



Federal Agency for
Cartography and Geodesy

Status Report of the EPN Troposphere Coordinator

Wolfgang Söhne

Outline

- **History / changes**
- **ZTD overall agreement**
- **Impact of LAC's software version change to BSW5.2**
- **ZTD estimates for twin stations**

History / Changes

- **June 2008: resolution #1 at the EUREF symposium → operational status**
- **GPS week 1558: contribution of MUT**
- **GPS week 1600: COE using 'WET VMF1'**
- **GPS week 1617: ASI switching from MicroCosm to GIPSY OASIS**
- **GPS week 1632: IGS08 coordinates & velocities (EUREF mail 5816)**
- **GPS week 1632: contribution of RGA (No. 5815)**
- **GPS week 1632: ASI switching to GIPSY OASIS II 6.0**
- **GPS week 1682: ZPD repro1 results released (No. 6335)**
- **GPS week 1707: COE switching to BSW5.3**

History / Changes

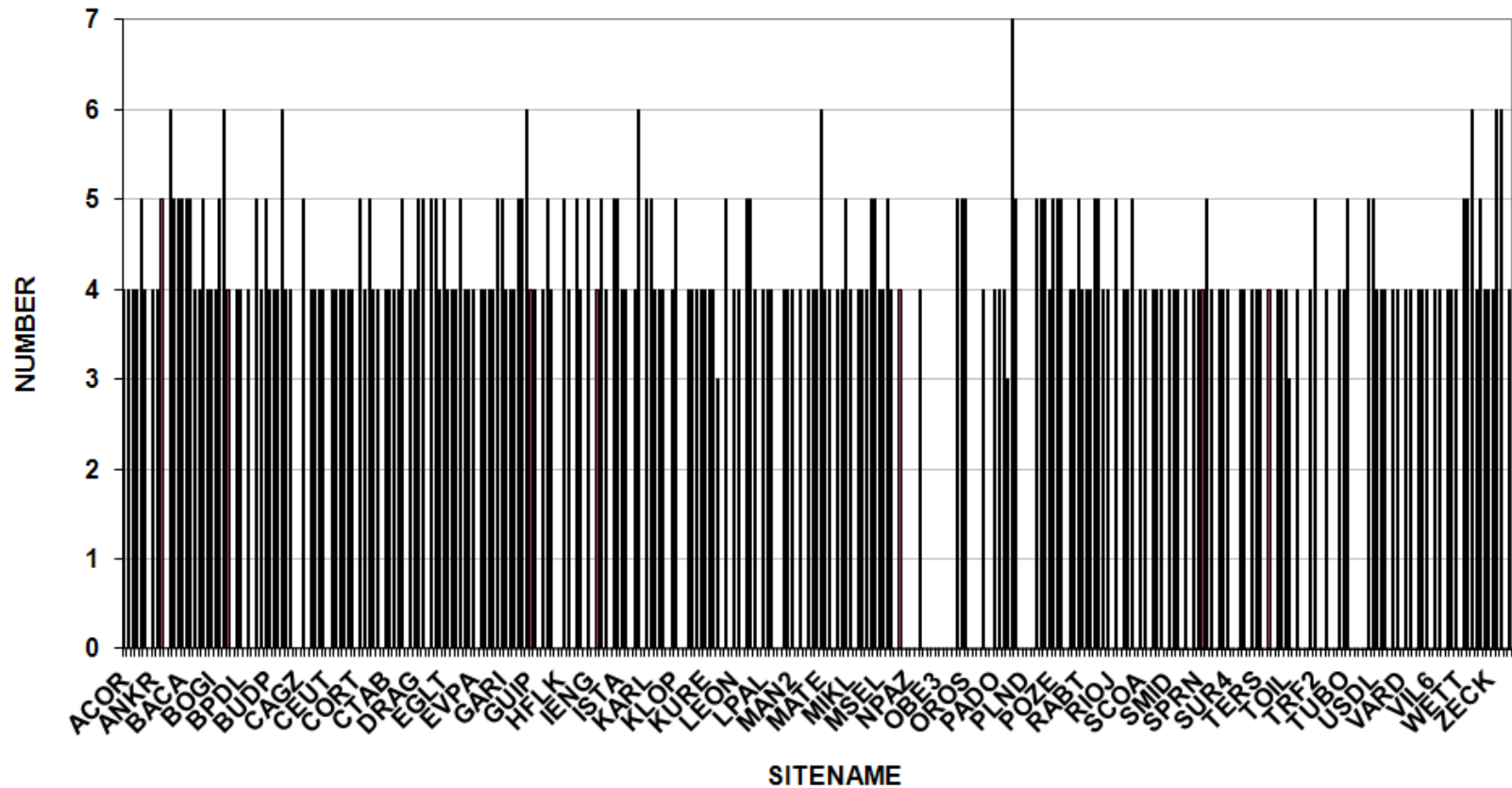
- **GPS week 1730: BKG switching to BSW5.2 ('WET GMF', EPN LAC mail 1661)**
- **GPS week 1731: LPT switching to BSW5.2 ('WET GMF', No. 1654)**
- **GPS week 1752: RGA switching to BSW5.2 (GLO, 'WET VMF', No. 1710)**
- **GPS week 1755: MUT switching to BSW5.2 (GLO, 'WET GMF', No. 1712)**
- **GPS week 1756: IGE switching to BSW5.2 (GLO, 'WET GMF', No. 1716)**
- **GPS week 1760: SGO switching to BSW5.2 (GLO, 'WET VMF', No. 7199)**
- **GPS week 1764: UPA switching to BSW5.2 (GLO, 'WET GMF', No. 7216)**

History / Changes

- **GPS week 1765: ROB switching to BSW5.2 ('WET GMF', No. 7204)**
- **GPS week 1765: NKG switching to BSW5.2 (GLO, 'WET VMF', No. 1743)**
- **GPS week 1765: WUT switching to BSW5.2 ('WET GMF', No. 1747)**
- **GPS week 1765: ASI switching to GIPSY OASIS II 6.2 ('VMF1')**
- **GPS week 1772: OLG changes in net configuration (No. 1762)**
- **GPS week 1773: RGA changes in net configuration (No. 1765)**
- **GPS week 1774: IGN switching to BSW5.2 (GLO, 'WET GMF', No. 7308)**
- **GPS week 1776: GOP stopped submitting weekly solutions**
- **GPS week 1786: BEK switching to BSW5.2 (GLO, 'WET GMF')**

