EPN CB Support to EPN Data Analysis and Future Strategy

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THE EPN … SINCE 1996

Since 1996 … 16 years:

- 35 stations → 244 stations
- GPS → GPS+GLONASS(+Galileo) – new formats, signals
- Antenna phase center offsets → Elevation & azimuth dependent models + individual calibrations
- Daily data & 1 data center
  - → daily, hourly & local + regional data centers,
  - → real-time, high-rate data & local + regional broadcasters
- 4 analysis centers
  - → 17 Analysis centers
- Weekly SNX solutions
  - → Daily & weekly SNX, cumulative solution, time series, official coordinates, ZTD

→ **Increasing work load (monitoring) and complexity (guidelines)**

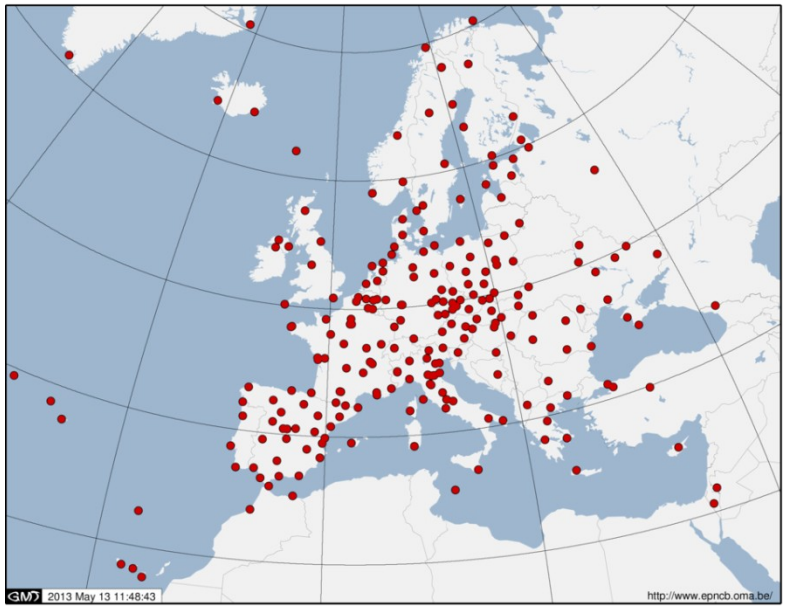
OUTLINE

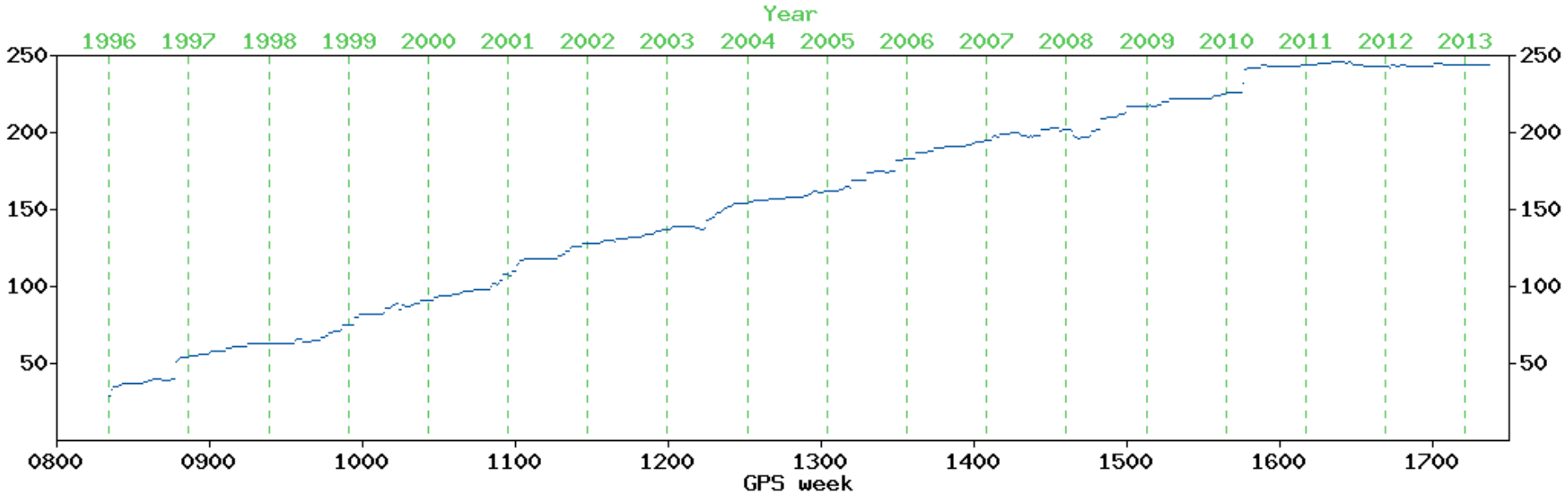
- Update on EPN Tracking Network
- EPN CB Support to LACs
- Reprocessing, lessons learned
- News from TWG

