

Results of the Met Ocean Domain Working Group Plugfest

Held at ECMWF, Reading, UK

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Executive summary

The OGC Met Ocean Domain Working Group held its latest plugfest at ECMWF as part of the *Visualisation in Meteorology Week*, 28 Sept to 2 Oct 2015. For the first time not only Web Map Services (WMS) clients and servers were used, but also Web Coverage Services (WCS) and Web Coverage Processing Services (WCPS).

The tests using the WMS services and clients showed many improvements from last year's plugfest at the EGOWS 2014 in Oslo. Fewer problems were found in the styling and overlaying of layers. However, some access problems were observed which were related to access restrictions and security settings.

There was limited testing for the WCS and WCPS, but some retrieved data could be visualised.

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Background

This plug fest is the results of work undertaken by the MetOcean DWG of the OGC and the EGOWS community.

The MetOcean DWG

The Meteorology and Oceanography Domain Working Group (Met Ocean DWG) is a community orientated working group of the Open Geospatial Consortium (OGC). The group does not directly revise OGC standards, but rather enables collaboration and communication between groups with meteorological and oceanographic interests. The Met Ocean DWG maintains a list of topics of interest to the meteorological and oceanographic communities for discussion, defining feedback to the OGC Standards Working Groups (SWG), and performing interoperability experiments. The DWG covers Oceanography as well, because of the long history of collaboration and shared institutions between meteorology and oceanography. Climatology is, of course, a subset of Meteorology.

Past of activities of the EGOWS community

EGOWS is a collaboration forum for European NMS (National Meteorological Services) in the field of workstations for duty forecasters. International co-operation is very important in meteorology and has a long history. A meeting of this group is held every year since 1990. Despite its name through time, EGOWS has also included non-European members.

Since 2010 the EGOWS community co-hosts interoperability tests sessions for OGC Web Map Services. The aim was to support each others developments with feedback on how clients and servers are developed and setup.

The MetOcean WMS interoperability test session at EGOWS 2014

The aim of this session was to test various Web Map Service (WMS) clients against various WMS servers providing meteorological maps and collect the experiences. This was the first interoperability session after the *OGC Best Practice for using Web Map Services (WMS) with Time-Dependent or Elevation-Dependent Data (1.0)* was finalized. The final version of the document is available at

<http://www.opengeospatial.org/standards/wms>

Only two service providers had yet implemented the new recommendation. These were the services by KNMI and IBL.

Beside the services listed on the MetOcean DWG Wiki at

http://external.opengeospatial.org/twiki_public/MetOceanDWG/MetocWMS_Servers

the following servers were tested:

- **ECMWF** <http://wrep.ecmwf.int/wms/?token=MetOceanIE&request=GetCapabilities&version=1.1.1>
- **MET Norway** (The 2nd and 3rd server are developed using Mapserver)
<http://thredds.met.no/thredds/catalog/arome25/catalog.html>
<http://bw-wms.met.no/barentswatch/default.map?service=WMS&request=GetCapabilities&version=1.3.0>
<http://public-wms.met.no/verportal/verportal.map?service=WMS&request=GetCapabilities&version=1.3.0>
<http://bw-wms.met.no/mapproxy/barentswatch/wmts/1.0.0/WMTSCapabilities.xml>
- **KNMI** http://geoservices.knmi.nl/cgi-bin/restricted/HARM_N55.cgi
- **IBL** <http://ogcie.iblsoft.com/metocean/wms>

This was the list of tested clients:

- NinJo 1.9 Development version
- Metview 4.4.7
- Visual Weather 3.6
- Online Weather 1.6
- KNMI ADAGUC 2.0 web interface
- QGIS 2.0
- Google Earth 7.1.2

The last two are non-meteorological GIS clients. They show no support for the TIME dimensions required to animate through forecast data.

