EUMETNET
EUROPEAN METEOROLOGICAL SERVICES NETWORK

E-GVAP-II

The EIG EUMETNET GNSS Water Vapour Programme

3rd plenary meeting
October 21 2011, Météo France, Toulouse

Agenda, E-GVAP-II 3nd plenary meeting Météo France, Toulouse

Start of meeting 13:00

- **Practicalities, agenda, minutes from previous meeting.**
- **Status and updates on the ground based GNSS meteorological status in each member country, by each member representative.**
- **Information from the E-GVAP team, including**
  - **Status**
  - **The effect on E-GVAP of the EUMETNET movement to an EIG**
  - **Beginning collaboration with EUCOS**
  - **Active quality control. Status, discussion, plans.**
  - **Collaboration with NOAA.**
  - **E-GVAP in the emerging new EUMETNET observations roadmap**
  - **COST action on ground-based GNSS meteorology?!**

- **Outlook, discussion of work in coming period.**
- **Time of next plenary meeting**
- **Any other matter**

Finish of meeting no later than 16:00.

National reporting from members

Belgium, Croatia, Iceland, Finland, Rep. of Ireland, Serbia: Nothing new relative to Oslo meeting

Hungary: A nationally funded project between geodesists and meteorologists have now been set up. This follows a discusions over several years between Ambrus Kenyeres and Henrik. Inclusion of data in E-GVAP database is expected later this year, starting with upload to the ”test” directory. Contacts: Ambrus Kenyeres from the Geodetic Observatory, Institute of Geodesy, Cartography and Remote Sensing in Budapest. Szabolcs Rozsa, Budapest University of Geodesy and Economics. Boloni Gergely and Balint Varga, OMSZ.

See: http://gpsmet.agt.bme.hu/indexen.php

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BME-ÁFGT 1777

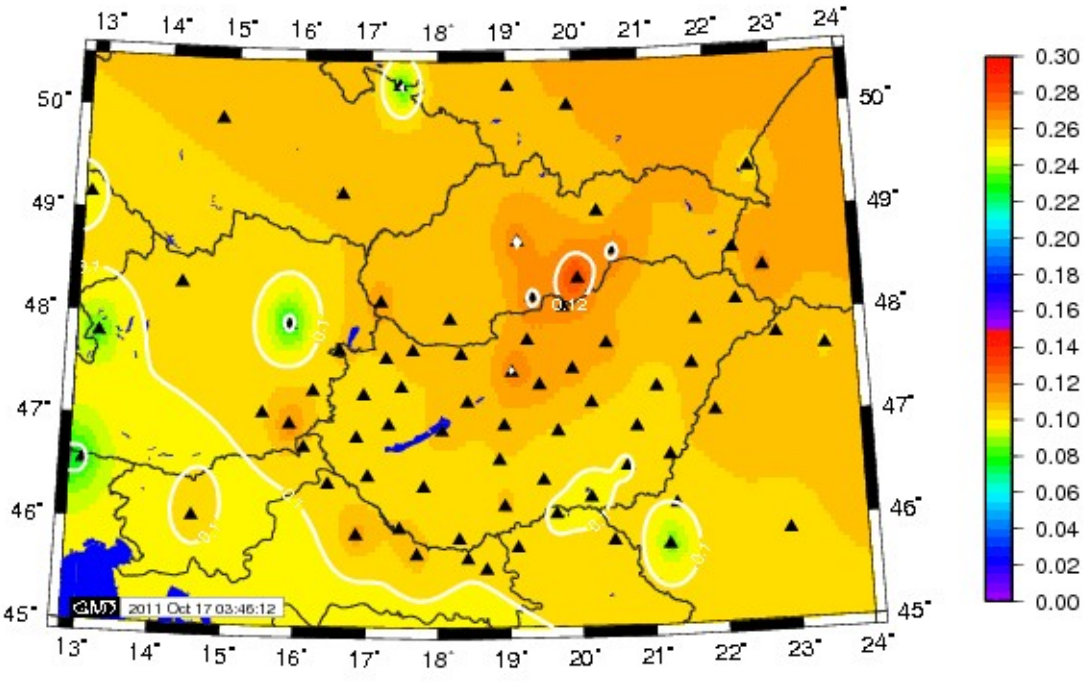
This site is under construction. Additional information will be posted soon.

The estimation of actual tropospheric zenith wet delays based on GNSS observations.

- Kezdőoldal
- GNSS és a vízgőz
- Archív térképek
- GNSS Adatok
- Partnerek
- Linkek
- Kapcsolat

MTA - BME
FGG
Fizikai Geodézia és Geodinamikai Kutatócsoport
BME Általános és Felsőgeodézia Tanszék
FÖMI Kozmikus Geodéziai Obszervatórium

Zenith Wet Delay [m] (11–10–17(00h)



Bulgaria

- Agreement being made about access to data from Bulgiarian Bulipos GNSS sites. Will be processed either at METO or GOP. Contacts Guergana Guerova, Department of Meteorology and Geophysics, Sofia University and Prof. Milev, director of the Bulipos network.

EUPOS sites

Last week on the EUPOS Steering Committee (ISC) meeting we discussed the possible cooperation of E-GVAP and EUPOS.

EUPOS is a cooperation of GNSS service providers, mostly covering Central- and East-European countries. This is the region with low representation in the GNSS network E-GVAP.

Some EUPOS countries are already contributing (e.g. Czech R.), some will contribute soon (e.g. Hungary) and some may think on this.

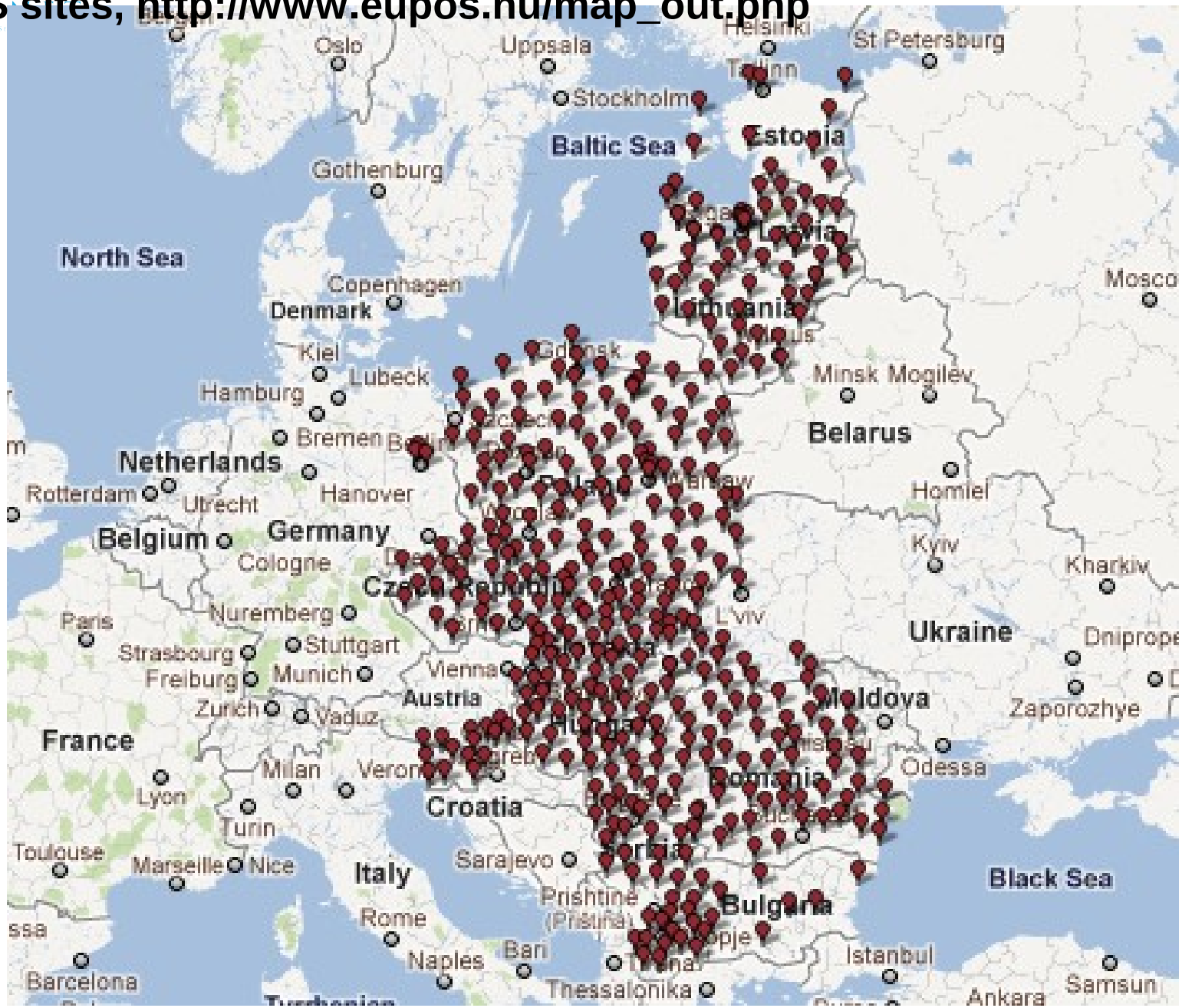
In our discussion we expressed that the current situation should be improved and we concluded that a general MoU may be prepared between E-GVAP and EUPOS, where EUPOS expresses its willingness to support the cooperation in general, but then the actual contribution should be organized in bilateral agreements.

In the MoU we should clarify also that the commercial services running in the countries are ready to support scientific activities, until the point that those research results are not becoming commercial.

Henrik, you may discuss this issue in your meeting and then please contact Gerd Rosenthal, Head of the EUPOS ISC to start the official preparation of the MoU. I am also ready to help you in the preparatory phase.

Wishing you a successful meeting, Ambrus

EUPOS sites, http://www.eupos.hu/map_out.php



Germany

Klaus Stephan at expert teams meeting:

Currently not a member of E-GVAP

Denmark, DMI

GB GNNS data. Access and processing.

- DMI is colaborating with the NRT GPS processing centre NGAA at SMHI, such that Danish GPS data are processed at SMHI.
- The Danish GPS data come from 2 sources:
    1. The national Danish mapping agency.
    2. A private network called GPSnet.
- The access is based on agreements between the data providers and Chalmers Space Observatory.
- Potential for more Danish data, as a second private network operator exits.
- Currently there is no direct interaction between DMI and the two private networks.

GPSnet (green, names) + Trimble network (red, numbers)

DMI

- Extraction of O-B site&AC specific statistics from passive assimimilation of all data uploaded data to E-GVAP as ”operational” (though only one per AC per assimilation cycle). Calculation of offset statistics. Continously since July 2007
- Derived preprocessing/data selection algorithms enabling selection of ”good and robust” ZTD data with Gaussian O-B distribtutions for assimilation resulting in whitelists.
  - Both processing centre and station dependent investigation.
  - Long term bias correction (more than a month of data).
  - Obserror from above statistics.

