Report on the EPN Special Project „Troposphere Parameter Estimation"

Wolfgang Soehne, Georg Weber

Federal Agency for Cartography and Geodesy, Frankfurt/Main, Germany

Routine processing: Participating Institutions

Local Analysis Centres (LACs):
Institute for Space Research, Austria (OLG)
Royal Observatory of Belgium (ROB)
Geodetic Observatory Pecny, Czech Republic (GOP)
Institut Geografique National, France (IGN)
Bavarian Academy of Sciences and Humanities, Germany (BEK)
Federal Agency for Cartography and Geodesy, Frankfurt, Germany (BKG)
FOMI Satellite Geodetic Observatory, Budapest, Hungary (SGO)
University of Padova, Italy (UPA)
Italian Space Agency (ASI)
Delft University of Technology, The Netherlands (DEO)
Warsaw University of Technology, Poland (WUT)
Sloval University of Technology, Bratislava, Slovakia (SUT)
Instituto Geografico Nacional, Spain (IGE)
Nordic Geodetic Commission, Sweden (NKG)
Federal Office of Topography, Wabern, Switzerland (LPT)
Astronomical Institute of the University of Berne, Switzerland (COE)
Combination Centres:
Federal Agency for Cartography and Geodesy, Frankfurt, Germany (BKG)
GeoForschungsZentrum Potsdam, Germany (GFZ)

Chronology of the Special Project

- GPS week 1110: Contribution of 4 LACs (ASI, BKG, COE, UPA)
- GPS week 1111: Contribution of IGN and LPT
- GPS week 1112: Contribution of OLG
- GPS week 1113: Contribution of WUT
- GPS week 1114: Contribution of NKG
- GPS week 1115: Contribution of GOP
- GPS week 1120: Contribution of BEK
- GPS week 1126: Contribution of IGE
- GPS week 1130: New EUREF processing options:
  - 10 degree elevation cutoff angle
  - Elevation-dependent weighting
  - Use of the „Dry Niell"-mapping function
  - 1 hour troposphere solution
  - Use of the IGS final orbits
  - Fixing (constraining) solutions to ITRF 97 coordinates
  - Re-substitution of weekly SNX solution
  - Contribution of DEO and ROB
- GPS week 1143: Switch to new reference frame ITRF 2000
  - Contribution of SGO
- GPS week 1185: Contribution of SUT
- GPS week 1203: Contribution of EPN to IGS

Available troposphere products

The following products are available at the BKG Data Analysis Center ('wwww' is the GPS week):

ftp igs.ifag.de (via anonymous ftp)
cd EUREF/products/wwww

LACwwwwd.TRO – individual solution for day 'd' of analysis center 'LAC'
EURwwww7.TRO - combined solution by BKG
EURwwww7.TSU - summary for combined solution of BKG
GFZwwww7.TRO - combined solution by BKG
GFZwwww7.TSU - summary for combined solution of BKG

Options and parameter actually used

| LAC	Sampling [hours]	Cutoff [deg]	Trop. Model	Software	Fixing coord.	Re-Subst. SNX	No. of sites analyzed
ASI	2	15	Niell	MicroCosm	yes (WTZR)	? (some mm or cm var. except for WTZR)	~ 23
BEK	1	10	Dry Niell	Bernese	yes (7 sites)	yes	~ 38
BKG	1	10	Dry Niell	Bernese	yes (7 sites)	yes	~ 45
COE	1	10	Wet Niell	Bernese	yes (all sites)	yes	~ 37
DEO	1	10	Dry Niell	Gipsy	no	no (some mm variation and discrepancy)	~ 25
GOP	1	10	Dry Niell	Bernese	yes (5 sites)	yes	~ 35
IGE	1	10	Dry Niell	Bernese	yes (YEBE)	yes	~ 21
IGN	1	10	Dry Niell	Bernese	no	no (some cm variation and discrepancy)	~ 23
LPT	1	10	Dry Niell	Bernese	yes (5 sites)	yes	~ 19
NKG	1	10	Dry Niell	Bernese	yes (8 sites)	yes	~ 36
OLG	1	10	Dry Niell	Bernese	yes (BUCU)	yes	~ 39
ROB	1	10	Dry Niell	Bernese	yes (2 sites)	yes	~ 27
SGO	1	10	Dry Niell	Bernese	yes (PENC)	? (few mm variation)	~ 17
SUT	1	10	Dry Niell	Bernese	yes (ZIMM)	yes	~ 26
UPA	1	10	Dry Niell	Bernese	yes (MATE)	yes (except some mm discr. for ref. site)	~ 16
WUT	1	10	Dry Niell	Bernese	yes (3 sites)	yes	~ 30

