

EPN Status and Network Management

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*EPN Central Bureau
Royal Observatory of Belgium*

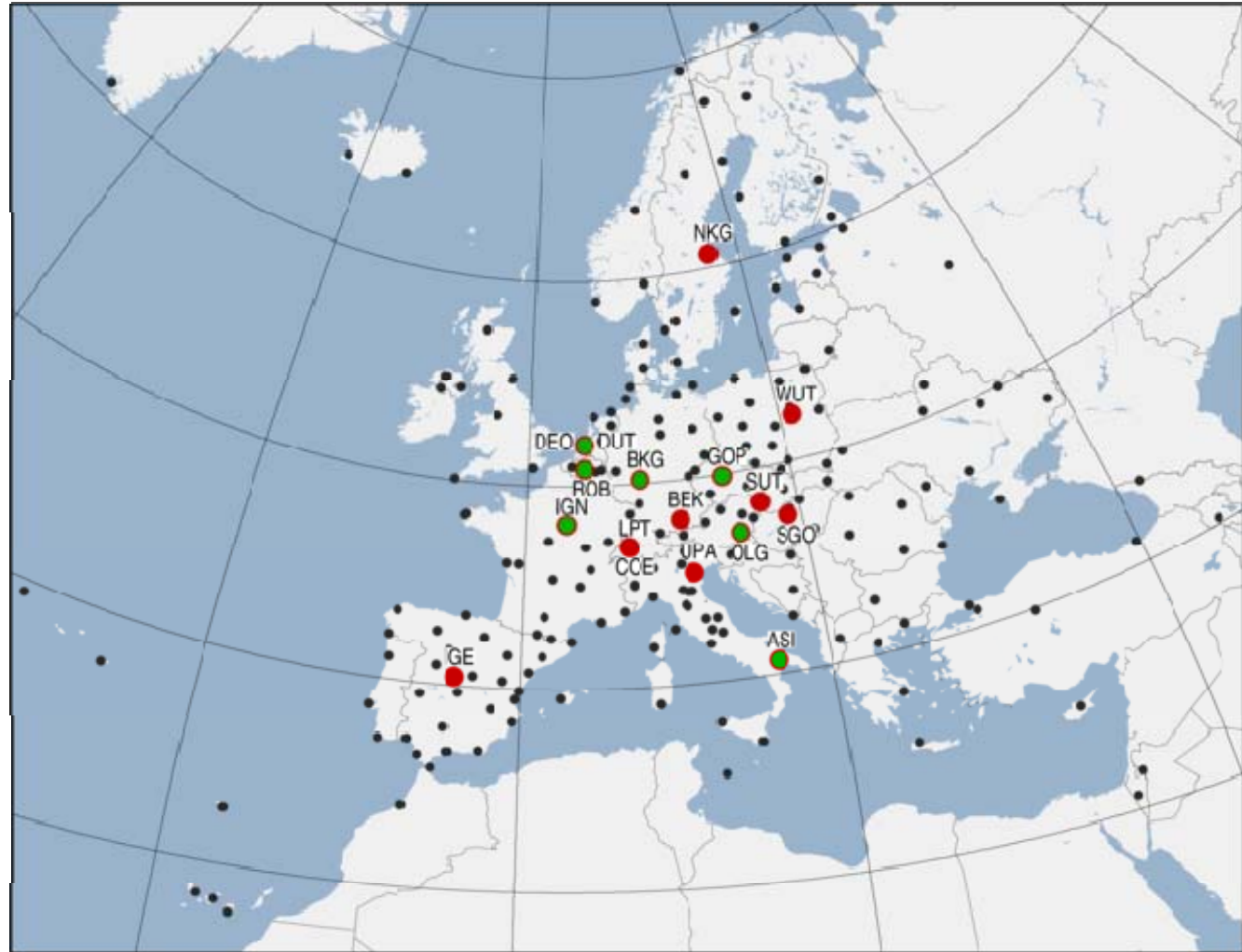
OUTLINE

- **EPN Tracking Network**
- Antenna Calibrations
- New @EPN CB
- EPN Modernisation
- Summary

223 GNSS tracking stations

7 Data Centres

16 Analysis Centers



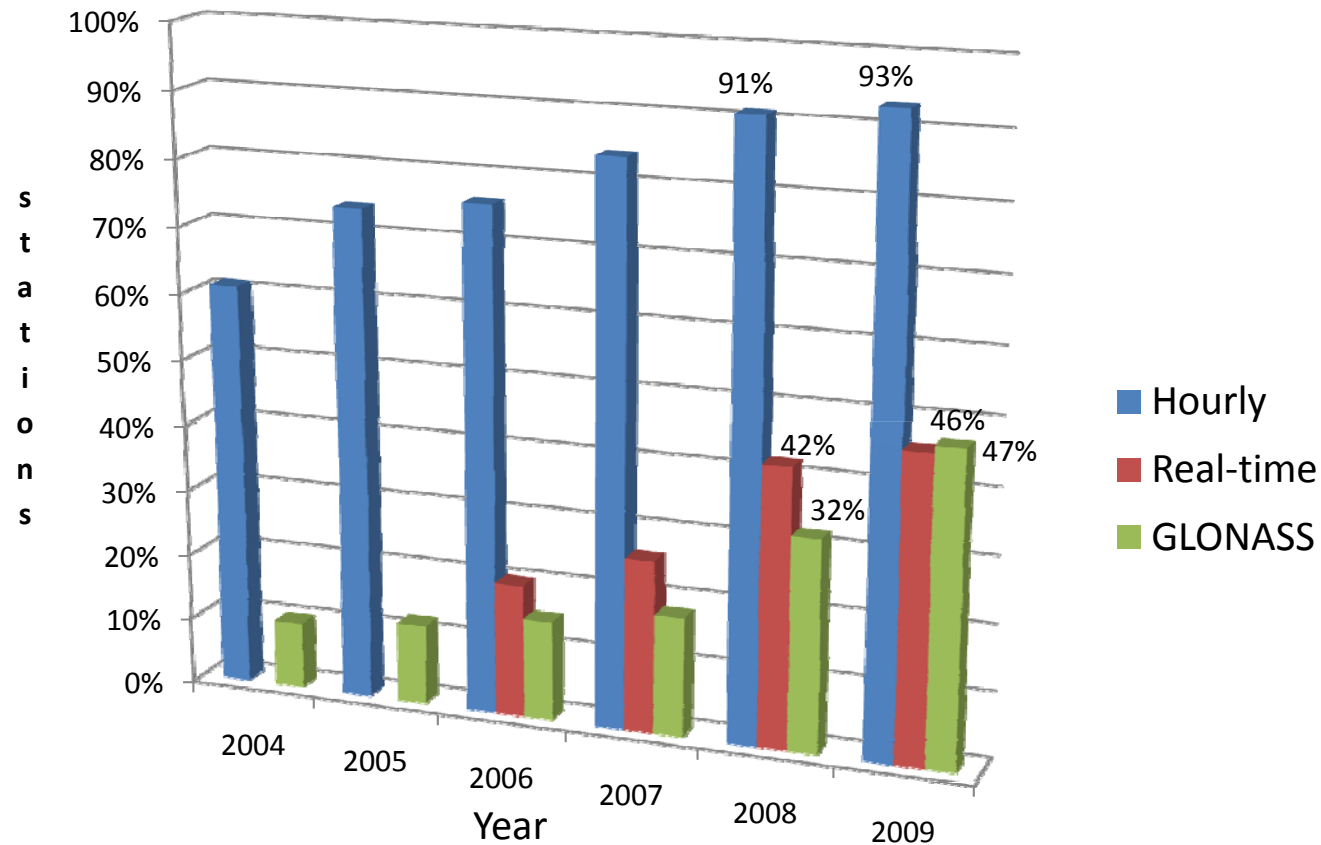
223 permanent GNSS stations

Since June 2008:
14 new EPN stations
1 station removed from
network



NEW EPN STATIONS

4-CHAR ID	LOCATION	FUNCTION		CALIB	FROM
FUNC	Funchal, Portugal	RT	GLO	Type	06/07/2008
MOP2	Modra-Piesok, Slovak Republic		GLO	Indiv.	24/08/2008
FLRS	Santa Cruz das Flores, Portugal	RT	GLO	Type	31/08/2008
TERU	Teruel, Spain	RT	GLO	Type	28/09/2008
HFL2	Innsbruck, Austria	RT		Indiv.	05/10/2008
PFA2	Bregenz, Austria		GLO	Indiv.	05/10/2008
SBG2	Salzburg, Austria		GLO	Type	05/10/2008
TRF2	Pernitz, Austria		GLO	Indiv.	05/10/2008
IZAN	Guimar, Spain	RT	GLO	Type	18/01/2009
DUTH	Xanthi, Greece		GLO	Type	22/02/2009
ENIS	Enniskillen, UK	RT	GLO	Type	15/03/2009
FOYL	Londonderry, UK		GLO	Type	15/03/2009
ALCI	Alchevsk, Ukraine			Type	19/04/2009
INVR	Inverness, UK	RT	GLO	Type	19/04/2009