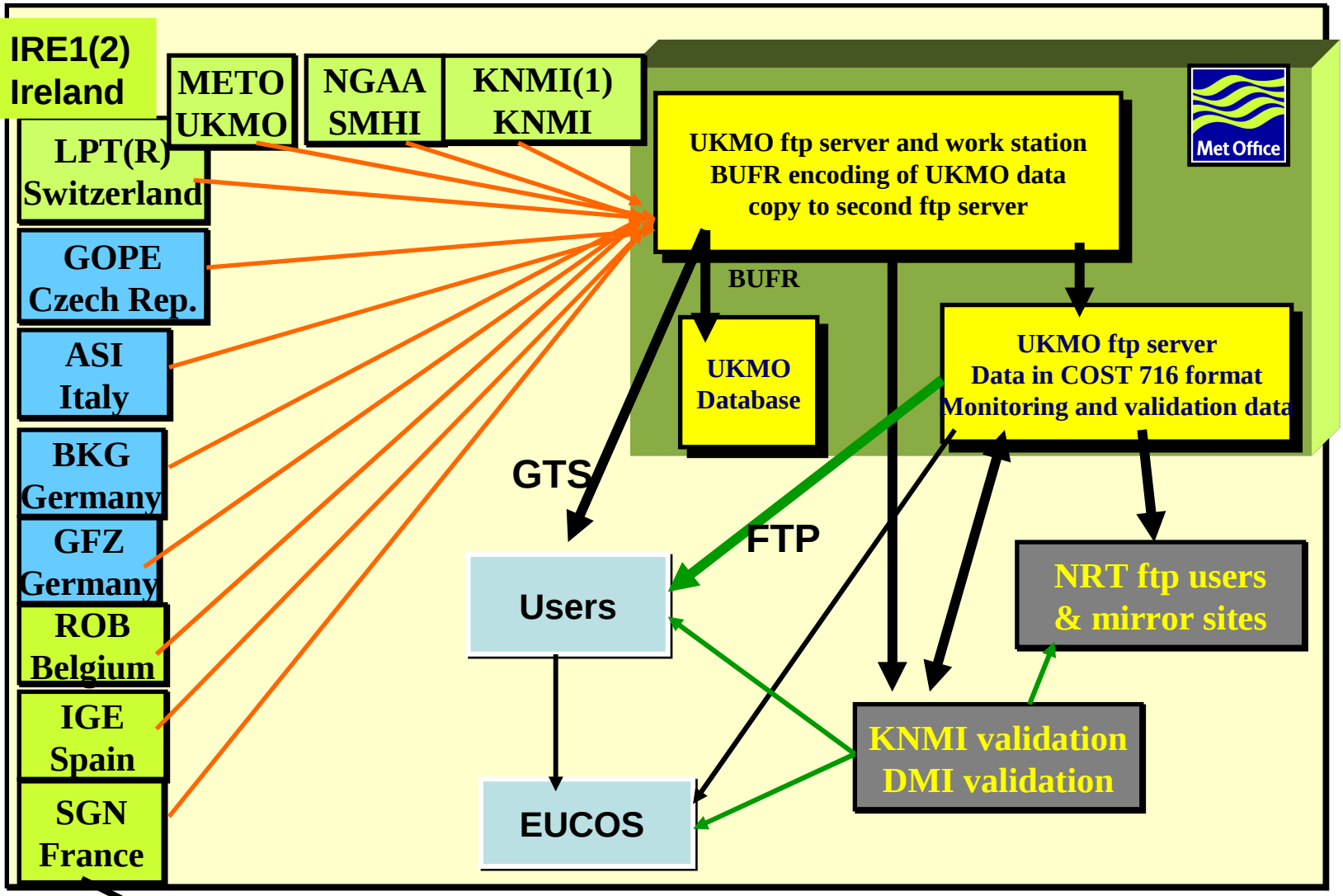
DMI

- Doing active assimilation in parallel to operatinal runs, at 10 and 3 km resolution, using new whitelists.
- Now using GNSS data operationally in ”Slippery Road Model”
- To start include assimilation of ZTDs in other operational models when impact studies have given satisfactory results (neutral to positive impact). Probably end of 2011
- *Timeliness is critical to our short cutoff runs* (order 95 min past NWP starttime). The data selection is different in our short and long cutoff runs.
- NGAA performance is important to DMI. The types of intermittent quality problems which NGAA sometimes suffer, have been found to be well detected by the AQC.

Status and outlook.

OBS system overview

NRT GNSS ZTD data flow Today

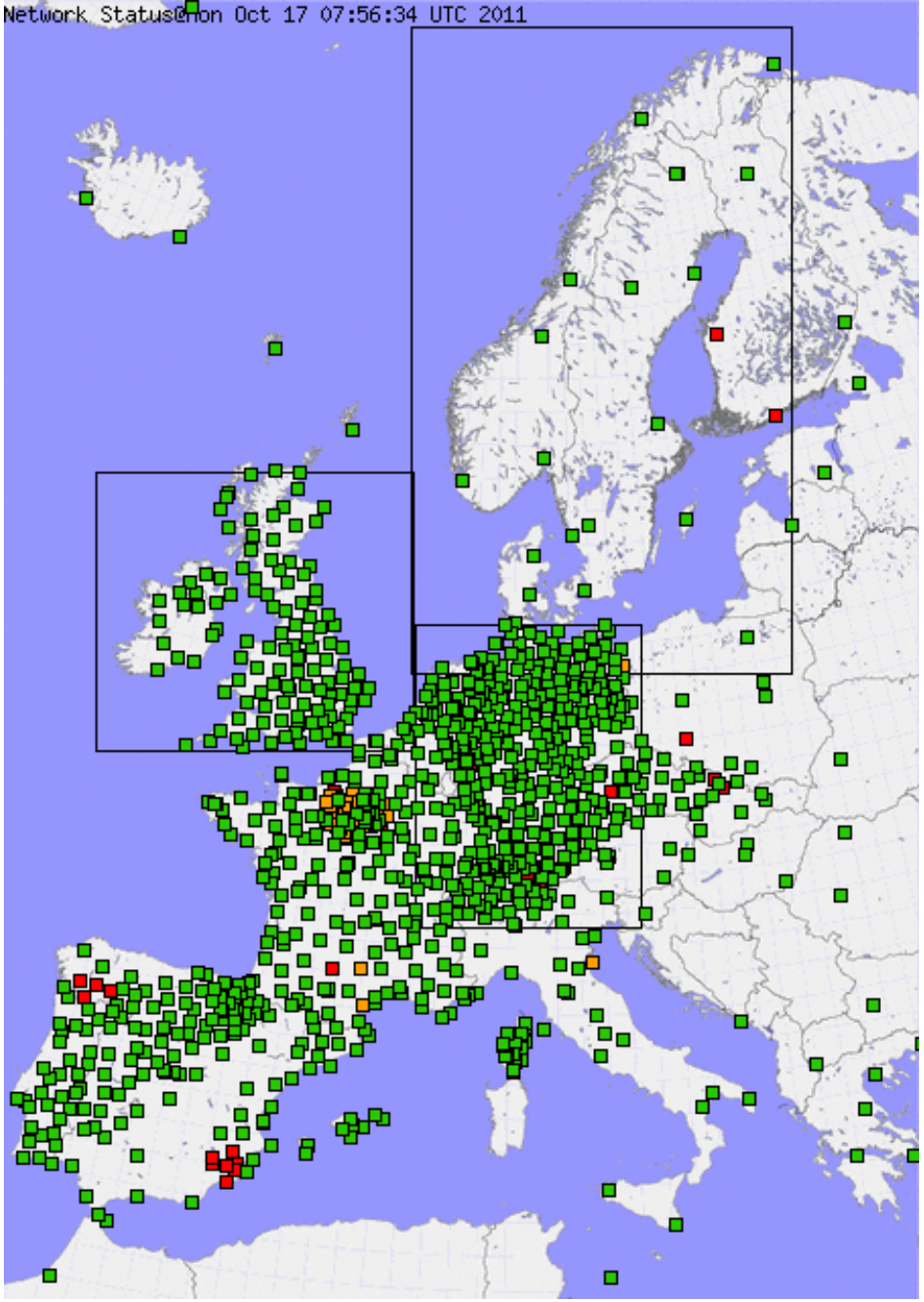


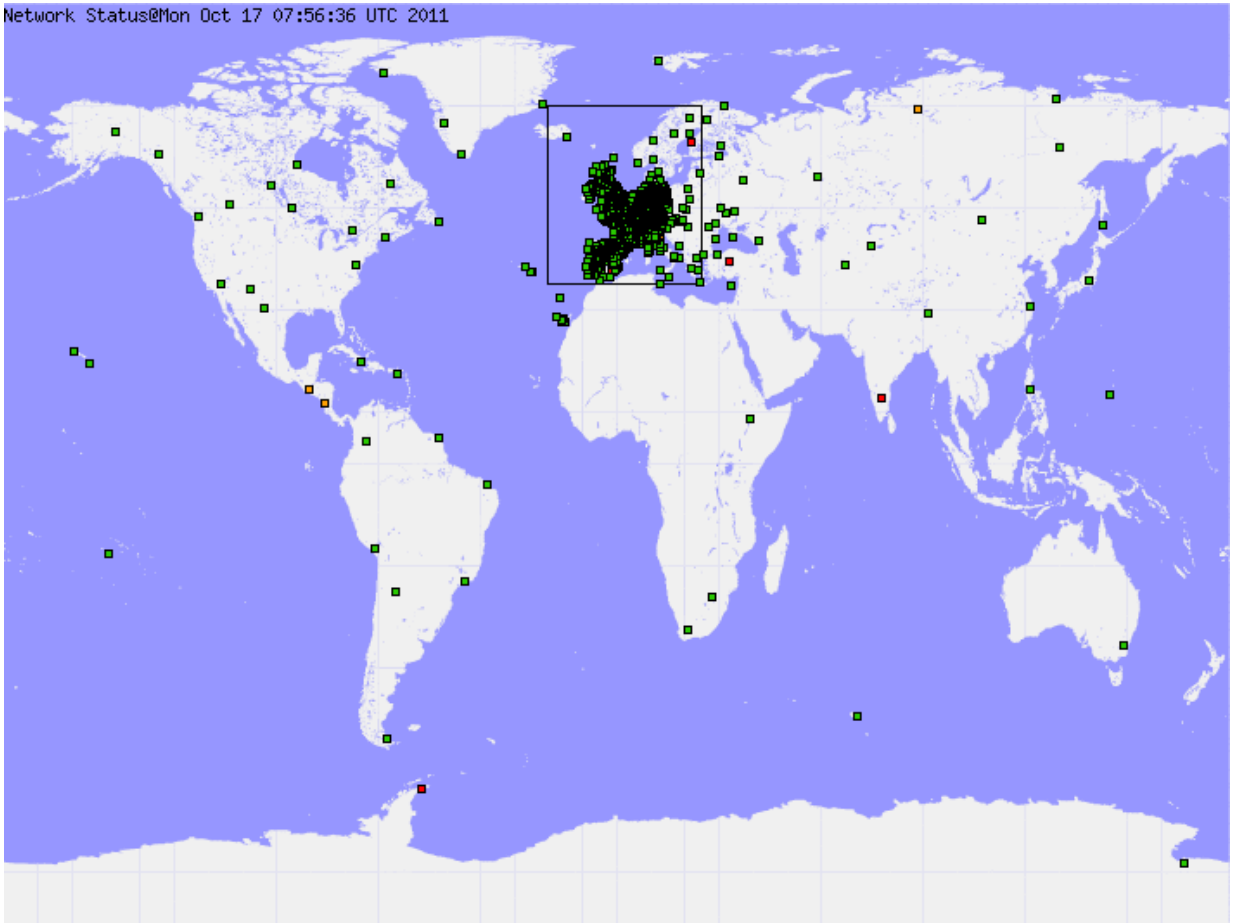
Analysis centres (ACs), each processing raw GNSS data from many sites. In many cases only national AC can get access to the raw data.

DATA COVERAGE

From validation link at homepage.

A click on a square/site opens a window with graphical and statistical monitoring and validation material





Global processing now at two ACs, products GOPG and METG. GOPG has just been moved to ”operational”.

Negotiating access to North Amr. ZTD/IWV data (many 100 of sites), and collaboration on real time quality control and data processing with NOAA.

Negotiating for a long time access to North Amr. ZTD/IWV data (many 100 of sites), and collaboration on real time quality control and data processing with NOAA.