Weekly mean biases for the LACs
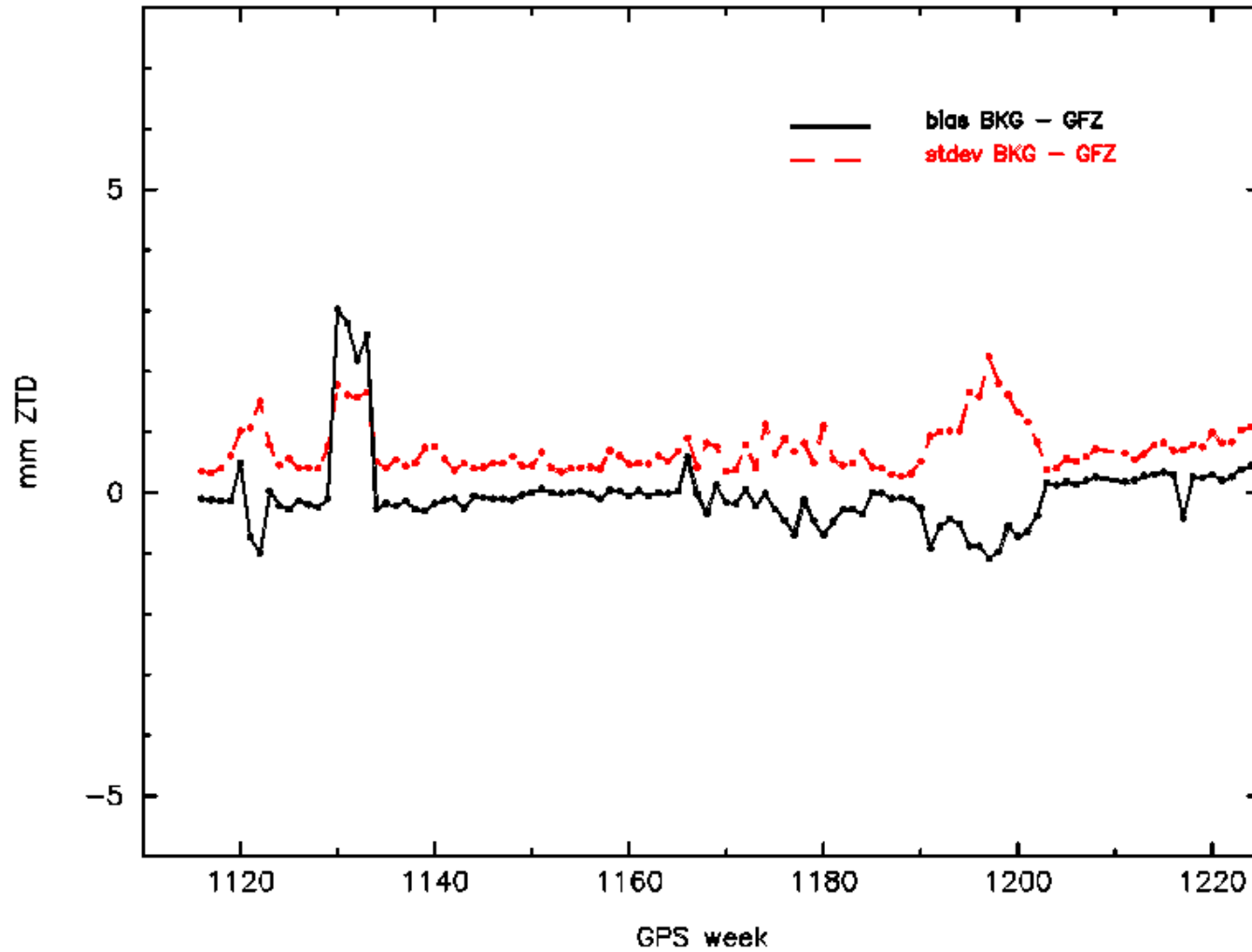
Standard deviation of weekly mean biases
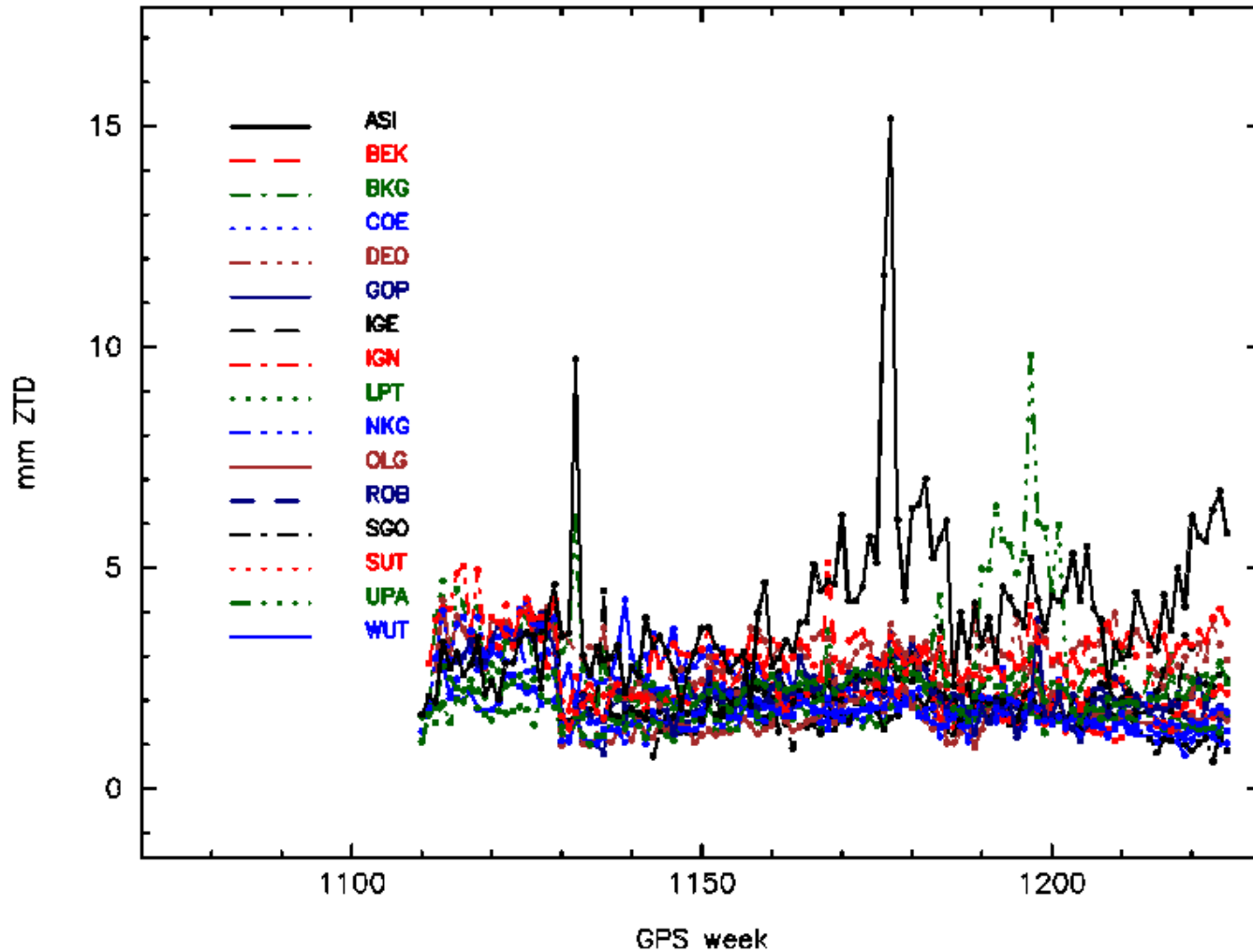
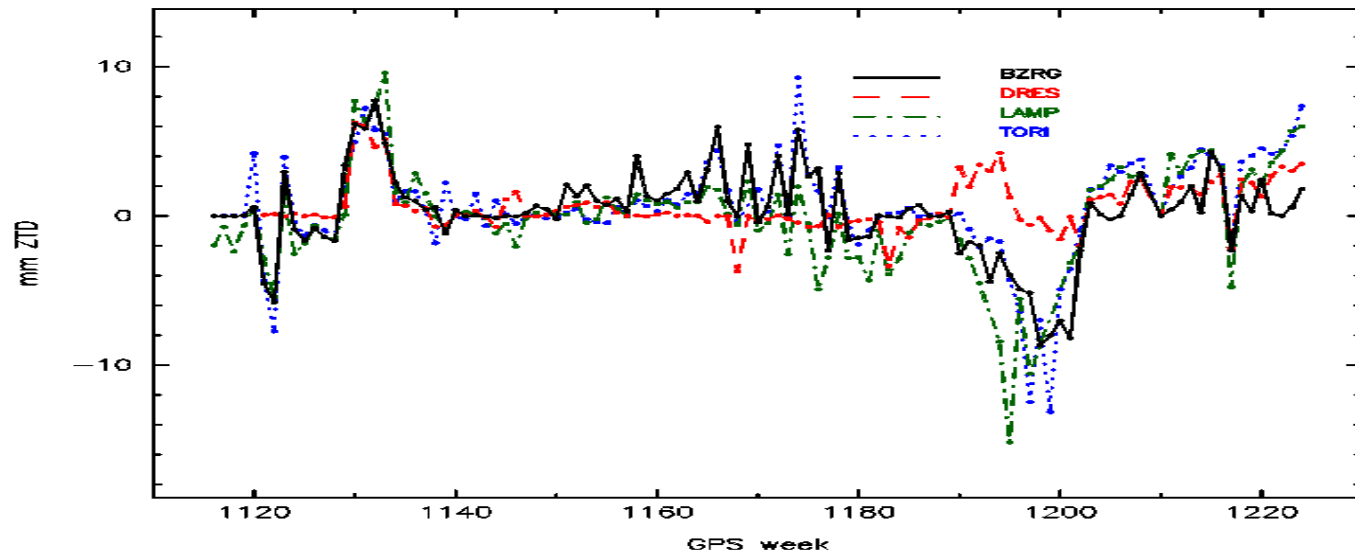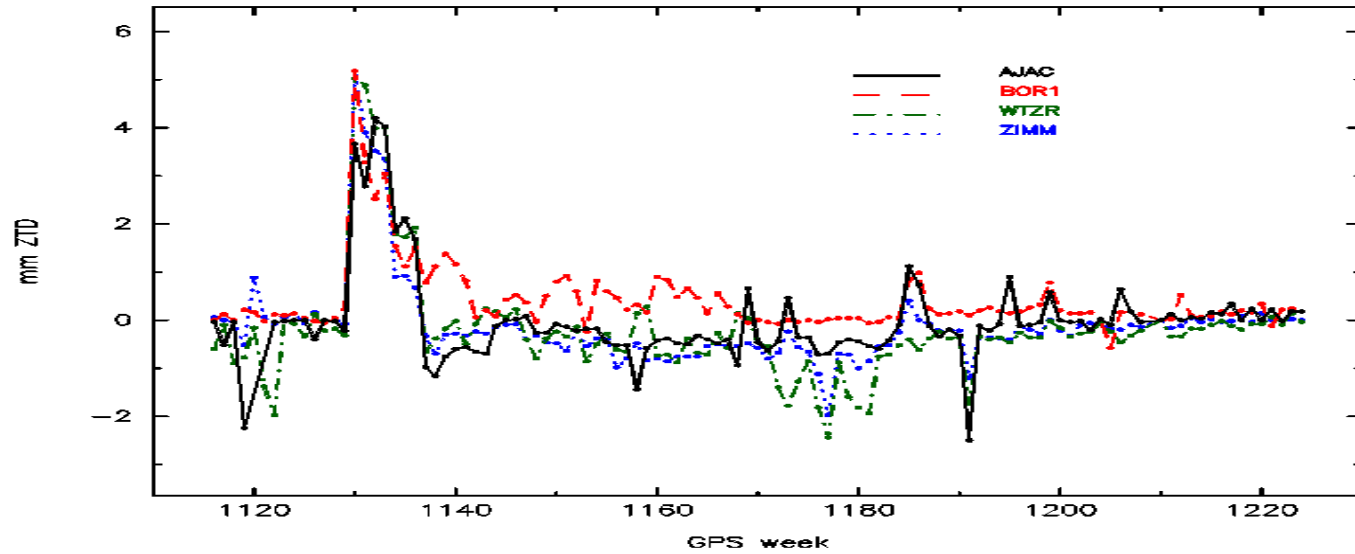# Weekly mean biases for sites CASC and MAS1
