



KTIMATOLOGIO S.A.



The EUREF GR 2007 campaign

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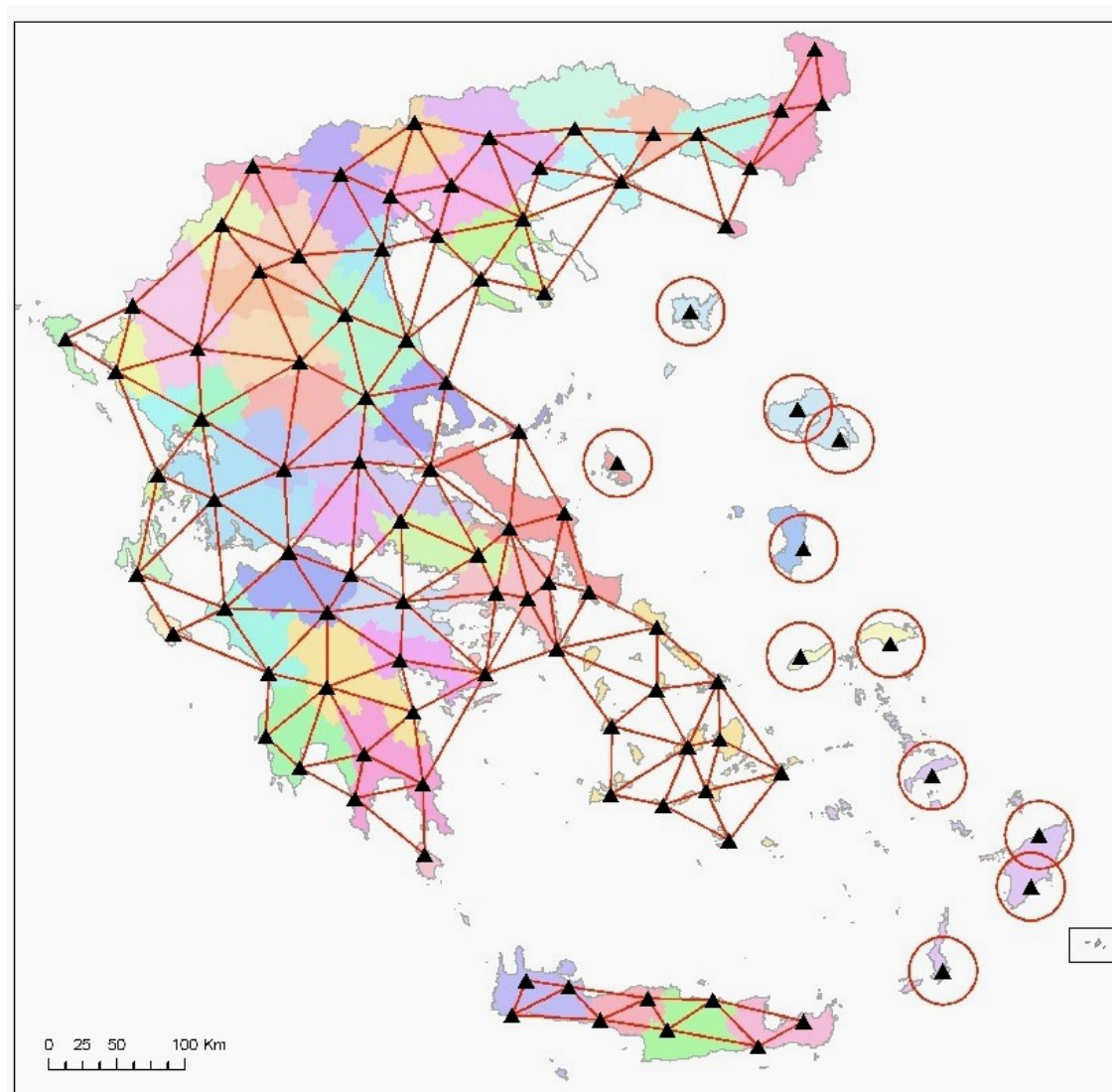
1. HEPOS Project