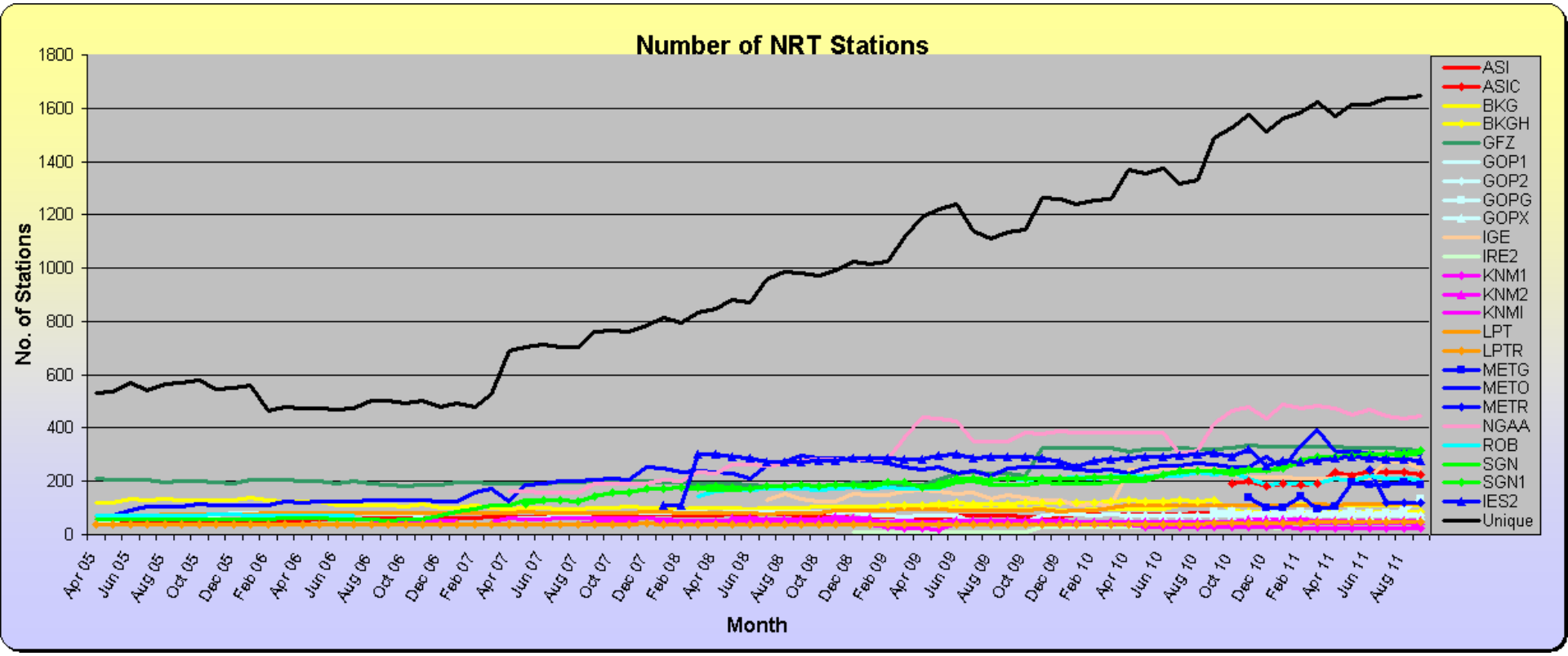
At the ESA Galileo Conference primo September Seth Gutman from NOAA and Henrik met.

Production of GNSS delays is currently in researcd mode at NOAA. There is a ressource problem in moving to operational mode, which prevents NOAA from engaging in an MoU based formal operational collaboration right now.

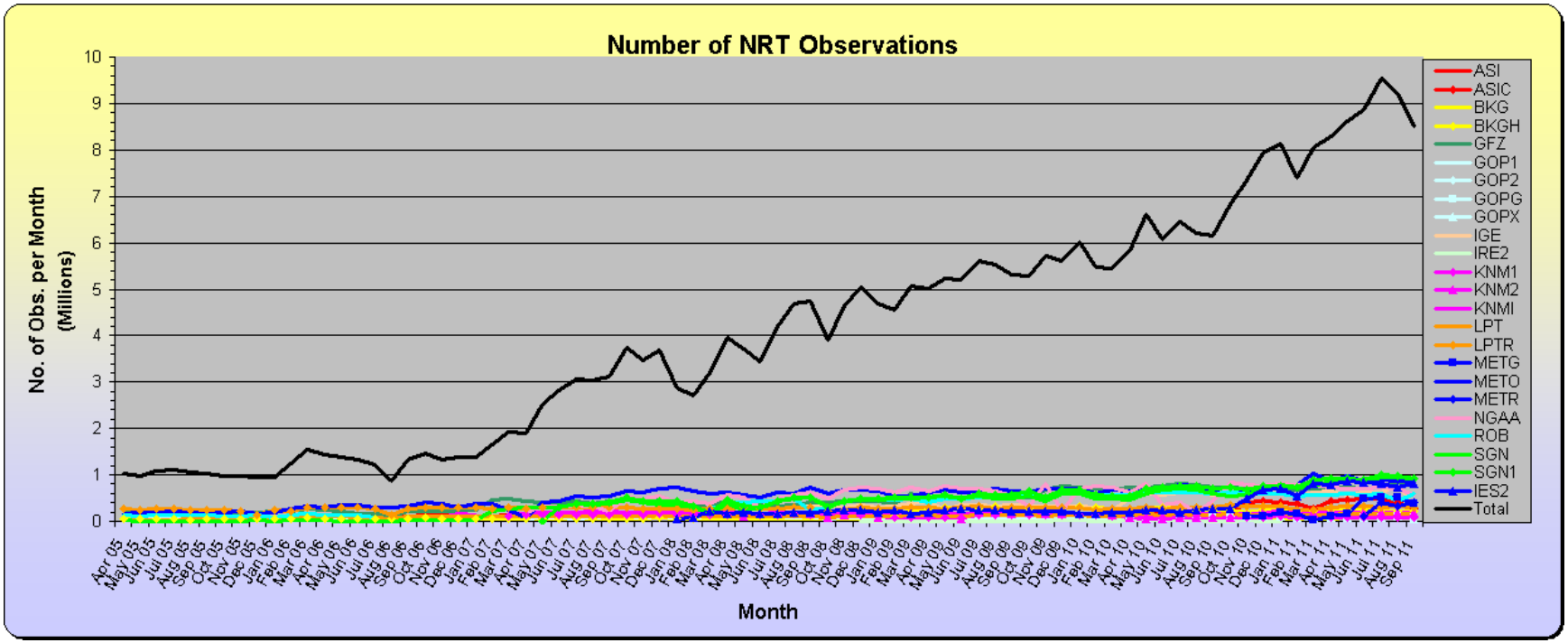
Recently NOAA has started formulation of a bussiness case, for operational production of GNSS delays.

On the E-GVAP side we have just become allowed to start collaboration with NOAA, *without* first making an MoU. The approach could be to to setup fetch the NOAA data via ftp ourselves, and convert them to the formats we use our side of the Atlantic.

Contacts have be made now also to Environment Canada, to gain access to Canadian GNSS delay data.

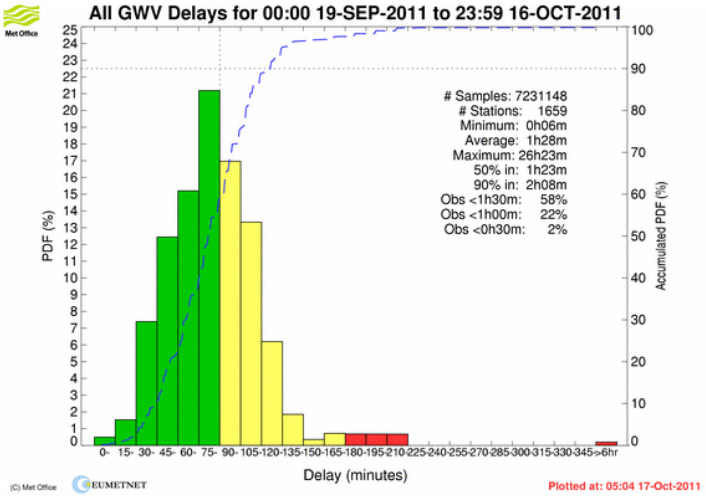


Number of unique GNSS sites versus time.

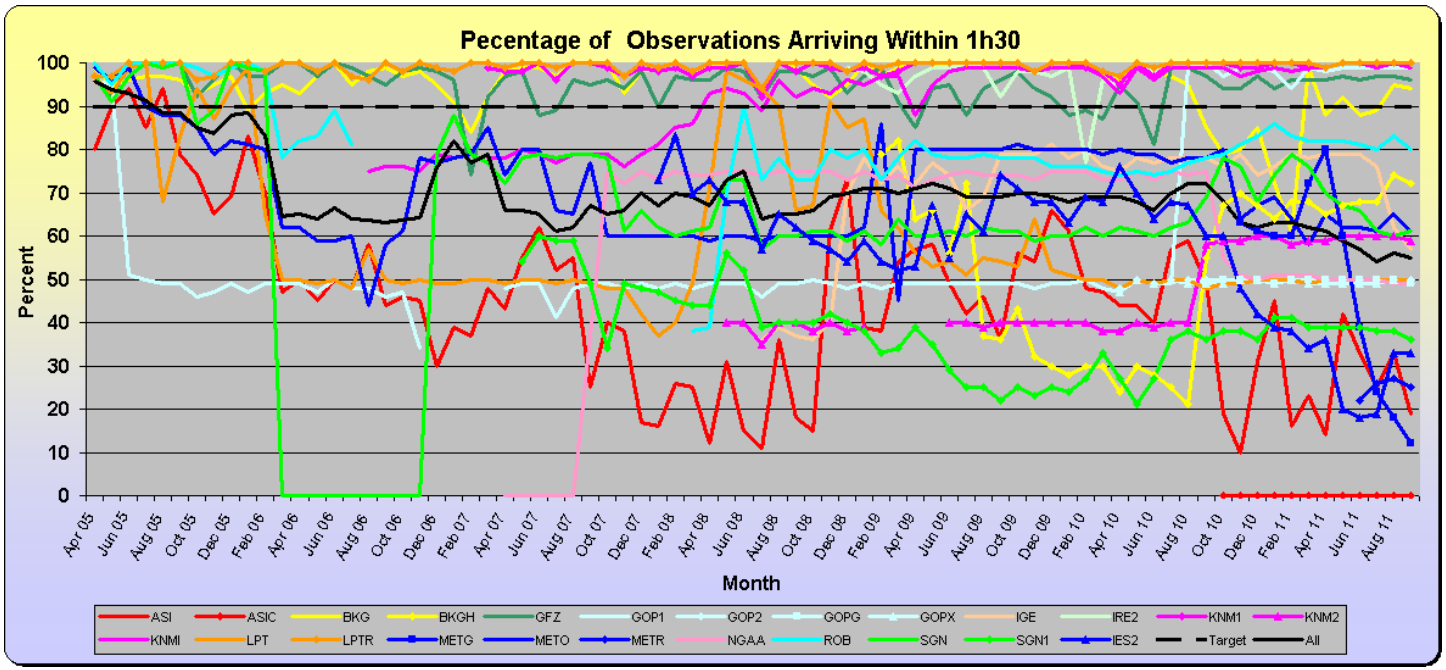


Number of observations versus time.
From E-GVAP homepage.

Delivery timeliness



- Most (non-TEST) ACs providing data with good timeliness – on average, 90% of all ZTD obs arrive within 1h50m (*target 1h30m*)
- Future trends to shorter NWP model cut-off times will demand reduced latency



Supersite processing, biases (one week)