Hourly data latency (twice a week, since fall 2008)

data available from both BKG and OLG																															
data only available from BKG																															
data only available from OLG																															
data unavailable from both BKG and OLG																															
	B B Y S	B O R J	B C U E	C A N E	D R E S	H O E 2	K A E L	K E R Y	K I R 0	K I R U	L A M P	M A S 6	N S S 1	O S S P	P O S A	Q A T Q	R A B T	R E D U	S A S U	S K E 0	S P T 0	T H U 3	T R D S	T R O 1	U N P G	V A L S	V I L 0	V I L 0	V I S 0	W A R N	
133/2009	24 24	24 0	0 0	0 0	24 0	24 0	24 0	24 0	0 0	24 0	24 0	0 0	24 0	22 0	24 0	24 0	24 0	24 0	24 0	24 0	24 0	24 0	17 24	0 24	24 0	24 0	24 0	24 0	24 0	24 0	24 0
132/2009	16 16	24 0	0 0	0 0	24 0	24 0	24 0	23 0	10 0	24 0	24 0	0 0	24 0	24 0	24 0	24 0	24 0	24 0	24 0	24 0	24 0	24 0	0 17	7 17	24 0	16 16	24 24	24 0	24 0	24 0	24 0
131/2009	0 0	24 0	0 0	0 0	13 13	24 0	24 0	24 0	23 0	15 15	24 0	15 15	24 0	24 0	15 15	24 0	24 0	24 0	24 0	24 0	15 15	15 15	24 0	10 20	12 21	24 0	0 0	15 15	24 0	15 15	24 0
130/2009	0 0	24 0	0 1	0 0	0 0	24 0	24 0	24 0	24 0	0 0	24 0	0 0	0 0	24 0	24 0	24 0	24 0	24 0	24 0	0 0	0 0	24 0	24 24	18 24	15 0	0 0	0 0	24 0	0 0	24 0	0 0
		B O R J	B C U A T M E E		D R E S	H O E 2	K A E L	K E R L		K I R M U	L A M P		M A S 1	N S S P		P O S A	Q A T Q	R A B T	R E D U	S A S U			T H U 3			U N P G			V I L L		W A R N

Daily data latency (once a week)

Hourly data latency (twice a week)

data available

data only

data only

data unavailable

	B	B
	O	O
	R	R
	J	J
133/2009	24	2
132/2009	16	2
131/2009	0	2
130/2009	0	2

Dear colleagues,

All hourly data of the EPN stations should be uploaded to both the OLG and BKG regional data centres.

We noticed that from 129/2009 to 131/2009, the hourly data of the station MAR6 are incomplete. Missing are (number of missing hourly files between brackets):
 at BKG: DOY 129/2009 (17), 130/2009 (24), 131/2009 (9)
 at OLG: DOY 129/2009 (17), 130/2009 (24), 131/2009 (9)

Please upload the missing data or, if applicable, send a EUREF mail to notify the EUREF community of the origin of the data gap.
 Consult <http://www.epncb.oma.be/ftp/center/data/BKGE.RDC> and
<http://www.epncb.oma.be/ftp/center/data/OLG.RDC> for data upload instructions.

Detailed hourly data holding information is available from BKG and OLG:
 BKG: ftp://igs.bkg.bund.de/EUREF/nrt/CHECK_HOURLY.BKG or ...
ftp://igs.bkg.bund.de/IGS/nrt/CHECK_HOURLY.BKG
 OLG: ftp://olggps.oeaw.ac.at/pub/hourly/OLGbase/check_hourly.graz

Best regards,

EPN Central Bureau / Carine and Dominique
epncb@oma.be

Daily data latency (once a week)

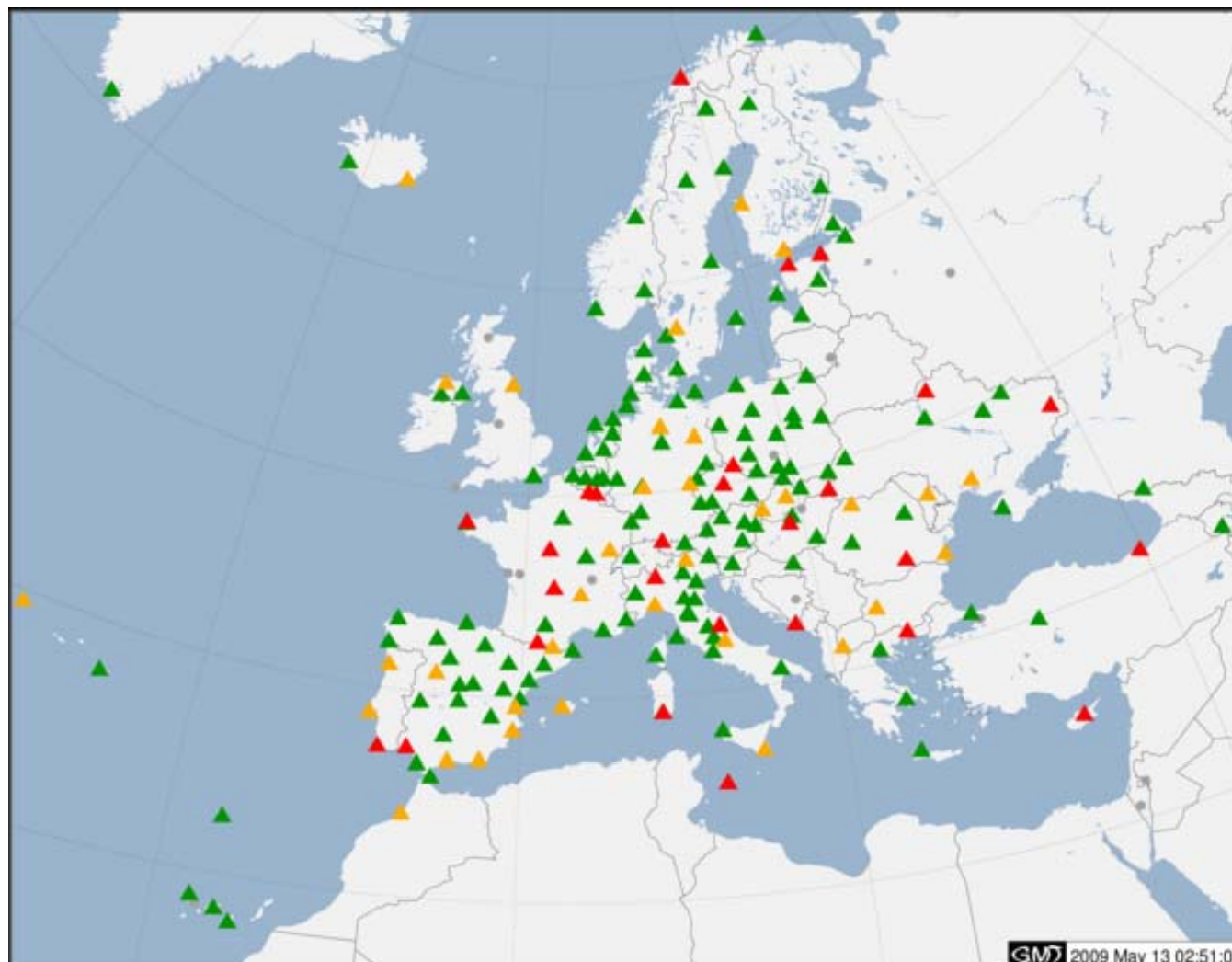
HOURLY DATA LATENCY (2009)

