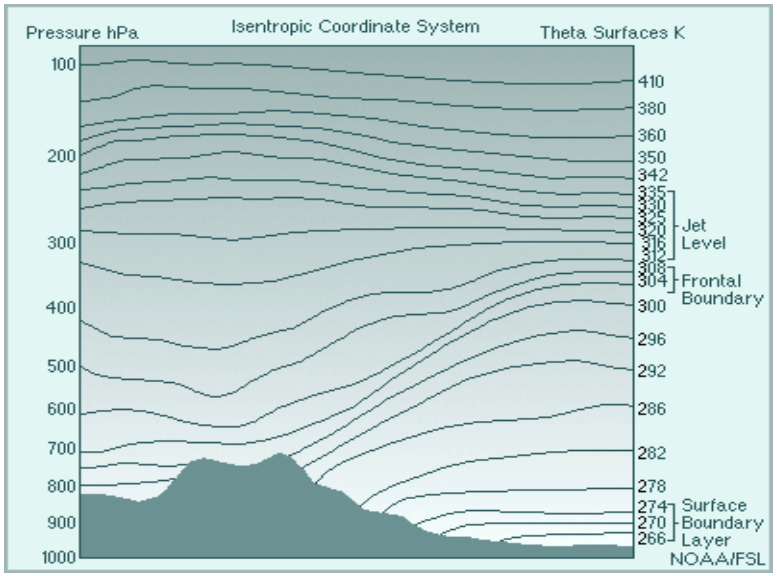
- Declare new EPSG codes ? (not parametric)
  - For “Space View” and other “Polar Stereographic”
    - Problem : too many codes to be declared ?
- Ask for new codes in AUTO2 namespace ? (parametric)
- Lat-Lon BBOX over the anti-meridian
  - WMS 1.1 was more permissive than WMS 1.3
    - It was possible to define BBOX out of [-180,-90,180,90]
    - E.g BBOX=[-180,-90,510,90]
  - AUTO2:40004 (Equirectangular) is mandatory under WMS 1.3
    - But in meters and not in degrees
- Explicit “PROJ4 like” parameters ?
  - E.g : In the MapFile of MapServer

Met requirements in term of vertical coordinates

- Z coordinates not current in meteorology, and often inappropriate
- Several systems :
  - Pressure, Isentropic, Sigma,
  - Hybrid (isentropic - Sigma combination)



Example of pressure & sigma coordinate model



Example of isentropic model

Source http://meted.ucar.edu/ (UCAR)

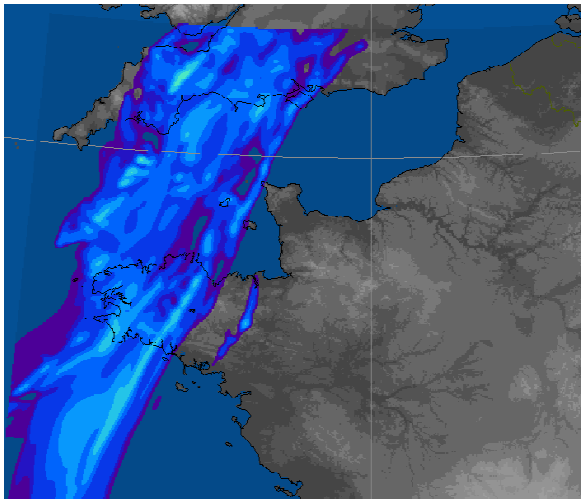
New issues raising out of the current works regarding vertical CRS

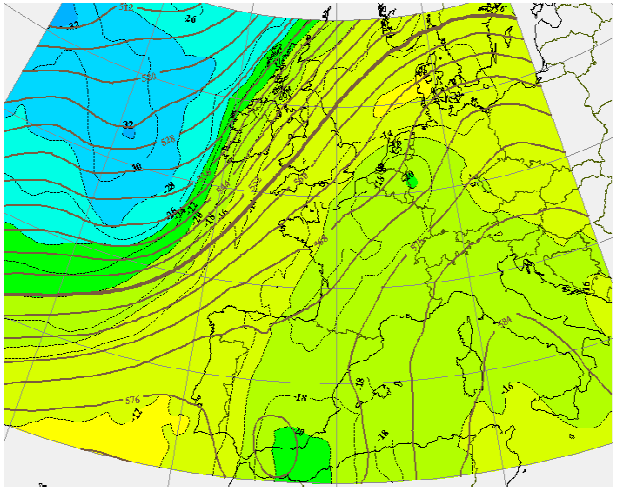
- Native WMS **ELEVATION** usage
  - CRS:88 (CRS based on the North American Vertical Datum 1988)
  - Reference (through an URL) to other ISO 19111- compliant vertical CRS definitions.
  - in most of the cases, ELEVATION will be inapplicable or inappropriate :
    - Not easy to map simulation levels onto CRS:88
    - Sigma, Pressure coordinates and others are not ISO 19111 compliant

