Federal Agency for
Cartography and Geodesy

EPN Analysis Coordinator Report 2011

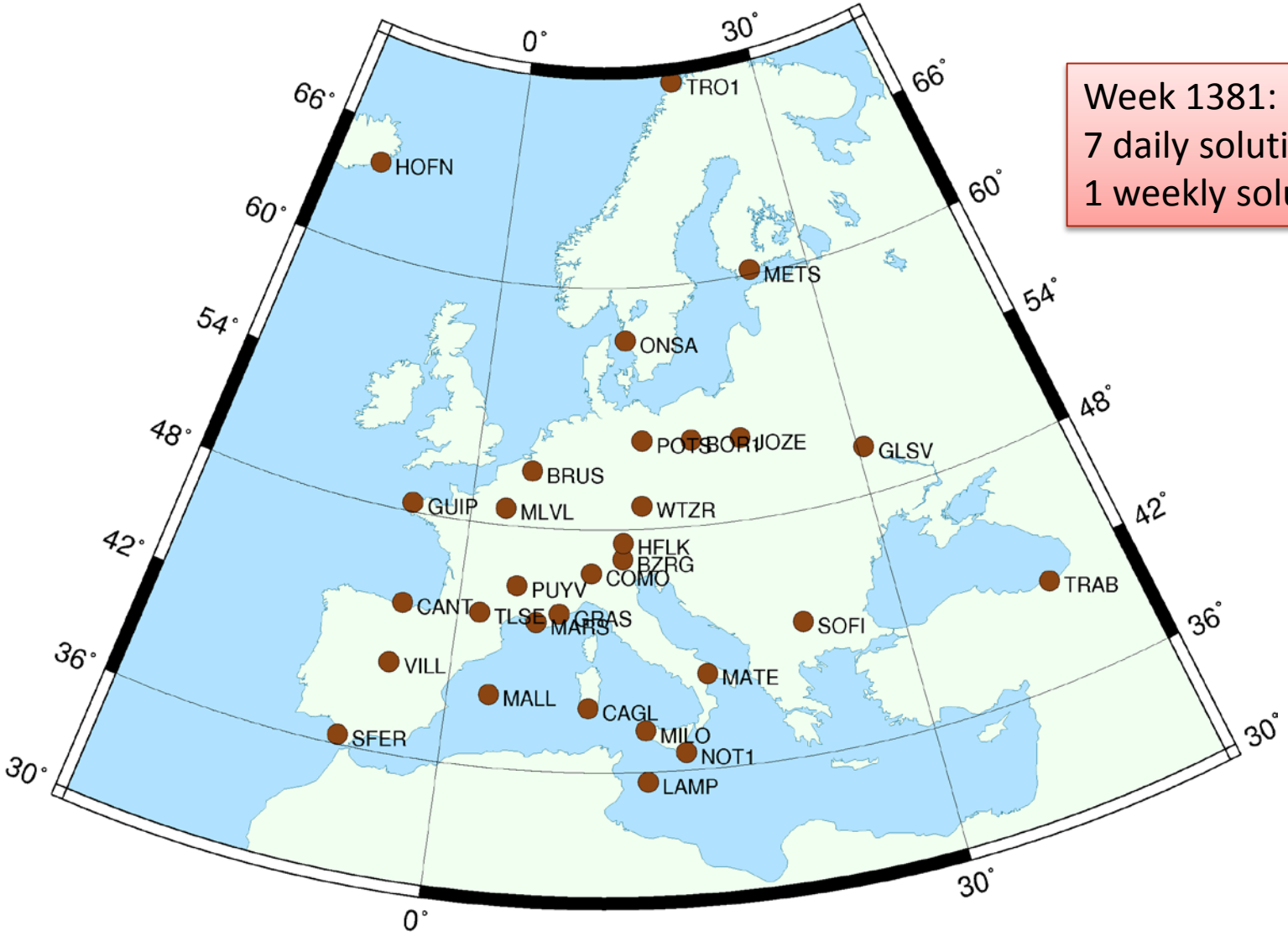
Heinz Habrich

Federal Agency for Cartography and Geodesy

Introduction

- EPN Reprocessing 1
  - Benchmark
  - Pilot Reprocessing
  - Full Reprocessing
- IGS08 reference coordinates and velocities for EPN
- 7th LAC Workshop in November 2010
- EUREF Proposal for Tide Gauge Benchmark Monitoring (TIGA)
- New LAC at RGA Serbia
- Outlook

EPN Repro1 “Benchmark Test”

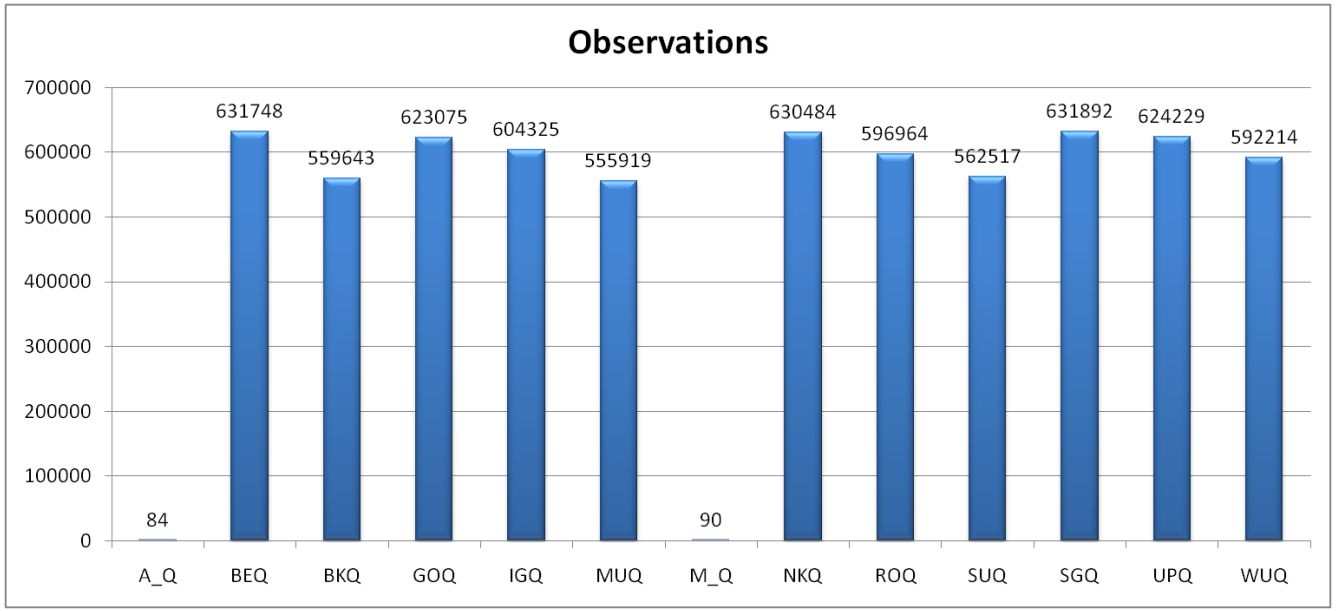


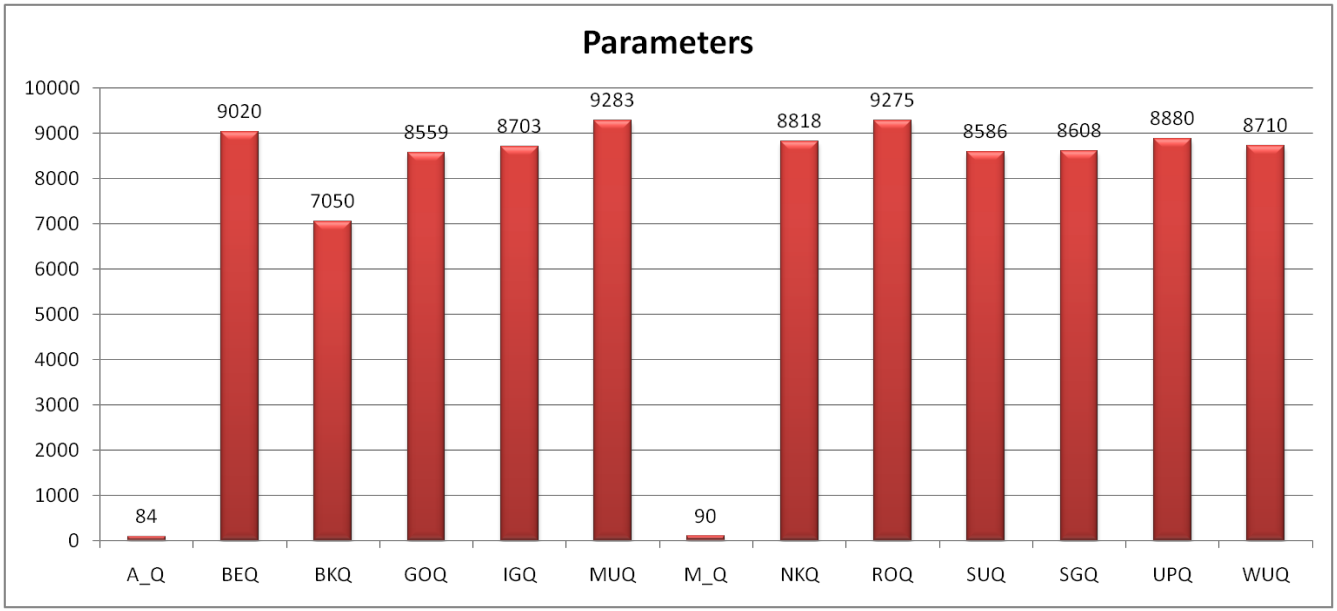
Week 1381:
7 daily solutions
1 weekly solution

13 LACs Already Contributing

A_Q - Italian Space Agency/Centro di Geodesia Spaziale, Matera – Italy	**GIPSY**
BEQ - Bayerische Kommission fuer die Internationale Erdmessung - Germany	
BKQ - Bundesamt fuer Kartographie und Geodaesie - Germany	
GOQ - Geodetic Observatory Pecny, Pecny - Czech Republic	
IGQ - Instituto Geografico Nacional / Centro de Obs. Geodesicas - Spain	
MUQ - Military University of Technology - Poland	
M_Q - Military University of Technology - Poland (GAMIT solution)	**GAMIT**
NKQ - Nordic Geodetic Commission / Lantmaeteriet / Onsala Space Obs. - Sweden	
ROQ - Royal Observatory of Belgium, Brussels - Belgium	
SUQ - Slovak University of Technology, Bratislava - Slovakia	
SGQ - FOEMI Satellite Geodetic Observatory - Hungary	
UPQ - University of Padova, Padova - Italy	
WUQ - Warsaw University of Technology, Warsaw - Poland	

