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OGC MetOcean DWG plug fest Engineering Report: Comparison on the Usage of OGC WMS/WCS

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Abstract

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.

Business Value

From a business perspective, in the field of operational weather forecasts it is crucial that information can be exchanged fast and reliable between the various stakeholders. This plug fest served as a showcase that OGC web services can be used to exchange weather maps between various operational services and clients.

Keywords

ogcdocs, MetOcean, plug fest, Web services

Met Ocean DWG plug fest Engineering Report

1 Introduction

1.1 Scope

This specification provides an overview of the definition of SOAP bindings across the OGC suite of standards. It identifies inconsistencies and gaps in defining SOAP interfaces and provides recommendations how all services could be extended with SOAP bindings in a consistent way. It further provides recommendations on how to implement the transfer of binary data for those services transferring either XML Schemas in binary form or other binary data such as e.g. images.

1.2 Document contributor contact points

All questions regarding this document should be directed to the editor or the contributors:

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1.3 Revision history

Date	Release	Editor	Primary clauses modified	Description
Feb 16, 2016	0.9	S. Siemen	all	initial version

1.4 Future work

No future work is planned to this document. It is expected that this document may result in changes in other documents.

1.5 Forward

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Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the standard set forth in this document, and to provide supporting documentation.

2 References

The following documents are referenced in this document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

OGC 06-121r3, *OGC[®] Web Services Common Standard*

OGC 06-121r9, *OGC[®] Web Services Common Standard*

06-042 OpenGIS Web Map Service WMS Implementation Specification

06-121r3 OGC Web Services Common Specification version 1.1.0 with Corrigendum 1

07-057r7 Web Map Tile Service Standard

07-063r1 OpenGIS Web Map Services - Application Profile for EO Products

12-111r1 Best Practices for WMS with Time or Elevation dependent data

Comment [SS1]: Is this the MetOcean one?

3 Terms and definitions

For the purposes of this report, the definitions specified in Clause 4 of the OWS Common Implementation Standard [OGC 06-121r9] shall apply.

4 Conventions

4.1 Abbreviated terms

KVP Key Value Pair

WCPS Web Coverage Processing Service

WCS Web Coverage Service
WMS Web Map Service
WMTS Web Map Tile Service

4.2 **Highlighted Sections**

Sections highlighted in yellow like this section lead to change requests.

5 Background

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

5.1 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.

5.2 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.

5.3 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 servers 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.

5.3.1 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)

5.3.2 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

5.3.3 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.

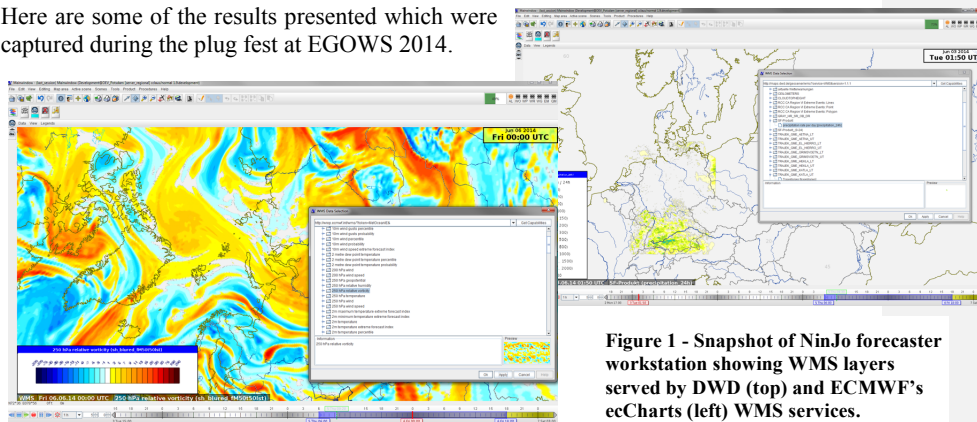


Figure 1 - Snapshot of NinJo forecaster workstation showing WMS layers served by DWD (top) and ECMWF's ecCharts (left) WMS services.

6 Overview of OGC Web Service Interfaces

7 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 2 Photos from the event held in ECMWF's Council Chamber.