Findings

- Orientation and size of legends makes it difficult to place them in display
 - E.g. ECMWF & IBL are horizontal versus KNMI's are vertically oriented with a lot of whitespace
- Best Practices can perhaps clarify Requirement 37 for "units"
 - E.g. KNMI uses "hpa", while IBL uses "isobaric-surface" inspired by other example in document "computed_surface"
- No isolines makes it harder to overlay with other maps
 - e.g. MET Norway radar versus Arome model
 - e.g. when areas of no precipitation are not transparent
- Styles in layers might not only be purely graphical
 - Some servers also offer different interpolations methods of the data
- Some layers offer extended time frames for years (e.g. 1903-2037)
 - This is because some statistical layers are actually valid for a selected month irrelevant of a year
 - In WMS 1.1 it was not compulsory to give a year, but 1.3 requires a year in the date.
 - Does ISO 8601 have a solution for this?
- Projections need to be checked carefully
 - Best for this are coastlines
 - E.g. ECMWF ecCharts/WMS
- It would be useful to recommend all server for limited list of projections
- Some servers do not correctly express the projection extents (i.e. Mapserver), meaning that a request using the default bounding box will fail
- Recommendation to show the extent of the data area
 - E.g. is hard to say if there is no precipitation or out of area.
- Do not cache maps which are sent as error (i.e. ones with error message)

Recommendations to the MetOcean DWG

These are the recommendations from the event:

- It would be beneficial to organise a blog to allow everyone to contribute test cases without waiting for IE events.
- The Best Practice document should take the comments above into account
 - Clarify unit naming
 - Clarify more what should (and shouldn't) happen in an error case
 - E.g. suggest not to send blank images as an error
 - Encourage layers to be more transparent for better overlays
 - Do not shade no-precipitation
 - Offer more contour line layers

Examples of results of the plug fest 2014

Here are some of the results presented which were captured during the plug fest at EGOWS 2014.

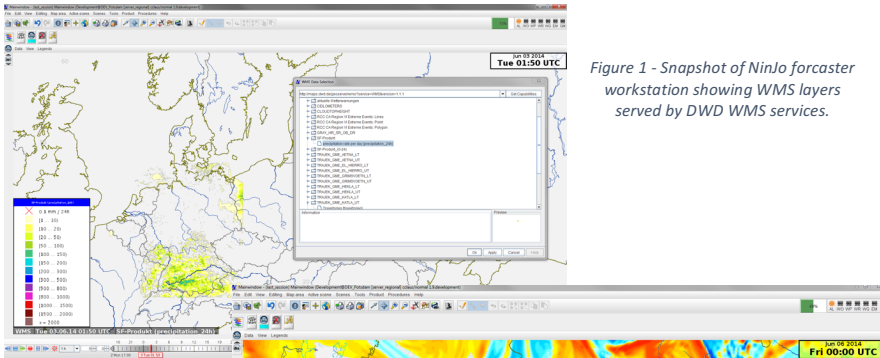


Figure 1 - Snapshot of NinJo forcaster workstation showing WMS layers served by DWD WMS services.

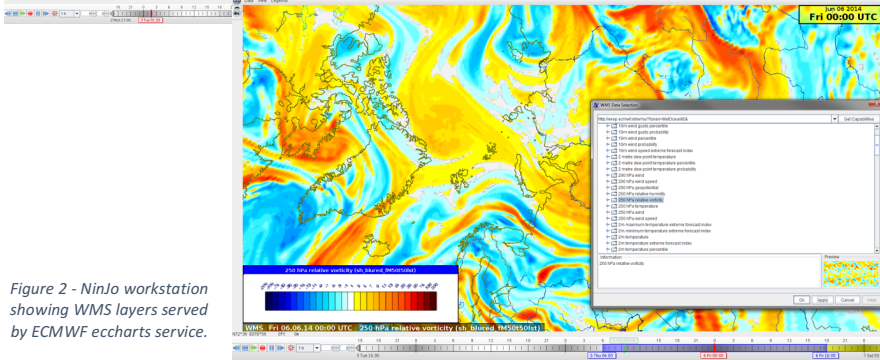


Figure 2 - NinJo workstation showing WMS layers served by ECMWF echarts service.

Setup of plug fest

The plugfest was held in the Council Chamber at ECMWF. Representatives of the tested clients were situated at the table while representatives of services and servers went around the table and ensured their services were tested.

Remote access was offered to WMS servers by the Canadian Meteorological Centre, but these were not fully tested because of the lack of time and effort.



