GOALS AND ACTIVITIES OF THE EUREF TECHNICAL WORKING GROUP

EUREF 2015 Symposium

Leipzig, Germany

June 3-5, 2015

C. Bruyninx for the EUREF TWG

For more info . . .
http://www.euref.eu/html/twg.html

MEMBER LIST

- Zuheir Altamimi, France
- Elmar Brockmann, Switzerland
- Carine Bruyninx, Belgium (TWG chair)
- Alessandro Caporali, Italy, (EUREF secretary)
- Rolf Dach, Switzerland
- Jan Dousa, Czech Republic
- Rui Fernandes, Portugal
- Heinz Habrich, Germany
- Johannes Ihde, Germany (EUREF chair)
- Ambrus Kenyeres, Hungary
- Martin Lidberg, Sweden
- Rosa Pacione, Italy
- Markku Poutanen, Finland
- Wolfgang Söhne, Germany
- Karolina Szafranek, Poland
- Günter Stangl, Austria

EUREF GOALS

Define, realise, maintain, provide access and promote the adoption of

- EVRS

  European Vertical Reference System

- ETRS89

  European Terrestrial Reference System

KEY INFRASTRUCTURES

- United European Levelling Network
  - EVRS
- EUREF Permanent GNSS Network
  - ETRS89

EUREF TECHNICAL WORKING GROUP

- Technical Working Group = EUREF steering committee
- The EUREF TWG was created at the EUREF symposium in Berne, 1992
- Meets three times a year to manage EUREF activities
- Minutes of the meetings : http://www.euref.eu/
- Members in charge of special tasks, members elected by the plenary (4 year term, renewable once), ex-officio members,

EUREF WEB SITE

http://www.euref.eu/

EUREF PRODUCT CATALOGUE

Updated, new version available from EUREF web site :

http://www.euref.eu/documentation/EUREF_Products-20141014.pdf

1. Validated/Official Products
2. Observational & Meta Data
3. Internal and Other Products / Monitoring
4. EUREF Standardization / Guidelines

EUREF WG

- Multi-GNSS WG, E. Brockmann
- Reprocessing WG, C. Völksen
- EPN Densification WG, A. Kenyeres
- Deformation models WG, M. Lidberg

MULTI-GNSS WORKING GROUP

Talk by E. Brockmann, S. Lutz

„Multi-GNSS activities at EPN and at swisstopo"

Session 3

EUREF WG

- Multi-GNSS WG, E. Brockmann
- Reprocessing WG, C. Völksen
- EPN Densification WG, A. Kenyeres
- Deformation models WG, M. Lidberg

REPROCESSING WORKING GROUP

Regular reprocessing of historical EPN data

- EPN-Repro1: 01/1996-01/2007, results released in 2012
  - + participation of almost all EPN analysis centers

- **EPN-Repro2**: 01/1996-12/2013, results expected in 2015
  - + just a few analysis centers, with focus on usage of different software (Bernese, GIPSY, GAMIT).
  - + data analysis almost finished
  - + first combination tests performed (coordinates and troposphere)

Talk by C. Völksen et al, EPN Repro 2: Activities in the EPN Working Group on Reprocessing, Session 2

EUREF WG

- Multi-GNSS WG, E. Brockmann
- Reprocessing WG, C. Völksen
- EPN Densification WG, A. Kenyeres
- Deformation models WG, M. Lidberg

NEW Working Group
Created June 1st 2015

DENSIFICATION OF THE EPN

Goal : high quality positions and velocities in an homogeneous reference frame, for a very dense network of GNSS stations

- ✓ Combine weekly position solutions (SINEX) from national dense GNSS networks with EPN
  - Mapping Agencies and other agencies are invited to participate!
- ✓ Collect station site logs for contributing stations, develop web site

Talk by A. Kenyeres et al "Overview of the recent advancements of the EPN Densification", session 2

EUREF WG

- Multi-GNSS WG, E. Brockmann
- Reprocessing WG, C. Völksen
- EPN Densification WG, A. Kenyeres
- Deformation models WG, M. Lidberg

WG ON DEFORMATION MODELS

Motivation:

- improving the knowledge of surface deformations in Eurasia and adjacent areas
- velocity model(s) will potentially be a valuable tool in the management and use of the national realisations of the ETRS89.

The results from the “EPN Densification” are an important input for the activities.

We now **ask for cooperation** with those of you who work on models of crustal deformations in specific areas and regions, or already use deformation models in your current activities.

Contact: Martin Lidberg (martin.Lidberg@lm.se)