% hourly data arrived
within 10 min:

> 90%

80% < % data < 90%

< 80%



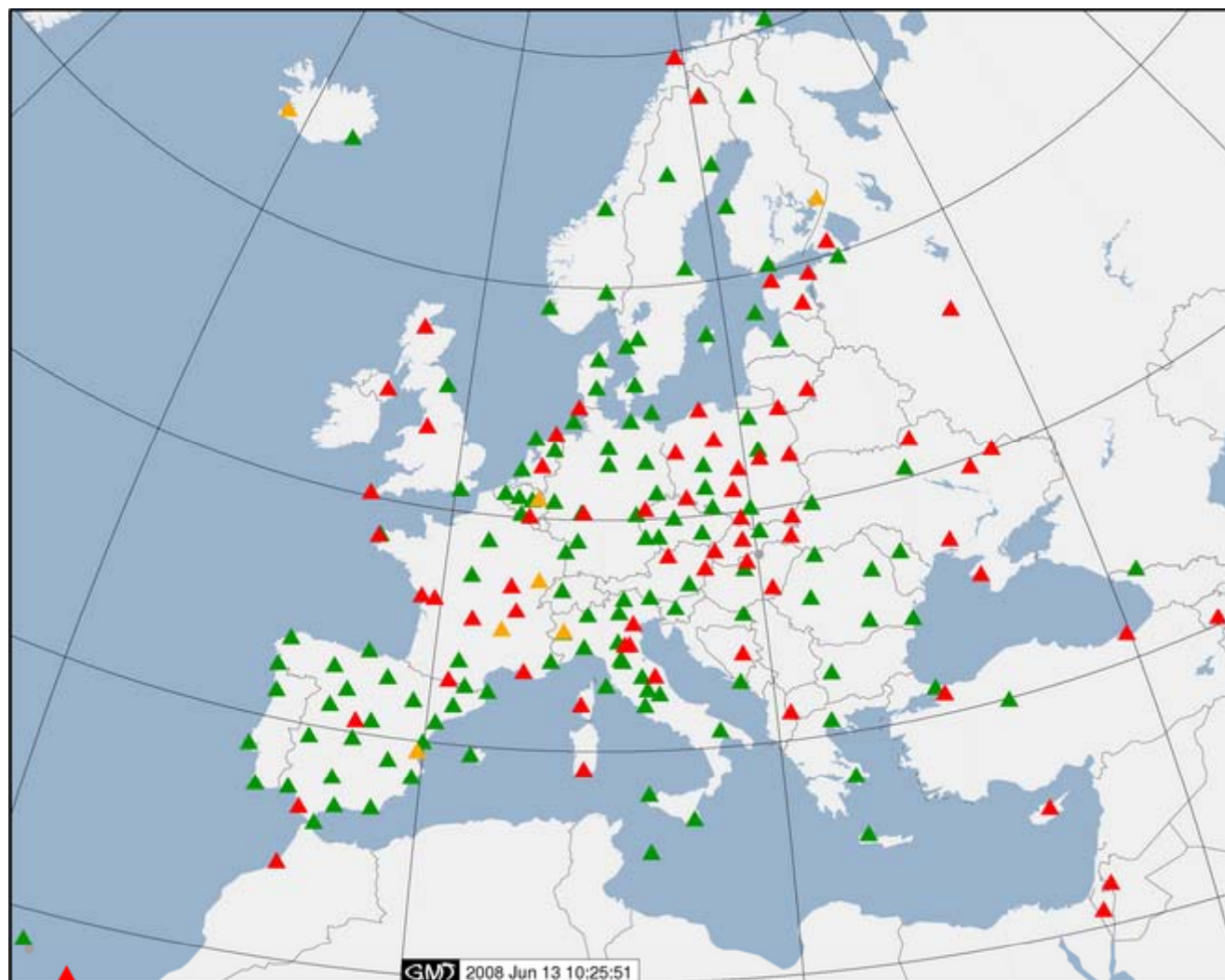
HOURLY DATA LATENCY (2008)

% hourly data arrived
within 10 min:

> 90%

80% < % data < 90%

< 80%



OUTLINE

- EPN Tracking Network
- **Antenna Calibrations**
- New @EPN CB
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EPN guidelines (Dec 2006):

- All antenna/radome combinations introduced within EPN station after Dec 5, 2006 must have TRUE absolute calibrations (taking radome into account).
- Individual or type absolute calibrations

http://www.epncb.oma.be/_trackingnetwork/equipment_calibration/index.php

ftp://igscb.jpl.nasa.gov/igscb/station/general/antenna_README.pdf

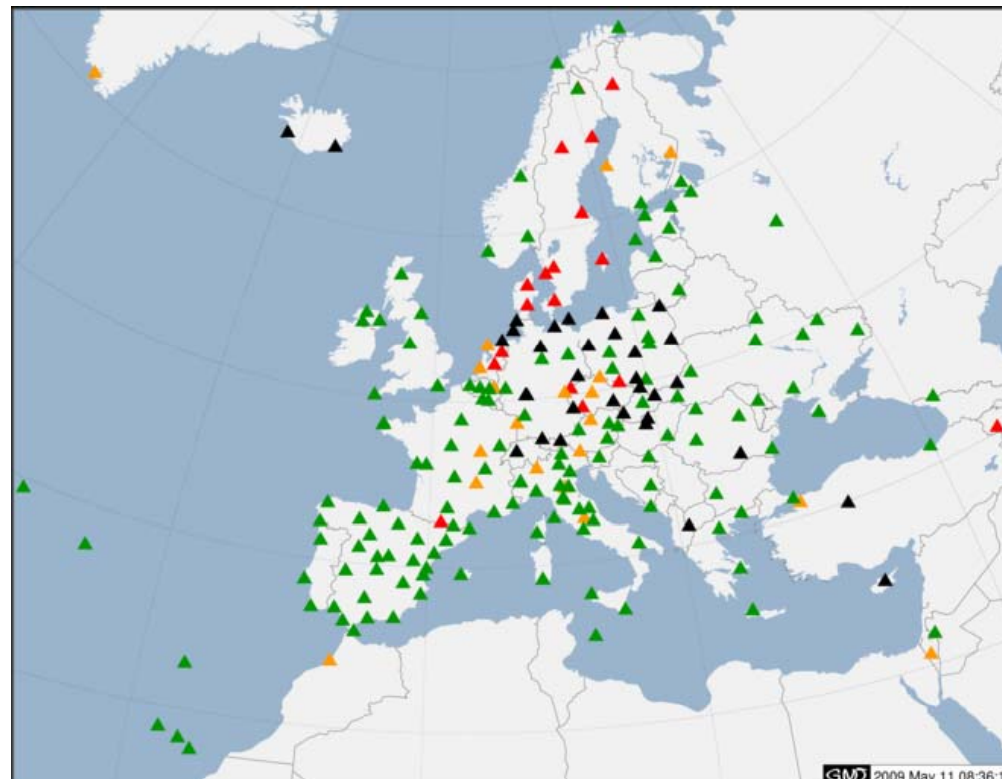
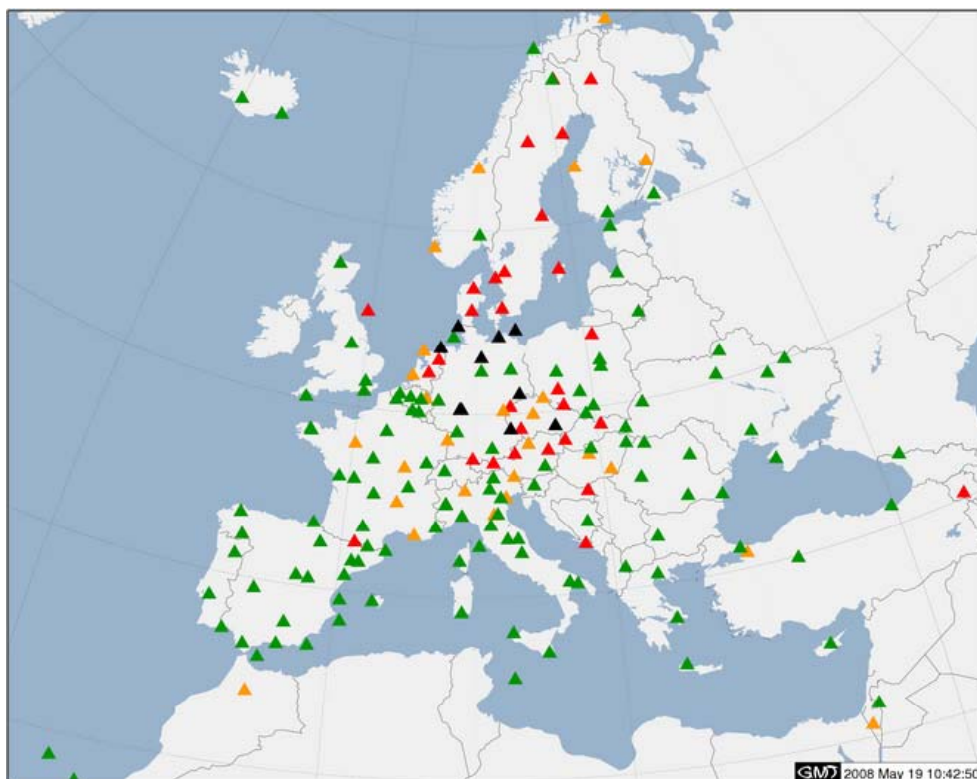
EPN ANTENNA CALIBRATIONS