Figure 3 Photos from the event held in ECMWF's Council Chamber.

Description of the WMS Servers

Overall 9 WMS servers were used in the tests. In the following all services are briefly described.

IBL

Blah blah blah

ECMWF

The WMS service operated by ECMWF is part of the ecCharts services to provide forecast weather maps to its users. The service is based on an in-house developed Python package translating WMS requests into the internal request to generate maps which is based on the Magics/Metview parameter language. Currently the service only provides WMS version 1.1.1 which its own convention on time, elevation and how to access ensemble bases layers. A service for version WMS 1.3 following the MetOcean DWG Best Practices for Elevation and Time is undergoing testing.

Access is controlled through tokens which are restricted to ranges of IP addresses. The token "MetOceanDWG" enables to some layers ...

DWD

Blah blah blah

NOAA

Blah blah blah

Météo-France

Blah blah blah

WOUDC

Blah blah blah

KNMI

Blah blah blah

Norway

Blah blah blah

EUMETSAT

This new pilot service, EUMETView, allows users to view EUMETSAT imagery in a more interactive way through a Web Map Service (WMS). Additionally, EUMETView implements the OpenGIS Web Map Service (WMS) Interface Standard and can be used to request and overlay EUMETSAT products in GIS clients supporting OGC WMS 1.3.0.

Description of the WMS Clients

During the event nine WMS clients were tested.

ADAGUC

ADAGUC is a geographical information system to visualize netCDF files via the web. The software consists of a server side C++ application and a client side JavaScript application. The software provides several features to access and visualize data over the web, it uses OGC standards for data dissemination.

GAIA

Gaia is a platform designed for advanced geospatial network and SDI needs. Based on the CarbonTools PRO open-geospatial development toolkit, this viewer can access an array of geospatial sources such as the Open Geospatial Consortium (OGC) Web Mapping Service (WMS), Web Map Tile Service (WMTS), Web Coverage Service (WCS), Web Feature Service (WFS), and Filter Encoding (FE).

Diana

Diana is open source meteorological workstation software developed and used mainly by Met Norway and SMHI, but also at other institutes and companies. Since version 3.39, Diana includes an alpha version of an WMS/WMTS/SlippyMap client.

Metview

This WMS client is developed as part of ECMWF's Metview workstation. The client lets users browse the available layers retrieved from the GetCapabilities document. Meta data including the legend is displayed at a side panel on the right. An additional panel allows entry of settings for various dimensions.

leaflet

The leaflet JavaScript web mapping web framework is a non-domain specific client which was kindly tested by ArabiaWeather Inc.

ArcGIS

The ArcGIS desktop client is a WMS client provided by ESRI. While there is a commercial client, during the test a freely available version test version was used.

NinJo

The NinJo forecaster workstation was developed by a consortium of Germany, Switzerland, Denmark and Canada, and since version 1.4 offers a WMS client.

IBL

Blah blah blah

QGIS

QGIS is an open source GIS supported by the Open Source Geospatial Foundation (OSGeo). It runs on Linux, Unix, MacOSX, Windows and Android and supports all major vector, raster and database geospatial formats. It is capable of analyzing data and producing maps.

WMS results sorted by clients

The WMS tests during the plugfest involved nine servers and clients. Table 1 gives the matrix of which combinations were tested and their outcomes. Green fields indicate success, while red indicates failure to display a map in the client. Orange is reserved to indicate where a map was displayed, but incorrectly or not as expected.

| Servers | Clients | | | | | | | | |
|--------------|----------------|------|----------------|------------------|---------|----------------|----------------|-----|------|
| | ADAGUC | GAIA | Diana | Metview | leafLet | ArcGIS | NinJo | IBL | QGIS |
| IBL | X MO | X | X ² | X http not https | X | X | X | X | X |
| ECMWF | | X | X ² | X | X | X | X | X | X |
| DWD | | X | X ² | X ¹ | | X ¹ | X ¹ | X | X |
| NOAA | | | | X | X | | | | |
| Météo France | X ³ | | X ² | X ⁴ | | X | X | X | X |
| WOUDC | | | | X | | | X | | |
| KNMI | | | X ² | X ⁵ | X | | X | X | X |
| Norway | | | | | | | | X | |
| EUMETSAT | X | | | X | | | X | X | X |

Table 1: Matrix of WMS test results between servers and clients.