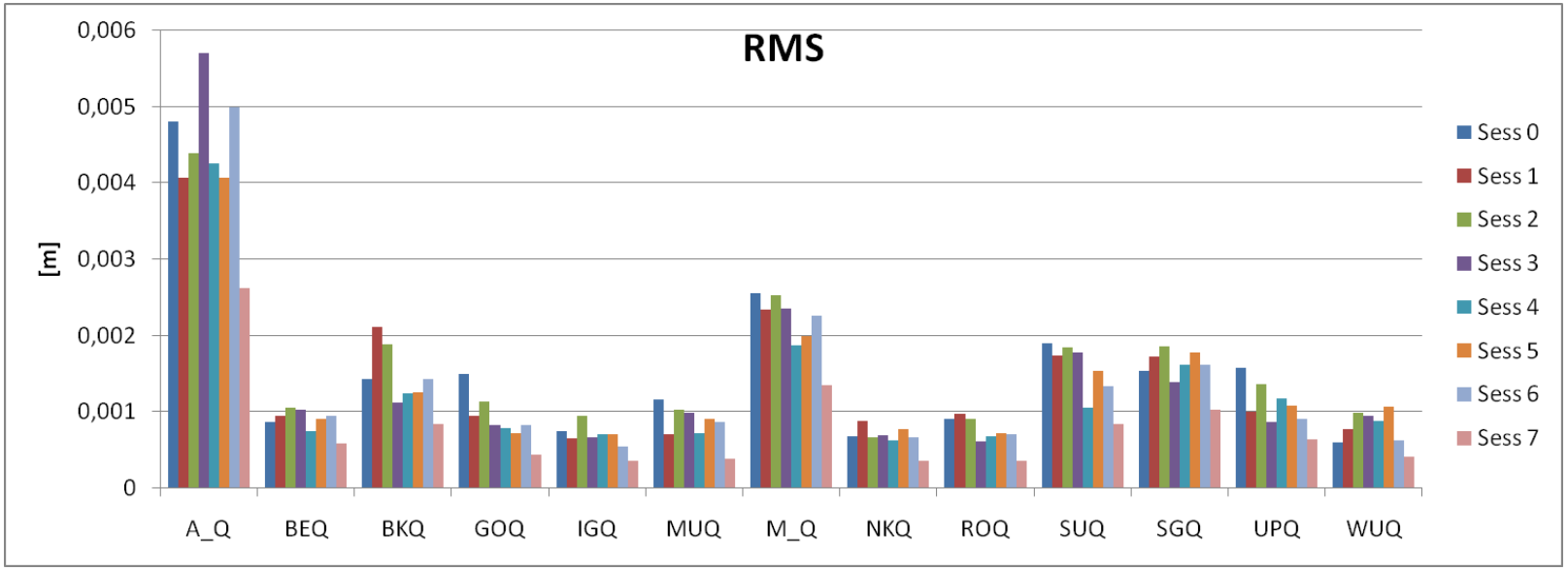
Main Characteristics of Normal Equations

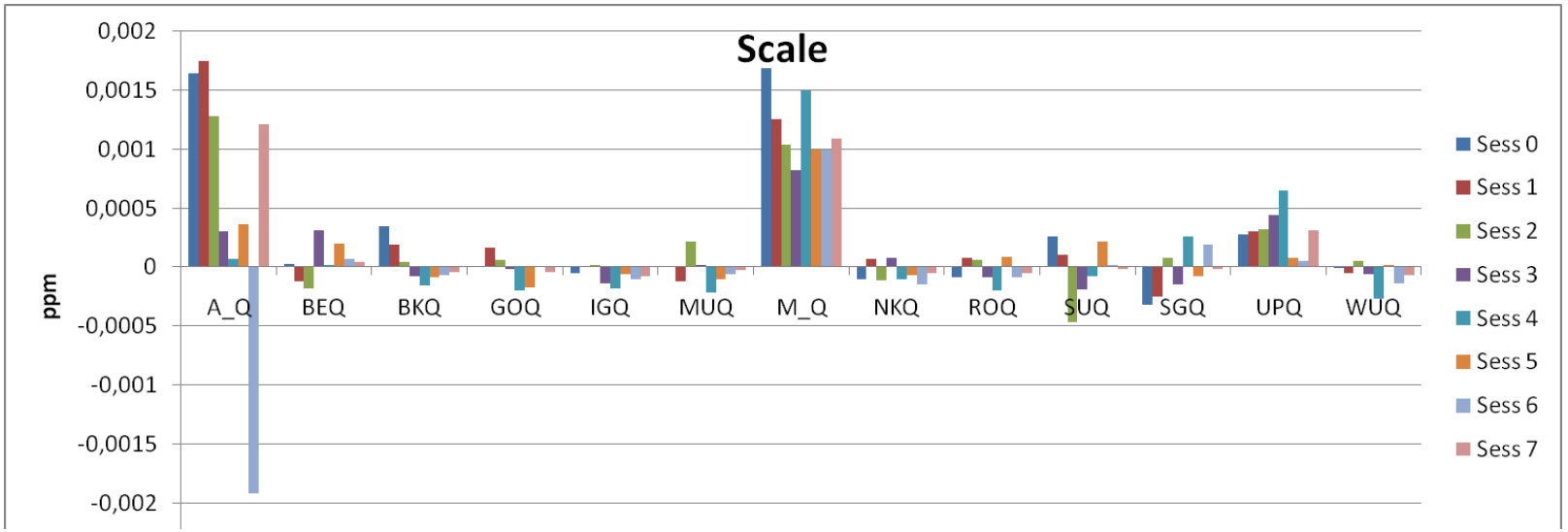




weekly benchmark result

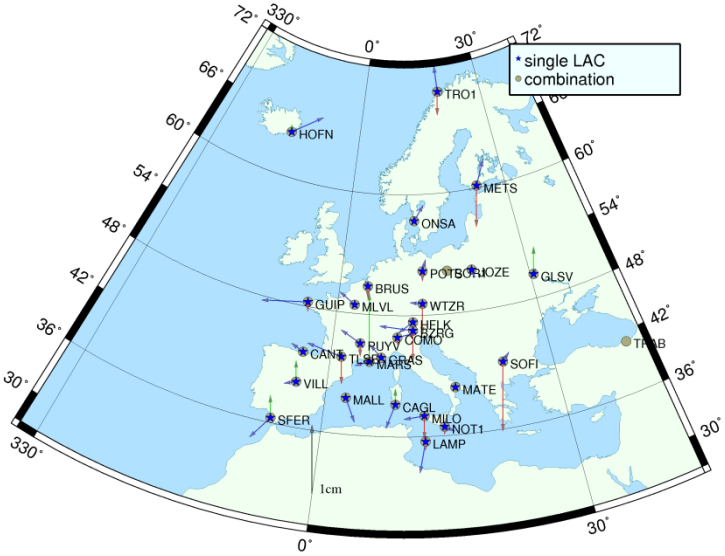
LAC vs. Combined Solutions
7 Parameter Helmert Transformation