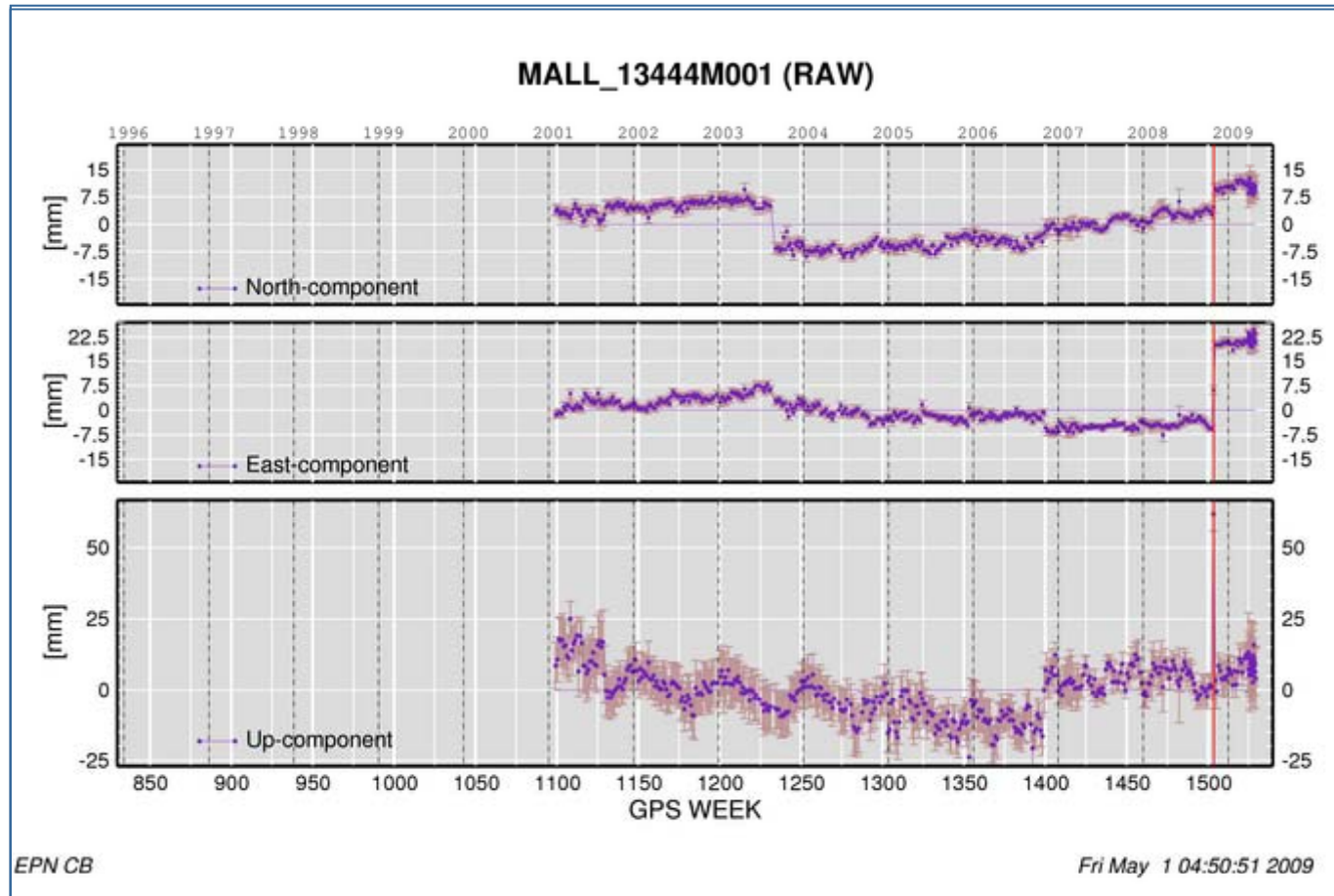
Dec. 2006

Indiv. abs. calib.	5 %	} 69%
True abs.calib	64 %	
Abs. calib. from field	14 %	
No abs. calib.	17 %	

May 2009

Indiv. abs. calib	15 %	} 81%
True abs. calib	66 %	
Abs. calib. from field	9,5%	
No abs. calib.	9,5%	





Antenna+radome with true absolute calibrations before and after switch

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http://www.epncb.oma.be/_dataproduts/analysiscentres/LACreports.php

ORGANISATION	TRACKING NETWORK	DATA & PRODUCTS	NEWS & MAILS	FTP & WEB ACCESS
Creation, Management, Structure, Relation to IGS, Projects, Guidelines, FAQ	Maps, Stations, Equipment and calibration, Station coordinates, Site log submission & test	Data access, Analysis centres, Products, Time series, IGS products	News, Mails, Calendar, Papers, Workshops, Web site history	Anonymous FTP, Web site index, Related links

[DATA & PRODUCTS](#) > [ANALYSIS CENTRES](#)

ANALYSIS CENTRES

In order to optimize the data processing within the EUREF Permanent Network, the principle of distributed processing is used. In this approach the EPN is divided in subnetworks which are separately processed by different [EPN Local Analysis Centres](#) (LACs). The below mentioned EPN LACs all process a subnetwork out of the EPN following the rules and guidelines set up by the International GPS Service and supplemented by the EUREF Technical Working Group. They submit weekly free-network solutions ([SINEX format](#)) to the [EPN Regional Data Centre BKG](#) ([availability](#)).

The EPN Combination Centre is responsible for combining the EPN subnetwork solutions into one European solution submitted to IGS. Until GPS week nr 1019, CODE, located at the [Astronomical Institute](#) of the University of Bern (Switzerland), was acting as Combination Centre. Since GPS week nr 1020, the [Bundesamt für Kartographie und Geodäsie](#) (BKG), located at Frankfurt (Germany), took over this responsibility.