- Additional **DIMENSION** for meteorological vertical axis ?
  - Vocabulary still to be defined : DIM_<parameter_name>
    - DIM_LEVEL_TYPE plus DIM_LEVEL ?
    - WMO (GRIB, BUFR) , CF conventions, AMS ?

Met requirements in term of styling

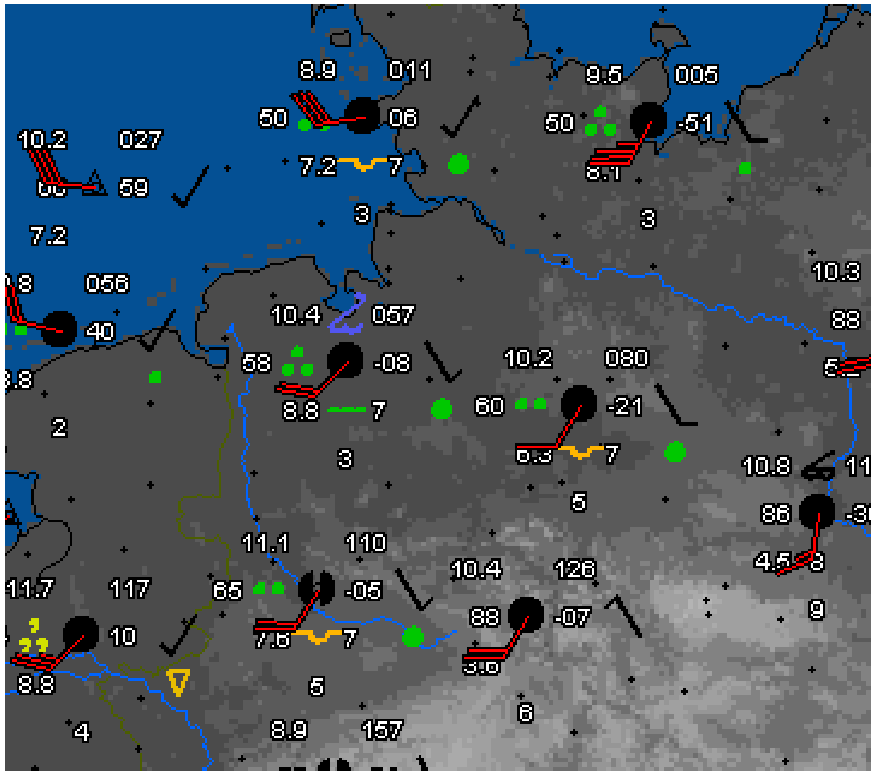
- Need pre-defined styles for light clients
- Pre-defined styles depends on the clients (Operational meteorology, Aeronautics, Mass Media, …)
- WMO styles are mandatory for official and institutional products
  - E.g : aeronautics, ground observations.
- Skilled clients may require customisable styles, especially for model data.