Notes to Table 1

1. Some clients struggled to handle the authentication of the DWD server
2. Diana: client side issues with bounding box calculation for some projections
3. ADAGUC/MF problem to access server (on ADAGUC side?)
4. Display in Metview was distorted because of a not well defined bounding box
5. Metview could not load a particular layer because the default time dimension was invalid

LeafLet/ECMWF: error

Ninjo/Météo-France: problem to parse getcapabilities

Ninjo/KNMI: problem dimension with observation layers

Ninjo/EUMETSAT: invalid parameter

Diana

The version of the WMS client that was tested at the plugfest had problems with calculating bounding boxes for requests to WMS servers if the map projections of client and server do not match. This problem was known and is under investigation.

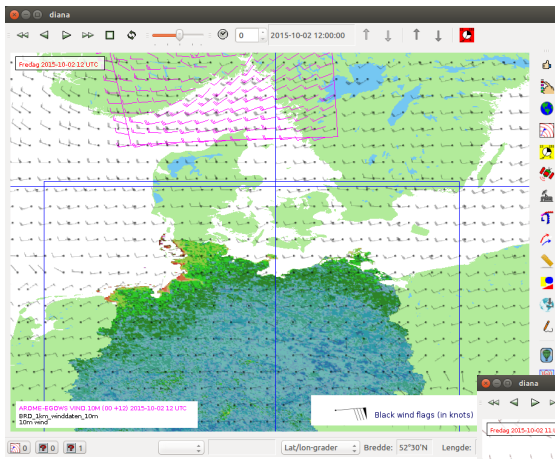
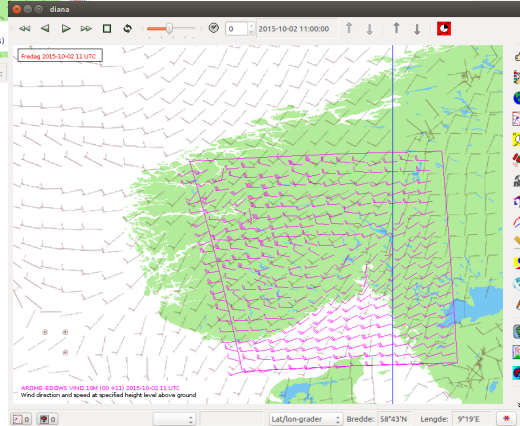


Figure 4 - Diana workstation overlaying layers served by ECMWF/eccharts (black wind arrows), DWD (filled), and AROME MetCoop (MET Norway and SMHI, magenta wind arrows).

Figure 5 - Layers served by Météo France (grey wind arrows), and AROME MetCoop (MET Norway and SMHI, magenta wind arrows).



ADAGUC

NinJo

The WMS client was content-wise much improved since last year's plug fest. With NinJo there were no problems with the content, but there were more problems with accessing the servers at all. For example, there is a need to support HTTP authentication. The client was successful in visualizing WMS layers from KNMI, ECMWF and IBL. The client was not able to visualize maps from DWD, Météo-France and EUMETSAT's EUMETview service.

Here is a more detailed problem report for the servers that we couldn't connect to:

DWD

Server: <http://maps.dwd.de/geoserver/wms?request=GetCapabilities&service=WMS&version=1.3.0>

There was an exception, when accessing the server. Probably because the server uses HTTP authentication and NinJo does not support that.

Météo-France

Again there was got an exception in the library that is used to contact the server (geo-tools library). The error happens in the parsing of the capabilities document.

During the plug fest it was found that the reason was a meta-data URL (attribute *MetaDataUrl*) in the French capabilities-document, which pointed to a server behind their firewall. It seems as if geo-tools library tries to resolve all URLs in the capabilities document.