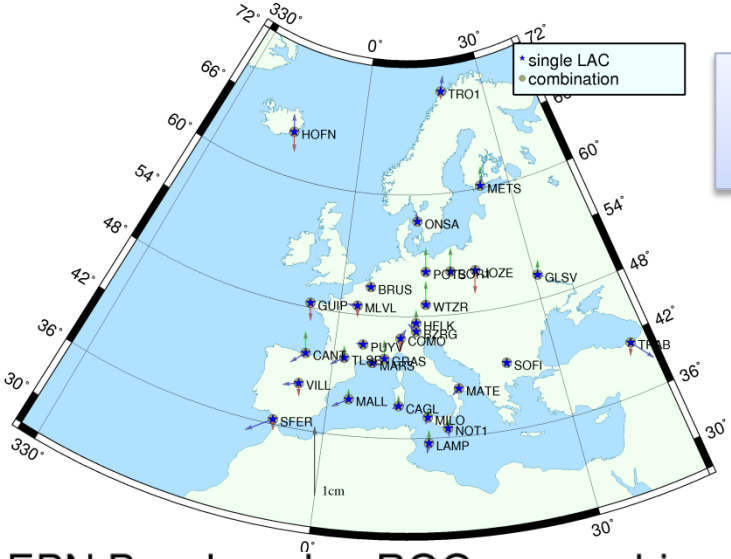


Coordinate Differences - LACs

EPN Benchmark – A_Q vs. combined



EPN Benchmark – M_Q vs. combined



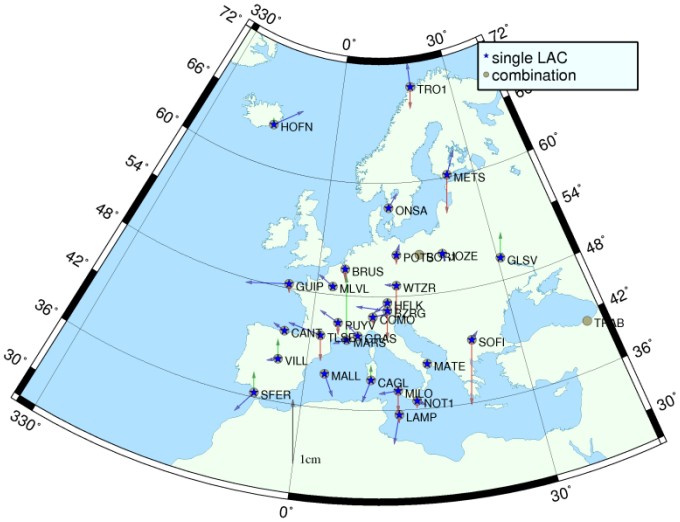
weekly benchmark result

EPN Benchmark – NKQ vs. combined

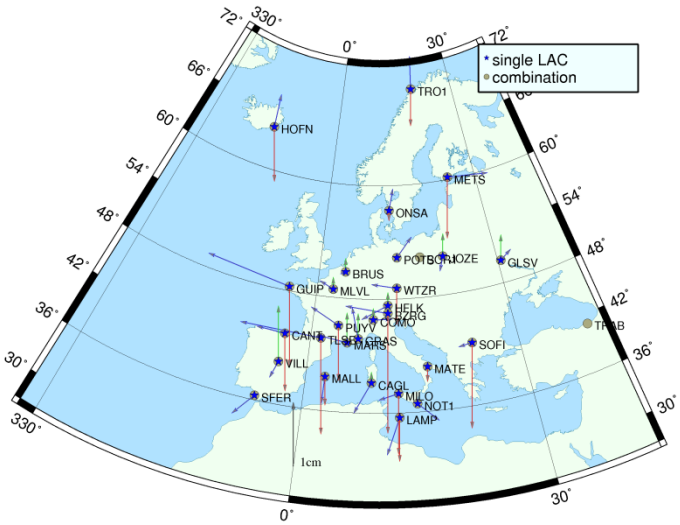
EPN Benchmark – ROQ vs. combined

Coordinate Differences - Days

EPN Benchmark – A_Q vs. combined



EPN Benchmark – A_Q vs. combined, day 0



EPN Benchmark – A_Q vs. combined, day 1

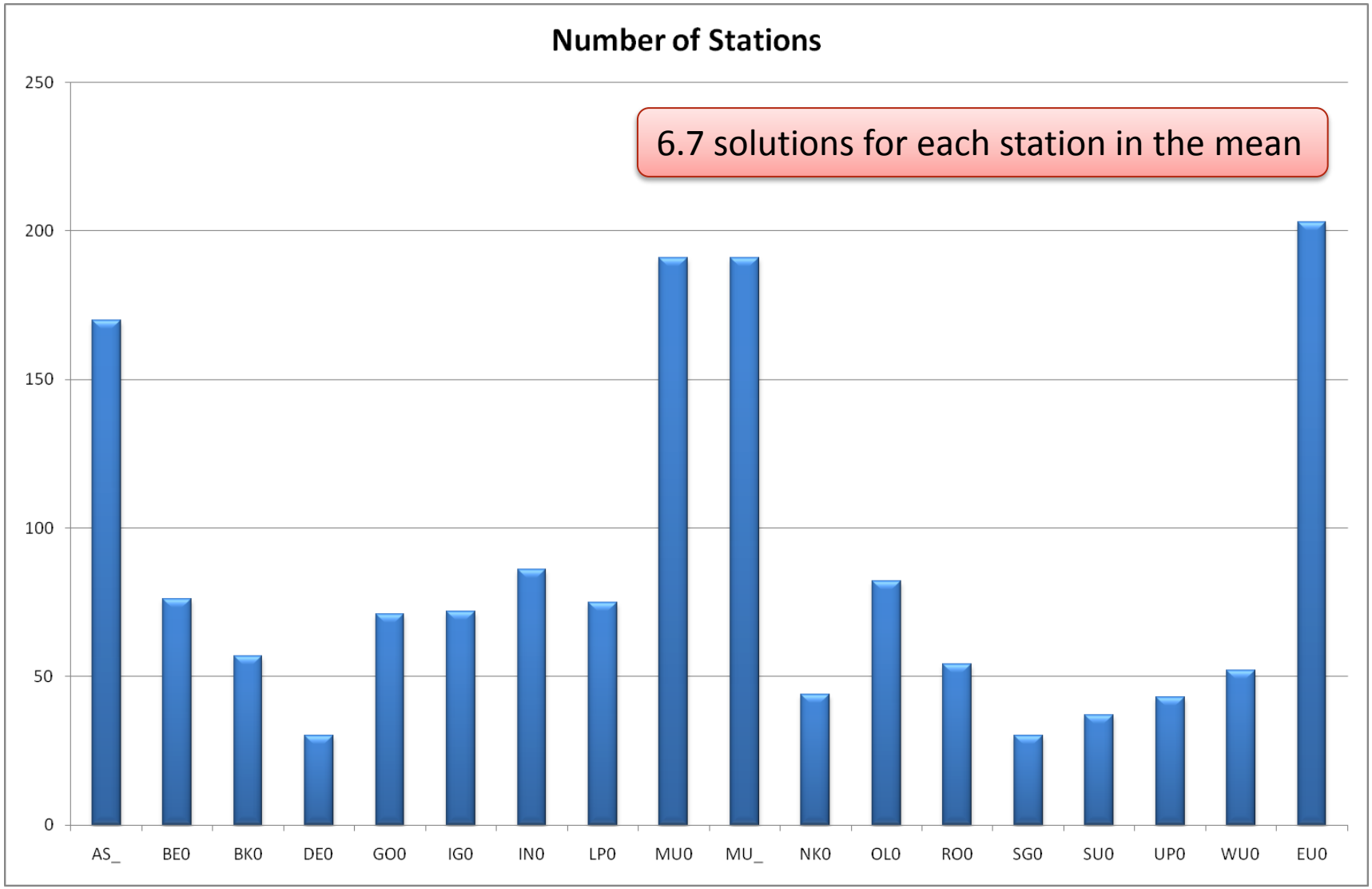
EPN Benchmark – A_Q vs. combined, day 2

Weekly Re-Processed Solutions

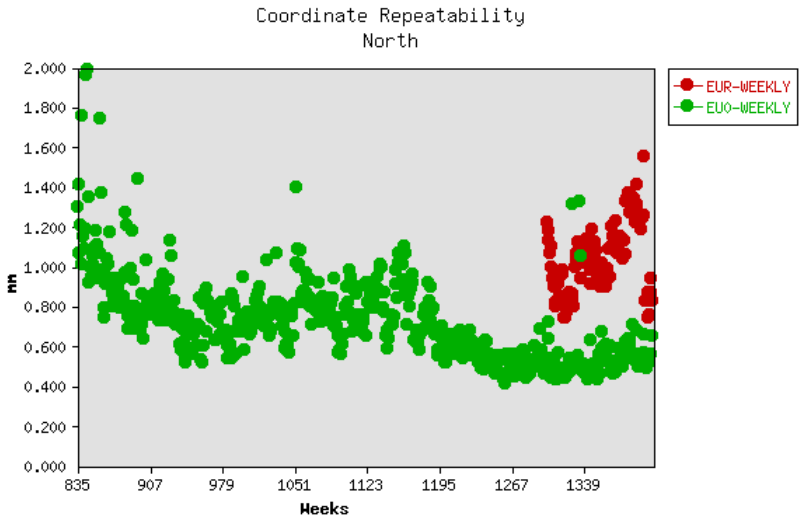
Selected time window:
First session 1996 - 0070 (Week.d 0835.0)
Last session 2006 - 3640 (Week.d 1407.6)

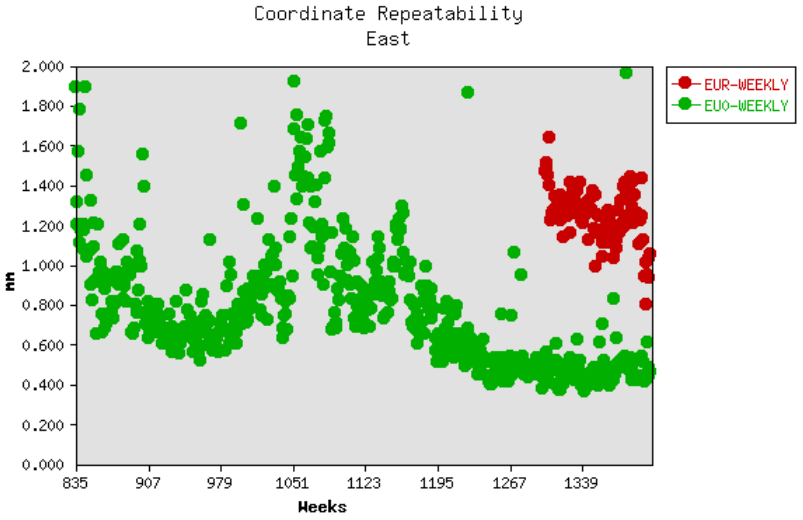
LAC	#Sol.	#Gaps	Integrity	Software	Remarks
AS_	101	472	17.6%	GIPSY	years 2005 – 2006 ! EXCLUDED !
BE0	573	0	100.0%	BSW	
BK0	573	0	100.0%	BSW	
DE0	557	16	97.2%	GIPSY	16 solution not used ! EXCLUDED !
GO0	573	0	100.0%	BSW	
IG0	573	0	100.0%	BSW	
IN0	365	208	63.7%	BSW	years 2000 - 2006
LP0	52	521	9.1%	BSW	year 2006 pilot re-processing
MU0	573	0	100.0%	BSW	
MU_	573	0	100.0%	GAMIT	
NK0	573	0	100.0%	BSW	
OL0	52	521	9.1%	BSW	year 2006 pilot re-processing
RO0	573	0	100.0%	BSW	
SG0	573	0	100.0%	BSW	
SU0	314	259	54.8%	BSW	years 2001 - 2006
UP0	573	0	100.0%	BSW	
WU0	573	0	100.0%	BSW	
EU0	573	0	100.0%	BSW	combination result

Repro 1 Sub-Networks for Week 1407



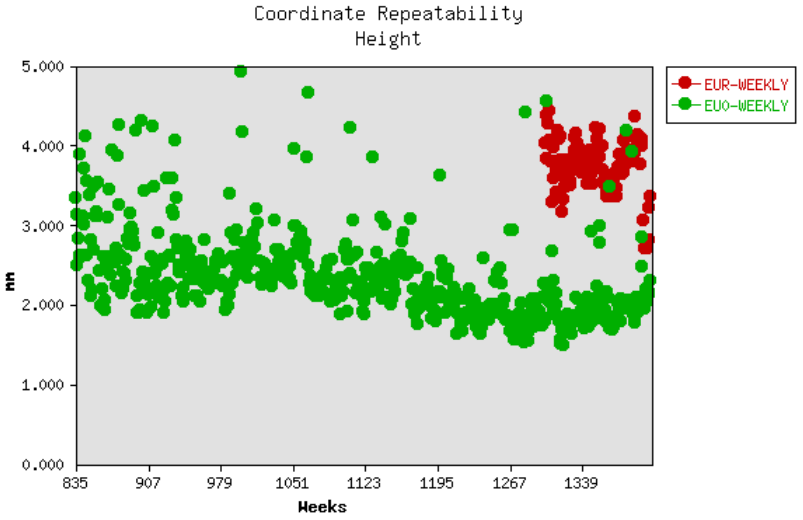
Coordinate Comparison
LAC vs. Combined Solution (RMS)