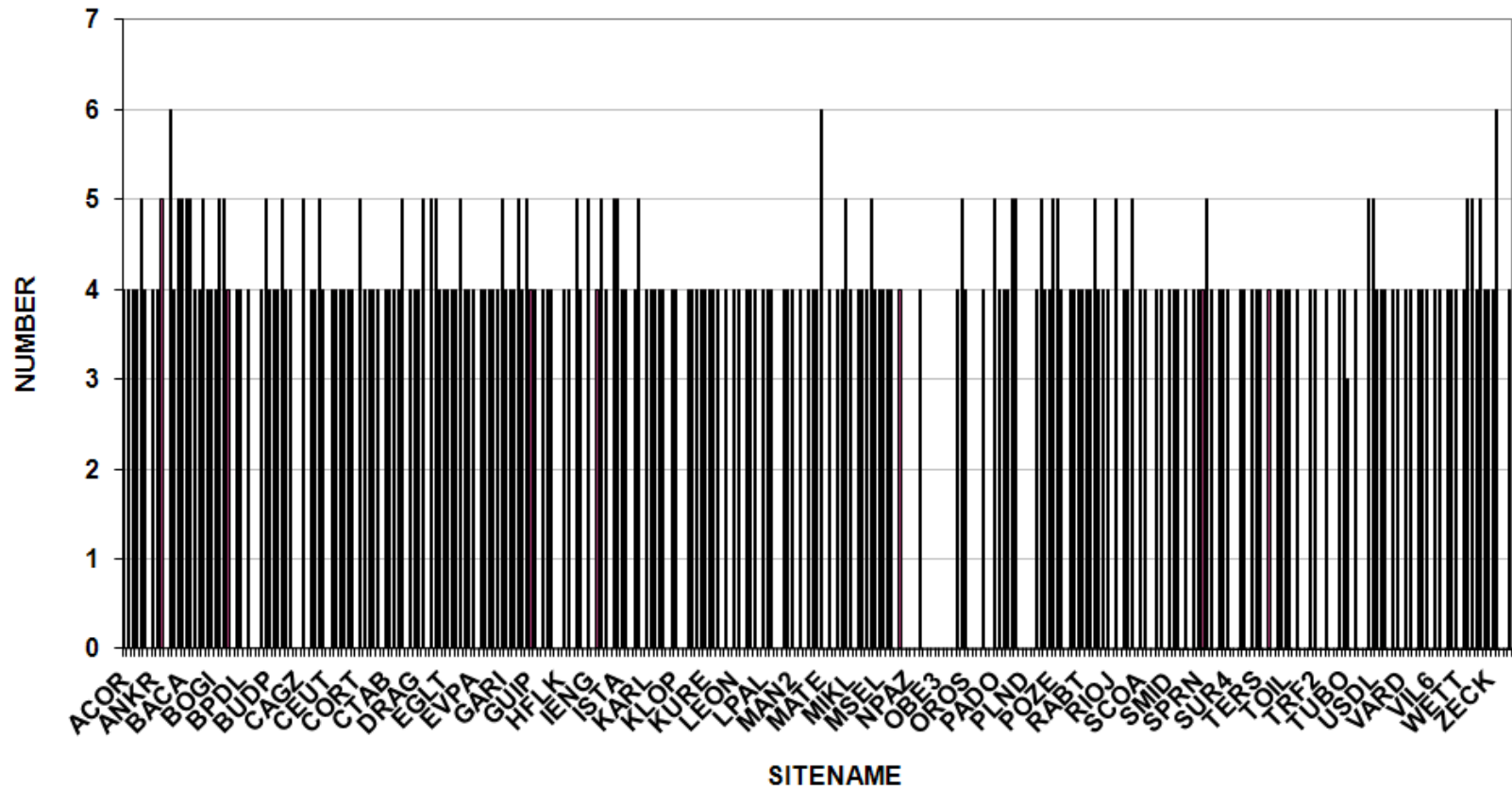
EPN ZTD Processing Redundancy

Number of LACs estimating the EPN stations' troposphere parameters (GPS week 1767, 17 LACs)



EPN ZTD Processing Redundancy

Number of LACs estimating the EPN stations' troposphere parameters (GPS week 1777, 16 LACs)

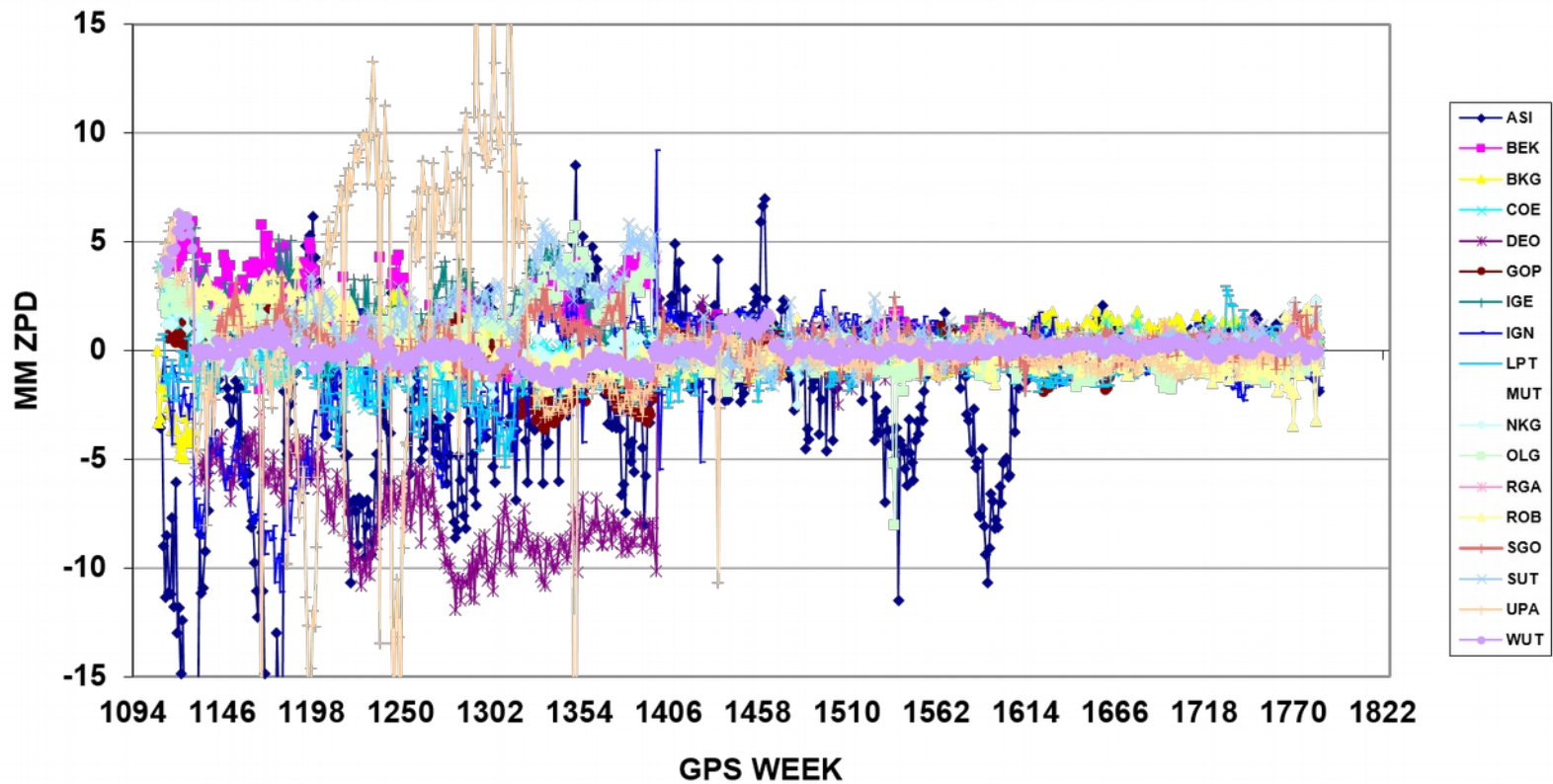


Outline

- History / changes
- **ZTD overall agreement**
- Impact of LAC's software version change to BSW5.2
- ZTD estimates for twin stations

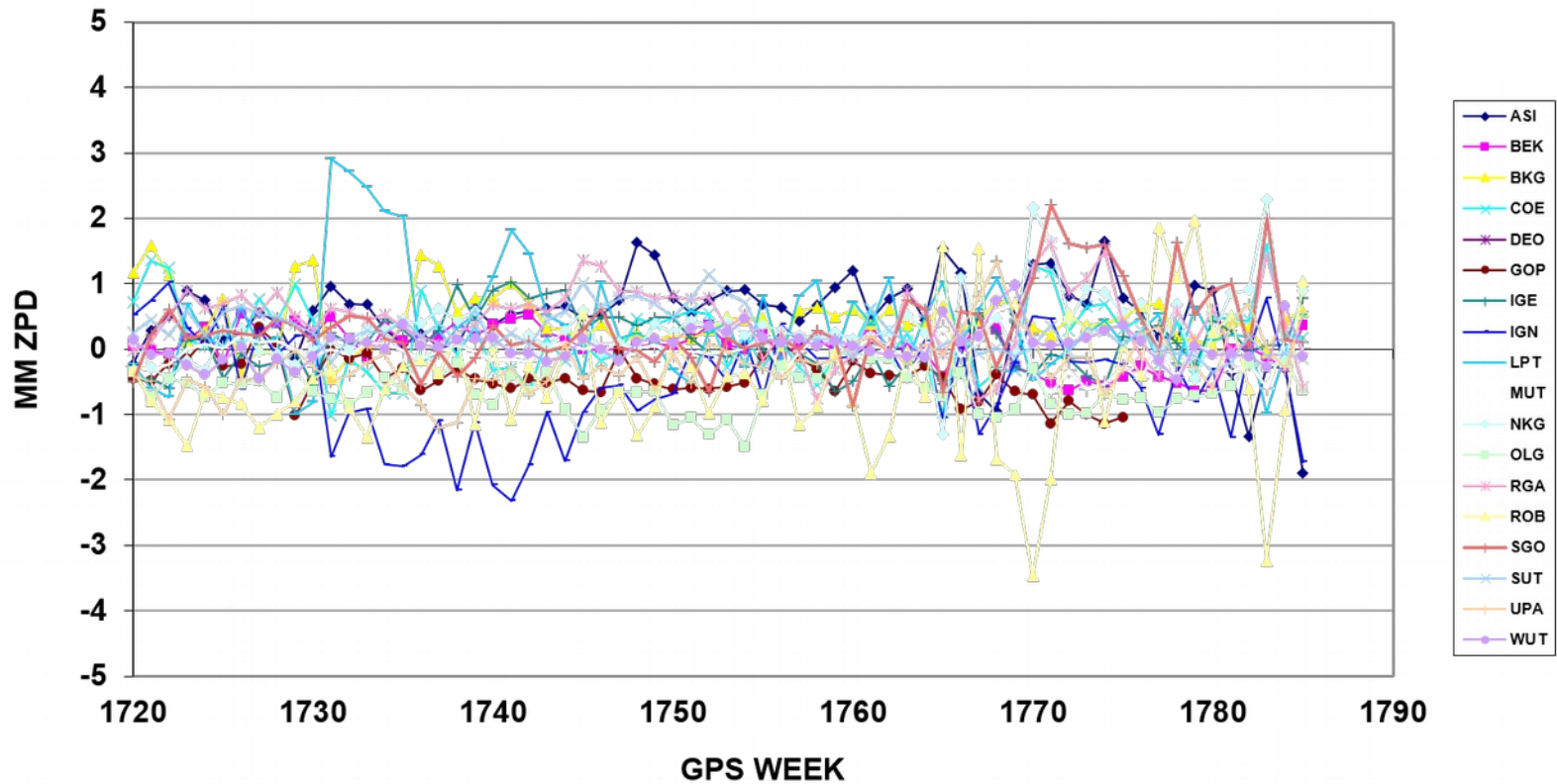
EPN ZTD overall agreement

Weekly mean biases of the individual LAC troposphere solutions with respect to the EPN combined solution



