

Status of the EPN Tropospheric Products

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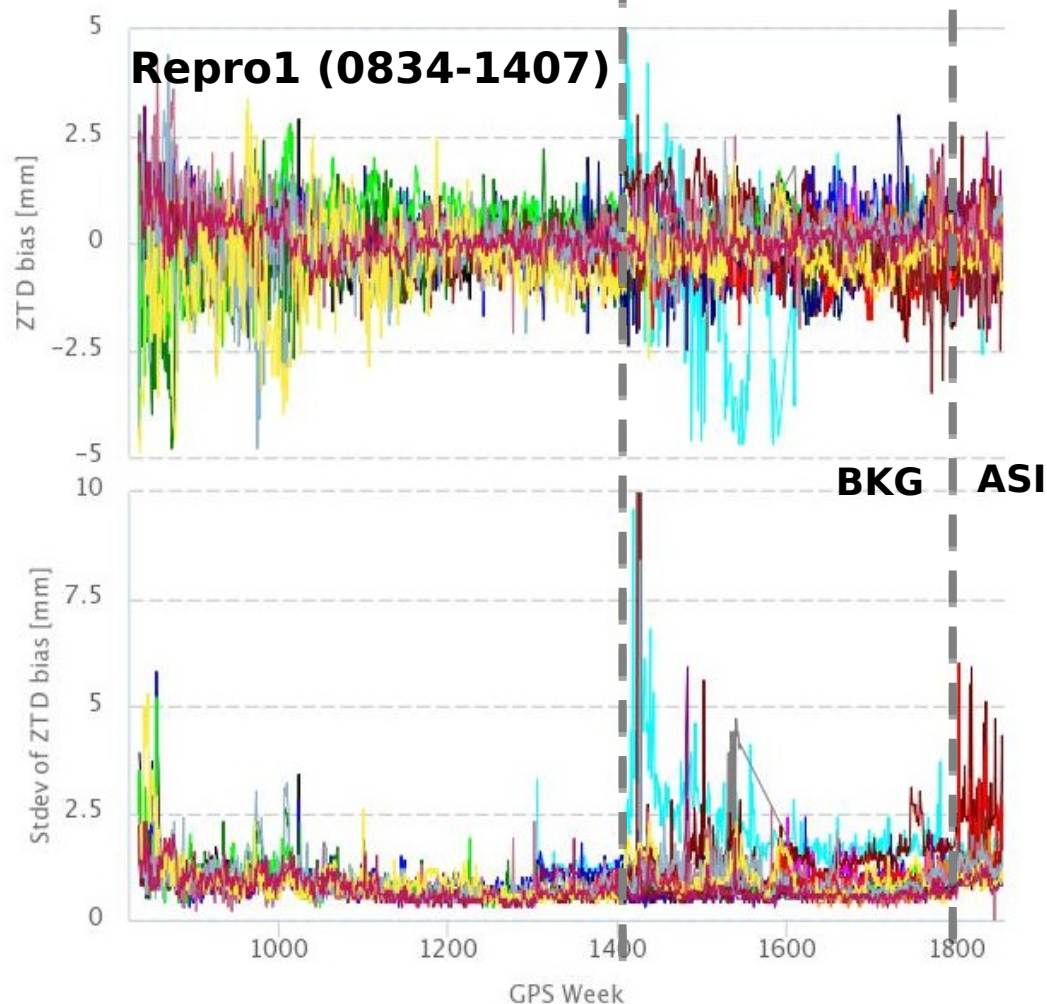


EPN Repro1 & Operational

http://www.epncb.oma.be/_productsservices/sitezenithpathdelays/

Operational (1408-now)

AC	MF	Gradients	cutt-off
ASI	VMF1	yes	3
BEK	WET_GMF	yes	3
BKG	WET_GMF	yes	3
COE	WET_VMF	yes	3
IGE	WET_GMF	yes	3
IGN	WET_GMF	<i>no</i>	3
LPT	WET_GMF	yes	3
MUT	WET_GMF	yes	3
NKG	WET_VMF	yes	3
OLG	WET_GMF	yes	3
RGA	WET_VMF	yes	3
ROB	WET_GMF	yes	3
SGO	WET_VMF	<i>no</i>	3
SUT	<i>WET_NIELL</i>	<i>no</i>	3
UPA	WET_GMF	yes	3
WUT	WET_GMF	yes	3

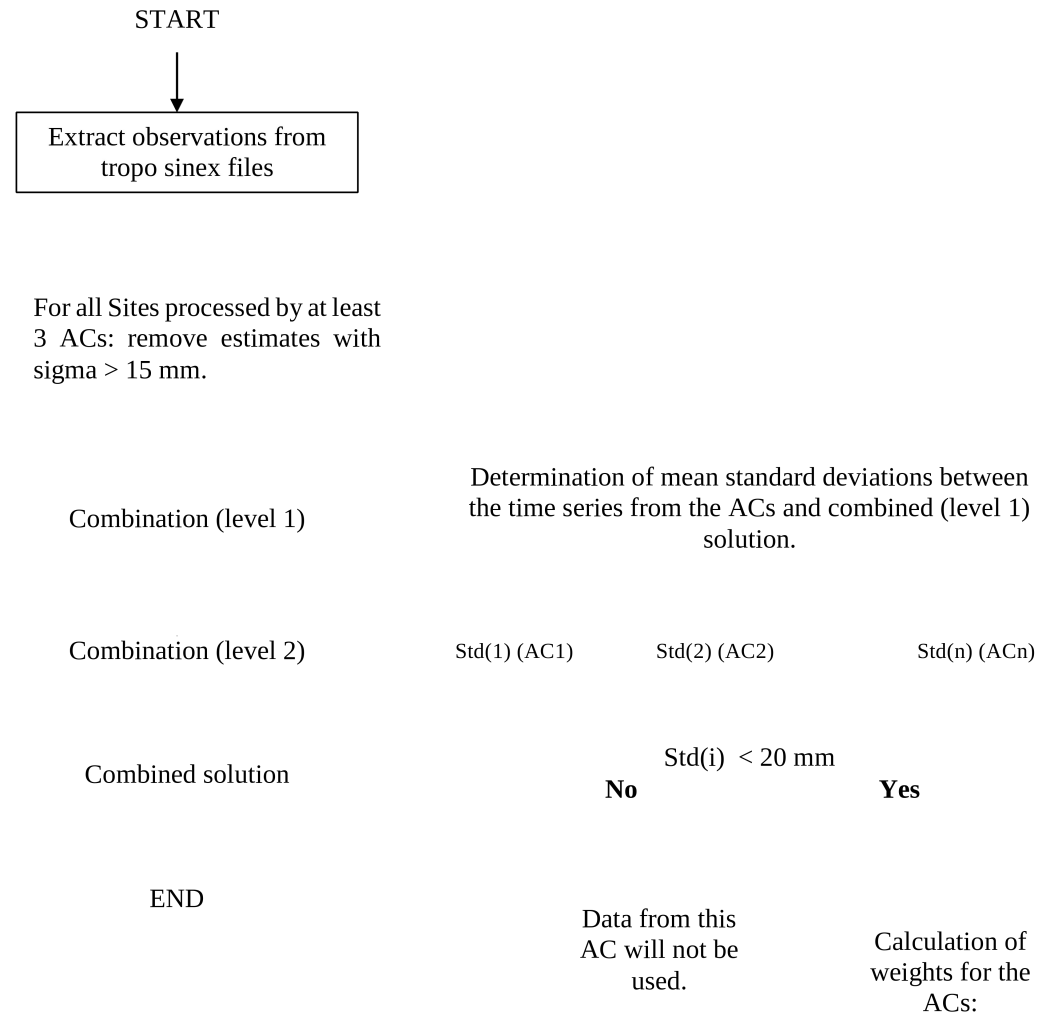


Analysis Centres *(Click to hide)*

ASI — BEK — BKG — COE — DEO — GOP — IGE — IGN — LPT
MUT — NKG — OLG — RGA — ROB — SGO — SUT — UPA — WUT



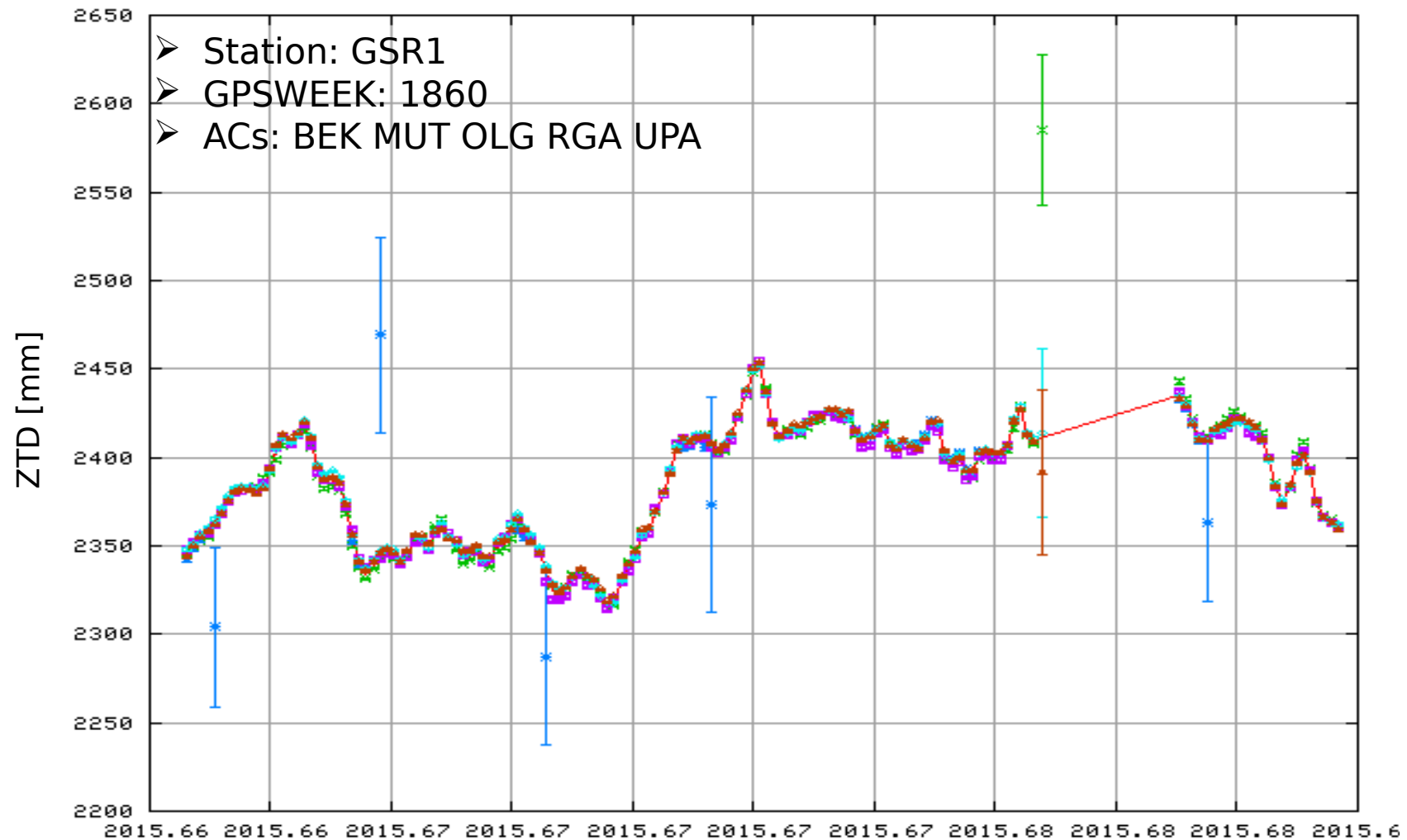
Combination Scheme



[Pacione et al., JASR 47 (2011) 323-335]

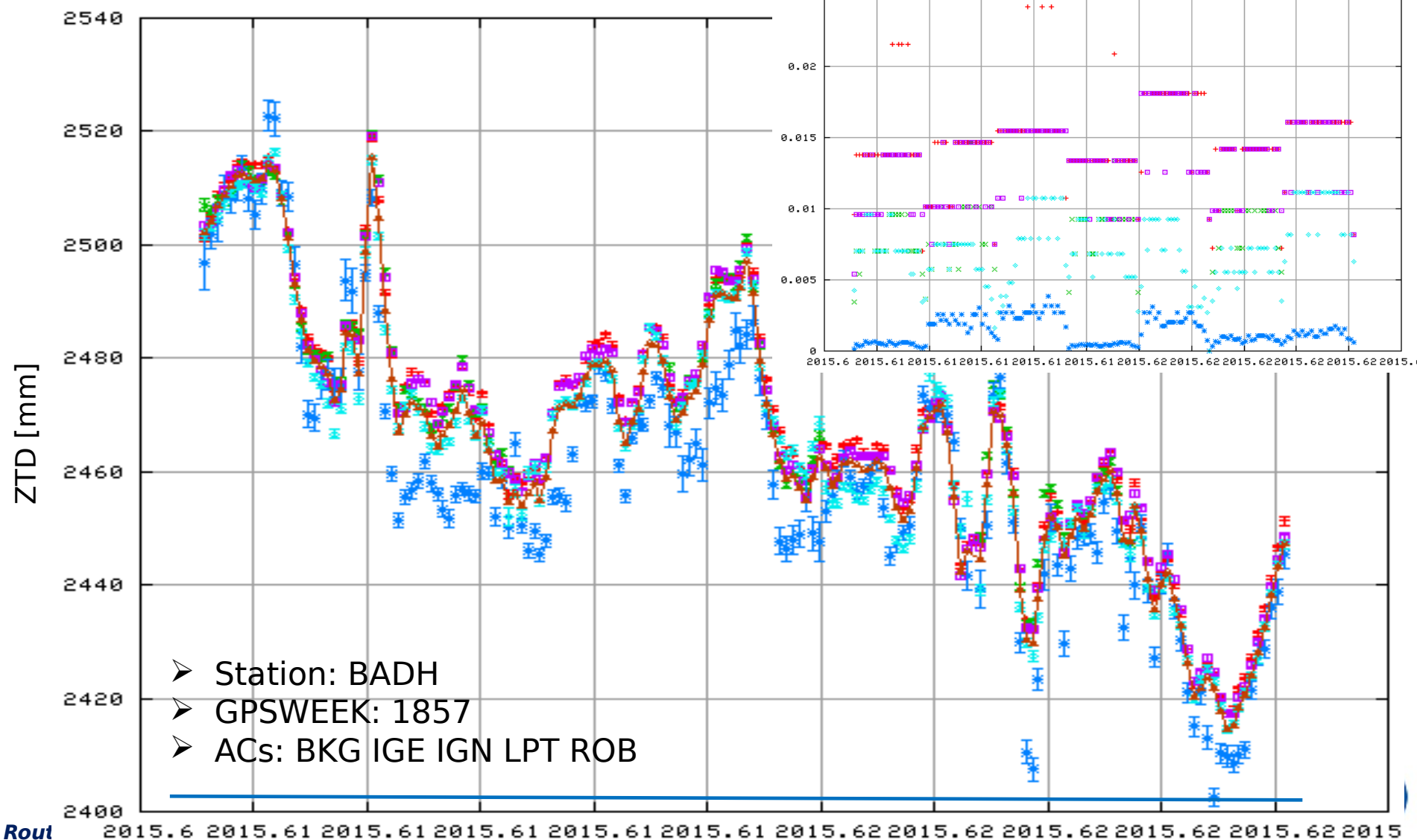
Gross Error

Weak ZTD estimates of the individual LACs solutions are excluded beforehand because of a standard deviation exceeding **15 mm**



