The EUREF Permanent Network: Status and Strategy

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EPN Central Bureau
Royal Observatory of Belgium

OUTLINE

- **EPN Update**
- EPN LAC Workshop
- Update of Guidelines
- Future

EPN COMPONENTS

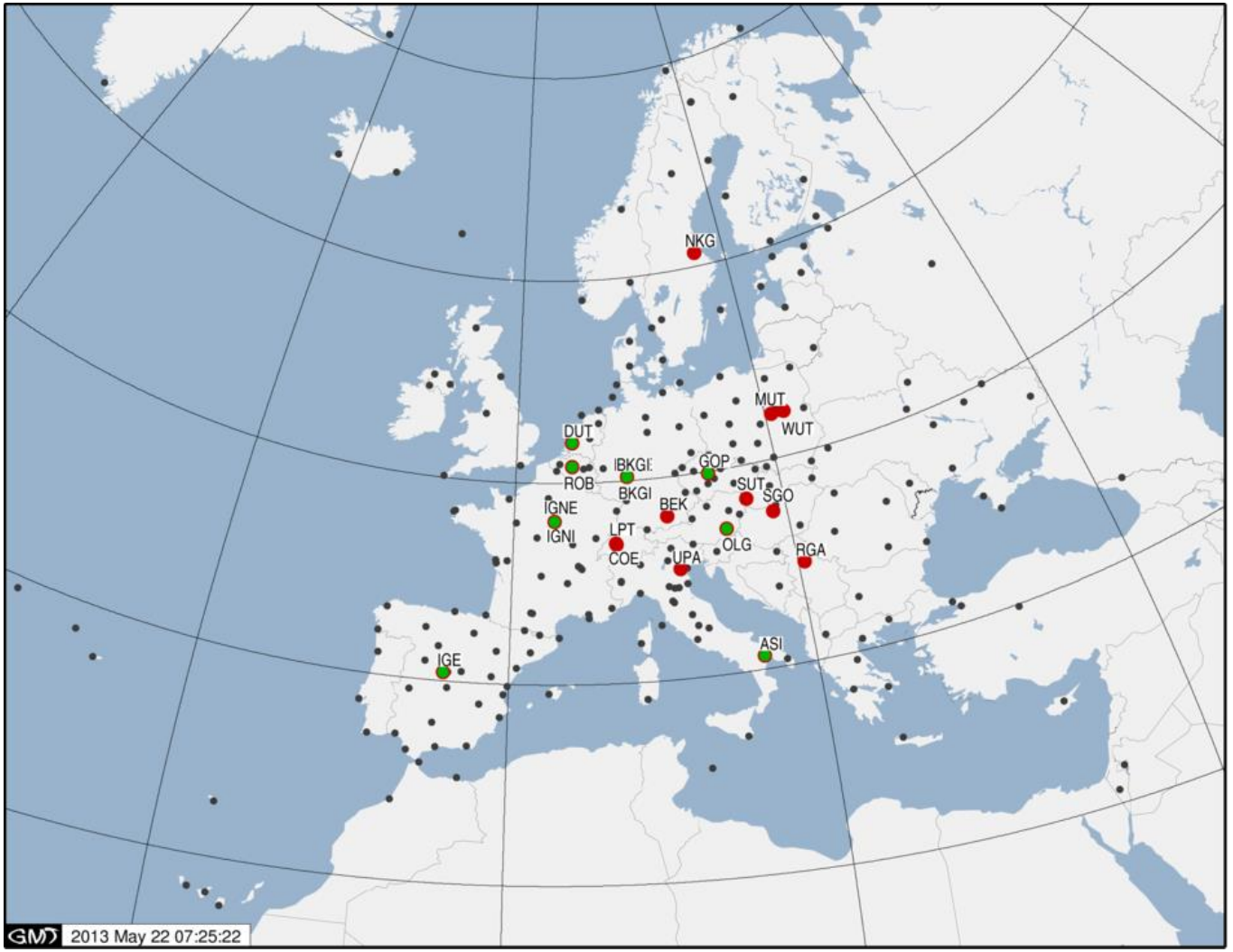
246 GNSS tracking stations (+3)

8 Data Centres

18 Analysis Centres

Special purpose data centres:

- Hourly data centre (GOP)
- High rate data centre (BKG)
- Historical data centre (ROB/EPN CB)



EPN TRACKING NETWORK

ROB

Since June 2012:

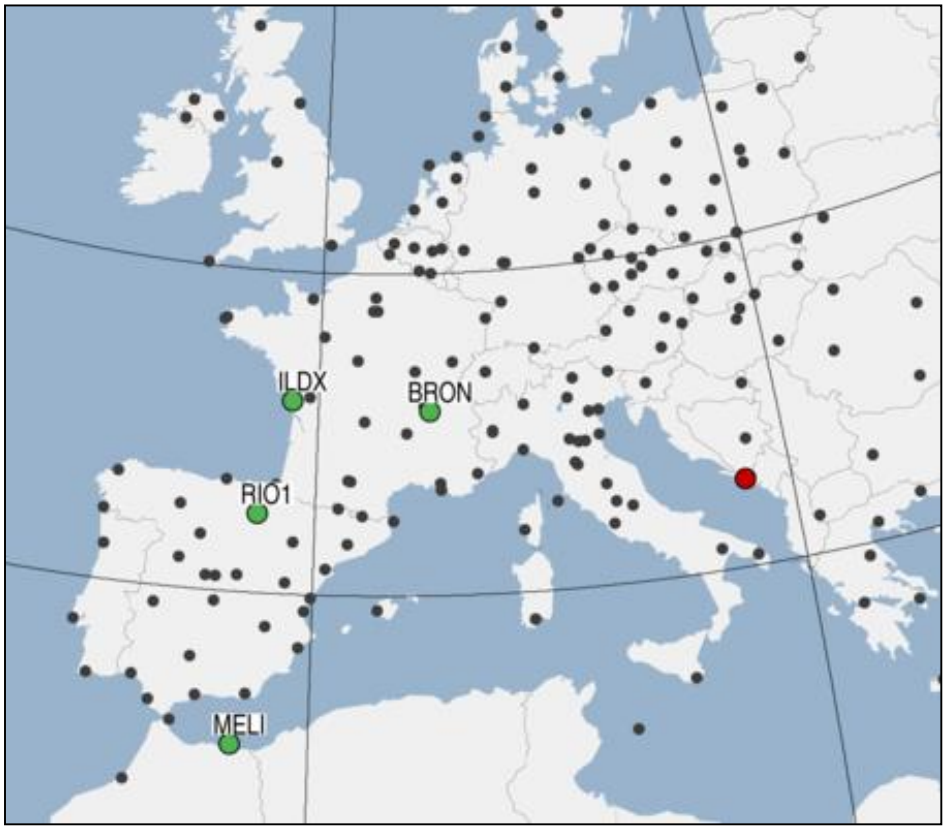
- 4 new EPN stations

NAME	LOCATION	FUNCTION	CALIB	FROM
BRON	Bron, France	GLO GAL	Type	12/05/2013
ILDX	Ile d'Aix, France	GLO GAL	Type	12/05/2013
MELI	Melilla, Spain	GLO GAL	Indiv	12/08/2012
RIO1	Logrono, Spain	RT GLO GAL	Indiv.	12/08/2012

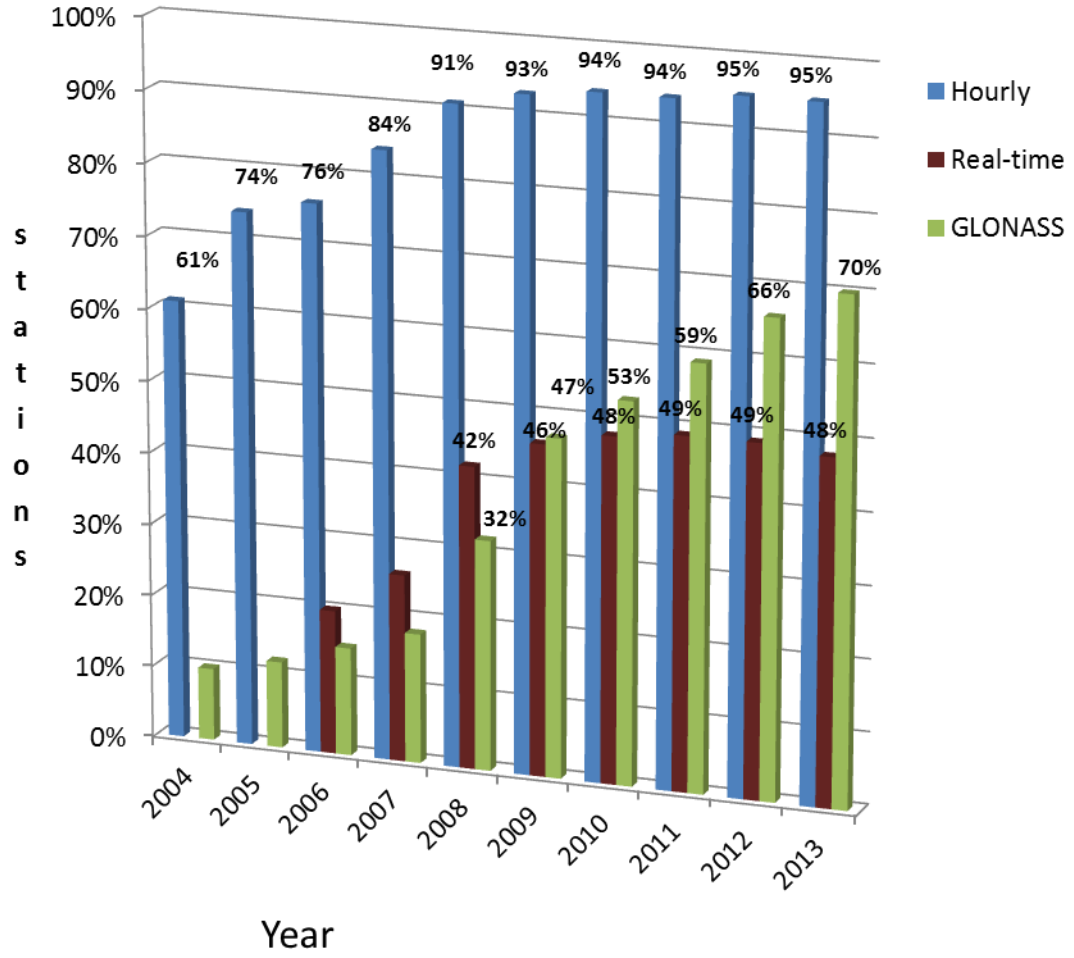
- 1 station removed from network

  DUBR (Croatia, 2000)