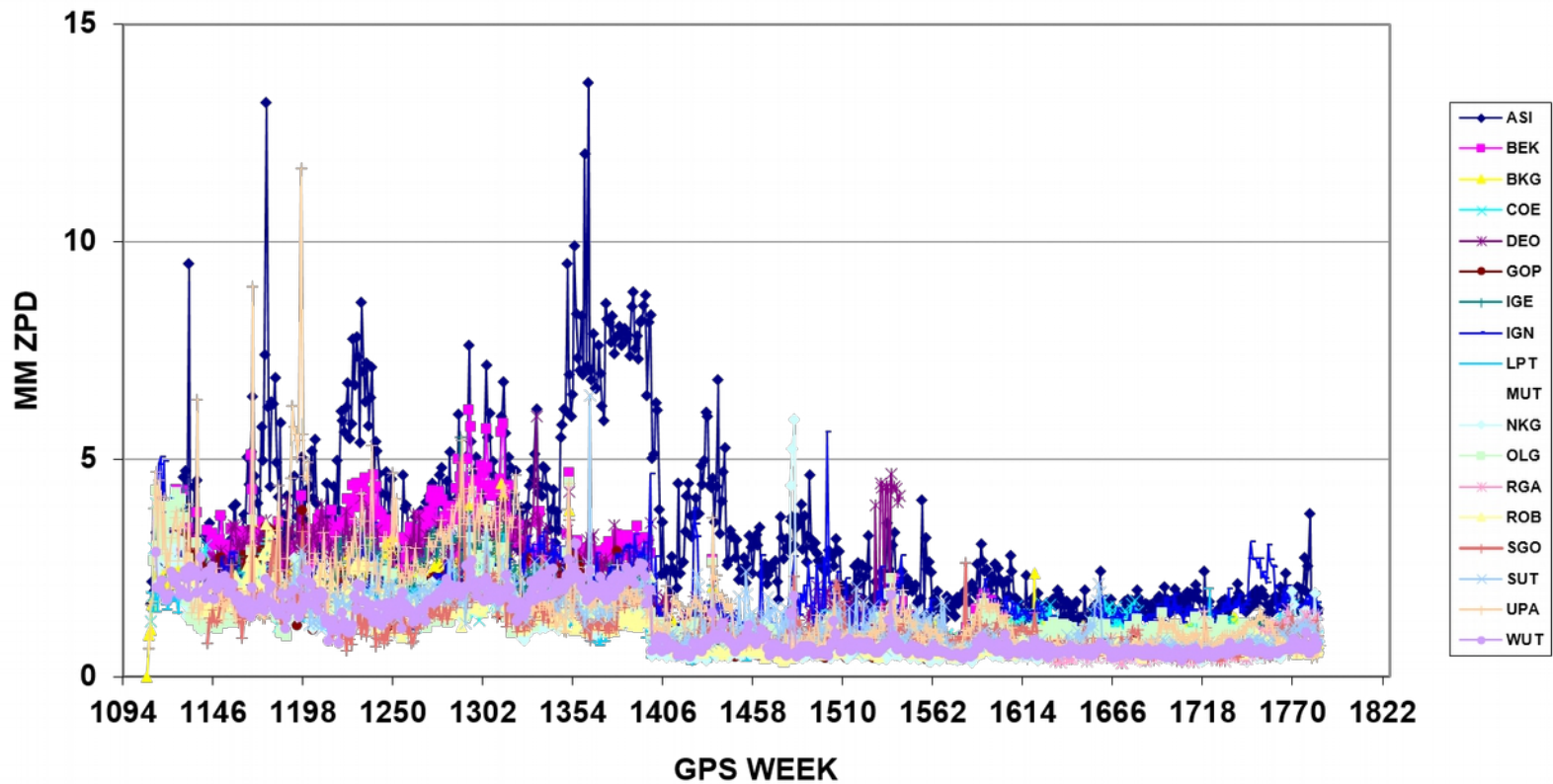
EPN ZTD overall agreement

Weekly mean biases of the individual LAC troposphere solutions with respect to the EPN combined solution



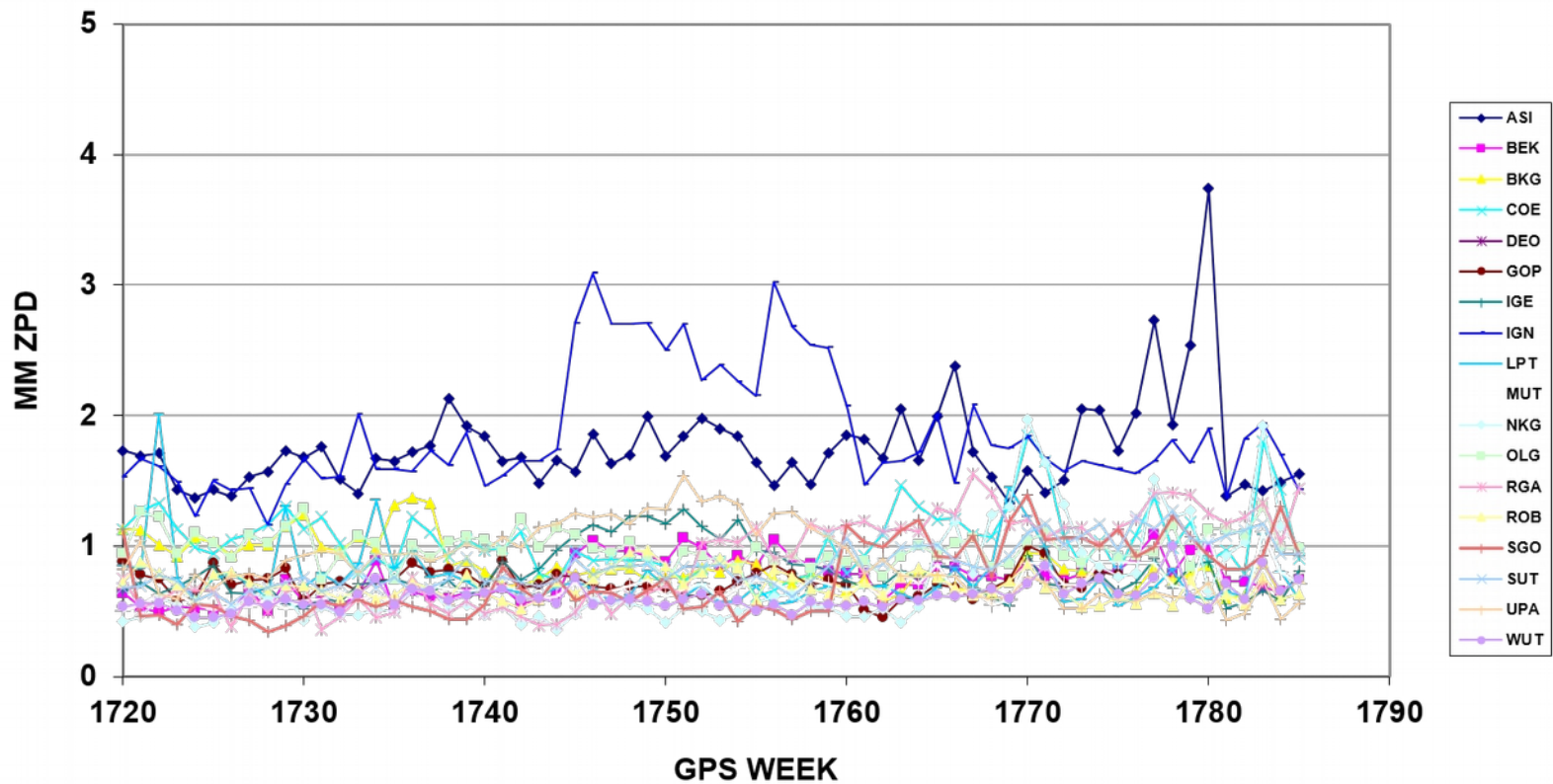
EPN ZTD overall agreement

Standard deviation of weekly mean biases of the individual LAC troposphere solutions with respect to the EPN combined solution