Framework of establishment

- part of the project “Information and Technology Infrastructure for a modern Cadastre”
- a CSF-III project, co-funded by the European Regional Development Fund
- HEPOS was deployed in 2007, in less than 12 months
- supports other CSF-III projects, i.e. production of orthophoto maps for whole Greece



1. HEPOS Project



98 Reference stations:

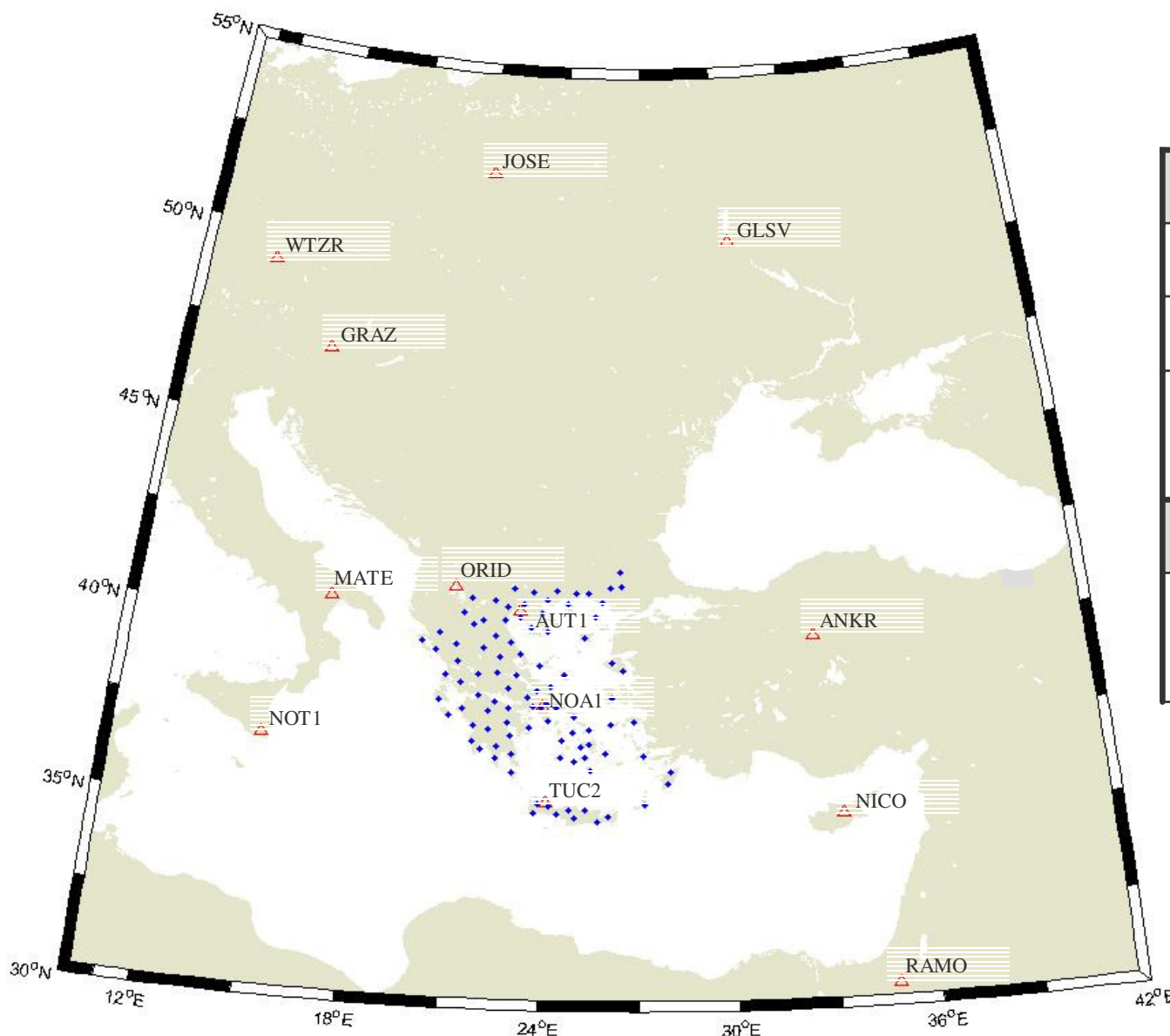
- 87 supporting network-based techniques (VRS - FKP - MAC)
- 11 for Single-base positioning