  → to be replaced by DUB2



OVERVIEW


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
stations
61%
74%
76%
84%
91%
93%
94%
94%
95%
95%
42%
32%
46%
47%
48%
53%
49%
59%
49%
66%
48%
70%
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Year
Hourly
Real-time
GLONASS

EPN ANTENNA REPLACEMENTS

ROB

24 antenna replacements (including new stations)

(6 with radome!)

GPS	GPS/GLONASS	GPS/GLONASS/GALILEO
	1 LEIAT504GG	3 LEIAR10
	1 NOV702GG	5 LEIAR25.R4
		3 SEPCHOKE_MC
		1 TPSCR.G5
		8 TRM55971.00
		2 TRM59800.00
0	2	22

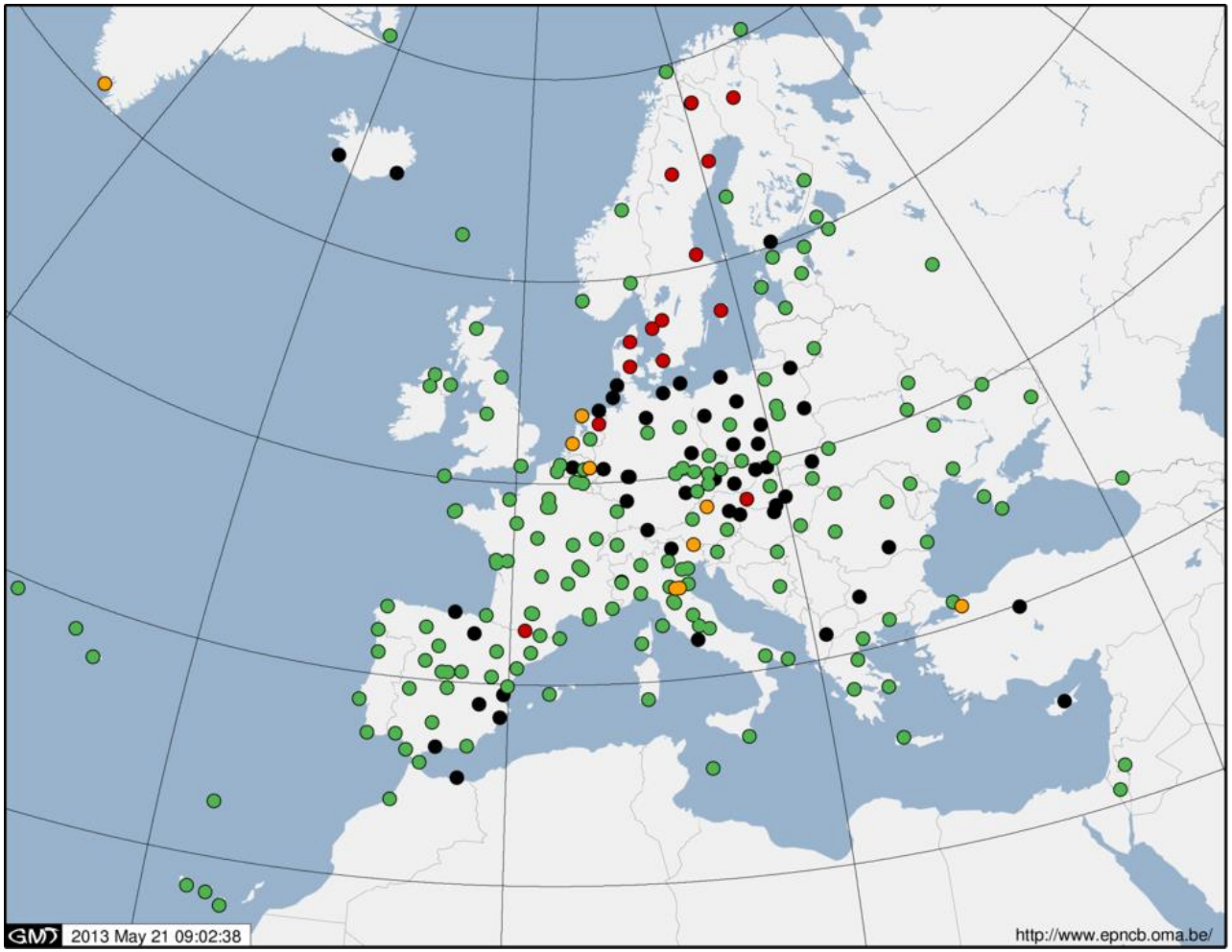
EPN ANTENNA CALIBRATIONS

Individual calibration (16%)