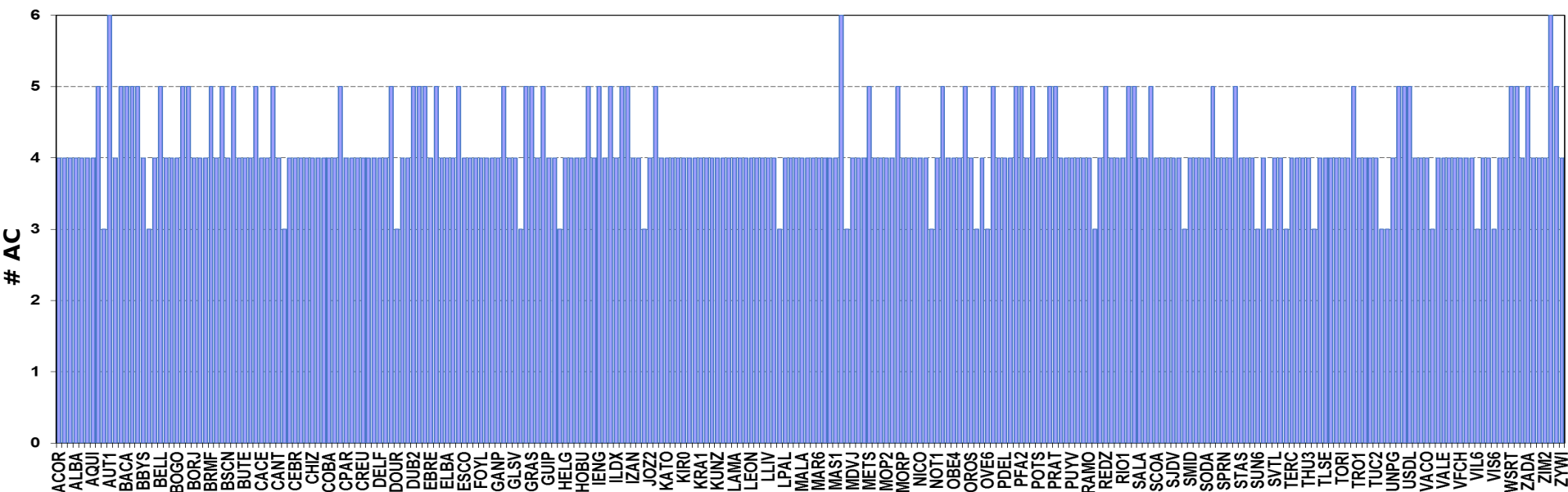
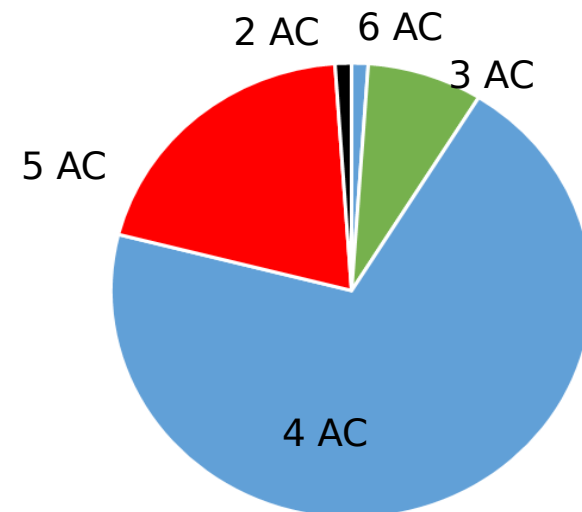
2nd Level Detection

Site-specific solutions of a particular LAC are eliminated if the standard deviation of the series exceeds 20 mm



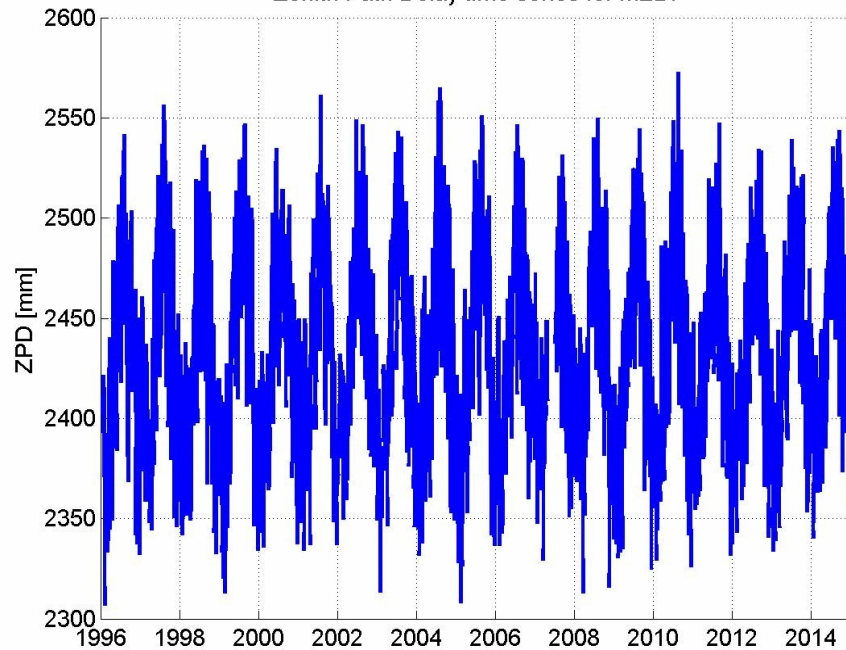
Station redundancy

- GPS week 1857
- 271 input stations
- 3 stations not combined: KAD6, LEK6, OST6

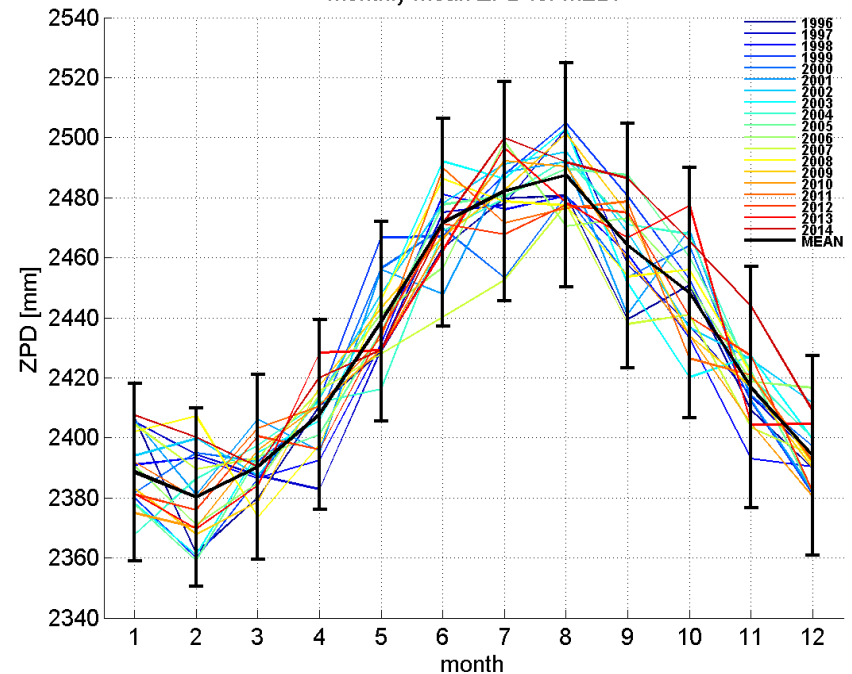


Plots Updated @ EPNCB

Zenith Path Delay time series for MEDI



Monthly mean ZPD for MEDI



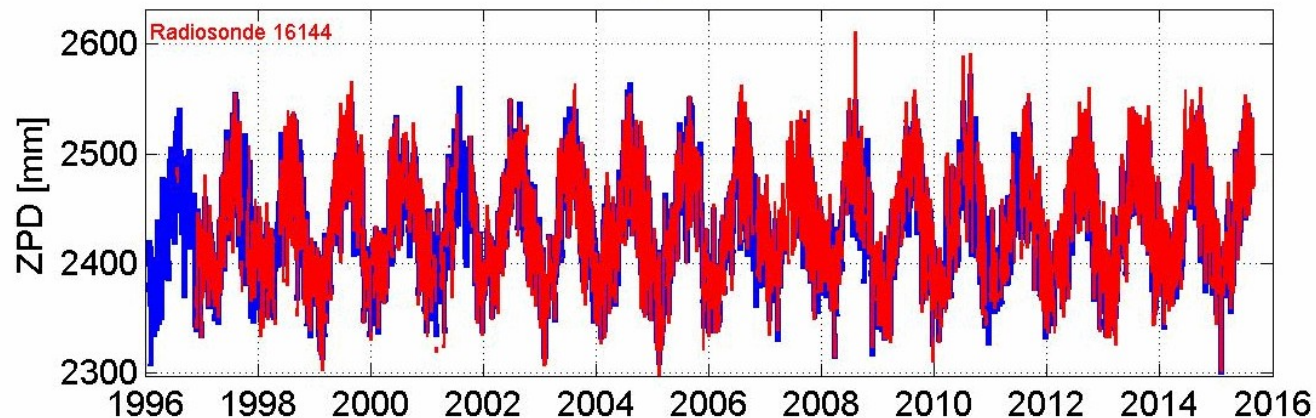
plots updated for all the EPN stations

http://www.epncb.oma.be/_productsservices/sitezenithpathdelays/

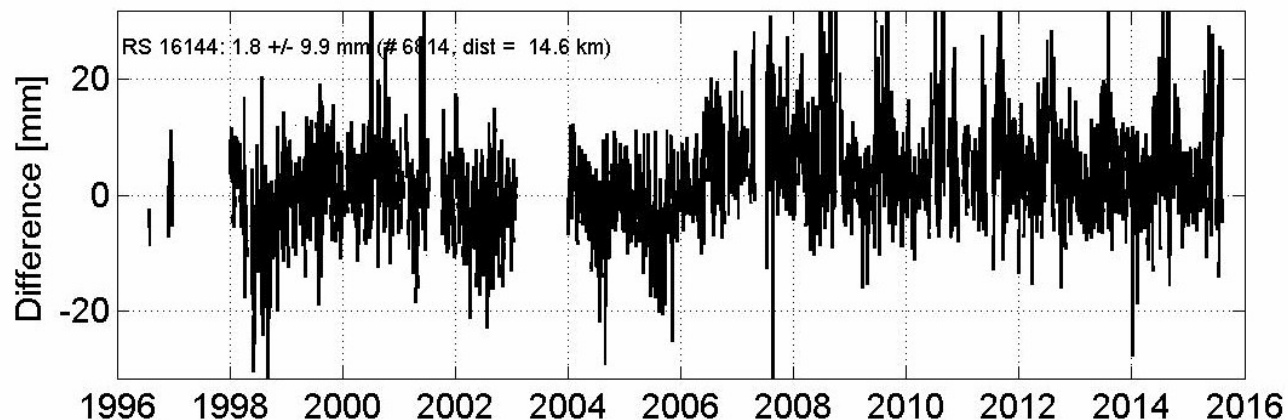
'EUR' vs Radiosonde

Period: 1996 till 15AUG08

Radiosonde and EUR ZPD time series for MEDI



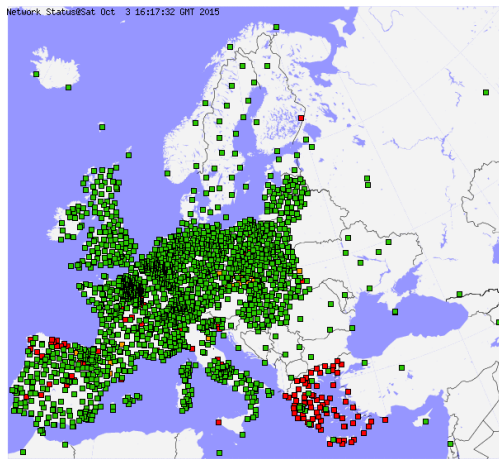
ZPD difference Radiosonde minus EUR for MEDI