EPN ZTD overall agreement

Standard deviation of weekly mean biases of the individual LAC troposphere solutions with respect to the EPN combined solution



Outline

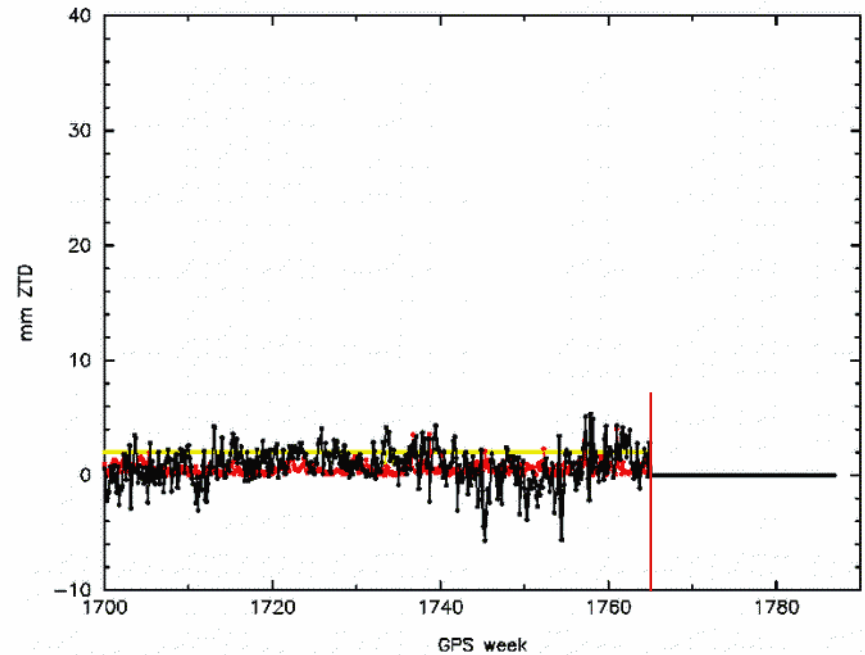
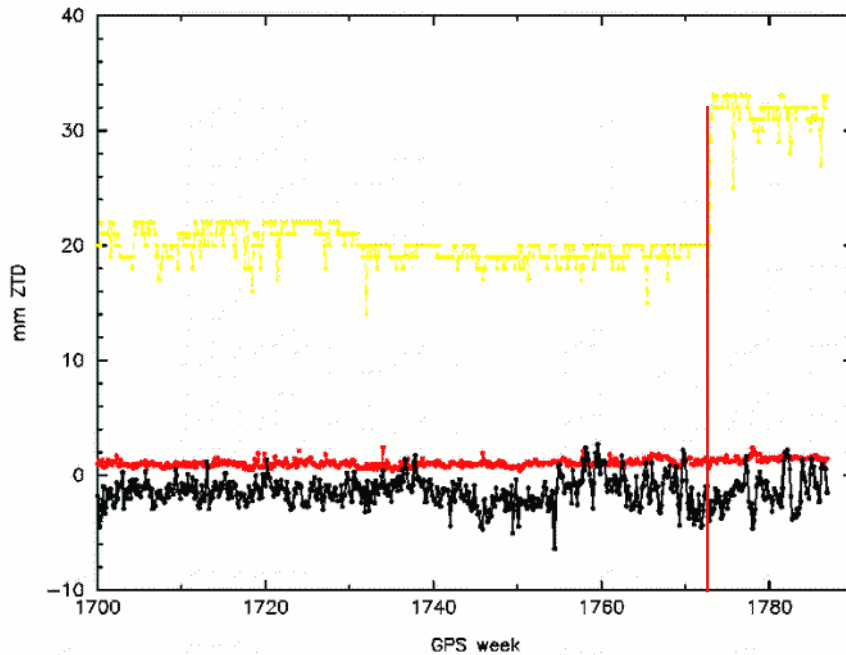
- History / changes
- ZTD overall agreement
- **Impact of LAC's software version change to BSW5.2**
- ZTD estimates for twin stations

EPN ZTD LAC-to-LAC agreement

- **Time series of daily mean biases, standard deviation and number of common stations for all LAC-to-LAC combinations**
→ **Söhne, 2007 (poster at the EUREF symposium)**
- **Number of common stations between two LACs varying**
 - **from 45-60 (GOP-MUT, MUT-OLG, MUT-WUT, OLG-WUT)**
 - **to 0-2 (ASI-LPT, ASI-NKG, ASI-ROB, BEK-NKG, COE-UPA, IGE-NKG, IGE-SGO, IGE-SUT, IGN-OLG, NKG-RGA, NKG-UPA, OLG-ROB, ROB-SGO)**

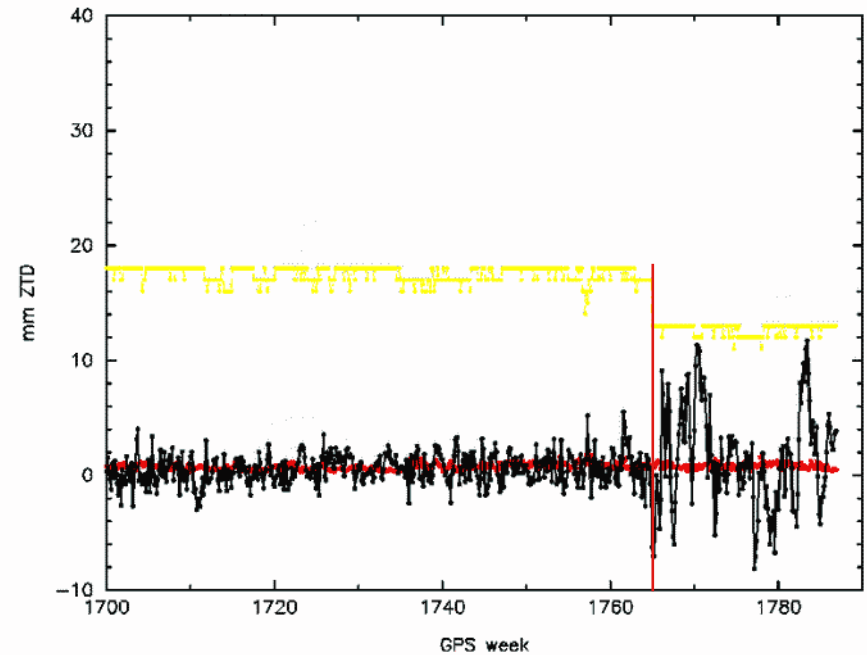
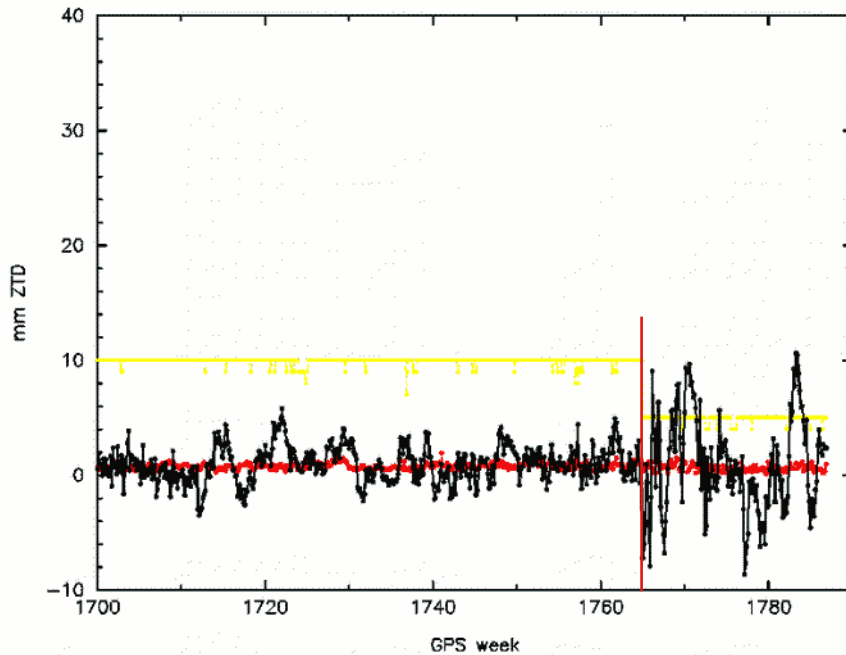
EPN ZTD LAC-to-LAC agreement