True absolute calibration (69%)

Converted from relative (7%)

No absolute calibration (8%)



Individual calibrations

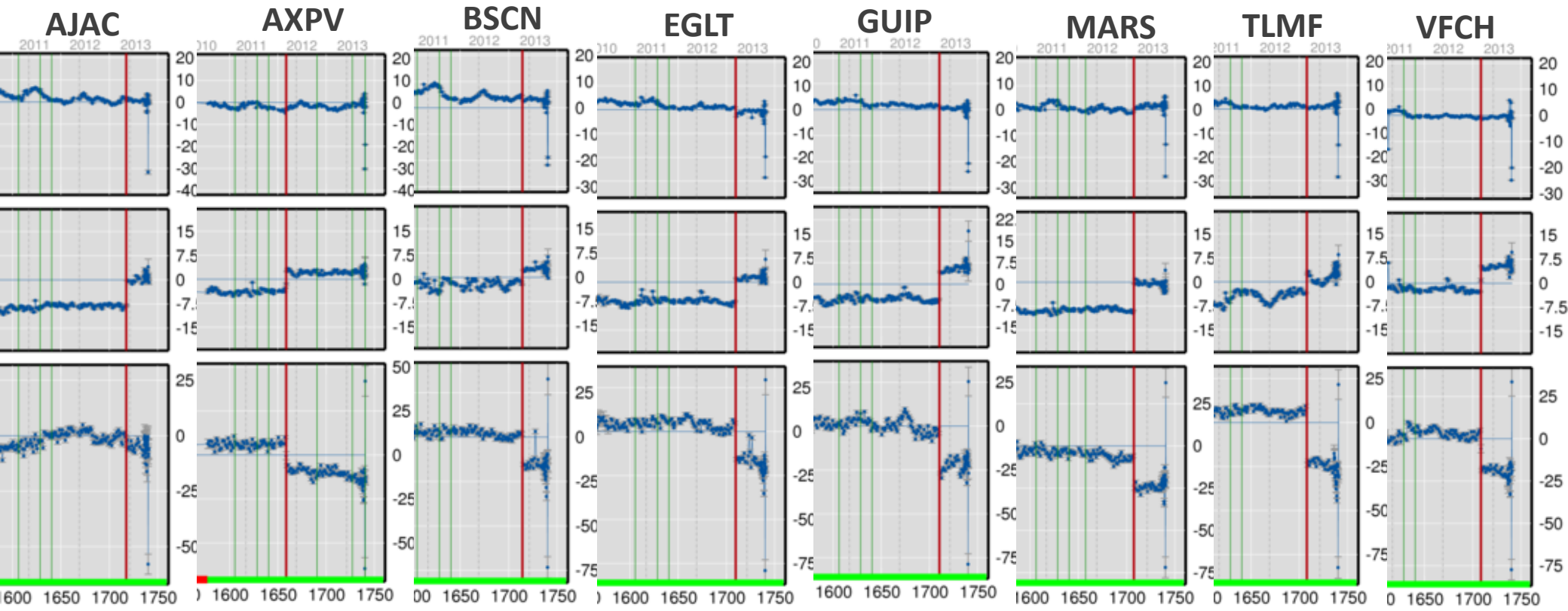
- *to be submitted to EPN CB few days before antenna installation !*
- *Major update due to spikes in GLONASS calibrations*

EPN ANTENNA REPLACEMENTS

ROB

LEIAT504GG NONE/LEIS → TRM57971.00 NONE

both type mean robot

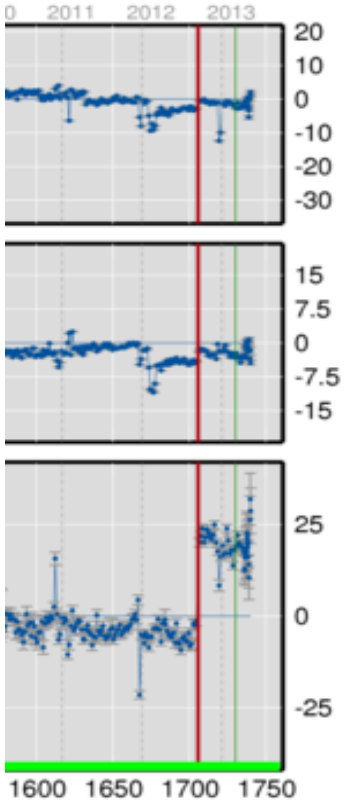


EPN ANTENNA REPLACEMENTS

ROB

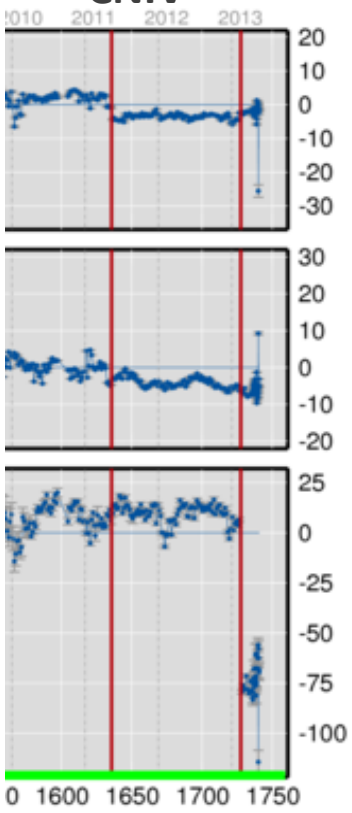
TRM41249.00 NONE
Type mean robot
→
TRM59800.00 NONE
Type mean robot