The resulting free-network solutions (= *official combined EPN solution*) are made available as SINEX files to the IGS Global Network Associate Analysis Centers (GNAAC).

The coordination of the subnetwork definition is performed by the EPN Network Coordinator, [Carine Bruyninx](#). The combined EPN solution is computed by the EPN Analysis Coordinator, [Heinz Habrich](#) of the BKG analysis centre.

Statistics on the agreement of the LAC solutions with the combined EPN solution are available from [here](#).

EPN Local Analysis Centres (EPN LAC)		LAC file	Network
ASI	Centro di Geodesia Spaziale G. Colombo, Matera - Italy The Centro di Geodesia Spaziale processes a European subnetwork comprising IGS and EPN stations in the South of Europe. Their solutions are incorporated in EUREF since September 1996.	Yes	available
BEK	Bayerische Kommission für die Internationale Erdmessung of the Bavaria Academy of Science, Munich - Germany The Bayerische Kommission für die Internationale Erdmessung of the Bavarian Academy of Science in Munich has been the Computing Center for the computation of the unified European Triangulation Network RETrig. It was also involved in the computation of the EUREF-89 GPS campaign. Since end of 1995, BEK has been producing weekly solutions of a EPN subnetwork.	Yes	available
BKG	Bundesamt für Kartographie und Geodäsie - Germany BKG has acquired the capacity to routinely process permanent IGS networks. Since early 1996 it has been processing part of the European Network on a weekly basis.	Yes	available
COE	Centre for Orbit Determination in Europe, Astronomical Institute of the University of Bern - Switzerland CODE is processing almost the complete European Permanent Network in order to create a reference solution which is used as a comparison for the solutions of the other EPN Local Analysis Centres. The Center for Orbit Determination in Europe is a joint operation of the four institutions : <ul style="list-style-type: none"> ♦ Astronomisches Institut (AIUB), Universität Bern, Switzerland ♦ Bundesamt für Landestopographie (L+T), Wabern, Switzerland 	Yes	available

http://www.epncb.oma.be/_dataproduts/analysiscentres/LACreports.php

[DATA & PRODUCTS](#) > [ANALYSIS CENTRES](#) > ANALYSIS REPORTS

ANALYSIS REPORTS

The EPN Local Analysis Centres (LAC) compute permanently the positions of the EPN stations as well as the tropospheric zenith path delays at the EPN stations. Each week these computed station positions (in SINEX format) and tropospheric parameters are combined by the EPN Analysis Coordinator (H. Habrich) and the coordinator of the EPN troposphere product (W. Sohne) to generate the weekly EPN final position and troposphere products.

During the combination process, the solutions from the individual analysis centres are compared against the combined product and associated statistics on the agreement between the solutions of the individual analysis centres and the combined solution are generated :

- General agreement between analysis centres

showing the time evolution of the

1. RMS of the Helmert transformation between each weekly LAC position solution and the combined EPN solution. Also the values of the Helmert transformation parameters are available. In all cases a priori values (before outlier rejection) and final values (after outlier rejection) are provided.
2. tropospheric biases (as well as their standard deviation) of each weekly LAC troposphere solution with respect to the combined solution.

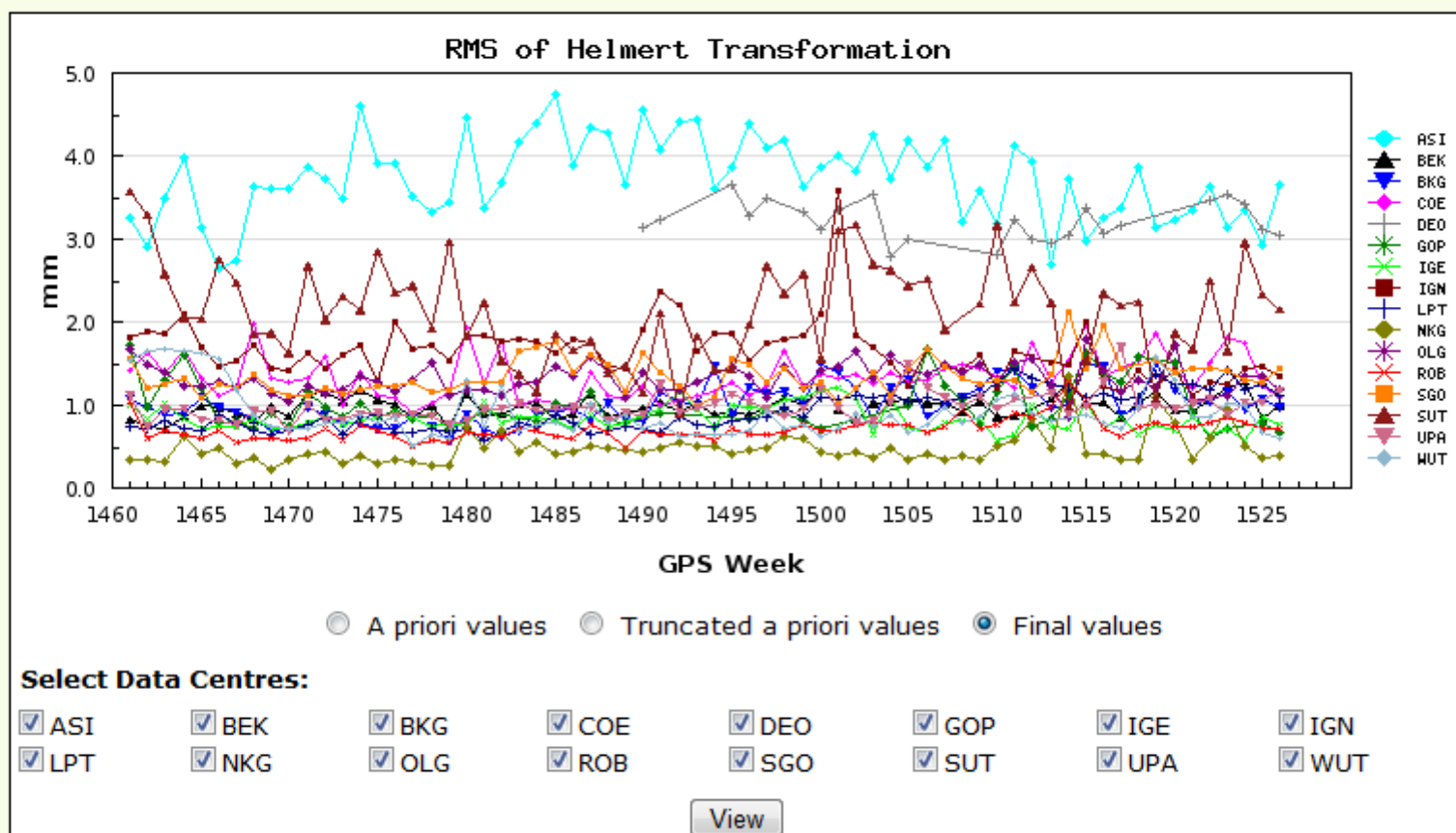
- Agreement between analysis centres - zoom into an EPN station

showing for each EPN station the time evolution of the

1. RMS and Helmert differences of the position estimates of each LAC with respect to the combined EPN solution, a priori values (before outlier rejection) and final values (after outlier rejection) are provided.
2. tropospheric biases (as well as their standard deviation) of each weekly LAC solution with respect to the combined solution.