7.1 Description of the WMS Servers

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

7.1.1 IBL

Variety of layers to demonstrate various combinations of WMS dimensions (elevation, EPS threshold, EPS member):

<https://ogcie.iblsoft.com/metocean/wms?SERVICE=WMS&VERSION=1.3.0>

7.1.2 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” is provided for this and allows access to 16 layers of forecast products. The service address is

<http://eccharts.ecmwf.int/wms/?token=public&request=GetCapabilities&version=1.1.1>

7.1.3 DWD

Provides a variety of different layers, e.g. forecast, climate, radar, satellite under

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

The service uses HTTP basic authentication for some layers and requires a user name and password. The user “plugfest” was provided on the day, but the credentials were removed after the plugfest.

7.1.4 NOAA

Blah blah blah

7.1.5 Météo-France

Three WMS services were made available which offered forecasts layer in the resolutions:

- Arpege 0°1 GetCapabilities
http://surf.meteo.fr/inspire/api/___MI04HB7fx2o5FefUp2HDSEct6HmYwTUo___/MF-NWP-GLOBAL-ARPEGE-01-EUROPE-WMS?SERVICE=WMS&REQUEST=GetCapabilities&version=1.3.0
- Arpege 0°5 GetCapabilities
http://surf.meteo.fr/inspire/api/___MI04HB7fx2o5FefUp2HDSEct6HmYwTUo___/MF-NWP-GLOBAL-ARPEGE-05-GLOBE-WMS?SERVICE=WMS&REQUEST=GetCapabilities&version=1.3.0
- Arome 0°025 GetCapabilities
http://surf.meteo.fr/inspire/api/___MI04HB7fx2o5FefUp2HDSEct6HmYwTUo___/MF-NWP-HIGHRES-AROME-0025-FRANCE-WMS?SERVICE=WMS&REQUEST=GetCapabilities&version=1.3.0

7.1.6 WOUDC

Blah blah blah

7.1.7 KNMI

KNMI provided access to two WMS services:

- http://geoservices.knmi.nl/cgi-bin/HARM_N25.cgi?service=WMS HARMONIE (real-time forecast)
- <http://msgcpp-ogc-realtime.knmi.nl/msgrt.cgi?> MSGCPP satellite products (real-time)

7.1.8 Norway

Blah blah blah

7.1.9 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 OGC 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.

7.2 Description of the WMS Clients

During the event nine WMS clients were tested.

7.2.1 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.

7.2.2 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).

7.2.3 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.

7.2.4 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.

7.2.5 leafLet

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

7.2.6 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.

7.2.7 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.

7.2.8 IBL

Blah blah blah

7.2.9 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 analysing data and producing maps.

8 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 ⁶	X	X ⁷
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. AGADUC finally succeeded in visualizing Météo-France WMS.
4. Display in Metview was distorted because of a not well defined bounding box. Météo-France fixed the bounding box inversion. Metview should now be able to visualize Météo-France WMS correctly.
5. Metview could not load a particular layer because the default time dimension was invalid
6. Ninjo could not parse Météo-France getCapabilities. Météo-France made the meta-data URL accessible, so Ninjo should be able to parse it now.
7. Météo-France fixed the bounding box inversion and the WMS can now be be visualized with QGIS.

LeafLet/ECMWF: error

Ninjo/KNMI: problem dimension with observation layers

Ninjo/EUMETSAT: invalid parameter

8.1 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 3 - Diana workstation overlaying layers served by ECMWF/ccCharts (black wind arrows), DWD (filled), and AROME MetCoop (MET Norway and SMHI, magenta wind arrows).