BBYS



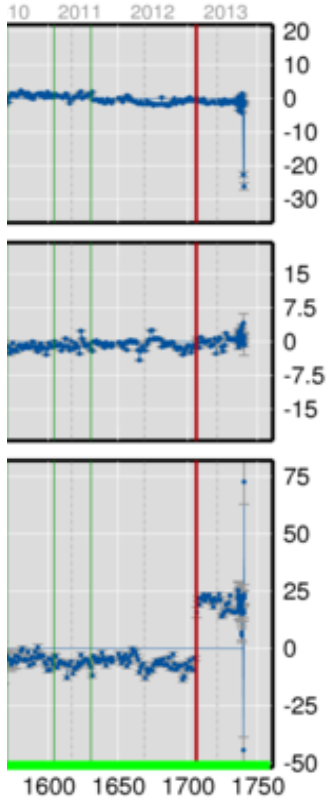
NOV702GG NONE
Type mean robot
→
LEIAR10 NONE
Type mean robot

CNIV

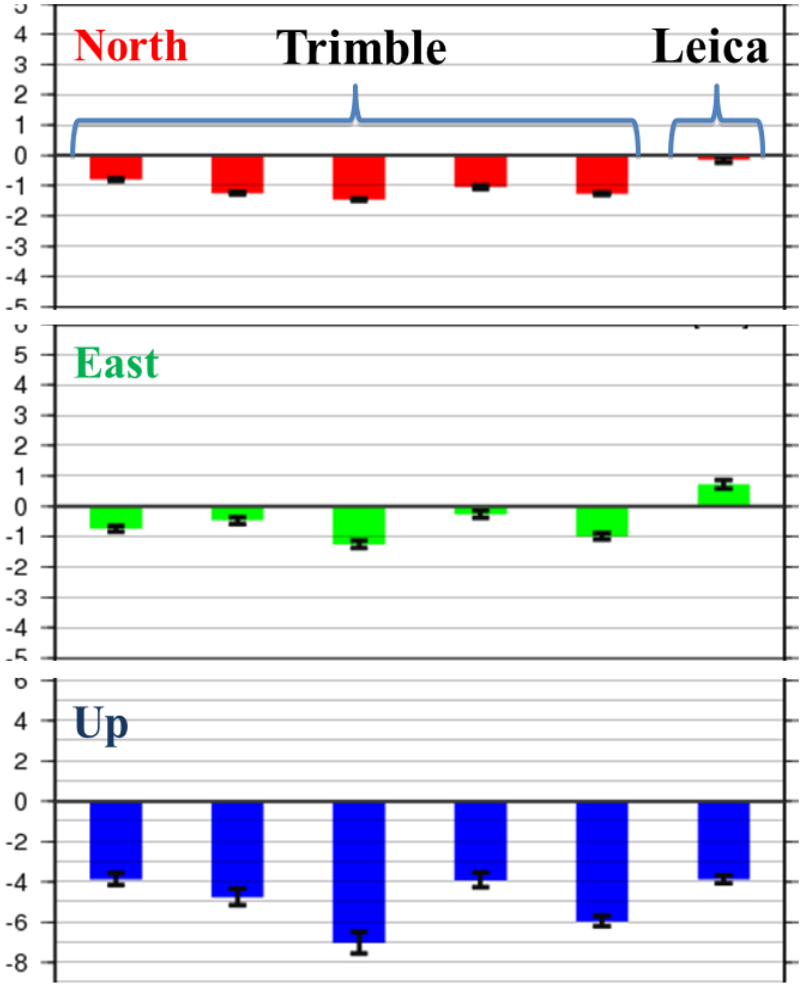


TRM41249.00 NONE
Indiv. robot
→
LEIAR10 NONE
Indiv. chamber

BADH



INDIVIDUAL ANTENNA CALIBRATIONS



5 TRM59800.00 and 1 LEIAR25.R3

individually calibrated at both Geo++ (robot) and UniBonn (chamber)