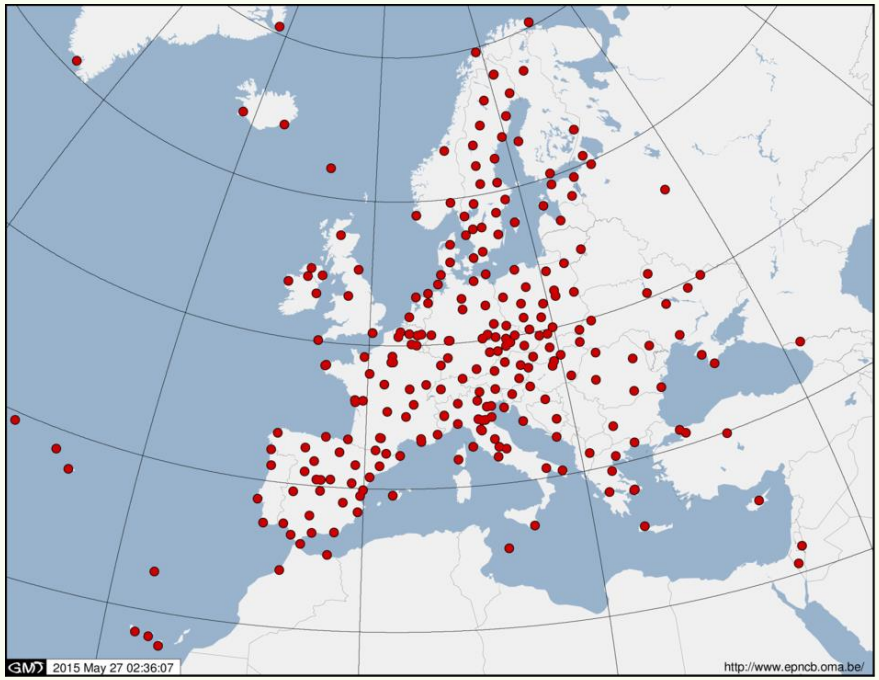
EPN COORDINATORS

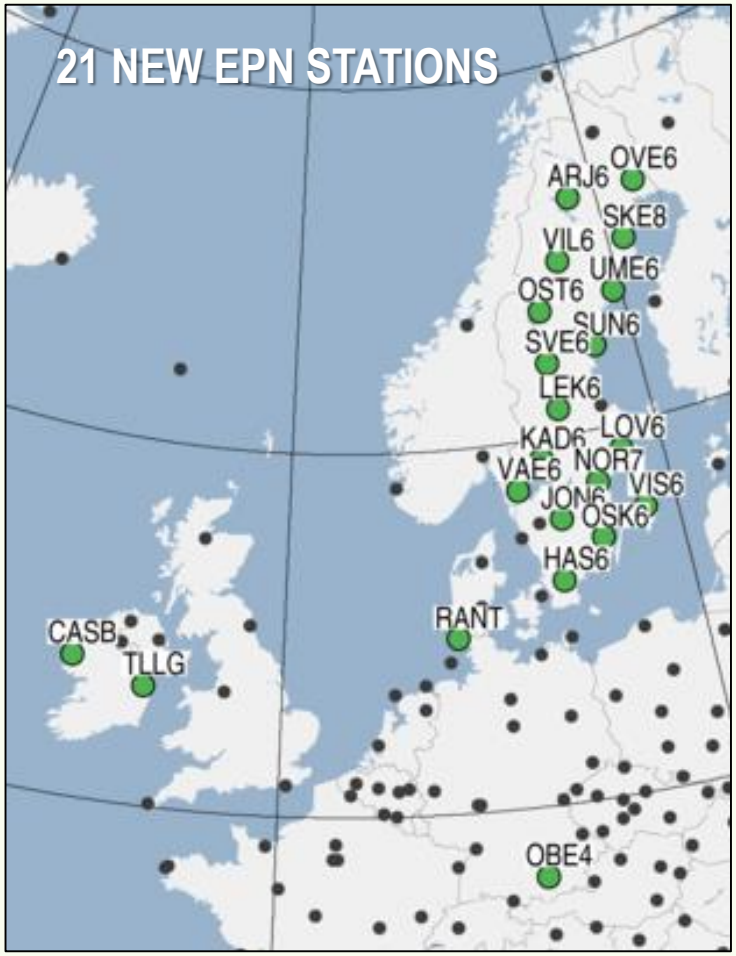
- Network Coordinator, C. Bruyninx
- Data flow Coordinator, G. Stangl

EUREF PERMANENT GNSS NETWORK

- 266 GNSS reference stations with freely available observations, meta-data, and known ETRS89 coordinates
- Central Bureau at ROB, Belgium

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





MULTI-GNSS TRACKING

Station site log:

```
3.x  Receiver Type            : (A20, from rcvr_ant.tab; see instructions)
     Satellite System         : (GPS+GLO+GAL+BDS+QZSS+SBAS)
     Serial Number            : (A20, but note the first A5 is used in SINEX)
     Firmware Version         : (A11)
     Elevation Cutoff Setting : (deg)
     Date Installed           : (CCYY-MM-DDThh:mmZ)
     Date Removed             : (CCYY-MM-DDThh:mmZ)
     Temperature Stabiliz.    : (none or (deg C) +/- (deg C))
     Additional Information   : (multiple lines)
```

Should indicate presence of satellite system in RINEX 2 (or RINEX 3) obs. files

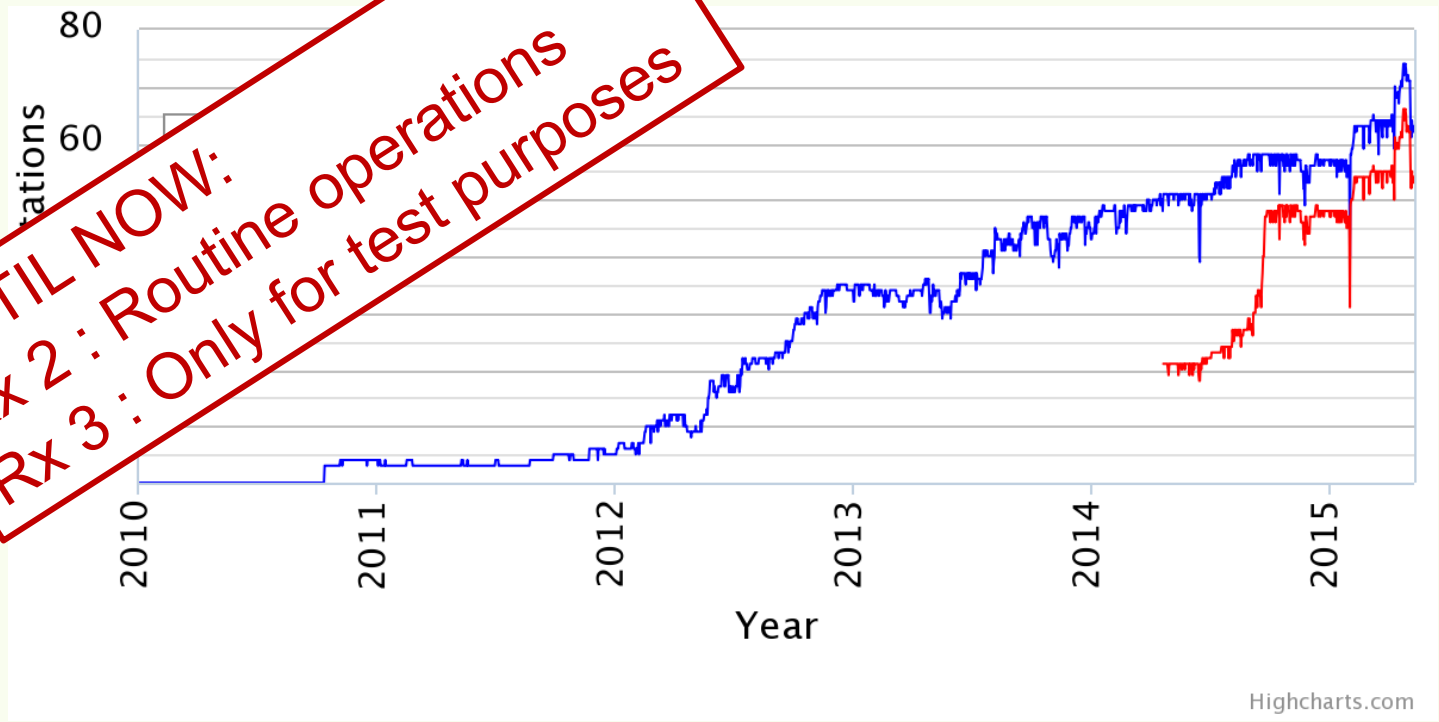
	GPS	GLO	GAL	BDS	QZSS	SBAS
In site log (Rx2/3)	266 (266)	218 (217)	79 (60)	33 (29)	6 (3)	68 (39)
Not in site log, but in Rx2/3	0	0	2	6	4	0

RINEX 3

+ RINEX 3 format to be used for multi-GNSS is **RINEX v3.02**

  (future: use last RINEX 3.0x format)

  ftp://igs.org/pub/data/format/rinex302.pdf



RINEX 3 TRANSITION PLAN

Slowly move RINEX 3 from test to operational

Final goal:

- Multi-GNSS dat… …SS, BDS) → Rx 3
- Rx 3 data… …ata centers should be
  1) R… …or newer) format
  2) Use long Rx3 filenames

mas12350.14d.Z

↓

MAS100ESP_R_20142350000_01D_30S_MO.crx.gz

RINEX 3 TRANSITION PLAN

- ✓ DC prepare to
  - ✓ **Receive** Rx 3 files with long names
  - ✓ **Check** correctness of Rx3 long file name
  - ✓ **Rename** Rx 3 files with short na… …ong names
  - ✓ **Store** Rx 3 wit lon…
- ✓ Stations … prepare to
  - ✓ **Submit** …), long name strongly preferred
- ✓ Users prepare to
  - ✓ Have Rx3 files with long names in same directory as Rx 2 files
  - ✓ Have adapted data download procedures