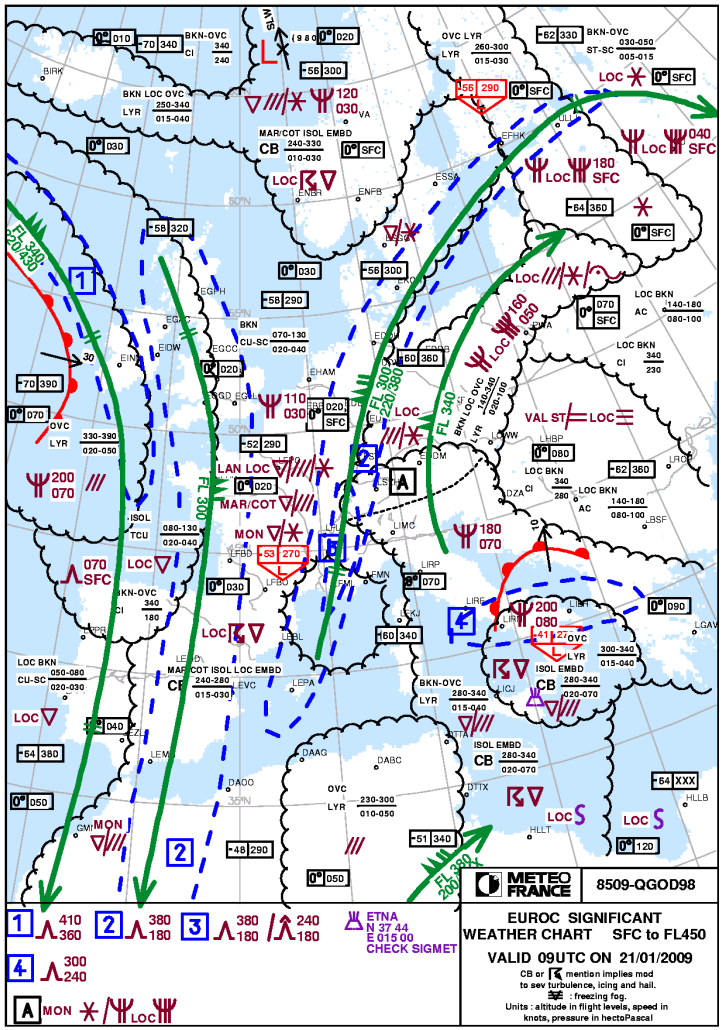




Met requirements in term of styling

Ground Observations





Aeronautic :TEMSI

New issues raising out of the current works regarding Styles

- Pre-defined style are handled by the **STYLE** WMS parameter
- One-to-Many relation between **LAYER** and **STYLE** in WMS specification, but how to associate a STYLE with DIMENSION values in GetCapabilities ?
  - *DIM_PHENOMENON=T : STYLE_1, STYLE_2*
  - *DIM_PHENOMENON=Wind : STYLE_3*
- Customisable styles are handled by the **SLD** WMS parameter, only if the server support the Style Layer Profile for the WMS implementation (OGC 05-078r4)
- Met Ocean DWG should specify names for the mandatory pre-defined styles and default styles if the mandatory STYLE parameter is not specified **(…&STYLE=&…)**
- No well-defined default styles can lead to interoperability problems and data interpretation pitfalls (e.g heterogeneous colour maps for radar data)
- Check if OGC SLD specification allows portrayal of model data
  - E.g In term of contouring : *contour interval, contour max/min levels, contour line colour, contour reference level, ….*

Layering and metadata model

- **Layer granularity**
  - Balance LAYER / Multi-dimensional LAYER (LAYER plus DIM)

  e.g :