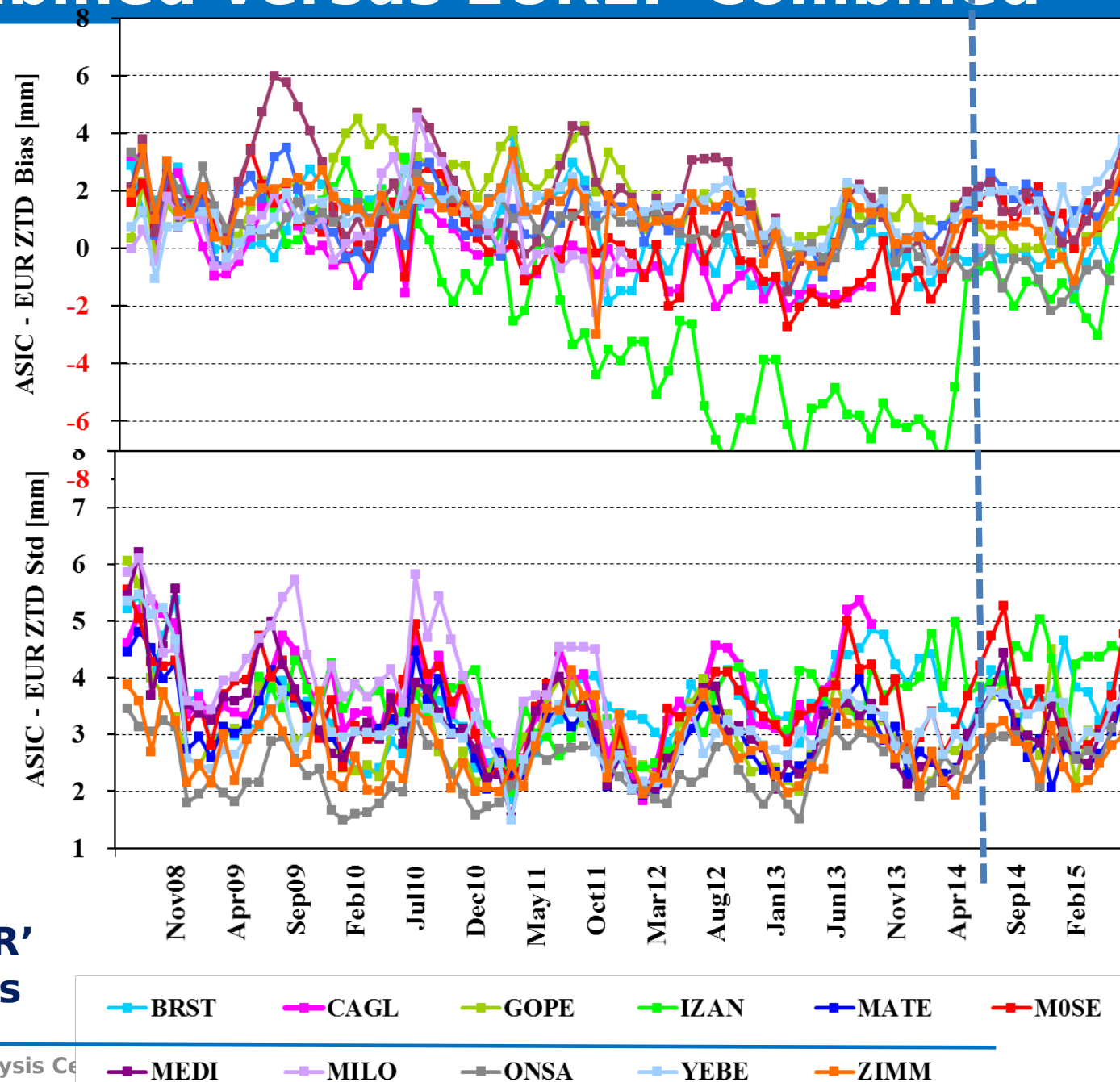
plots updated for 184 EPN stations

http://www.epncb.oma.be/_productsservices/sitezenithpathdelays/

E-GVAP Combined versus EUREF Combined

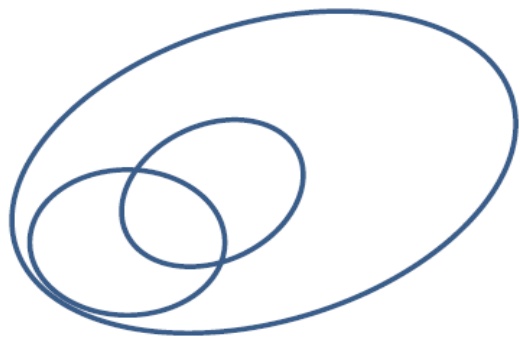


 **EUMETNET**
The Network of European Meteorological Services



EPN Repro2 GNSS Solutions

- **5 ACs:** ASI GOP IGE LPT MUT
- **8** input solutions available
- Tropospheric Parameters: **ZTDs & Gradients**



3 BSW solutions:

- GOP (full EPN)
- LPT (EPN subnetwork)
- IGE (EPN subnetwork)

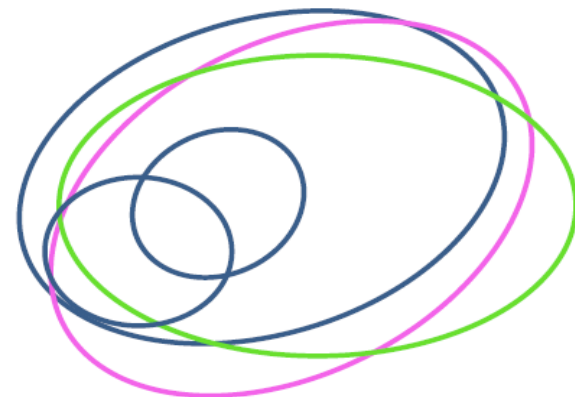
THE SAME SOFTWARE,
DIFFERENT NETWORKS



3 solutions (full EPN):

- GOP (BSW)
- ASI (GIPSY-OASIS)
- MUT (GAMIT)

DIFFERENT SOFTWARE,
THE SAME NETWORKS



5 solutions:

- GOP (full EPN, BSW)
- ASI (full EPN, GIPSY-OASIS)
- MUT (full EPN, GAMIT)
- LPT (subnetwork, BSW)
- IGE (subnetwork, BSW)

ALL SOLUTIONS

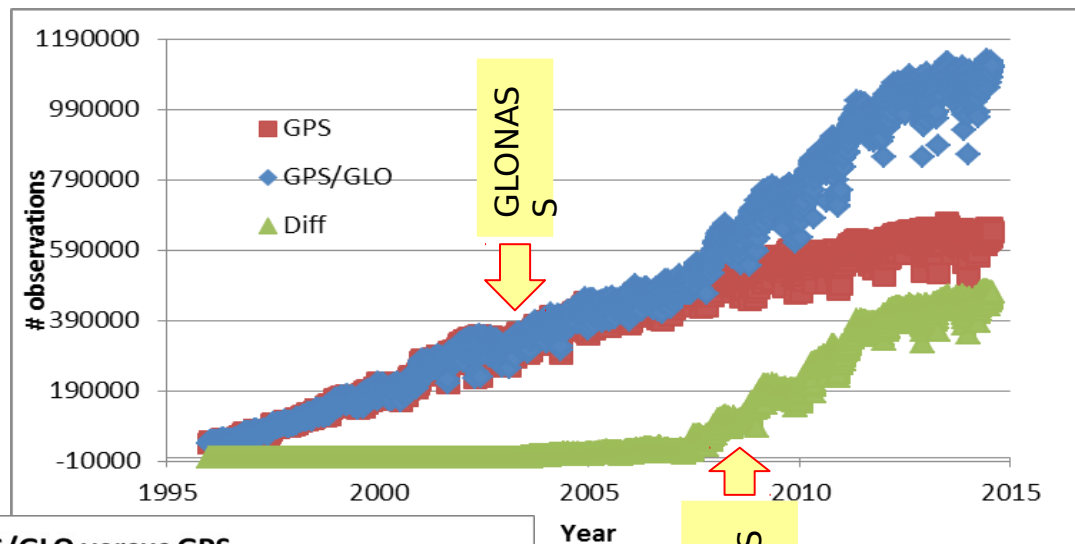
Available Solutions @ BKG

	AS0	GO 0	GO 1	GO4	IG0	LP0	LP1	MU4
SW	GIPSY 6.2	BSW 5.2			BSW 5.2	BSW 5.2		GAMIT 10.5
GNSS	G	G			G + R (since 1147)	G + R (since 1222)		G
SOLUTION TYPE	PPP	NET			NET	NET		NET
STATIONS	ALL EPN+ IGS CORE	ALL EPN			PART EPN	PART EPN + IGS(8)		ALL EPN
ORBITS	JPL R2 (prelim.)	CODE R2			CODE R2	CODE R2		CODE R2
ANTENNAS	IGS08	IGS08 + IND.			IGS08 + IND.	IGS08	IGS08+ IND	IGS08
IERS	2010	2010			2010	2010		2010
GRAVITY	EGM08	EGM08			EGM08	EGM08		EGM08
TROPOSPHERE Estimated Param	ZTD (5min) GRAD (5min)	ZTD (1h) GRAD (6h)			ZTD (1h) GRAD (6h)	ZTD (1h) GRAD (24h)		ZTD (1h) GRAD (24h)
MAPPING FUNCTION	VMF1	GMF	VMF1	VMF1	GMF	GMF	VMF1	VMF1
ZTD/GRAD time stamp	hh:30 24 estimates/day	hh:30 (and hh:00) 24(+24) estimates/day			hh:30 24 estimates/day	hh:30 (and hh:00) 24(+24) estimates/day		hh:30 24 estimates/day
IONOSPHERE	(HOI included)	CODE (HOI included)			CODE (HOI included)	CODE (HOI included)		CODE IONEX + IGRF11 (HOI included)
REF. FRAME	IGb08	IGb08			IGb08	IGb08		IGb08
OCEAN TIDES	FES2004	FES2004			FES2004	FES2004		FES2004
T-ATML	NO	NO			YES	YES	YES	YES
NT-ATML	NO	NO	NO	YES	NO	NO	YES	NO
ELEV. CUTOFF	3	3			3	3		5
Delivered SNX_TRO Files	0835-1772	0836-1771			0835-1816	0835-1772		0835-1771

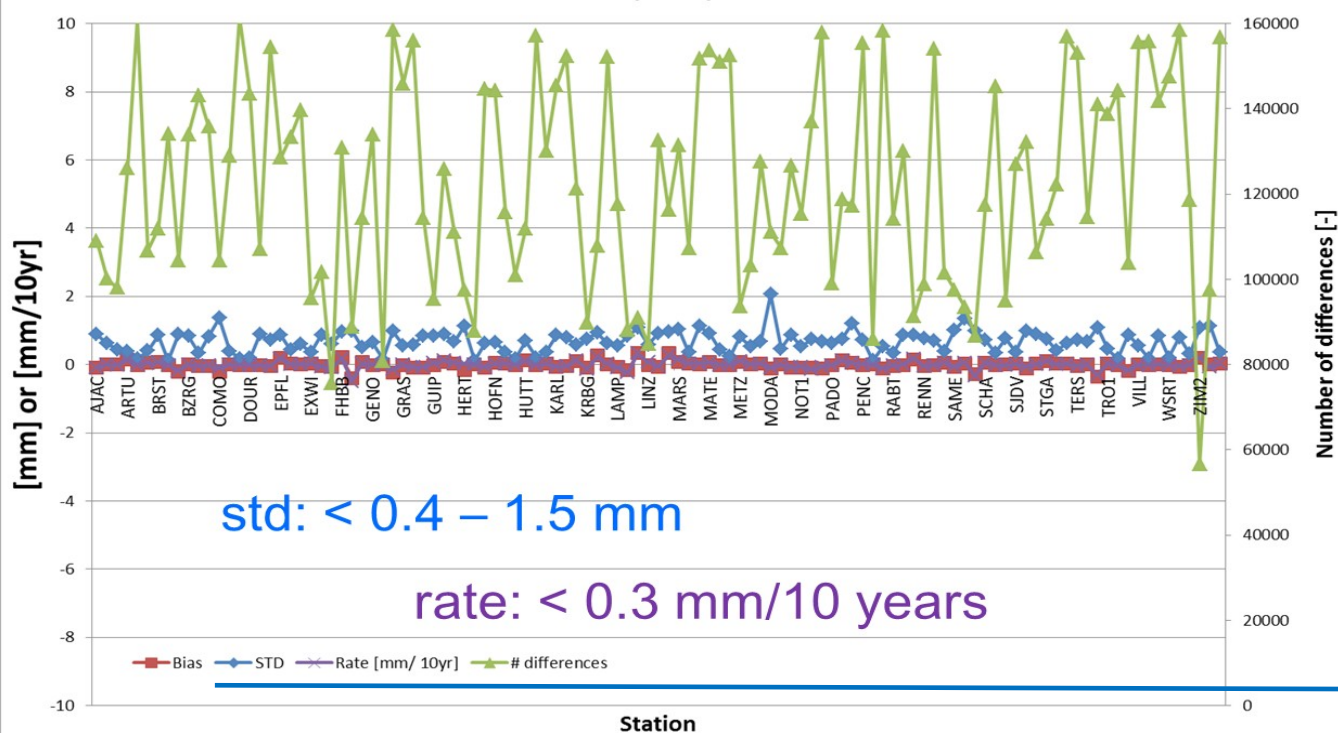
Features of the solutions

- **GLONASS**
 - available since 2003, very few stations in the beginning
 - only used LPT and IGE solutions
- Different PCV corrections used: **'type mean' & 'type mean + individual'**
- Different MF used: **GMF & VMF1**
- Non Tidal Atmospheric Loading: **Yes/No**
- **Orbits:** CODE reprocessed with exception of JPL reprocessed for ASI