Bias

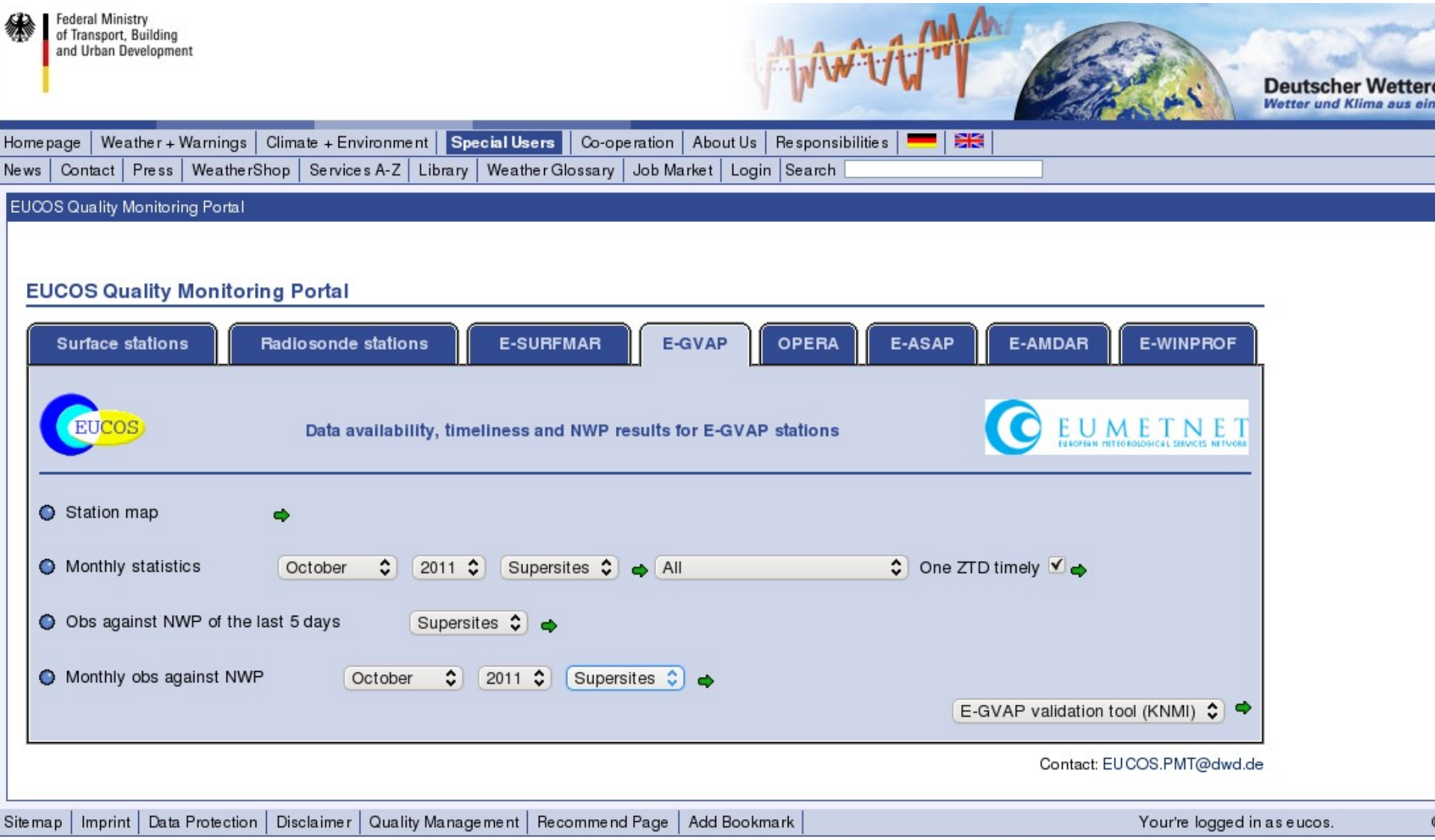
AC	BRST	CABW	CAGL	CAMO	GOPE	IZAN	LDB2	M0SE	MEDI	MILO	ONSA	PAYE	SMNE	YEBE	ZIMM
ASI_	-5.85		-2.42		13.81		24.99	22.65	-6.01	3.42	30.44		-12.63	2.30	1.07
ASIC	-4.26	0.21	-1.00	-0.96	15.26		20.15	22.60	-5.63	1.02	31.70	2.73	-2.66	1.38	5.45
BKG_			-2.41		11.90		23.42		-8.27		29.69			-1.43	4.00
GFZ_	8.36		-4.83		25.41		12.39		2.55		37.32			13.27	37.16
GOP1	-4.90	-0.96	0.37		12.91		19.16	23.77	-6.81		31.65		-0.09	2.04	9.13
IGE_	-4.33		1.28		14.76			23.93		1.14	32.46		-1.31	0.70	9.29
KNM1	-4.68				18.38						33.22				
KNMI	-2.01	1.38	-10.83					14.03	-4.46					5.79	9.63
LPT_	-5.91	0.36	-0.23		15.99		22.59	22.17	-7.67	0.23	30.70	3.93	-1.23	0.85	7.19
LPTR												3.82			
METO	-6.78		20.71	-2.68	18.76		20.09	21.97	-5.35	0.46	31.84	-0.52		-0.67	4.98
METR	-5.05			-2.36				21.89		2.04			-2.07		
ROB_	-4.22	-0.23	0.56	1.18	11.71		19.09	21.40	-7.91	0.76	28.83		-5.42	-0.45	4.72
ROBT															
SGN_	-3.90	0.53	0.05	-1.19	13.71		20.86	20.25	-5.47	1.28	31.13	4.10	-0.37	0.49	6.08
SGN1	-3.99	1.18	0.48	-0.98	14.07		20.82	20.23	-4.98	1.46	31.10	4.04	-0.11	-0.57	5.91

Supersite processing, standard deviations (one week)

Standard Deviation

AC	BRST	CABW	CAGL	CAMO	GOPE	IZAN	LDB2	M0SE	MEDI	MILO	ONSA	PAYE	SMNE	YEBE	ZIMM
ASI_	8.83		15.98		9.24		9.79	9.57	8.89	13.01	4.95		8.70	7.72	6.53
ASIC	9.22	6.74	12.06	9.81	8.07		8.50	8.87	7.94	12.00	4.82	6.83	8.27	5.81	6.17
BKG_			11.67		8.56		7.71		7.68		4.75			7.17	5.28
GFZ_	8.08		11.55		8.81		7.31		9.46		3.90			7.95	8.29
GOP1	8.79	8.16	11.85		7.06		8.31	10.38	8.24		4.86		8.59	5.65	5.68
IGE_	9.20		13.51		8.04			9.82		11.67	7.12		8.27	5.80	6.64
KNM1	11.64				9.78						9.63				
KNMI	13.49	14.53	24.81					19.62	9.31					7.31	18.38
LPT_	8.76	8.00	12.81		8.63		8.52	8.41	8.52	12.54	4.44	5.87	8.11	5.41	7.00
LPTR												9.92			
METO	7.54		25.61	9.03	16.27		9.24	9.63	10.73	13.70	7.91	5.66		6.91	6.49
METR	8.55			12.08				8.00		12.12			9.64		
ROB_	7.41	4.45	11.37	8.98	8.92		11.89	11.96	8.62	14.61	4.84		9.71	6.73	7.38
ROBT															
SGN_	8.63	6.82	11.67	10.61	9.35		8.92	10.92	7.64	11.79	5.44	6.37	9.47	6.54	7.69
SGN1	8.37	6.80	11.18	10.46	9.34		9.50	10.86	8.16	12.20	5.84	6.38	9.29	5.68	7.72

EUCOS Quality Monitoring Portal (QMP)
To obtain uid and pw, ask per email!



EUCOS Quality Monitoring Portal

Surface stations | Radiosonde stations | E-SURFMAR | E-GVAP | OPERA | E-ASAP | E-AMDAR | E-WINPROF

EUCOS

Monthly statistic of E-GVAP data *(09/2011)*
Analysing Centre: METO one ZTD timely: true

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Legend

, Export as CSV

291 stations found.

Identifier	Station	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Σ / Ø	%
ABEP	METO	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	23	24	24	24	23	24	24	24	24	24	24	24	24	24	718	100
		49	51	55	55	55	55	54	52	52	53	53	50	51	52	52	52	50	52	51	53	52	51	52	51	52	53	50	53	53	52	52	100
ABYW	METO	-	-	-	-	-	-	12	-	-	-	-	-	-	-	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35	5
		-	-	-	-	-	-	54	-	-	-	-	-	-	-	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	53	100
ACOR	METO	23	24	24	24	24	24	24	23	24	24	24	24	24	24	24	24	23	23	23	24	23	23	24	24	23	24	24	24	24	23	711	99
		49	51	55	55	55	55	54	52	52	53	53	50	51	52	52	52	50	52	51	53	52	51	52	51	52	53	50	53	53	52	52	100
ADAR	METO	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	23	24	24	24	23	24	24	24	24	24	24	24	24	24	718	100
		49	51	55	55	55	55	54	52	52	53	53	50	51	52	52	52	50	52	51	53	52	51	52	51	52	53	50	53	53	52	52	100
AILT	METO	6	9	13	12	13	16	13	15	17	17	21	22	21	23	23	24	17	21	24	24	23	22	23	23	23	22	20	24	24	23	578	80
		53	52	55	56	56	55	53	52	52	53	53	51	51	52	52	52	50	52	51	53	52	51	52	51	52	53	51	53	53	52	52	100
ALDB	METO	24	24	24	24	24	24	24	24	24	24	23	24	24	24	24	24	23	24	24	24	23	24	24	24	24	24	24	24	24	24	717	100
		49	51	55	55	55	55	54	52	52	53	53	50	51	52	52	52	50	52	51	53	52	51	52	51	52	53	50	53	53	52	52	100
ALME	METO	24	22	24	23	24	23	23	23	24	24	23	23	23	21	24	22	23	23	24	22	22	22	24	23	23	23	23	23	23	23	691	96
		49	51	55	55	55	55	53	52	52	53	53	50	51	52	52	52	50	52	51	53	52	51	52	51	52	53	50	53	53	52	52	100
AMBE	METO	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	23	24	24	24	23	24	24	24	24	24	24	24	24	24	718	100
		49	51	55	55	55	55	54	52	52	53	53	50	51	52	52	52	50	52	51	53	52	51	52	51	52	53	50	53	53	52	52	100
AMER	METO	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	23	24	24	24	23	24	24	24	24	24	24	24	24	24	718	100
		49	51	55	55	55	55	54	52	52	53	53	50	51	52	52	52	50	52	51	53	52	51	52	51	52	53	50	53	53	52	52	100
ANKR	METO	-	-	-	-	-	-	-	-	1	-	3	-	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	11	2
		-	-	-	-	-	-	-	-	53	-	51	-	52	53	-	-	-	-	-	-	-	-	-	-	-	-	-	52	-	51	52	79
ANLX	METO	24	24	24	24	24	24	24	24	24	24	24	23	24	24	24	24	23	24	24	24	23	24	24	24	24	24	24	24	24	24	717	100
		49	51	55	55	55	55	54	52	52	53	53	50	51	52	52	52	50	52	51	53	52	51	52	51	52	53	50	53	53	52	52	100
APPL	METO	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	23	24	24	24	23	24	24	24	24	24	24	24	24	24	718	100

EUCOS

E-GVAP monthly obs against NWP selection (09/2011)
Analysing Centre: METO

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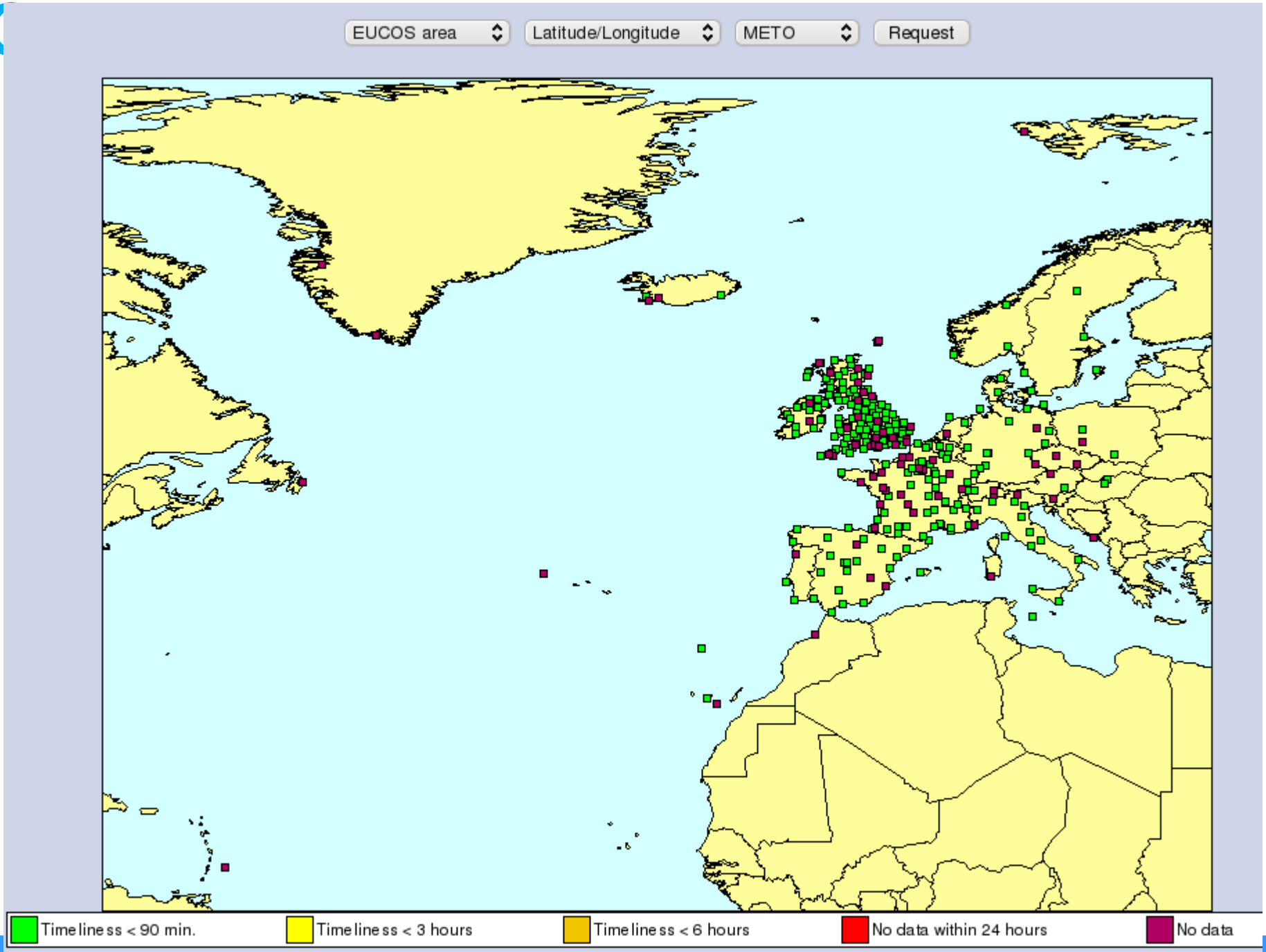
, Export as CSV

288 stations found.