GROWTH OF EPN TRACKING NETWORK

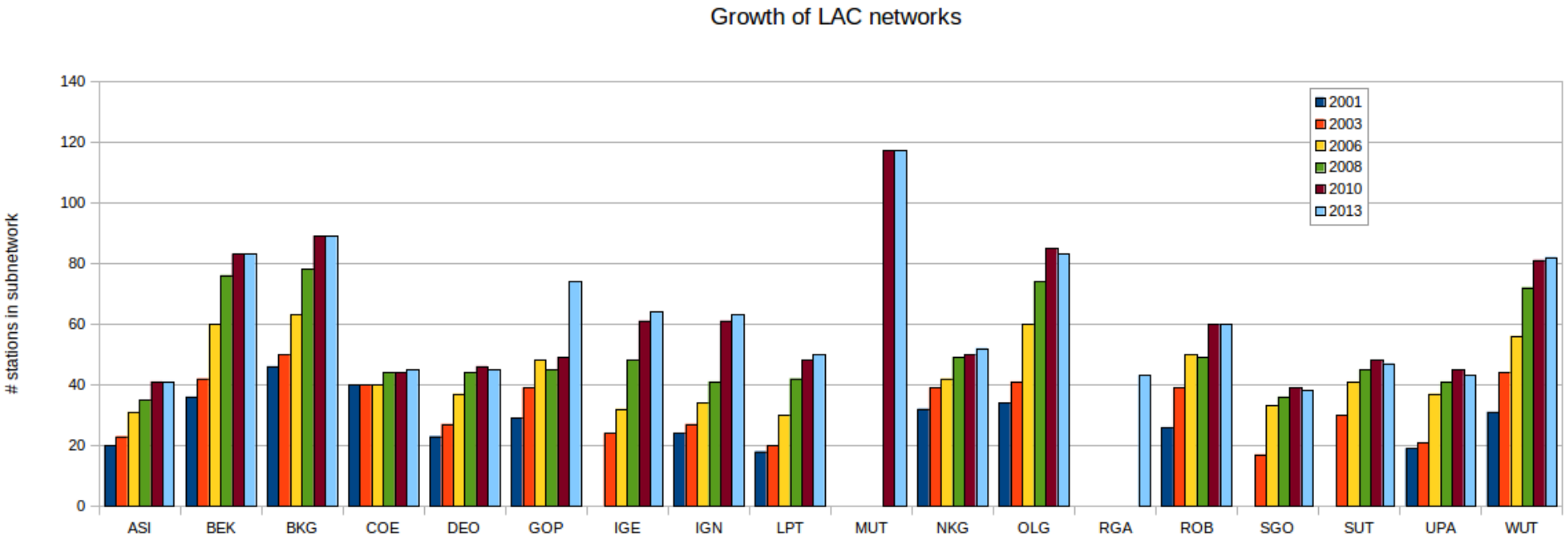
EUREF Permanent Tracking Network

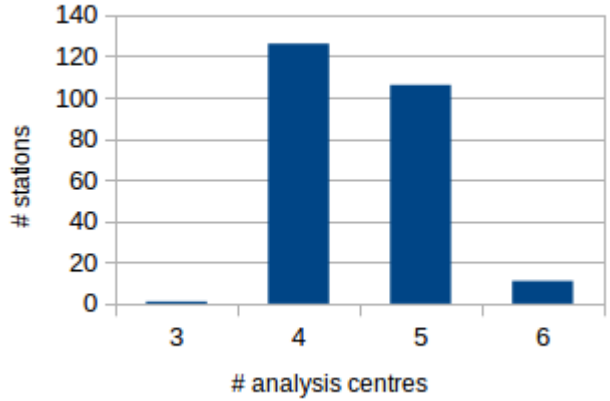
ROB





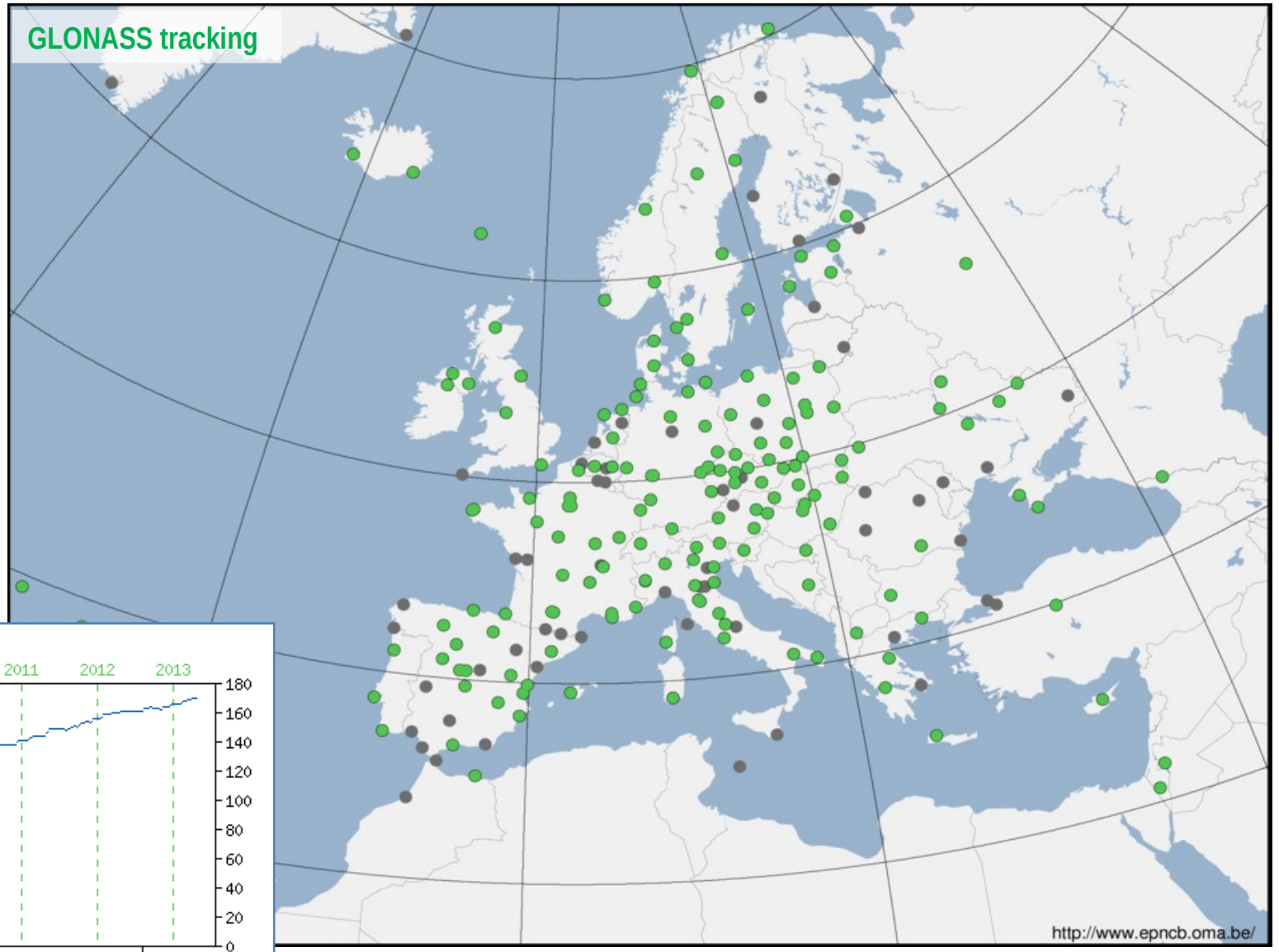
GROWTH OF LAC NETWORKS

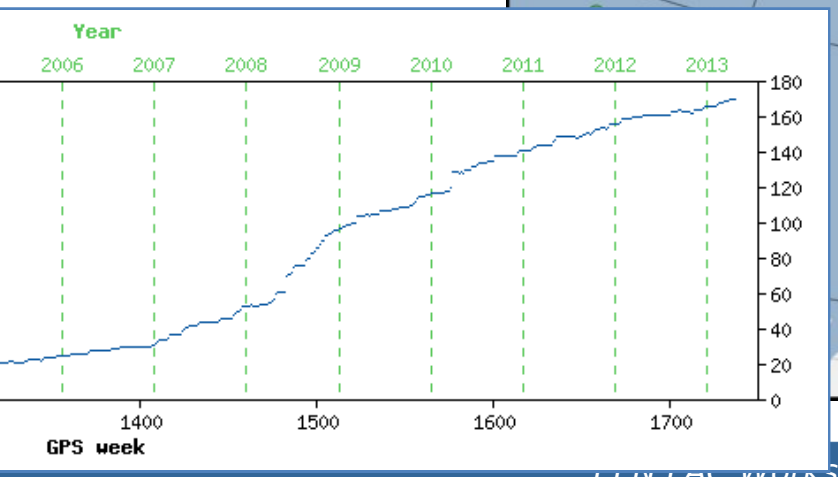




GLONASS TRACKING

70% of EPN





AC's PROCESSING

EPN Local Analysis Centre	GNSS Software	GLONASS capable	GPS+GLONASS processing
BEK	Bernese V5.0	yes	Yes
GOP			No
IGE			No
IGN			Planned (2010)
NKG			Planned (2010)
OLG			Planned (2010)
ROB			Yes
SGO			Planned (2010)
SUT			Planned (2010)
UPA			Planned (2010)
WUT			Yes
MUT			?
RGA			?
LPT	Bernese 5.0 ??? → 5.2	yes	Yes
COE	Bernese 5.0??? → 5.2	yes	Yes
BKG	Bernese V5.2	yes	Yes
ASI	MicroCosm software Vs. 2009.0	no	no

Information based on LAC forms

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EPN CB SUPPORT TO LAC

ftp://epncb.oma.be/pub/station/general

- station coordinates in Bernese format (weekly): IGS08.CRD, updated weekly
- station coordinates in SSC format from cumulative EPN solution (A. Kenyeres)

ftp://epncb.oma.be/pub/station/general

- Ocean loading table (BLQ format): EPN_FES2004.BLQ
- Antenna calibrations (type+individual): epn_08.atx → recent update of individual calibrations (spikes in GLONASS calibrations)
- Meta-data files based on site logs: euref.snx (SINEX), EUREF.STA (Bernese), *EUREF52.STA*

ftp://epncb.oma.be/pub/station/general/excluded

EPN CB SUPPORT TO LAC

Guidelines for EPN analysis centers (update?) → maintained by EPN ACC

Dedicated Data Analysis web page
http://www.epncb.oma.be/_productsservices/analysiscentres/

- Subnetwork descriptions, processing options (need for update!) → ACC task in collaboration with LAC

- Archive of all LAC Mails sent to euref_ac@ifag.de

- Analysis reports in graphical form (based on reports from analysis coordinator and troposphere coordinator) → partly moved to ACC web site?
  - General agreement between LAC
    - RMS of Helmert with combined solution
    - Tropospheric biases
  - Agreement between LAC for a specific station