Impact of Glonass



ZTD differences: swisstopo repro GPS/GLO versus GPS



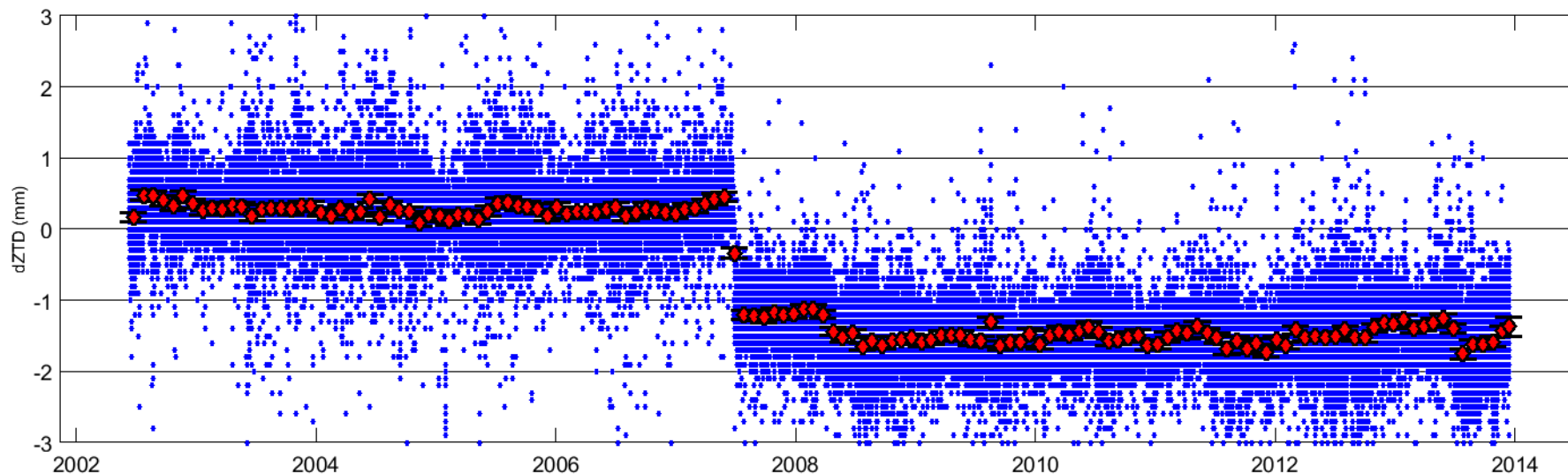
LPT processing

Individual vs Mean Type calibration

KLOP00DEU (KLOP): differences between 'individual' & 'type mean' calibration

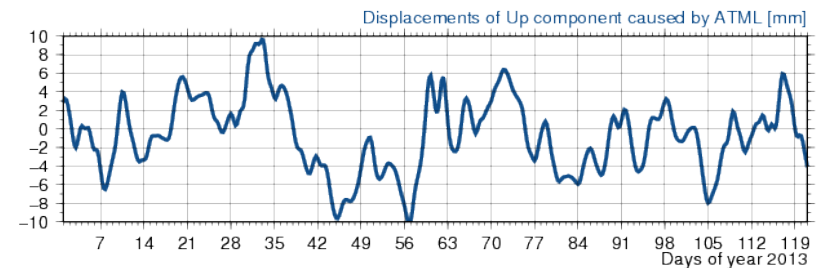
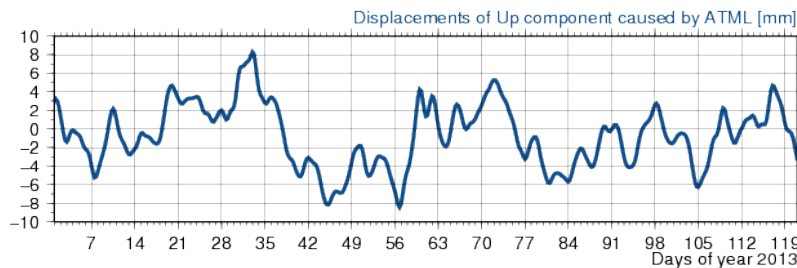
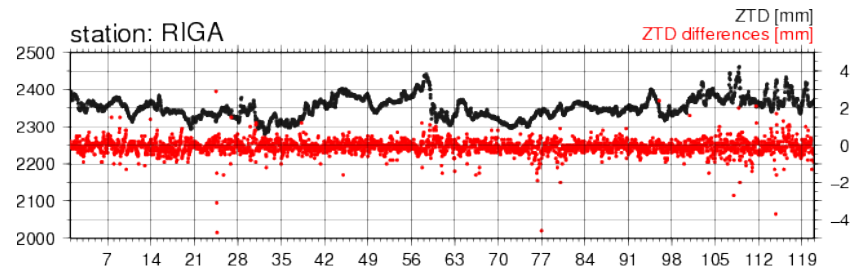
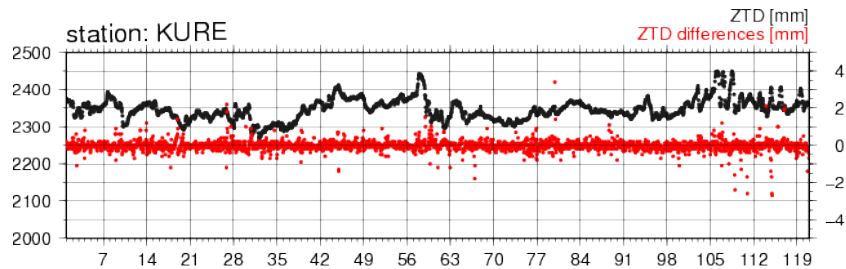
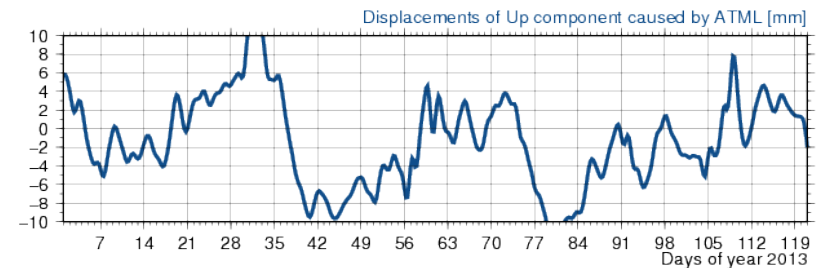
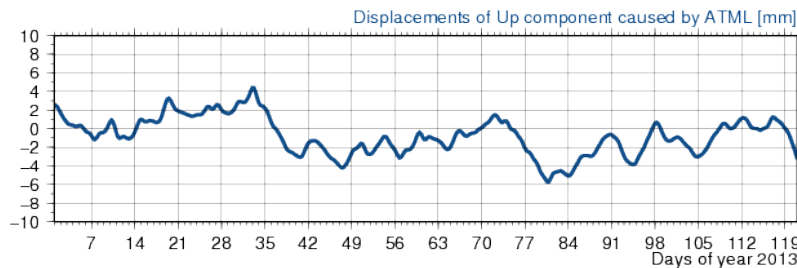
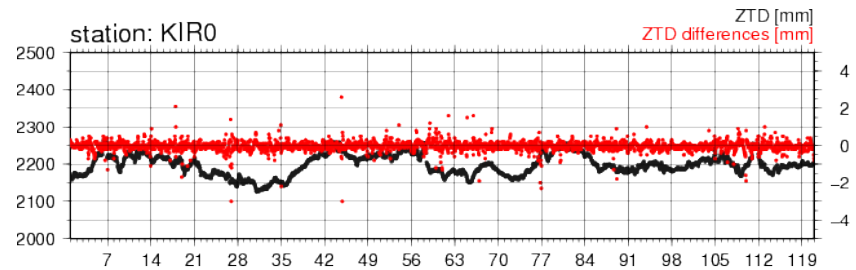
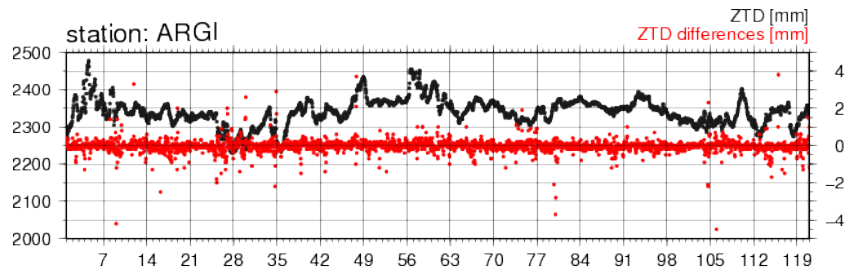
MUT processing

PERIOD	Diff . Up	Diff. ZTD	Antenna + Radome	
2002-07-02 : 2007-06-27	- 5.2 mm	0.4 mm	TRM29659.00	NONE
2007-06-27 : 2013-06-28	8.7 mm	- 1.3 mm	TRM55971.00	TZGD
2013-06-28 : 2013-12-31	5.1 mm	-1.4 mm	TRM57971.00	TZGD

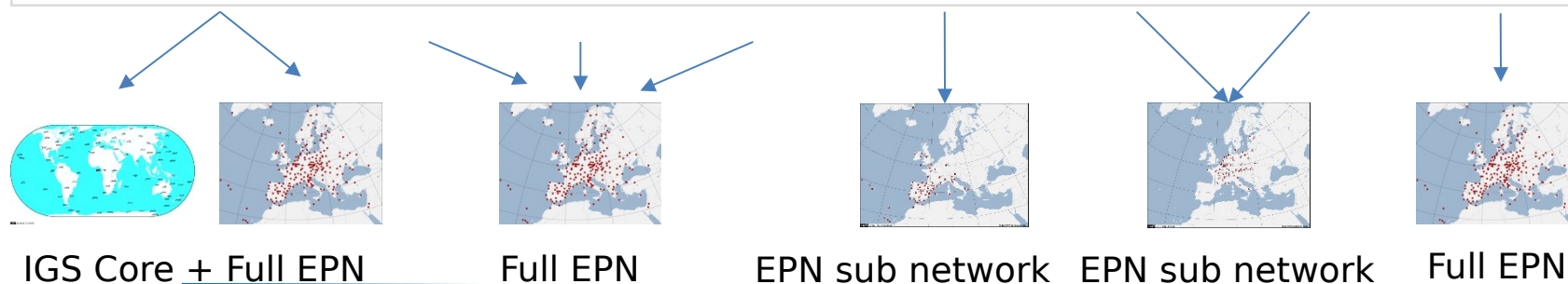
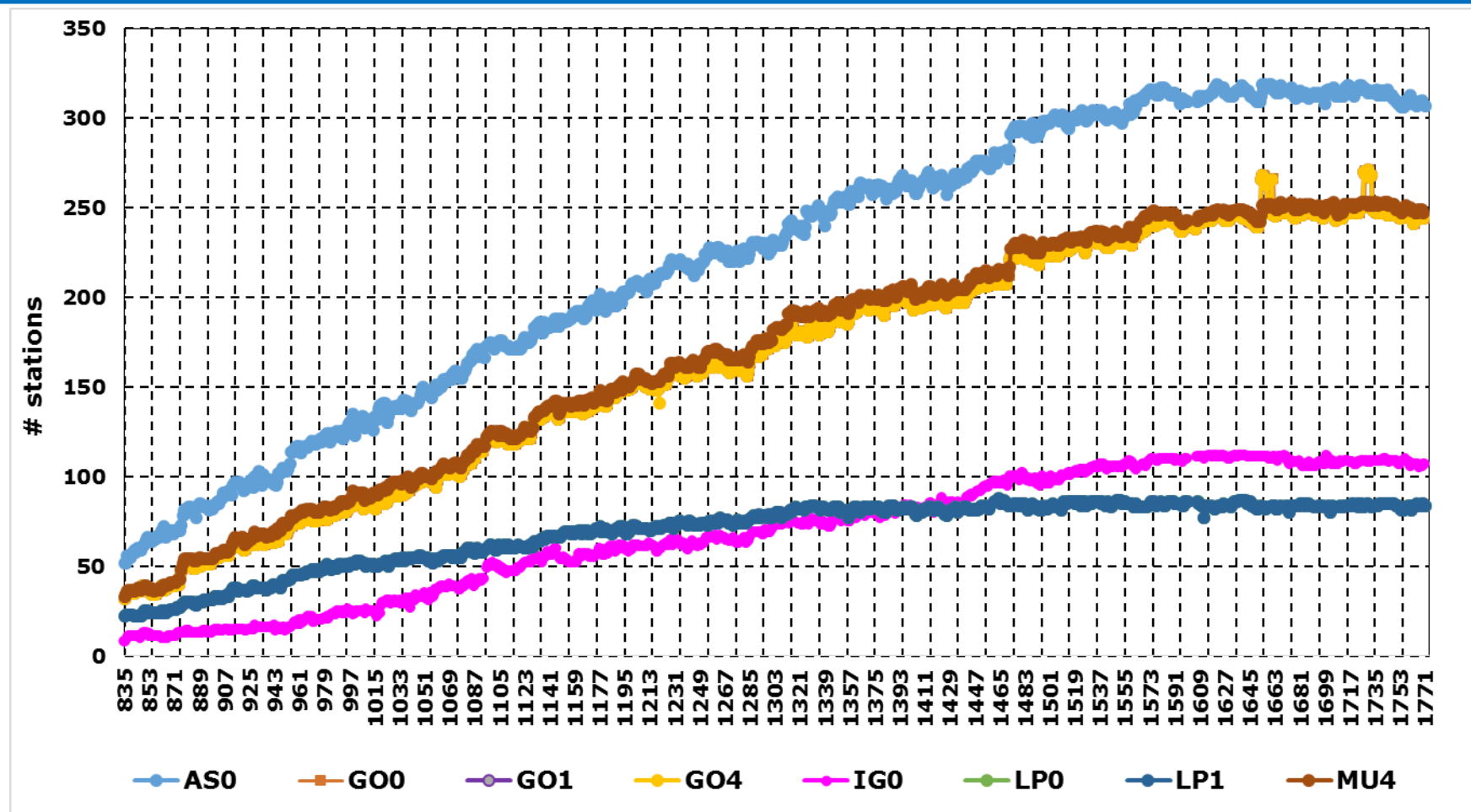