- OLG vs. RGA (left) and ROB -



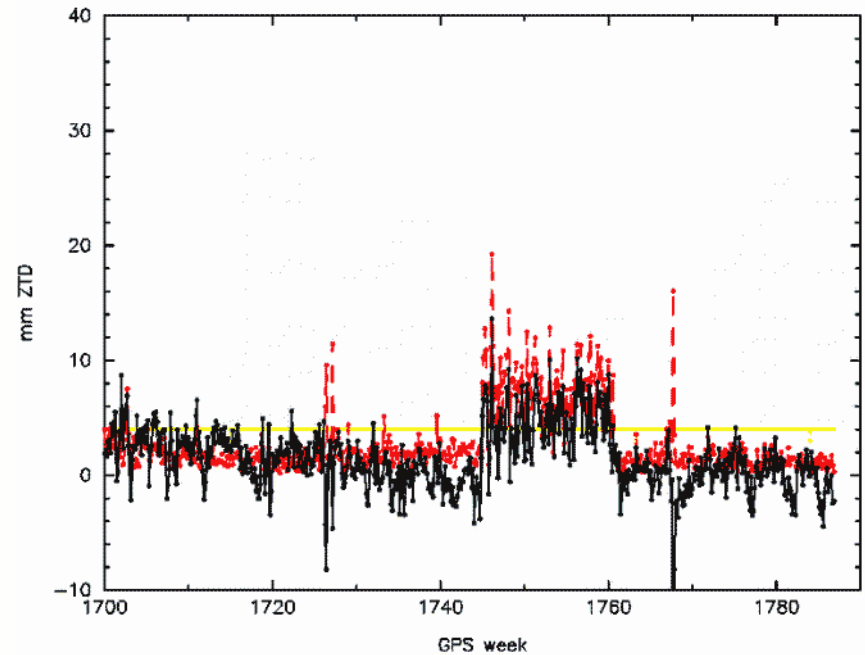
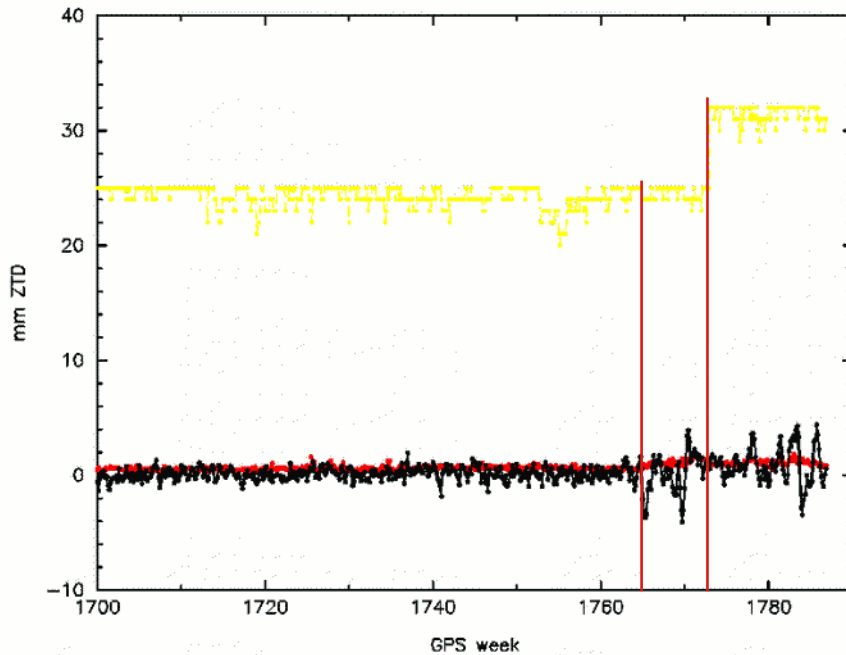
EPN ZTD LAC-to-LAC agreement

- COE (left) and NKG vs. ROB -



EPN ZTD LAC-to-LAC agreement

- NKG vs. WUT (left) and IGN vs. UPA -



Outline

- History / changes
- ZTD overall agreement
- Impact of LAC's software version change to BSW5.2
- **ZTD estimates for twin stations**

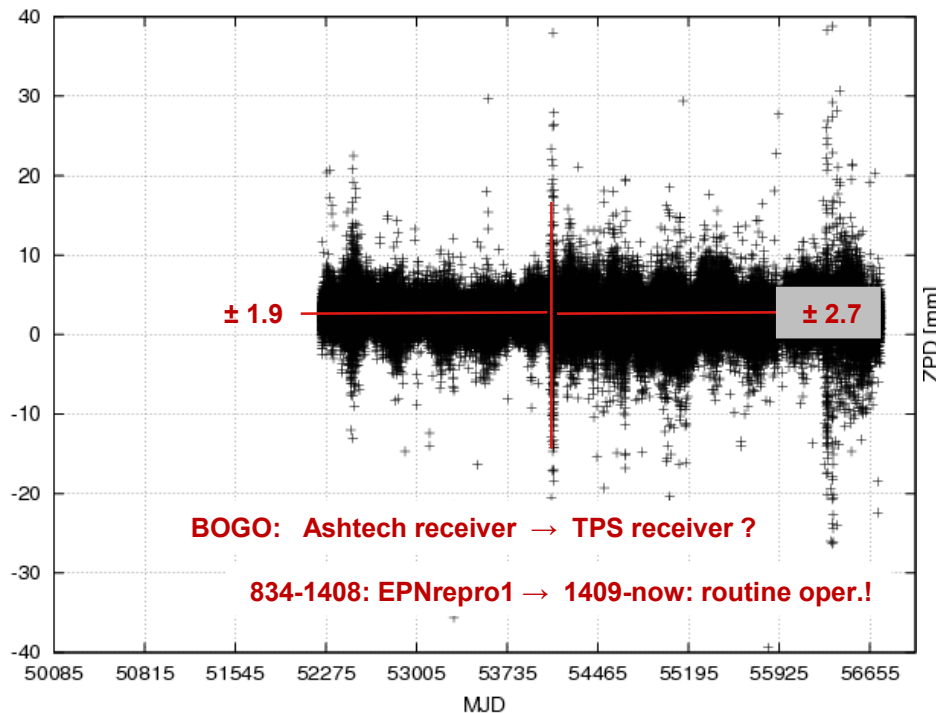
ZTD estimates for twin stations

- Time series of ZTD differences using EUREF combined solution
- Number of co-location sites: 33
 - BOGI-BOGO, BORJ-BORK, CAGL-CAGZ, HERS-HERT, JOZ2-JOZE, KRA1-KRAW, MAD2-MADR, MOP2-MOPI, NYA1-NYAL, OBE2-OBET, PEN2-PENC, THU1-THU3, TRO1-TROM, WETT-WTZR, ZIM2-ZIMM
- Many co-located stations without common observation period
 - CEU1-CEUT, DUB2-DUBR, HOE2-HOER, HFL2-HFLK, INVE-INVR, LIL2-LILL, MAN2-MANS, NOT1-NOTO, OSLO-OSLS, PADO-UPAD, PFA2-PFAN, RIO1-RIOJ, SBG2-SBGZ, STAS-STAV, SUR4-SUUR, TRF2-TRFB, VARD-VARS, VEN1-VEVE
- Station pairs with distances up to 30-40 km
 - BADH-KLOP, BOLG-MEDI, BRON-MDOR, BRST-GUIP, EIJS-EUSK, EIJS-WARE, IENG-TORI, ILDX-LROC, KIR0-KIRU, MEDI-MSEL, MDOR-SJDV, MLVL-SMNE, TLMF-TLSE

