



## E-GVAP Activities at ASI/CGS



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- Tropospheric solutions delivered to E-GVAP:

- European NWP DA **ASI\_**
- NWP DA , QC **ASIC**
- rapid-cycle NWP DA **ASIS**
- hourly PPP test solution **ASIR**



- E-GVAP Super Sites

- Tropospheric solutions delivered to EUREF:

- Routine **ASI, EUR**
- Reprocessed **AS0, EU0**





# Tropospheric solutions delivered to E-GVAP

## 4 solutions delivered to E-GVAP

ASI\_

Available from June 2001  
Input: hourly RNX files/IGU  
Update cycle: hourly  
*Purpose: NWP data assimilation*

Operational

4 scores per hour every 15min  
COSTV2.2a/ZTD + gradients  
~ 225 stations

ASIC

Available from November 2008  
Input: hourly operational cost solutions  
Update cycle: hourly  
*Purpose: NWP data assimilation + QC*

Operational

4 scores per hour every 15min  
COSTV2.2a/ZTD  
~ 166 stations

ASIS

Available from January 2014  
Input: RT GNSS observation/IGS RT  
Update cycle: 15min  
*Purpose: test RT obs+prod in sub-hourly PPP for nowcasting*

Test

4 scores per hour every 15min  
COSTV2.2a/ZTD + gradients  
~ 17 stations

ASIR

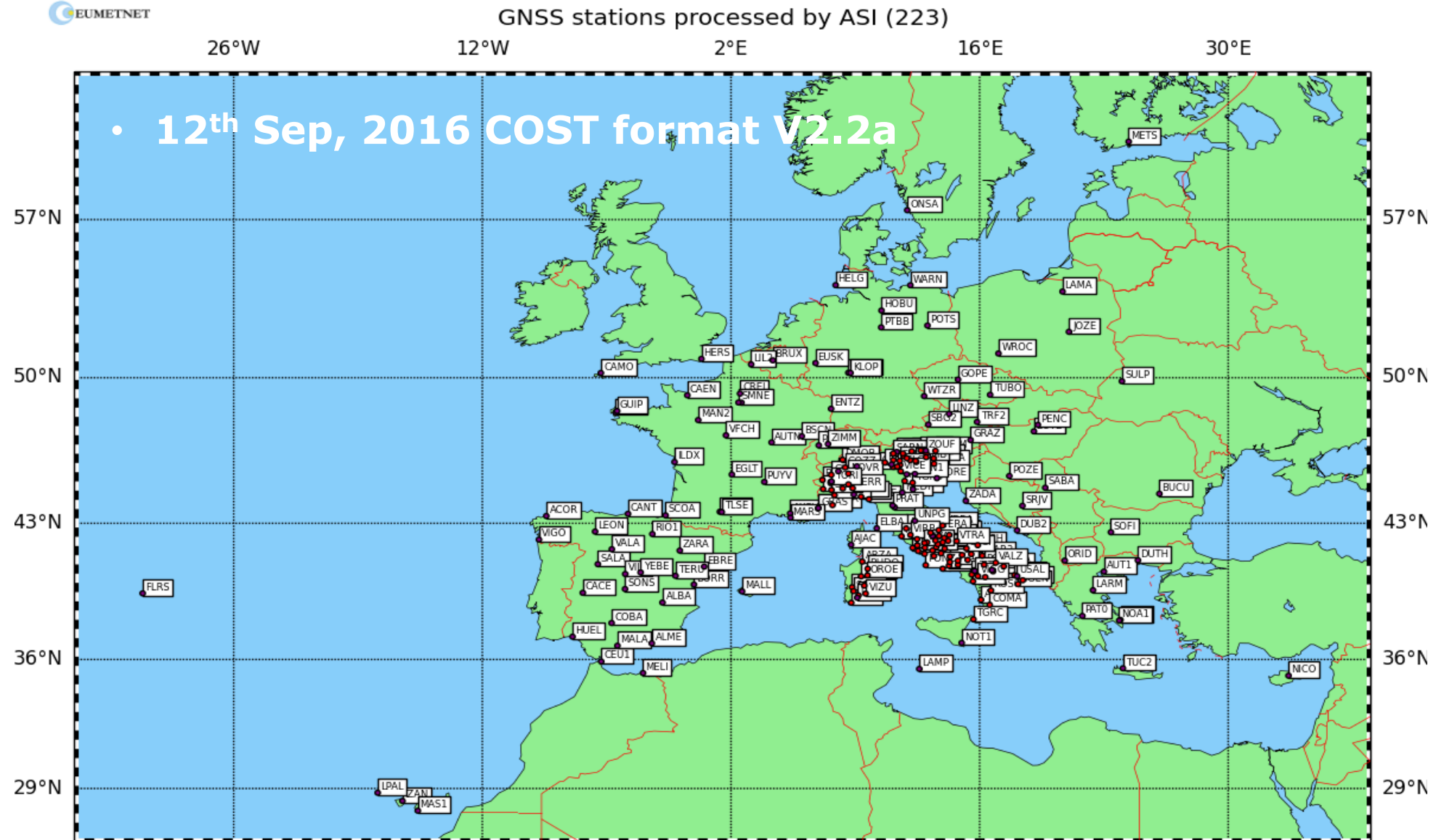
Available from March 2014  
Input: Hourly RNX files/IGS RT  
Update cycle: hourly  
*Purpose: test IGS RT prod in hourly PPP for NWP*