Impact of NT-ATL on ZTD and Height

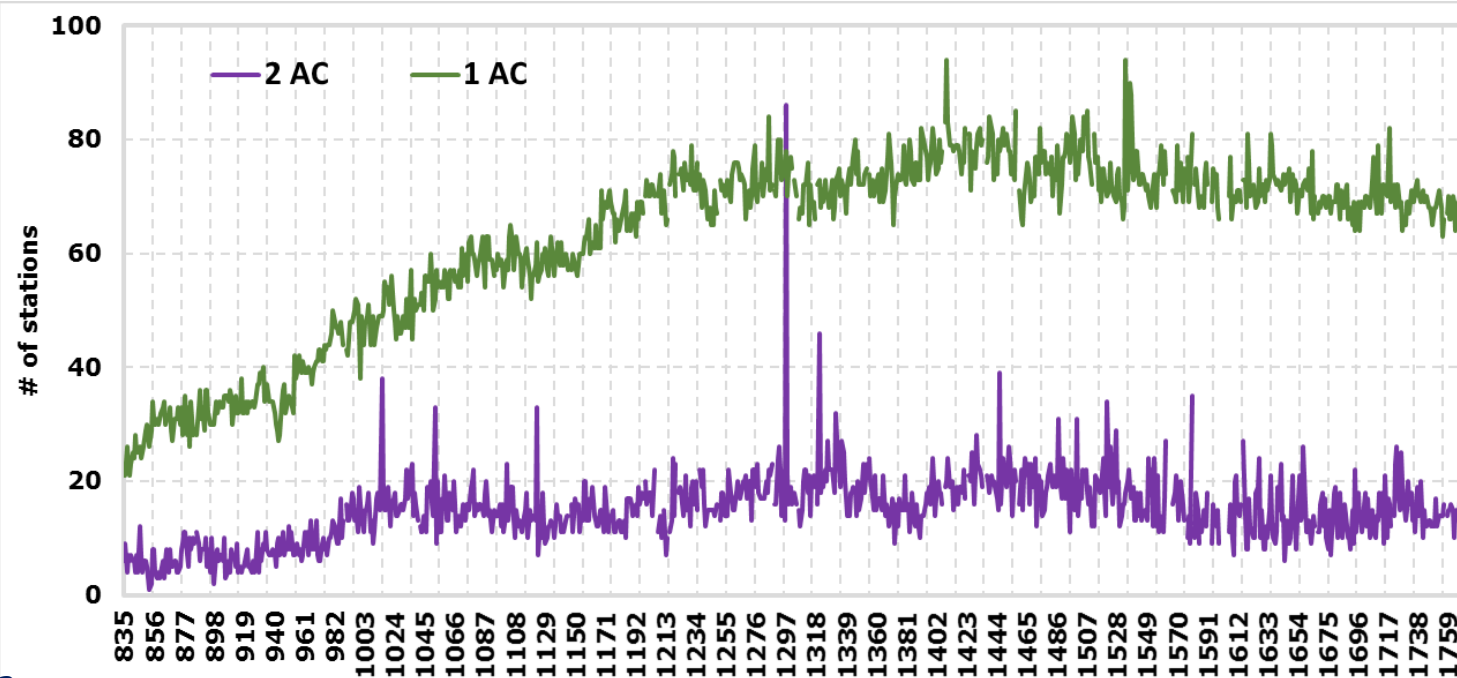
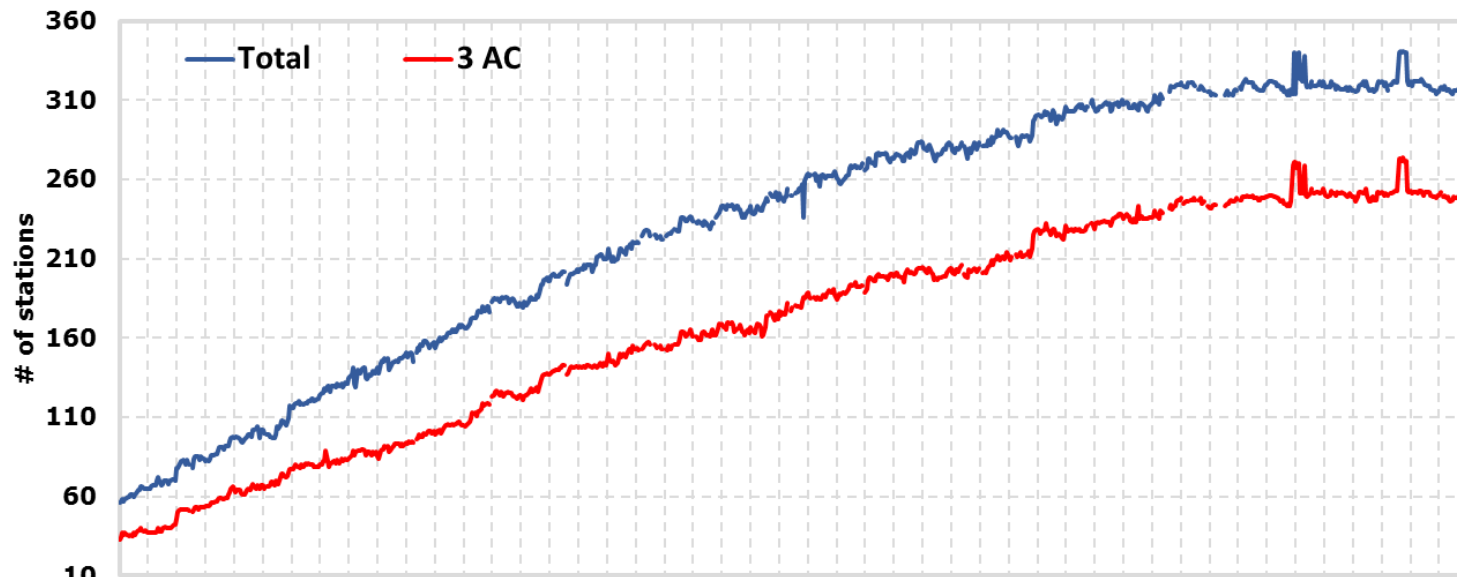
MUT processing