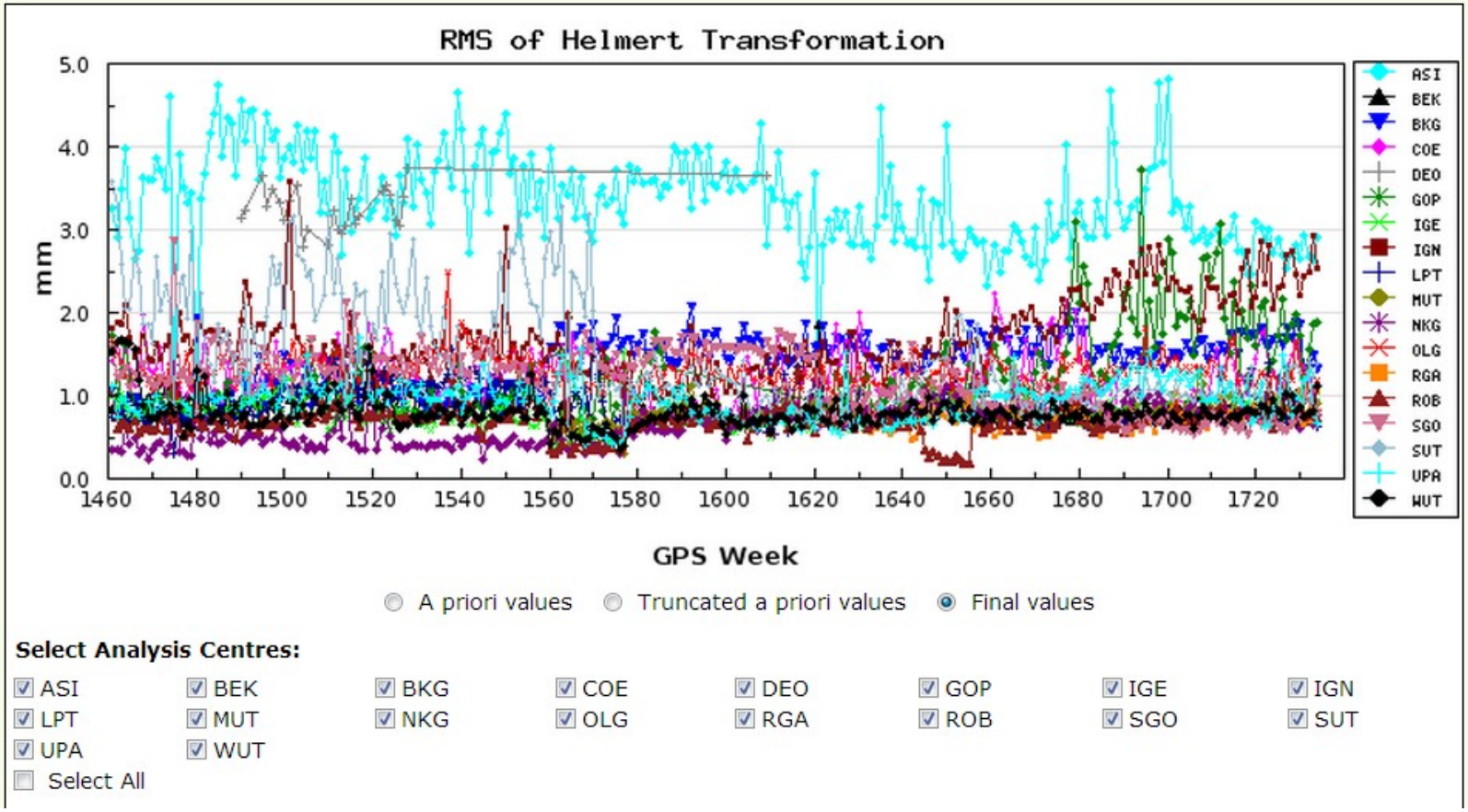
AGREEMENT BETWEEN LAC SOLUTIONS AND COMBINED SOLUTION

ROB

DATA & PRODUCTS > ANALYSIS CENTRES > ANALYSIS REPORTS > **AGREEMENT BETWEEN LAC SOLUTIONS**

The information below is extracted from the weekly EUREF AC REPORTS and EUREF TROPOSPHERE COMBINATION REPORTS distributed through LAC mail.

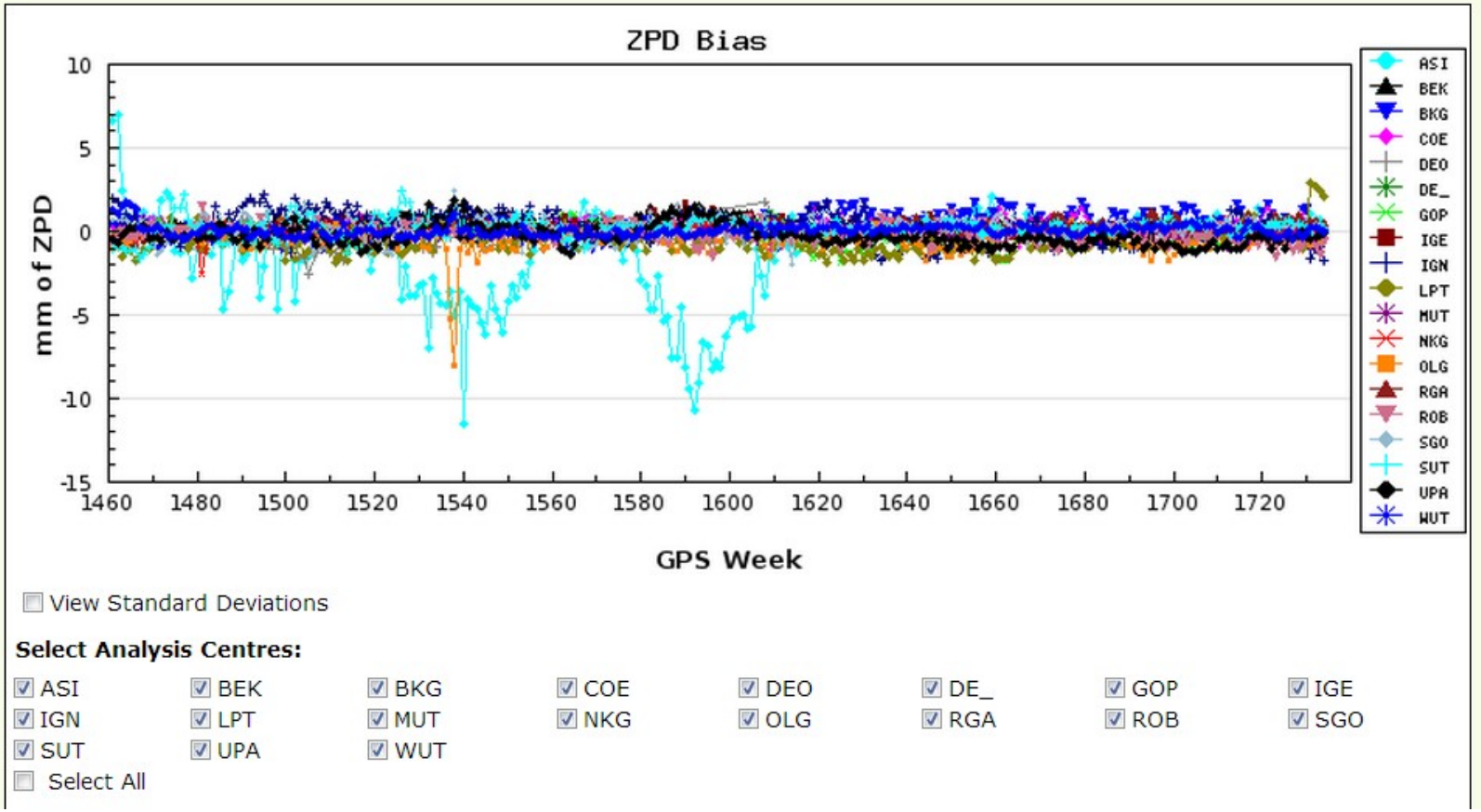
A. RMS of the Helmert transformation (values of Helmert parameters) between each weekly LAC position estimates and the combined EPN solution. A priori values (before outlier rejection) and final values (after outlier rejection) are provided.