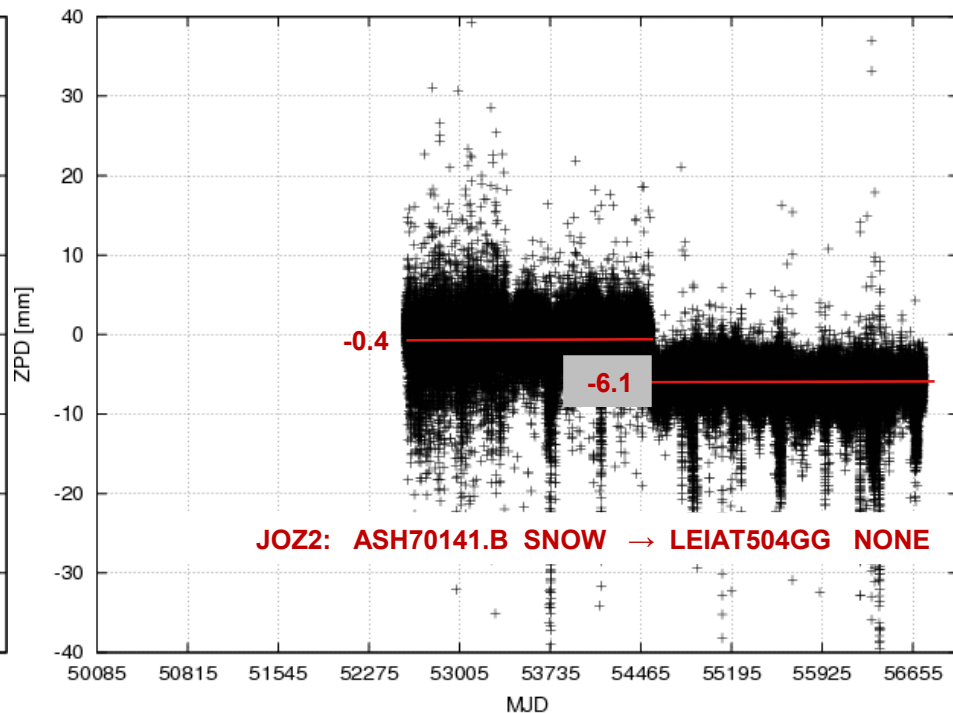
ZTD estimates for twin stations

- BOGI/BOGO (left) and JOZ2/JOZE -

ZPD differences BOGI minus BOGO from EUR: $+2.5 \pm 2.5$ mm (anz 98374, dist 0 km)



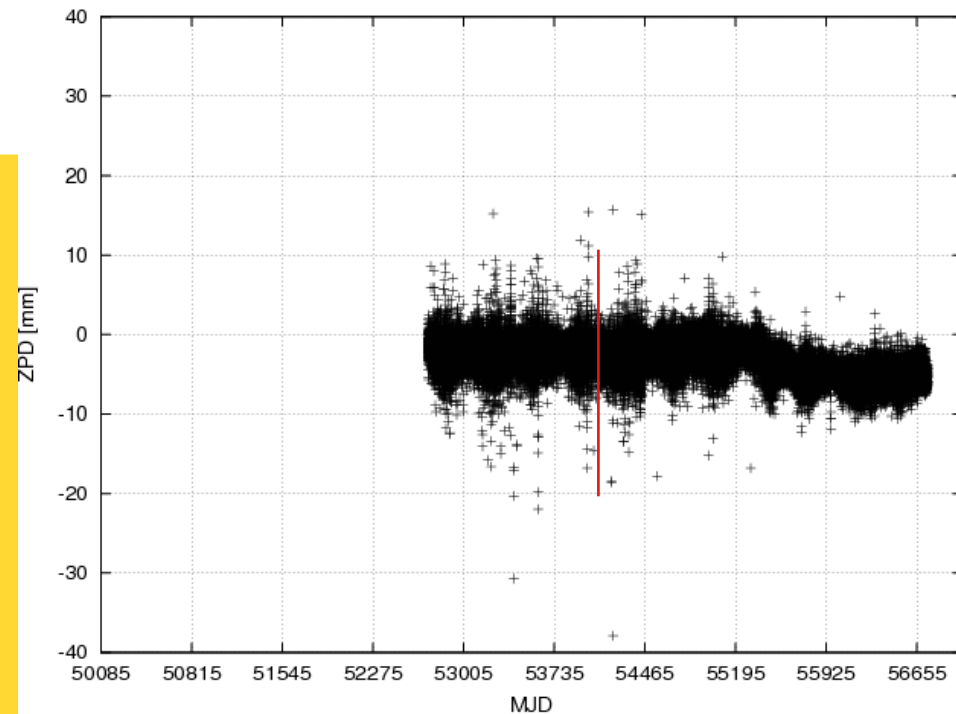
ZPD differences JOZ2 minus JOZE from EUR: -3.4 ± 4.4 mm (anz 89312, dist 0 km)



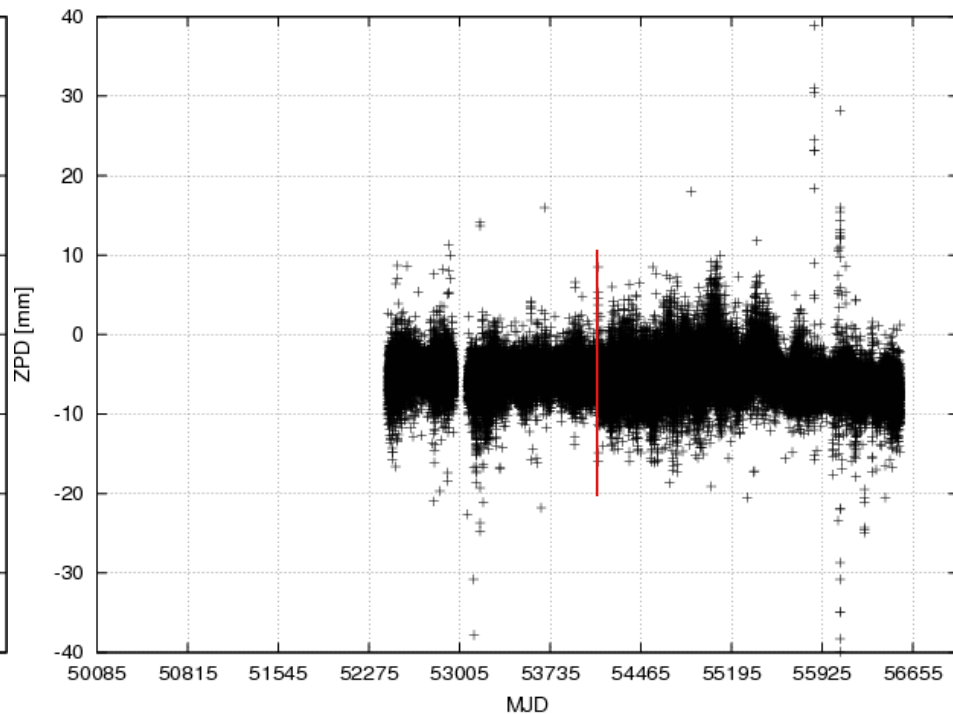
ZTD estimates for twin stations

- HERS/HERT (left) and CAGL/CAGZ -

ZPD differences HERT minus HERS from EUR: -3.2 ± 2.2 mm (anz 93310, dist 0 km)



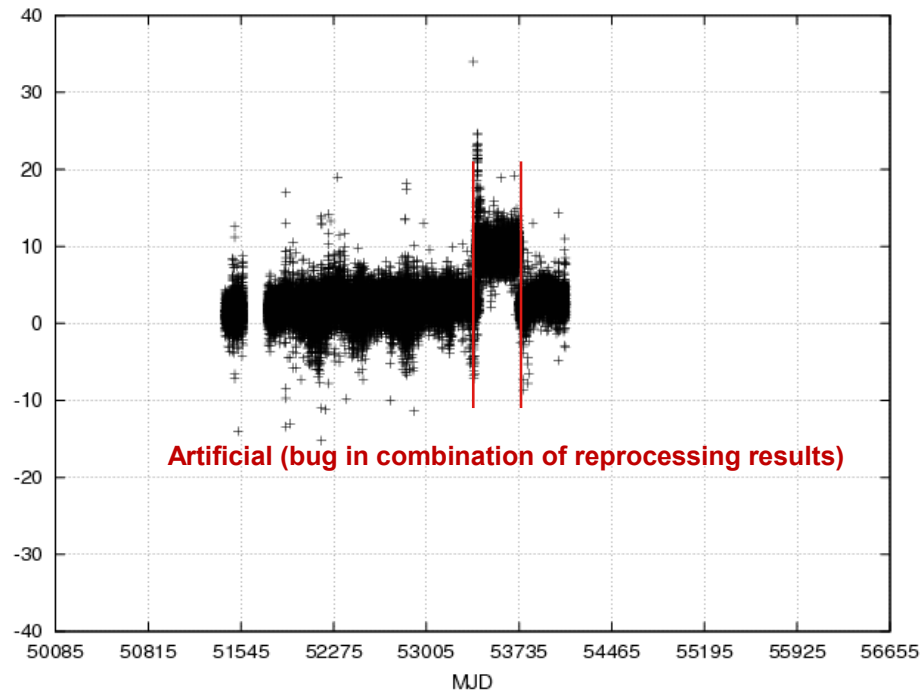
ZPD differences CAGZ minus CAGL from EUR: -5.3 ± 2.5 mm (anz 86719, dist 0 km)