  LAYER=**ALADIN_20091123000000_36H_T_850**

  LAYER= **ALADIN_T_850** *DIM_RUN_START_TIME*=2009-11-23T00:00:00 *DIM_FORECAST_OFFSET*=36H

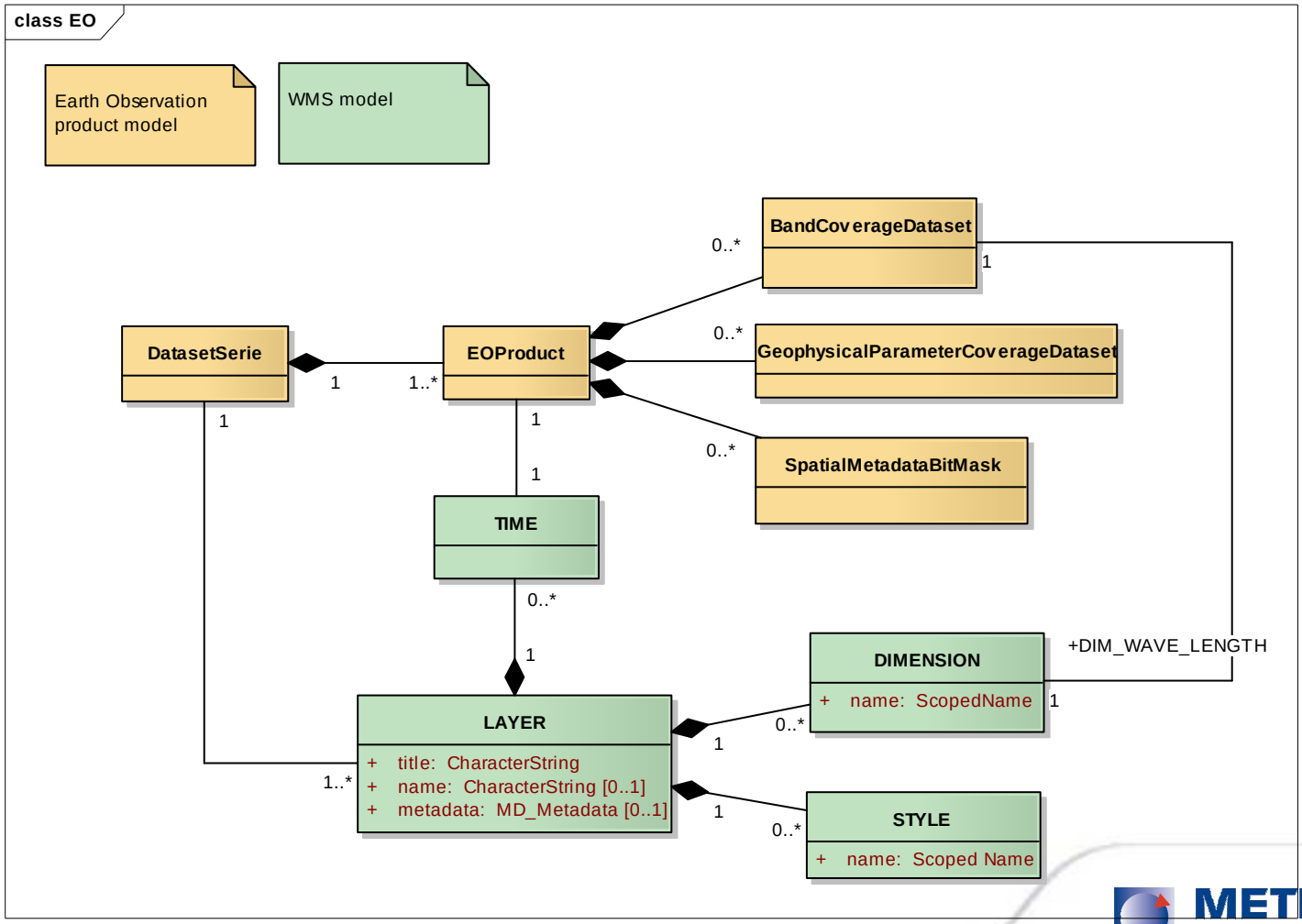
  LAYER=**ALADIN** *DIM_RUN_START_TIME*=2009-11-23T00:00:00 *DIM_FORECAST_OFFSET*=36H *DIM_LEVEL_TYPE*=PRESSURE *DIM_LEVEL_VALUE*=850 *DIM_PHENOMENON*=T

- **The granularity of the layers will impact** :
  - The efficiency of catalogue searching
  - The size of GetCapabilities response and performances

8 offsets * 10 days * 20 levels * 10 phenomena = **16000** LAYERS !