Test

4 scores per hour every 15min  
COSTV2.2a/ZTD + gradients  
~ 41 stations

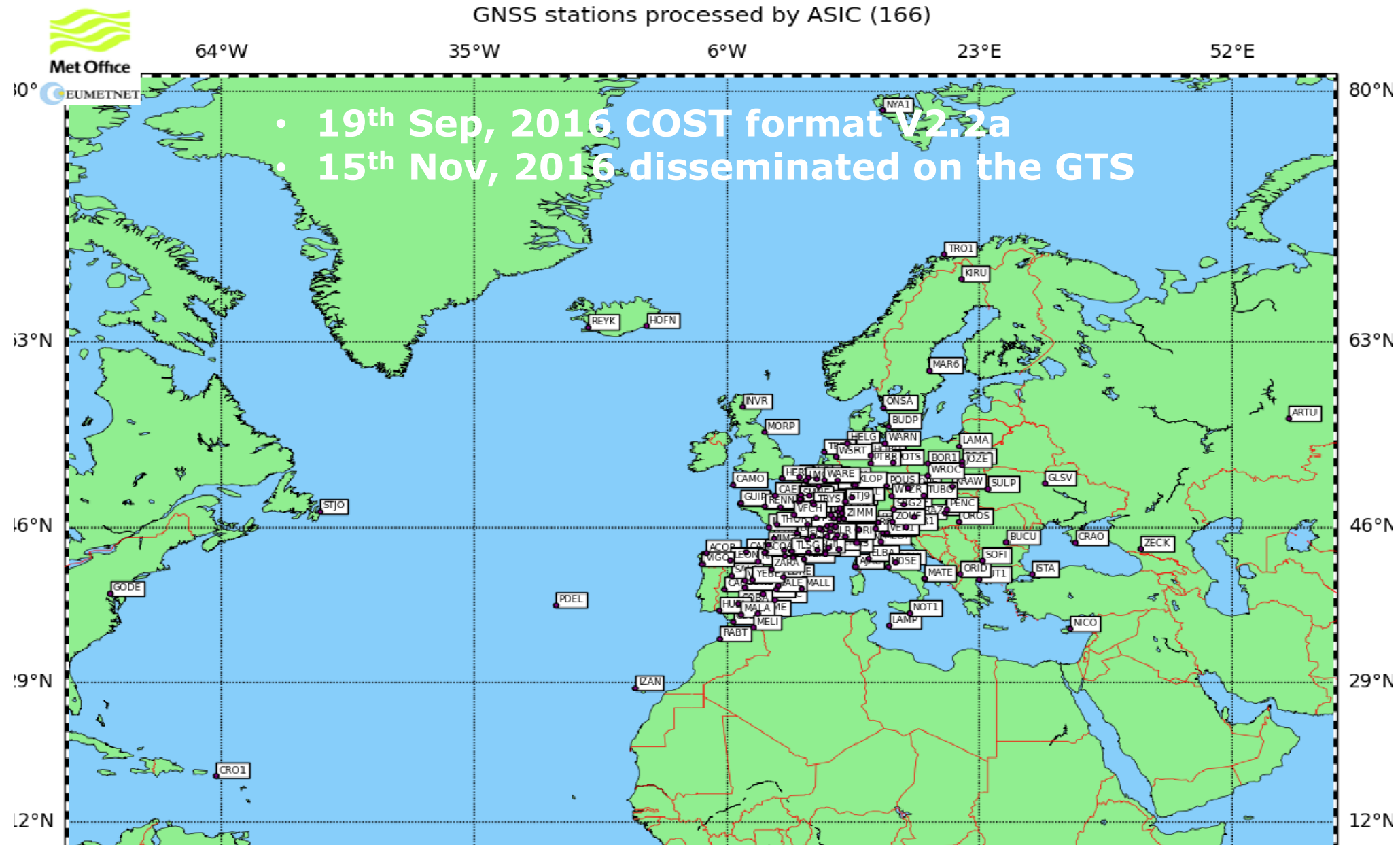


# ASI\_Operational Network





# ASIC Operational Network





# ASIC Operational Solution

- ASIC is a **combination on hourly basis** of hourly operational ZTD estimates delivered by E-GVAP ACs in 'COST 2.2a' format;
- **statistical mean** of the input estimates performed station by station if, and only if, at least 3 contributions are available for that station;
- ASIC **timeliness is larger** than that expected for the usual near-real time products, because its inputs are the ZTD operational solutions;
- ASIC data are available around **2.5-4 hours after observation time** (compared to around 1-2 hours for the near-real time single-AC products);