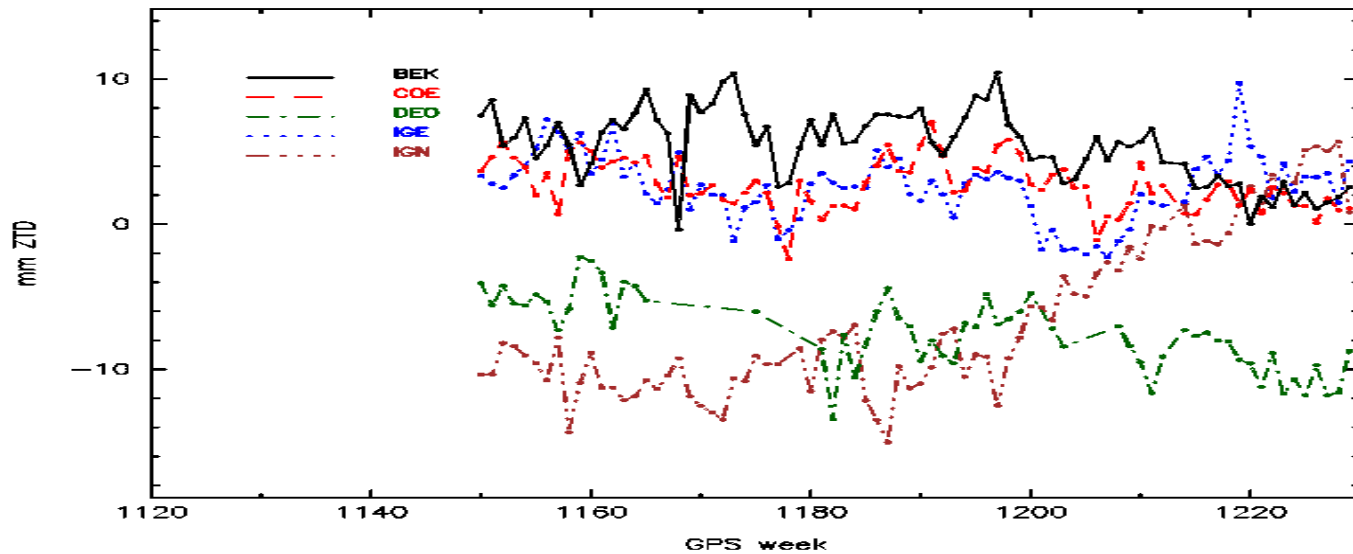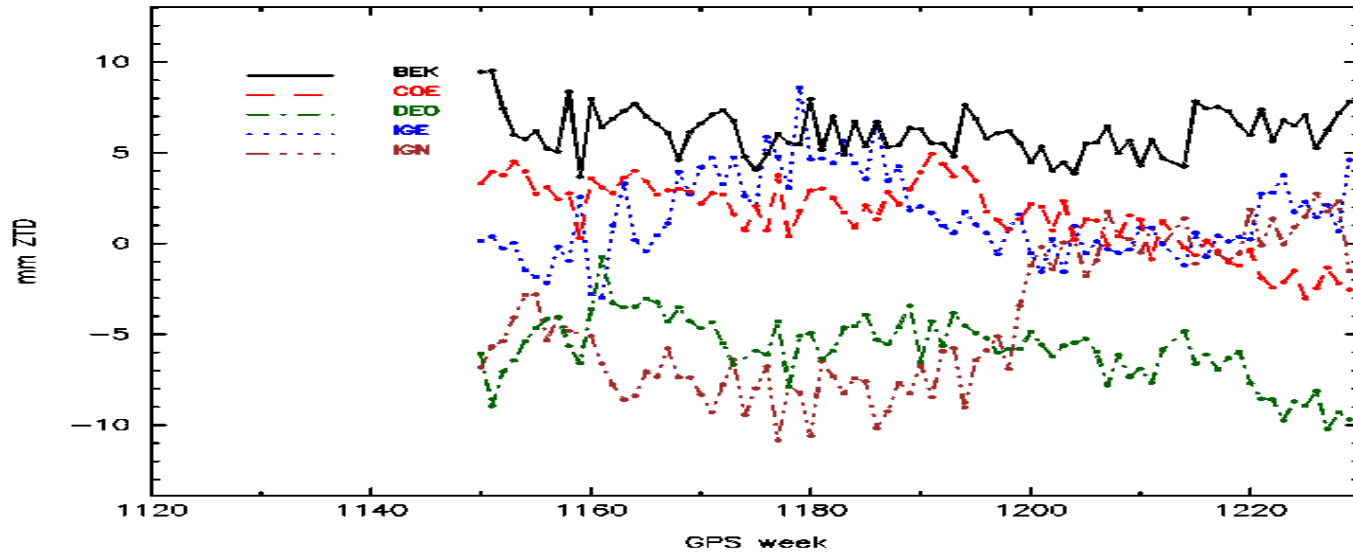
Weekly mean biases for sites VILL and ZIMM
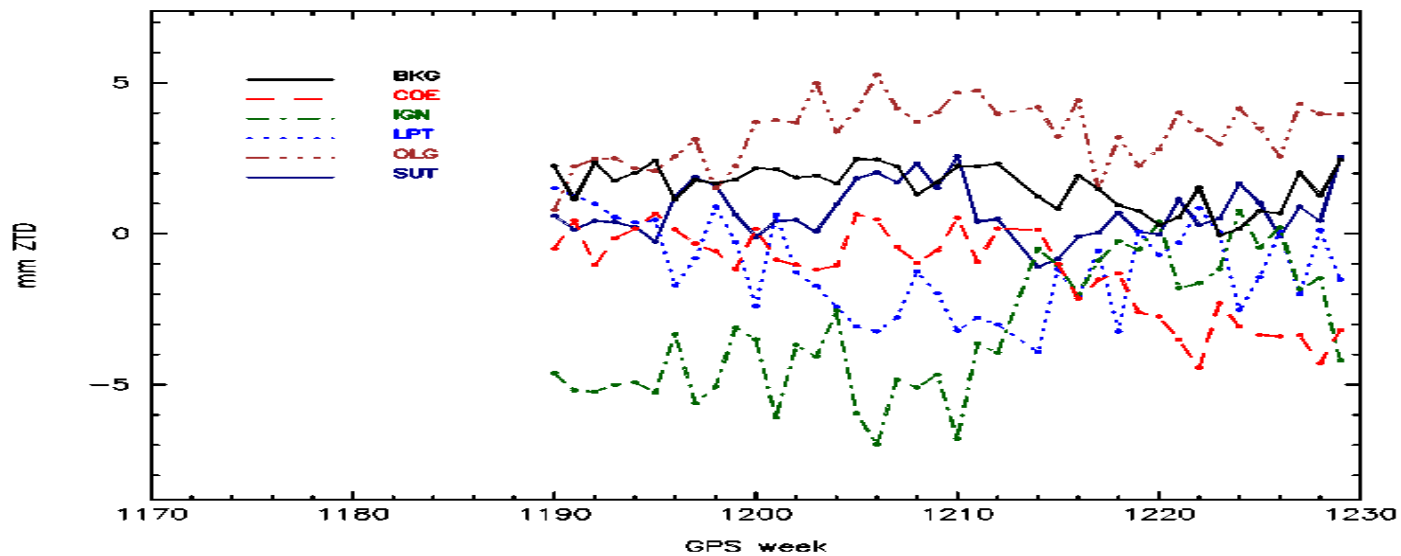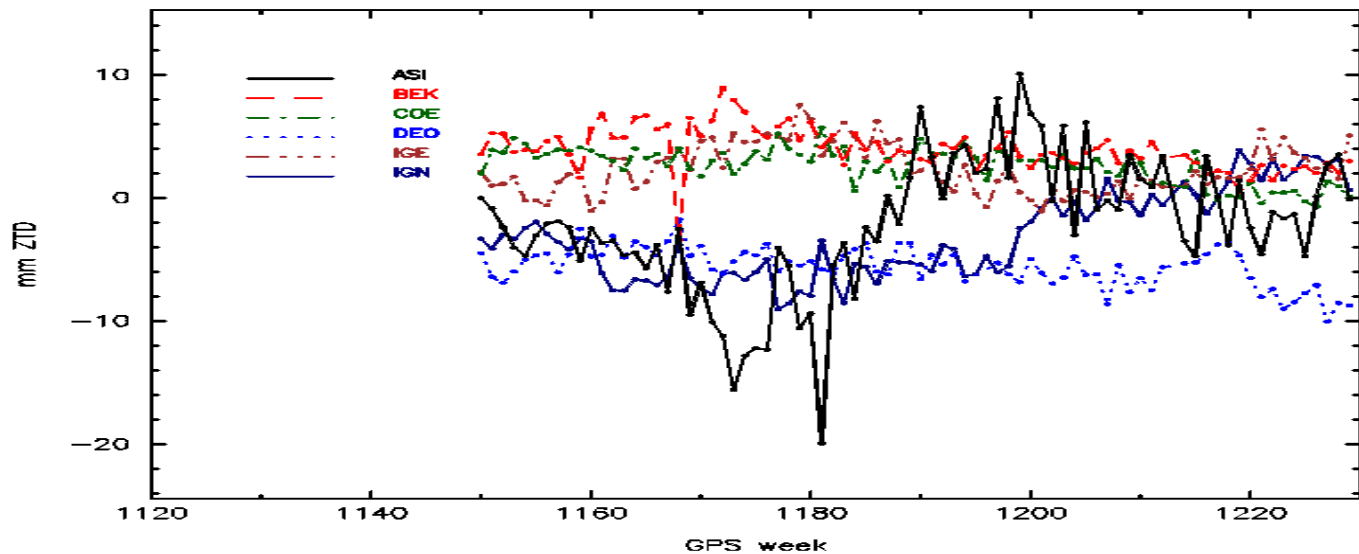
# Differences between GFZ and BKG