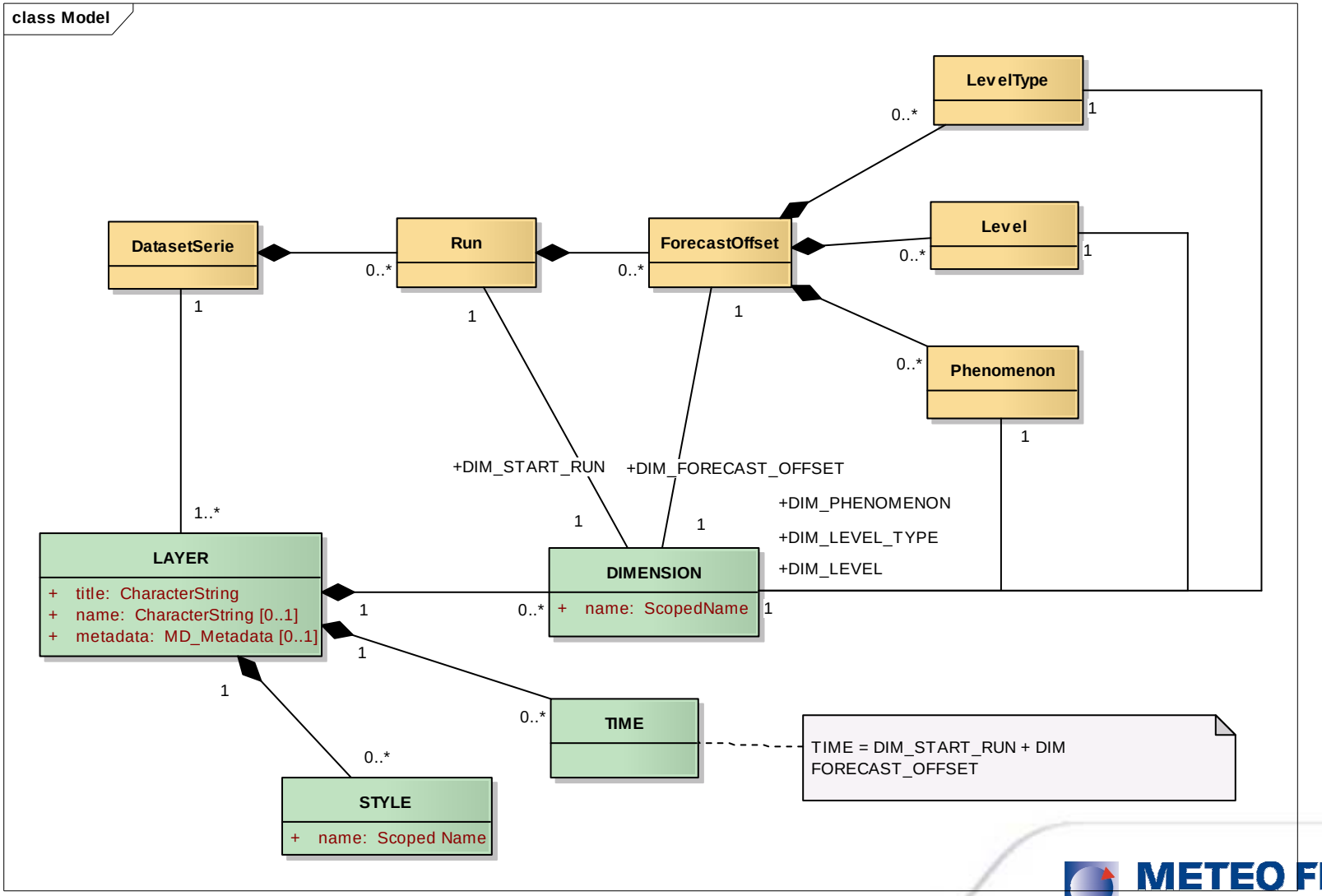
Layering and metadata model for observations

- The reference metadata model for observations could be derived from the OGC WMS application profile for EO products :



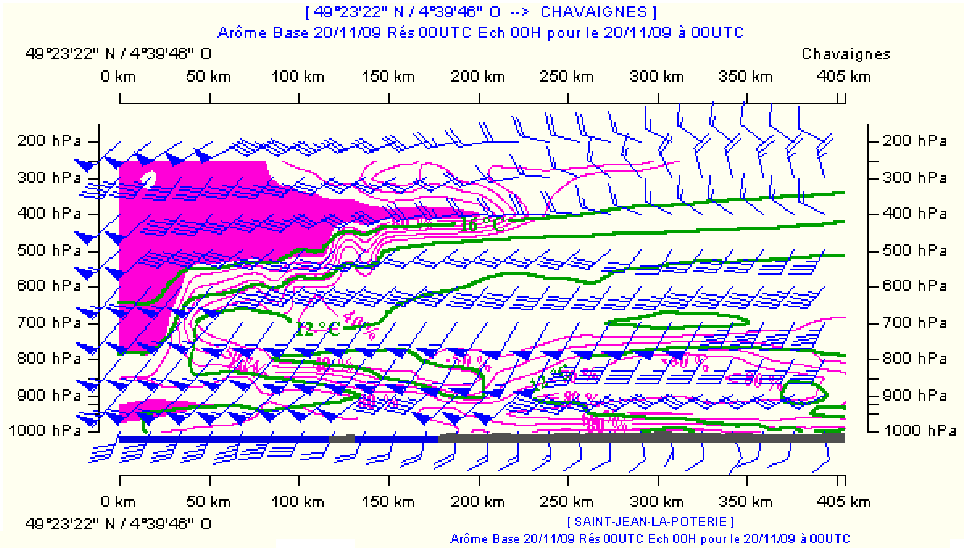
Layering and metadata model : Forecasts and simulations

