



# Status of the EPN troposphere product

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- **History**
- **Status**
- **To do**



- **GPS week 1108: first solutions (June 2001)**
- **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, e.g.,  
switch to 1 hr ZPD resolution  
Contribution of DEO and ROB**



- **GPS week 1143: Switch to new reference frame ITRF 2000  
Contribution of SGO**
- **GPS week 1143: COE using Wet Niell, switching to  
(unofficial) BSW v5.0**
- **GPS week 1185: Contribution of SUT as 16<sup>th</sup> LAC (Sep '02)**
- **GPS week 1203: Contribution of EPN rapid troposphere  
solution to IGS combination**
- **GPS week 1307: GFZ stops EPN combination (IGS  
troposphere combination is moving  
from GFZ to JPL)**
- **GPS week 1317: LPT switching to 5.0, Wet Niell mf  
(EUREF mail 2360)**



- **GPS week 1318: WUT switching to 5.0, Wet Niell mf (EUREF mail 2363)**
- **GPS week 1319: BKG switching to 5.0, Wet Niell mf (EPN LAC mail 490)**
- **GPS week 1320: GOP switching to 5.0, Wet Niell mf (EPN LAC mail 508)**
- **GPS week 1321: NKG switching to 5.0, Wet Niell mf (EPN LAC mail 505)**
- **GPS week 1324: UPA switching to 5.0, Wet Niell mf**
- **GPS week 1325: ROB switching to 5.0, Wet Niell mf**
- **GPS week 1335: New interpolation procedure for ASI solution (EPN rapid troposphere combination only)**

- **GPS week 1346: “Small” outliers rejection improved**
- **GPS week 1364: IGE switching to 5.0, Wet Niell mf (EPN LAC mail 623)**
- **GPS week 1374: ASI switching from Microcosm 2003.0 to 2005.0**
- **GPS week 1381: SGO switching to 5.0, Wet Niell mf**
- **GPS week 1397: OLG switching to 5.0, Wet Niell mf**
- **GPS week 1400: BEK switching to 5.0, Wet Niell mf  
IGN switching to 5.0, Wet Niell mf  
SUT switching to 5.0, Wet Niell mf**



### Resolution no. 1

- **GPS**

The IAG Reference Frame Sub-commission for Europe (EUREF)

*recognising* the quality of:

- the combined tropospheric zenith path delays produced weekly by the EPN Troposphere Special Project, and
- the time series of station positions and velocities generated regularly by the EPN Time Series Special Project,

- **GPS**

- **GPS**

- **June**

*noting* that both projects have reached a level of maturity where their results are now being used in routine EPN operations

*recommends* the transition of both projects to operational status and that their products are used as standard in routine EPN operations.

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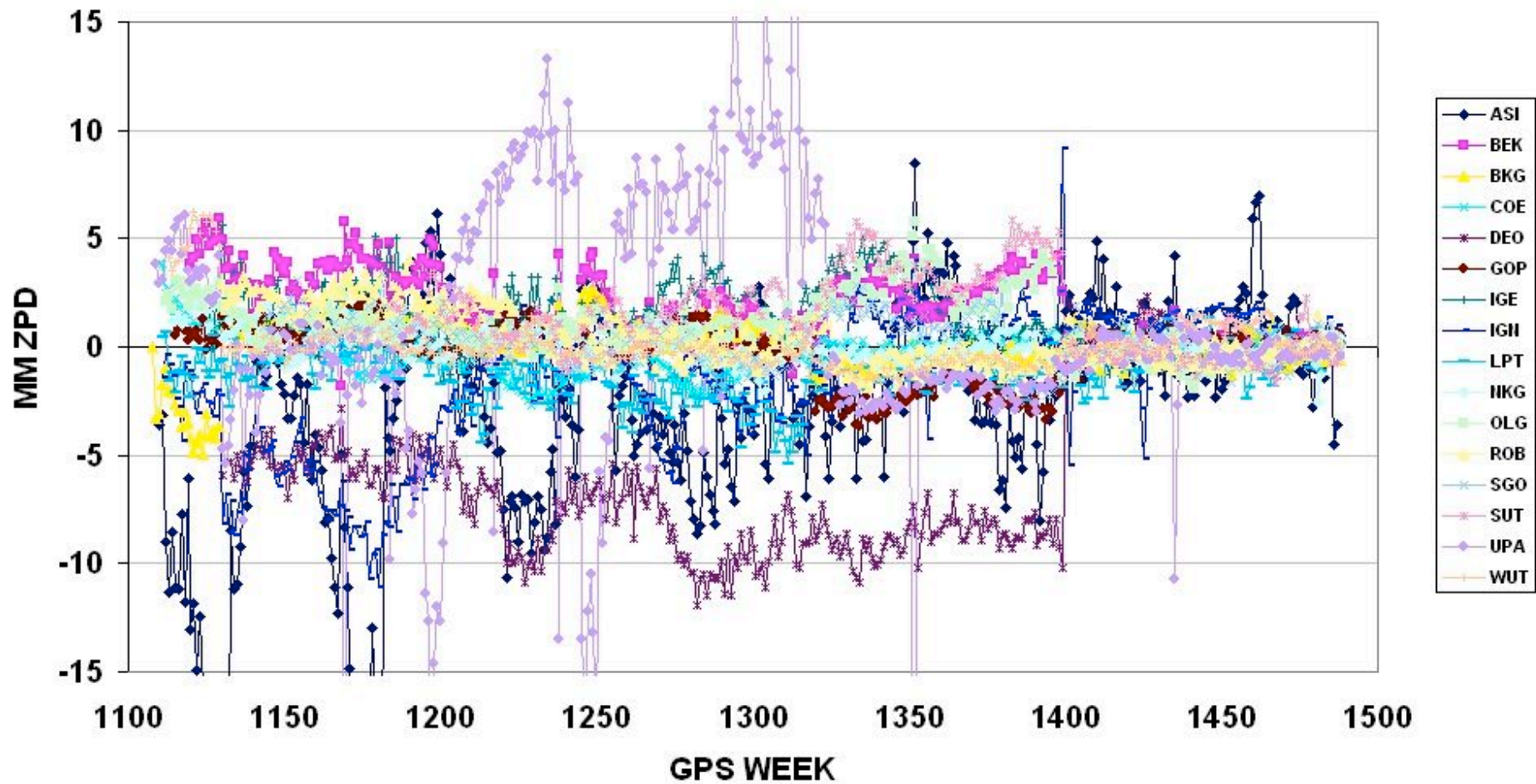
fficial)