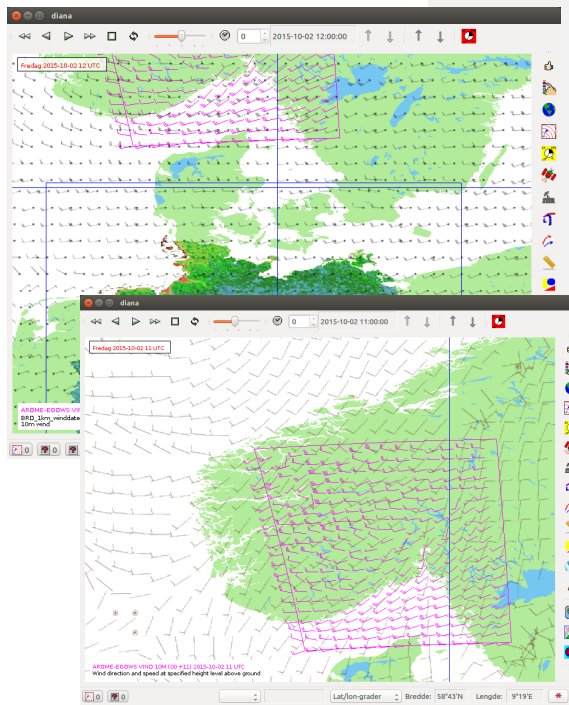


Figure 4 - Layers served by Météo France (grey wind arrows), and AROME MetCoop (MET Norway and SMHI, magenta wind arrows).

8.2 ADAGUC

During the plugfest a few minor problems in the ADAGUC viewer surfaced:

- accessing services behind https can sometimes be challenging, needs extra attention
- accessing services behind some kind of authentication can be challenging. The ADAGUC viewer supports key based authentication and can also handle basic authentication.
- ADAGUC server supports WCS 1.0, but there was no time (nor any clients I believe) to that.

There was a closer investigation why the ADAGUC viewer could not access the WMS services on surf.meteo.fr, or more precisely why the ADAGUC viewer could not parse the GetCapabilities provided by Météo France's services.

It turns out that the ADAGUC viewer checks if the getCapabilities response starts with a so-called XML Declaration, in the form of `<?xml version="1.0" encoding="UTF-8" standalone="no" ?>`. We actually check if the response starts with `<?XML`. The WMS services at surf.meteo.fr do not provide these XML declarations at the beginning of the GetCapabilities response. If I turn of this check in the ADAGUC software, the GetCapabilities are parsed correctly. It turns out that the XML declaration is strongly recommended for all XML documents, but is not mandatory (at least in XML version 1.0). So I guess we might have to change ADAGUC's GetCapabilities parsing to conform better with the "daily practices" in WMS services. After changing the parsing I can see the services of on surf.meteo.fr in the ADAGUC viewer. I can then for example make a combination of KNMI's HARMONIE and AROME. The ADAGUC viewer can match HARMONIE and AROME using the TIME and the REFERENCE_TIME dimension.

A few remarks about the services from surf.meteo.fr observed with the ADAGUC client are noted in the paragraph about the Météo-France server.

All-in-all it looks like the surf.meteo.fr are (more or less) interoperable with the ADAGUC viewer after all. The handling of TIME and REFERENCE_TIME dimensions is interoperable.

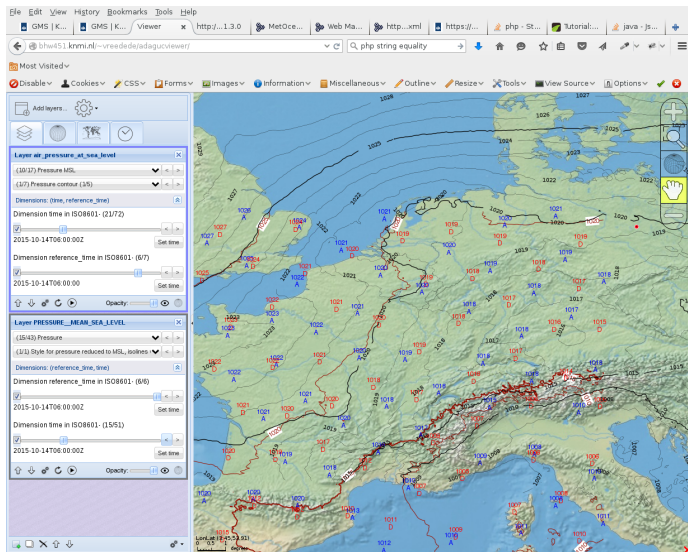


Figure 5 ADAGUC showing a comparison of MSL pressure fields of Harmonie and Arome served by Météo France.

8.3 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.

A few remarks about the services from surf.meteo.fr observed with the ADAGUC client

- Only one projection is supported (EPSG:4326).
- Vertical levels do not always seem to have the correct units; for example “Temperature at specific height level above ground” has levels like 10,1000,...,2,200,... and units are hPa. I assume that should be meters (above surface ??) ? Also these vertical levels are sorted alphabetically, which can be a bit confusing.
- There are no legends available.
- There is no GetFeatureInfo available (this is not required)
- Not all layer names are clear (like 2 layers named pressure in one service).