BIAS BETWEEN LAC ZPD AND COMBINED ZPD

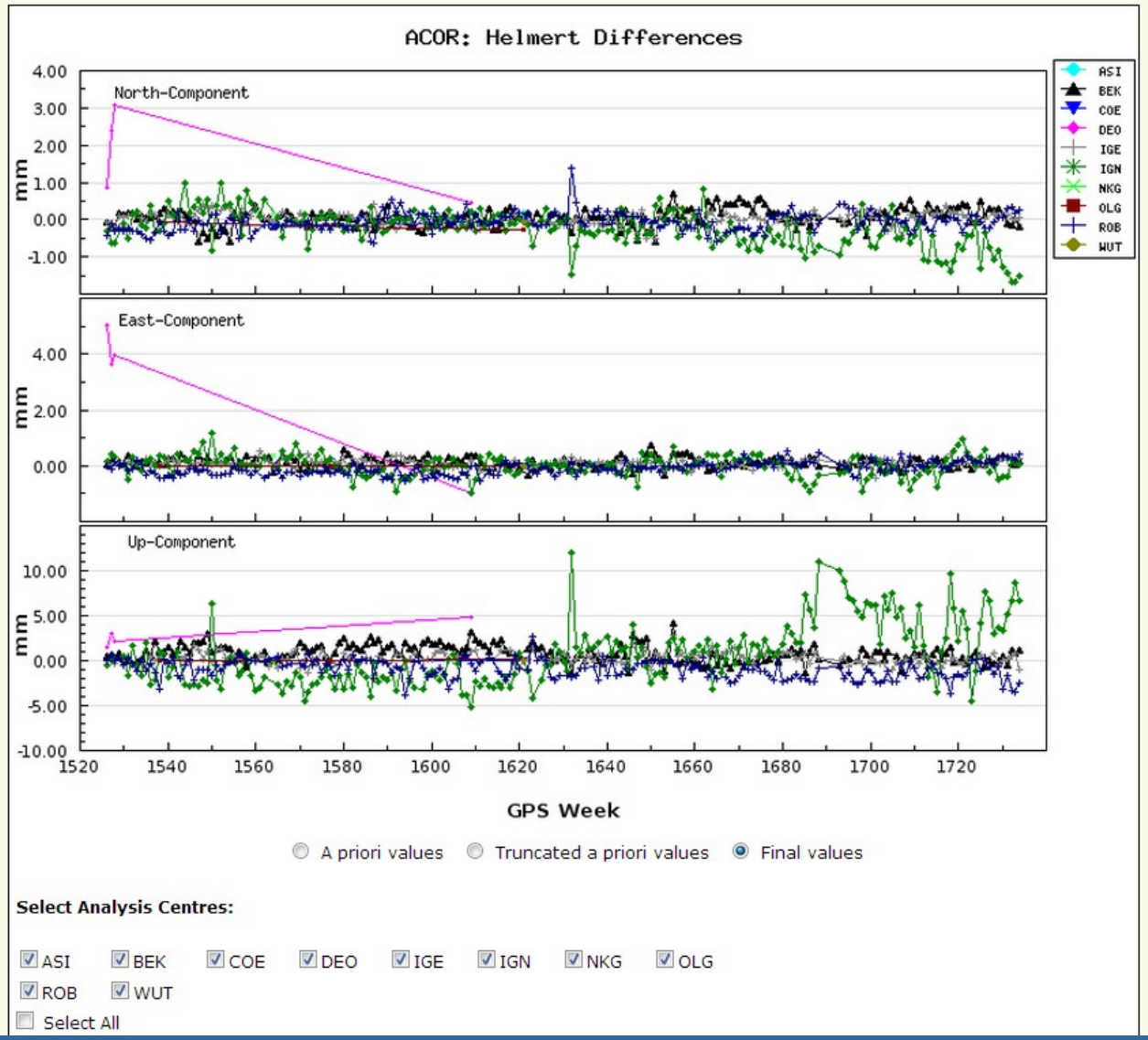
ROB

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.



HELMERT DIFFERENCES WRT COMBINED SOLUTION

B. Differences (after a Helmert transformation) between the weekly position estimated for ACOR by each LAC and the position of ACOR 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.



Need for careful review of plots/results!

EPN CB VERIFICATIONS

Meta-data in individual weekly SINEX files :

- antenna type and SN, antenna eccentricity
- antenna calibration model (N, E, U)
- receiver type

vs.

site log info + EPN antenna calibration file

EPN CB action : Error message sent to LAC + ACC→ no EPN CB follow up after that

Procedure to be reviewed together with new ACC !