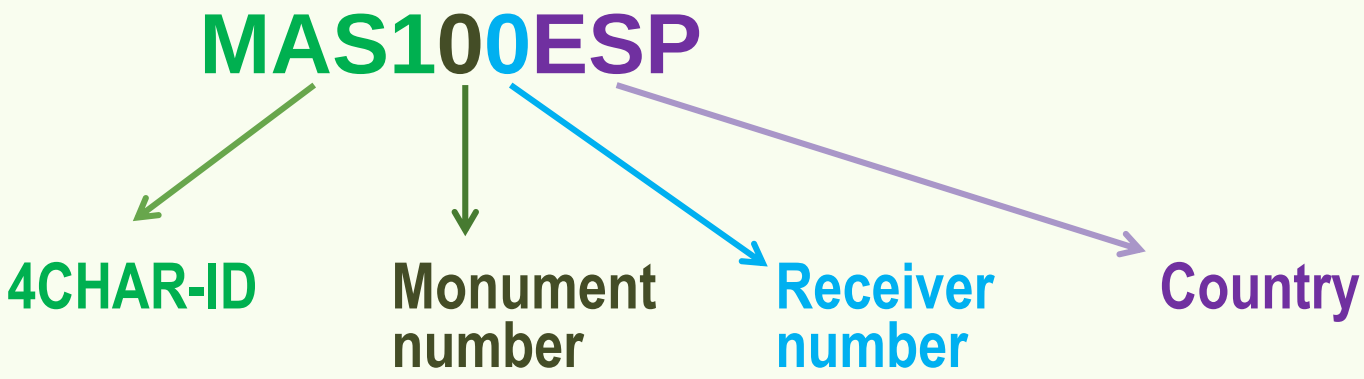
Nobody will be forced to stop with Rx2

Full EPN will continue to be available for some time in Rx2

RINEX 3 FILE NAMING

MAS100ESP_R_20142350000_01D_30S_MO.crx.gz

New long station name



Min. 3 years backward compatibility between new long station names and old ones

RINEX 3 FILE NAMING

MAS100ESP_R_20142350000_01D_30S_MO.crx.gz

Data source

R

From data collected at Receiver

S

From real-time data stream

U

Unknown

RINEX 3 FILE NAMING

MAS100ESP_R_20142350000_01D_30S_MO.crx.gz

Start time

2014 235 0000

YYYY DOY HH MM

RINEX 3 TRANSITION PLAN

New Rx3 long station names are defined for all EPN stations by EPN CB

Long Station Name	City	Country	DQ (%)		Availability					Latency			
					Daily (%)		Hourly (%)		RT (%)	Last Data Available	Hourly (%)		RT (s)	G
			0°	15°	BKG	OLG	BKG	OLG			BKG	OLG		
ACOR00ESP	A Coruna	Spain	84	99	100	100	100	100	100	2015-05-27	99	99	0.8	✔
AJAC00FRA	Ajaccio	France	93	100	100	100	100	100	100	2015-05-27	96	86	1.0	✔
ALAC00ESP	Alicante	Spain	97	100	96	100	99	99	94	2015-05-27	76	76	0.8	✔
ALBA00ESP	Albacete	Spain	97	100	100	100	100	100	100	2015-05-27	87	87	0.7	✔
ALME00ESP	Almeria	Spain	85	97	100	100	100	100	100	2015-05-27	97	96	1.9	✔
ANKR00TUR	Ankara	Turkey	88	96	100	100	96	96	_	2015-05-27	95	0	_	✔
AQUI00ITA	L'Aquila	Italy	84	100	100	100	100	99	_	2015-05-27	97	96	_	✔
ARGI00FRO	Argir, Tórshavn	Faroe Islands	90	100	100	100	100	100	_	2015-05-27	100	99	_	✔
ARJ600SWE	Arjeplog	Sweden	94	100	100	100	100	99	_	2015-05-27	97	95	_	✔
AUT100GRC	Thessaloniki	Greece	87	100	100	100	100	99	100	2015-05-27	99	99	0.9	✔
AUTN00FRA	Autun	France	92	100	100	100	100	100	_	2015-05-27	22	0	_	✔
AXPV00FRA	Aix En Provence	France	78	86	100	100	100	100	_	2015-05-27	82	16	_	✔

RINEX 3 TRANSITION PLAN

- ✓ DC prepare to
  - ✓ **Receive** Rx 3 files with lon
  - ✓ **Check** correct
  - ✓ **P** th long names
- ✓ Stati
  - ✓ **Su** me strongly preferred
- ✓ Users p to
  - ✓ Have Rx3 files with long names in same directory as Rx 2 files
  - ✓ Have adapted data download procedures

Stepwise procedure will be set up together will involved DC, station operators and users!

Process will slowly start after this symposium.

RINEX 3 FILE NAMING

MAS100ESP_R_20142350000_01D_30S_MO.crx.gz

File Period

01D — Daily

01H — Hourly

15M — 15-minute

RINEX 3 FILE NAMING

MAS100ESP_R_20142350000_01D_30S_MO.crx.gz

Data Sampling

30S — Daily

05H — 5 Hz

05M — 5 minute

RINEX 3 FILE NAMING

MAS100ESP_R_20142350000_01D_30S_MO.crx.gz

Data Type

MO → Mixed Observations

GN → GPS Navigation

RN → Galileo Navigation

ftp://igs.org/pub/data/format/rinex302.pdf

EPN COORDINATORS

- Network Coordinator, C. Bruyninx
- Data flow Coordinator, G. Stangl
- Real-time Analysis Coordinator, W. Söhne

REAL-TIME STREAMS

- Three regional broadcasters
  - ASI: euref-ip.asi.it
  - BKG: www.euref-ip.net
  - ROB: www.euref-ip.be
- Goal: user access should be equally distributed
- Prerequisite: user should be able to switch between RBs w/o loss of performance (availability, latency, …)
- Needs identical setup of each broadcaster
  - All mountpoints available at all RBs
  - Identical mountpoint names
  - Identical format descriptions

EUREF BROADCASTER GUIDELINES

- Release of EUREF broadcaster guidelines (April 14, 2015)
  - Valid for all EUREF-related broadcasters (regional, national, local)
  - Implemented into the Data Centre guidelines → "Guidelines for EPN Data Centres & EPN Broadcasters" (http://www.epncb.oma.be/_documentation/guidelines/guidelines_data_centres.pdf)

- *Talk by W. Söhne, EPN Real-Time Analysis Coordinator - Status Report, Session 3*

EPN COORDINATORS

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- Real-time Analysis Coordinator, W. Söhne
- Analysis Coordinator, K. Szafranek

ANALYSIS COORDINATION

- Routine EPN Products — Bernese 5.2
  - Final products: daily and weekly position solutions based on 16 individual AC solutions
    15 - Bernese 5.2, 1 – Bernese 5.0,1 – GIPSY-OASIS II
    14 GPS+GLONASS solutions, 2 GPS solutions
  - Rapid products: daily position solutions
    based on 9 individual AC solutions
  - Ultra-rapid products: hourly position solutions
    based on 3 individual AC solutions

http://www.epnacc.wat.edu.pl

ANALYSIS COORDINATION

- Special Products
  - Daily combined solution from REPRO2
  - 5 individual solutions (ASI, GOP, IGE, LPT, MUT).
  - Bernese 5.2, GAMIT/GLOBK, GIPSY-OASIS II.

Combination software: Bernese 5.2 (ADDNEQ) and CATREF (tests).