# Differences between GFZ and BKG for sites

EPN contribution to IGS ZTD combination

- Started in GPS week 1203
- IGS ZTD combination periodically
- Seven global IGS Analysis Centers
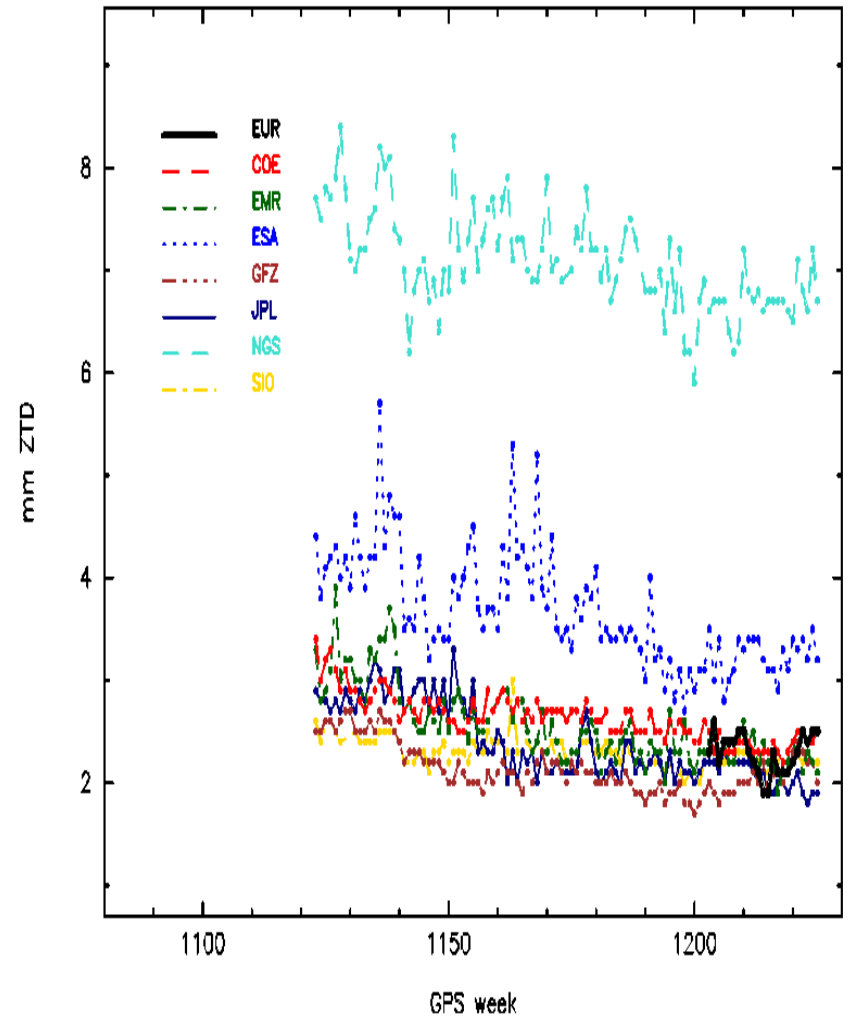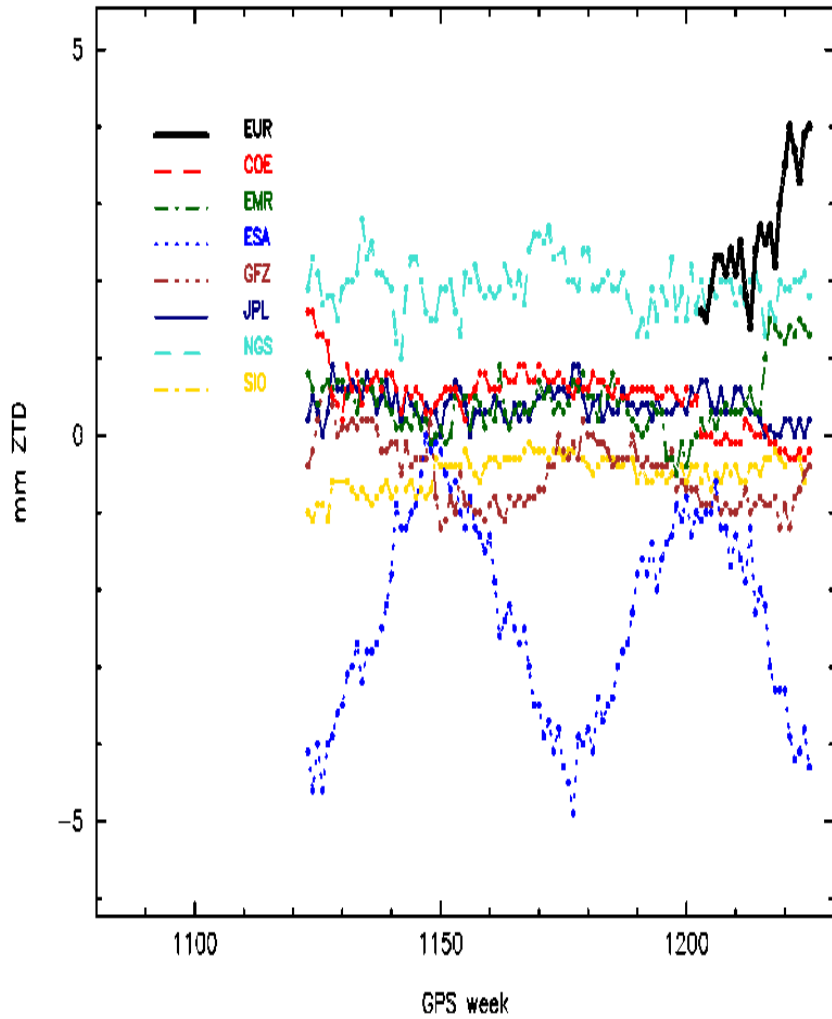- EPN contribution should be available within short time delay after IGS final orbits are available
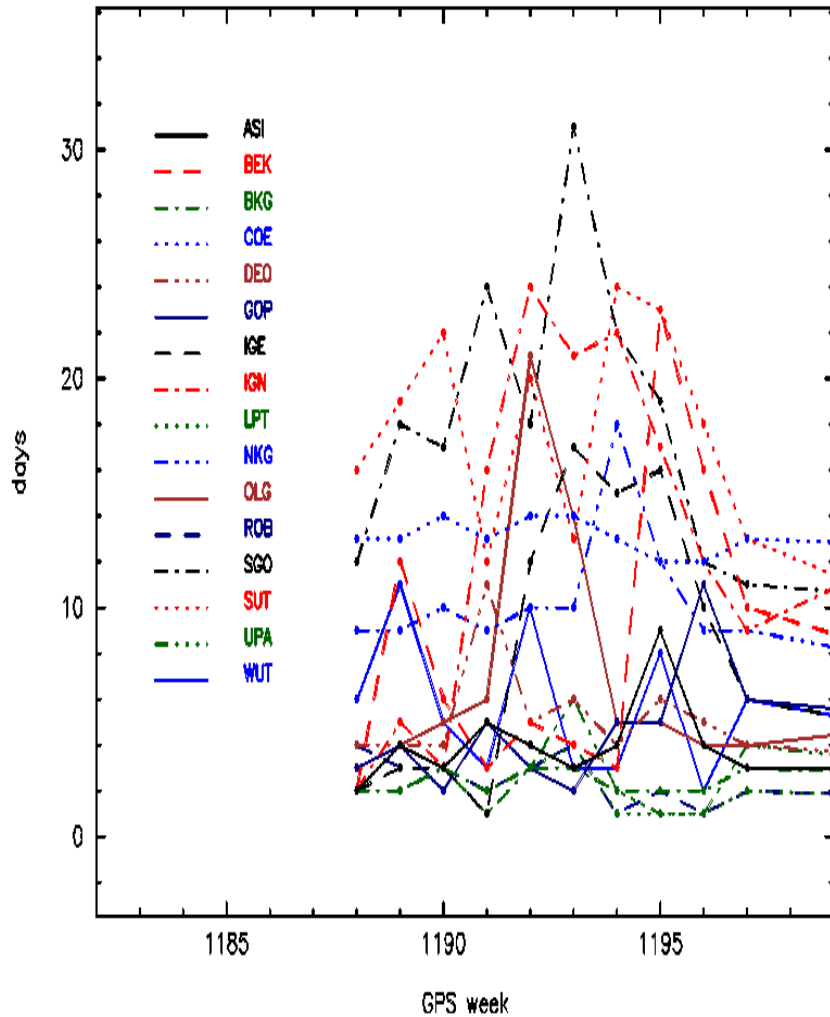