Solution: EUR
Type: WEEKLY
Inspected solutions: 106

Median North: 1.035 mm
East: 1.25 mm
Height: 3.76 mm

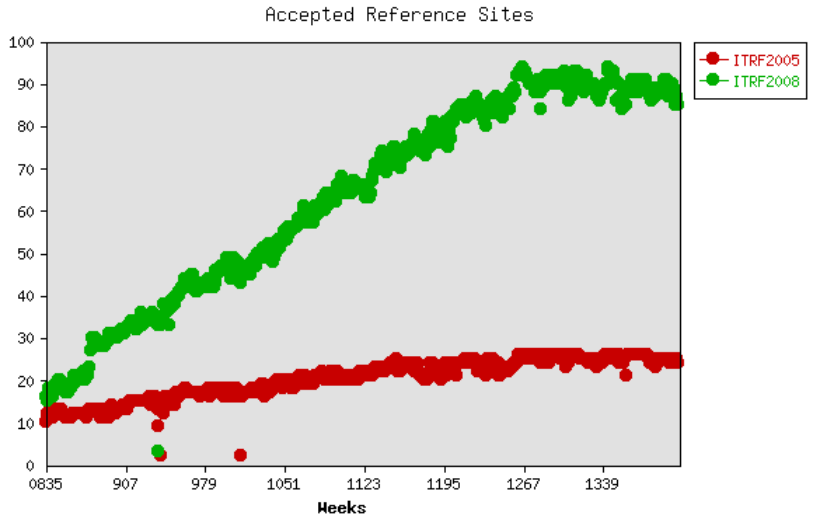


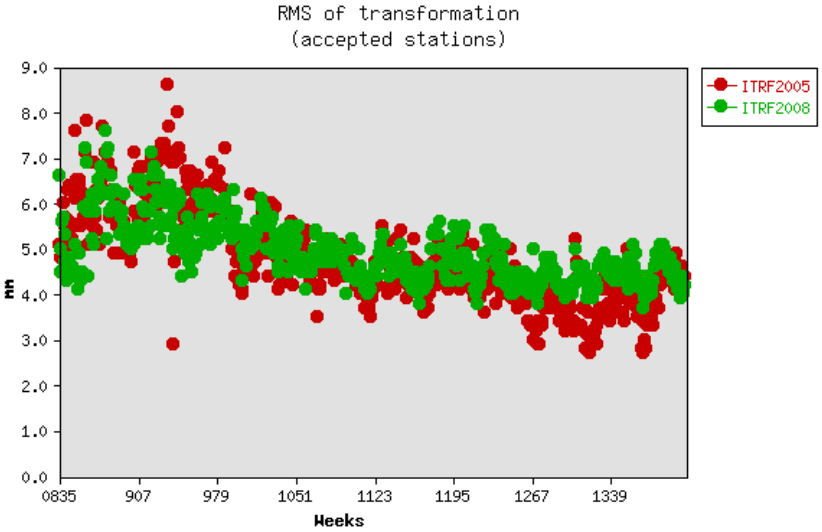
Solution: EUO
Type: WEEKLY
Inspected solutions: 573

Median North: 0.69 mm
East: 0.70 mm
Height: 2.24 mm

Validation of Reference Site Coordinates - ITRF2005 and ITRF2008 -

- Helmert transformation (3 parameters for shift)
- Estimated vs. reference coordinates (of reference sites only)
- “Case study“ for next EPN-Repro referenced to IGS08

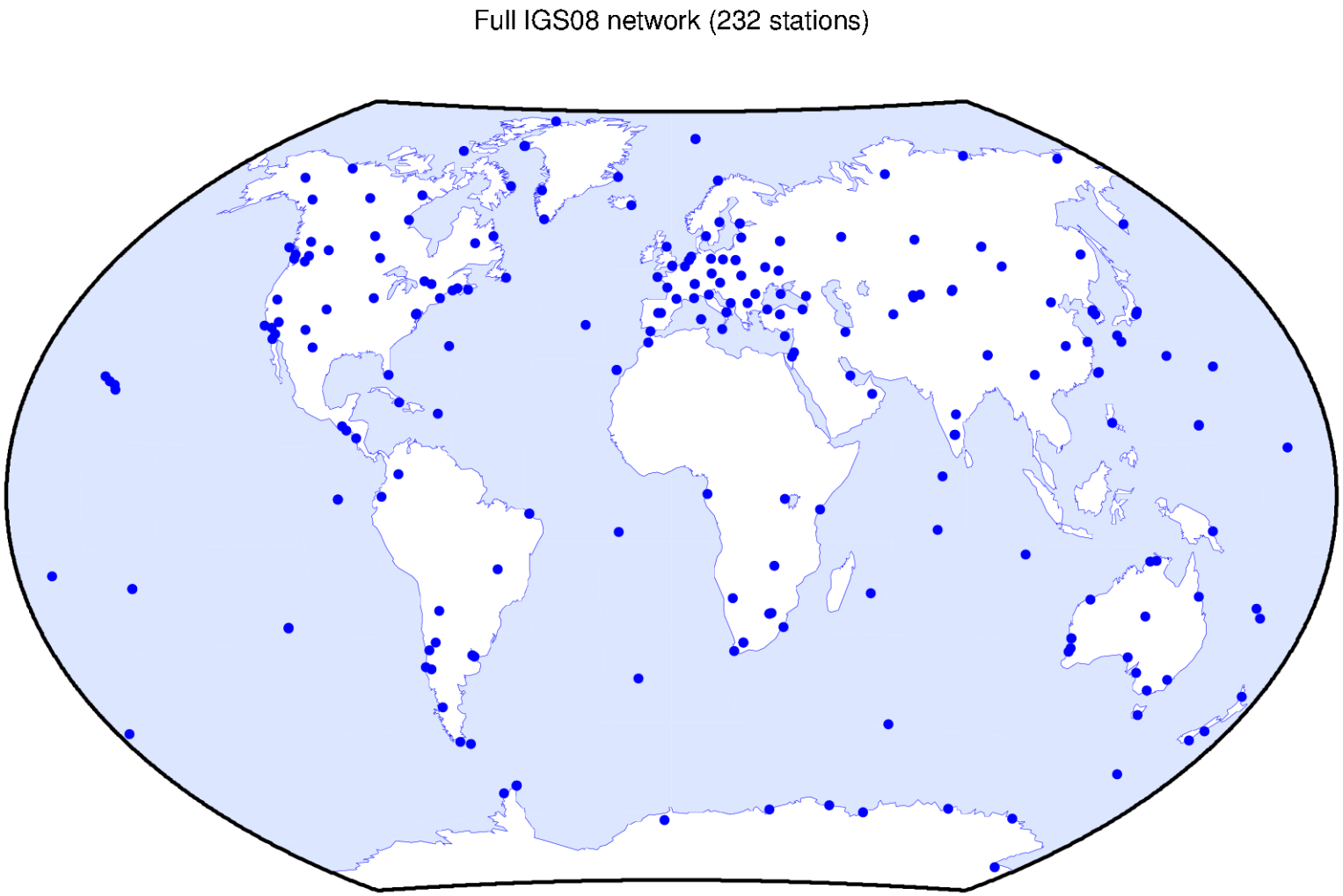




IGS08 Reference Coordinates and Velocities for EPN

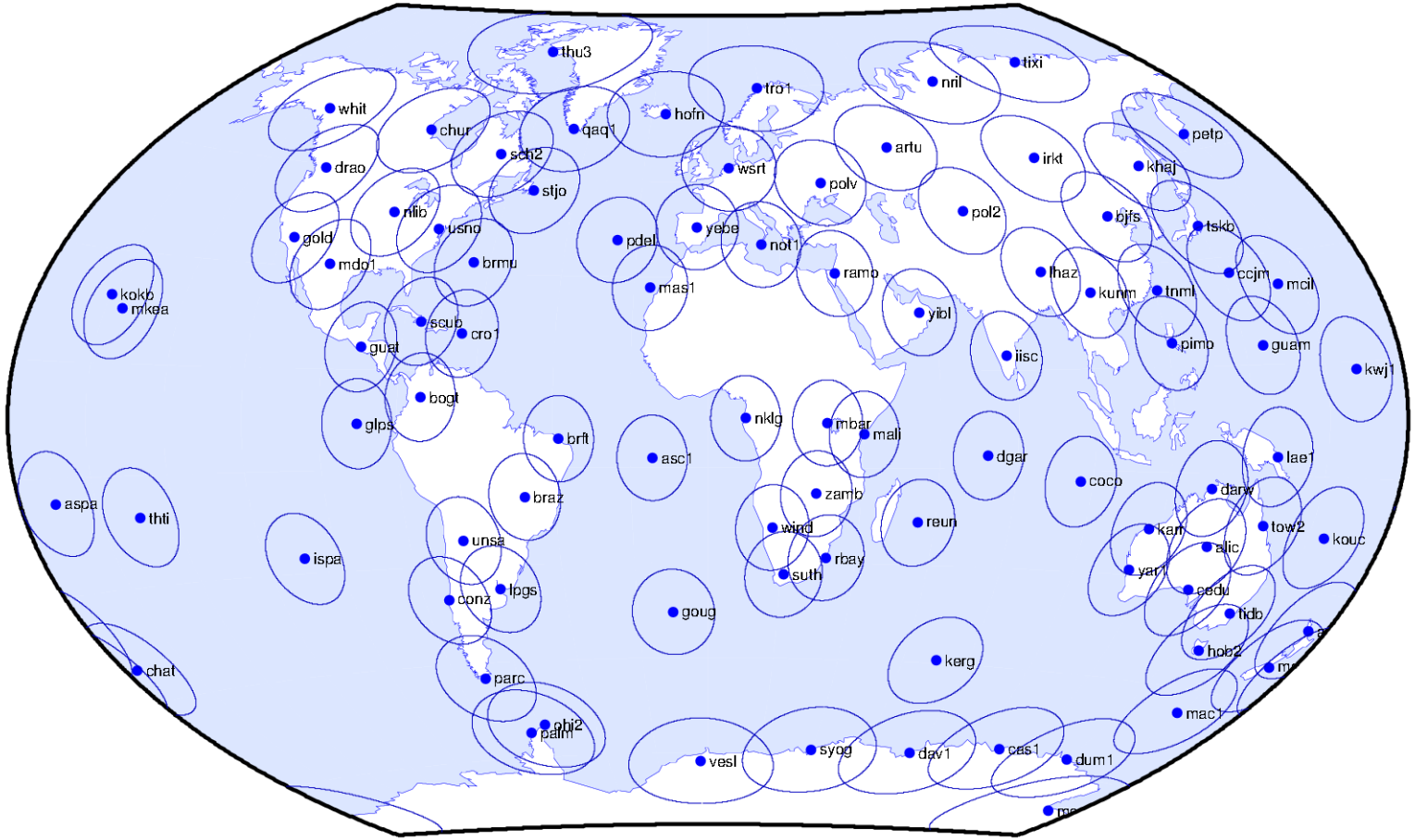
- Scope:
  - EPN will use IGS08 to reach maximum consistency with IGS products starting with week 1632
- Remark 1:
  - IGS08 must be considered as interaction of IGS08.snx and IGS08.atx (satellite and receiver antenna PCOs and PCVs)
- Remark 2:
  - IGS08 is essentially a subset of 232 stable, well-performing IGS stations from ITRF2008 (in total 580 stations)

Dense Coverage to Satisfy Regional Users



Homogeneous Sub-Network for Alignment of Global Frames

The 91 primary stations of the IGS08 core network



Definition of IGS08

Update of receiver antenna corrections in IGS08.atx

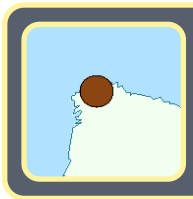
Impact of calibration update of station coordinates assessed by PPP strategy and applied to ITRF2008 coordinates

a) non-significant impact: IGS08=ITRF2008
b) significant impact:
IGS08=ITRF2008+correction