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 [SS2]: 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>
```

This error is almost certainly caused by the client requesting data for a time for which there is no data available in the service.

The ADAGUC server advertises rather large legend sizes in the GetCapabilities, but “shrinks” the actual legends to a minimal size by removing excess whitespace. This is done because with ADAGUC legend size is often dependent of the data displayed (i.e. data value range can vary according to zoom-level). Therefore at the moment the GetCapabilities is called there is no way to be sure what the size a future GetLegendGraphic call would be. The ADAGUC clients copes with this by not interpreting the size in the GetCapabilities as a hint about the maximum size; it displays the legend in it’s actual size.

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>
```

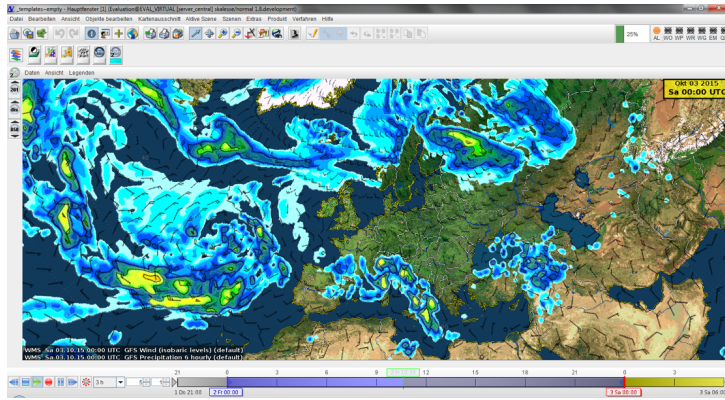


Figure 6 - NinJo client showing layers served by IBL WMS server.

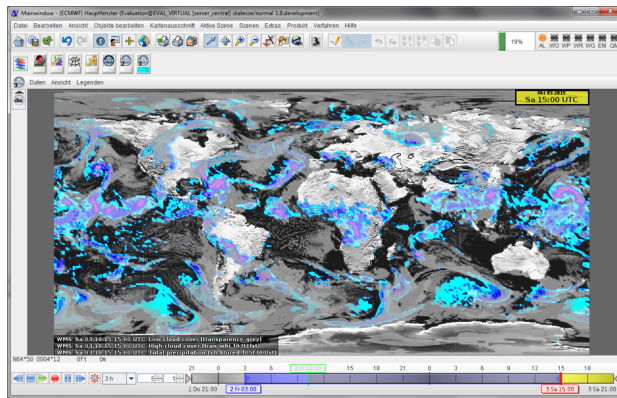
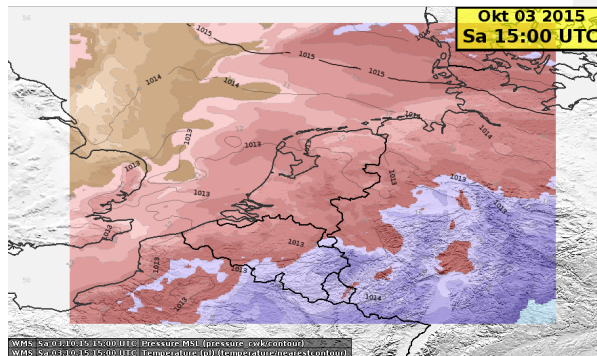


Figure 7 - Layers served by ecCharts/ECMWF shown in NinJo.

Figure 8 - KNMI WMS layers shown in NinJo.



8.4 VisualWeather

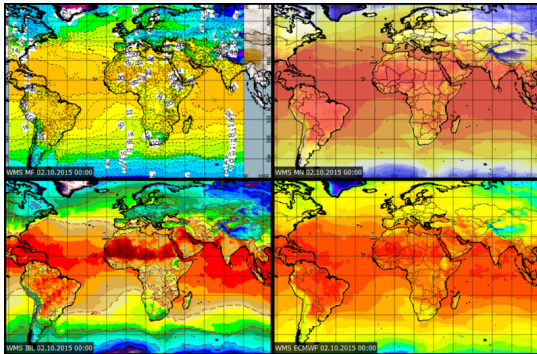


Figure 9 - VisualWeather showing satellite layers from EUMETview and wind from the GFS service from IBL.