KNMI

The observation server did send a service exception. The server returned an error when it was tried to access the layers itself. Querying the capabilities documents worked fine. The error was also reported by someone else

Comment [SS1]: Who?

```
<?xml version='1.0' encoding='ISO-8859-1' standalone='no' ?>
<!DOCTYPE ServiceExceptionReport SYSTEM
"http://schemas.opengis.net/wms/1.1.1/exception_1_1_1.dtd">
<ServiceExceptionReport version="1.1.1">
  <ServiceException>
    Invalid dimension value for layer cloud_area_fraction;
    No results for query: 'hidden';
    Unable to fill in dimensions;
    WMS GetMap Request failed;
  </ServiceException>
</ServiceExceptionReport>
```

EUMETSAT

Server: <http://eumetview.eumetsat.int/geoserver/wms?service=wms&version=1.3.0&request=GetCapabilities>

The server complained that the request for capabilities was invalid. There was not sufficient time to find out exactly why it didn't like the request. The error was as follows:

```
<ows:ExceptionReport xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:ows="http://www.opengis.net/ows" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" version="1.0.0" xsi:schemaLocation="http://www.opengis.net/ows
http://eumetview.eumetsat.int:80/geoserv/schemas/ows/1.0.0/owsExceptionReport.xsd">
  <ows:Exception exceptionCode="InvalidParameterValue" locator="service">
    <ows:ExceptionText>Single value expected for request parameter service but instead found: [wms,
WMS]</ows:ExceptionText>
  </ows:Exception>
</ows:ExceptionReport>
```

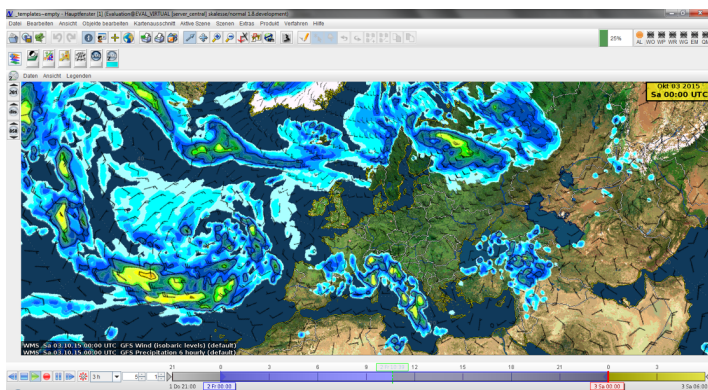


Figure 6 - NinJo client showing layers served by IBL WMS server.

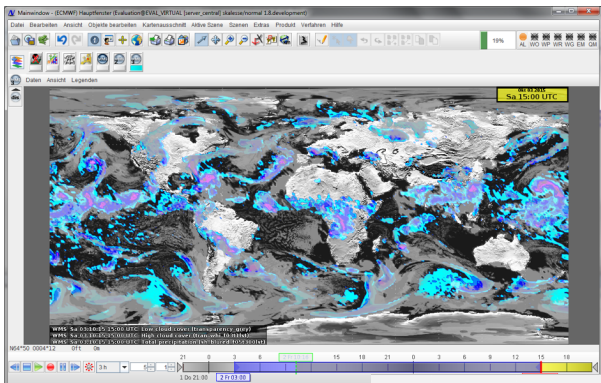
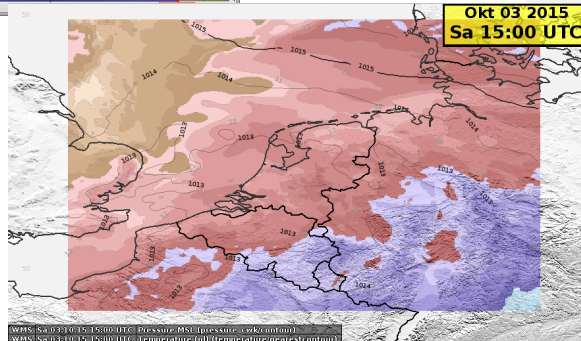


Figure 7 - Layers served by ecCharts/ECMWF shown in NinJo.