Significant impact for 35 EPN stations belonging to IGS08 detected

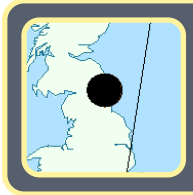
Satellite PCO re-estimated consistently with IGS08 scale (~1 ppb difference to IGS05 scale)

ITRF2008 versus IGS08



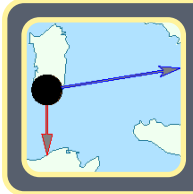
ITRF2008 station

- Not included in IGS08
- Consistency with IGS08.atx unclear



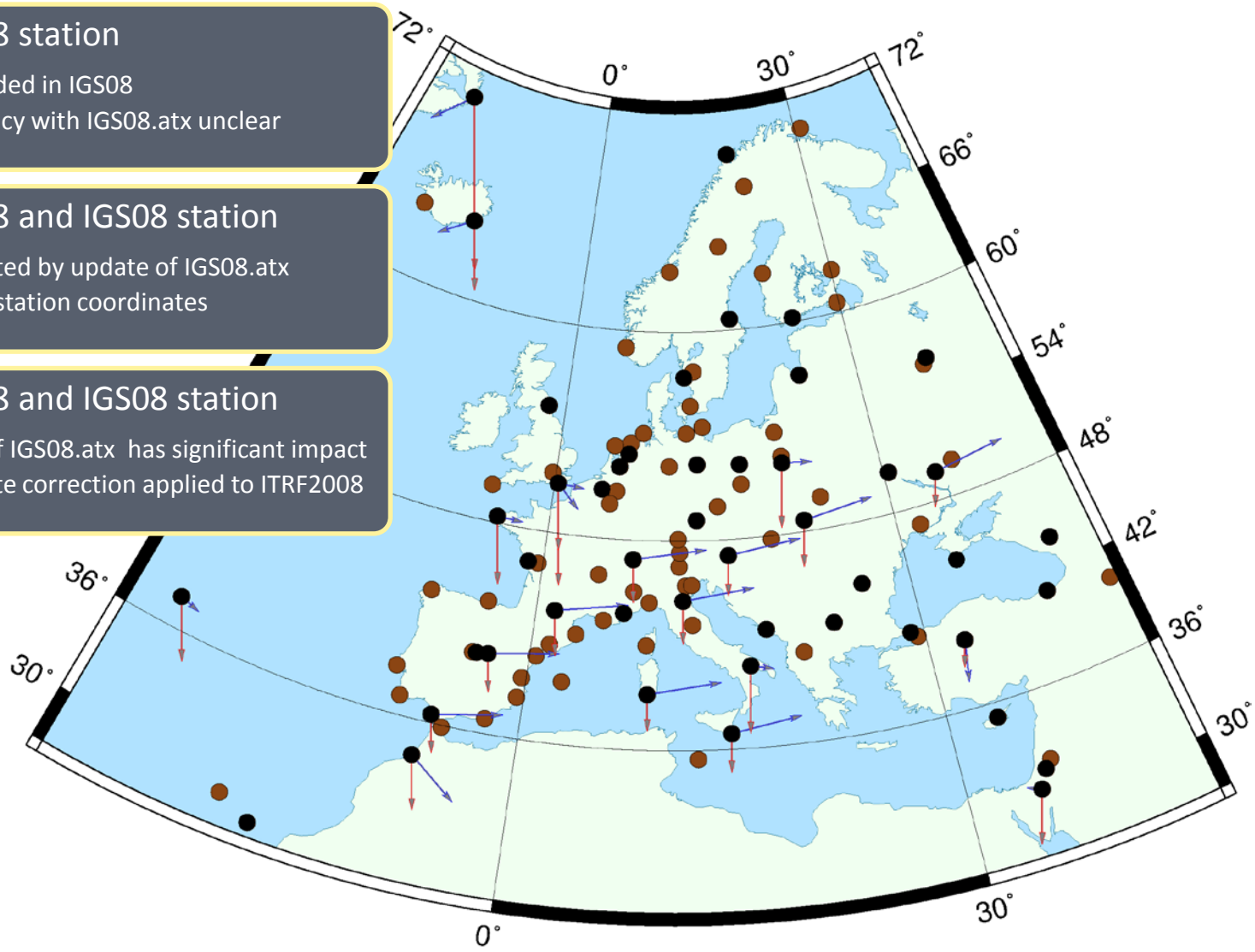
ITRF2008 and IGS08 station

- Not affected by update of IGS08.atx
- Identical station coordinates

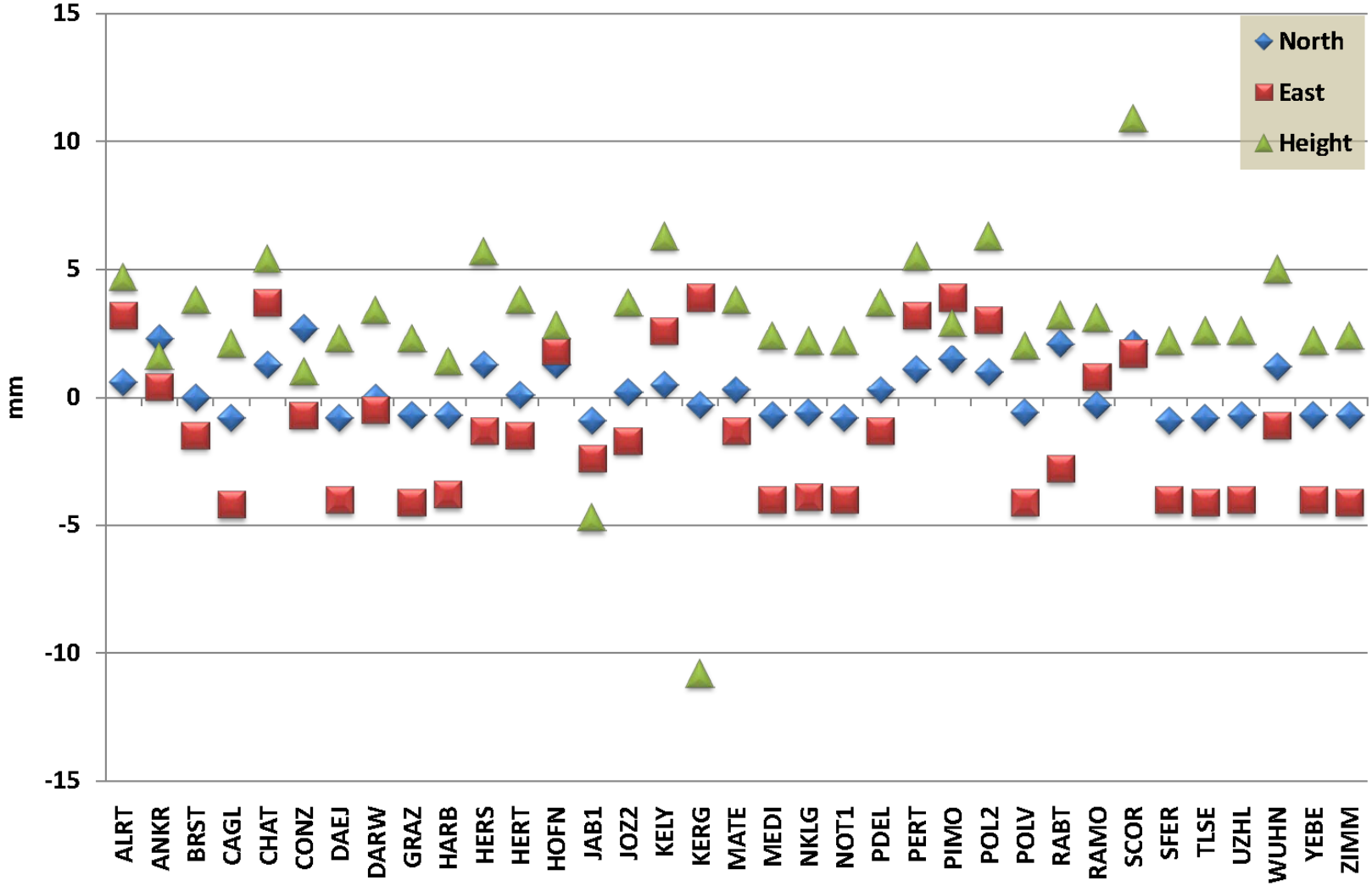


ITRF2008 and IGS08 station

- Update of IGS08.atx has significant impact
- Coordinate correction applied to ITRF2008



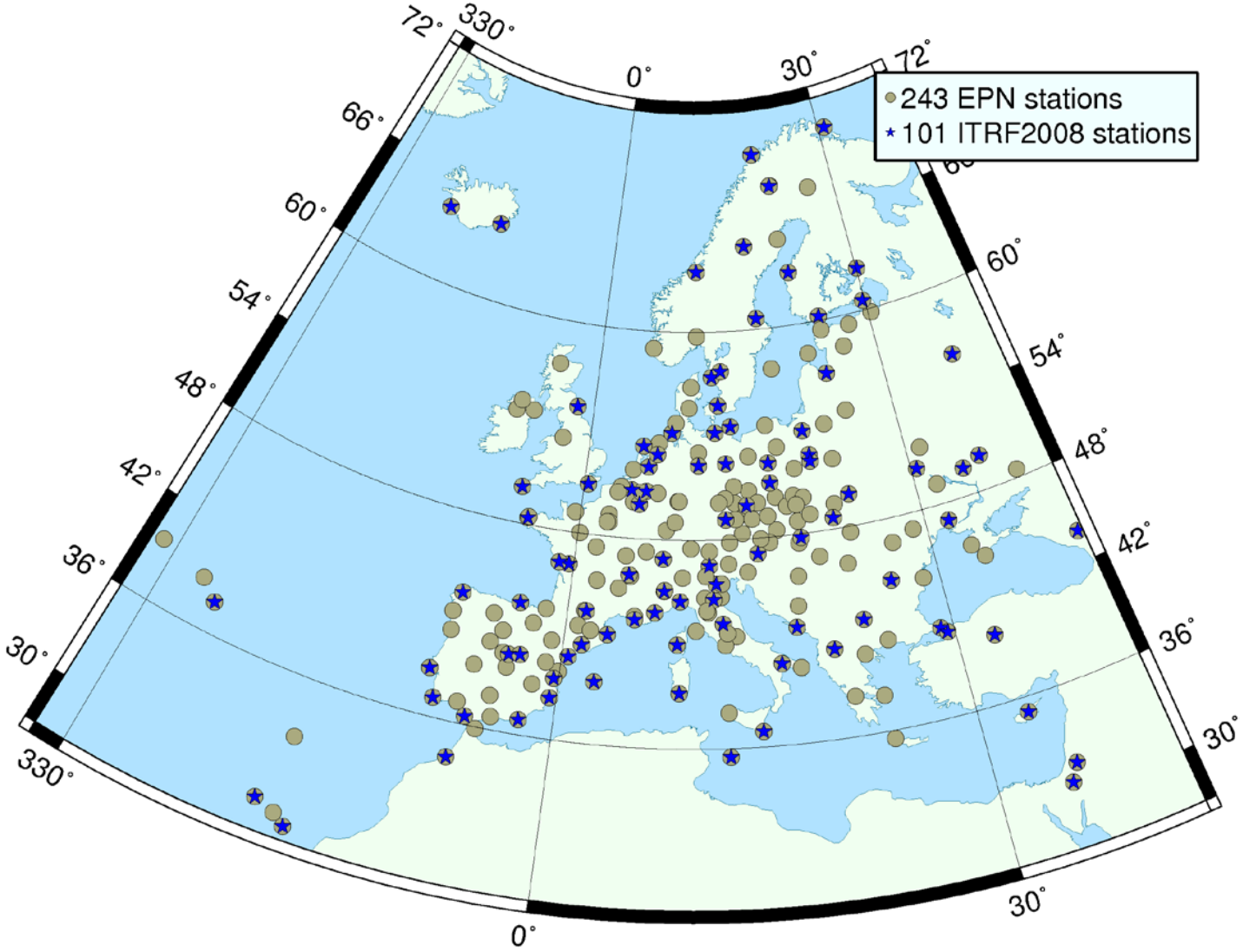
ITRF2008 to IGS08 Coordinate Corrections of Affected EPN Stations