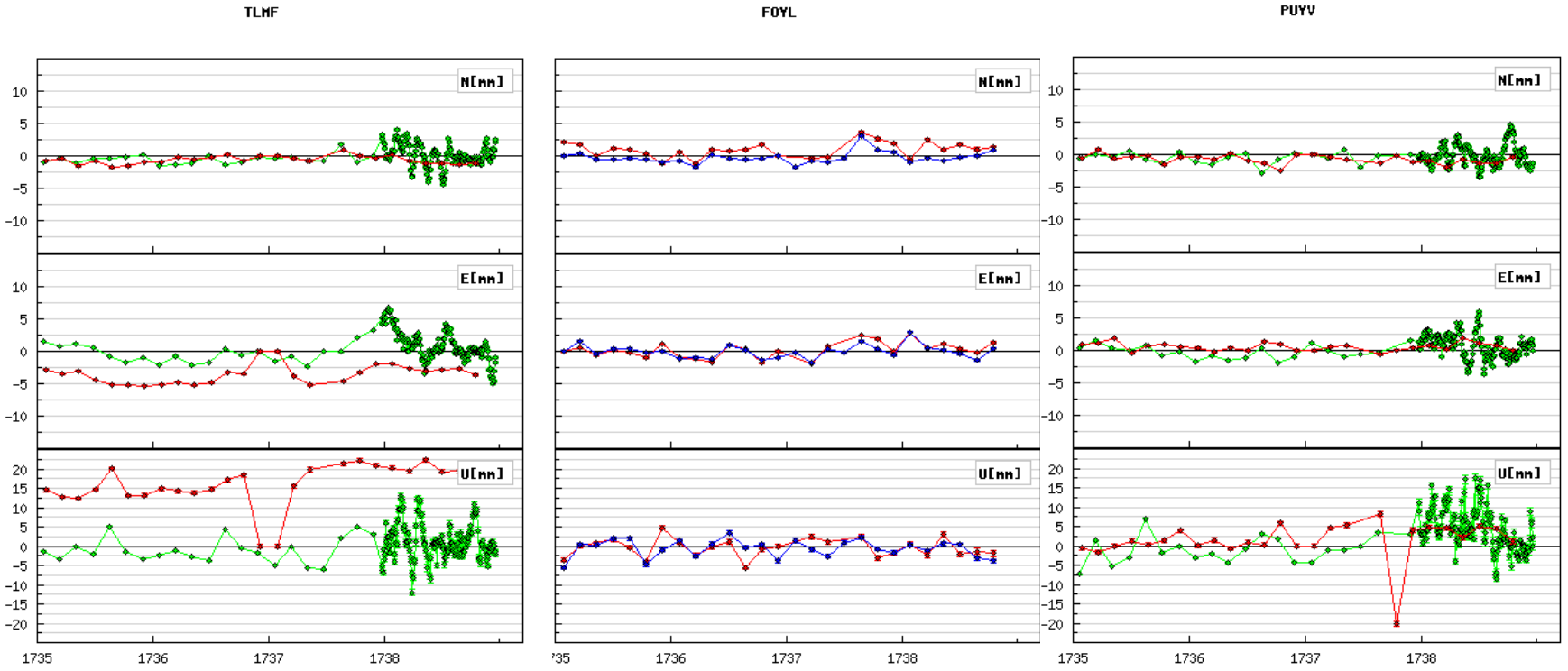
RAPID SOLUTIONS

No official EUREF product

Comparison of rapid daily solutions: ASI, LPT (daily and hourly), ROB, WUT

http://www.epncb.oma.be/_dataproducts/analysiscentres/LACrapidts/

→ Problems with some of the daily rapid solutions → follow up required by ACC



INDIVIDUAL ANTENNA CALIBRATIONS

Antenna change:

Site log + individual antenna calibration file is sent to EPN CB.

Site log update → submission form under full control of station manager

Antenna calibration update → requires manual interaction of EPN CB.

Should be send few working days advance! But is NOT done in practice

Not always possible straight away

Data are distributed without correct antenna calibration information

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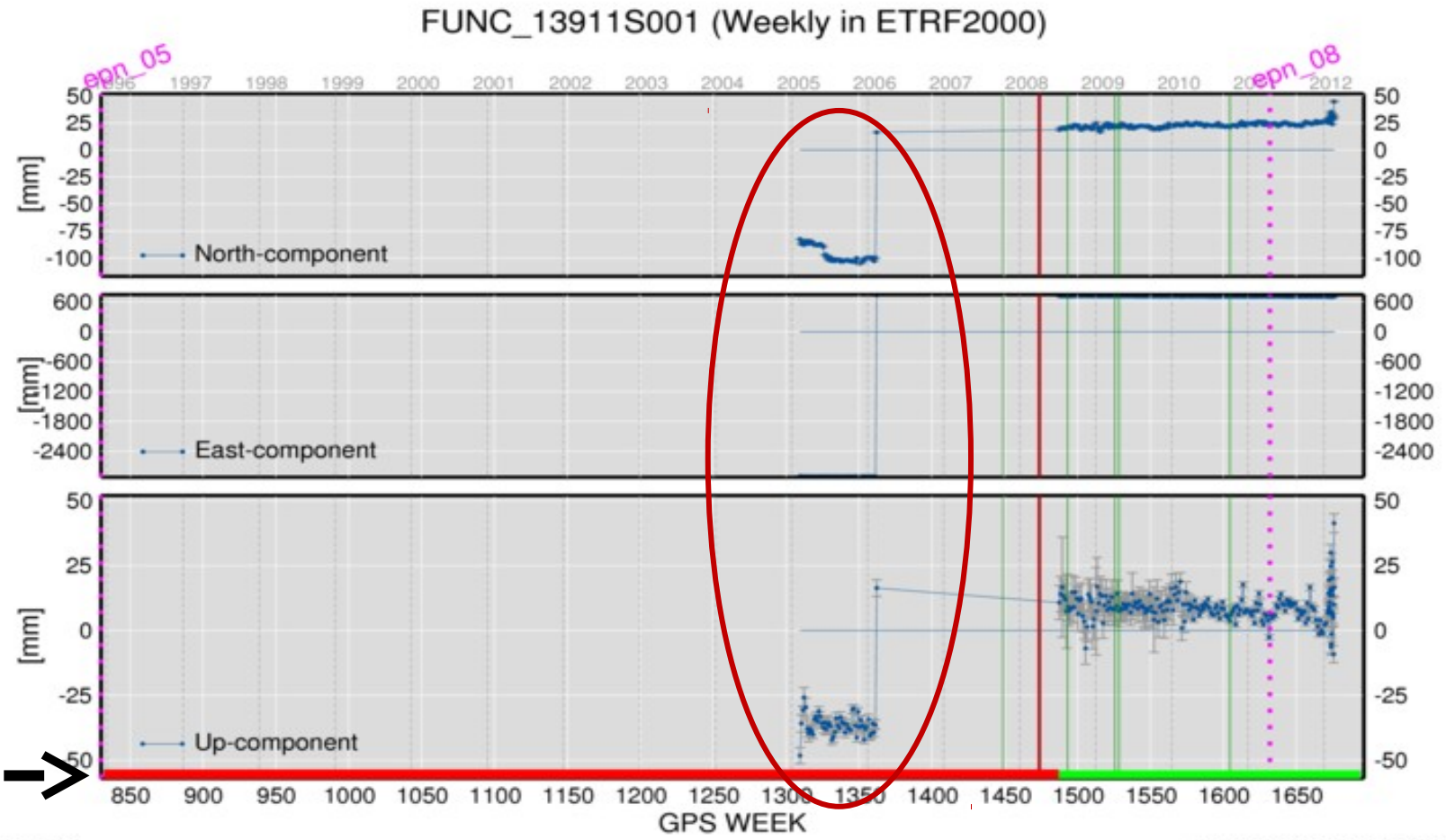
EPN - REPRO1