- **EPN troposphere combination done by a mixture of Perl scripts, Fortran programs and shell scripts**
- **Combination procedure still based on the scheme developed by Gerd Gendt for the IGS combination**
- **Combination still in two steps**
  - **“Rapid” solution each Friday night (8 days after IGS finals)**  
→ to find big errors, missing solutions etc. to inform the LACs
  - **Final solution following SNX combination**



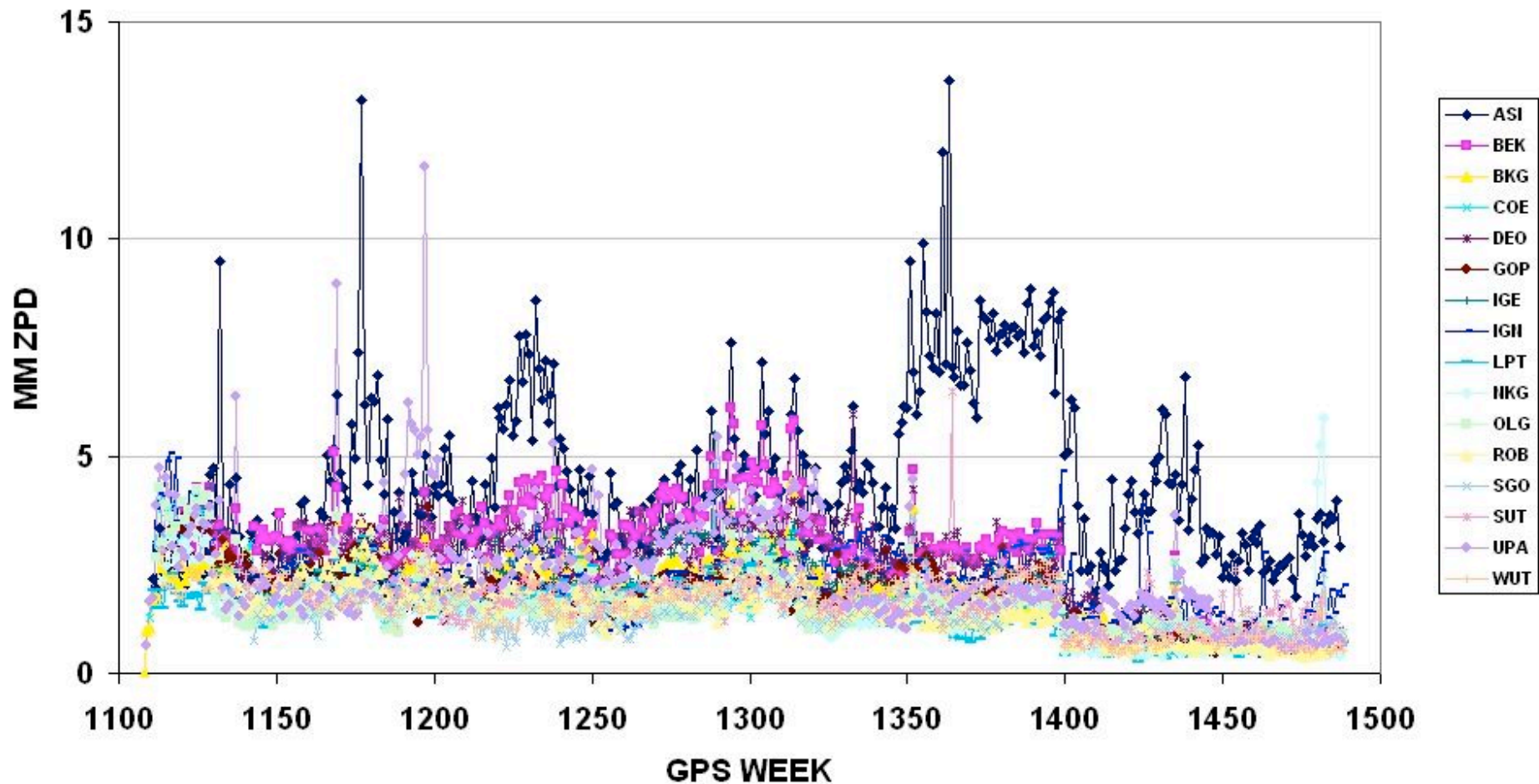


### Weekly mean biases of the individual LAC troposphere solutions with respect to the EPN combined solution





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




EUREF Permanent GNSS Network > Data & Products > Products - Windows Internet Explorer

http://www.epncb.oma.be/\_dataproduts/products/

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## PRODUCTS

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### Weekly EPN Solutions

The core product of the EUREF Permanent Network is the weekly coordinate estimates for the EPN tracking stations and their covariance information in the SINEX format. These coordinates are outcome from the so-called "combined EPN solution" which is based on the subnetwork solutions submitted by the EPN Analysis Centres.

### Station Coordinates and Velocities

The coordinates and velocities of the EPN tracking sites are available with an accuracy of a cm or better in the different realizations of the ITRS and ETRS89. In addition, regularly updated coordinates using the latest tracking data as well as coordinates for recent sites not yet included in the ITRS are also given.

### Time Series Analysis

By stacking the weekly EPN solutions (available since the start of the EPN until today), precise station coordinates/velocities, as well as information on the non-linear behaviour of the coordinates and their noise type is obtained. The raw and cleaned coordinate times series show how the site coordinates change with time.

### Site Zenith Path Delays

Within the routine analysis of a network of ground-based GPS receivers, such as the EPN, the tropospheric parameters are a by-product of the parameter estimation. The EPN makes available the tropospheric zenith path delays at all of its stations based on the estimates of all its Local Analysis Centres.

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http://www.epncb.oma.be/\_dataproduts/products/sitezenithpathdelays/

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As the result of the combination two files for each week 'www' are produced:

- a summary file (EURwww7.TSU) with some statistics about, e.g., frequencies of the analyzed sites and accuracies of a single AC solution, providing the feedback to the contributing LACs, and