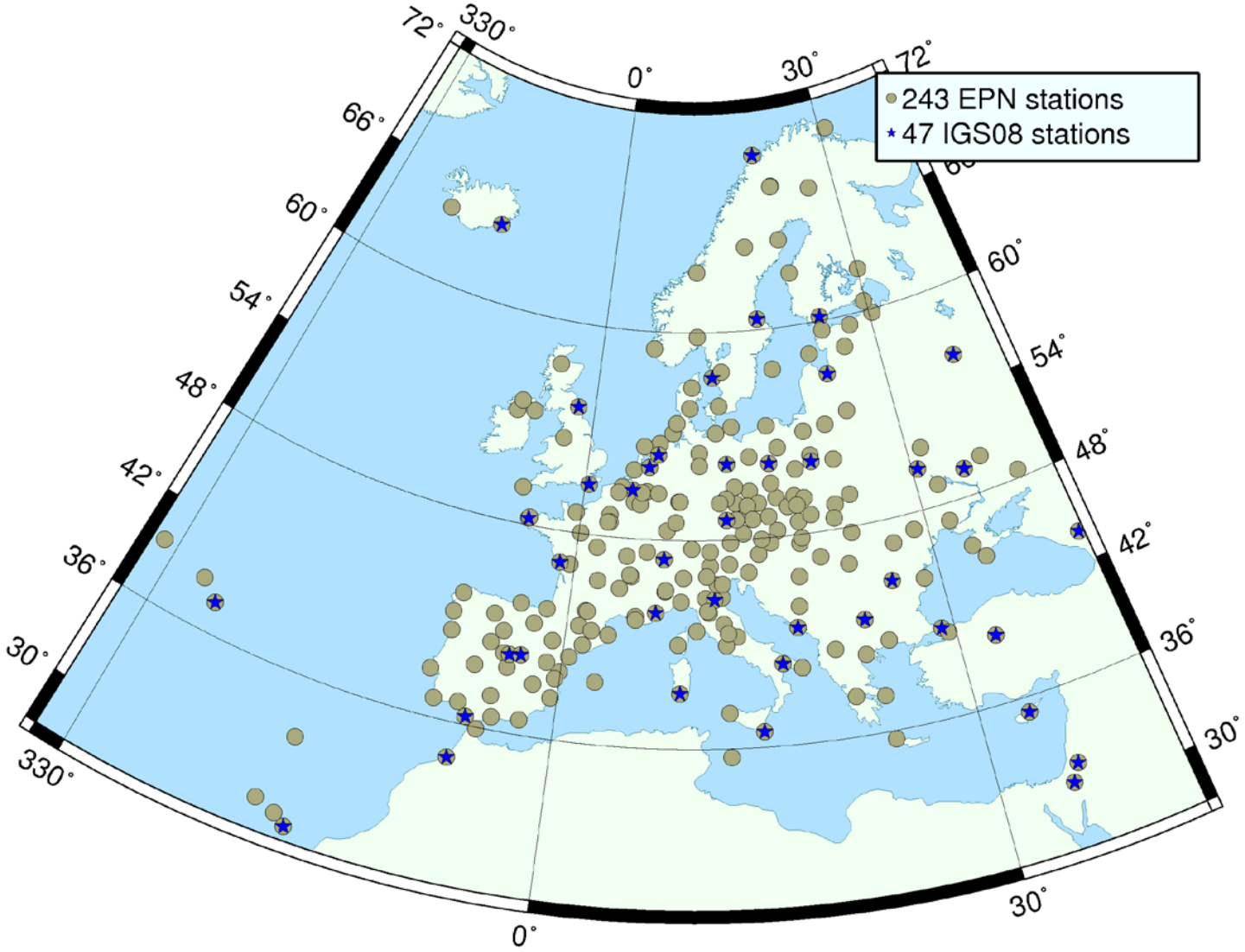
Preparation for Switch to IGS08 in EPN Analysis

- Select a proper option:
  - Option 1: Use IGS08 stations only
  - Option 2: Use IGS08 and unaffected ITRF2008 stations
  - Option 3: Use IGS08, unaffected and corrected ITRF2008 stations
- Investigation of ITRF2008 stations not included in IGS08 needed for option 3:
  - select EPN stations of recent weekly EPN solution, here week 1622
  - verify IGS latitude-dependent model correction for known IGS08 stations of EPN
  - compute and apply model corrections to ITRF2008 coordinates