OnlineWeather

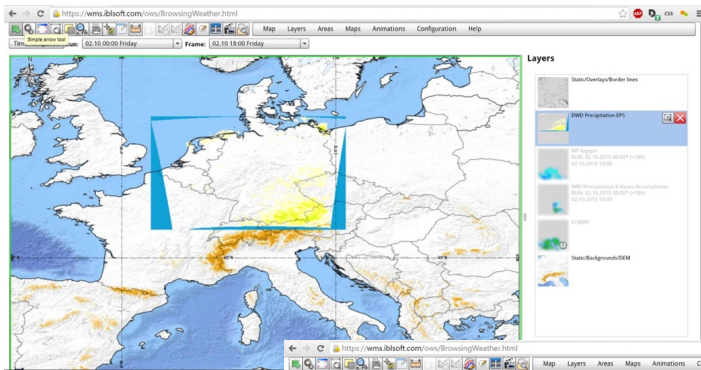


Figure 11 - OnlineWeather showing WMS layers from DWD.

Figure 12 - OnlineWeather showing precipitation forecasts from Météo France.

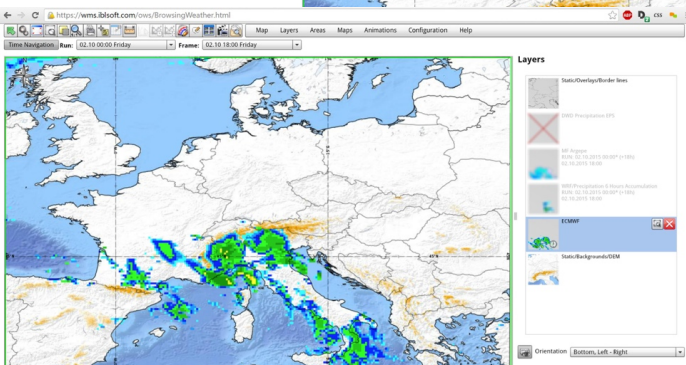
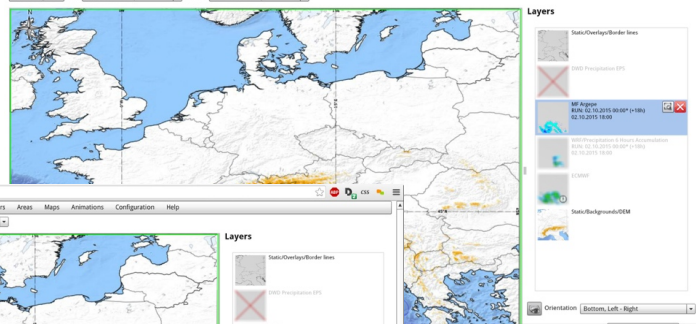


Figure 13 - OnlineWeather showing precipitation forecasts from ECMWF.

Metview

Metview could not connect to DWD's WMS service because of its use of https and user login.

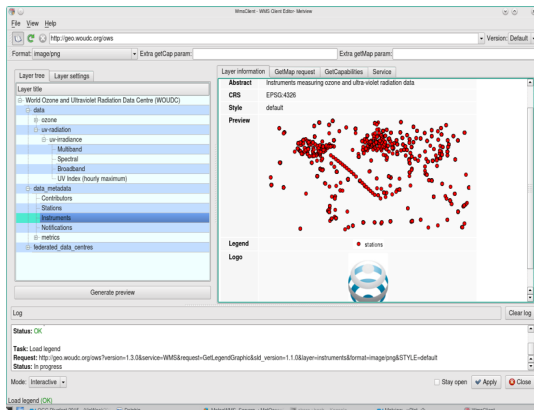


Figure 14- Metview showing the getCapabilities returned by Environment Canada. Layers are shown on the left, on the right a preview is shown. The layer we selected made it hard to check whether it was correctly geo-located, but it seemed plausible.