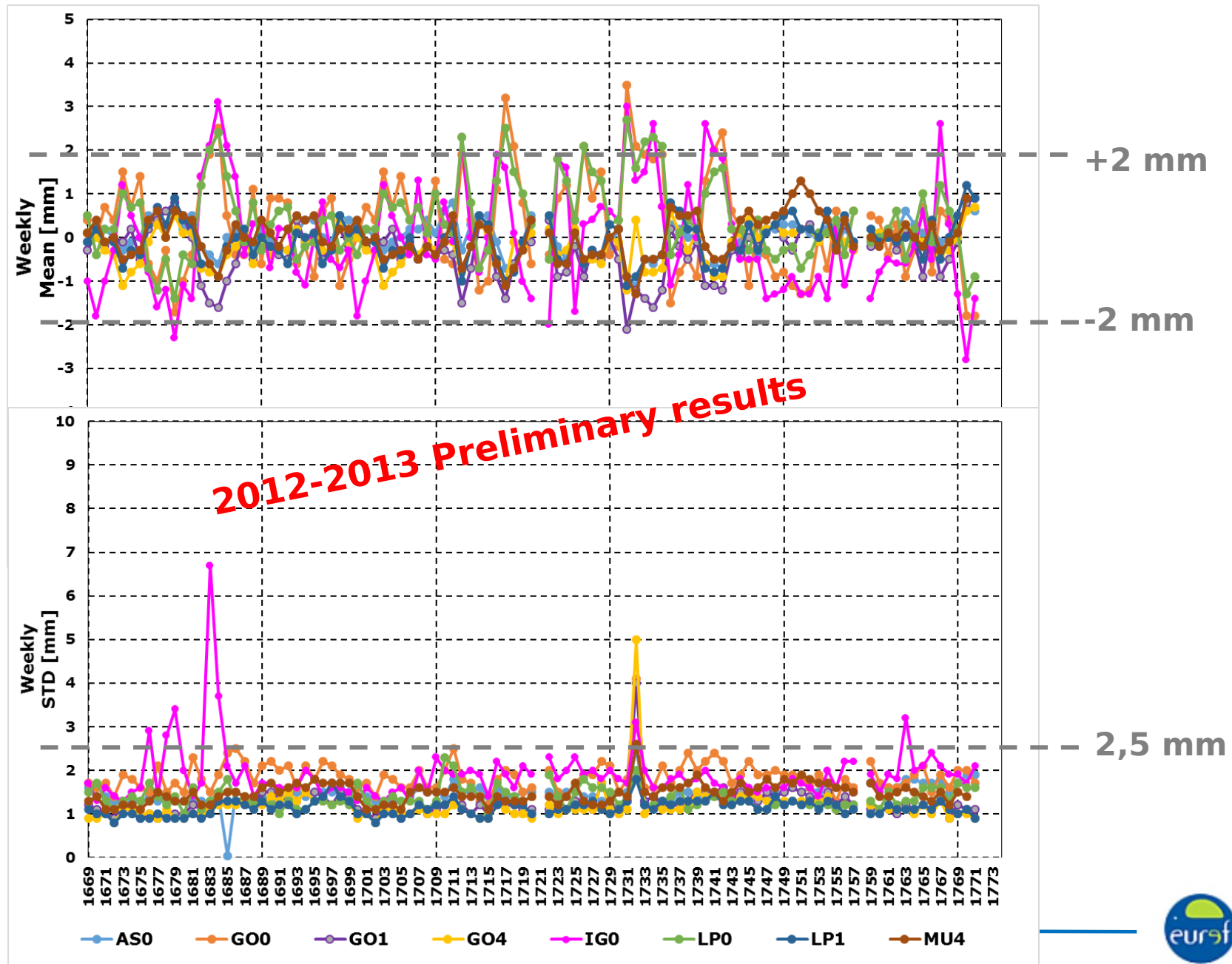
EPN-Repro2: Available Sites



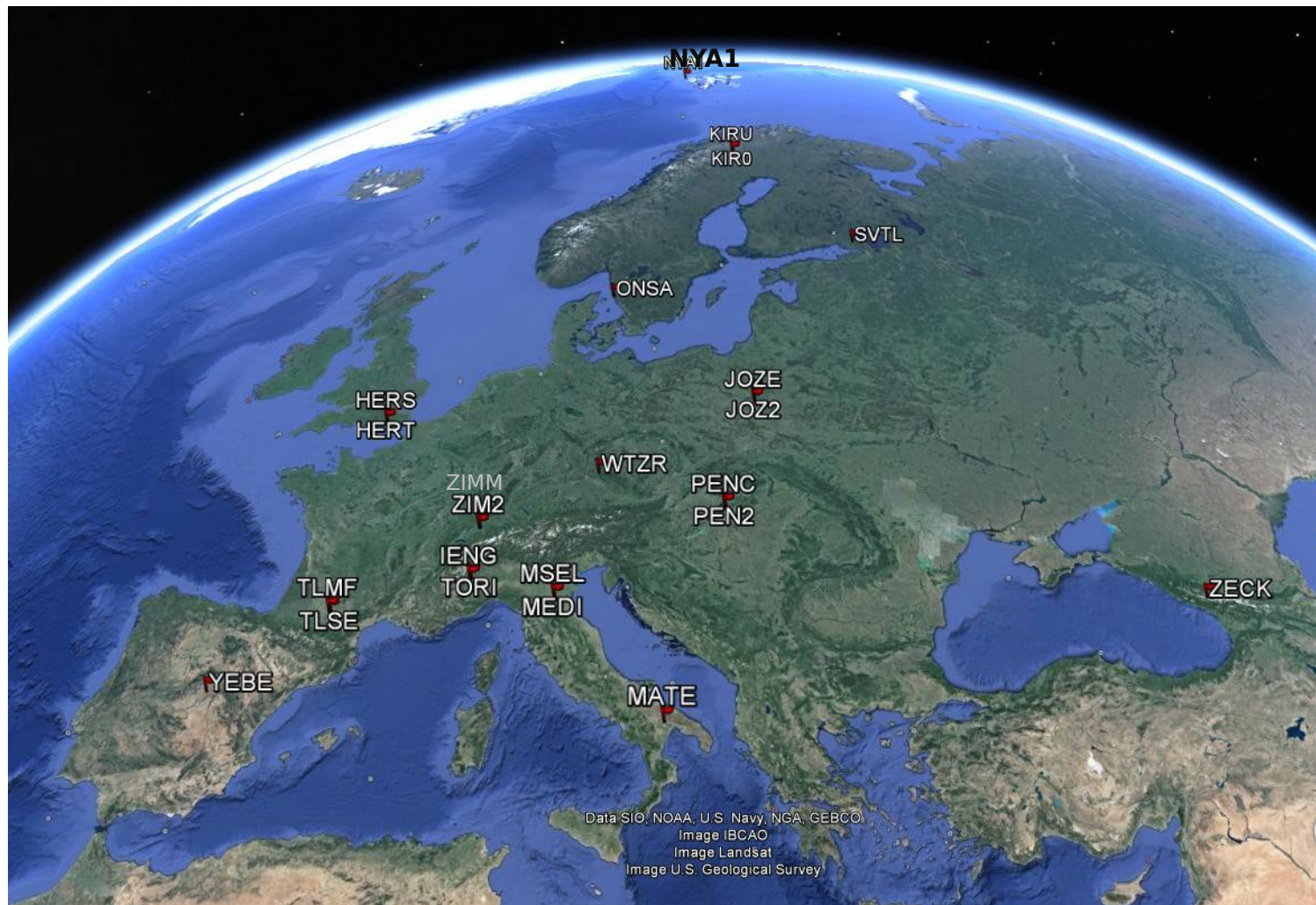
EPN-Repro2: Sites redundancy



Weekly mean bias/std w.r.t. the combination



Ground Network for Gradient Evaluation



GNSS Twin Sites

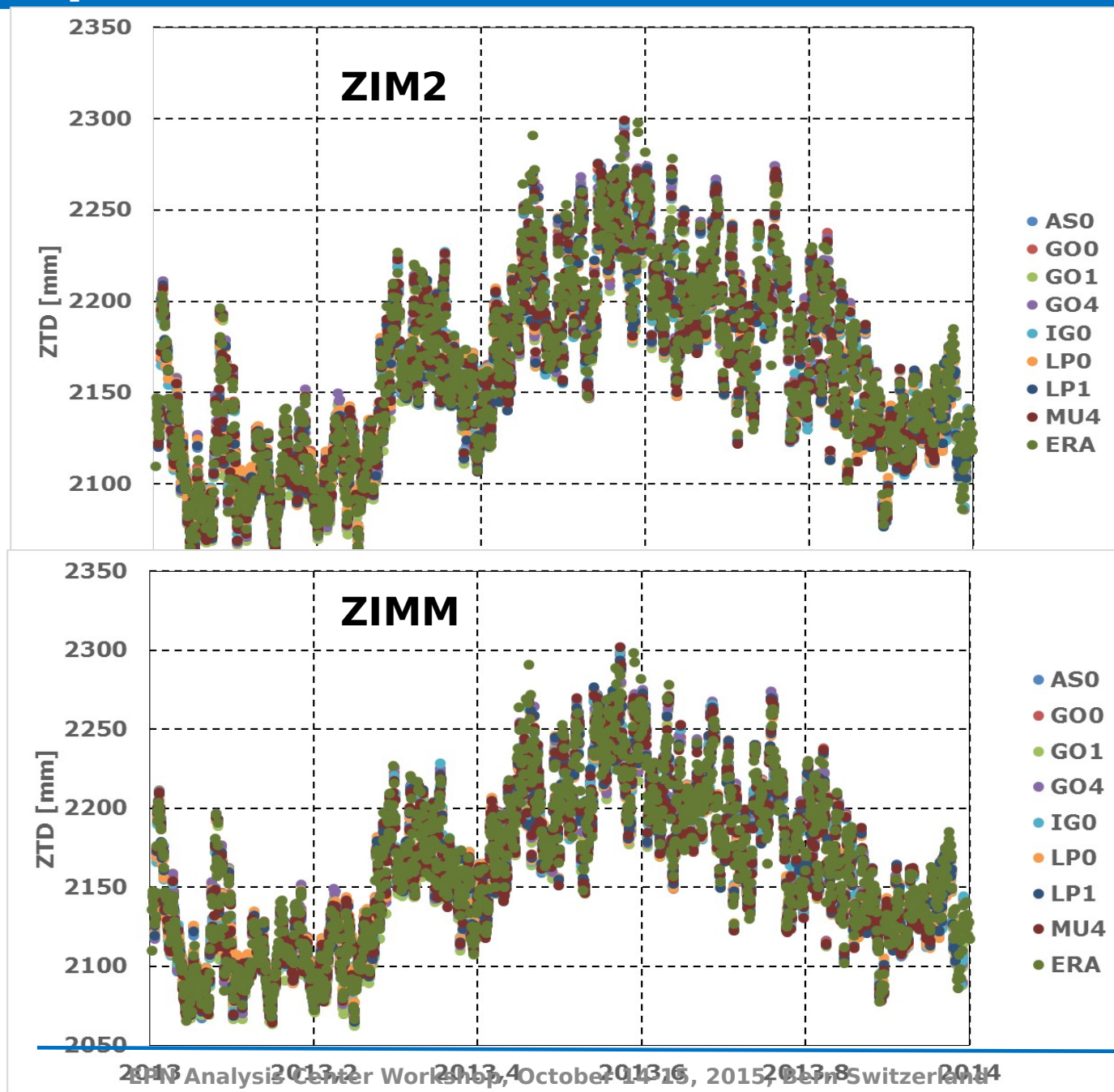
BOGI00POL
BOGO00PO
HERT00GB
HERS00GB
JOZ200POL
JOZE00POL
KIRU00SW
KIR000SW
KRAW00PO
KRA100POL
MEDI00ITA
MSEL00ITA
PENC00HU
PEN200HU
IENG00ITA
TORI00ITA
TLSE00FRA
TLMF00FRA
ZIMM00CH
ZIM200CHE