2. Description of the campaign

113 stations

EPN	
Total	13
Class A	13
In the densi- fication zone	3
HEPOS	
Total	99 (98+1)



2. Description of the campaign

EPN stations

	4-char ID	Full Name	Country	Domes No.	Network
1	GLSV	KIEV	UKRAINE	12356M001	EPN class A, IGS
2	JOZE	JOZEFOSLAW	POLAND	12204M001	EPN class A, IGS
3	MATE	MATERA	ITALY	12734M008	EPN class A, IGS
4	NICO	NICOSIA	CYPRUS	14302M001	EPN class A, IGS
5	NOT1	NOTO	ITALY	12717M004	EPN class A, IGS
6	WTZR	BAD KOETZTING	GERMANY	14201M010	EPN class A, IGS
7	RAMO	MITZPE RAMON	ISRAEL	20703S001	EPN class A, IGS
8	ANKR	ANKARA	TURKEY	20805M002	EPN class A, IGS
9	GRAZ	GRAZ	AUSTRIA	11001M002	EPN class A, IGS
10	AUT1	THESSALONIKI	GREECE	12619M002	EPN class A
11	NOA1	ATHENS	GREECE	12620M001	EPN class A
12	TUC2	CHANIA	GREECE	12617M003	EPN class A
13	ORID	OHRID	FYROM	15601M001	EPN class A, IGS

2. Description of the campaign

HEPOS stations

All HEPOS stations are equipped with the same GPS equipment

Equipment	Model	IGS code
Receivers	Trimble NetRS	TRIMBLE NETRS
Antennas	Trimble Zephyr geodetic	TRM41249.00
Domes	Trimble spherical	TZGD

2. Description of the campaign

HEPOS stations

All HEPOS antennas are mounted on steel masts

On roof of buildings

or

On side of buildings





2. Description of the campaign

HEPOS stations

All HEPOS antennas are mounted
on the frame of the building (reinforced concrete)