Figure 10 - VisualWeather showing surface temperature from four WMS services. Clock-wise from the top left they are: Météo France, ECMWF, MET Norway and IBL-GFS.

8.5 OnlineWeather

Figure 11 - OnlineWeather showing WMS layers from DWD.

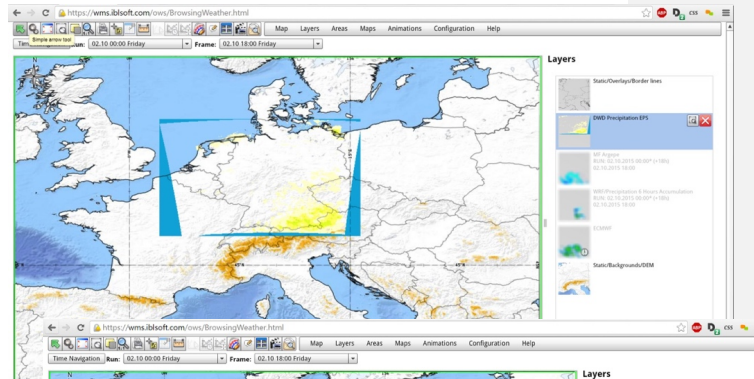


Figure 12 - OnlineWeather showing precipitation forecasts from Météo France.

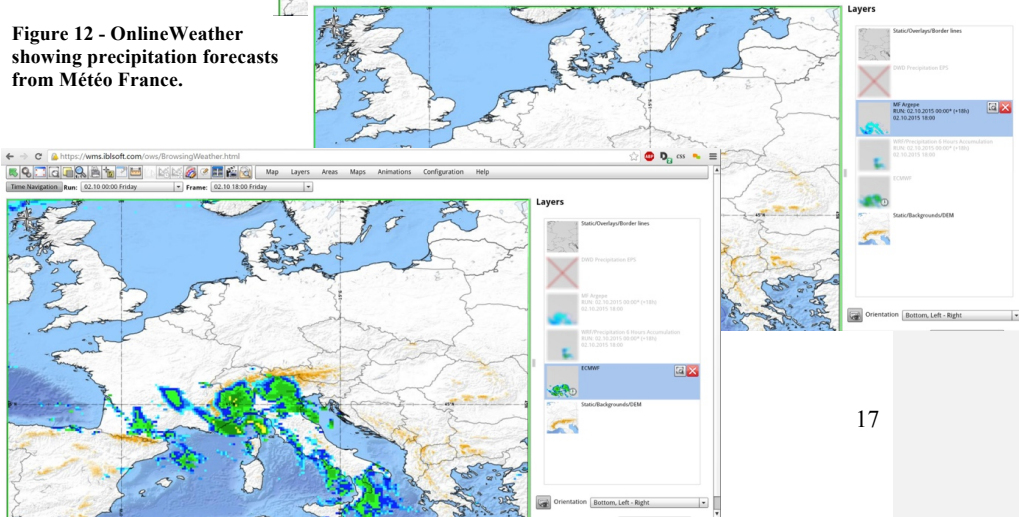


Figure 13 - OnlineWeather showing precipitation forecasts from ECMWF.

8.6 Metview

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

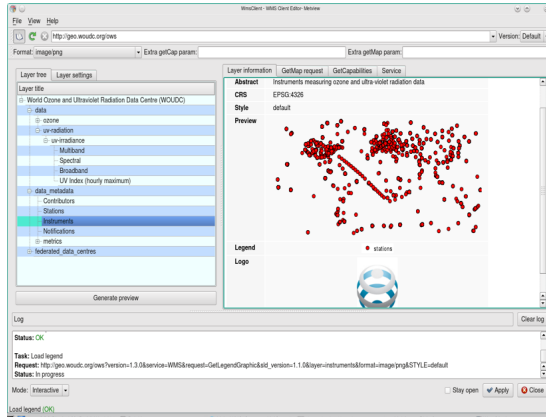


Figure 14- Metview showing the getCapabilities returned by Environment Canada. Layers are shown on the left, on the right a preview is shown. The layer we selected made it hard to check whether it was correctly geo-located, but it seemed plausible.