Identifier	21	22	23	24	25	26	27	28	29	30	Ø
ABEP-METO	115.0	120.0	120.0	120.0	90.0	120.0	120.0	115.0	120.0	120.0	106.2
	-8.8	-4.9	-2.9	0.4	-4.9	-10.5	-6.9	-11.2	6.1	-9.3	-6.9
	12.3	8.2	8.2	5.7	10.8	16.6	11.0	13.2	14.6	17.4	12.3
ABYW-METO	-	-	-	-	-	-	-	-	-	-	31.0
	-	-	-	-	-	-	-	-	-	-	-0.2
	-	-	-	-	-	-	-	-	-	-	6.1
ACOR-METO	115.0	120.0	115.0	120.0	90.0	120.0	120.0	115.0	120.0	115.0	105.2
	-6.9	-7.3	7.6	-8.9	-3.7	2.0	-15.6	-12.7	-16.1	-7.7	-8.6
	10.9	9.8	12.4	17.6	8.7	8.1	25.5	15.5	17.2	14.6	16.0
ADAR-METO	115.0	120.0	120.0	120.0	90.0	120.0	120.0	115.0	120.0	120.0	106.2
	-2.4	-4.8	-3.1	1.9	-6.7	-8.0	-12.0	-8.1	-0.4	-2.9	-5.2
	9.6	11.6	7.5	18.5	17.0	14.3	13.4	11.2	12.6	13.1	12.0
AILT-METO	115.0	110.0	120.0	120.0	85.0	120.0	85.0	115.0	120.0	115.0	91.6
	3.8	-2.5	-1.8	-7.6	-3.8	1.5	-1.4	-4.0	0.4	-2.3	-2.9
	7.9	7.4	5.2	10.2	10.1	9.2	5.6	7.8	7.5	5.4	10.7
ALDB-METO	115.0	120.0	120.0	120.0	90.0	120.0	120.0	115.0	120.0	120.0	106.0
	-4.8	-9.6	-5.4	-6.7	-6.6	-2.6	-4.8	-7.3	-8.6	-5.0	-6.9
	11.3	12.5	7.5	9.8	10.5	8.4	7.7	9.1	11.5	9.7	10.7
ALME-METO	110.0	110.0	120.0	115.0	85.0	115.0	115.0	110.0	120.0	115.0	101.4
	-16.5	2.3	-4.2	-7.5	-10.6	-14.8	-15.9	-7.5	-20.1	-16.6	-11.5
	19.4	11.6	20.6	13.9	13.3	20.5	17.7	12.5	22.8	18.7	17.1
	115.0	120.0	120.0	120.0	90.0	120.0	120.0	115.0	120.0	120.0	106.2


EUCOS area
Latitude/Longitude
METO
Request
Timeliness < 90 min.
Timeliness < 3 hours
Timeliness < 6 hours
No data within 24 hours
No data

The EUCOS and E-GVAP monitoring and validation is supplementary.

The EUCOS monitoring provides members a QM product that is as similar to the the monitoring done by EUCOS of other obs programmes as possible, given the differences between the different observing systems.

Expert team on data processing

The primary contact point between the meteorological and geodetic side.

Team involves both the real processing experts, and people from institutes starting to process GNSS data for delivery to E-GVAP.

Rosa Pacione/Brigida Pace, e-geos, Italy
Jan Dousa, GOP, Czeck Republic.
Elmar Brockmann, Swisstopo, Switzerland
Galina Dick, GFZ, Germany
Jan Johansson, Chalmers Tech. Univ., Sweden
Marcelino Valdes/Miquel Angel Cano, IGE, Spain
Romain Fages/Sylvain Dauriach, SGN/IGN, France.
Eric Pottiaux/Carine Bruyninx, ROB, Belgium
Wolfang Soehne, BKG, Germany
Jonathan Jones, Siebren de Haan, Henrik Vedel.
Responsible person: Jonathan Jones.

Inter European scale (EUREF)

- Joao Agria Torres, Chairman of EUREF.
- Elmar Brockmann, Swisstopo
- Hans van der Marel, Tech. Univ. Delft.
- Carine Bruyninx, Roy. Obs. Belgium, EUREF coordinator
- Henrik Vedel E-GVAP, DMI
- Jonathan Jones E-GVAP, UK Metoffice
- Siebren de Haan E-GVAP, KNMI

Responsible person: Henrik Vedel.

Very fine collaboration with both above geodesists.

National scale.

- E-GVAP team.

Responsible person: Henrik Vedel.

- EUMETNET directors prefer national arrangements.
- Practical matters, e.g. national GPS data obtained by a national mapping agency also points to national arrangements.
- A changing liaison group, involving persons from currently active partners
- Database with examples of agreements/contracts between data owners and met. inst.
- EUMETNET Council: Agreements made between met. Offices and GPS providers
- Formally each E-GVAP member institute is responsible for making available GPS data from that country for E-GVAP, or trying to, depending on the current level of national GPS meteorological collaboration. Help in this process can be provided from the E-GVAP team.

Expert team on GNSS observation usage

Purpose: To further the use of gb GNSS data in NWP and now-casting through sharing of results and expertise, to provide guidance material for others, and to provide feedback to processing centres.

Gemma Bennitt & Dave Officer, UKMO,
(Daniel Leuenberger, MeteoSwiss, not working on GNSS usage currently)
Jana Sanchez Arriola, AEMET, Spain
Patrick Moll, Meteo-France.
Klaus Stephan, DWD.
Henrik Vedel, DMI and E-GVAP
Jonathan Jones, UKMO and E-GVAP
Siebren de Haan, KNMI and E-GVAP.

Responsible person: Henrik Vedel.

Operational status:

- Three institutes, assimilate E-GVAP data in their operational models.
  - Météo France in Arpege (global), Aladin (regional) and Arome (meso scale, at 2.5 km).
  - UKMO in NAE (regional) and UK4 (meso scale).
  - DMI in “Slippery Road Model”
- A positive impact from the use of the E-GVAP data is reported.
- Assimilation is done of NRT ZTD using variational data assimilation systems (3 and 4DVar). Besides there are significant differences.
- MF and DMI uses a white list for selection of sites&processing centres to be included in the data assimilation. The list is determined based on the O-B statistics. Site&processing centre specific bias correction (from month long offset averages) and observation errors.
- UKMO uses available data from a subset of the E-GVAP processing centres. Bias correction based on month long offset averages.
- Many HIRLAM/HARMONIE countries are close to assimilation (DMI, KNMI, AEMET).
- Beginning now-casting use at AEMET, Barcelona. Research in this at UKMO and KNMI.

Timeline and members

E-GVAP started 2005-04-01, ran for 4 years, from April 2005 to March 2009.

E-GVAP-II started April 1´st 2009.

To run for 4 years 9 months, however with a midterm review at 2 years 9 months, considering whether it has matured to become a EUCOS programme.

Currently 15 members:

Belgium, Croatia, Denmark, Iceland, Ireland, Finland, France, Hungary, Netherlands, Norway, Serbia, Spain, Sweden, Switzerland, United Kingdom

E-GVAP economy

The ordinary yearly E-GVAP-II budget is:

•Project manager	43.0 k€	DMI
•Contract to support hub/central processing	25.5 k€	UK Metoffice
•Contract to quality control facility	25.5 k€	KNMI
•Expert teams, liaison and project travel	25.0 k€	
•Total	119.0 k€	

(10 k€ less than E-GVAP-I)

The payment from members is less these years, due to the use of surplus money from previous years.

The surplus money is handled by the EUMETNET Secretariat in Brussels.

This limits somewhat our flexibility to utilise the full amount of travel money, since the possibility of over spending one year versus under spending is uncertain.

Details in pdf-file.

Risks and issues (from report to EIG EUMETNET Office)

- **The economic crisis has hit both EUMETNET members and E-GVAP ACs. So far we have not had indications among the ACs about problems. But it must be remembered that the majority of the data are exchanged on “best effort” basis, and that very swift changes are made in governmental spending these years.**

- **Within EUMETNET cost reductions are being considered because Assembly has expressed their wish to keep their overall contributions during the coming years (2011-2013) on the same level as for 2010.**

- **The E-GVAP team members’ considered if it would be possible to make further budget cuts in the Programme.**

- **E-GVAP Team couldn’t identify individual items that could be stopped or not done in order to make savings. All expenses, except travel money, goes directly to the 3 hosts institutions DMI, KNMI, UKMO, as payment for work on E-GVAP. The PM’s opinion is that the travel money is absolutely essential to the collaboration with the GNSS geodesist.**

Economic risks and issues

- **It should also be taken into account that E-GVAP already made cost reductions, by lowering the budget of E-GVAP with 10,000 € between phase I and II, and by not doing any inflation related increases in costs during the whole period since 2005.**

- The PM considers budget reductions dangerous even if accepted by team members and their institutions. There is a clear risk of either in-efficiency or long response times if personal spend only a very small part of their time on a long time project. All E-GVAP personal is part-time. For most a rather small part already today.

At time of plenary meeting:

- At present there is no expectation of cuts in E-GVAP. (Which is of course no guaranty). Eventual cuts in EUCOS budget may reduce efficiency of collaboration.

E-GVAP primary contact and information points

- Email address: egvap@dmi.dk
- Web address: http://egvap.dmi.dk
- Uid and pw at website: egvap, gps2user. Site links to validation site and dataserver.
- Access to database is institute specific, password protected.
  - Contact Jonathan Jones or Dave Offiler for access.

E-GVAP goals

1. Ensure the system built up in E-GVAP-I is maintained and continue to run, to make available for assimilation and now-casting data from the sites currently available in E-GVAP-I beyond March 2009.
2. Continue the established, fruitful close collaboration with the geodetic community. Thereby increase the number of sites, in particular in regions with poor coverage and data, and increase the homogeneity and quality of the NRT ZTDs.
3. Further and improve the construction of IWV maps and animations for use in now-casting.
4. Ensure that data server and data monitoring facilities have backups in case of failure, minimising the risk of a complete lack of ZTD/IWV data.
5. In collaboration with the geodetic community, and possibly EUMETSAT, attempt to improve quality and security of access to so-called “satellite orbit and clock estimates”, which are used in the data processing by the processing centres.

Milestones year 2011

- Workshop on the production and use of gb GNSS delay data. In connection with expert team meeting or an international conference.
- Reports from expert, liaison and E-GVAP teams.
- Common E-GVAP and EUCOS report on the prospects of immediate implementation into EUCOS.

Milestones year 2012

- A review/discussion of the future route for European ground based GNSS observations for meteorology
- Draft proposal for the future of E-GVAP.
- Reports from expert, liaison and E-GVAP teams.
- Nominal start of operations under EUCOS

Milestones year 2013

- Review of processing, utilisation, and impact of ground based GNSS data at European meteorological services.
- Workshop on the production and use of gb GNSS delay data. In connection with expert team meeting or with international conference.
- Reports from expert, liaison and E-GVAP teams.
- Final report
- Formal hand-over of operations to EUCOS

Past meetings and near future meetings.

- **E-GVAP joint expert team meeting, Oslo, 23 Sept 2010**
- **E-GVAP plenary meeting, Oslo 24 Sept. 2010.**
- COST EG_CLIMET meeting, Køln/Cologne, Nov 17, 2010
- EUMETNET PM meeting, Budapest, December 2010.
- EUCOS PM meeting, Météo France, Brest, 26-27/1, 2011.
- ESAT meeting, ECMWF, primo March 2011
- EGU session on “Atmospheric Water Vapour Retrieval by Space Geodetic Tehcniques”, April 3-8, 2011.
- EUREF annual symposium, Moldova, mid May 2011-05-28
- EIG EUMETNET Obs. Roadmap drafting meeting, DWD primo July.
- EUCOS PM meeting, Copenhagen, 29/8 – 30/9 2011
- EIG EUMETNET Obs. Roadmap drafting meeting, Copenhagen, 2011-08-31
- ESA Galileo Workshop, Copenhagen, 2011-08-31 to 2011-09-02.
- EUMETNET Observation Roadmap drafting team, Copenhagen, 31/8 2011.
- **E-GVAP joint expert team meeting and E-GVAP plenary meeting** combined, Météo France, Toulouse, 1 ½ and ½ respectively, Oct. 20-21, 2011.
- AGU meeting, San Francisco, Dec. 2011
- EUMETNET PM meeting, Dec 2011
- EMS meeting, US, Jan. 2012 (possibly).