VLBI and GNSS co-located sites

MATE00ITA
MEDI00ITA
NYA100NO
ONSA00SW
SVTL00RUS
WTZR00DEU
YEBE00ESP
ZECK00RUS

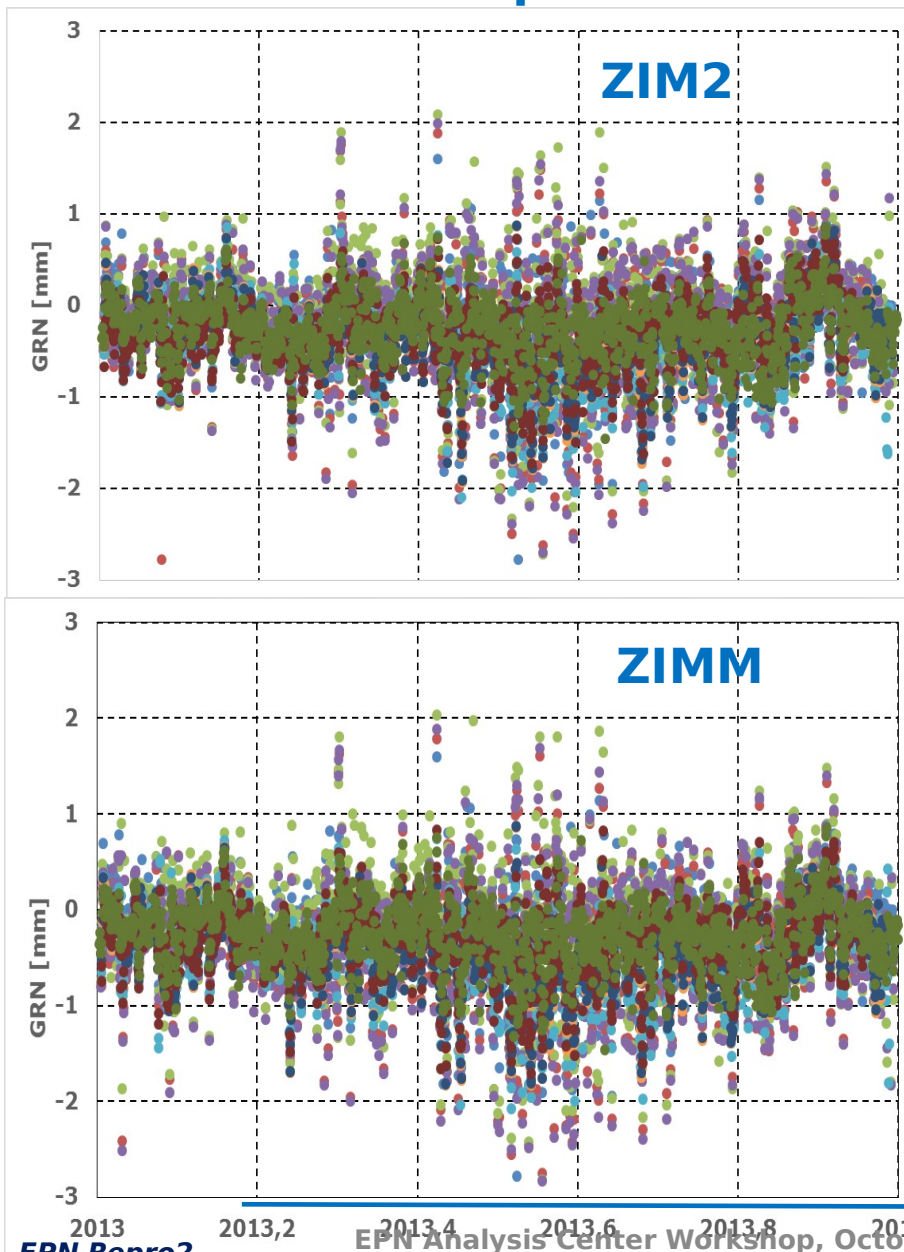


EPN Repro2: 2013 ZTD time series

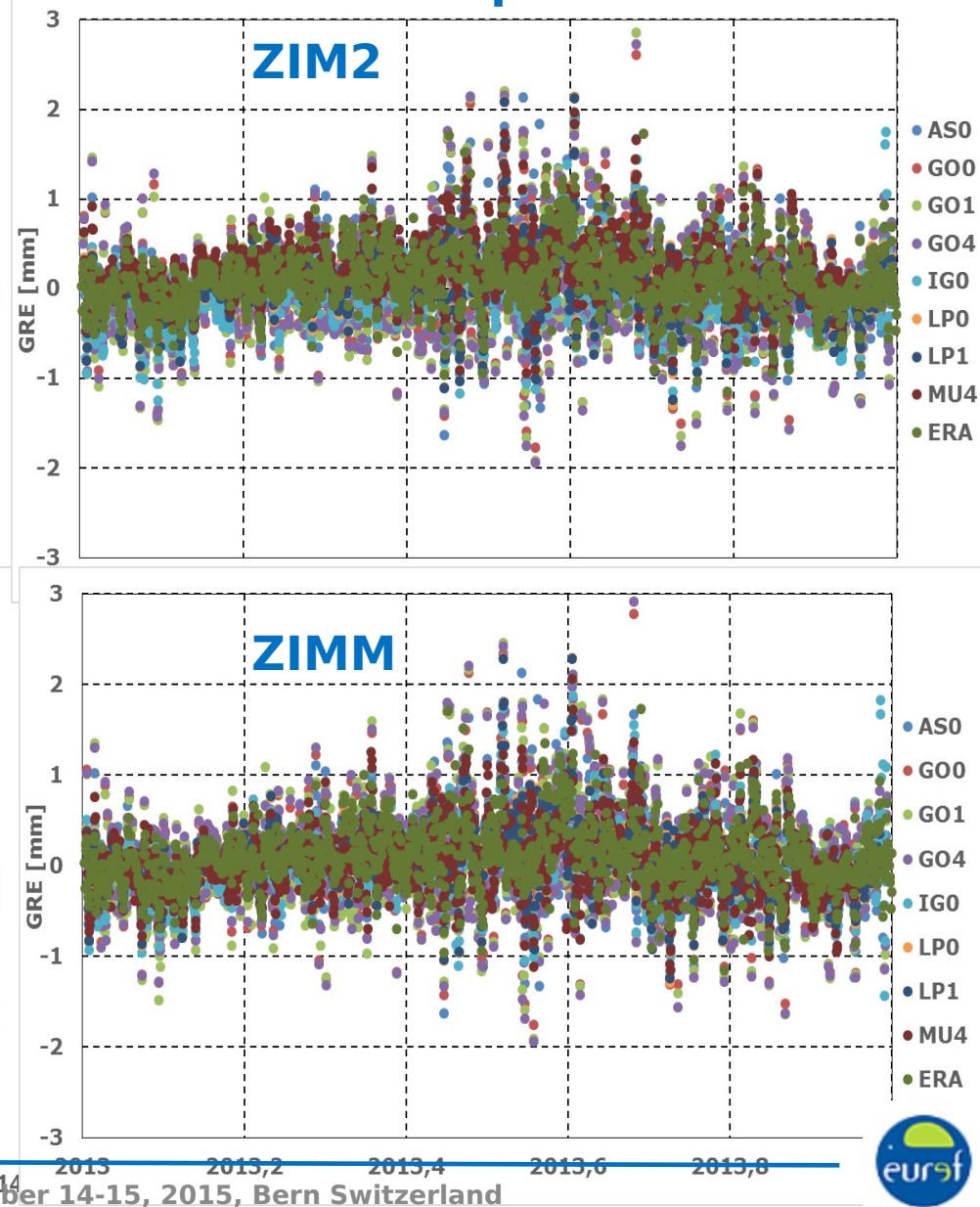


EPN Repro2: 2013 gradient time series

North component

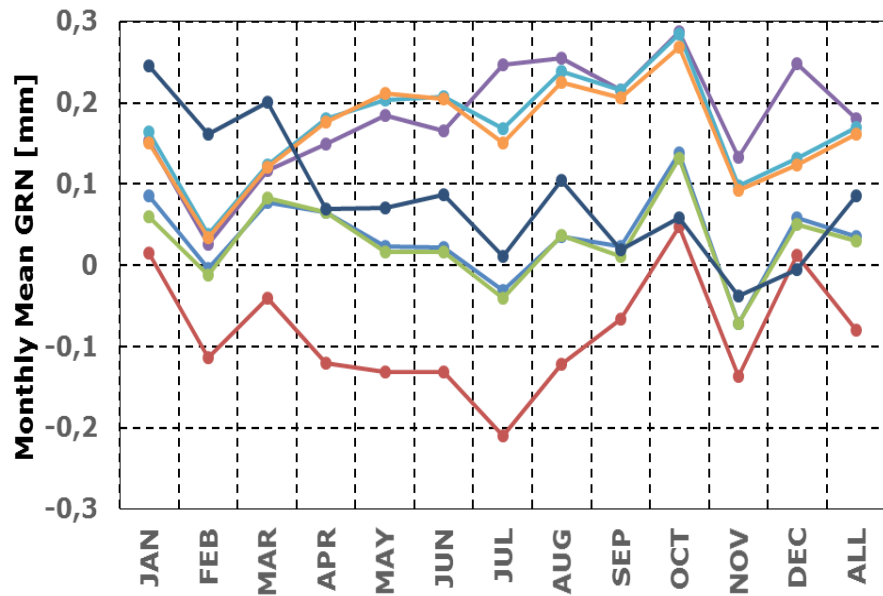


East component



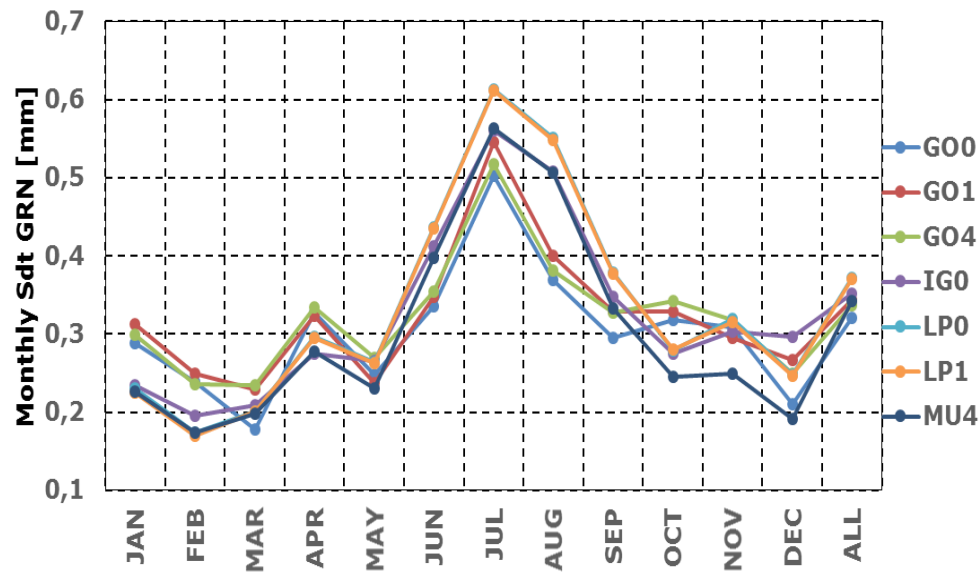
North Gradient intra-technique evaluation

ZIM2

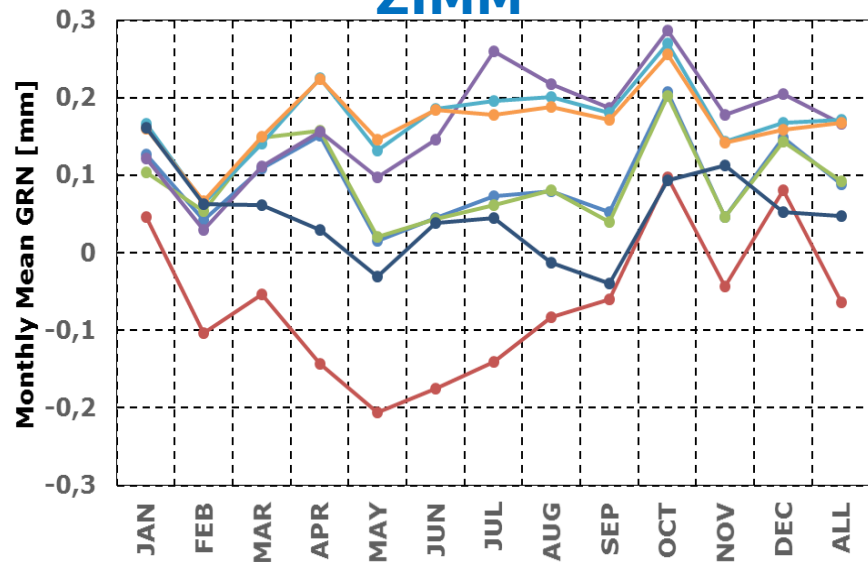


ZIM2

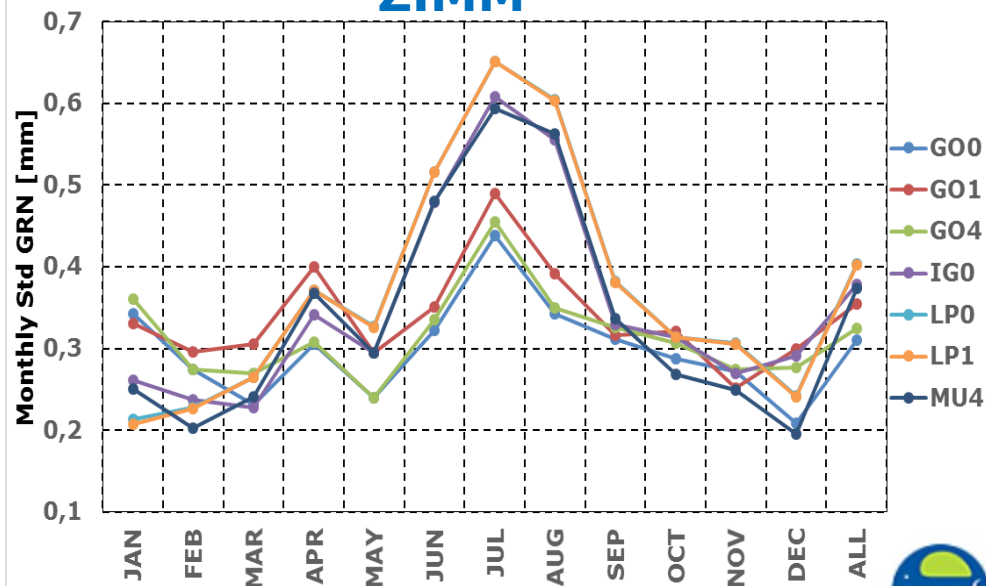
AS0 as reference



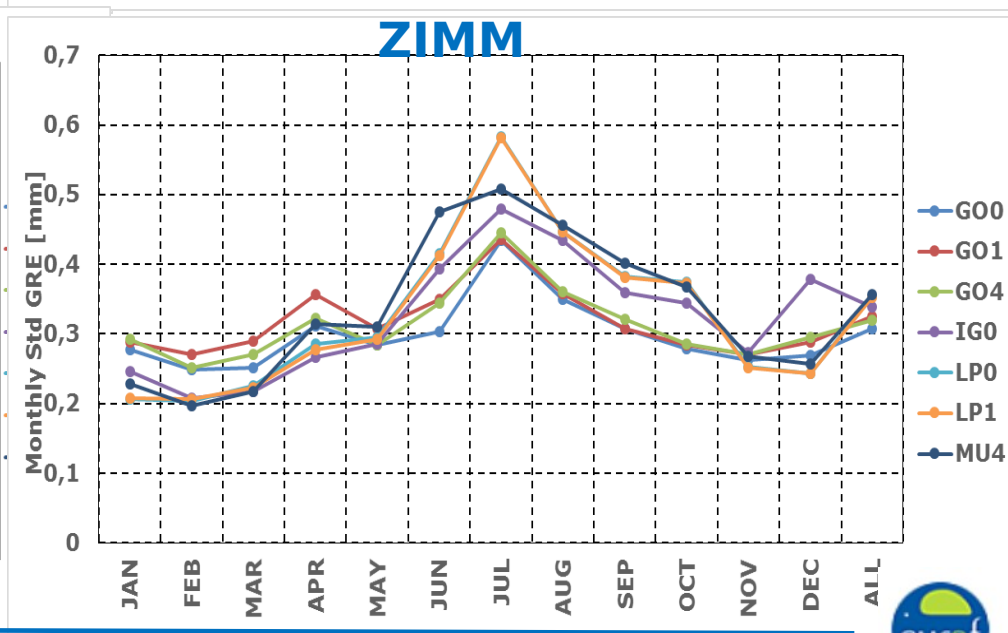
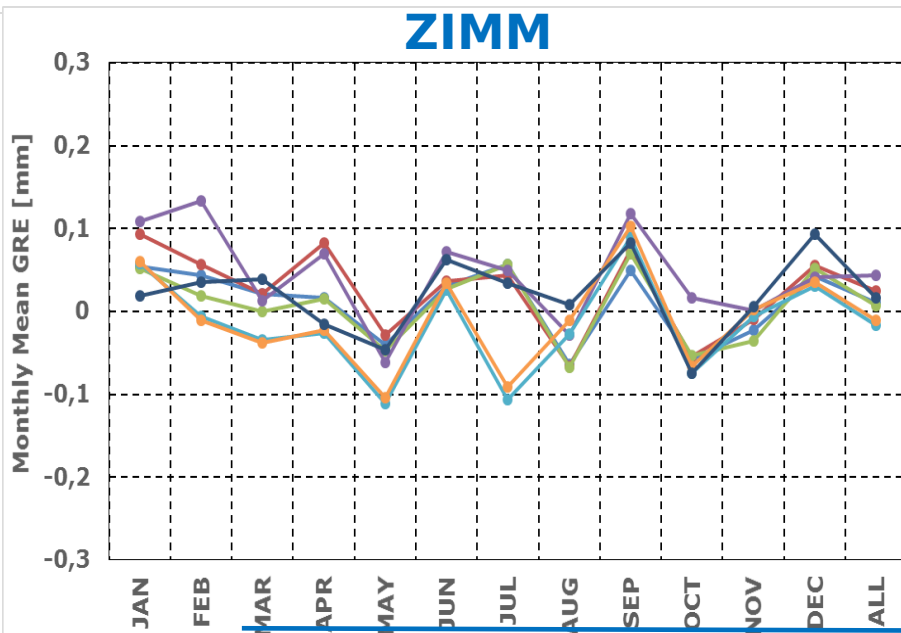
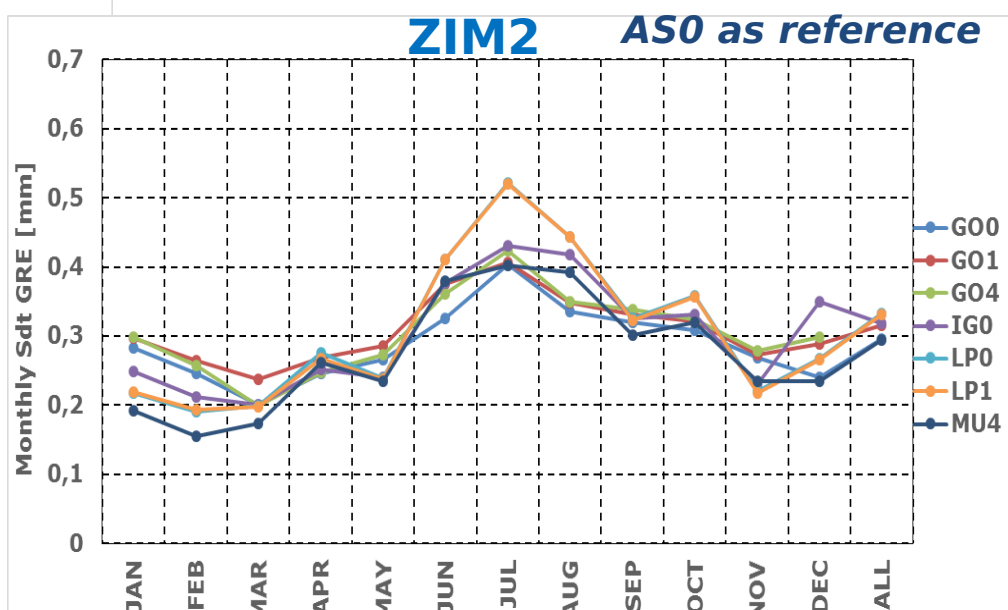
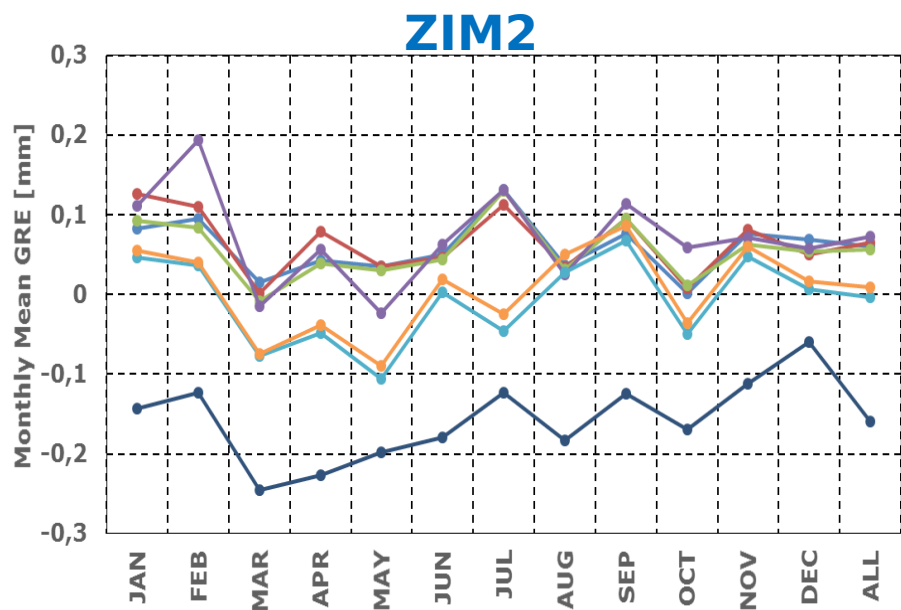
ZIMM