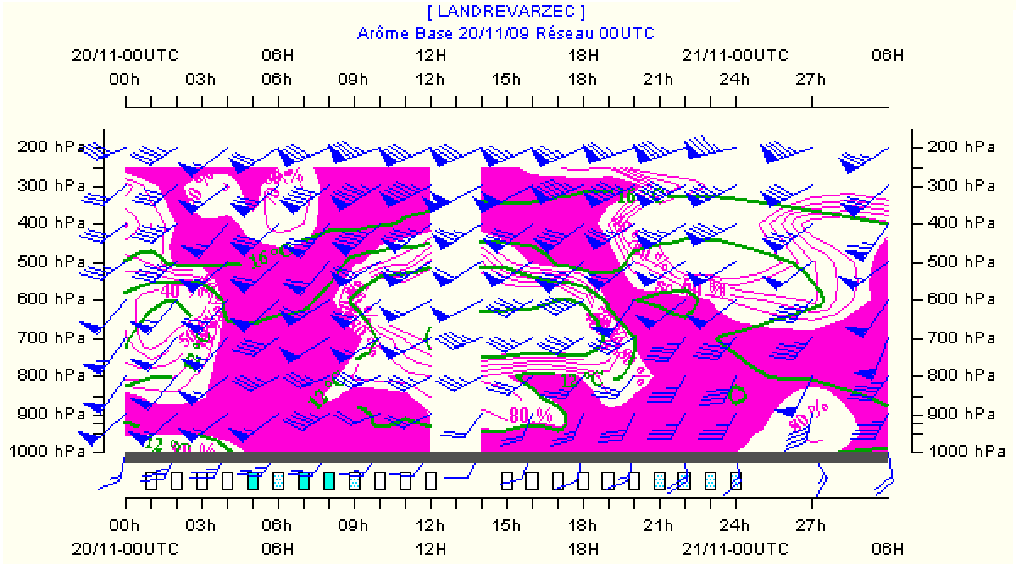
- A WMS metadata model for simulations and forecasts (to be discussed)

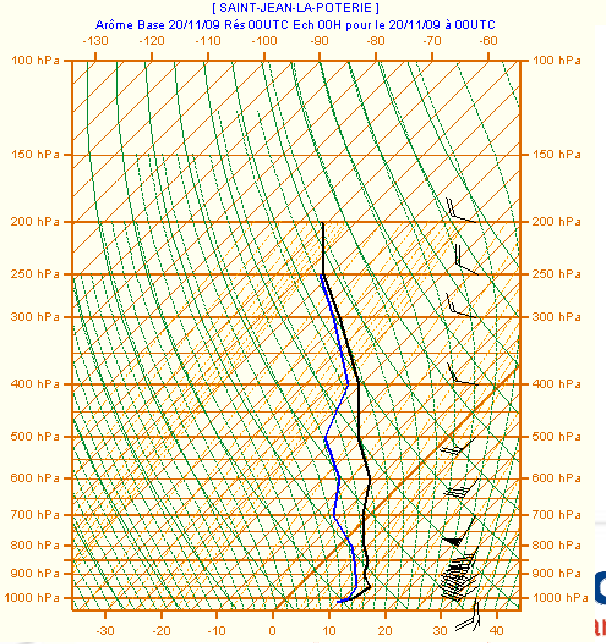


Other requirements and issues

- Performances
- Asynchronous delivery
- Cross sections
  - Spatial : f(X, Z)
  - Temporal : f(t, Z)
- Graphics ?
  - But are they really maps ?