Talk by K. Szafranek et al, Activities of the EPN Analysis Combination Centre, Session 2

EPN COORDINATORS

- Network Coordinator, C. Bruyninx
- Data flow Coordinator, G. Stangl
- Real-time Analysis Coordinator, W. Söhne
- Analysis Coordinator, K. Szafranek
- Troposphere Coordinator, R. Pacione

E

Coordina

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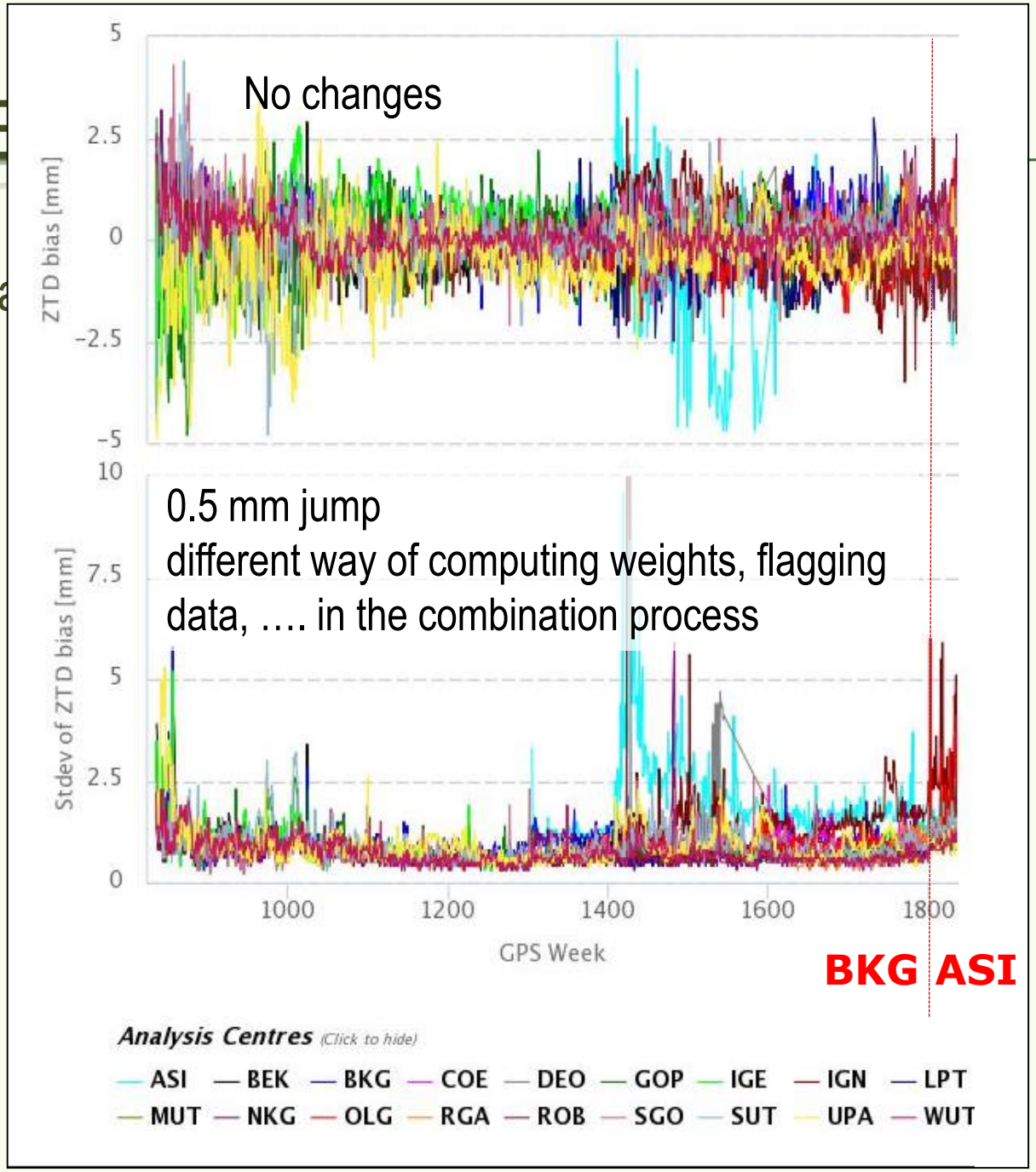
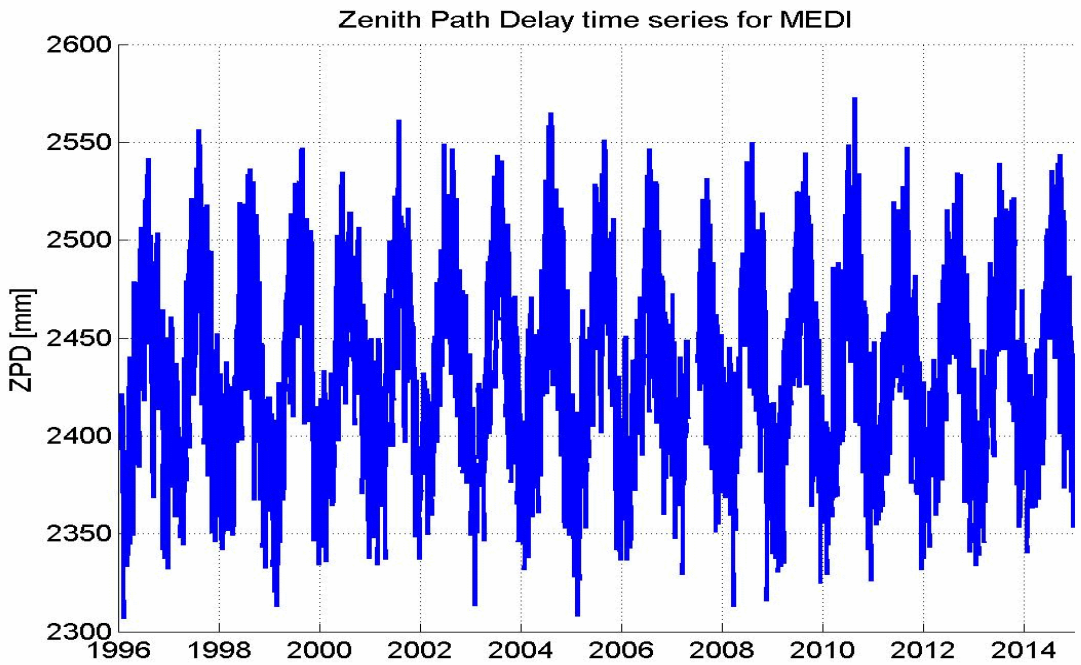