Weekly mean bias and standard deviation compared to IGS solution
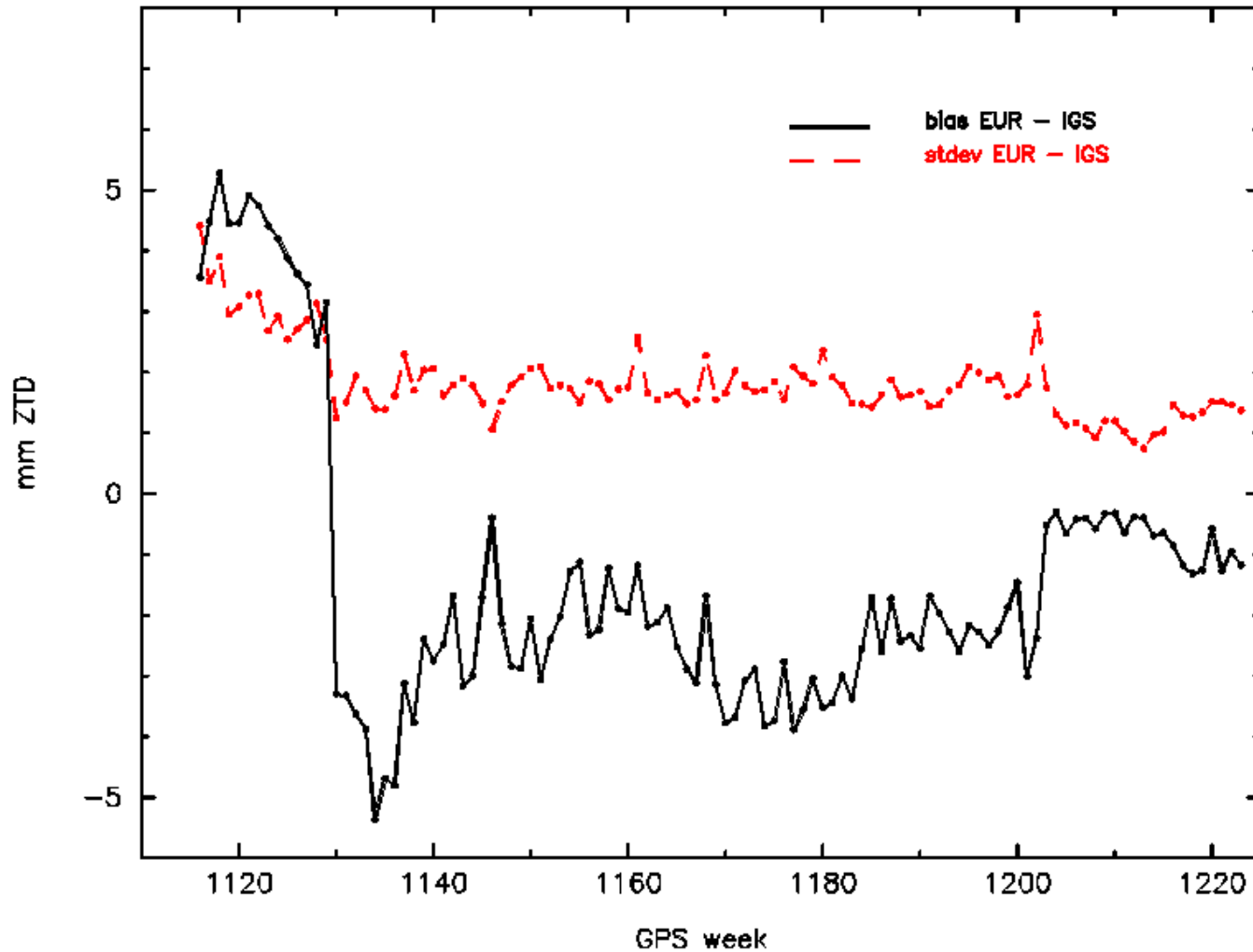
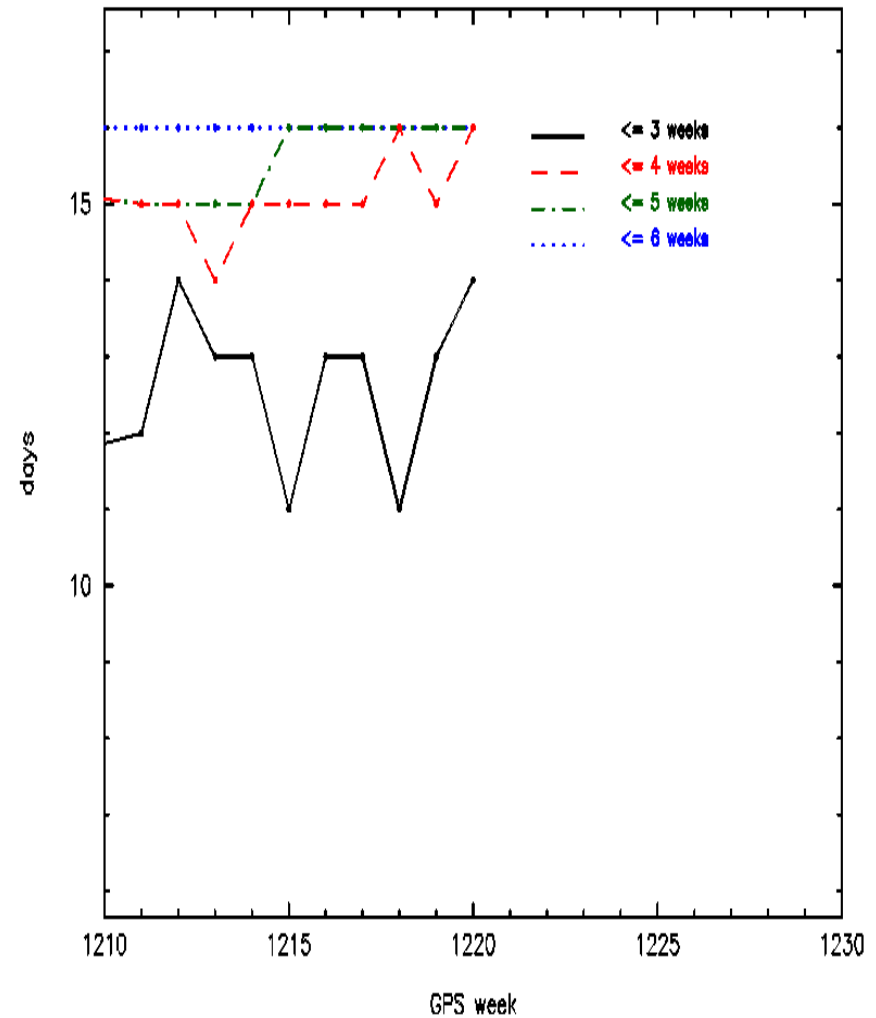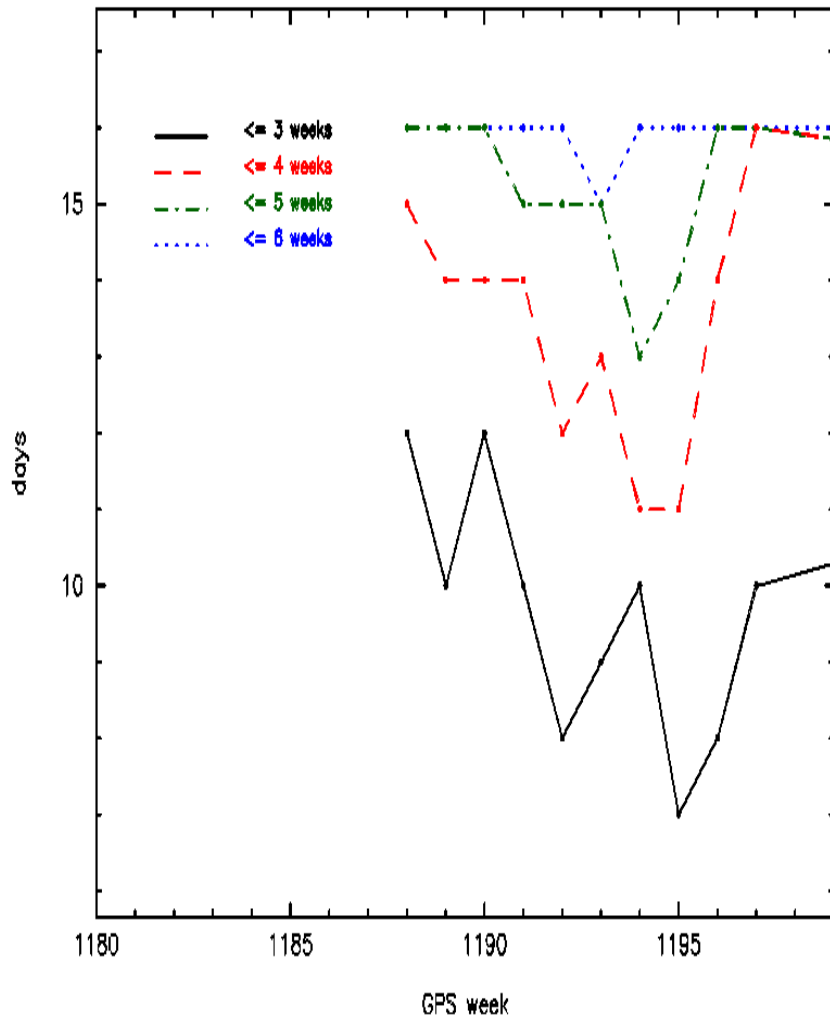# Weekly mean bias and standard deviation and site dependent biases compared to IGS
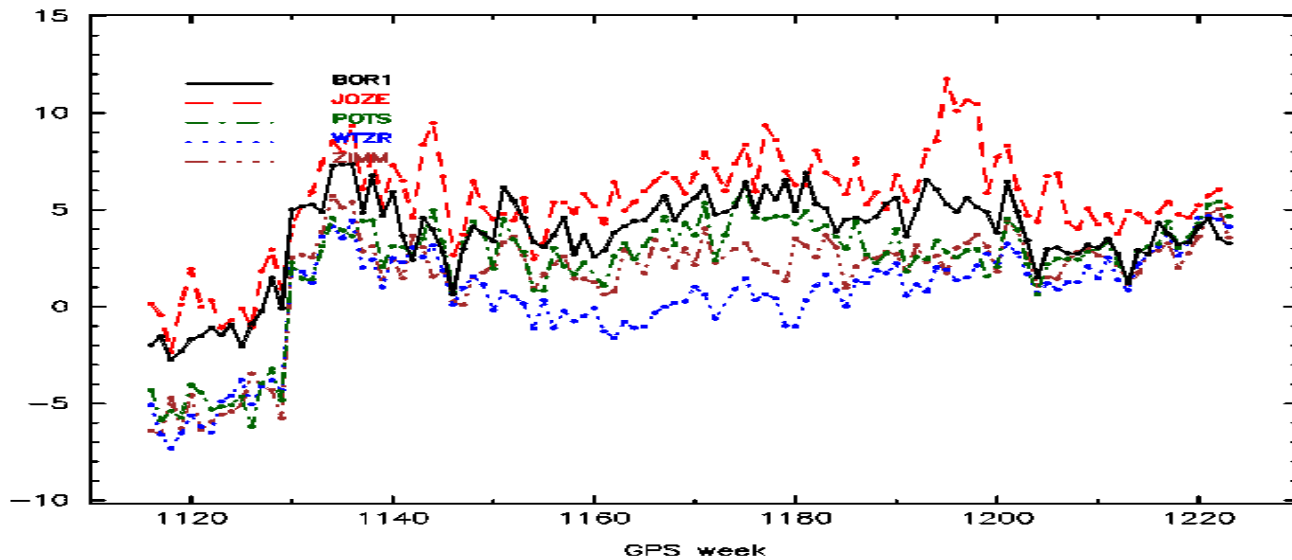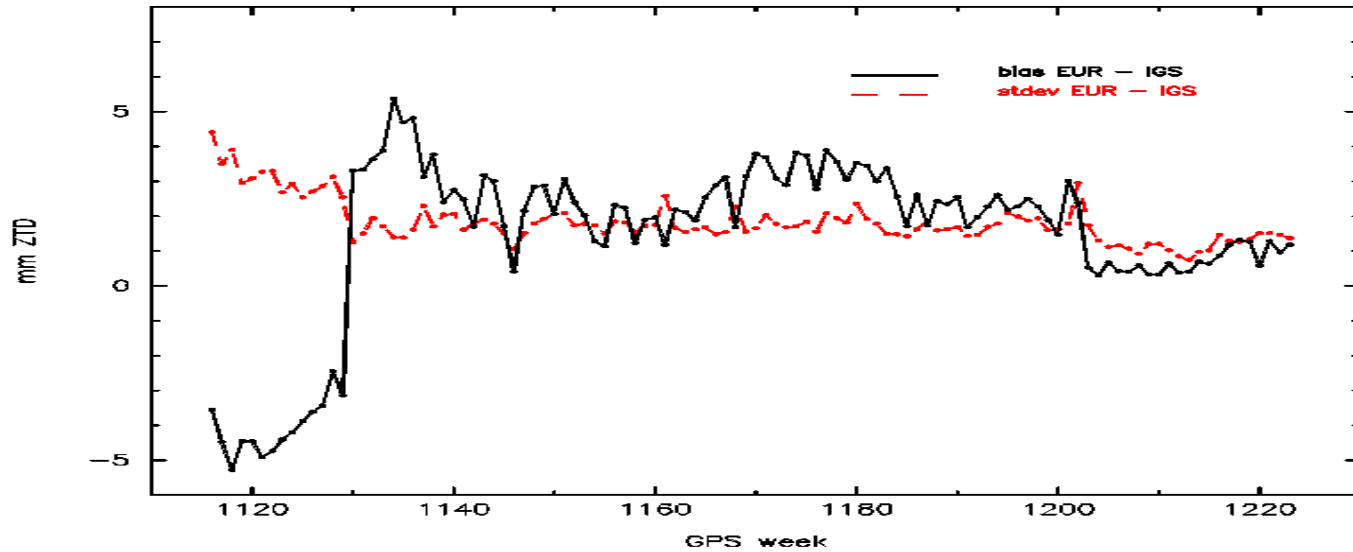
Weekly mean bias and standard deviation of IGS ZTD combination