- the output file (EURwww7.TRO) containing the combined troposphere estimates with a two hours sampling rate. The coordinates as a necessary part of this file, are taken from EUREF's official combined SINEX file. Hence, stations without estimated coordinates in the weekly SINEX file are not included in the combined troposphere solutions.

The troposphere-related files can be downloaded from the [EUREF product directory](#) at BKG since GPS week 1110.

### Products

ZPD time series	ZPD biases time series
Zenith Path Delay time series extracted from weekly EPN troposphere combined solution.	Time series of Zenith Path Delay biases for the participating LACs.
Updated weekly (select a station) (select a station) ACOR (A Coruna, Spain) AJAC (Ajaccio, France) ALAC (Alicante, Spain) ALBA (Albacete, Spain) ALME (Almeria, Spain) AMMN (Amman, Jordan) ANKR (Ankara, Turkey) AQU1 (L'Aquila, Italy) AUT1 (Thessaloniki, Greece) AUTN (Autun, France) BACA (Bacau, Romania) BADH (Bad Homburg, Germany) BAIA (Baia Mare, Romania) BBYS (Banska Bystrica, Slovak Republic) BELF (Belfast, United Kingdom) BELL (Bellmunt de Segarra, Spain) BISK (Zlate Hory, Czech Republic) BOGI (Borowa Gora, Poland) BOGO (Borowa Gora, Poland) BOLG (Bologna, Italy) BOR1 (Borowiec, Poland) BORJ (Borkum (Island of Borkum), Germany) BORK (Borkum, Germany) BORR (Borriana, Spain) BRST (Brest, France) BRUS (Brussels, Belgium) BSCN (Besançon, France) BUCU (Bucuresti, Romania) BUDP (Kobenhavn, Denmark)	Updated weekly (select a station)  Purpose : <ul style="list-style-type: none"> <li>• Show the agreement of the individual EPN LACs ZPD solutions</li> <li>• Visualize potential periodic signals</li> <li>• Reflect changes in, e.g. used options, analysis procedures etc.</li> </ul> Procedure : <ul style="list-style-type: none"> <li>• EPN LACs are delivering estimated ZPD parameters on a daily basis</li> <li>• These solutions are combined to the EPN combined (mean) solution considering the biases between the individual solutions (this way jumps will be avoided if single observations of the individual solutions are missing)</li> <li>• The resulting daily biases show the agreement of the LACs individual solutions to each other and to the mean</li> </ul>
derived from the EPN combined  of the individual LACs solutions  al LACs solutions are excluded eiation exceeding 15 mm tions are excluded before the  ar LAC are eliminated for single series exceeds 20 mm solution exceeding a standard for potential outliers	
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## TRACKING NETWORK