2 ACs have larger std values

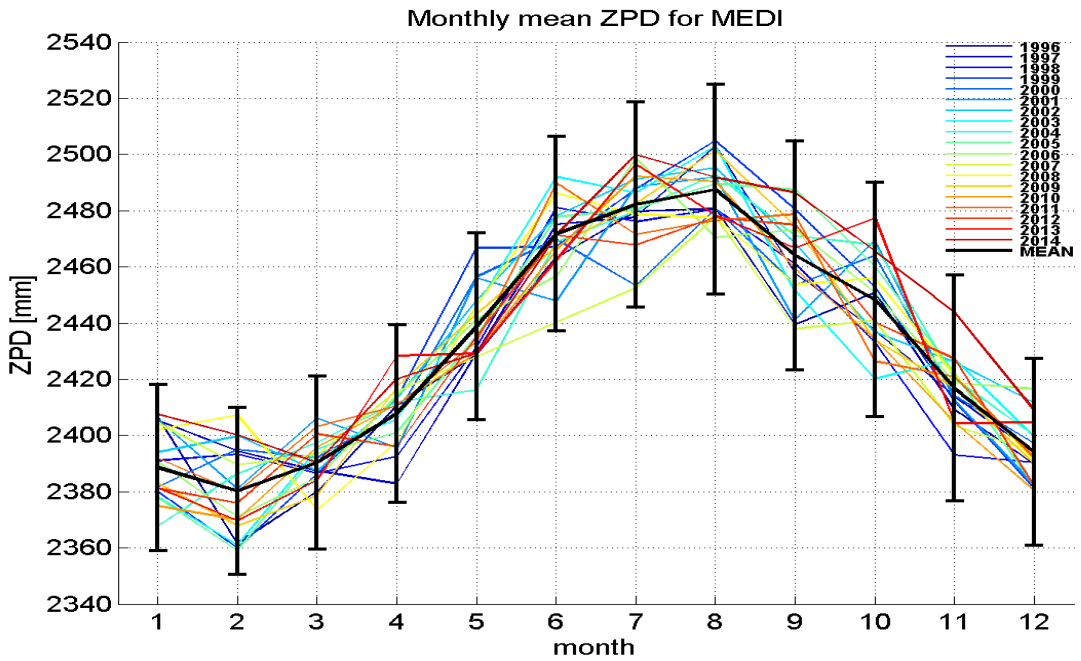
TR

Restyled

http://epr elays/



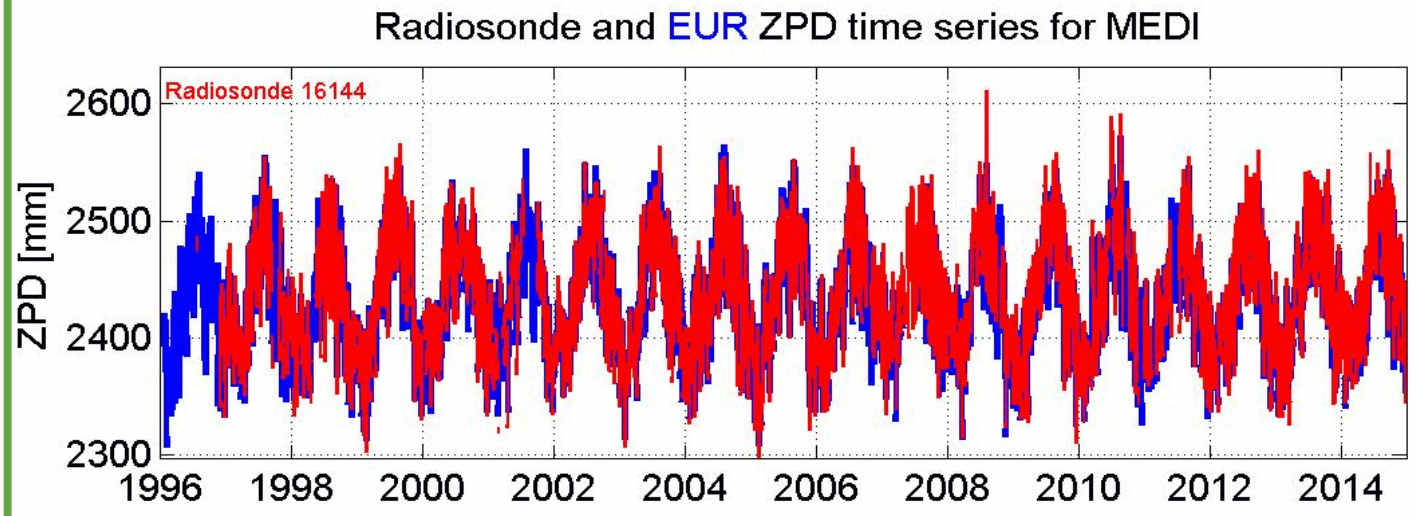
Long term Time series

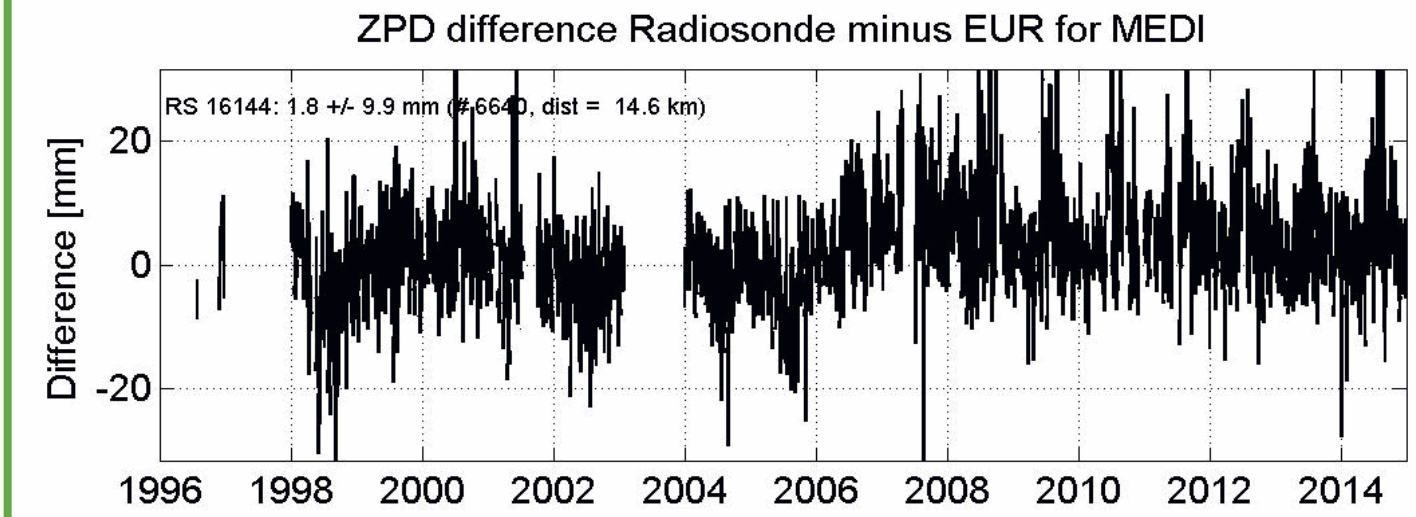


Monthly means

180 EPN - RADIOSONDE CO-LOCATIONS

The radiosondes used are provided by DMI in the framework of the EUREF - EUMETNET MoU.





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- Data flow Coordinator, G. Stangl
- Real-time Analysis Coordinator, W. Söhne
- Analysis Coordinator, K. Szafranek
- Troposphere Coordinator, R. Pacione
- Reference Frame Coordinator, A. Kenyeres