# Latency of LACs daily troposphere solutions after GPS week 1203
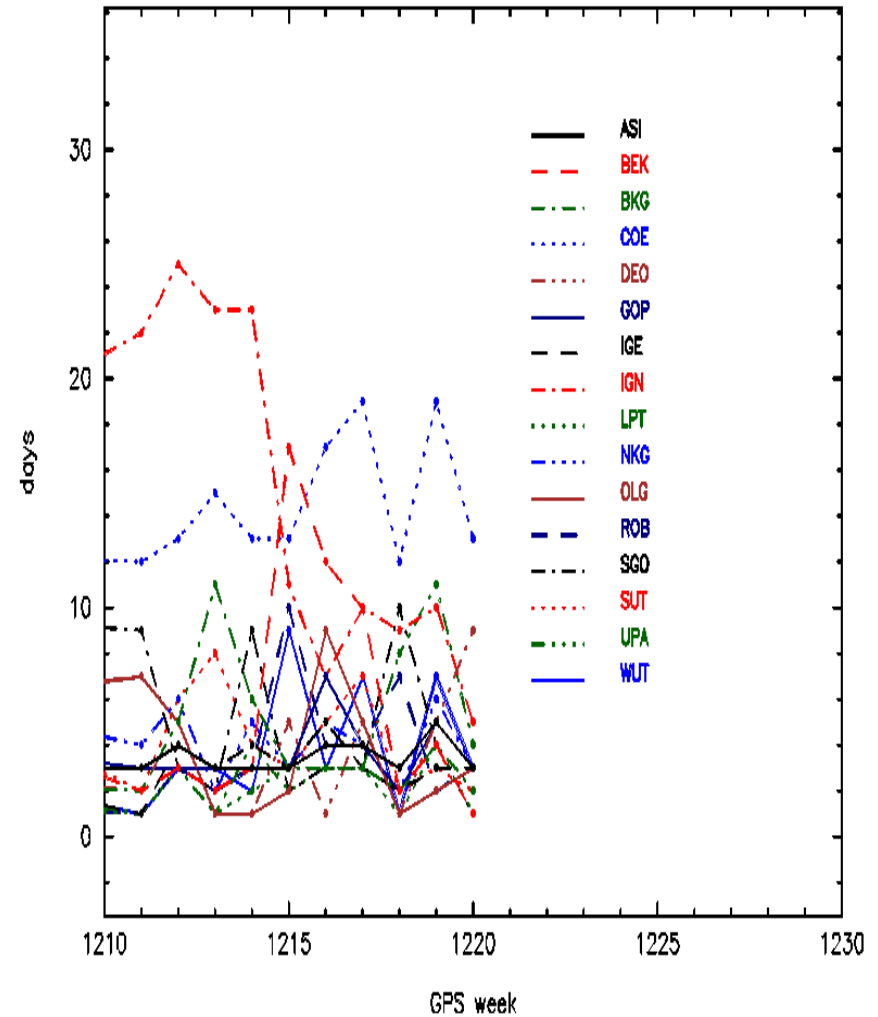
# Availability of LACs daily troposphere solutions after GPS week 1203