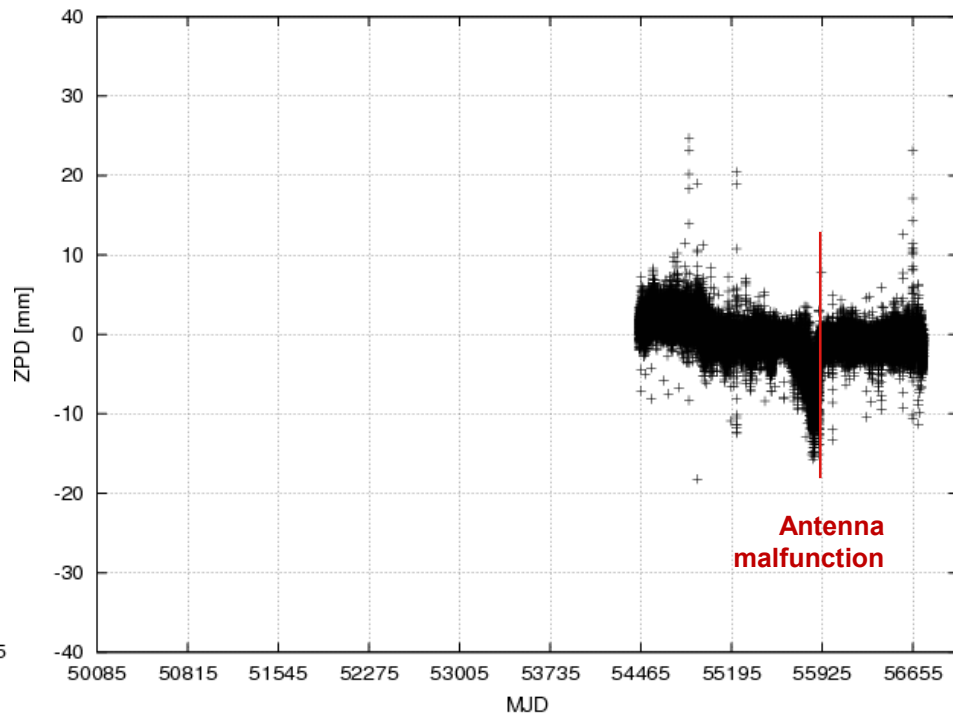
ZTD estimates for twin stations

- TRO1/TROM (left) and ZIM2/ZIMM -

ZPD differences TROM minus TRO1 from EUR: $+3.4 \pm 2.9$ mm (57995 data points)



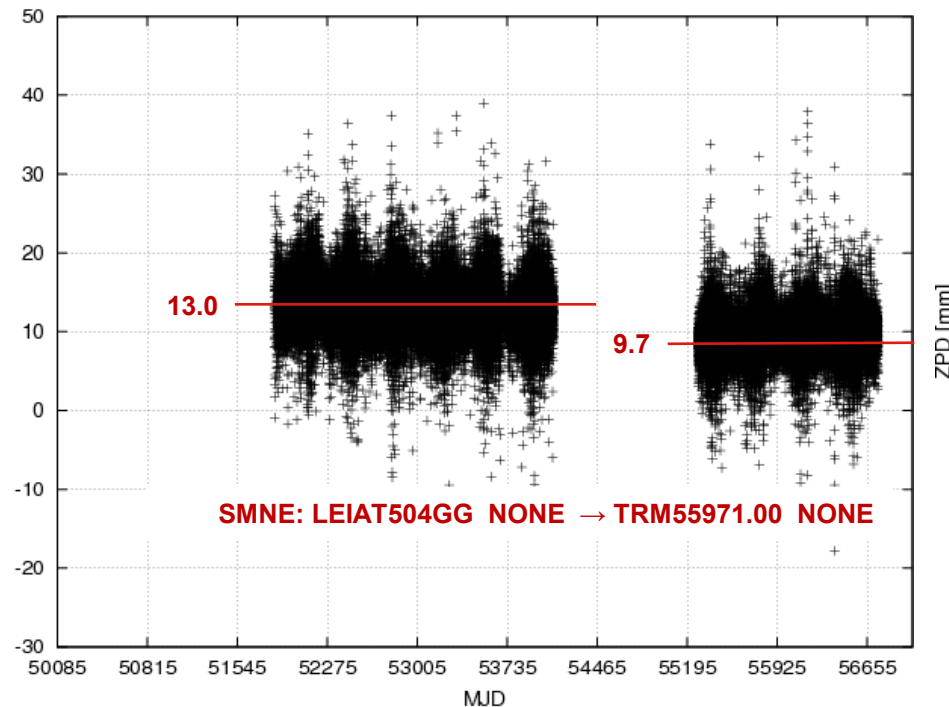
ZPD differences ZIM2 minus ZIMM from EUR: -0.5 ± 2.3 mm (anz 54504, dist 0 km)



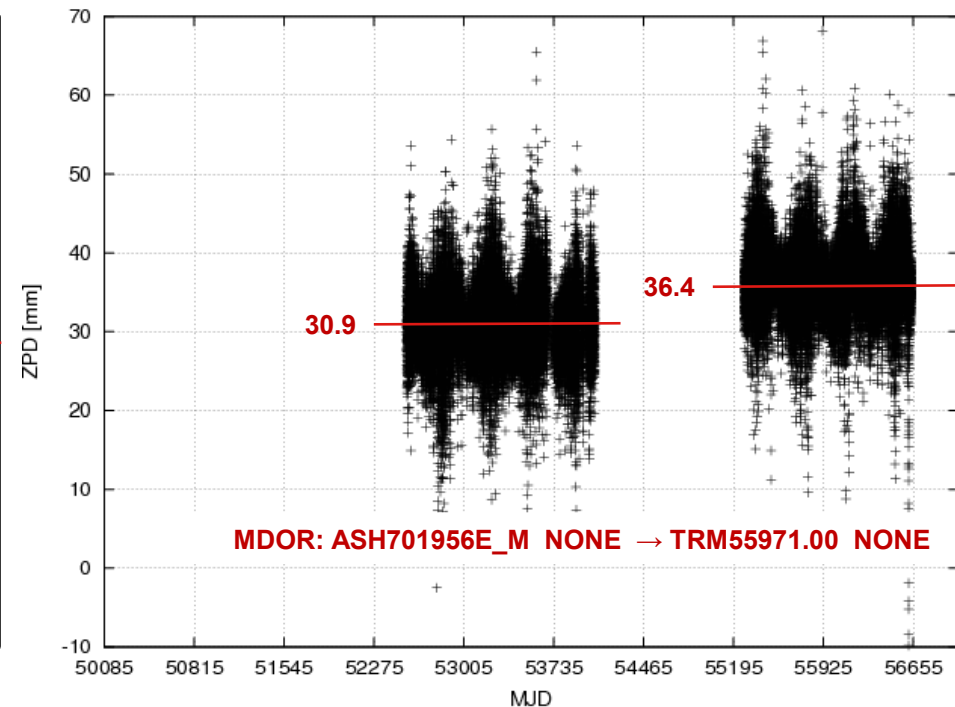
ZTD estimates for neighbored stations

- MLVL/SMNE (left) and MDOR/SJDV -

ZPD differences SMNE minus MLVL from EUR: $+11.6 \pm 3.4$ mm (anz 81852, dist 8 km)



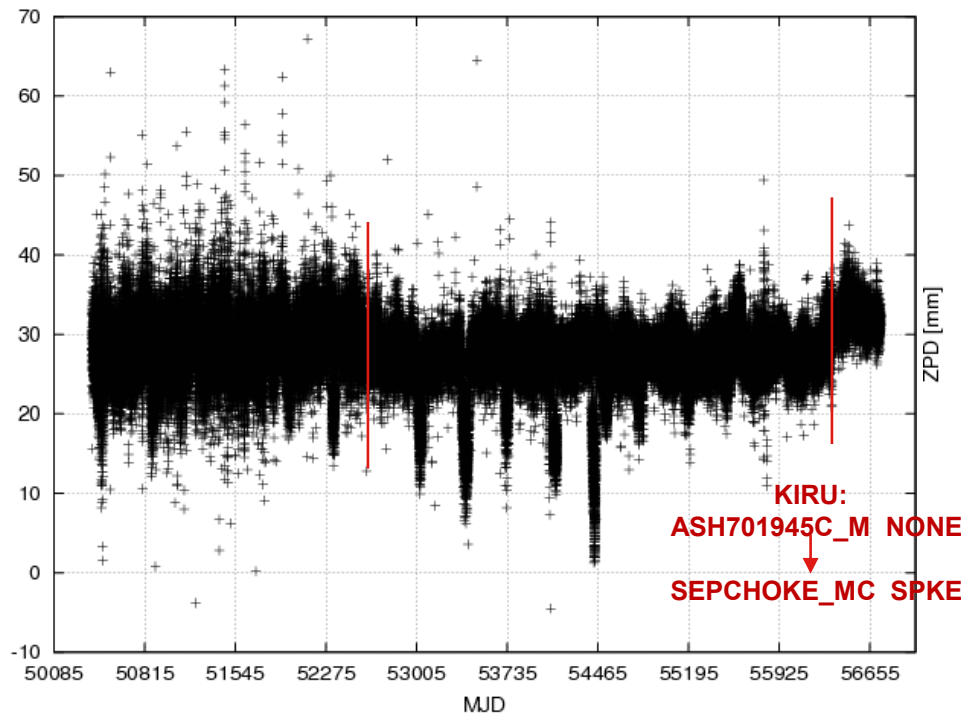
ZPD differences MDOR minus SJDV from EUR: $+33.8 \pm 5.1$ mm (anz 56550, dist 13 km)