Comparison of estimated positions

Robot Chamber

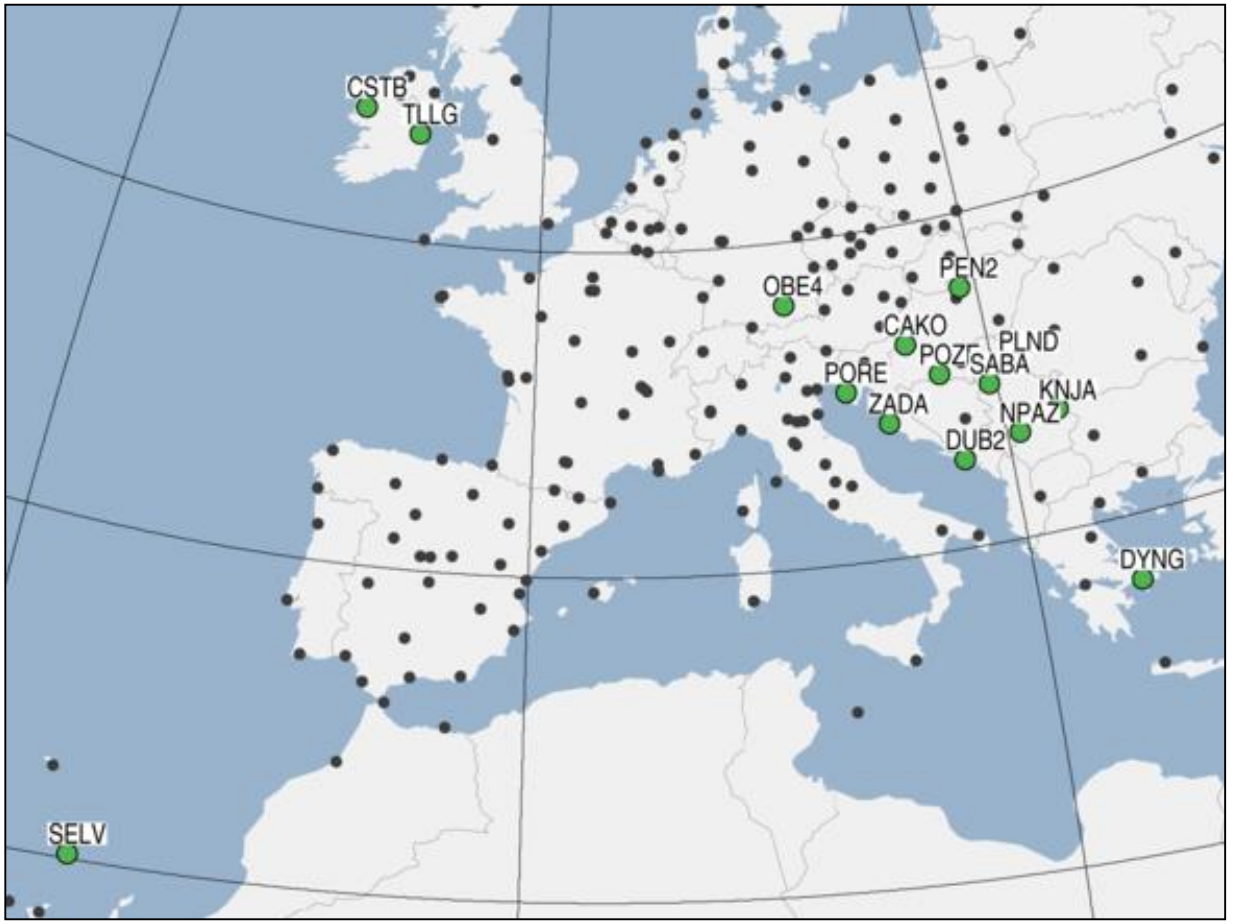
Up ≠ 4 mm - 7 mm

Mean problem: near-field multipath during calibration AND station installation !!

PROPOSED EPN STATIONS

- ✓ Croatia (5)
- ✓ Germany (1)
- ✓ Greece (1)
- ✓ Hungary (1)
- ✓ Ireland (2)
- ✓ Portugal (1)
- ✓ Serbia (4)

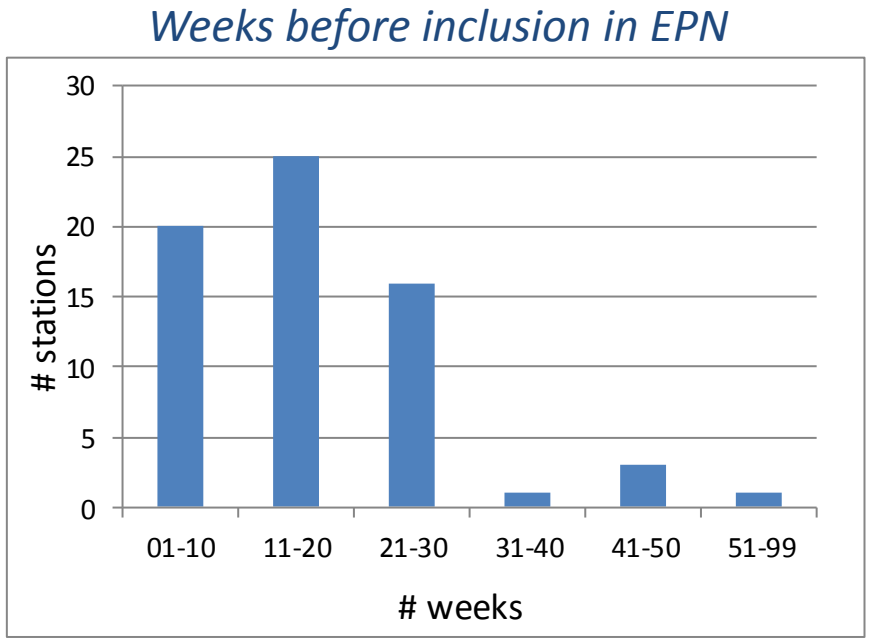
Allready proposed last year



PROPOSED EPN STATIONS

Reasons for delays in integrating proposed station into the EPN:

- Communication with station manager
- Meta-data: site log, operational center form, site pictures , commitment letter
- Data availability at data centers (large latencies, format errors, data missing in one data centre)
- Data quality (data gaps → linked with data availabiity)
- Antenna/radome without absolute calibrations



Majority of proposed EPN stations is integrated into the EPN within 6 months after proposal date

PROPOSED EPN STATIONS

ROB

Marker Name	Proposed at	City	Country	DQ (%)		Availability (%)					Latency			Documentation				Meta-data		Rele-vance to EPN	Data	
				0°	15°	Daily		Hourly		RT	Hourly(%)		RT (s)	CL	SL	SP	NC	Daily	RT		AC	DQ
						BKG	OLG	BKG	OLG		BKG	OLG										
CAKO	2011-09-21	Cakovec	Croatia	90	95	96	96	98	98	_	93	81	_	✔	✔	✔	✔	✔	__	R	T	✔
CSTB	2010-06-09	CastleBar	Ireland	86	94	100	96	99	99	_	94	80	_	✔	✔	✔	✘	✔	__	R	T	✔
DUB2	2011-12-12	Dubrovnik	Croatia	83	95	93	96	98	98	_	93	80	_	✔	✔	✔	__	✔	__	R	T	✔
DYNG	2012-04-02	DIONYSOS	Greece	87	97	25	14	49	28	_	36	0	0.6	✔	✔	✔	__	✔	✔	R, E, C	T	✔
KNJA	2012-03-14	Knjazevac	Serbia	80	93	93	0	0	93	_	0	86	_	✘	✔	✔	__	✔	__		T	✔
NPAZ	2011-05-04	Novi Pazar	Serbia	80	93	93	0	0	93	_	0	86	_	✔	✔	✔	✔	✔	__	R	T	✔
OBE4	2012-11-14	Oberpfaffenhofen	Germany	96	99	71	0	100	100	_	96	94	_	✔	✔	✔	__	✔	__	R, E	I	✔
PEN2	2012-09-28	Penc	Hungary	85	94	93	93	98	98	_	96	78	_	✔	✔	✔	__	✔	__	R, E	I	✔
PLND	2011-05-04	Plandiste	Serbia	76	87	82	0	0	75	_	0	72	_	✔	✔	✔	✔	✔	__	R	T	✘
PORE	2011-09-21	Porec	Croatia	88	95	96	96	94	98	_	93	77	_	✔	✔	✔	✔	✔	__	R	T	✔
POZE	2011-09-21	Pozega	Croatia	86	95	86	96	93	98	_	93	77	_	✔	✔	✔	✔	✔	__	R	T	✔
SABA	2011-05-04	Sabac	Serbia	88	93	93	0	0	93	_	0	86	_	✔	✔	✔	✔	✔	__	R	T	✘
SELV	2012-03-05	Selvagem Grande Island	Portugal	_	_	0	0	0	0	_	0	0	_	✔	✔	✔	__	✔	__	R	T	✔
TLLG	2010-06-09	Dublin	Ireland	88	95	100	96	100	100	_	96	77	_	✔	✔	✔	✘	✔	__	R	T	✔
ZADA	2011-09-21	Zadar	Croatia	83	95	86	96	93	94	_	92	73	_	✔	✔	✔	✔	✔	__	R	T	✔

OUTLINE

- EPN Tracking Network
- **EPN LAC Workshop**
- Update of Guidelines
- Future

EPN Local Analysis Centres Workshop

Brussels - May 15-16, 2013

Organized by the Royal Observatory of Belgium
and the Solar-Terrestrial Centre of Excellence

Menu

When - Where

Introduction to Bernese GNSS software 5.2 :

Tuesday, May 14, 2013
- 14:00-16:00 : New features
- 16:30-18:00 : Processing examples

EPN Local Analysis Centres Workshop :

Wednesday, May 15, 2013
- 10:00-12:30 : Work meeting
- 12:30-13:30 : Lunch
- 13:30-16:30 : Work meeting
- 19:00-22:00 : Dinner

Thursday, May 16, 2013
- 09:00-12:00 : Work meeting

Location :

"Meridian" meeting room of the
Royal Observatory of Belgium
avenue Circulaire - Ringlaan, 3
B-1180 - Brussels, Belgium

EPN LAC WORKSHOP 2013

ROB

Program

May 14, 2013

14:00-16:00 : Introduction to Bernese 5.2 - presentation and demonstration by Rolf Dach