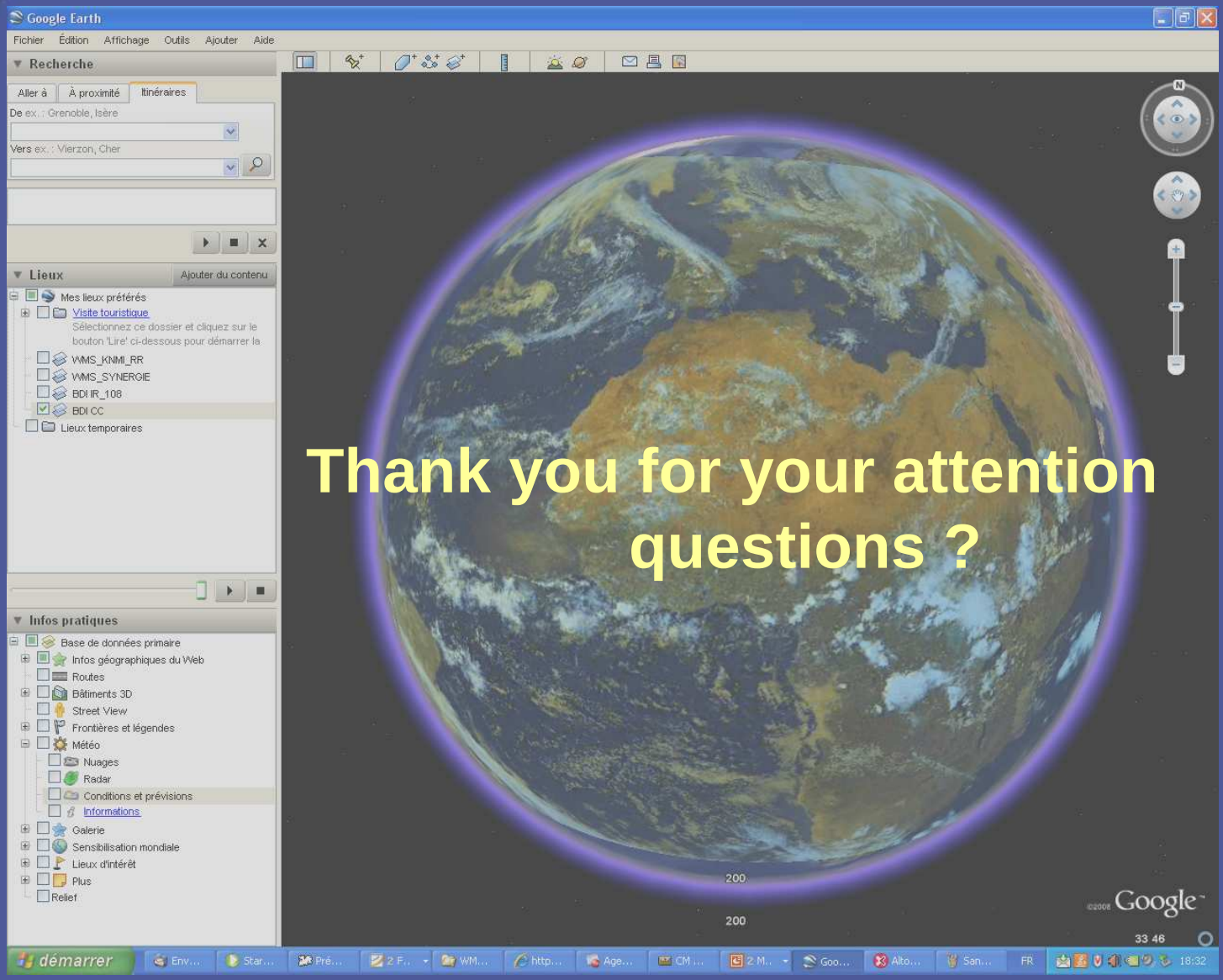






Conclusion : Goals and way forward

- The target would be an OGC “Best Practice” document :
  - “*WMS application profile for Met-Ocean Products*”
- The time issue is almost resolved, even though some aspects remain to be discussed
- Other issues, perhaps less complex, have to be addressed :
  - CRS, STYLES, CROSS-SECTIONS, …
- The Identified solutions will have to be validated through interoperability experiments
- Remaining pitfalls, without answer within existing standards will have to be submitted to other working groups : WMS SWG and SLD SWG.



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