Test processing

- Assumption: reducing/eleminating the height differences leads to reduced biases

- Comparison of three different results:

- Routine processing

- Height corrected troposphere values

- Use of a common set of station coordinates

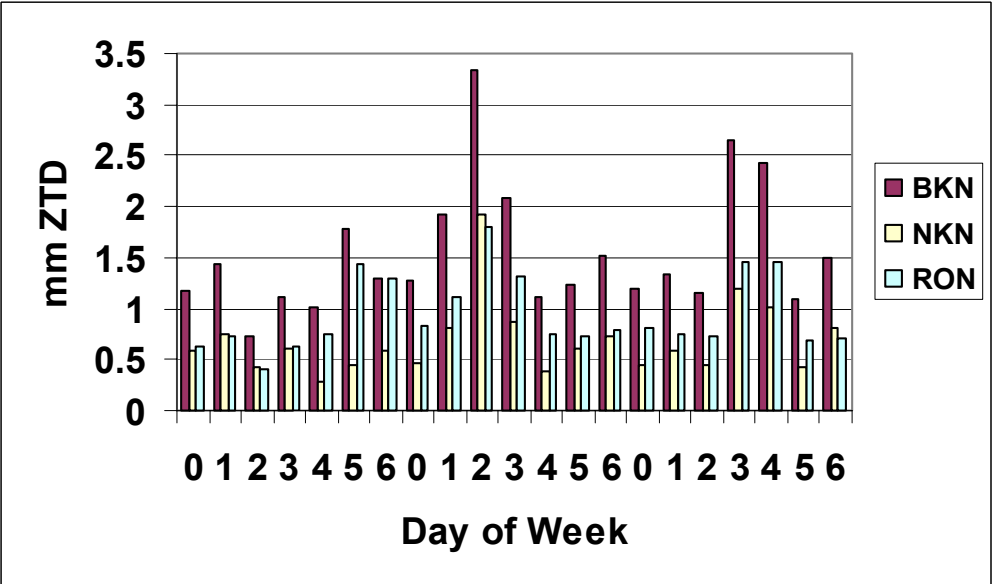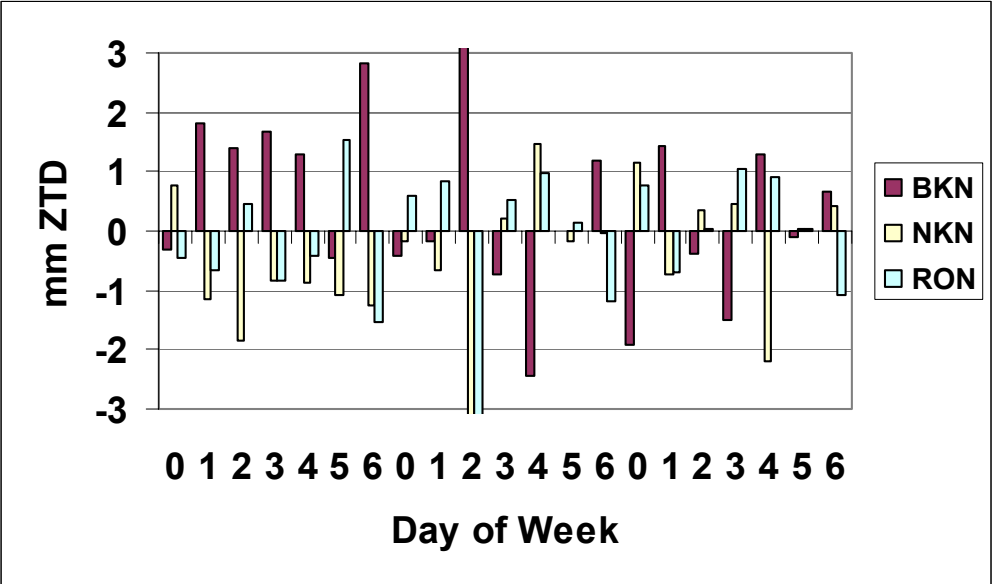- 5 LACs contributed for GPS weeks 1143-1163 (ASI, BKG, NKG, ROB, WUT)