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## DATA & PRODUCTS

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## NEWS & MAILS

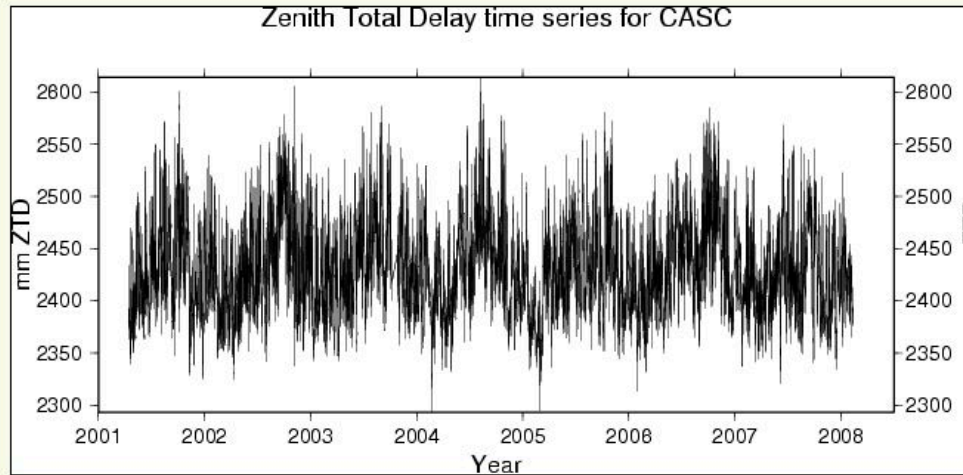
News, Mails, Calendar, Papers, Workshops, Web site history

## FTP & WEB ACCESS

Anonymous FTP, Web site index, Related links

[TRACKING NETWORK](#) > [STATIONS](#) > [SITE INFORMATION](#) > [CASC\\_139095001](#) > ZENITH PATH DELAY TIME SERIES

## ZENITH PATH DELAY TIME SERIES



### Explanations

#### Purpose

- Show time series of Zenith Total Delay (ZTD) parameters derived from the EPN combined solution

#### Procedure

- Combination of daily SINEX TRO files of the individual LACs solutions on a weekly basis
- Weak ZTD estimates of LACs solutions are excluded because of a standard deviation exceeding 15 mm
- Outliers of the input solutions are excluded before the combination
- Site-specific solutions of a single LAC eliminated for particular days if the standard deviation of the series exceeds 20 mm
- ZTD values of the combined solution exceeding a standard deviation of 20 mm were investigated for outliers



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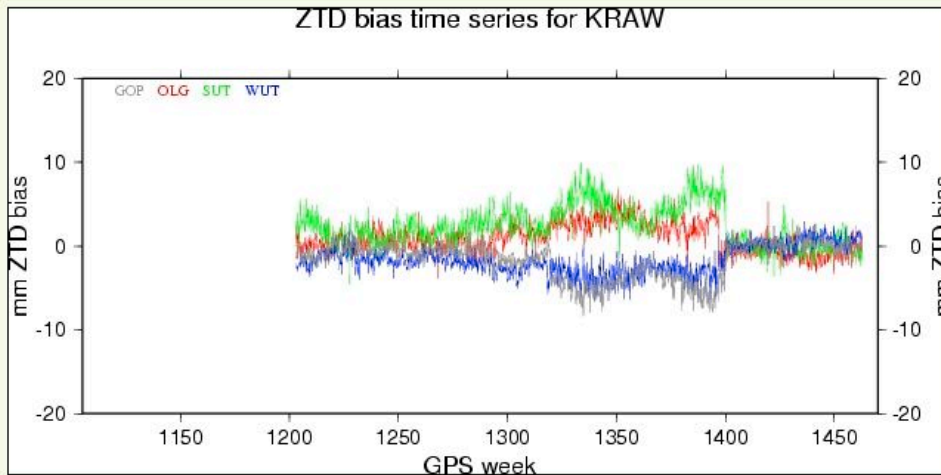
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[TRACKING NETWORK](#) > [STATIONS](#) > [SITE INFORMATION](#) > [KRAW\\_12218M001](#) > DAILY ZTD BIASES FROM EUREF COMBINATION

## DAILY ZTD BIASES FROM EUREF COMBINATION



### Explanations

#### Purpose

- Show the agreement of the individual EPN Local Analysis Centres (LACs) zenith total delay (ZTD) solutions
- Visualize potential periodic signals
- Reflect changes in, e.g. used options, analysis procedures etc.