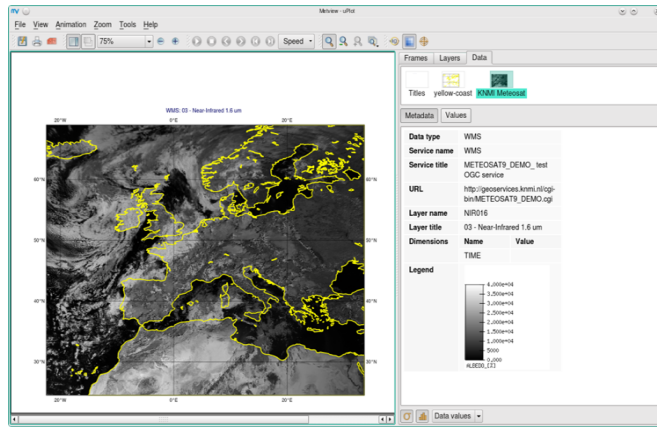


Figure 15 - Metview showing a satellite layer served from the KNMI server, with layer information displayed on the right. The alignment with Metview's own coastlines was perfect.

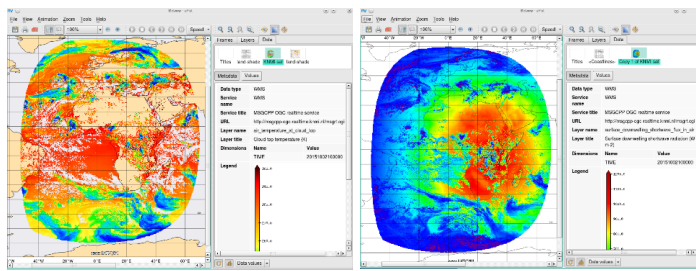


Figure 16 - Metview showing more satellite data from KNMI. This was harder to verify but it looked like it matched the coastlines well.

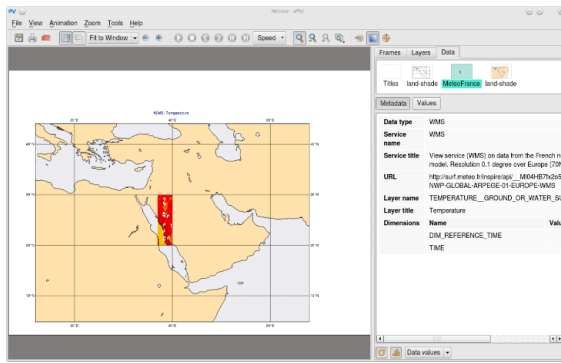


Figure 21 - Metview showing a later from Météo France's Arpege 0.1 service, using WMS 1.3.0. Metview did not request a specific area. The returned minX,maxX etc coordinates seemed to be wrong.

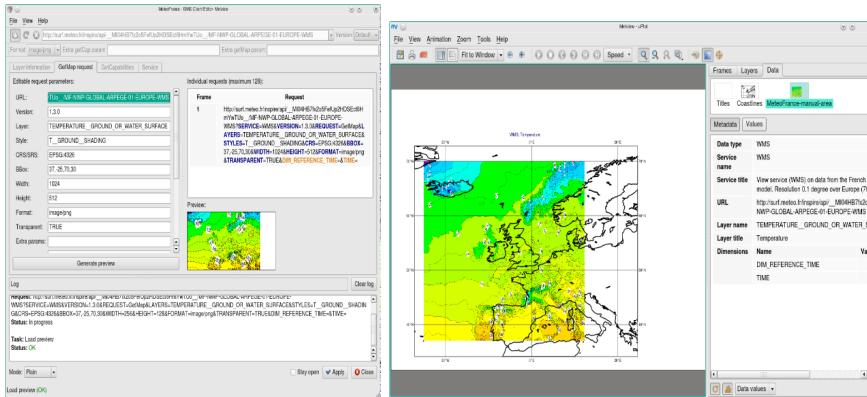


Figure 22 - Metview with Météo France again. We tried to swap the coordinates (x with y) but the resulting plot, although better, was shifted.

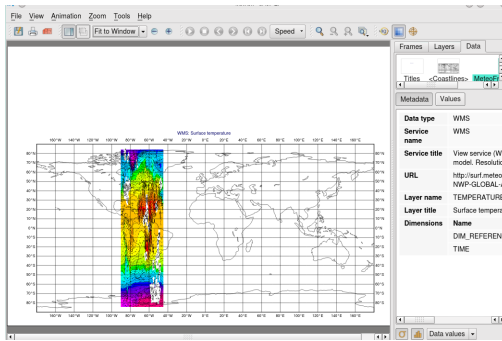


Figure 23 - Metview showing a layer from Météo France's Arpege 0.5 service. The scaling seemed quite wrong.