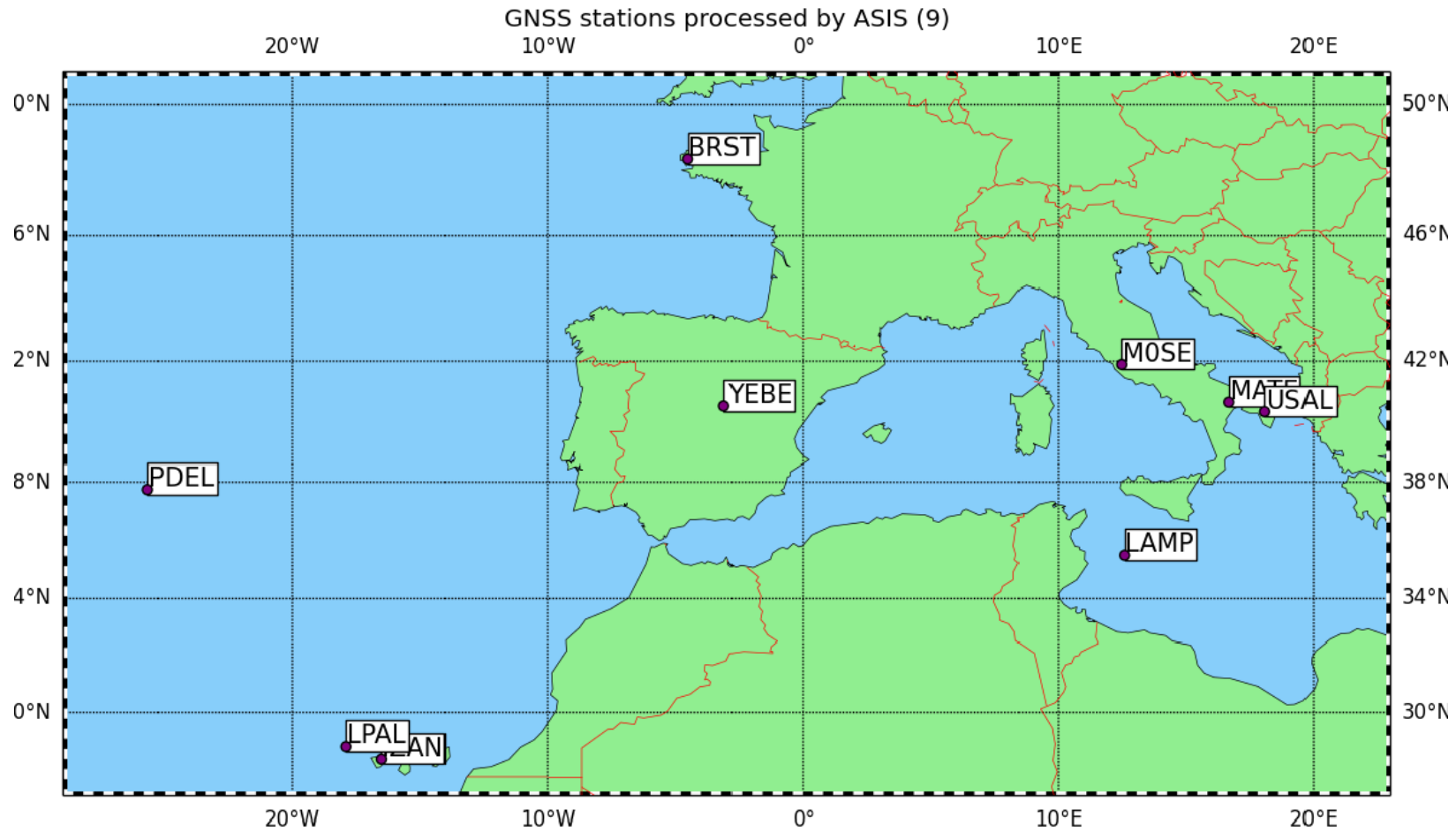


# ASIC Operational Solution

- ASIC **data quality can be expected to be better than individual AC solutions** for any given GB-GNSS station;
- **ASIC header** is 'copy&paste' from whichever NRT AC is processed in the combination first (in strict alphabetic order); so the ID, DOMES, name & country and coordinates value need to be checked/corrected by that AC;
- KNMI, ROB and GFZ solutions will be included in ASIC as soon as they will be in 'COST 2.2a' format as operational solutions.



# ASIS Test Network

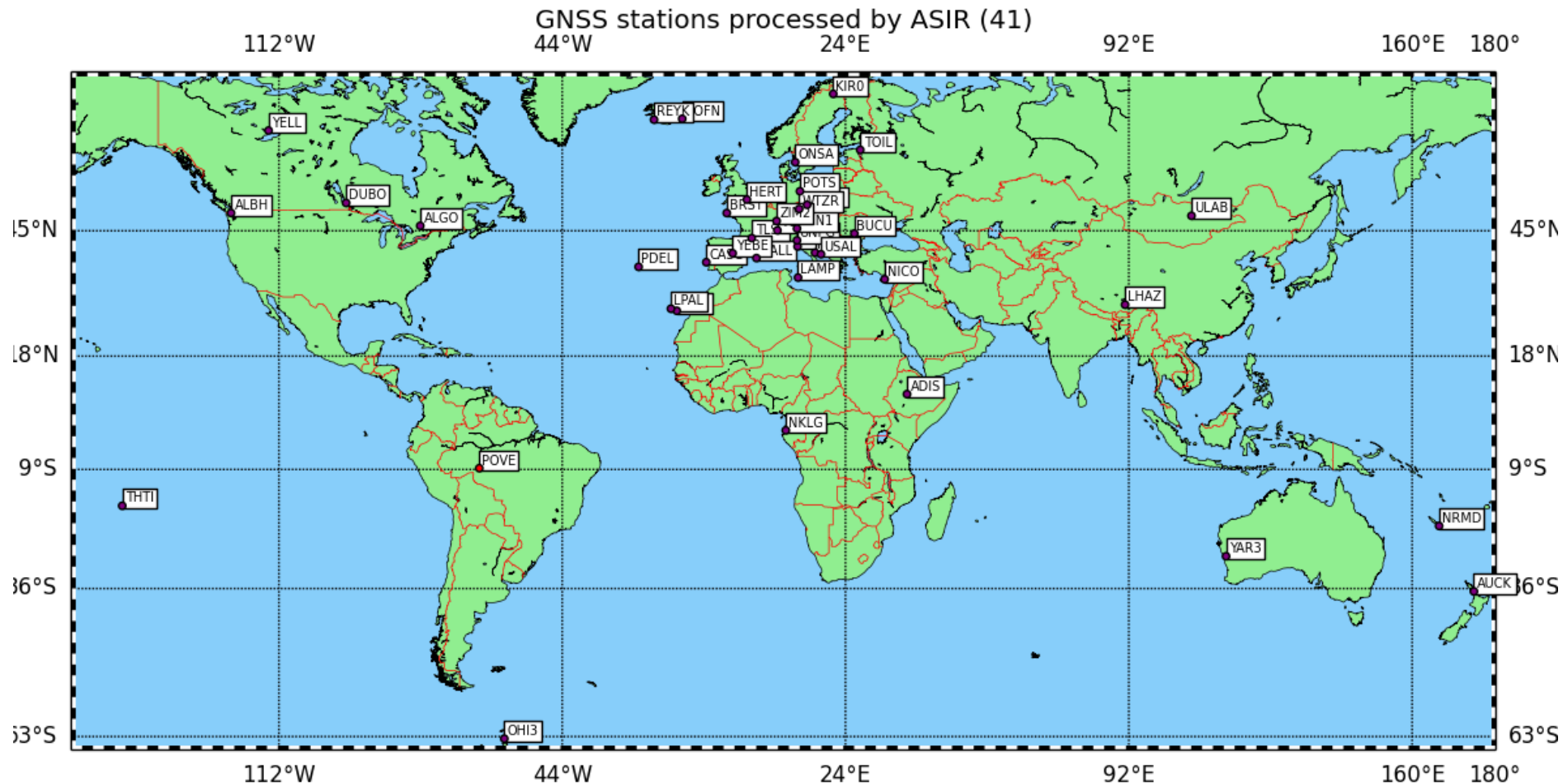




# ASIR Test Network



- Set up to evaluate IGS RT prod in hourly PPP for NWP
- Contribution to GNSS4SWEC WG1 Real Time PPP Campaign from May 2015
- Monitoring and Evaluation <http://www.pecny.cz/COST/RT-TROPO/>.