EPN-REPRO1 weekly SNX solutions have been generated by ACC taking LAC solutions “as is”

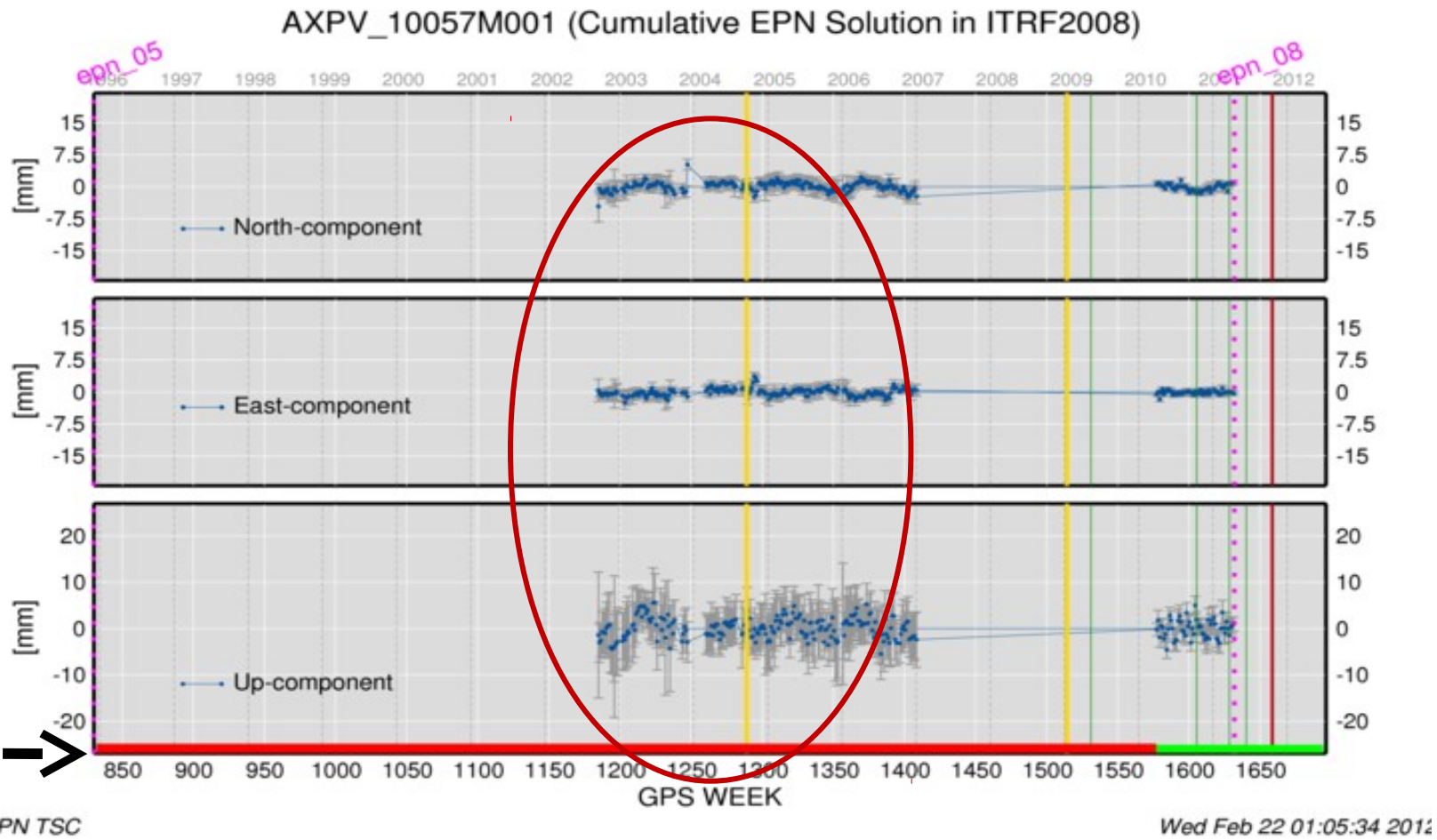
EXAMPLE: FUNC



Status in EPN:
Not included
Included
Inactive

2005: Station not yet included in EPN, no info in site log
But: results in REPRO1