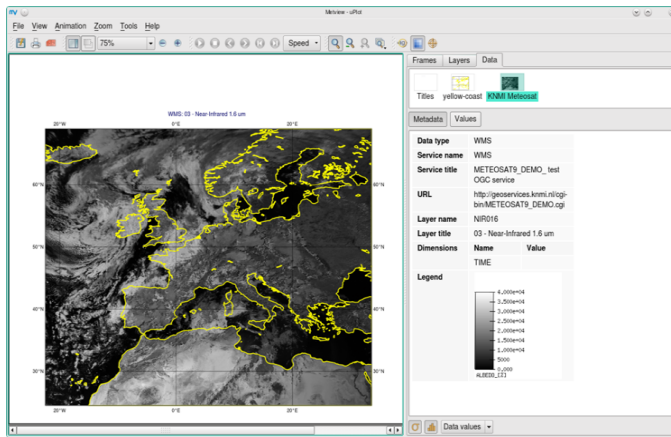


Figure 15 – Metview showing a satellite layer served from the KNMI server, with layer information displayed on the right. The alignment with Metview’s own coastlines was perfect.

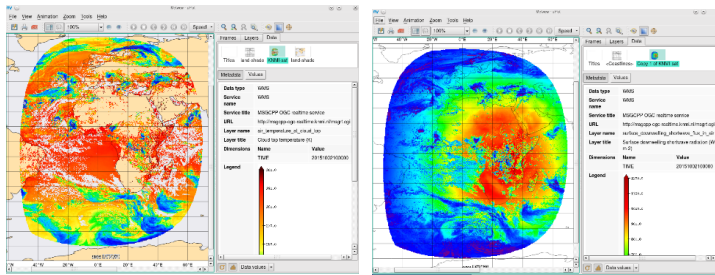


Figure 16 – Metview showing more satellite data from KNMI. This was harder to verify but it looked like it matched the coastlines well.

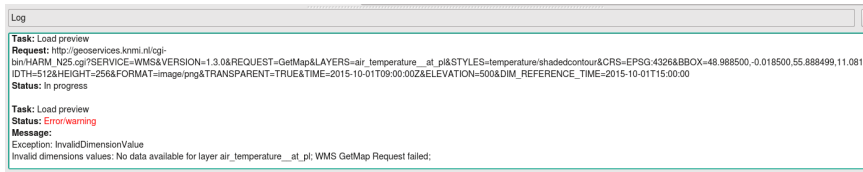


Figure 17 – Metview could not retrieve the air temperature layer from KNMI’s HARMONIE server when using the default time dimensions. These were invalid, with the default TIME being before the default reference time. With manually-specified times it was ok.

Figure 18 - Metview showing a layer served by ECMWF's ecCharts/WMS service. Layer information is displayed on the right.

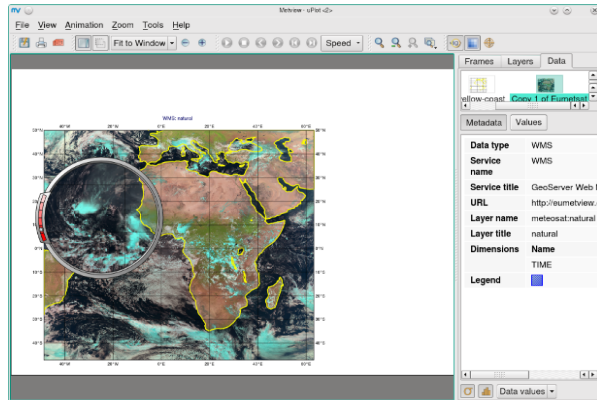
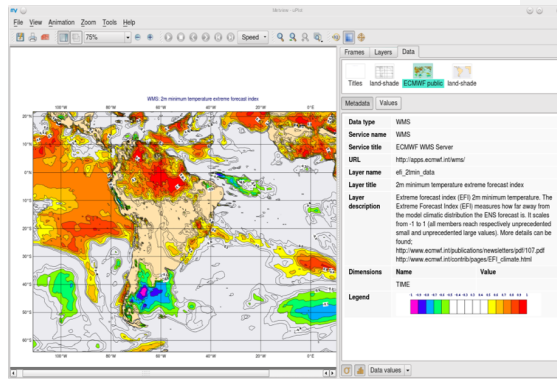
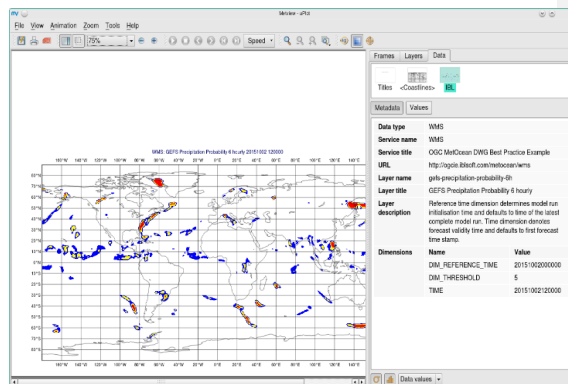