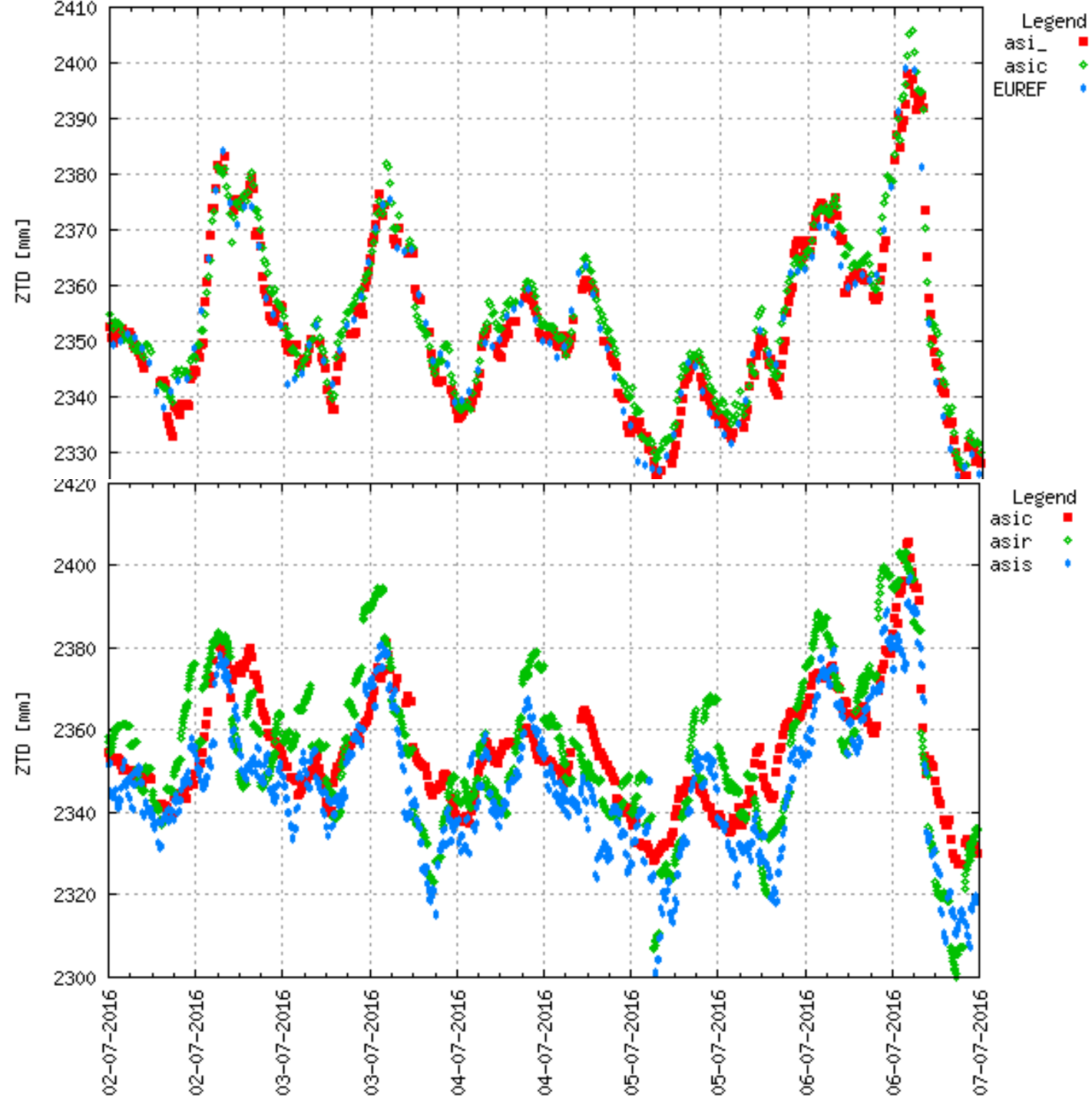




# MATE Time Series

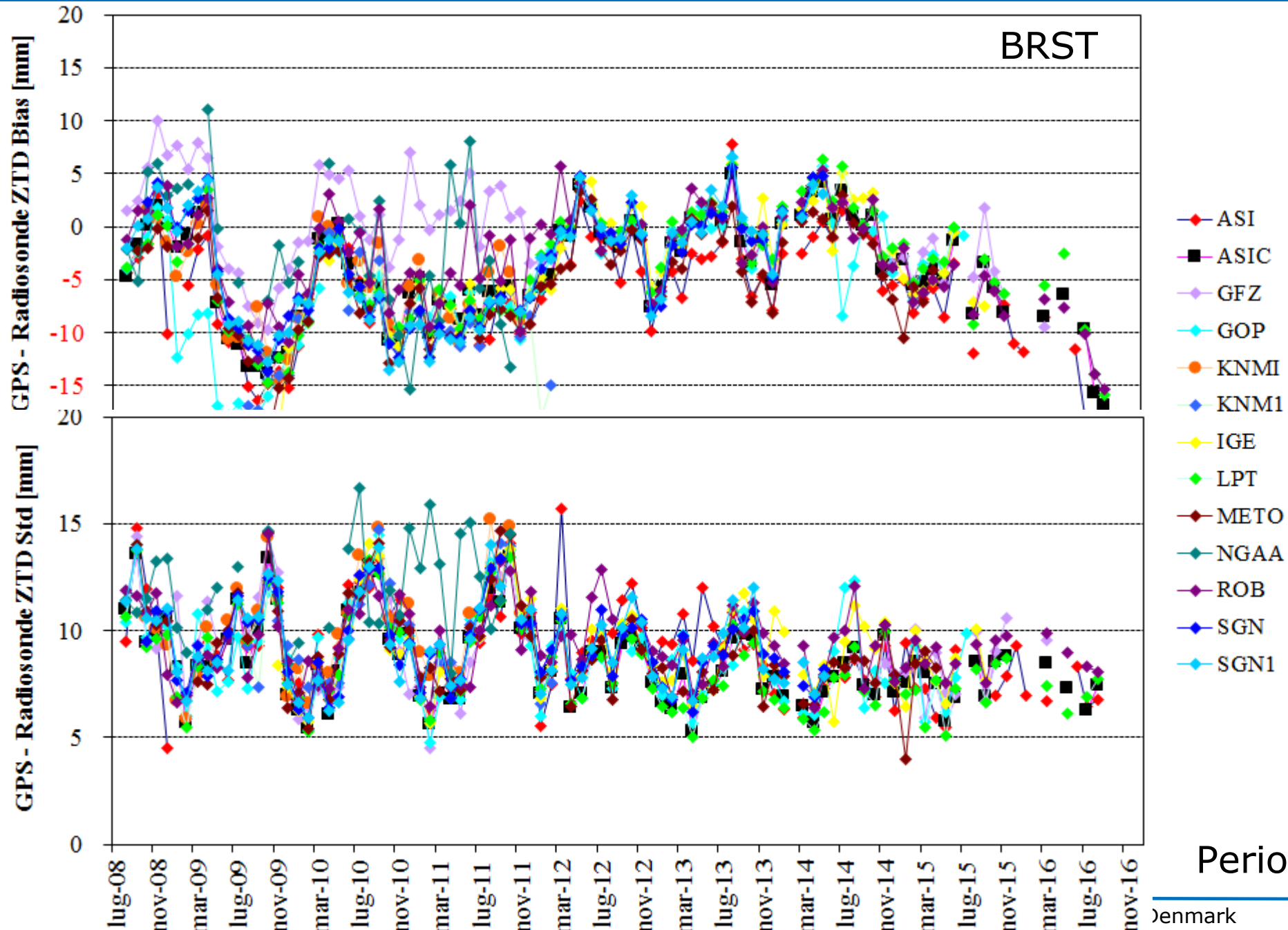
ASI\_  
ASIC  
EUREF

ASIC  
ASIR  
ASIS





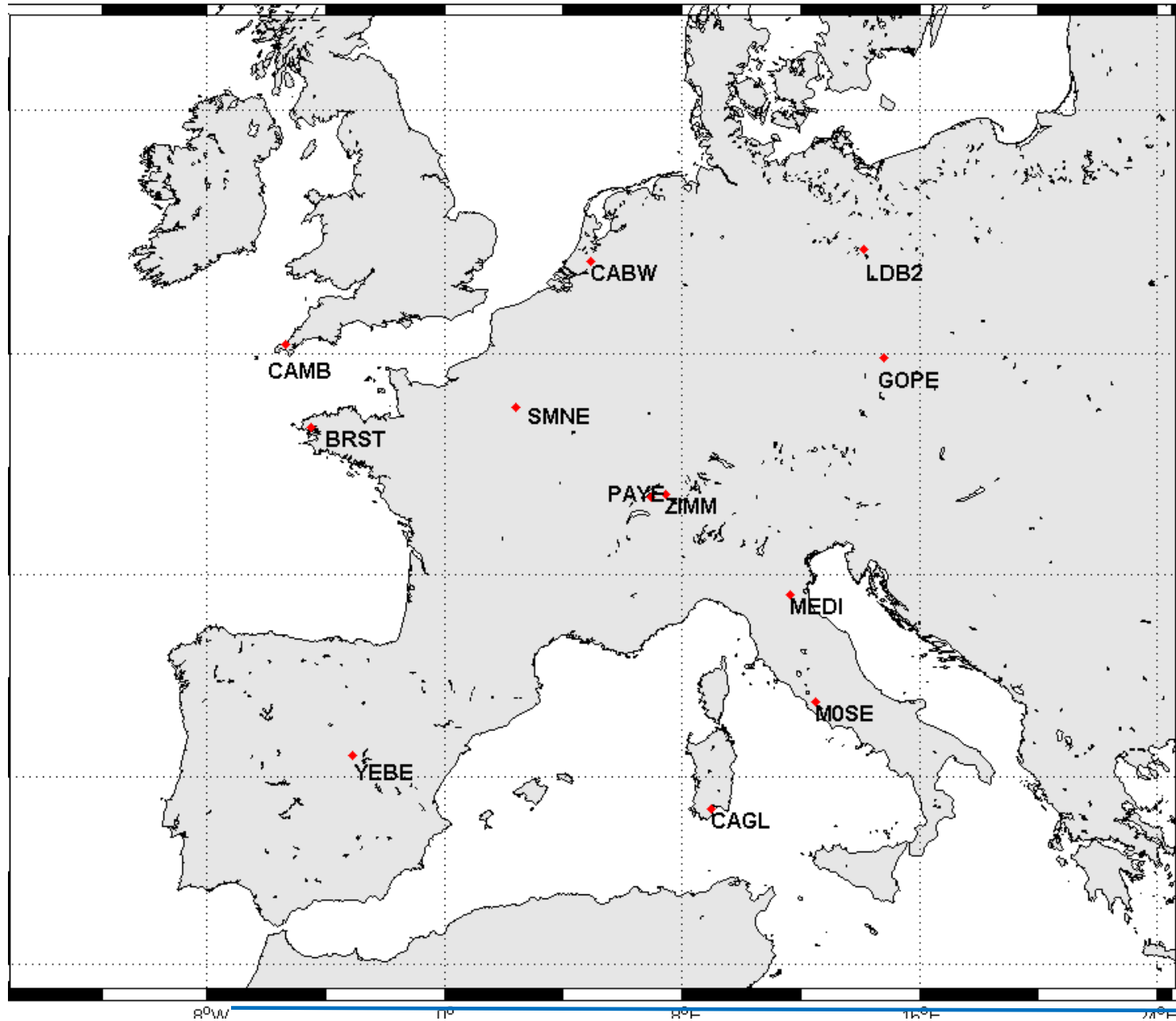
# E-GVAP ACs versus Radiosonde @ Super Sites



Period: Jul 2008- Sep 2016



# E-GVAP Super Sites as of 2008



R. Pacione et al., *Near Real Time GPS Zenith Total Delay validation at E-GVAP Super Sites*, *Bulletin of Geodesy and Geomatics* , Vol. LXVIII pag. 65-77

Figure 1: E-GVAP Super-Sites geographical location. In May 2008, two other Super Sites have been added: Milo (MILO, Italy) and Onsala (ONSA, Sweden), not shown in the figure.




# E-GVAP Super Sites

http://egvap.dmi.dk/



E-GVAP

File Modifica Visualizza Preferiti Strumenti ?