Test processing: values from routine processing
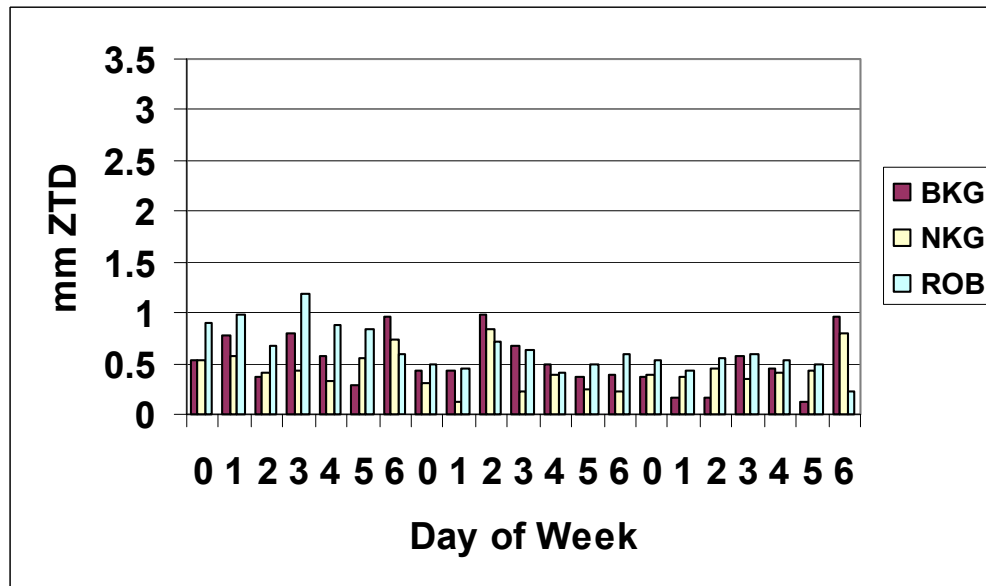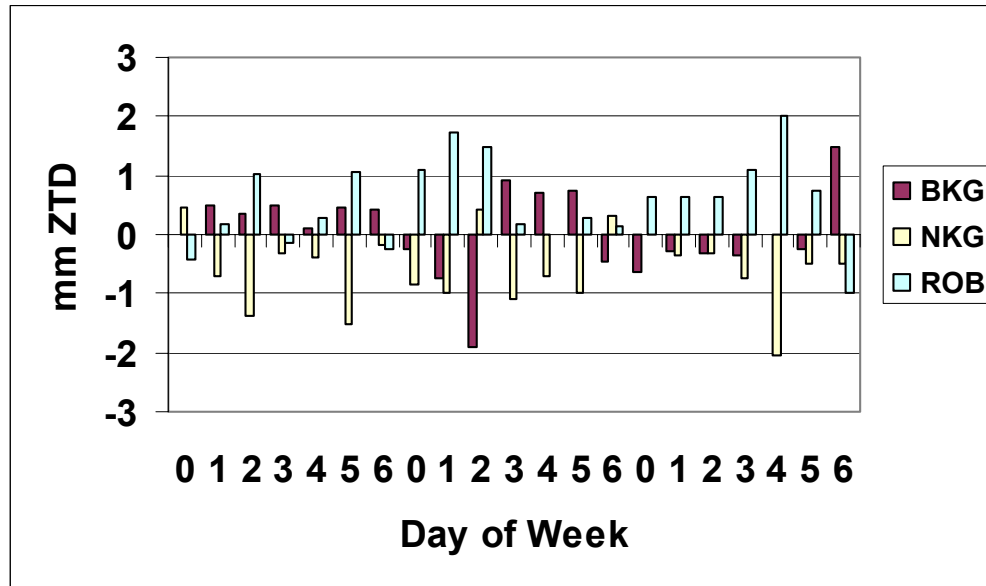
Test processing: height corrected trop. values
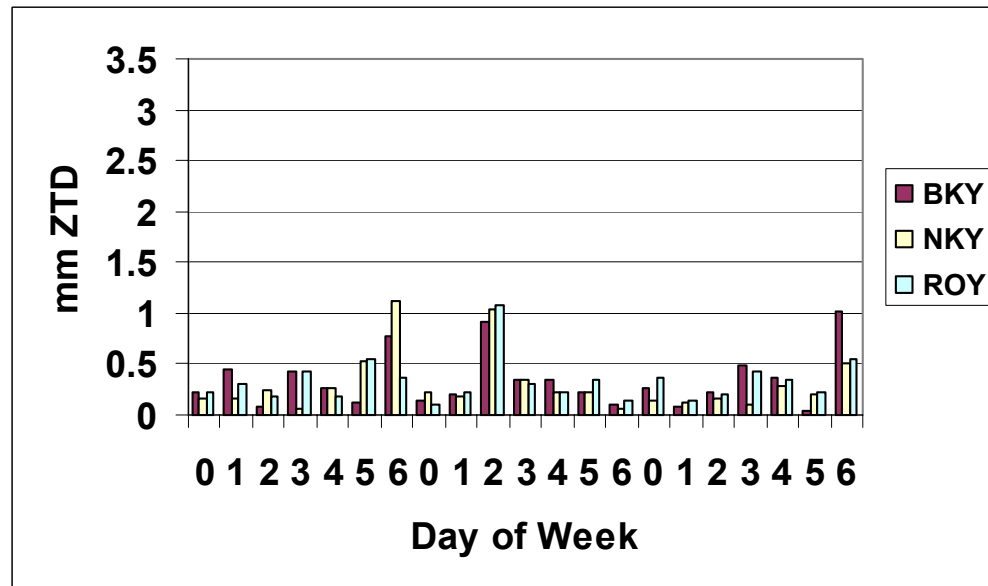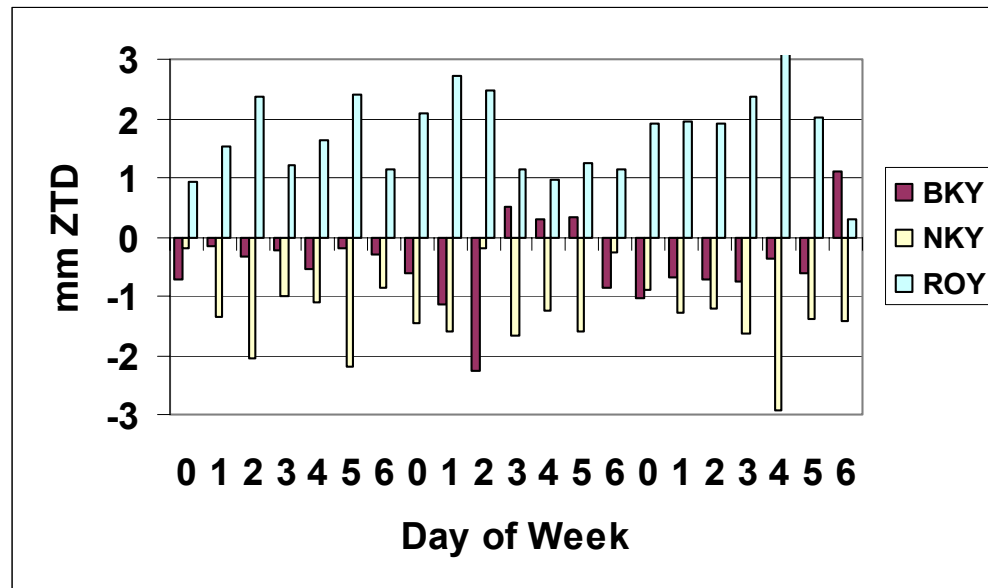
Test processing: common set of coordinates

Test processing

	Own solution Only WTZR fixed	Own solution All fixed	Whole net solution Only WTZR fixed	Whole net solution All fixed	EUREF solution All fixed
Sub-net 1	-0.14 ± 0.19	-0.12 ± 0.19	-0.14 ± 0.19	-0.11 ± 0.08	-0.62 ± 0.29
Sub-net 2	0.49 ± 0.20	0.51 ± 0.20	0.49 ± 0.20	0.17 ± 0.19	0.02 ± 0.34
Sub-net 3	-0.46 ± 0.14	-0.45 ± 0.14	-0.46 ± 0.14	-0.07 ± 0.11	0.82 ± 0.13
Whole net	0.06 ± 0.16	0.04 ± 0.16	0.06 ± 0.16	0.00 ± 0.11	-0.13 ± 0.39

Test processing: NKG and ROB
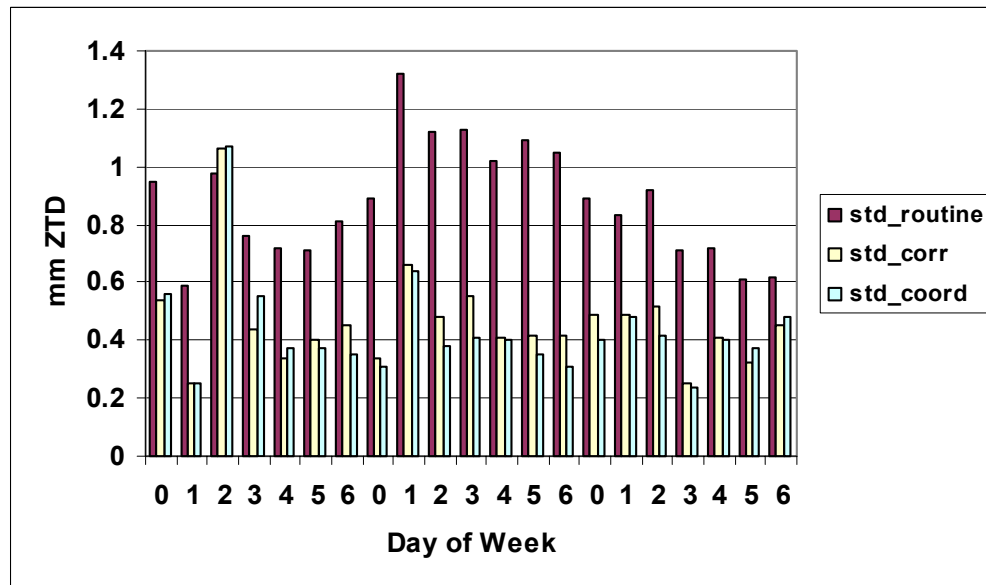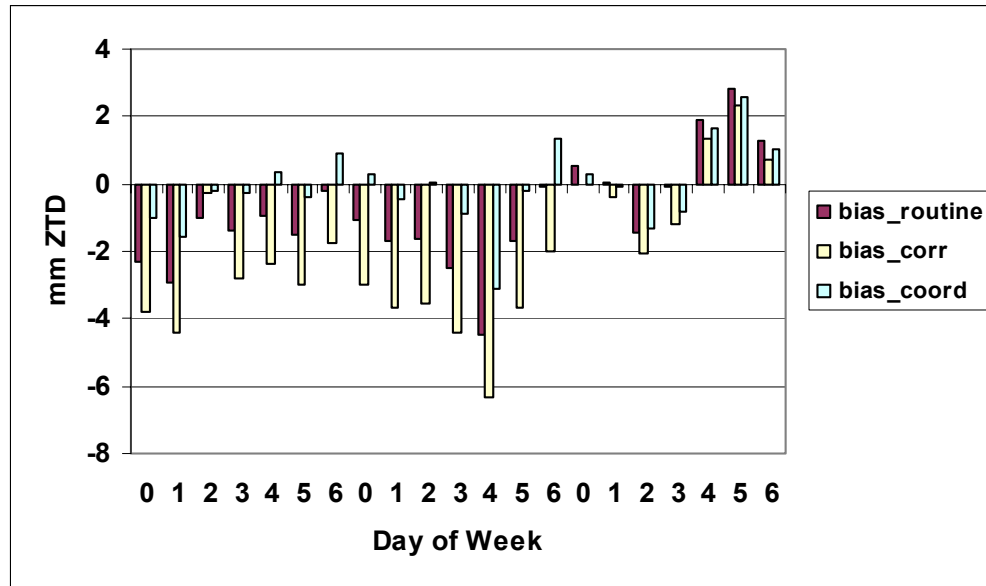
Conclusions and Recommendations

- EPN troposphere contribution to IGS is working
- Using a common set of coordinates did not give the aimed improvement
- All individual troposphere solutions should be available within one week after IGS finals
- All LACs should solve for troposphere parameter with one hour resolution