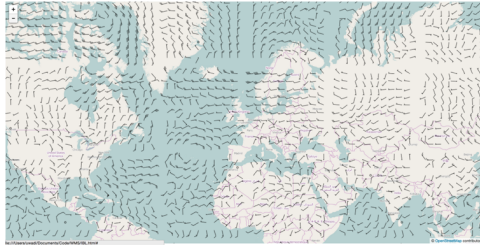


Figure 27 - Leaflet showing GFS 10m wind field served by the server from IBL.

ArcGIS

ESRI's main GIS application is very popular with decision makers in enterprises and government agency. Again, this client is not domain specific and shows how layers served by this community can be successfully integrated.

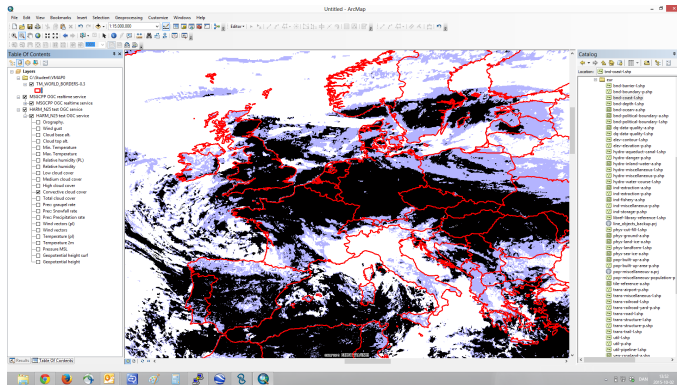


Figure 28 - Satellite layer served by KNMI in ArcGIS.

General observations

In the following some general observations are noted.

- Users found that the naming of layers in EUMETview, the service provided by EUMETSAT, could be improved. Currently the user needs expert knowledge to understand what the layers contain.

Improvements triggered by the plug fest

Many issues identified during the plug fest were addressed either during or shortly after the plug fest. For example, Météo France updated their services shortly afterwards and offered them to the community for testing. Also the Diana client was improved during the plug fest.

Appendix 1: List of participants

| Name | Organisation | Involvement |
|-------------------------|-----------------------------|--|
| Jozef Matula | IBL | VisualWeather, OnlineWeather, OpenWeather |
| Michal Weis | IBL | VisualWeather, OnlineWeather, OpenWeather |
| Martin Franek | IBL | VisualWeather, OnlineWeather, OpenWeather |
| Stephane Dekeyzer | IRM-KMI Belgium | |
| Sören Kalesse | DWD | NinJo WMS client layer |
| Daniel Lee | DWD | QGIS as WMS client |
| Yousef Wadi | Arabia Weather Inc. | Leaflet.js as WMS client |
| Mikko Visa | FMI | QGIS as WMS and WCS client |
| Iain Russell | ECMWF | Metview as WMS client |
| Sandor Kertesz | ECMWF | Metview as WMS client |
| Carlos Valiente | ECMWF | ecCharts WMS server |
| Vlad Merticariu | Jacobs University Bremen | Rasdaman WC(P)S server & EarthServer clients |
| Julia Wagemann | ECMWF | Rasdaman WC(P)S server & EarthServer clients |
| Marc Rautenhaus | Technical University Munich | |
| Ernst de Vreede | KNMI | ADAGUC as WMS client |
| Michal Koutek | KNMI | ADAGUC as WMS client |
| Alexandro Coque | Vestas | ArcGIS as WMS client |
| Alexander Bürger | MET Norway | Diana as WMS client |
| Marie-Françoise Voidrot | Météo-France | Event co-ordinator |
| Jürgen Seib | DWD | DWD WMS server |
| Rémy Giraud | Météo-France | Météo-France WMS & WCS servers |
| Gabrielle Kaufmann | Météo-France | Météo-France WMS & WCS servers |
| Chris Little | UK Met Office | Event co-ordinator |
| Stephan Siemen | ECMWF | Event co-ordinator |