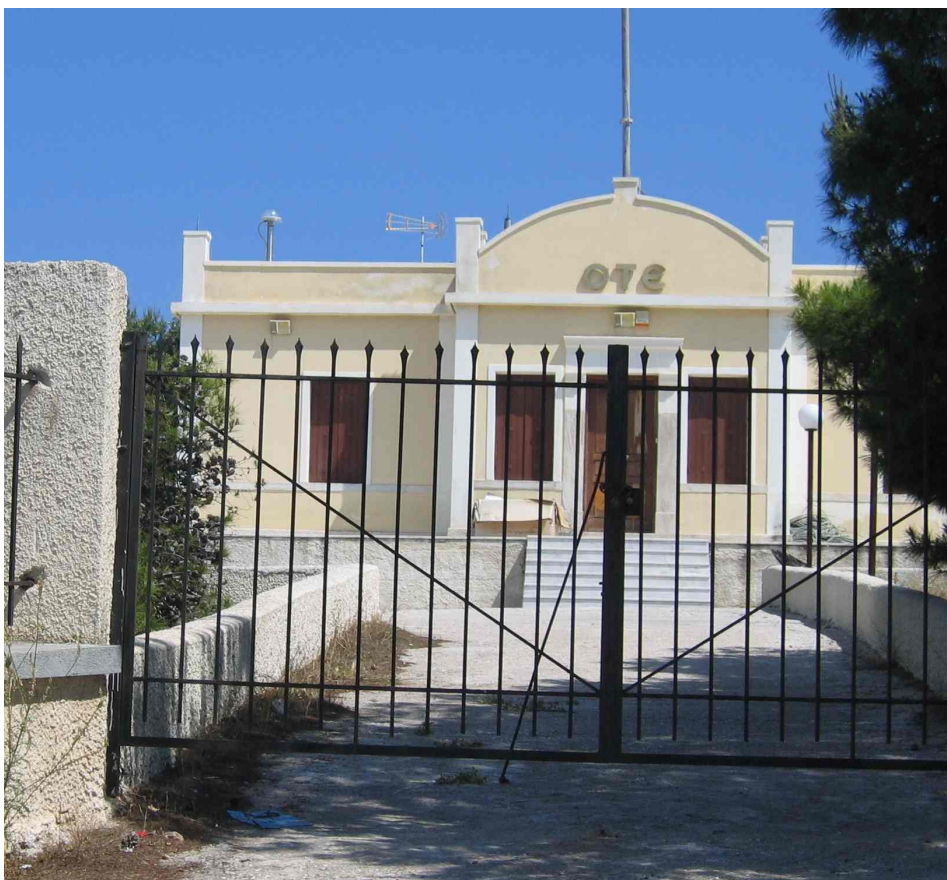




2. Description of the campaign

HEPOS stations

The HEPOS antennas are installed on low buildings



2. Description of the campaign

Observations used

14 days of observations (7-20 October 2007)

3 additional days (17-19 November 2007)

to include in the solution station 018B, which replaced station 018A.

2. Description of the campaign

Computations

Computations are made:

- in May 2010
- by IGN-Spain*
- following the latest **EUREF standards, i.e.:**
 - “Specifications for reference frame fixing in the analysis of a EUREF GPS campaign” Ver. 7, 24/10/2008
 - “Guidelines for EUREF Densifications”, Ver. 1, 26/05/2009

* KTIMATOLOGIO S.A. procured the establishment of HEPOS as a turn-key solution including the computation of the station coordinates. This task was assigned by the contractor (Trimble Europe B.V.) to IGN-Spain.

3. Datum definition

Fiducial points

	4-char ID	Country	Network	Comment
1	AUT1	GREECE	EPN class A	In the densification zone
2	ANKR	TURKEY	EPN class A, IGS	
3	GLSV	UKRAINE	EPN class A, IGS	
4	GRAZ	AUSTRIA	EPN class A, IGS	
5	JOZE	POLAND	EPN class A, IGS	
6	MATE	ITALY	EPN class A, IGS	
7	NICO	CYPRUS	EPN class A, IGS	
8	NOT1	ITALY	EPN class A, IGS	
9	NOA1	GREECE	EPN class A	In the densification zone
10	ORID	FYROM	EPN class A, IGS	
11	RAMO	ISRAEL	EPN class A, IGS	
12	TUC2	GREECE	EPN class A	In the densification zone
13	WTZR	GERMANY	EPN class A, IGS	

3. Datum definition

Datum definition (ITRF2005)

The ITRF2005/2007.83 coordinates of the fiducial points were computed using the EUREF solution C1570.

Datum definition using minimal constraints to compute three translation parameters on the network's barycentre.

This strategy has the advantage that small errors in the coordinates do neither distort the network geometry nor significantly degrade the datum definition.

4. Processing parameters

Software used

Bernese 5.0

Processing Agency

IGN-Spain *

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4. Processing parameters

Orbits and ERPs

IGS final orbit and ERP information

Antenna calibrations – stations

Absolute antenna phase center corrections based on IGS05 model (exceptions for stations with individual absolute calibrations listed in epnc_05.atx) considering antenna radome codes.