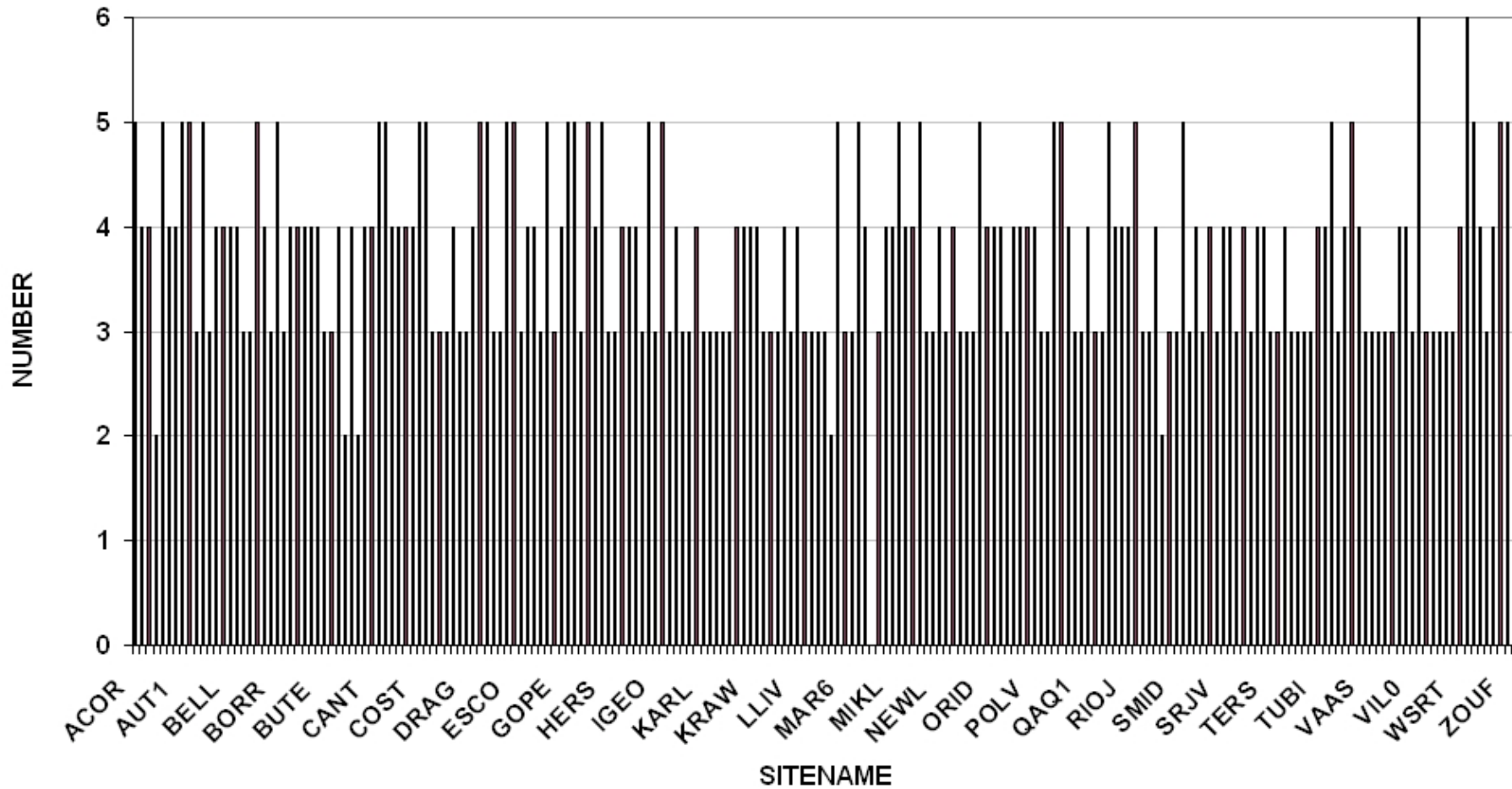
#### Procedure

- EPN Local Analysis Centres (LACs) are delivering estimated zenith total delay (ZTD) parameters on a daily basis
- These solutions are combined to the EPN combined (mean) solution considering the biases between the individual solutions
- The resulting daily biases show the agreement of the LACs individual solutions to each other and to the mean