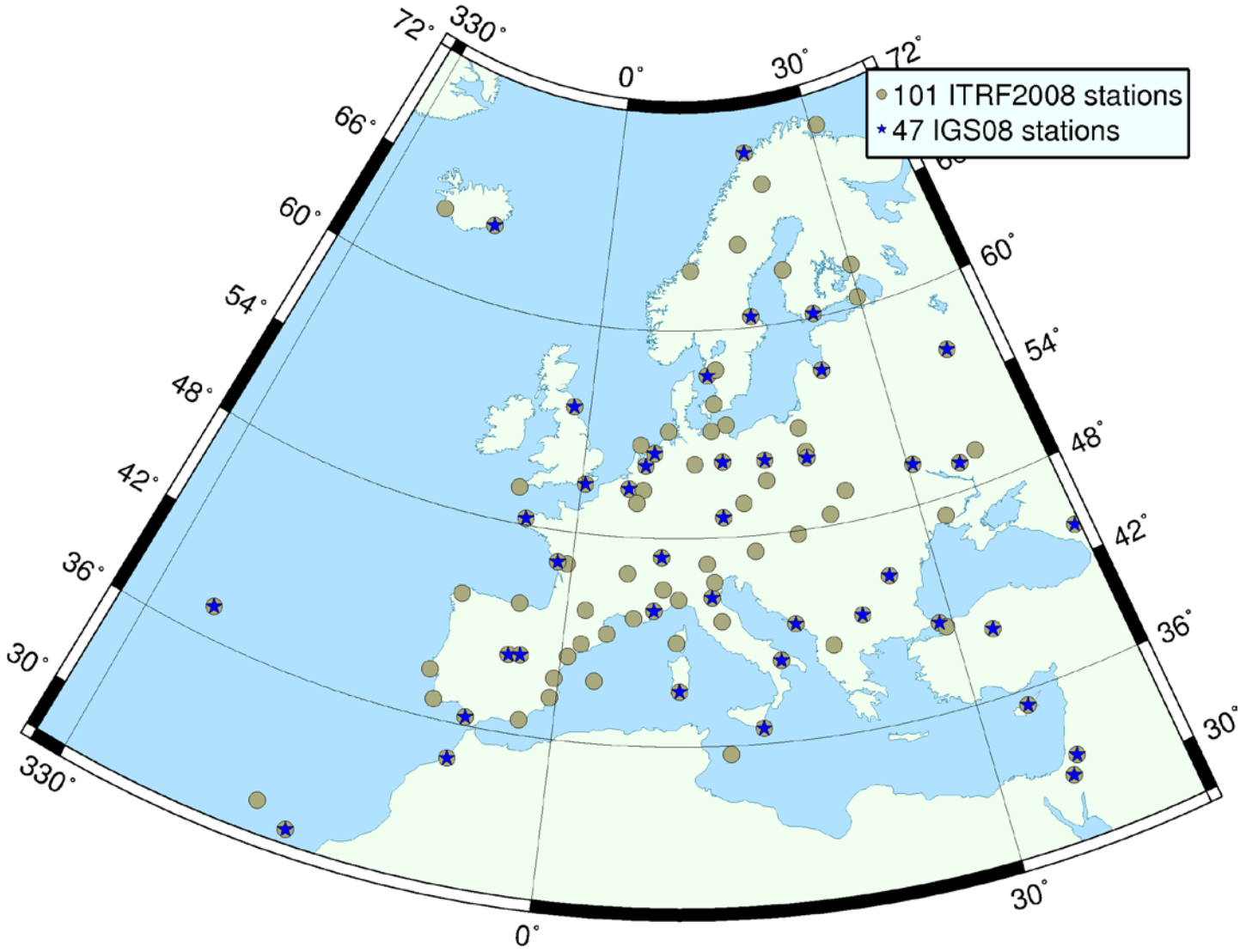
EPN and ITRF2008



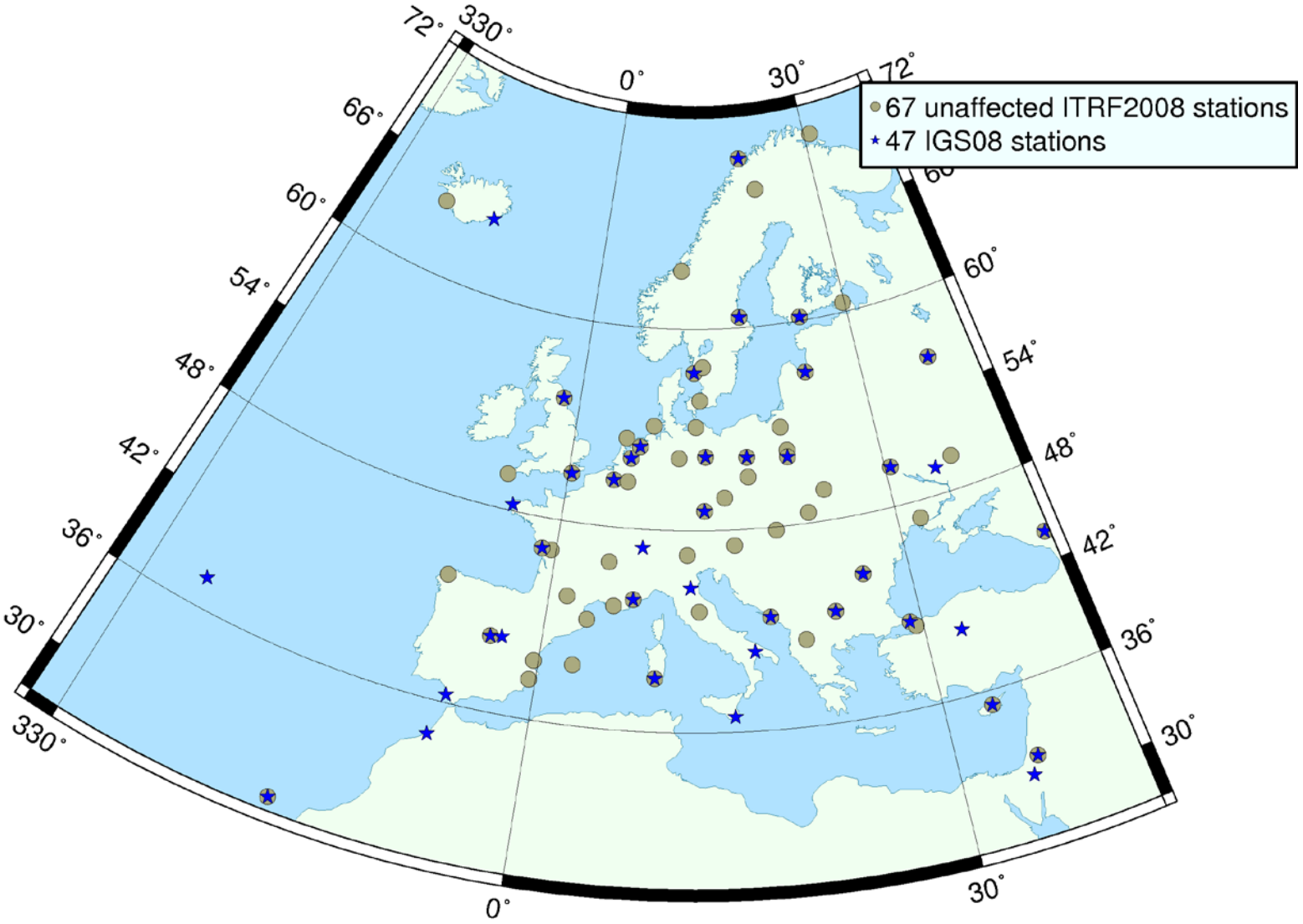
EPN and IGS08



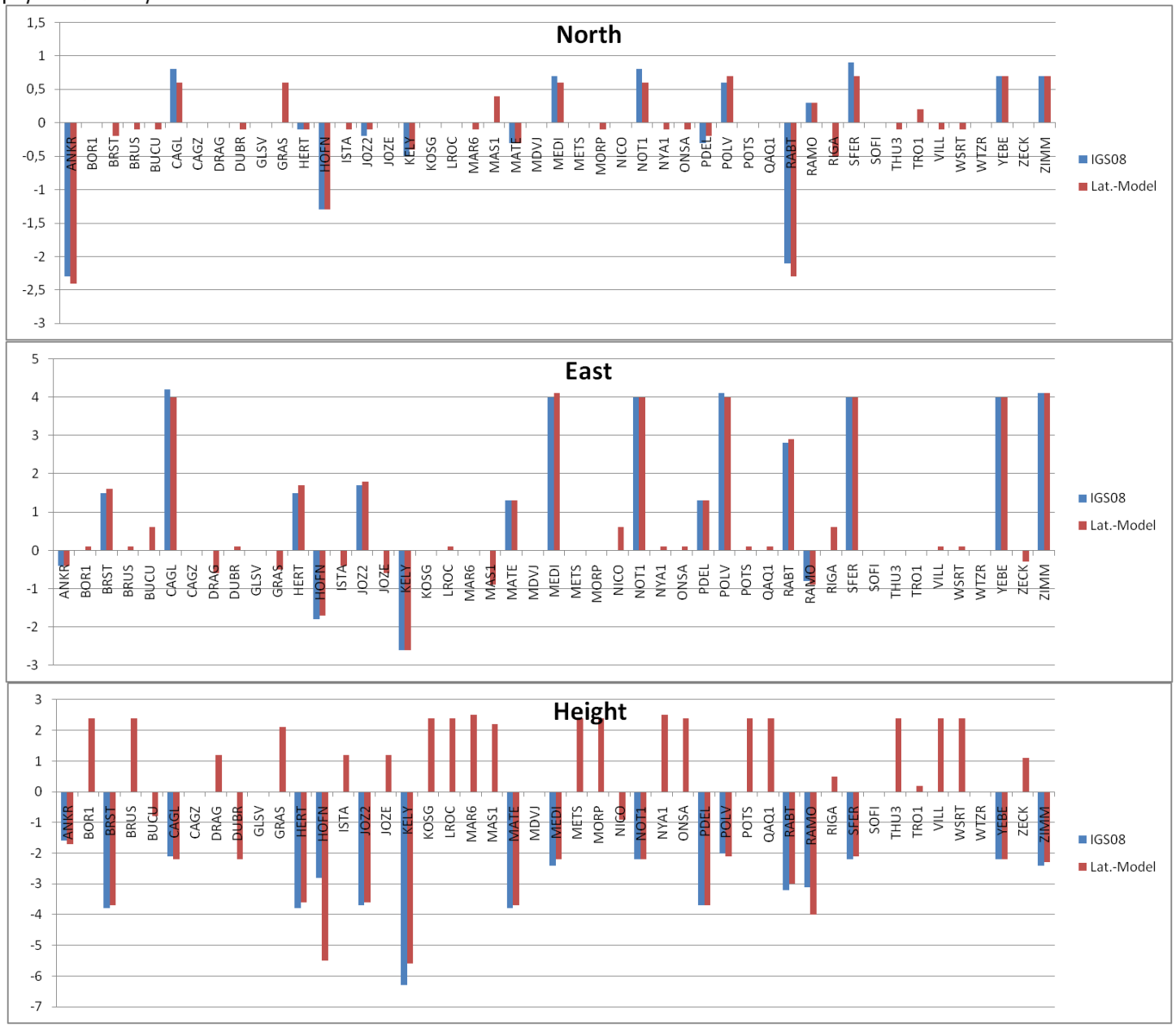
ITRF2008 and IGS08

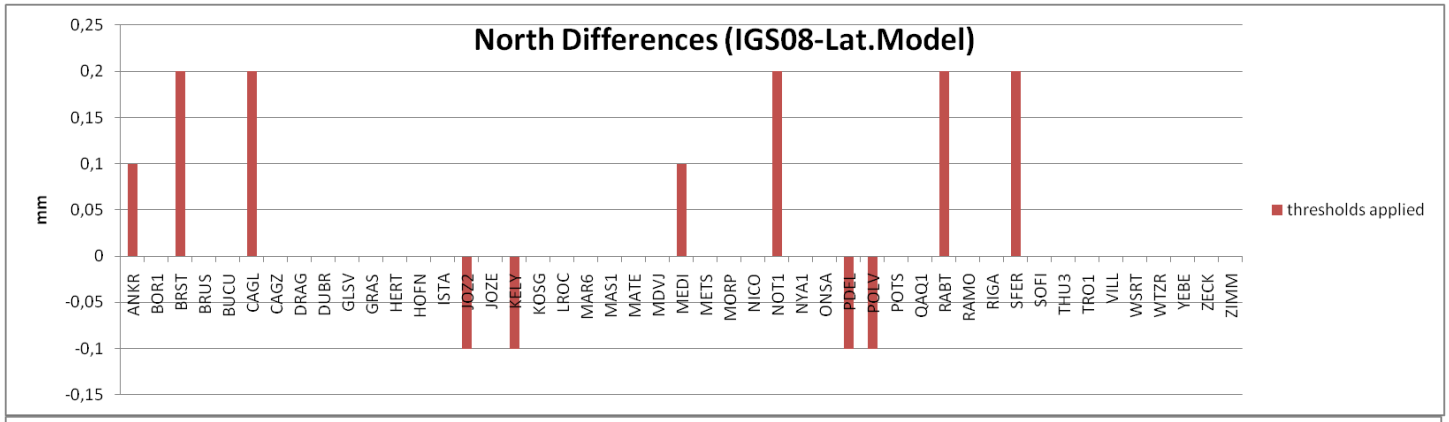


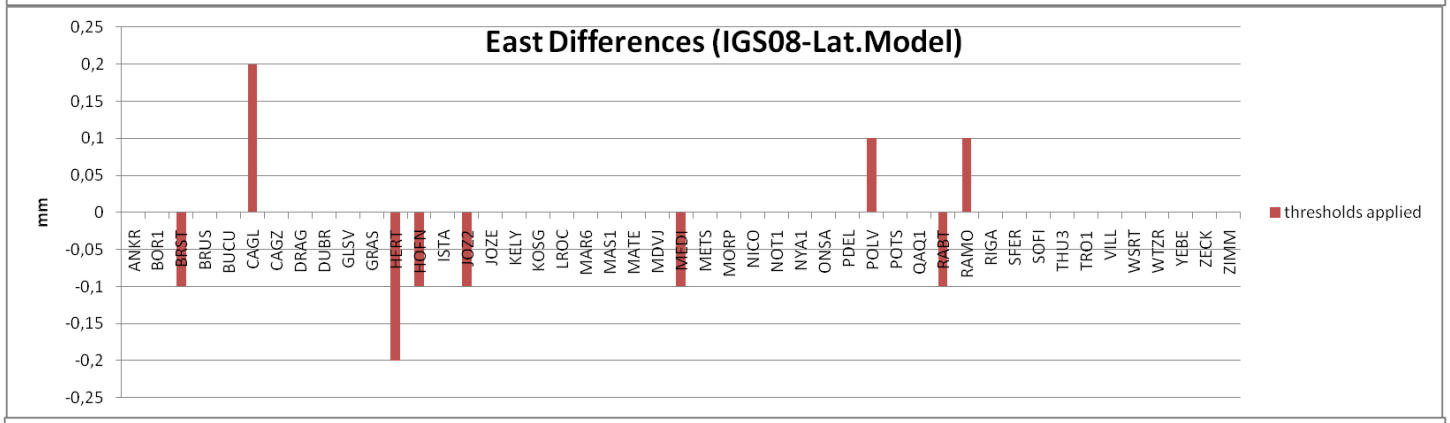
84 Potential EPN Reference Stations

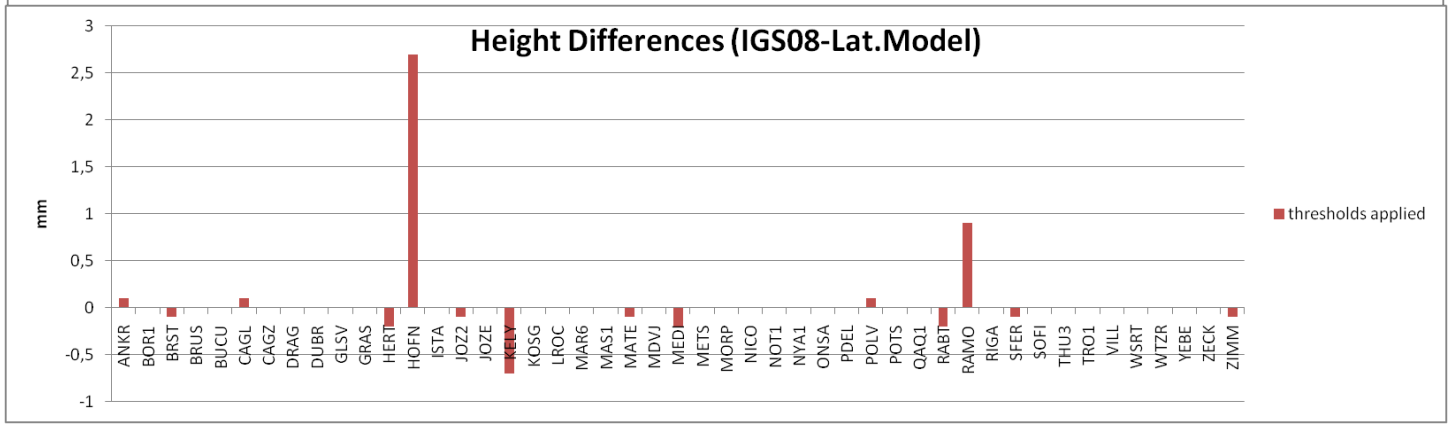


ITRF2008 to IGS08 Corrections




North Differences (IGS08-Lat.Model)
mm
0,25
0,2
0,15
0,1
0,05
0
-0,05
-0,1
-0,15
ANKR BOR1 BRST BRUS BUCU CAGL CAGZ DRAG DUBR GLSV GRAS HERT HOFN ISTA JOZ2 JOZE KELY KOSG LROC MAR6 MAS1 MATE MDVJ MEDI METS MORP NICO NOT1 NYA1 ONSA PDEL POLV POTS QAQ1 RABT RAMO RIGA SFER SOFI THU3 TRO1 VILL WSRT WTZR YEBE ZECK ZIMM
thresholds applied


East Differences (IGS08-Lat.Model)
mm
0,25
0,2
0,15
0,1
0,05
0
-0,05
-0,1
-0,15
-0,2
-0,25
ANKR BOR1 BRST BRUS BUCU CAGL CAGZ DRAG DUBR GLSV GRAS HERT HOFN ISTA JOZ2 JOZE KELY KOSG LROC MAR6 MAS1 MATE MDVJ MEDI METS MORP NICO NOT1 NYA1 ONSA PDEL POLV POTS QAQ1 RABT RAMO RIGA SFER SOFI THU3 TRO1 VILL WSRT WTZR YEBE ZECK ZIMM
thresholds applied


Height Differences (IGS08-Lat.Model)
mm
3
2,5
2
1,5
1
0,5
0
-0,5
-1
ANKR BOR1 BRST BRUS BUCU CAGL CAGZ DRAG DUBR GLSV GRAS HERT HOFN ISTA JOZ2 JOZE KELY KOSG LROC MAR6 MAS1 MATE MDVJ MEDI METS MORP NICO NOT1 NYA1 ONSA PDEL POLV POTS QAQ1 RABT RAMO RIGA SFER SOFI THU3 TRO1 VILL WSRT WTZR YEBE ZECK ZIMM
thresholds applied

Selected Reference Sites

- In total 97 reference stations proposed:
  - **4 of 101 ITRF2008** reference stations rejected, because of discontinuity involved by equipment change after release of IGS08 (GRAZ, HERS, TLSE, and UZHL)
  - for **47 stations use IGS08** coordinates as provided by IGS
  - for remaining **50 stations corrections** of latitude-dependent model computed, where the correction is **zero for 33 stations** (station not affected by igs08.atx update or computed correction below threshold), for **17 station correction applied** to ITRF2008 coordinates
  - active for “daily rapid” and “hourly” EPN combination
- Relevant information:
  - IGS-Mail 6354, 6355, 6356 and 6374
  - EUREF-Mail 5732 and 5734
  - BSW-Mail 0297

7th EPN LAC Workshop
November 18-19, 2010, Warsaw, Poland