 **EUMETNET**  
The Network of European Meteorological Services

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Period 2016/11/15 - 2016/11/23

Number of Observations

AC	BRST	CABW	CAGL	CAMO	GOPE	IZAN	LDB2	M0SE	MEDI	MILO	ONSA	PAYE	SMNE	YEBE	ZIMM
ASI_	56			56	56			56	56		56	56	56	56	56
ASIC	56			56	56			56	56		56	56	56	56	56
AUT1	56				56			56		56				56	56
BEU1	56				56									56	56
BKG_					56		56		56		56			56	56
GFZ_					56		56		56		56		56	56	54
GOP1	56							56			56			56	56
GOPG	56										56				
IMO1	56				56						56			56	56
KNM3					56			56			56	56		56	
KNM4											56				
KTU1	56				56						56			56	56
LPT_	56				56		56	56	56		56	56	56	56	55
LPTR												56			
METO	35			56	56				56		56	56	56	56	56
ROBG	56			56	56		56	56	56		56	56	56	56	56
ROBH	56			56	56		56	56	56		56	56	56	56	56
SGN_	56			56	56				56		50	56	56	56	55
SGN1	56			56	56				56		56	56	56	56	56
SGO1	56				56			56	56				56		56
WLIT															

Bias

Former Super Sites:

1. CABW
2. CAGL
3. MILO

- UCAG can replace CAGL
- Other?



# Tropospheric solutions delivered to EUREF

2 solutions delivered to EUREF on routine basis

## ASI

From 2001  
Input: daily RNX files of ASI LAC EPN sub-network/IGS final  
Update cycle: daily  
*Purpose climate monitoring*

12 scores per day every h  
SINEX\_TRO/ZTD + gradients  
50 stations ASI EPN sub-network

## EUR

From July 2014  
Input: daily operational EPN LAC solutions  
Update cycle: daily  
*Purpose climate monitoring + QC*

12 scores per day every h  
SINEX\_TRO/ZTD  
Full EPN Network

1 solution for internal use only

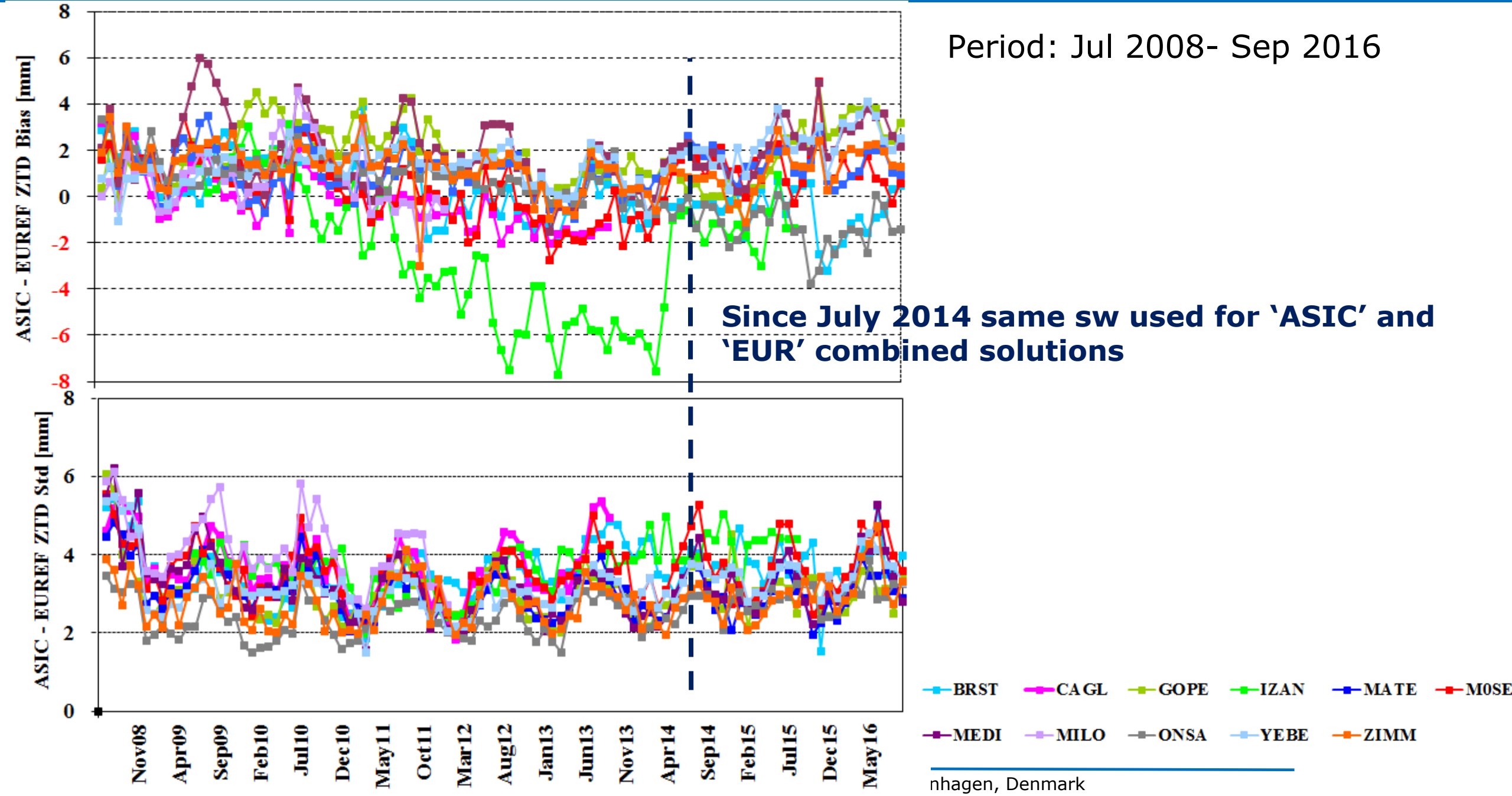
## ASIP

Available from 2000  
Input: daily RNX files of Italian network/JPL final  
Update cycle: daily  
*Purpose coordinates monitoring*

scores every 5min  
SINEX\_TRO/ZTD + gradients  
~ 325 stations



# E-GVAP Combined 'ASIC' versus EUREF Combined 'EUR'





# Tropospheric solutions delivered to EUREF

## 2 solutions Reprocessed delivered to EUREF

**AS0**

Available from 1996  
Input: daily RNX files of EPN + IGS Core network/JPL Repro  
Update cycle: daily  
Purpose *climate monitoring*