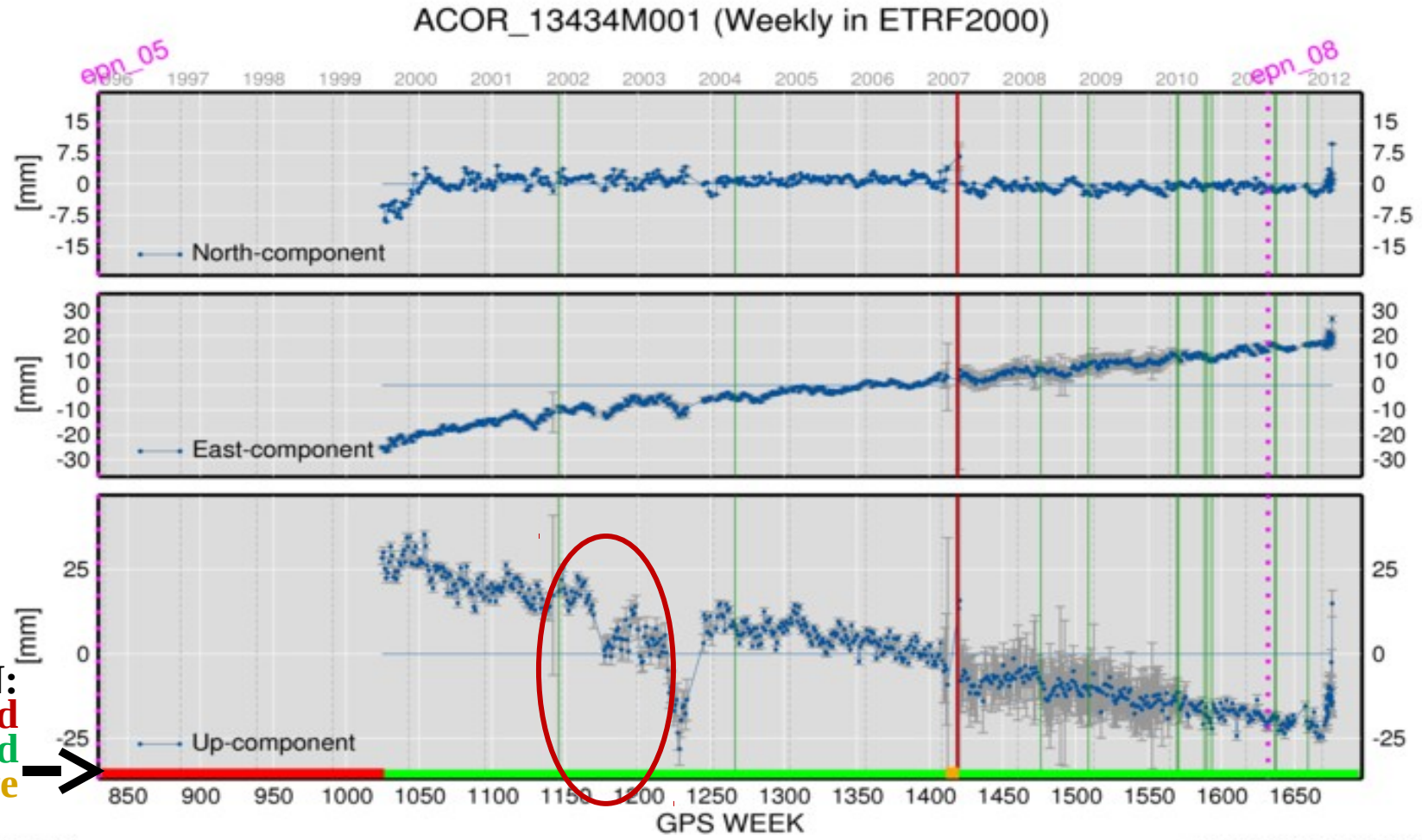
EXAMPLE: AXPV



Status in EPN:
Not included
Included
Inactive

Pre-EPN data, but data are OK! after outlier rejection and introduction of discontinuity → include in REPRO2?

EXAMPLE: ACOR



Status in EPN:
Not included
Included
Inactive

Known tracking problem, but included in REPRO1
Should be removed from all analysis

REPRO 2 IDEAS

Included in weekly combined EPN-REPRO1 SNX files:
1. Pre-EPN data: some good, some bad
2. Inactivity periods for EPN stations: some good, some bad
3. Outliers and known tracking problems for EPN stations → ugly

Some LAC used only data from EPN historical data base, others not.

Historical data base contains (almost) all available data for EPN stations

- except periods without site log information
- also pre-EPN data…

BUT needs cleaning up!

Implement the info from REPRO1 (inventory available, EPN CB, Dousa, Kenyeres) in EPN historical data base to

- take advantage of valuable pre-EPN data in agreement with station manager AND only if site log information is available
- avoid bad data are included in analysis

But: effort only makes sense if LAC involved in REPRO2 agree to use this inventory…

→ coordinated by chair EPN Reprocessing project ?

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NEWS FROM EUREF TECHNICAL WORKING GROUP

EUREF Retreat Nov. 12-13, 2012 Bern

Goal:

- Review EUREF key themes and organizational structures
- Derive plan to achieve EUREF objectives

for the next 4-8 years

EUREF RETREAT

AGENDA

- The EUREF products and services in the context of IAG services and GGOS (Dach)
- Review of the EPN and possible ways to improve weaknesses (Bruyninx)
- The EUREF products and services for positioning and georeferencing (Söhne)
- Link of EUREF to other geodisciplines
  - Troposphere (Pacione, Soehne)
  - Ionosphere (Bruyninx)
  - InSAR with GNSS for monitoring of ground deformation (Caporali)
  - Gravimetry (Ihde)
- EUREF's representation – promotion and outreach (Söhne and Poutanen)
- EUREF organizational aspects (Ihde/Caporali/Torres)

EUREF RETREAT

CONCLUSIONS/RECOMMENDATIONS EXTRACT!

- The inconsistency between the antenna phase center modeling between IGS (type-specific) and EUREF (individual) for stations contributing to both networks shall be resolved in the context of an upcoming reprocessing.

- Complexity of the EPN network coordination grows with the growth of the network, increasing GNSS satellite signal variety and stricter requirements in terms of data availability and latency.
  - Coordinators (or WG/Project chairs) should take over certain responsibilities/tasks and report to the EPN CB.
  - The number of LAC's – currently 17 – is more than necessary and their specific task could be redefined to contribute to EPN activities.

EUREF RETREAT

CONCLUSIONS/RECOMMENDATIONS EXTRACT

Atmosphere (tropo+iono)

- More stations required in the North and East of Europe, to improve the coverage.

- Possible impacts of NRT and RT activities on EUREF troposphere product shall be investigated. The possible output of troposphere gradients shall be investigated.

- It shall be investigated if a EUREF ionosphere product could be made available.
  - Some LACs could be redirected from coordinates to ionosphere processing

EUREF TWG NEWS

Two New Working Groups:

- Deformation Modeling (Martin Lidberg)

- Multi-GNSS (Elmar Brockmann) → presentation

Review of EUREF Terms of Reference:

- explicit mentioning of EPN components (LAC, AC) → more visibility, key EUREF infrastructures!

- Clarification/simplification of Working Groups, Projects, Coordinators (limited term?)

SUMMARY

Local Analysis Centers

- ✓ 70 % of EPN is tracking GLONASS, but LACs are not following
- ✓ LACs need to be careful when individual calibrations are introduced → few days of delay wrt installation.
- ✓ Too many LAC (growth of EPN stabilized) → redirect some to dedicated new EPN tasks/products ??? (TBD!)

Future ACC

- ✓ Meta-data checking when combining solutions (routine & repro)
- ✓ Feedback to stations/LAC/EPN CB when outliers are detected
- ✓ Update of EPN Analysis Guidelines required → new models…

REPRO2 needs to be started ! See presentation by Legrand et al.

GLOBAL → TBD! see presentation by Legrand et al. + TIGA presentation