EUMETNET EIG restructuring and the future of E-GVAP

- The members of EUMETNET have formed an entity which has it own legal and economic status, thus can make contracts, take loans, etc. This is called the **EUMETNET EIG**.
- One purpose is to make it more easy for the members in common to take part in collaborations with for example the EU and other large organisations.
- For the current goals of E-GVAP, this has little consequence.
- For the administration of E-GVAP it has significant consequences.
  - New contracts, so-called programme decisions, are made for all EUMETNET programmes. These have to agreed by the EIG assembly.
  - Mainly the E-GVAP-II programme decision is similar to the current contract, with a alterations.
  - Invoicing for participation in EUMETNET EIG programmes will be done by the EIG Office in Brussels, which will subsequently distribute money to the programmes.
  - Any surplus in any programme at the turn of the calendar year will be transferred to the EIG bank account.

EUMETNET EIG

- ‘Net’ payments will not be possible anymore. This will have consequences for UKMO and KNMI, which will have to pay in full their contributions for E-GVAP to the EIG, then claim their payment for E-GVAP work.
- Dealing with travel money for expert team and E-GVAP team travel will take place via DMI as currently.
- Reporting will be standardised between the EUMETNET EIG programmes, with 3 quarterly reports, and a yearly report. Possibly with additional reporting up to EUMETNET EIG Assembly meetings, and the body(ies) which will replace PB-OBS.
- New MoUs on general level with be with EIG EUMETNET on the EUMETNET side..

EUMETNET has reorganized itself regarding advisory boards and decision making. Two bodies, STAC and PFAC advice Assembly on scientific and technical matters and economic matters, respectively.

These bodies 3 have decided to review all programmes under EUMETNET, and make plans for their future, until 2020. For observations this is called the EUMETNET Observation Roadmap. Also roadmaps for Climate and SRNWP (short range forecasting) has been made.

For E-GVAP this part is positive. There is a high interest in ground based GNSS products, including interest in “next generation products”, such as GNSS ZTD gradients, slants and tomographic reconstruction of water vapour fields.

See separate pdf-file.

- The discussions about selecting between the options in the roadmaps takes place at a time when the majority of the met offices suffer heavy cuts in governmental funding.
- Right now the three bodies advice a max spending of 6 M Euro for the common programmes.
- Depending on the choice of programmes this leaves E-GVAP in or out.
- The current advice from STAC&PFAC is to have proposals for the four major, common programmes for a next phase. When the cost of the bids is known, EUMETNET will consider the future of the other programmes.
- Since E-GVAP is an optional and small programme (not common for all EUMETNET members) it is a possibility that E-GVAP can continue as an optional programme, even if EUMETNET as whole is not supporting it.
- For the moment we should not worry too much. I am optimistic we can navigate E-GVAP through to a next phase.
- But it is very important that people knowledgable about E-GVAP inform at their respective met-officies about the collaborative nature of the programme, and the fine impact on NWP forecast skill.

De-central data dissemination and naming

- Purpose is to establish a more robust distribution system, with reduced impact in case of single point failure.
- For the majority of the ACs it should be simple to accomplish, since COST 716 ascii format to BUFR conversion software made by Dave Offiler is available, and the ACs can either distribute to the GTS themselves (UKMO, KNMI, and SMHI/NGAA) or via their NMS.
- Actual setup has been awaiting setup of active quality control and a workable solution to the “naming/identifier”, now also outcome of NOAA negotiations, in which format and site name issues are on the table.

- It is not realistic that all GNSS sites will be named according to the needs of meteorology. Only the “higher level” GNSS sites have unique names. Opting to use only such sites in E-GVAP will limit the number of sites from which we can use ZTDs ☹
- It has been accepted now, within E-GVAP ACs, to not upload new sites names without prior consultance of an E-GVAP master name file.
- Needs in the longer run also to be solved also on a global level.

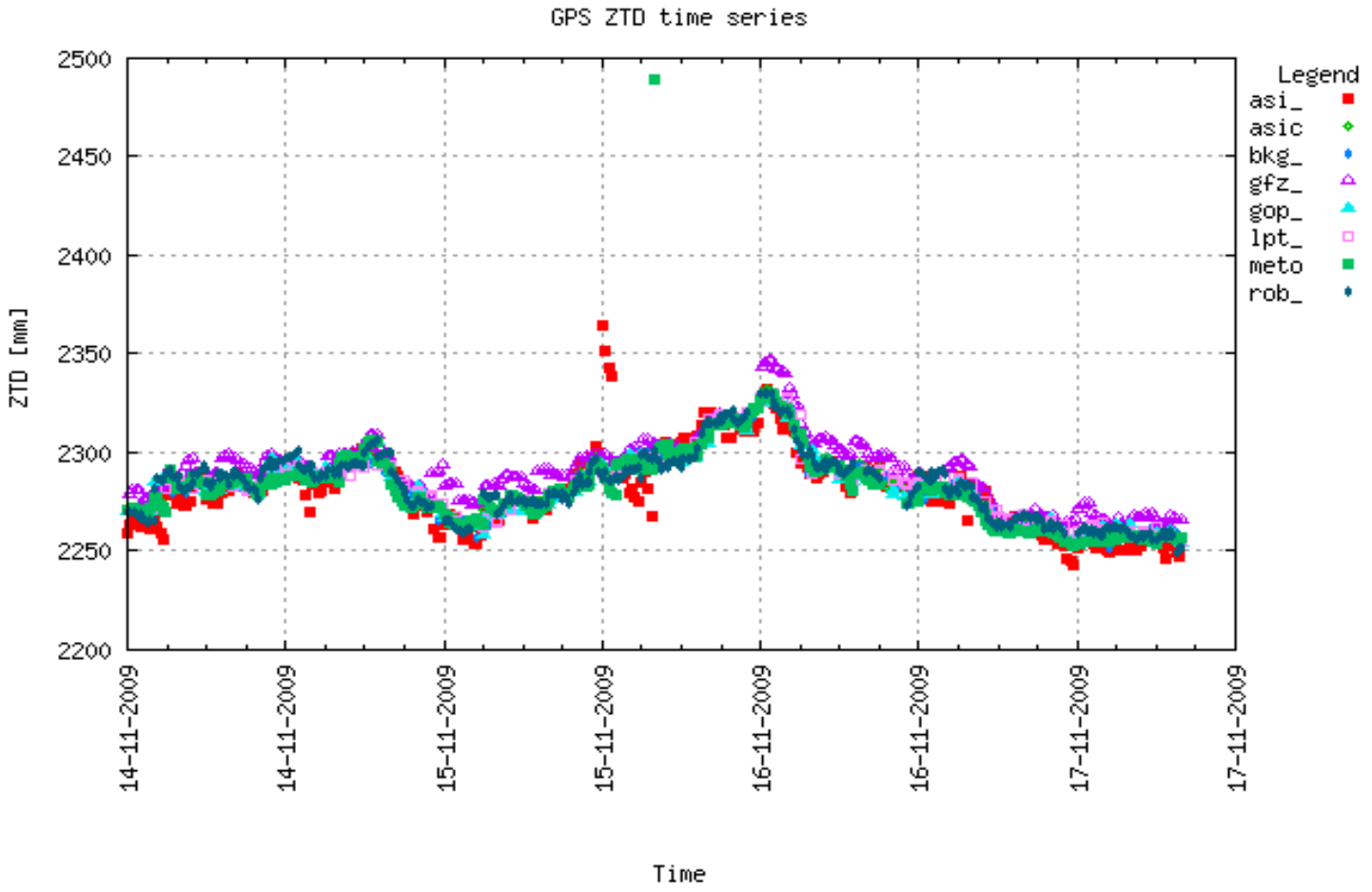
Active quality control, AQC

A central aspect of E-GVAP-II

Why active quality control?

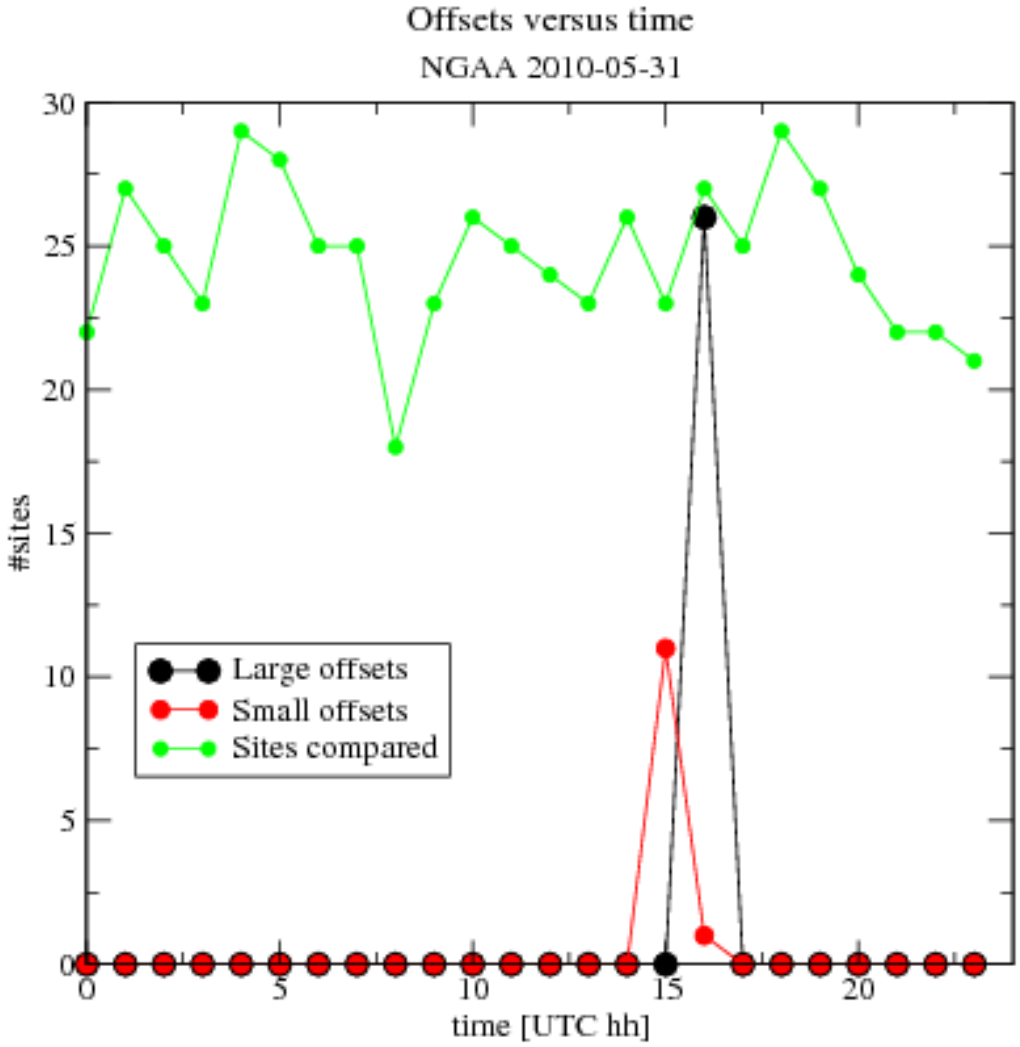
- Only by combining many different pieces of information, from different sources, can the ZTDs be estimated, with the use of quite complex analysis software. Different software exist for this. While they give almost similar results with the right input, they behave differently when there are problems with the quality of the input.
- The NRT processing is very time critical. In particular when done hourly.
- It is not conceivable that all ACs (analysis centres) in E-GVAP use the same software. Some of the ACs are involved in the development of GNSS processing software, it is central to them to use their own software.
- Certain types of errors in the input can lead to heavily correlated, systematic errors in the estimated ZTDs. This is very dangerous to a data assimilation system. Such systems can deal well with a few incorrect observations here and there, but systematically incorrect errors in a whole region can lead to drastic errors in the data assimilation, and hence the forecasts. Use of such data must be avoided. Avoiding the odd forecast with big forecast errors can be more important to an NWP centre, than the small, but regular benefit of the observations in normal periods.
- Examples. If a satellite position or a satellite clock error estimate is wrong, yet still used, it will effect all results at an AC using the ppp-solution. If the assumed position of a GNSS receiver is wrong at an AC doing a network solution, it will effect the ZTD of all the sites in the network.