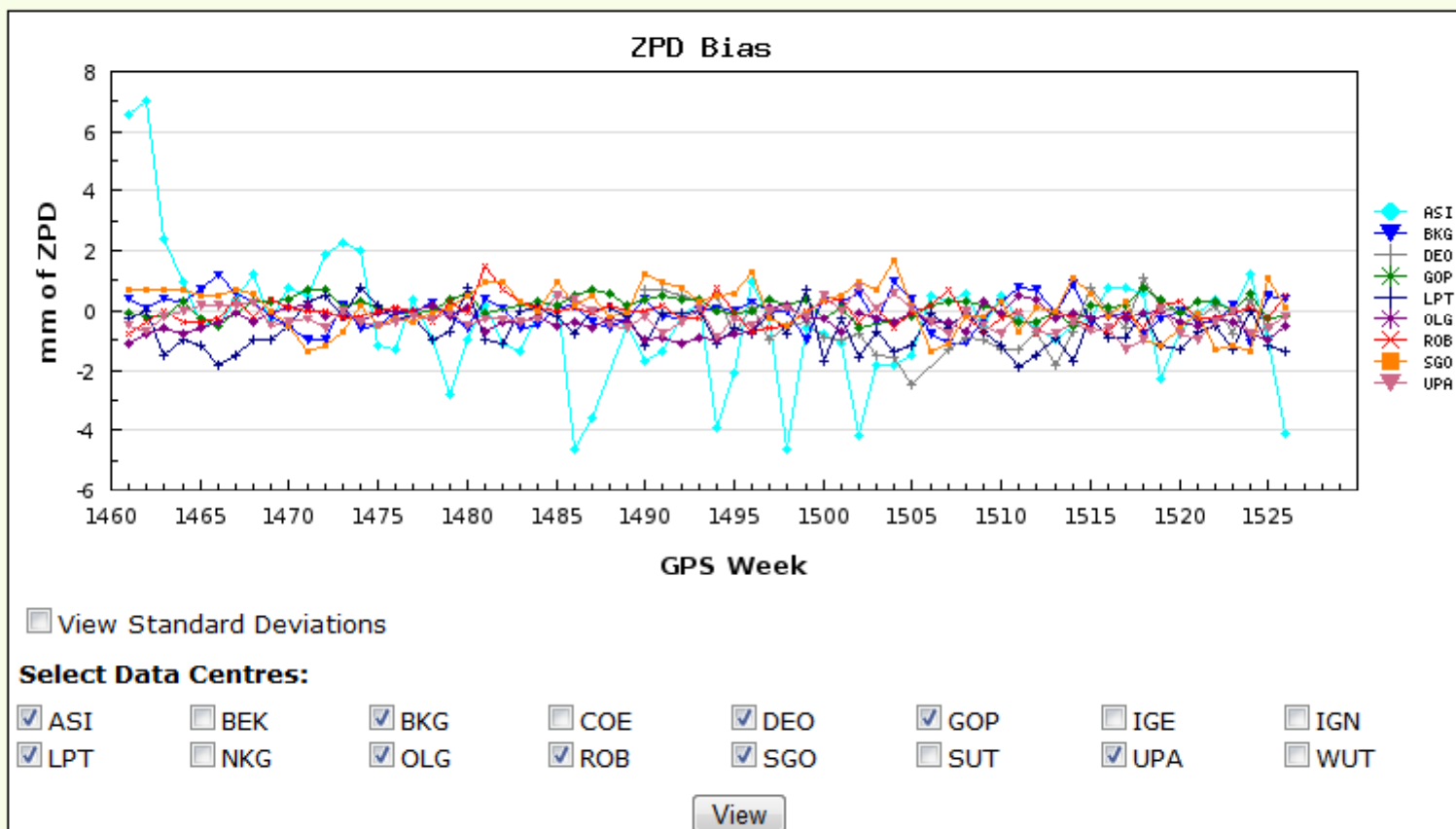
http://www.epncb.oma.be/_dataproduts/analysiscentres/LACreports.php

A. RMS of the Helmert transformation ([values of Helmert parameters](#)) between each weekly LAC position estimates and the combined EPN solution. A priori values (before outlier rejection) and final values (after outlier rejection) are provided.



http://www.epncb.oma.be/_dataproduts/analysiscentres/LACreports.php

B. Mean bias (and Standard Deviation) of the Tropospheric Zenith Path Delay (ZPD) estimations by each LAC with respect to the combined EPN tropospheric ZPD solution.



http://www.epncb.oma.be/_dataproduts/analysiscentres/LACreports.php

[DATA & PRODUCTS](#) > [ANALYSIS CENTRES](#) > ANALYSIS REPORTS

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showing the time evolution of the

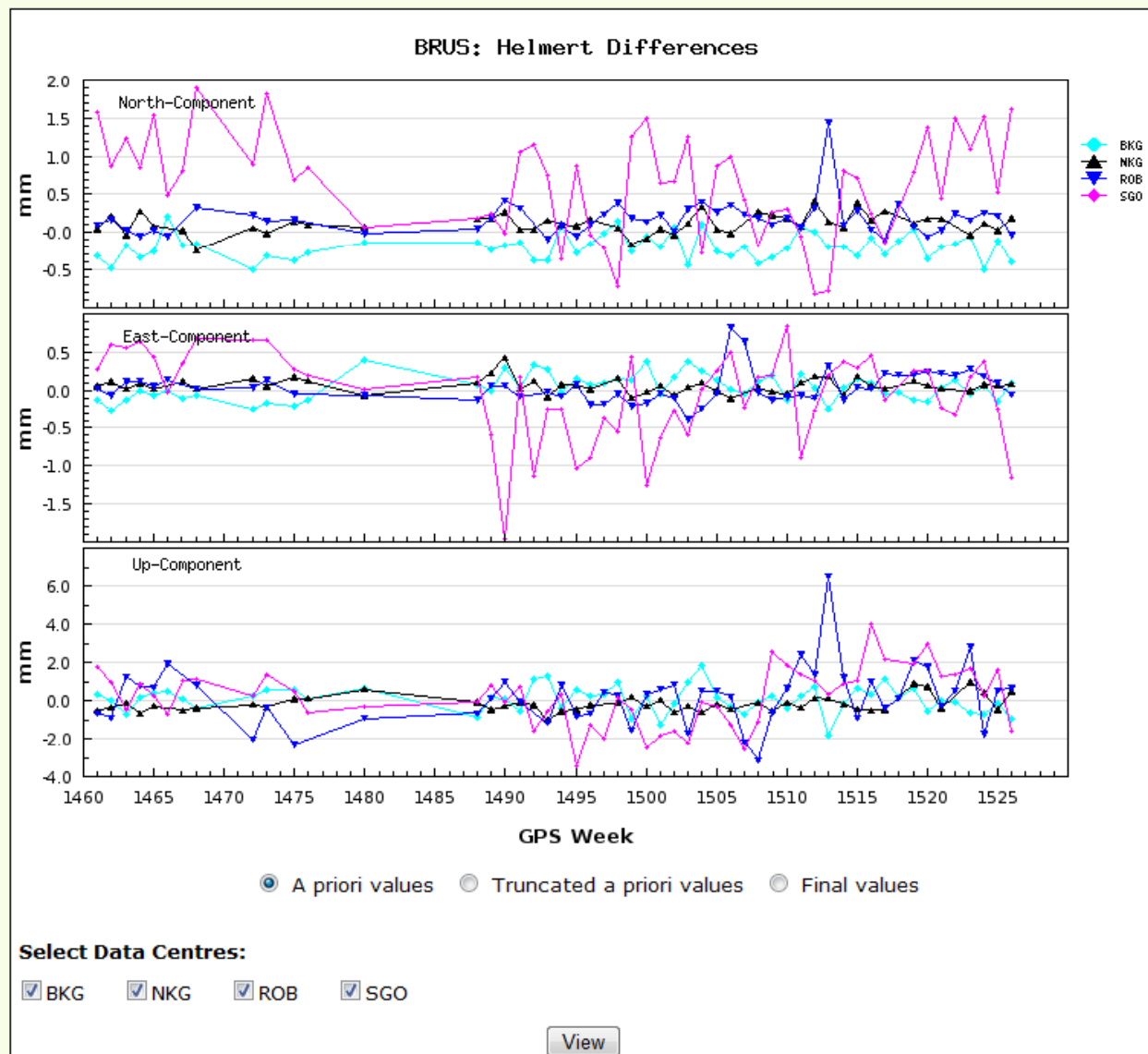
1. RMS of the Helmert transformation between each weekly LAC position solution and the combined EPN solution. Also the values of the Helmert transformation parameters are available. In all cases a priori values (before outlier rejection) and final values (after outlier rejection) are provided.
2. tropospheric biases (as well as their standard deviation) of each weekly LAC troposphere solution with respect to the combined solution.