Antenna calibrations – satellites

Absolute antenna phase centre corrections based on IGS05 model calibrations

4. Processing parameters

Preprocessing

Phase preprocessing in a baseline by baseline mode using triple differences. In most cases cycle slips are fixed looking simultaneously at different linear combinations of L1 and L2.

Basic Observable

Carrier phase, code only used for receiver clock synchronization.

4. Processing parameters

Elevation angle cutoff

3 degrees + elevation dependent weighting

Data sampling

For ambiguity resolution: 30 s.

For final processing: 180 s.

Modeled observable

Double-differences, ionosphere-free linear combination.

4. Processing parameters

Troposphere

Dry-Niell as a priori model, estimation of zenith delay corrections at 1 hour intervals for each station, using the wet-Niell MF, no a priori sigmas. Horizontal gradient parameter estimated/day/station (TILTING), no a priori constraints. Compute daily TRO files with fixed cumulative. Coordinates input from weekly solution.

Ionosphere

Regional ionospheric model calculated. Only used for QIF ambiguity resolution. Not modeled in final solution (ionosphere eliminated by forming the ionosphere-free linear combination of L1 and L2).

Ambiguity resolution

Ambiguity resolution is performed by using the quasi-ionosphere-free (QIF) strategy with regional TEC information. Elevation angle cutoff: 10 degrees.

4. Processing parameters

Planetary Ephemeris

DE200

Tidal effects

Solid earth tidal displacements are modeled according to IERS conventions 1996.

Ocean loading

Using model computed by H.G.Scherneck Onsala Space Observatory FES2004 model for each station.

Atmospheric loading

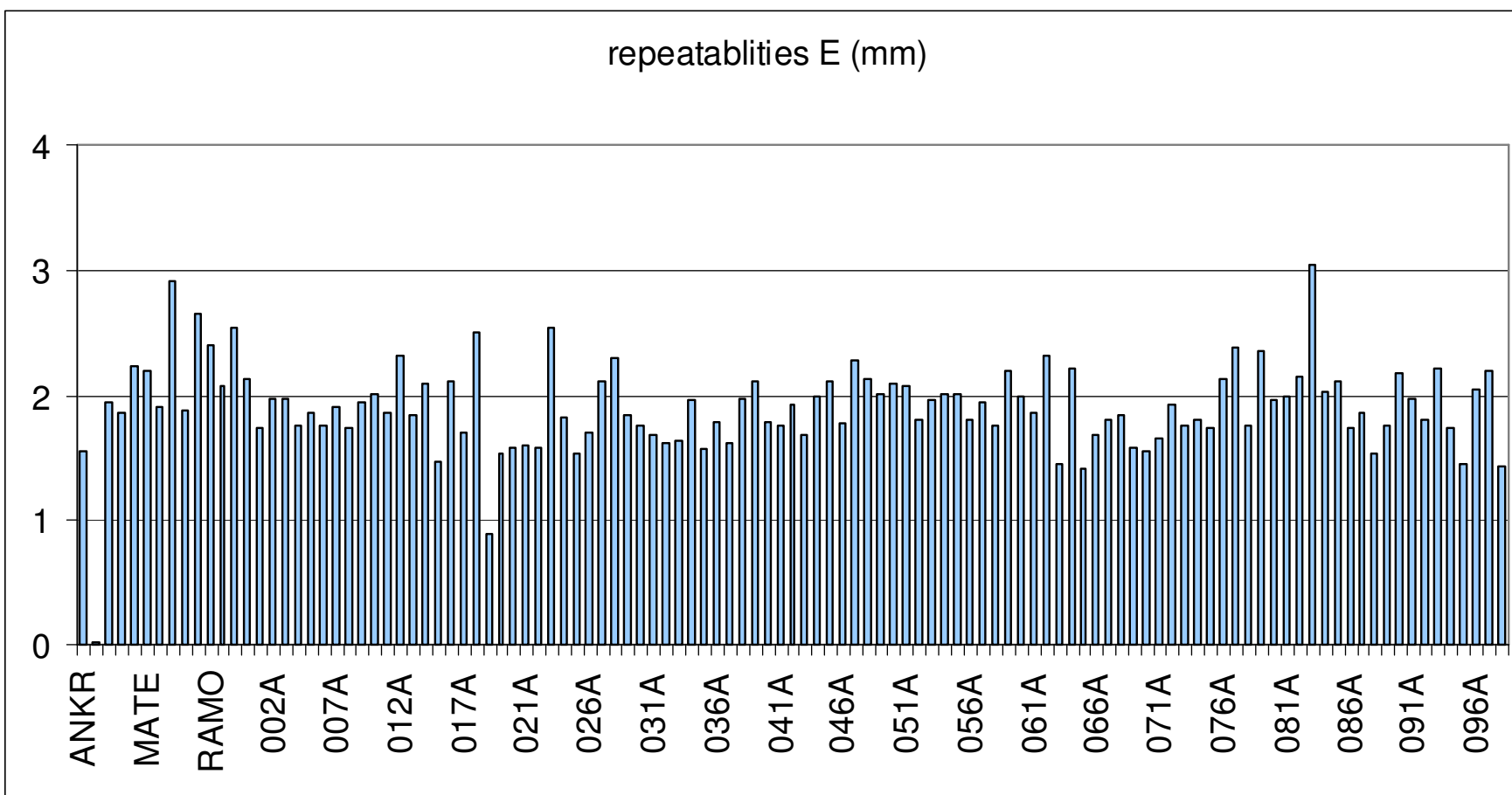
No atmospheric loading corrections are taken into account.