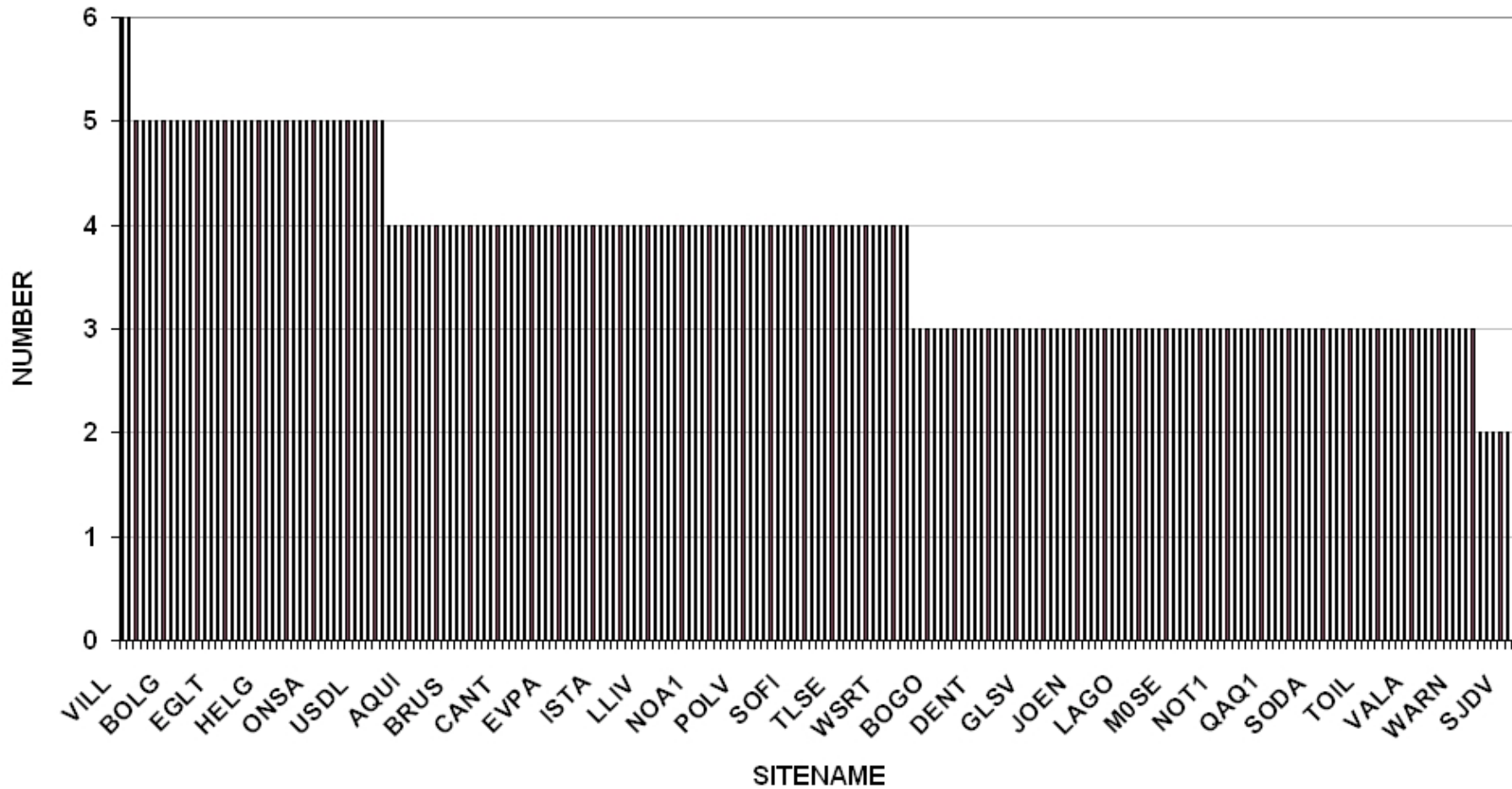


Number of LACs estimating the EPN stations for troposphere (GPS week 1491, all 16 LACs available)  
- alphabetical order





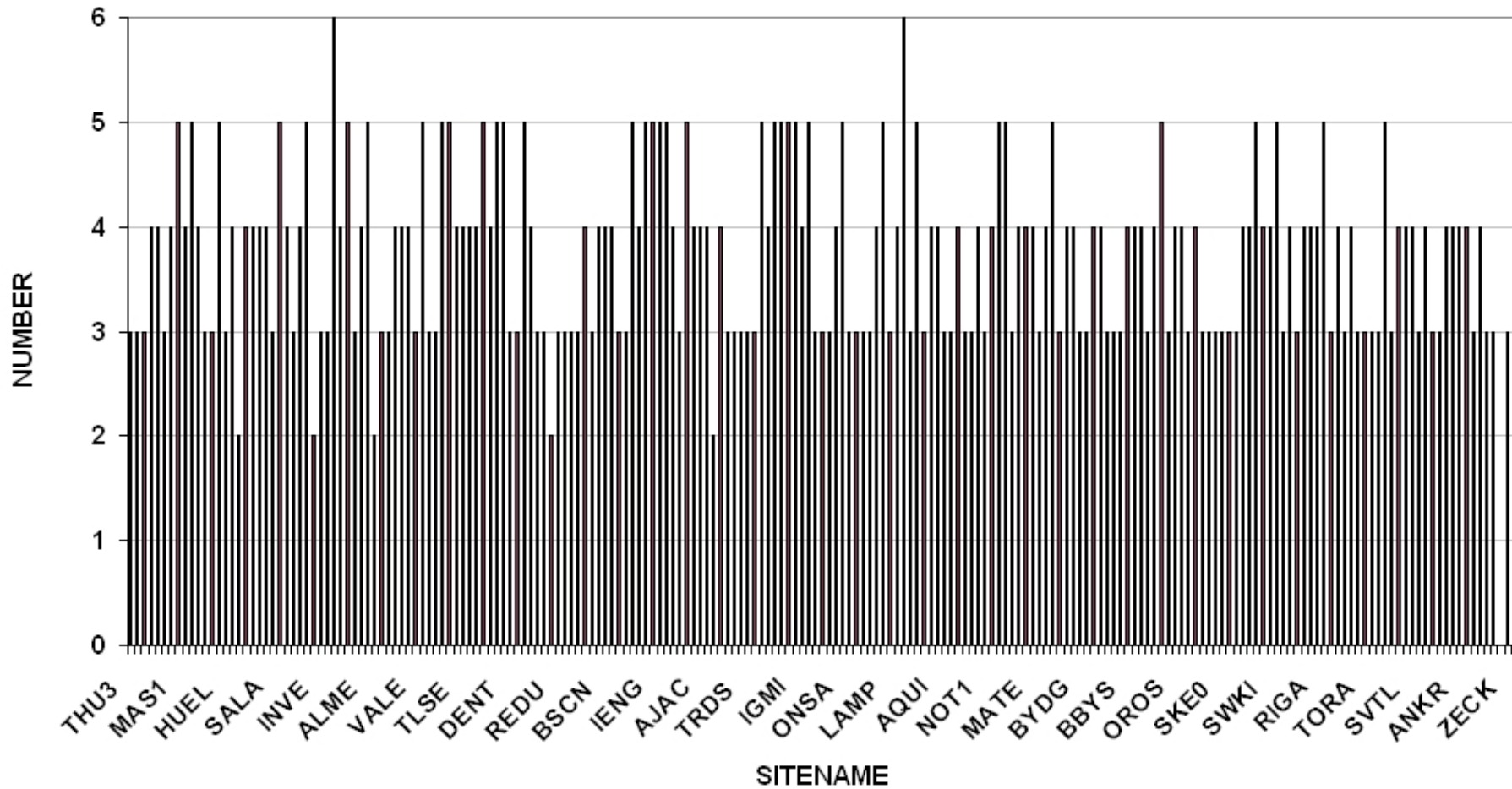
Number of LACs estimating the EPN stations for troposphere (GPS week 1491, all 16 LACs available)  
- sorted by number of LACs