A combined solution is a ZTD estimate made by statistical combination of a number (at least 3) of individual ZTD estimates. ASIC is a combined solution made by ASI. Plot shows NRT solutions from 7 ACs versus ASIC. Notice very transient problem at ASI and METO. In the future KNMI and ASI will each deliver combined solutions, derived using different statistical methods.



Active quality control, method tested and proposed for for offset counting and assessment of eventual widespread problems at an AC

1. Data from all available costfiles with data valid in a certain period are extracted, e.g. one hour, yyyymmddhh to yyyymmddh+1, and loaded into the comparison program.
2. Only data from GNSS sites processed by a minimum number of ACs are selected for intercomparison (tested with 4). Can be reduced to contain only supersites, but there is no reason not to include additional sites processed by enough ACs.
3. For each site
   - Determine median of ZTDs from each AC.
   - Determine median of medians (MoM).
   - For each AC, check whether some ZTDs have offsets larger than certain predefined sizes wrt MoM.
1. For each AC, sum up the number of sites with devations of certain sizes = ACdev_size. Large ACdev = large risk of general error at AC.
2. Write results to flagging file, including info about # sites compared, etc.



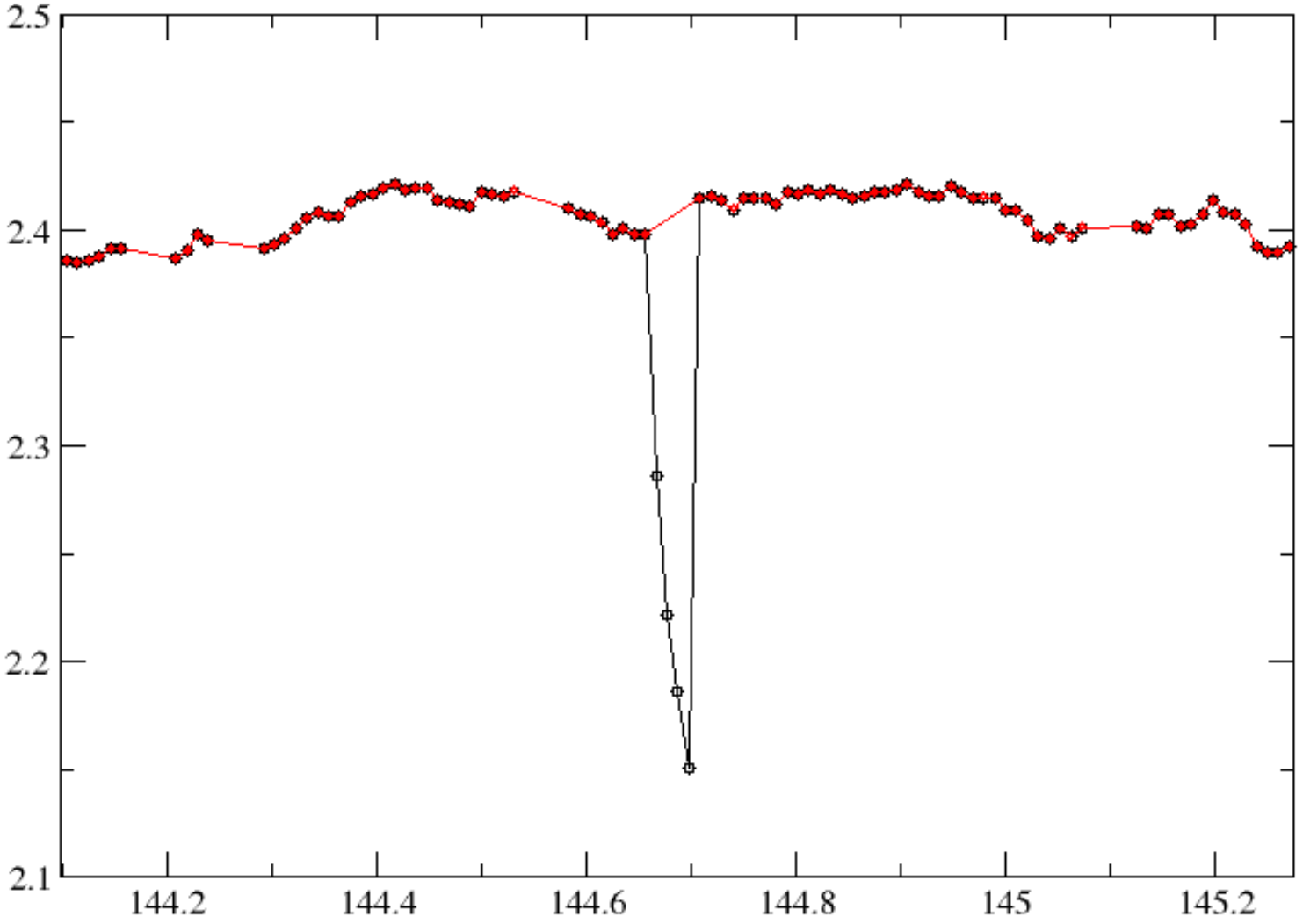
An example of a **transient** error at an AC.
Based on this data in the NGAA files stamped 2010053115 and 2010053116 should not be used in assimilation, but there is no reason to disregard NGAA data from other timebins.

- The distributions per AC of ZTD offsets relative to the MoM (median of medians) for sites processed by at least 4 ACs have been studied. Based on that, thresholds of 20 and 40 mm for “small”, respectively, “large” outliers have been found to be useful in AQC outlier detection.

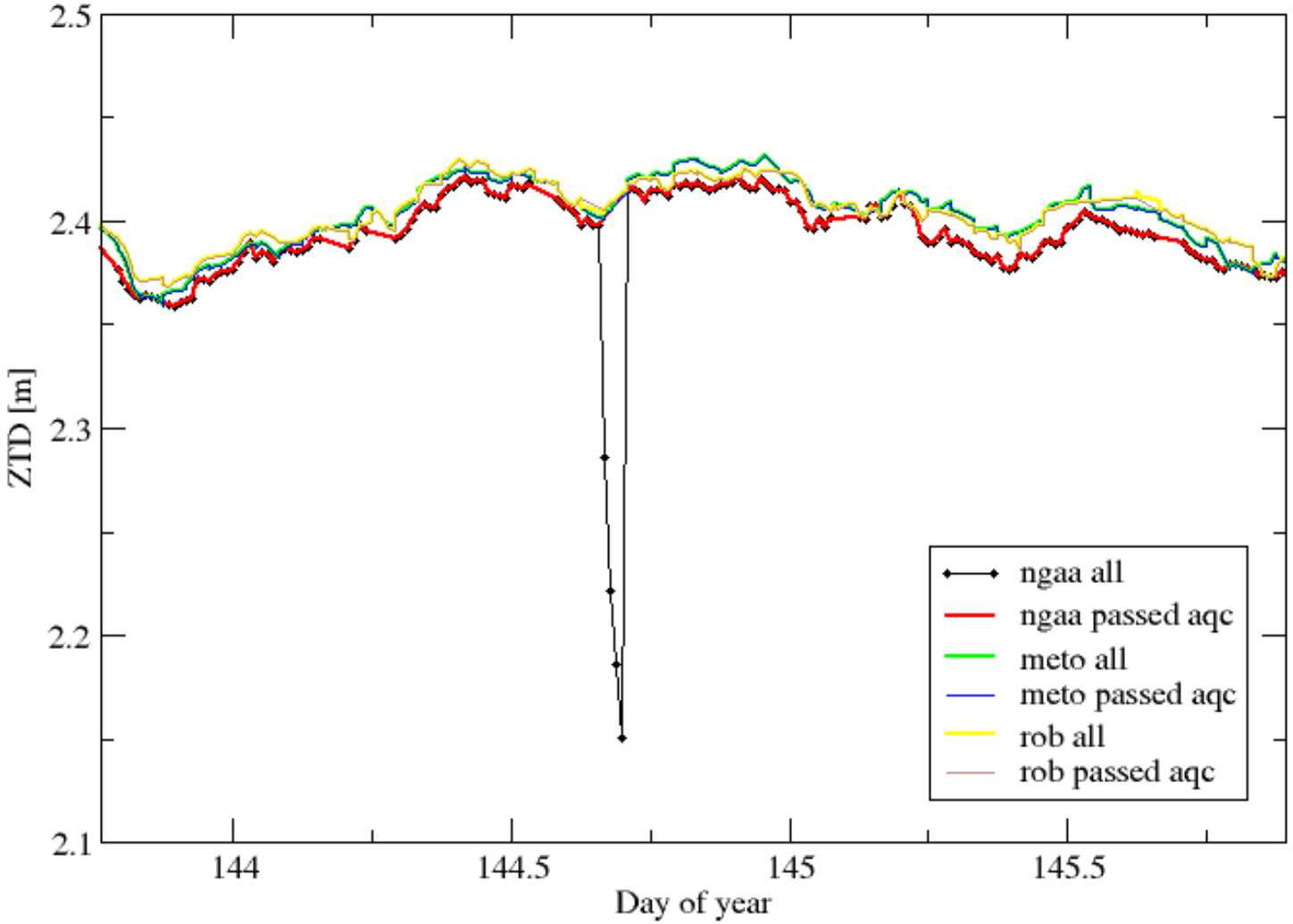
- It is planned to run the AQC for the entire E-GVAP database, to provide a “cleaned” NRT ZTD dataset.
- This set will be converted to IWV as well. But IWV is less well determined, since distance to nearest SYNOP data available to us, can be very very large! And offset in time too.

- A cleaned dataset was made for Sofus for 2*2 sites in Norway, for a special study.