Repeatabilities (North)



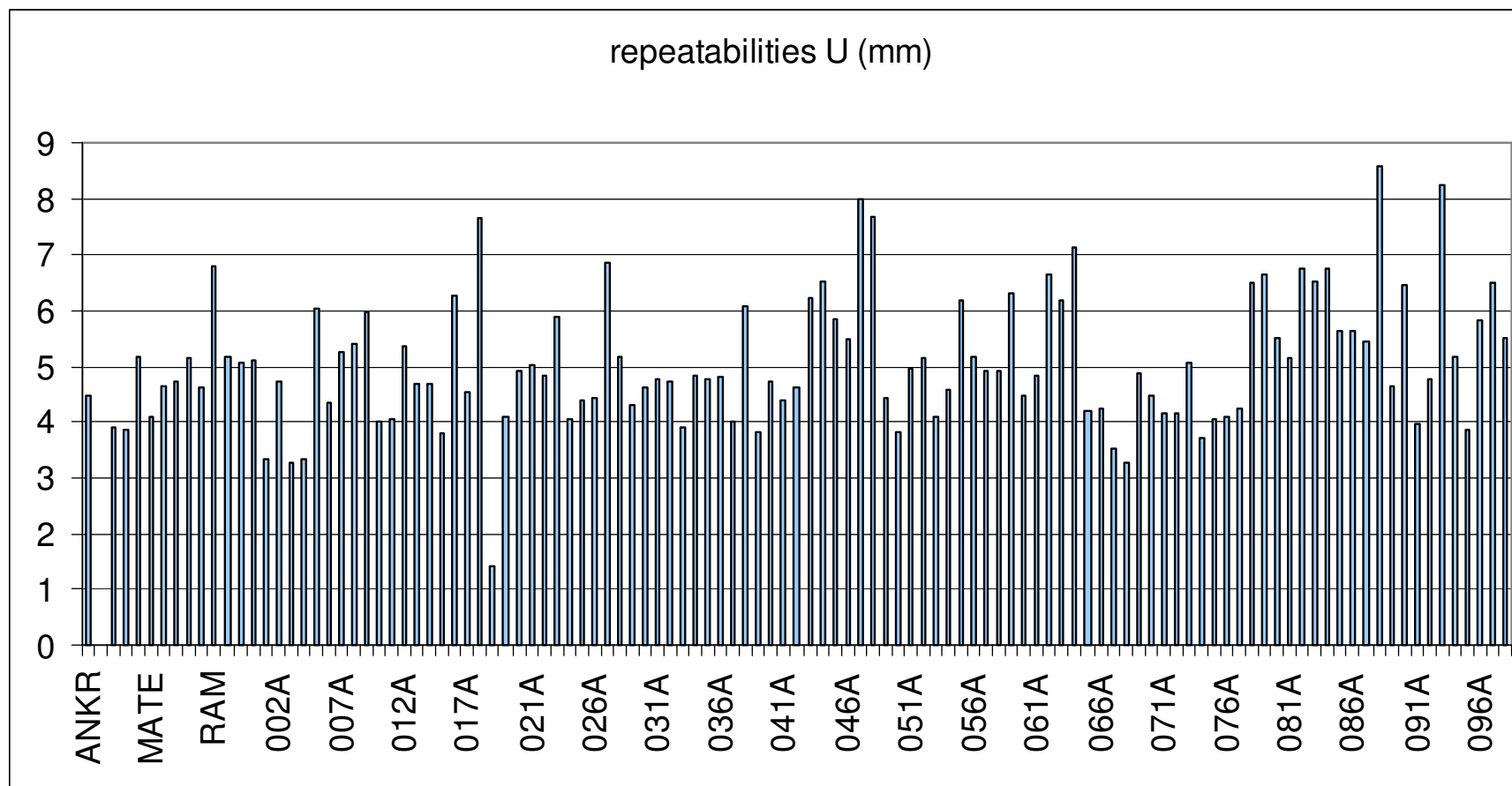
5. Results

Repeatabilities (East)



5. Results

Repeatabilities (Up)



5. Results

Comparison of ITRF2005/2007.83 coordinates: estimated vs. EUREF solution (EPN A ITRF2005 C1570)

In XYZ

Stn	DX (mm)	DY (mm)	DZ (mm)
ANKR	-2.6	-1.8	1.2
AUT1	1.3	2.9	1.9
GLSV	4.5	0.8	5.9
GRAZ	4.0	3.3	2.4
JOZE	4.5	2.1	3.3
MATE	-2.2	0.2	-1.9
NICO	-4.1	-0.7	4.6
NOT1	-4.3	-2.0	-5.1
NOA1	-3.0	1.5	-2.2
ORID	1.5	1.5	-1.9
RAMO	-9.4	-2.8	-2.4
TUC2	-2.7	-0.2	-3.4
WTZR	4.4	3.0	2.3

In NEU

Stn	North (mm)	East (mm)	Up (mm)
ANKR	2.8	-0.2	-1.8
AUT1	-0.2	2.0	3.0
GLSV	0.4	-1.8	7.2
GRAZ	-2.0	2.0	5.0
JOZE	-2.0	0.2	5.8
MATE	-0.2	0.6	-2.8
NICO	5.8	1.6	-0.6
NOT1	-0.4	2.2	-3.4
NOA1	-1.0	0.0	-6.8
ORID	-2.8	0.6	0.2
RAMO	2.6	3.0	-9.2
TUC2	-1.2	1.0	-4.0
WTZR	-2.4	1.8	5.0

5. Results

Transformation to ETRS89

The transformation of the ITRF2005/2007.83 coordinates to ETRF2000/2007.83 was done using the Memo B&A and is verified with the EPN web page tool.

6. Validation of the campaign

The campaign was presented on 1/6/2010 to the TWG of EUREF during the 53th TWG Meeting and has been validated (class B stations).

Acknowledgments

IGN-Spain for the computation of the HEPOS network.

The chair and the members of EUREF-TWG for their valuable assistance.

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