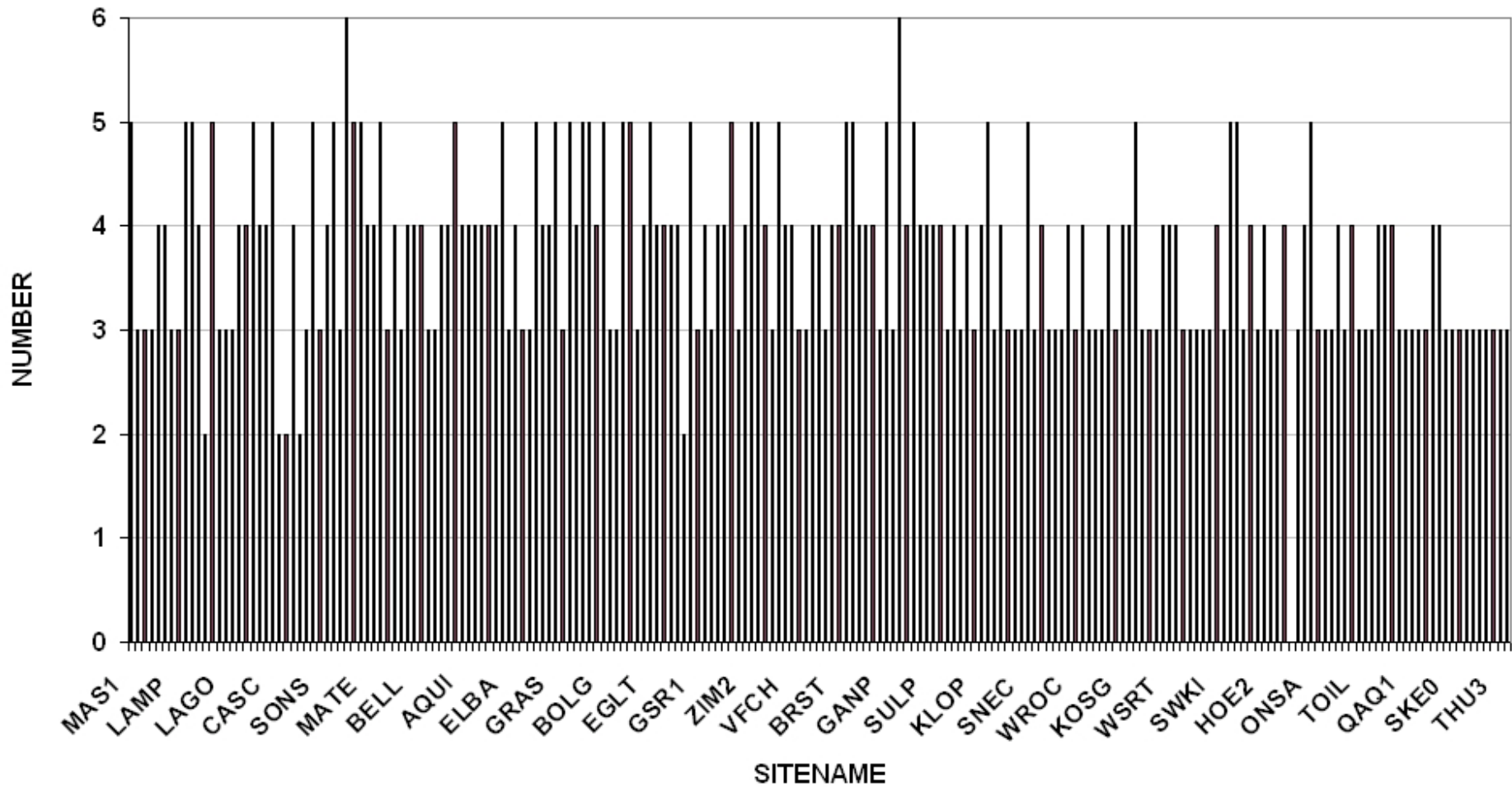


Number of LACs estimating the EPN stations for troposphere (GPS week 1491, all 16 LACs available)  
- sorted by longitude