Figure 19- Metview showing data from the EUMETSAT server, looks correct.

Figure 20 – Metview showing a later from IBL’s server. Metview could not connect to this server through https, but http worked. The problem seemed to be on Metview’s side.



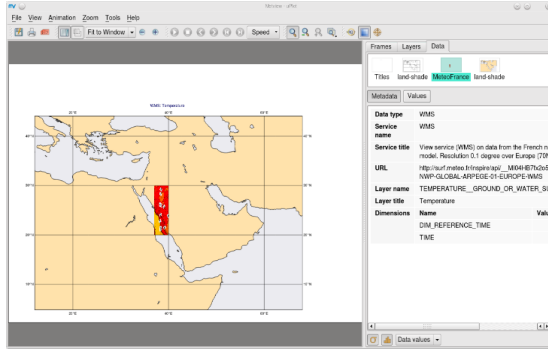


Figure 21 - Metview showing a later from Météo France’s Arpege 0.1 service, using WMS 1.3.0. Metview did not request a specific area. The returned minX, maxX etc coordinates seemed to be wrong.

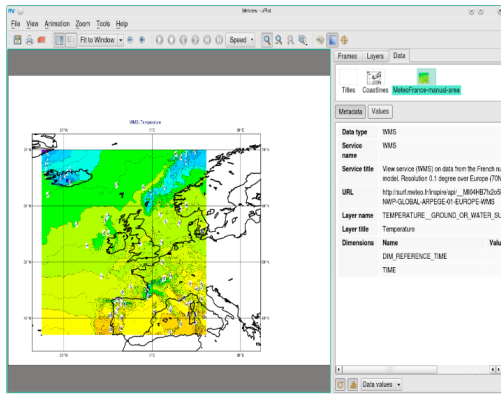
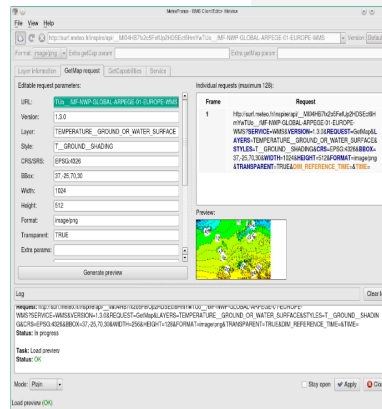


Figure 22 – Metview with Météo France again. We tried to swap the coordinates (x with y) but the resulting plot, although better, was shifted.



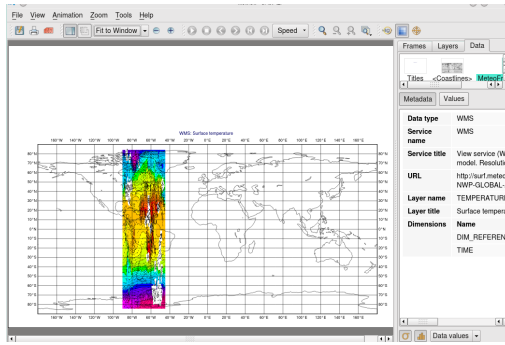


Figure 23 – Metview showing a layer from Météo France’s Arpege 0.5 service. The scaling seemed quite wrong.