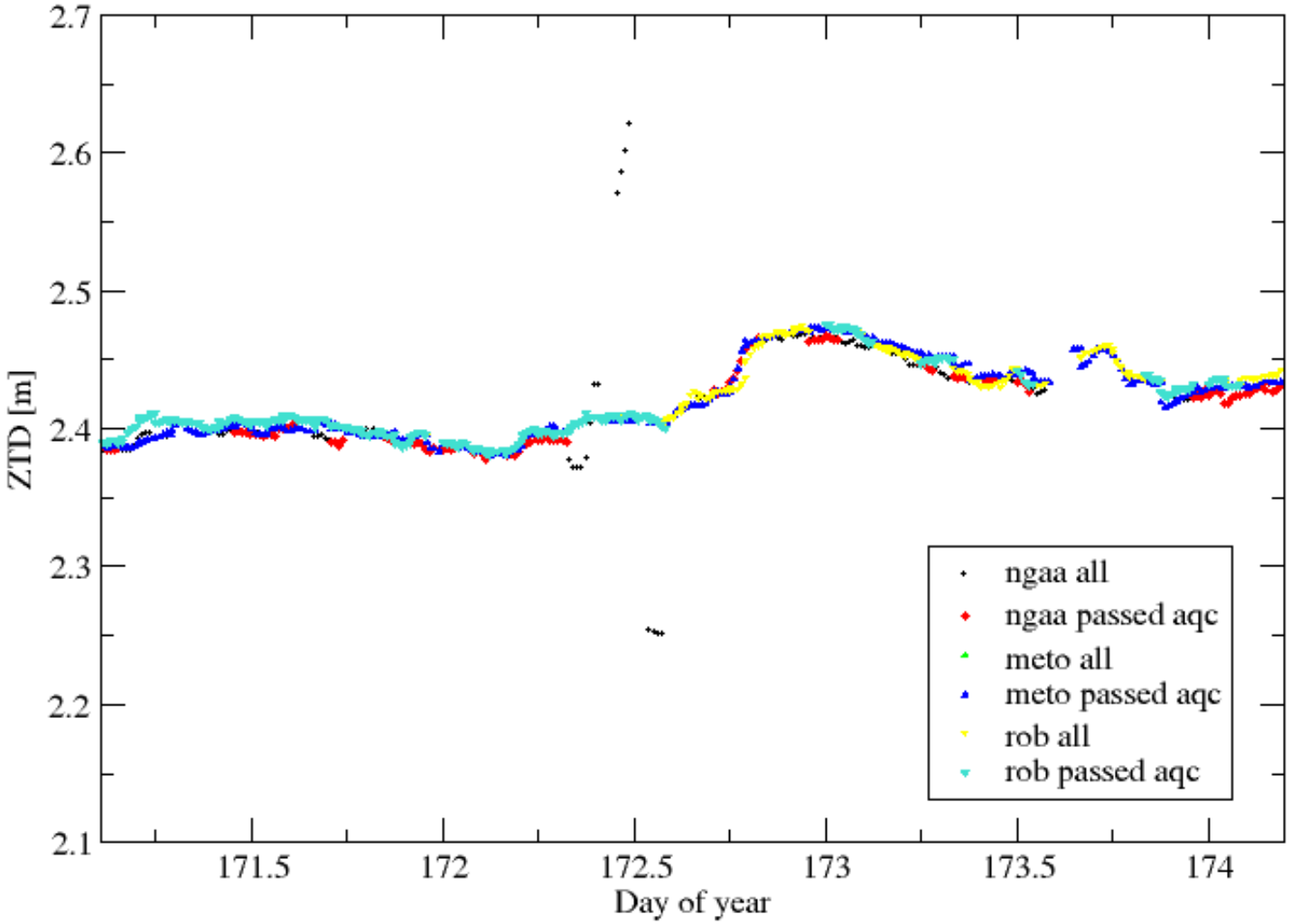
STAS, NGAA



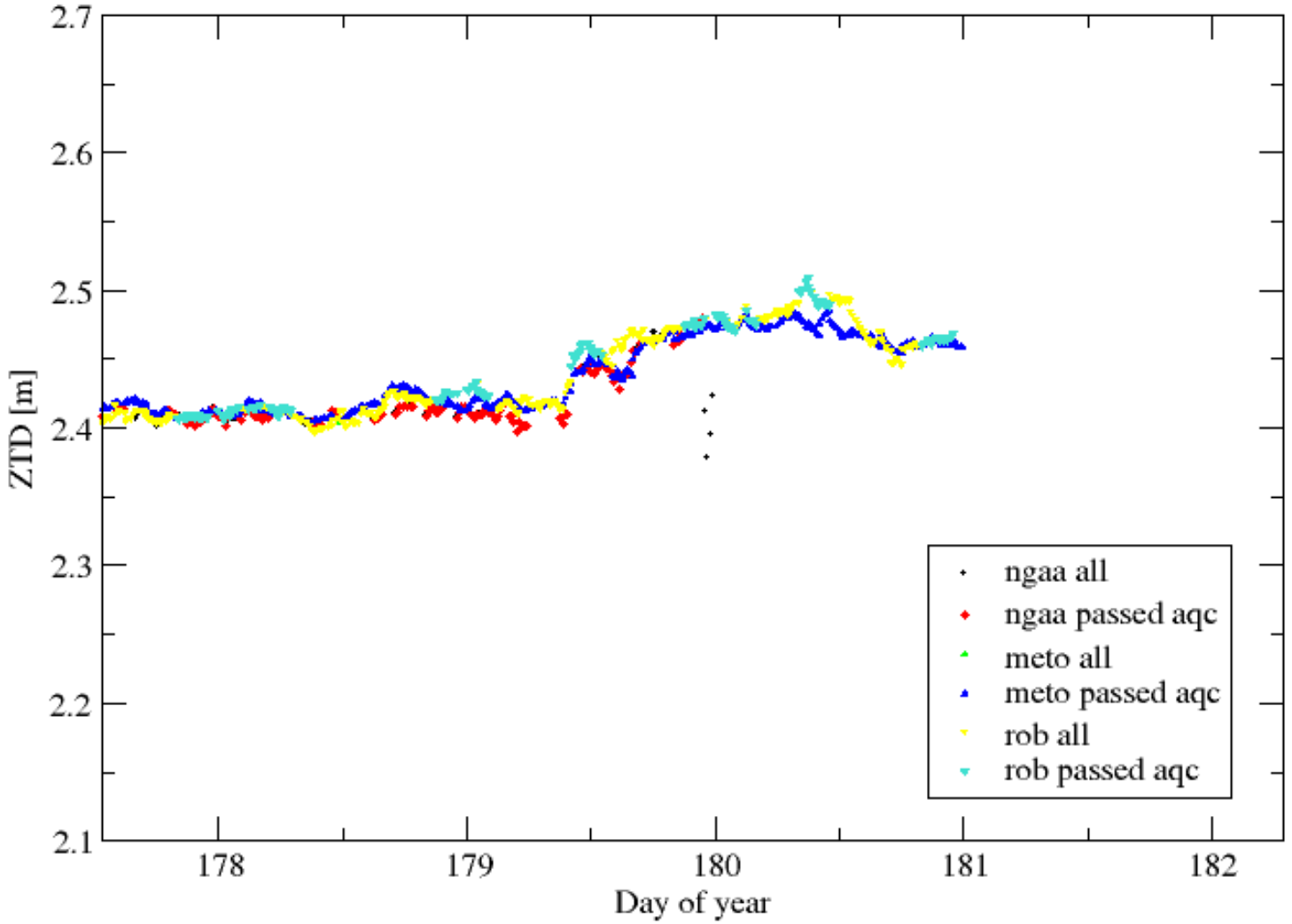
STAS, NGAA


2.5
2.4
2.3
2.2
2.1
ZTD [m]
144
144.5
145
145.5
Day of year
ngaa all
ngaa passed aqc
meto all
meto passed aqc
rob all
rob passed aqc

STAS


2.7
2.6
2.5
2.4
2.3
2.2
2.1
ZTD [m]
171.5
172
172.5
173
173.5
174
Day of year
ngaa all
ngaa passed aqc
meto all
meto passed aqc
rob all
rob passed aqc

STAS


2.7
2.6
2.5
2.4
2.3
2.2
2.1
ZTD [m]
178
179
180
181
182
Day of year
ngaa all
ngaa passed aqc
meto all
meto passed aqc
rob all
rob passed aqc

Active quality control, method tested proposed

Issues for discussion

- **It is clear that AQC is effective in catching transient errors effecting multiple sites.**
- **However, if an AC is using sub network solutions,**
  - **we need to know about subnet works (possibly in a rough sense is enough) in order to identify precisely the sites not to use,**
  - **or we need to agree that it is OK to warn against the entire dataset from that AC in the problematic period.**
  - **Possibly the latter option is only one which is sufficiently easy to work with at the user end, for it to be helpful.**
- **Having decided on this, AQC can be quickly implemented.**

- **Notice. Nobody is forced to use AQC and it will not withhold data. It is an option. Essentially it works as an on/off AC black-list.**
- **At DMI we certainly plan to use the AQC filter.**

aqc-2009073020-210.log

2009073020 201107151650 Timestamp-costfiles Time-of-compar [UTC yyyymmddhhmm]

0 #ACs WITH OFFSETS

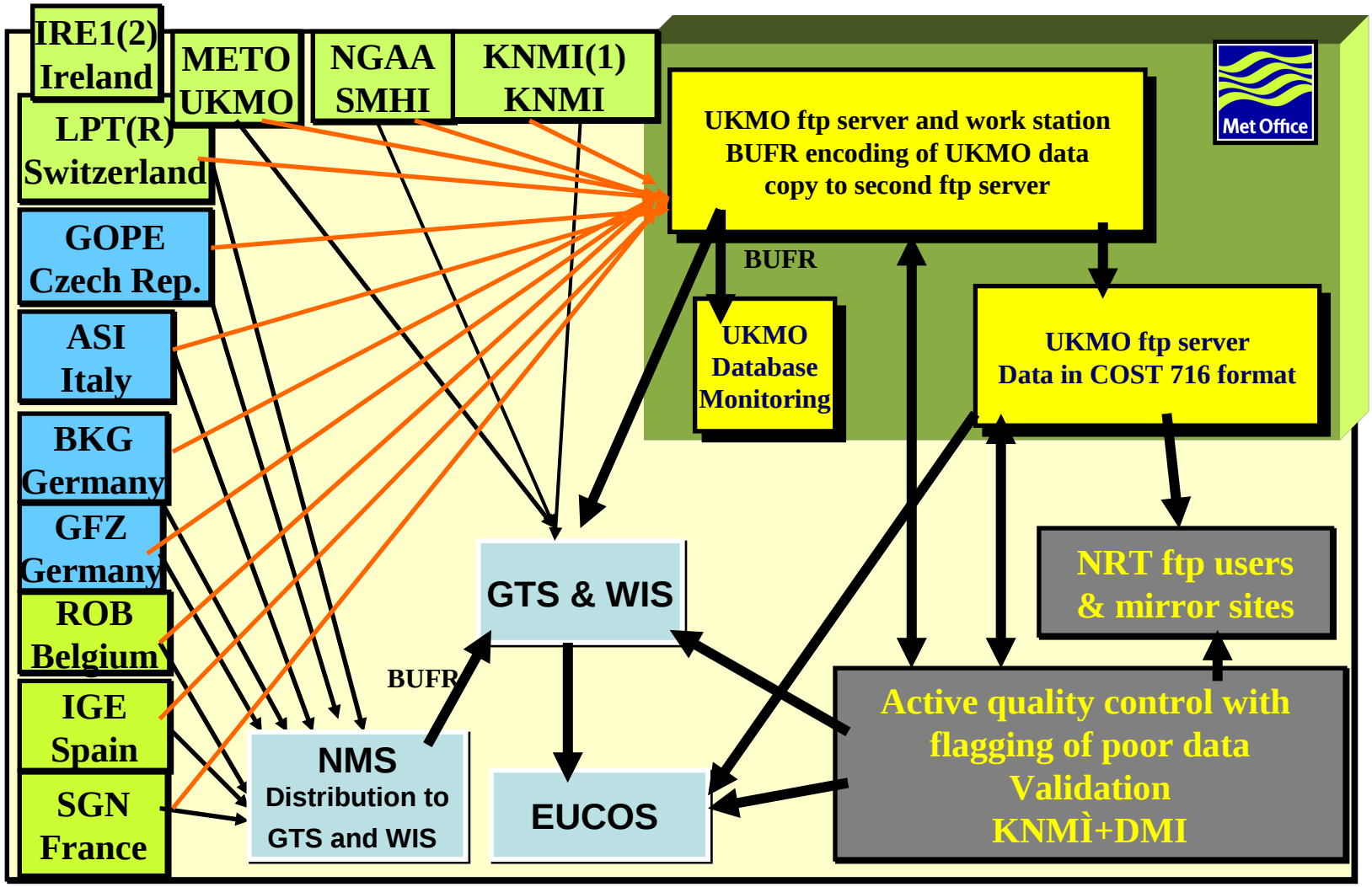
2009073020 totals: Analysed 12 ACs of 13, 65 sites of 706, 1485 ZTDs of 5776

ACs and #sites: BKG_ 42 GFZ_ 41 GOP_ 27 IGE_ 21 KNM1 9 KNMI 17 LPTR 1 LPT_ 23 METO 36 ROB_ 59 SGN1 46 SGN_ 46

aqc-2009073116-211.log

2009073116 201107151652 Timestamp-costfiles Time-of-compar [UTC yyyymmddhhmm]
2 #ACs WITH OFFSETS
ASI_ 0 8 0 3 37 0 4 148 (AC %Lsite %Ssite #Lsite #Ssite #sites #Lztd #Sztd #ztd)
Large offset sites:
Small offset sites: DRES UNPG WTZR
ROB_ 0 1 0 1 69 0 1 345 (AC %Lsite %Ssite #Lsite #Ssite #sites #Lztd #Sztd #ztd)
Large offset sites:
Small offset sites: TLSE
DRES 0 20 0 1 5 0 1 19 (Site %L_AC %S_AC L-offs S-offs #ACs #Loffztd #Soffztd #ztd)
Large offset ACs:
Small offset ACs: ASI_
TLSE 0 16 0 1 6 0 1 26 (Site %L_AC %S_AC L-offs S-offs #ACs #Loffztd #Soffztd #ztd)
Large offset ACs:
Small offset ACs: ROB_
UNPG 0 25 0 1 4 0 1 18 (Site %L_AC %S_AC L-offs S-offs #ACs #Loffztd #Soffztd #ztd)
Large offset ACs:
Small offset ACs: ASI_
WTZR 0 12 0 1 8 0 2 28 (Site %L_AC %S_AC L-offs S-offs #ACs #Loffztd #Soffztd #ztd)
Large offset ACs:
Small offset ACs: ASI_
2009073116 totals: Analysed 13 ACs of 13, 77 sites of 708, 1795 ZTDs of 6298ACs and #sites: ASI_ 37 BKG_ 49 GFZ_ 42 GOP_ 31 IGE_ 26 KNM1 9 KNMI 20 LPTR 1 LPT_ 31 METO 39 ROB_ 69 SGN1 48 SGN_ 48

NRT GNSS ZTD data flow Future



ACs which are not at an NMS, will have to transmit BUFR via NMS to GTS and WIS

Next meeting?

In connection with another meeting?

Change of format?

Any other matter?

FIN

Many thanks to Florence, her team, and Météo France for organising the meeting!

Contact Details

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