- [Agreement between analysis centres - zoom into an EPN station](#)

showing for each EPN station the time evolution of the

1. RMS and Helmert differences of the position estimates of each LAC with respect to the combined EPN solution, a priori values (before outlier rejection) and final values (after outlier rejection) are provided.
2. tropospheric biases (as well as their standard deviation) of each weekly LAC solution with respect to the combined solution.

B. Differences (after a Helmert transformation) between the weekly position estimated for BRUS by each LAC and the position of BRUS from the weekly combined EPN solution. A priori values (before outlier rejection) and final values (after outlier rejection - available since GPS week 1526) are provided.

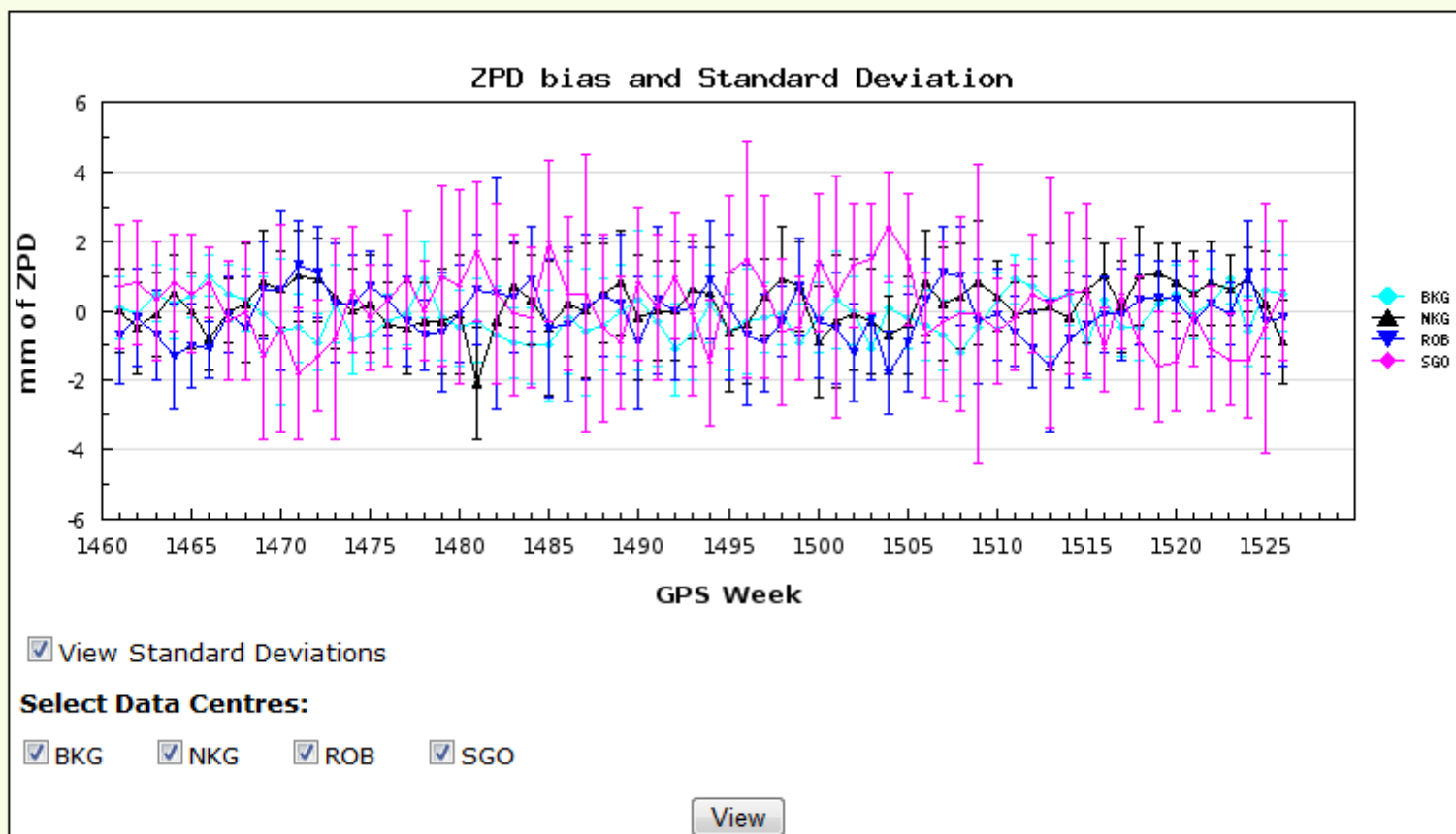


PERFORMANCE OF LAC SOLUTIONS

ZOOM ON STATION

http://www.epncb.oma.be/_dataproduts/analysiscentres/LACreports.php

C. Biases and standard deviations between the Tropospheric Zenith Path Delays (ZPD) estimated for BRUS by each LAC and the combined EPN tropospheric ZPD solution for BRUS.