12 scores per day every h  
SINEX\_TRO/ZTD + gradients  
full EPN Network

**EU0**

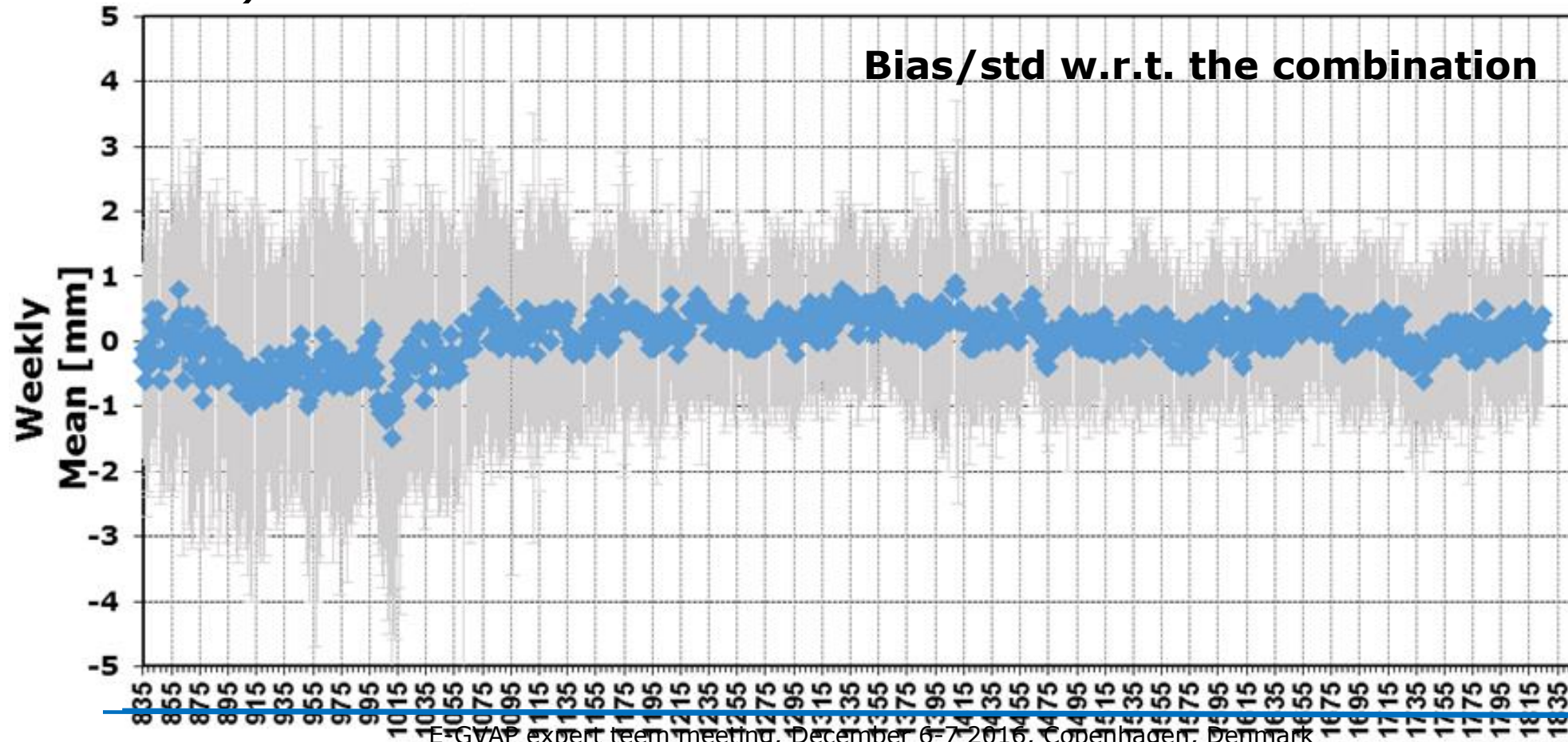
Available from 1996  
Input: daily RNX files of EPN + IGS Core network/JPL Repro  
Update cycle: daily  
Purpose *climate monitoring*