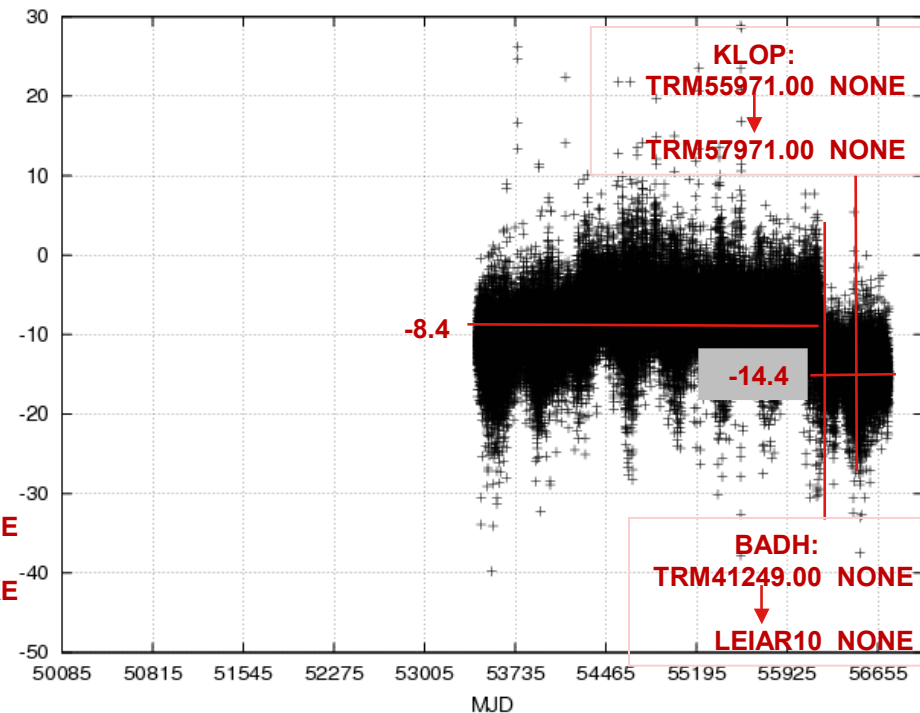
ZTD estimates for neighbored stations

- KIR0/KIRU (left) and BADH/KLOP -

ZPD differences KIRU minus KIR0 from EUR: +27.9 +/- 3.8 mm (anz 142698, dist 4 km)



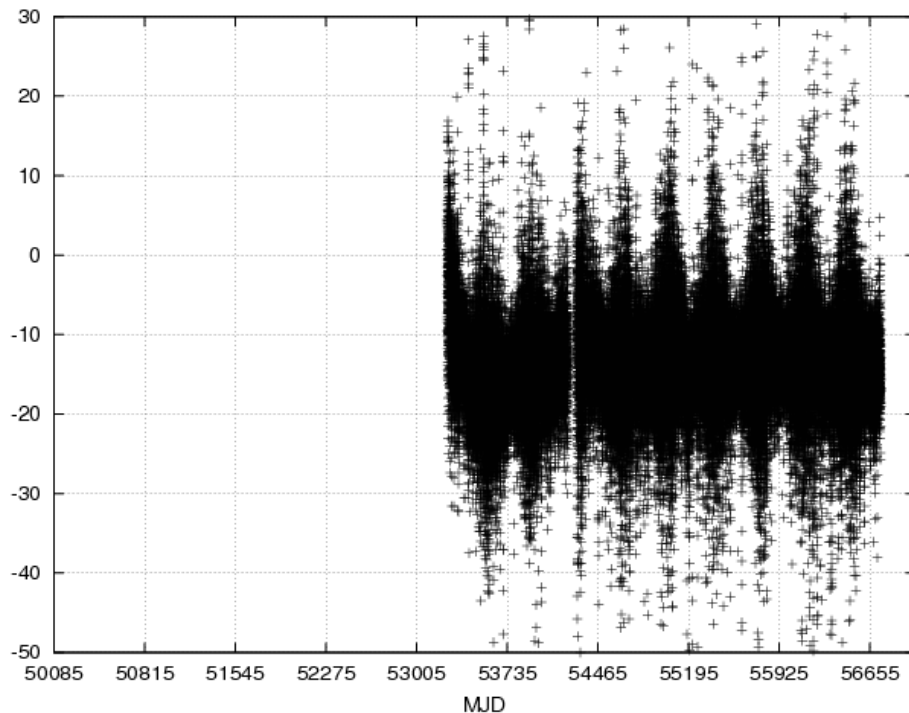
ZPD differences BADH minus KLOP from EUR: -9.3 +/- 4.3 mm (anz 76678, dist 9 km)



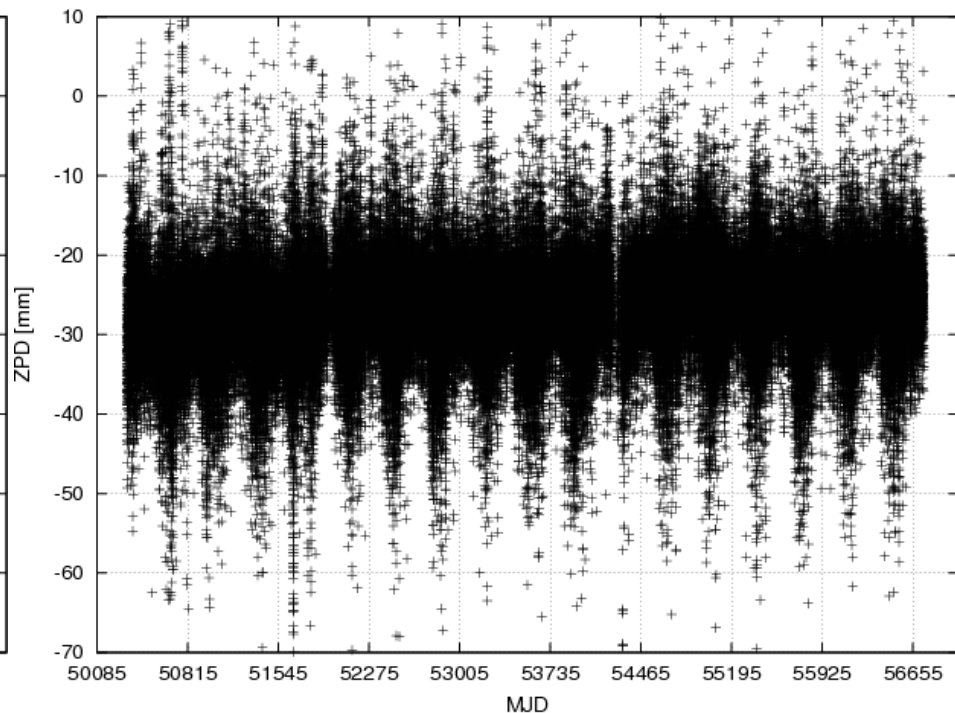
ZTD estimates for neighbored stations

- BOLG/MEDI (left) and EIJS/WARE -

ZPD differences BOLG minus MEDI from EUR: -13.5 ± 6.6 mm (anz 75876, dist 23 km)



ZPD differences WARE minus EIJS from EUR: -26.8 ± 6.1 mm (anz 145270, dist 32 km)



Summary / Outlook

- **Impact of BSW version change up to 1-2 mm ZTD bias but increased scattering in few cases**
- **Change of antenna (other manufacturer) may lead to jumps in time series up to 6 mm ZTD**
- **Comparison of ZTD time series at twin stations may be interesting or even useful as part of a general analysis**
- **Results from EPNrepro2 may further reduce noise level of difference time series**
- **Combination of gradients may be a topic for the future**

Thank you for your kind attention!

Contact:

Bundesamt für Kartographie und Geodäsie
Referat G2
Richard-Strauss-Allee 11
60598 Frankfurt

Contact person:
Wolfgang Söhne
wolfgang.soehne@bkg.bund.de
www.bkg.bund.de
Tel. +49 (0) 69 6333-263