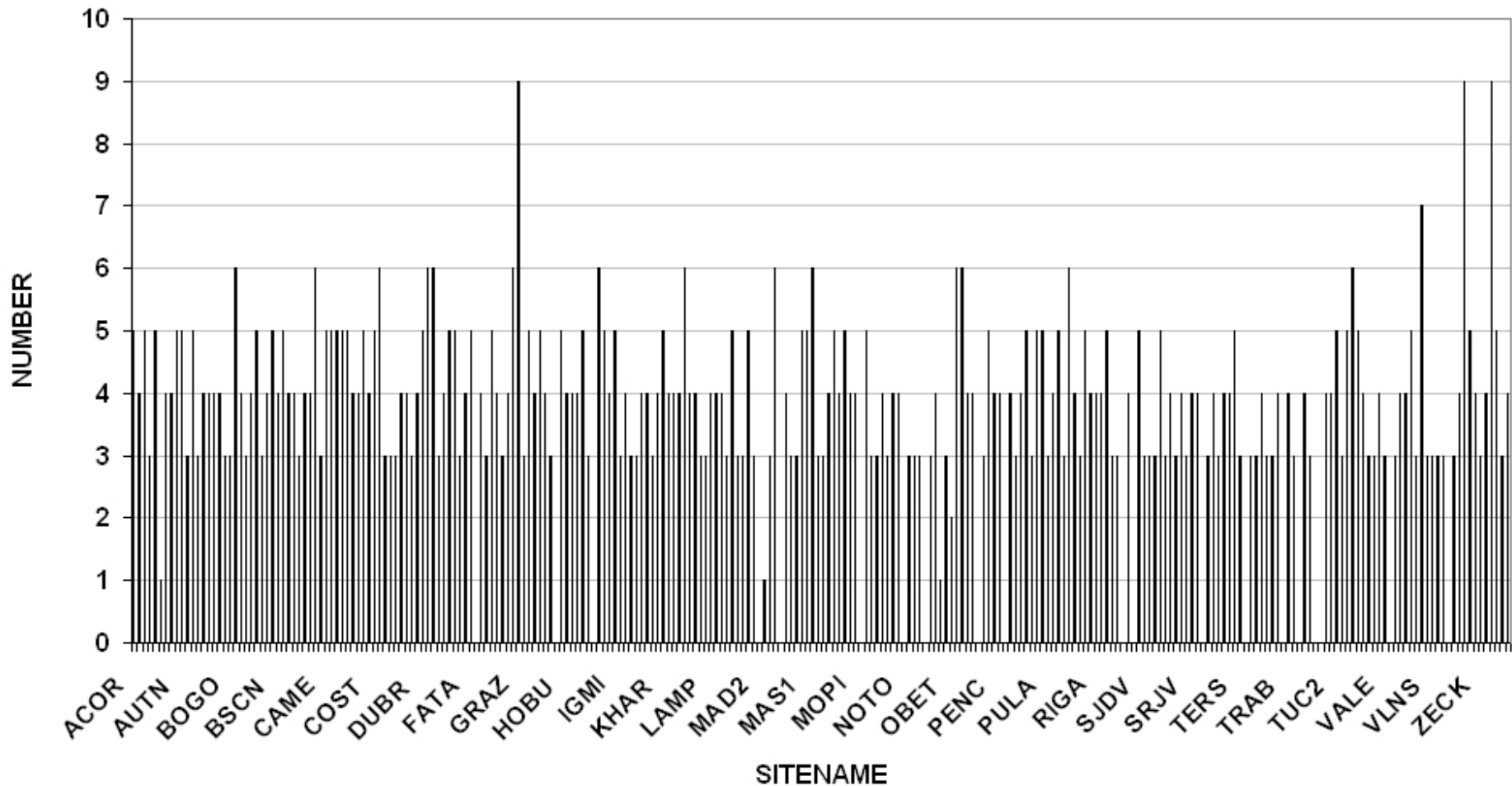


Number of LACs estimating the EPN stations for troposphere (GPS week 1491, all 16 LACs available)  
- sorted by latitude





Number of LACs estimating the EPN stations for troposphere (all GPS weeks, 258 stations) -  
alphabetical order





**ZTD difference between IVS combined solution and EUR combined solution for Ny  
Alesund,  $\Delta H=3.1$  m (not corrected for)  
Mean:  $-6.5 \pm 2.6$  //  $-1.1 \pm 2.8$  mm ZTD**