- Sincere thanks are given to the Military University of Technology for hosting this workshop !
- Main activities were reported by the LACs
- Important round table discussion results were
  - the introduction of IGS08 at the same time as IGS changes from IGS05 to IGS08,
  - to provide RINEX version 3 observation files in preparation for the future Galileo system,
  - and to ask LACs to include GLONASS for routine EPN analysis
- Second day of the workshop was reserved for re-processing issues
- Minutes are available at the EPN-CB

7th EPN LAC Workshop
November 18-19, 2010, Warsaw, Poland

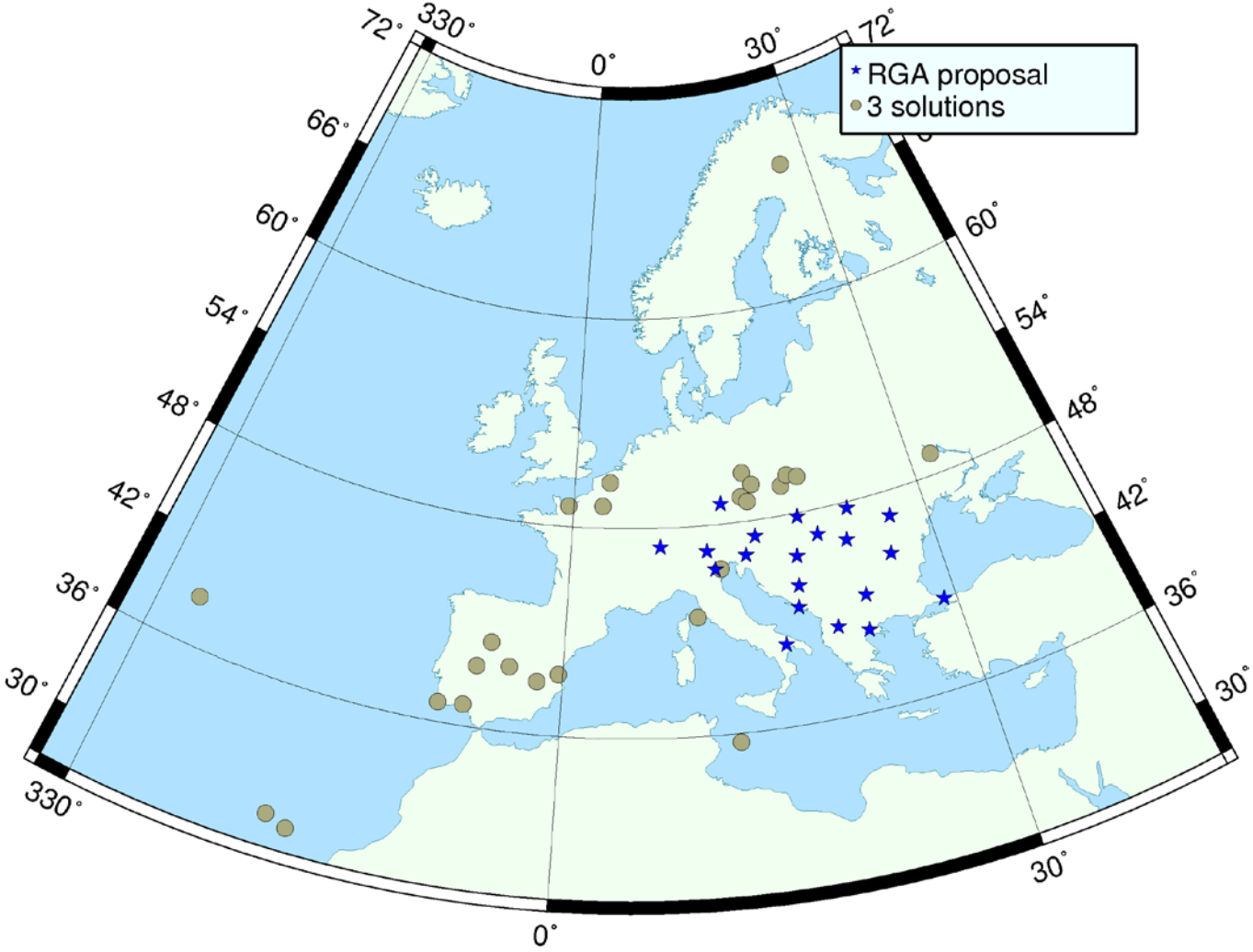
EPN Contribution to Tide Gauge Benchmark Monitoring (TIGA)

- In 2001 IGS Governing Board accepted proposal for “Tide Gauge Benchmark Monitoring Pilot Project (TIGA-PP)”, EPN contributes since that time by providing weekly EPN operational solutions
- In 2011 transition into a an “IGS Working Group” (a permanent service)
  - CfP on February 2, 2011 (IGS-Mail 6341)
  - Submission of EUREF Proposal on March 15, 2011
  - Review by IGS Governing Board going on
- Focus of new EPN proposal on “repeated reprocessing” asked in CfP

Republic Geodetic Authority (RGA), Serbia, - Proposal for EPN Local Analysis Center -

- EPN-CB contacted in April 2011 by Serbian colleague Zoran Veljkovic
- Following “Guidelines for EPN Analysis Centers” RAG submitted a proposal of 20 stations to be analyzed and a LAC description form
- EPN Coordination Group added 25 EPN stations that are analyzed by 3 LACs only → RGA provides “added-value”
- Weekly test solution RGA16167.SNX successfully combined with other LACs
- New LAC accepted by TWG and submission of solution will start with week 1632
- **Also:** Implementation of 4 new EPN stations in Serbia

RGA Sub–Network (44 Stations)



Outlook

- Investigation of benchmark test to reach best possible consistency of all LAC contributions
- Computation of final reprocessed weekly solutions
- Computation of reprocessed daily solutions
- Discussion of further reprocessing as EPN Repro-2 and within the scope of TIGA
- Complete and validate the introduction of IGS08 in all analysis steps of EPN
- Welcome the new LAC at the Republic Geodetic Authority Serbia (RGA)