12 scores per day every h  
SINEX\_TRO/ZTD  
full EPN Network



# AS0 homogeneously reprocessed solution

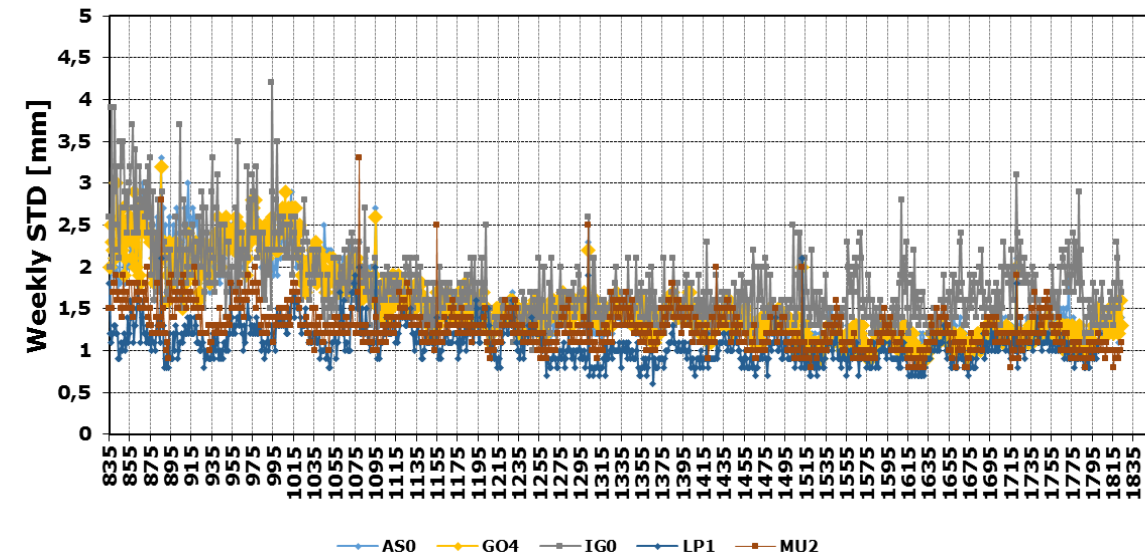
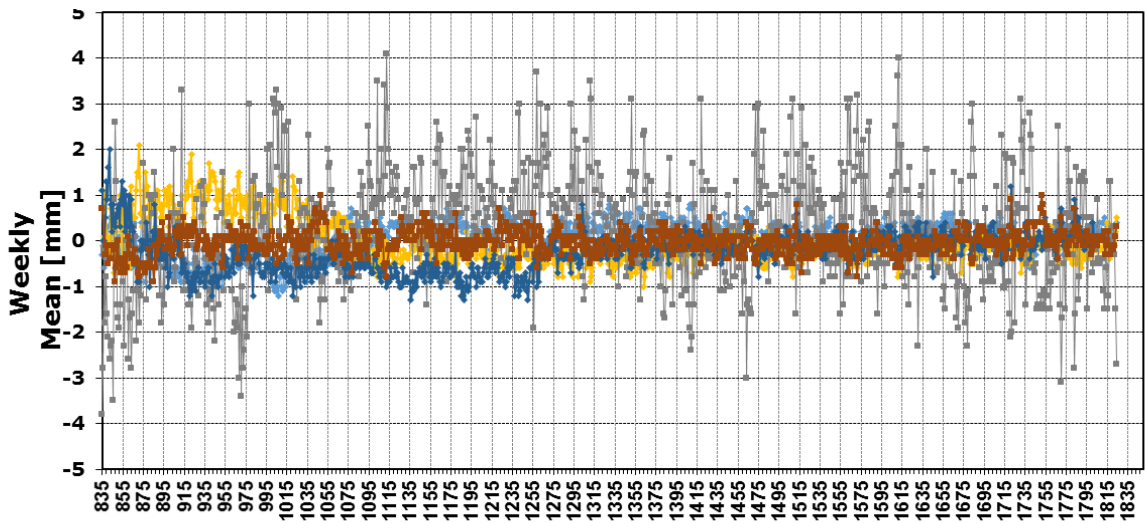
- AS0 is ASI homogeneously reprocessed solution delivered for EPN Repro2
- Period: 1996-2014
- Full EPN Network
- Assimilated in the framework of the European FP7 project UERRA (G.Halloran)





# EU0 reprocessed combined solution

[http://epncb.oma.be/\\_productsservices/troposphere/](http://epncb.oma.be/_productsservices/troposphere/)  
[http://epncb.oma.be/\\_productsservices/analysiscentres/repro2.php](http://epncb.oma.be/_productsservices/analysiscentres/repro2.php)



- Period: 1996-2014
- 5 EPN AC:

AC	Full name	Country	SW	EPN Network
ASI	Agenzia Spaziale Italiana	Italy	GIPSY-OASIS II	Full EPN
GOP	Geodetic Observatory	Czech Republic	Bernese	Full EPN
IGE	National Geographic Institute	Spain	Bernese	EPN-Subnetwork
LPT	Federal Office of Topography	Switzerland	Bernese	EPN-Subnetwork
MUT	Military University of Technology	Poland	GAMIT	Full EPN





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Discussion papers



Abstract

Discussion

Metrics

23 Nov 2016

## Research article

### EPN Repro2: A reference GNSS tropospheric dataset over Europe

Rosa Pacione<sup>1</sup>, Andrzej Araszkiewicz<sup>2</sup>, Elmar Brockmann<sup>3</sup>, and Jan Dousa<sup>4</sup>

<sup>1</sup>e-GEOS S.p.A, ASI/CGS, Italy

<sup>2</sup>Military University of Technology, Poland

<sup>3</sup>Swiss Federal Office of topography swisstopo

<sup>4</sup>New Technologies for the Information Society, Geodetic Observatory Pecný, RIGTC, Czech Republic

Received: 05 Nov 2016 – Accepted: 16 Nov 2016 – Published: 23 Nov 2016

#### Review status

This discussion paper is under review for the journal Atmospheric Measurement Techniques (AMT).

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#### Short summary

The use of ground-based GNSS data for climate research is an emerging field. The reprocessing...  
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**Abstract.** The present availability of 18+ years of GNSS data belonging to the EUREF Permanent Network (EPN, <http://www.epncb.oma.be/>) is a valuable database for the development of a climate data record of GNSS tropospheric products over Europe. This data record can be used as a reference for a variety of scientific applications and has a high potential for monitoring trend and variability in atmospheric water vapour, improving the knowledge of climatic trends of atmospheric water vapour and being useful for regional Numerical Weather Prediction (NWP) reanalyses as well as climate model simulations. In the framework of the EPN-Repro2, the second reprocessing campaign of the EPN, five Analysis Centres homogeneously reprocessed the EPN network for the period 1996–2014. A huge effort has been made for providing solutions that are the basis for deriving new coordinates, velocities and troposphere parameters for the entire EPN. The individual contributions are then combined in order to provide the official EPN reprocessed products. This paper is focused on the EPN Repro2 tropospheric product. The combined product is described along with its evaluation against radiosonde data and European Centre for Medium-Range Weather Forecasts (ECMWF) reanalysis (ERA-Interim) data.

**Citation:** Pacione, R., Araszkiewicz, A., Brockmann, E., and Dousa, J.: EPN Repro2: A reference GNSS tropospheric dataset over Europe, Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-369, in review, 2016.

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#### Journal metrics



IF 2.989



IF 5-year  
3.489



SNIP 1.273





# SINEX\_TRO format current status

- Format Description Document      **READY**
- Step by step consultation      **DONE**
- Different proposal about the name of the format:
  - 1) Tro-SINEX - legacy name and reflecting 'SINEX' background structure
  - 2) SINEX\_TRO - like SINEX\_BIAS and also reflecting 'SINEX' background
  - 3) SINEX\_ATM - like above, but use Atmosphere (neutral) instead of Troposh.
  - 4) TROPEX - like IONEX, but with fully different structure and content which contains only station time-series, but no grid data.
- Format able to support:
  - a) parameters from different sources than space geodetic techniques such as numerical weather prediction models and re-analyses, radiosondes and water vapour radiometers,
  - b) long station names (9 characters) in concordance with RINEX 3 data format,
  - c) products including slant tropospheric delays,
  - d) parameters corresponding to long-term time-series of individual stations.