May 15, 2013

10:00-10:20 : Opening Session (Chair: C. Bruyninx)
10:20-12:30 : Reports from EPN Coordination Group and EUREF TWG (Chair: E. Brockmann)
12:30-13:30 : Lunch
13:30-14:00 : New processing strategies & EPN-REPRO2 (Chair: C. Völksen)
14:00-14:15 : Coffee break
14:15-15:00 : EPN LAC Reports (Chair: A. Kenyeres)
15:00-15:30 : Coffee break
15:30-16:30 : EPN LAC Reports (Chair: A. Kenyeres)

37 participants
17 LACs

May 16, 2013

09:00-10:30 : EPN LAC Reports (Chair: W. Söhne)
10:30-11:00 : Coffee break
11:00-12:00 : Closing Session (Chair: C. Bruyninx)

EPN LAC 2013 / CONCLUSIONS

ROUTINE EPN ANALYSIS

- 70% of EPN stations track GLONASS in addition to GPS → the LACs are again urged to include GLONASS observations in their routine analysis.
- several improved modeling options have recently become available to all LACs → the new EPN ACC
  - to review and update the "EPN Analysis Guidelines" (for June 2013).
  - to coordinate switch of LAC to new modeling (proposed period is October 2013).
- LACs are invited to contact EPN CB and ACC
  - to discuss a possible re-orientation of their contribution to the EPN.
  - to express their willingness to process a global network.

EPN LAC 2013 / CONCLUSIONS

NEW MODELING OPTIONS

The following list of recommended modeling options is agreed upon by the LACs:

- General: consistent with IGS REPRO2
- Inclusion of GPS and GLONASS observations
- Apply GPS+GLONASS PCV, if available
- Troposphere: GMF or VMF + gradient estimation (Chen Herring is recommended)
- Atmospheric tidal loading is optional
- IERS2010 conventions
- Second order ionospheric correction + ray bending
- Elevation cut off: 3°-5°
- LACs working with Bernese should submit NEQ-SINEX, MC solution, and are recommended to use CODE orbits/clocks.

EPN LAC 2013 / CONCLUSIONS

REPROCESSING

- A new reprocessing of the EPN is necessary. The chairman of the EPN reprocessing project is asked to get this initiative started (not to wait for IGS-REPRO2 results). A first step is to send out asap a questionnaire to the LACs asking for contributions.
- The EPN-REPRO2 analysis should be done in agreement with the updated guidelines (modeling options) for the routine EPN products.
- Few solutions with different software including full EPN (+global stations?) or continue as before? Or ? → LAC meeting at symposium to re-discuss the issue

EPN LAC 2013 / CONCLUSIONS

TWG DISCUSSION MAY 28, 2013

- Should the EPN follow the IGS and move to daily submissions (for REPRO2 and final routine solution)?

- Should EPN go for a global analysis to reduce network effect ?

  → benchmark coordinated by new ACC

OUTLINE

- EPN Tracking Network
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- **Update of Guidelines**
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GUIDELINES

ROB

http://www.epncb.oma.be/_documentation/guidelines/

ORGANISATION	NETWORK & DATA	PRODUCTS & SERVICES	DOCUMENTATION
Creation, Management, Structure, Relation to IGS, Projects	Station list, Maps, Tracking status, Data access, Proposed stations, Station log submission, Station picture submission	Data analysis, Weekly EPN solutions, Coordinates, Position time series, Tropospheric delays, ETRS89/ITRS transformation, Satellite Orbit & Clock Correction Streams	Formats, Guidelines, Equipment & calibration, Papers, FAQ

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Last updated: January 21, 2013

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Last updated: June 13, 2012

Guidelines for EPN Data Centres
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EUREF Guidelines

Specifications for Reference Frame Fixing in the Analysis of a EUREF GPS Campaign
Last updated: April 27, 2011

Guidelines for EUREF Densifications (previously know as "EUREF Campaign Guidelines")
Last updated: June 13, 2012

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Updated stepwise procedure for more clarity

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New guidelines approved
by EUREF TWG on May 28, 2013
→ to be published asap

→ Quality priority over quantiity
→ GLONASS+Gallileo, real-time, data quality, …

GUIDELINES

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→ Updated guidelines to be prepared by new EPN ACC

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→ to be published

GUIDELINES FOR EUREF DENSIFICATIONS

EPN CLASS A solution remains backbone for all EUREF densifications

- Maintained by EPN reference frame coordinator
- Updated each 15 weeks

Now tied to IGb08 (latest "IGS version" of ITRF2008)

Increased consistency with presently used EPN antenna model (epn_08.atx → in use since April 2011)

Careful when combining multi-year campaigns analyzed with different antenna models!

OUTLINE

- EPN Tracking Network
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- Update of Guidelines
- **Future**

THE FUTURE …

- Previous presentations … new RINEX version…not to be used for standard EPN operations yet!
- Need to speed up inclusion of new EPN stations
- LAC need to analyse GLONASS observations in addition to GPS
- EPN-REPRO2 to be started in the Fall of 2013
- New ACC from June 1st, 2013 on.
- Several EPN guidelines will be updated soon!

- Registration required for EUREF data/products to monitor usage/users?

Part of the EPN CB is funded by the Solar-Terrestrial Centre of Excellence