ZIMM



East Gradient intra-technique evaluation

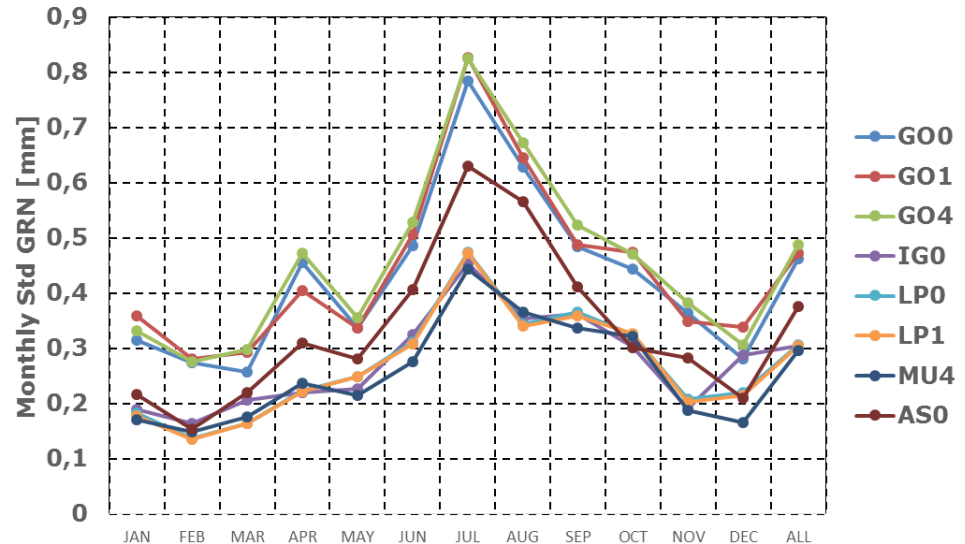
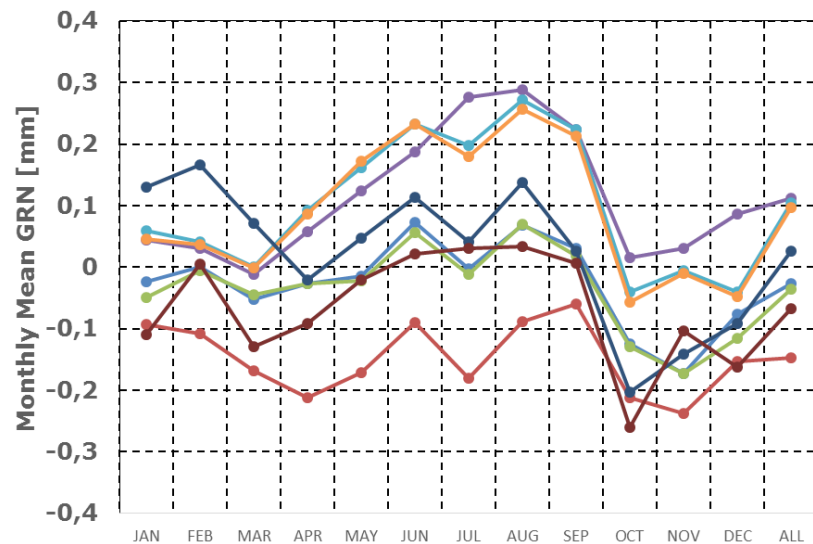


North Gradient inter-technique evaluation

ZIM2

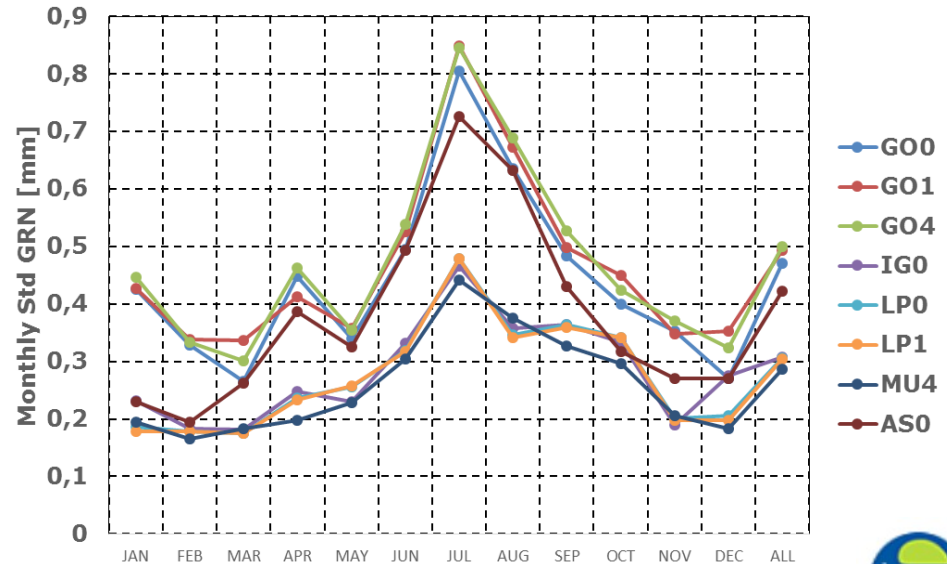
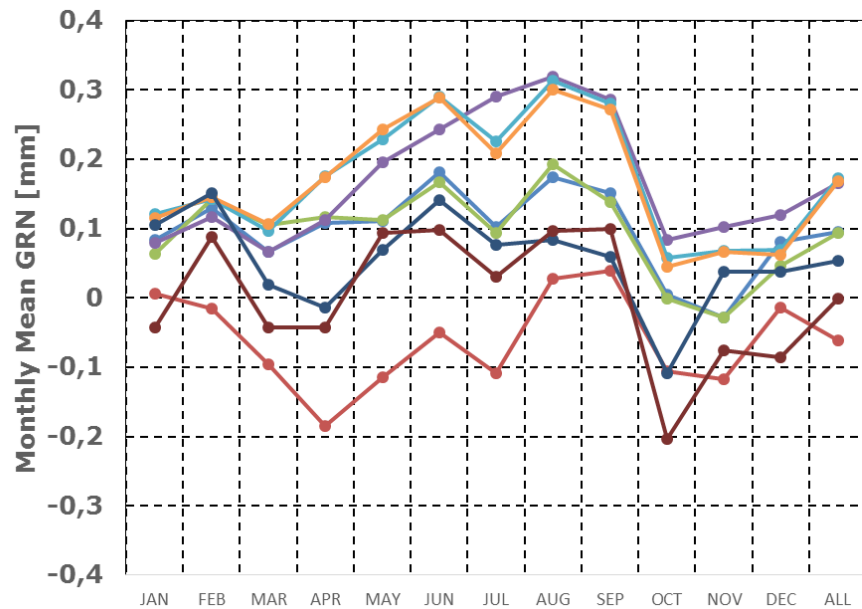
ERA-Interim as reference

ZIM2



ZIMM

ZIMM

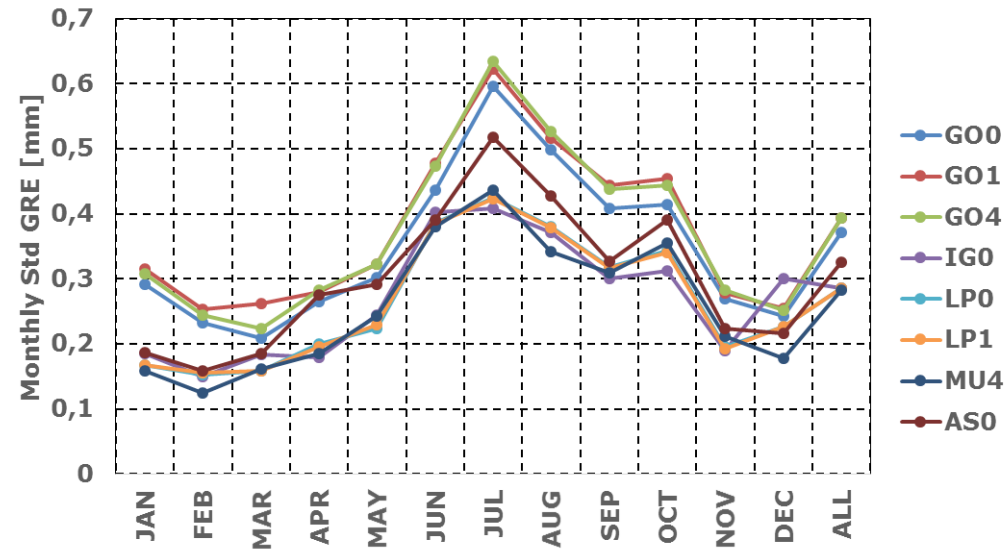
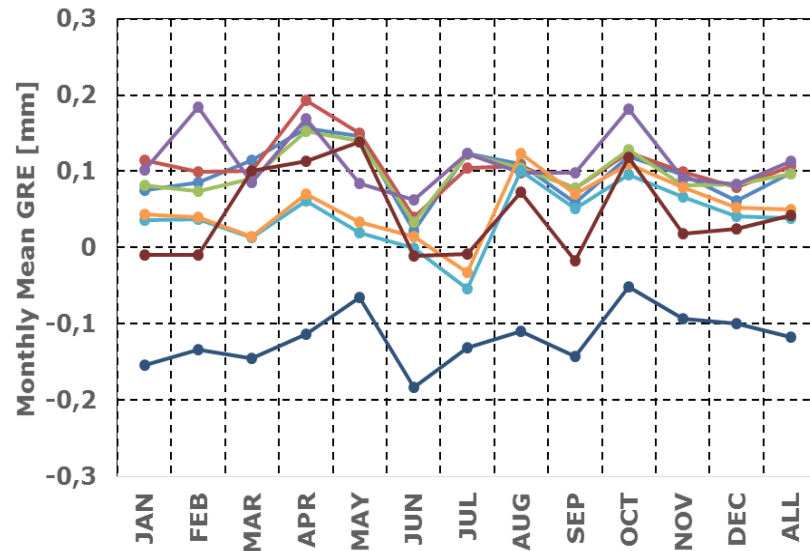


East Gradient inter-technique evaluation

ZIM2

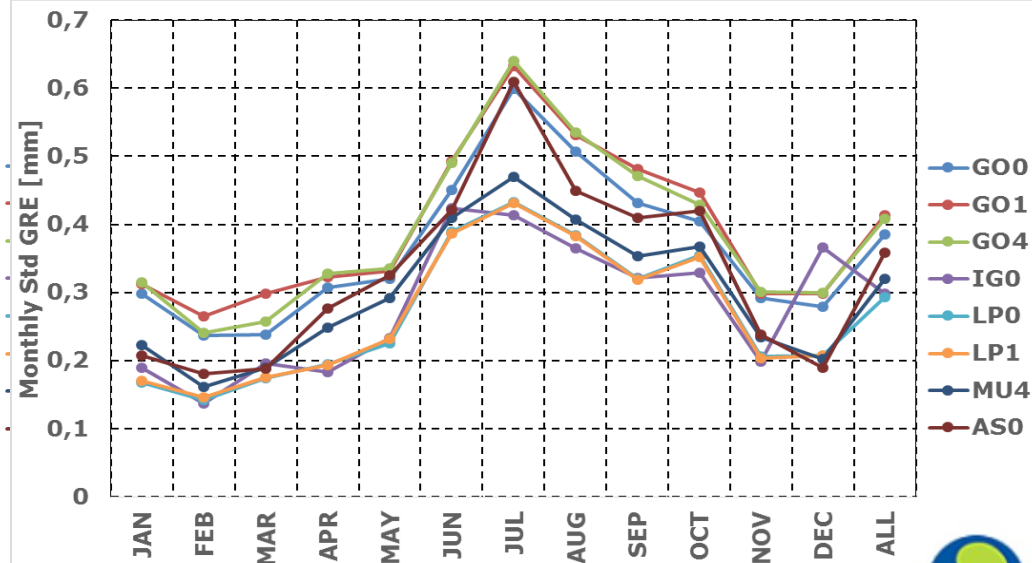
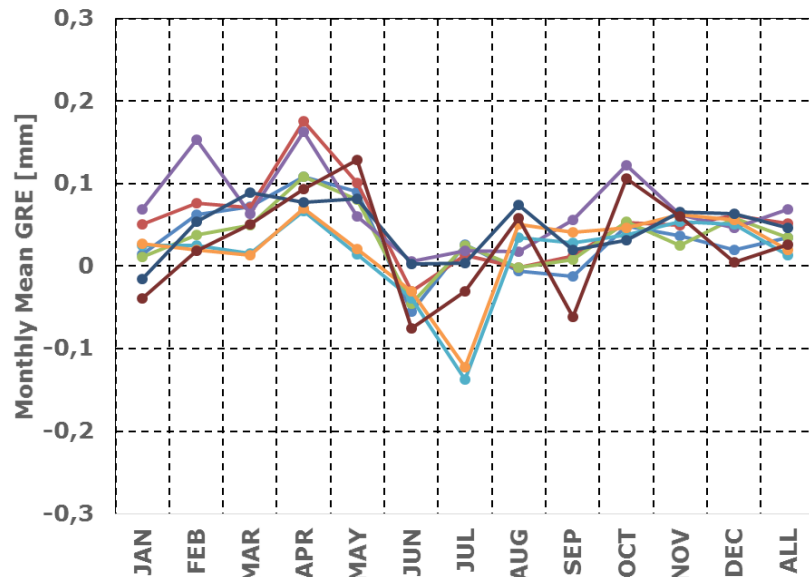
ERA-Interim as reference

ZIM2



ZIMM

ZIMM



Summary

- **Routine tropospheric monitoring activities** have been carried out at ASI/CGS since gpsweek 1800 (July 2014).
- A **preliminary EPN Repro2 ZTD** combined solution, based on 8 input solutions delivered by 5 EPN ACs, is available for investigation on **site/AC specific bias** in order to provide feedback to the EPN ACs.
- **Horizontal Gradients** evaluation, both intra-technique and inter-technique, is started and will continue.
- Final **EPN Repro2 combined solution** for the period **1996-2013** (with possible extension to 2014) consistent with **EPN Repro2 position combined solution** will be delivered.