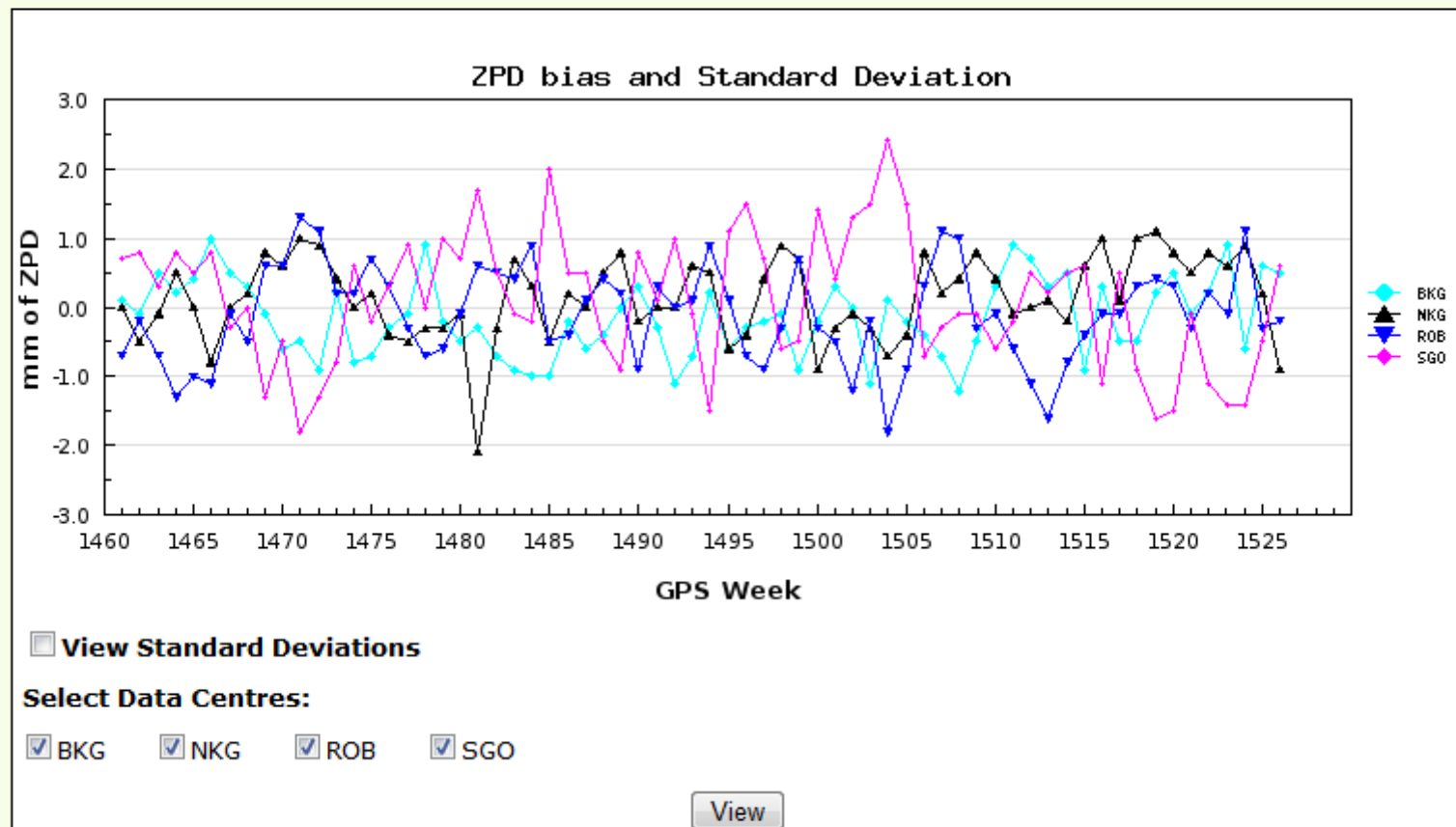


PERFORMANCE OF LAC SOLUTIONS

ZOOM ON STATION

http://www.epncb.oma.be/_dataproduts/analysiscentres/LACreports.php

C. Biases and standard deviations between the Tropospheric Zenith Path Delays (ZPD) estimated for BRUS by each LAC and the combined EPN tropospheric ZPD solution for BRUS.



- **create** a new site log
- **upload** a site log from the local disk or from the EPN CB
- **update** the site log
- **save** the site log on the local disk or in the EPN CB data base (all in IGS/EPN site log format)


LOGIN

Operational centre :

Password:

[Forgot \(or request\) password ?](#)

Security code:



Select station from ROB OC form:

Send updated [ROB.OC](#) to [EPN CB](#) for missing stations

☒ Upload the log from EPN CB (blank if log file does not exist)

☐ Upload site log from disk

NOT REGISTERED ?

Use the [guest account](#) (Operational Centre=*guest*, password=*guest*). This account does not allow to upload a site log to the EPN data base.

... or register by completing the [Operational Centre \(OC\) form](#) and mailing it to the [EPN CB](#). The contact persons listed in the OC form will receive the password by email. Please allow for a work day to check the validity of and process the submitted OC form.

**Beta-testing now
On-line in a few weeks**

SECTIONS:
 0
1
2
3
4
5
6
7
8.1
8.2
8.3
8.4
8.5
9.1
9.2
9.3
10
11
12
13

0. Form

Prepared by*	Bruyninx Carine
Date prepared*	2009-05-14
Report*	UPDATE
Previous Log	brus_20050425.log
Modified/Added Sections	3.1, 3.2, 13

SITE LOG

Test (Validate)
 Submit to EPN CB
 Save on local disk

ADD SUB-SECTION TO SITE LOG

3.11 GNSS Receiver Information
 4.3 GNSS Antenna Information
 5.2 Local Surveyed Ties
 6.6 Frequency Standard

Add

ERRORS SUMMARY

SECTIONS:

0 1 2 3 4 5 6 7 8.1 8.2 8.3 8.4 8.5 9.1 9.2 9.3 10 11 12 13

3. GNSS Receiver Information

3.1

Receiver Type*	TRIMBLE 5700
Satellite System*	GPS
Serial Number*	20297248
Firmware Version*	1.24
Elevation Cutoff Setting (deg)*	5
Date Installed*	2003-11-29 10 h 40 min UTC
Date Removed*	CCYY-MM-DD hh h mm min UTC
Temperature Stabilization average \pm tolerance (deg C)*	<input type="text"/> \pm <input type="text"/>
Additional Information	<div style="border: 1px solid black; height: 100px; width: 100%;"></div>

SITE LOG

ADD SUB-SECTION TO SITE LOG

3.2 GNSS Receiver Information

4.2 GNSS Antenna Information

5.1 Local Surveyed Ties

6.2 Frequency Standard

REPORT

✓

File upload successful.

SECTIONS:

0 1 2 3 4 5 6 7 8.1 8.2 8.3 8.4 8.5 9.1 9.2 9.3 10 11 12 13

4. GNSS Antenna Information

4.1

Antenna Type* + Serial Number*	TRM41249.00	68812
Antenna Radome Type* + Radome Serial Number	NONE	
Antenna Reference Point*	BAM	
Marker->ARP Up, North, East Ecc.*	000.0000 m	000.0000 m
Alignment from True N (deg; + is clockwise/east)*	0	
Antenna Cable Type	Trimble	
Antenna Cable Length*	30 m	
Date Installed*	2003-11-29 hh min UTC	
Date Removed*	CCYY-MM-DD hh min UTC	
Additional Information	There is not a north point on the Zephyr antenna (TRM41249.00)	

SITE LOG

Test (Validate)

Submit to EPN CB

Save on local disk

ADD SUB-SECTION TO SITE LOG

3.2 GNSS Receiver Information

4.2 GNSS Antenna Information

5.1 Local Surveyed Ties

6.2 Frequency Standard

Add

REPORT

✓

Your submitted site log has been browsed successfully and complies with the IGS/EPN format.

Section 1 - Bedrock Type

Warning : missing input.

Section 1 - Bedrock Condition

Warning : missing input.

Section 1 - Fracture Spacing

Warning : missing input.


Section 3.1 - Temperature Stabiliz.














Warning : missing input for the tolerance.

<ftp://epncb.oma.be/pub/obs>

- All daily EPN data, presently only active stations, 1996 → 2008
- hatanaka compressed RINEX
- RINEX headers corrected following site logs

Index van ftp://epncb.oma.be/pub/obs/

 Naar map op hoger niveau gaan

Naam	Grootte	Laatst gewijzigd
 1996		15/05/2009 12:30:00
 1997		15/05/2009 12:30:00
 1998		15/05/2009 12:30:00
 1999		15/05/2009 12:30:00
 2000		15/05/2009 12:30:00
 2001		15/05/2009 12:30:00
 2002		15/05/2009 12:30:00
 2003		15/05/2009 12:30:00
 2004		15/05/2009 12:30:00
 2005		15/05/2009 12:30:00
 2006		15/05/2009 12:30:00
 2007		15/05/2009 12:30:00
 2008		15/05/2009 12:30:00

```

1      2      OBSERVATION DATA      G (GPS)      RINEX VERSION / TYPE
HEADER CHANGED BY EPN CB ON 2009-05-18      COMMENT
TO BE CONFORM WITH THE INFORMATION IN      COMMENT
ftp://epncb.oma.be/pub/station/log/ankr_20080509.log      COMMENT
RGRINEXO V2.4.2 VM IFAG-WEIZELL      04-JAN-96 10:12      PGM / RUN BY / DATE
BIT 2 OF LLI (+4) FLAGS DATA COLLECTED UNDER "AS" CONDITION      COMMENT
0.000000000000      HARDWARE CALIBRATION (S)      COMMENT
0.0000000084672      CLOCK OFFSET (S)      COMMENT
ANKR      MARKER NAME
20805M002      MARKER NUMBER
  
```

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31 antenna replacements (including new stations)

(18 with radome!)

GPS	GPS/GLONASS	GPS/GLONASS/GALILEO
1 AOA/M_T	17 LEIAT504GG	3 LEIAR25
1 ASH701945E_M	1 NOV702GG	3 TPSCR.3G
1 ASH700936E	1 TPSSCR3_GGD	1 TRM59800.00
	2 TRM55971.00	
3	21	7

- Significant discontinuities associated with antenna changes
- Majority of antenna replacements today : multi-GNSS antenna

Strong recommendation:

use **multi-GNSS antenna** (GPS/GLONASS/GALILEO)
for EPN antenna replacements or when introducing
new stations in EPN

... be ready for introduction of new EPN guideline ...!

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SUMMARY & FUTURE PLANS

- EPN tracking network is continuously improving (data flow, antenna calibrations)
- Antenna replacements continue to be a problem
- Prepare for upgrade to multi-GNSS tracking
- New tools at EPN CB
 - LAC performance
 - On-line site log submission
 - Reprocessing data centre
- Future: archives of station pictures