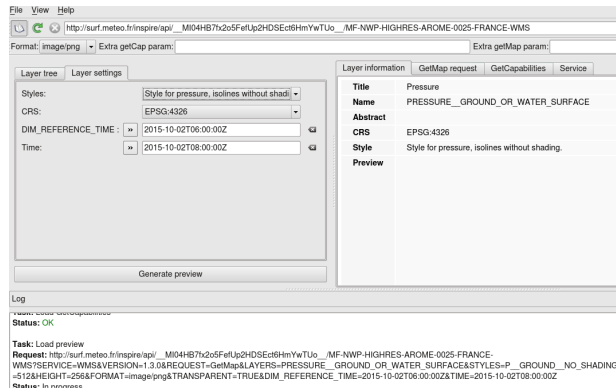


Figure 24 – Metview attempting to plot a layer from Météo France’s Arome server. The layers seemed to be blank.

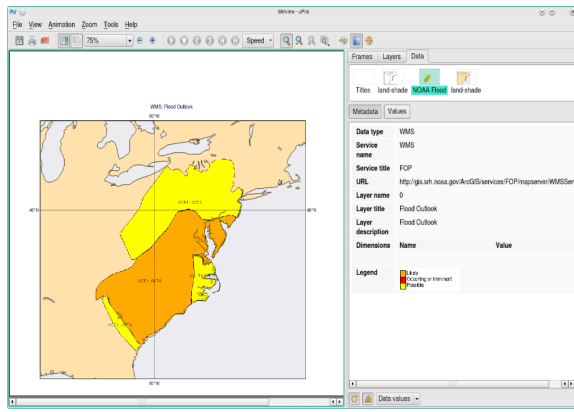


Figure 25 – Metview displaying a layer from NOAA. It seemed to be located correctly

8.7 Leaflet.js

This JavaScript framework is not domain specific and therefore was a good test to see how these services would be able to integrate in a generic viewer.

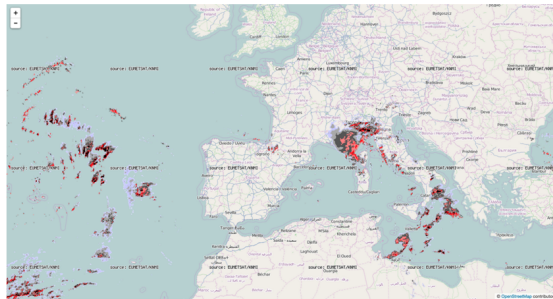


Figure 26 - Leaflet.js showing satellite overlay of Harmony KNMI field.

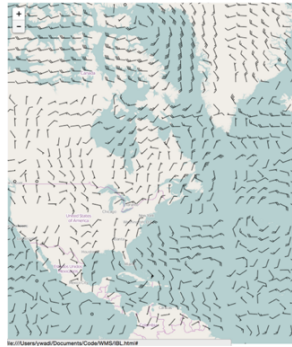


Figure 27 - Leaflet showing GFS 10m wind field served by the server from IBL.

8.8 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.

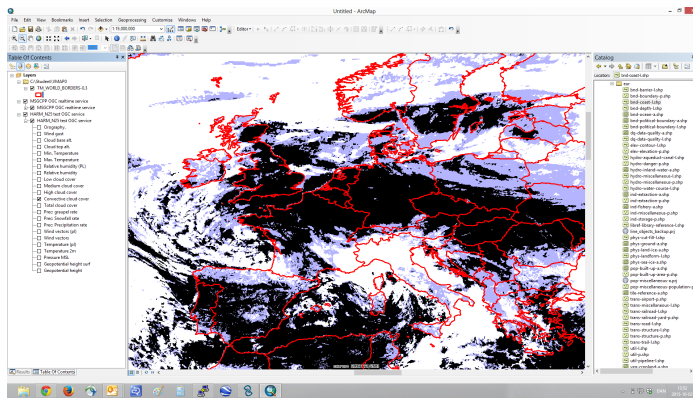


Figure 28 - Satellite layer served by KNMI in ArcGIS.

9 General observations

In the following some general observations are noted.

- This plugfest showed the progress this community has achieved over the last years. There were much fewer technical issues than before.
- A new group of challenges appeared in form of authentications. More services use either https or an account system to limit the access to their services.
- Users found that the naming of layers is very important, especially if non-domain experts want to use the services. An example is EUMETview, the service provided by EUMETSAT, where currently the user would need expert knowledge to understand what the layers contain.

10 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.

11 Recommendations

11.1 Service improvements

12 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 Kertész	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 & server
Michal Koutek	KNMI	ADAGUC as WMS client & server
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
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Bibliography

[1]