ETRS89 MAINTENANCE

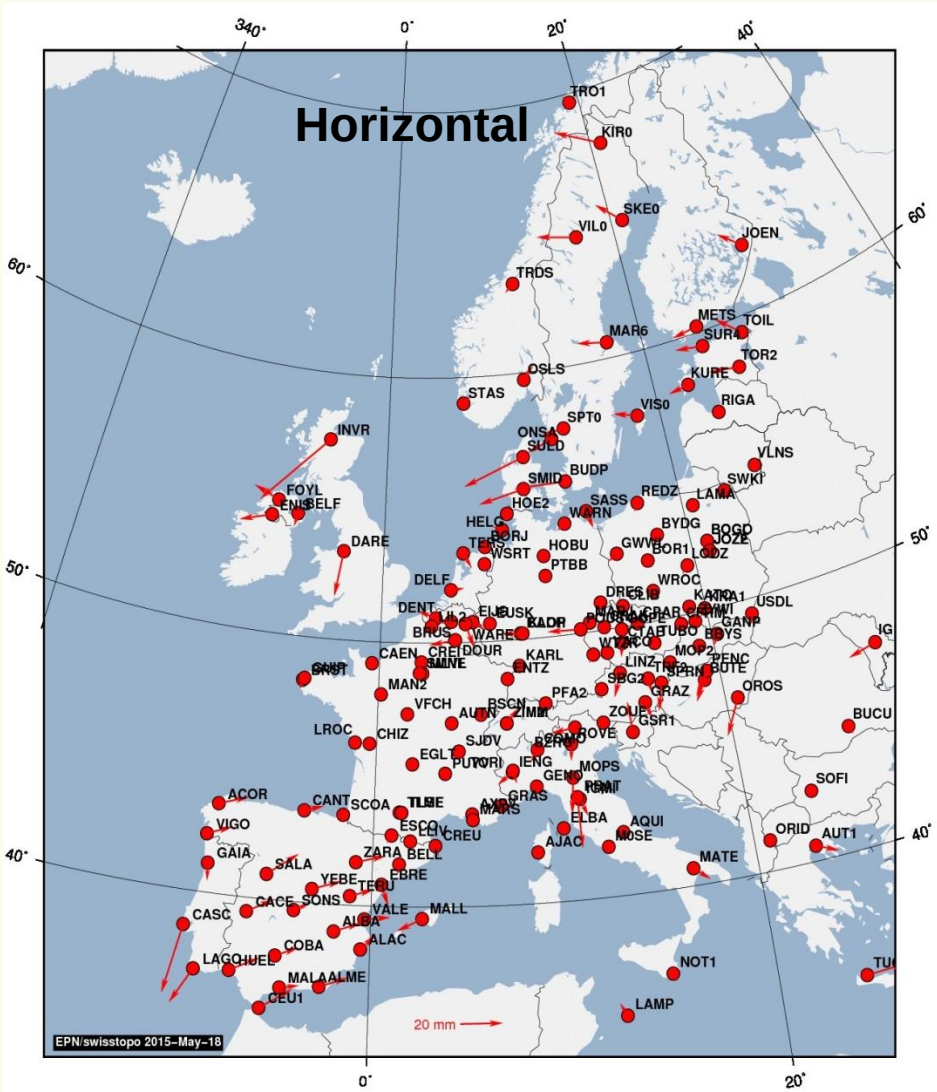
15-weekly updates of multi-year EPN positions and velocities

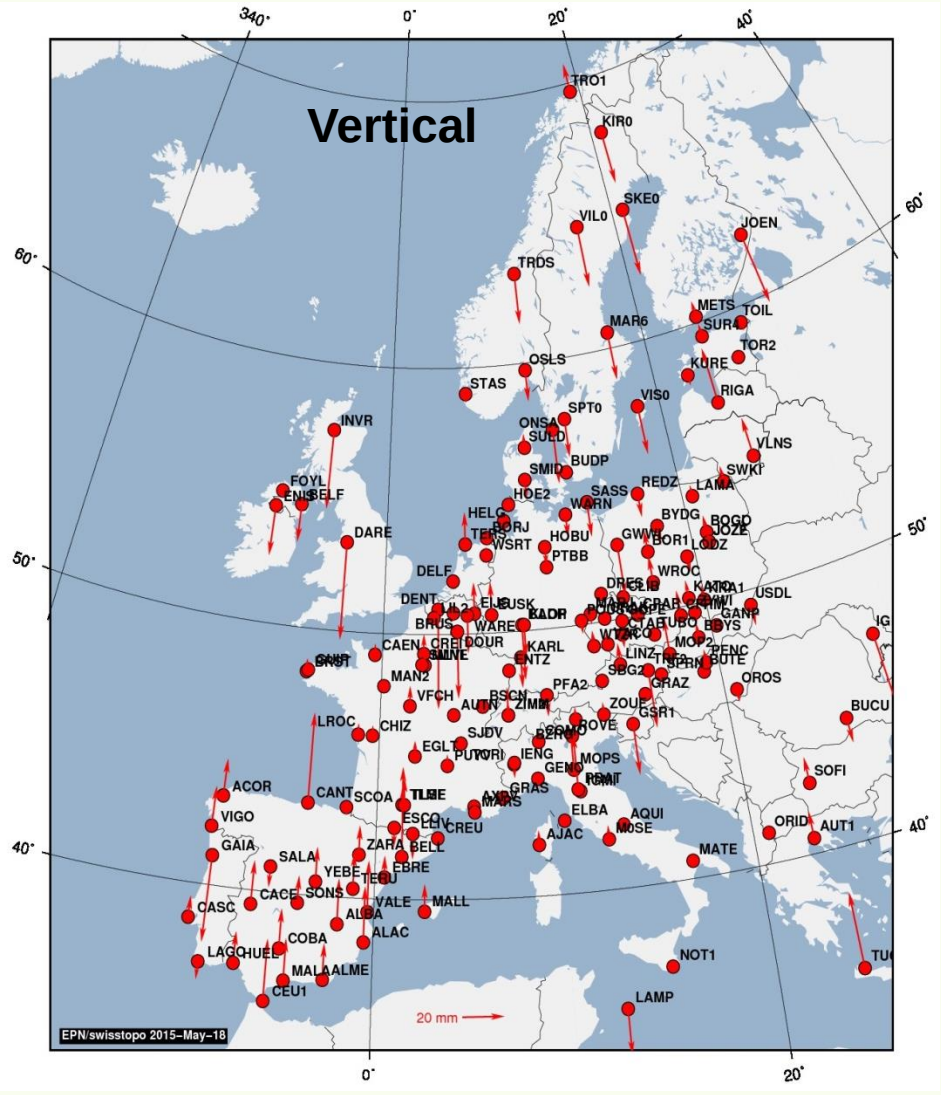
+ In ETRF2000 / IGb08 (ITRF2008) – min. constraints on 14-param

based on weekly EPN coordinate solutions
GPS wk 834 – now (last solution 1830)

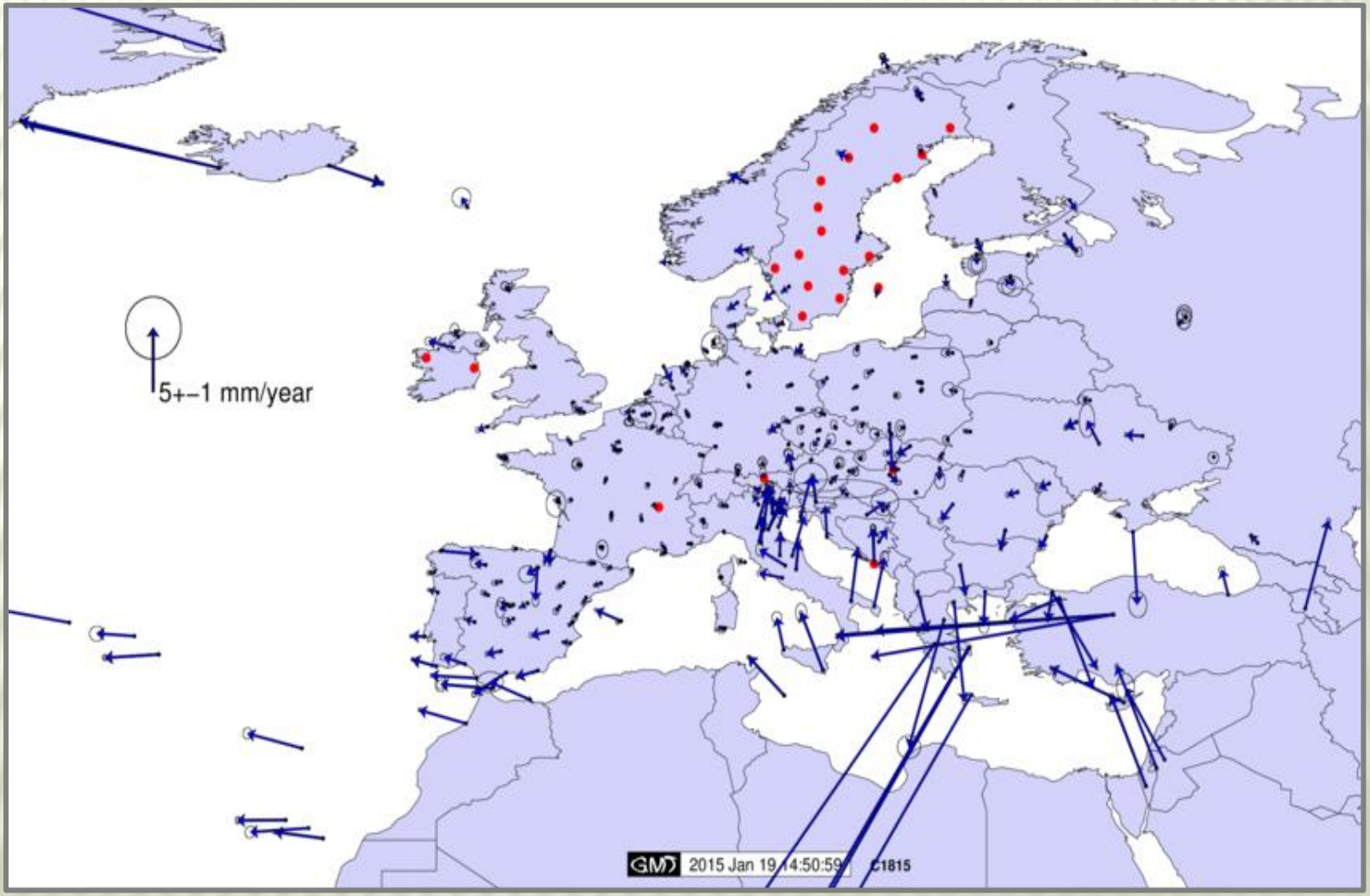
Published on EPN CB web site (positions & velocities, meta-data, plots)

NATIONAL ETRS89 COORDINATES

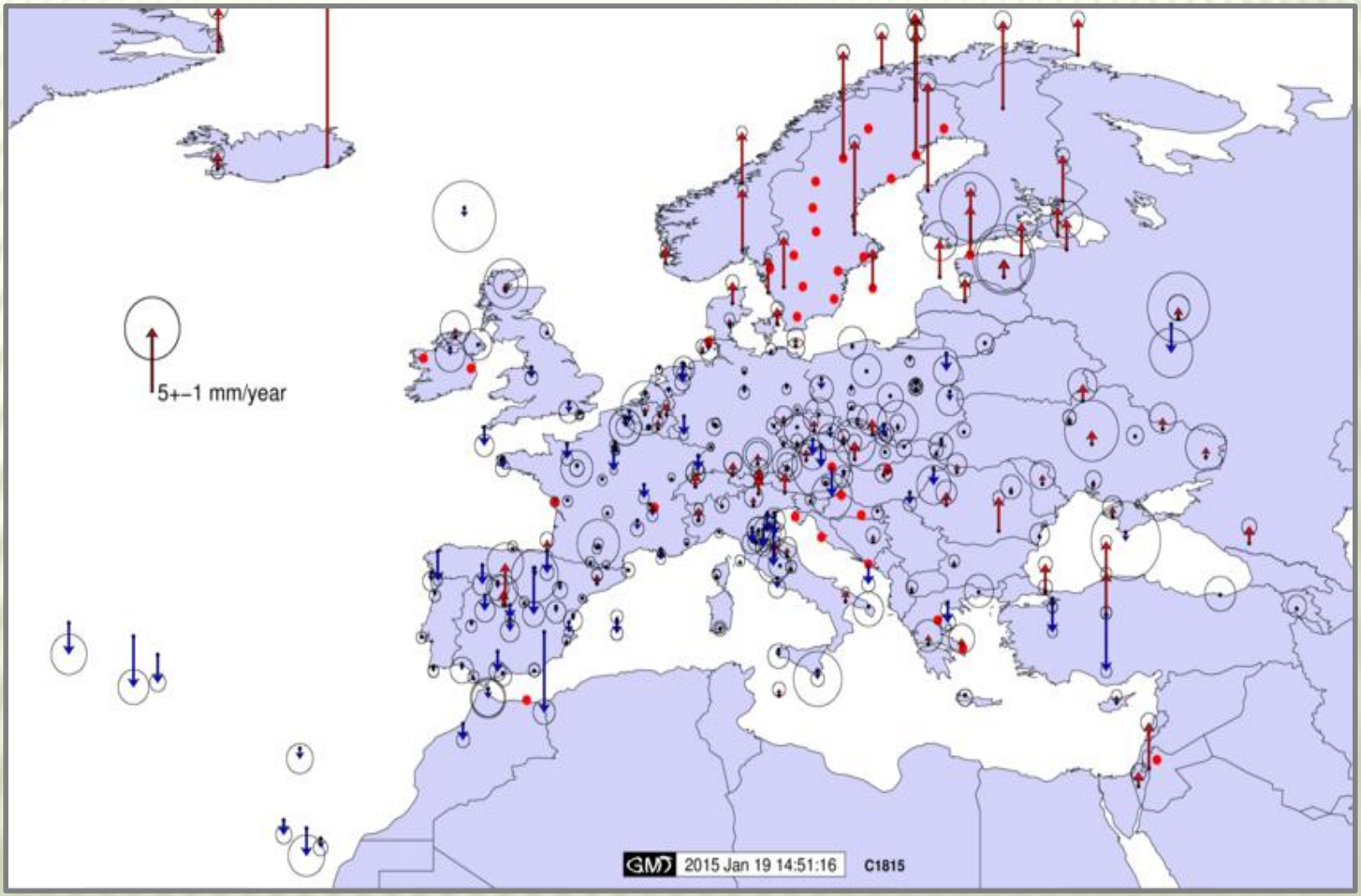




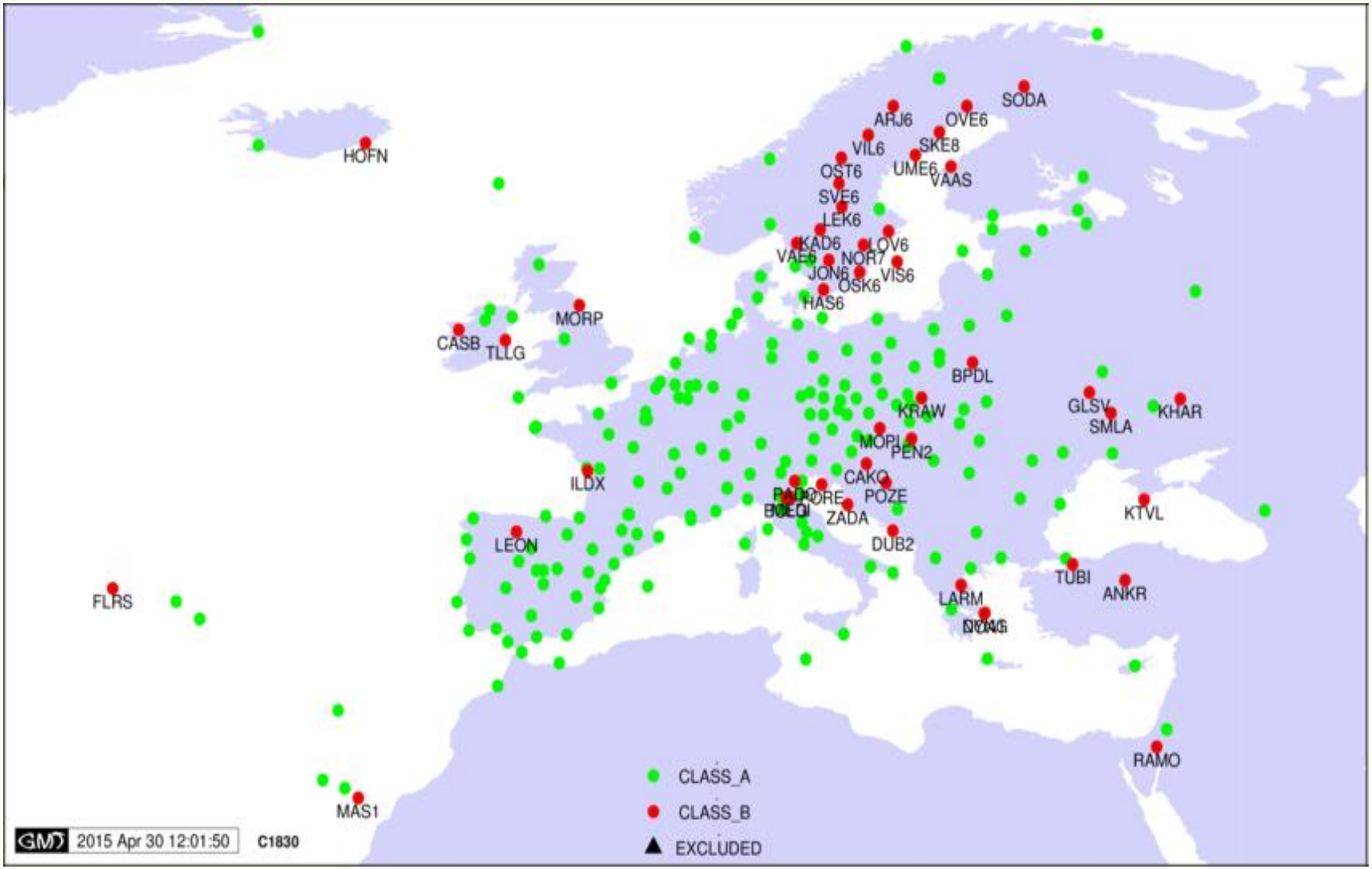
ETRS89 HORIZONTAL VELOCITIES



ETRS89 UP VELOCITIES



STATION CATEGORIZATION

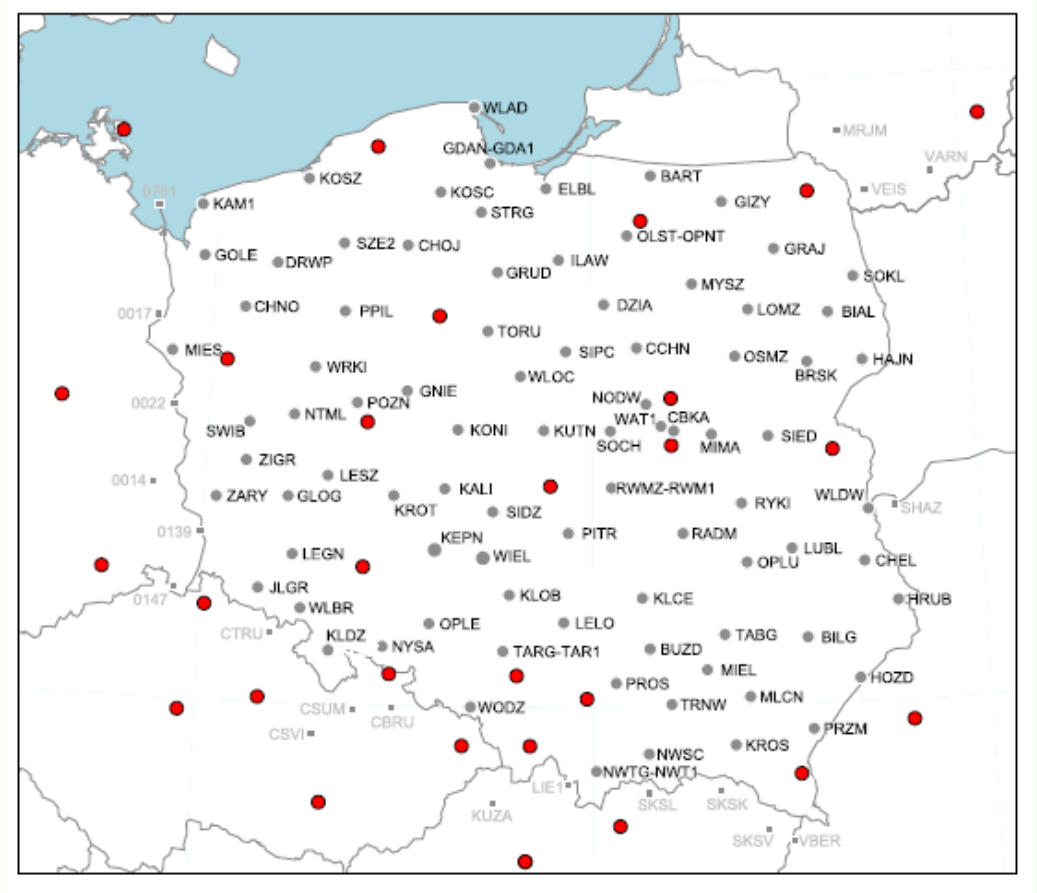


EUREF CAMPAIGN VALIDATIONS

Poland

- ASG-EUPOS network
- 4/2011-12/2014

- Class A
- 1cm acc.@ all epochs
- ETRS89 densification



- *Talk by M. Ryczywolski in Session 1*

EUREF CAMPAIGN VALIDATIONS

CEGRN : Central Europe

- 9 1-week Campaigns (1997-2013)
- ETRS89 densification
- 55 sites : Class A
- 80 sites : Class B

Talk by A. Caporali et al.

A contribution to ETRS89 in Central Europe: results from the CEGRN Activity, Session 2

COLLABORATIONS

- International GNSS Service
  - Cross-fertilization
  - Common standards
  - EUREF involved in IGS Governing Board + WGs

- EUMETNET
  - MoU signed June 2007
  - Mutual exchange of data
  - *Talk by R. Pacione, COST Action ES1206: GNSS for Severe Weather and Climate (GNSS4SWEC)*

COLLABORATIONS

- CERGOP, Central European GPS Geodynamic Network Consortium
  - MoU signed May 2011
  - facilitate the densification of the European GNSS network for reference frame definition and geokinematical applications
  - *Talk by A. Caporali et al., A contribution to ETRS89 in Central Europe: results from the CEGRN Activity', Session 2*

- EUPOS, (European Position Determination System), partnership of DGNSS service providers
  - MoU signed June 2014
  - Collaboration in the frame of EuroGeographics Knowledge Network on Positioning
  - *Several talks in Session 5*

UNITED NATIONS

- UN-GGIM : UN Initiative on Global Geospatial Information Management
  - Global Geodetic Reference Frame Expert Group
  - Resolution on the Global Geodetic Reference Frame for Sustainable Development (GGRF) adopted on Feb. 26, 2015
- UNOOSA: UN Office for Outer Space Affairs
  - International Committee on GNSS (ICG)
- *Talk by Z. Altamimi, United Nations Initiatives in relation with global geodetic reference frames, Session 5*

MORE INFORMATION

- EUREF
  - http://www.euref.eu/
- EUREF Permanent Network
  - http://epncb.oma.be/
- ETRS89
  - http://etrs89.ensg.ign.fr/
- EVRS
  - http://www.bkg.bund.de/geodIS/EVRS/
- CRS (Information system for European Coordinate Reference Systems)
  - http://www.crs-geo.eu/

Thank you !