Contribution of Jozefoslaw Astro-Geodetic Observatory and WUT LAC to EPN and Geodynamical Studies in Central Europe

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Introduction

WUT Local Analysis Centre is one of 15 LACs acting in the frame of EUREF. We process every week our subnetwork of European Permanent Network (EPN). It consists of 32 stations now. The network is shown on figure 1.

The one of the others activities of our centre is processing of the CERGOP network. The Central European Geodynamic Project (CERGOP) is a project acting within Central European Initiative (CEI) section C "Geodesy". To date, there have been performed seven campaigns in following years: 1994, 1995, 1996, 1997, 1999 and 2001. Last two of them were carried out as CERGOP-2 campaigns increased by additional GPS epoch stations.

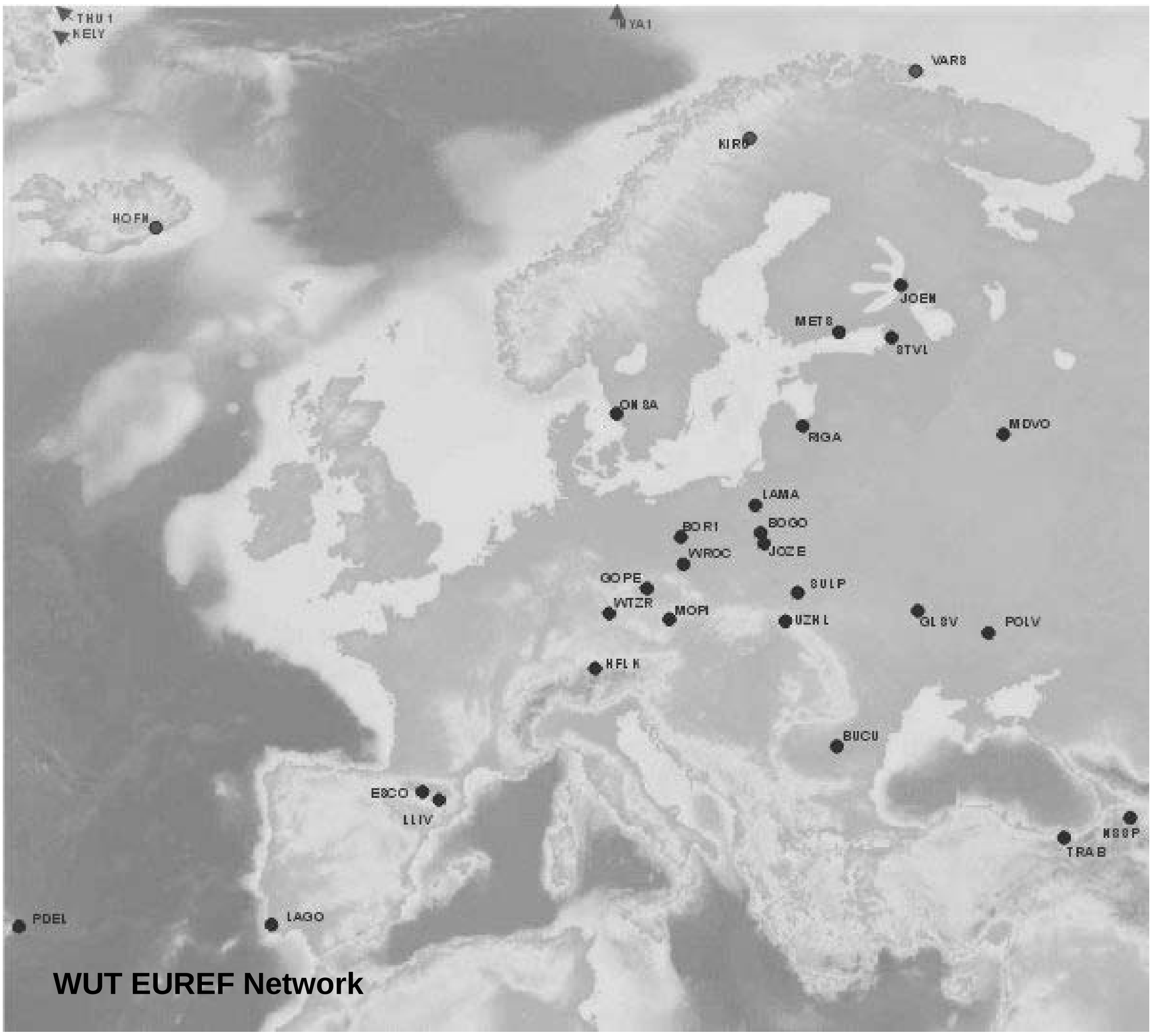

Figure 1: EUREF subnetwork processed by WUT Local Analysis Centre

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EUREF LAC

Current strategy used in our centre:

- orbits and ERP: IGS final,
- WTZR coordinates constrained to ITRF97 (X, Y, Z 0.1 mm),
- no apriori model for troposphere is used and Dry-Niell as mapping function is applied,
- ambiguity resolution : QIF,
- elevation mask: 10/,
- antenna phase eccentricities: IGS model 01,
- planetary ephemeris: DE200,
- ocean loading applied,
- tropospheric parameters estimated every 2 hours for each station,
- elevation dependent weighting of observations

The results:

- INEX file,
- RO-SINEX for each day of week are submited weekly to BKG Data Centre

CERGOP-2 2001 by WUT LAC

Here we would like to describe the latest campaign performed in 2001 and make an attempt to compare its quality with the former ones.

The campaign was being performed from 169 to 174 day of 2001. The network consisted of 53 stations (28 permanent stations IGS/EUREF and 25 epoch stations).

Map of the network is shown in Figure 2.

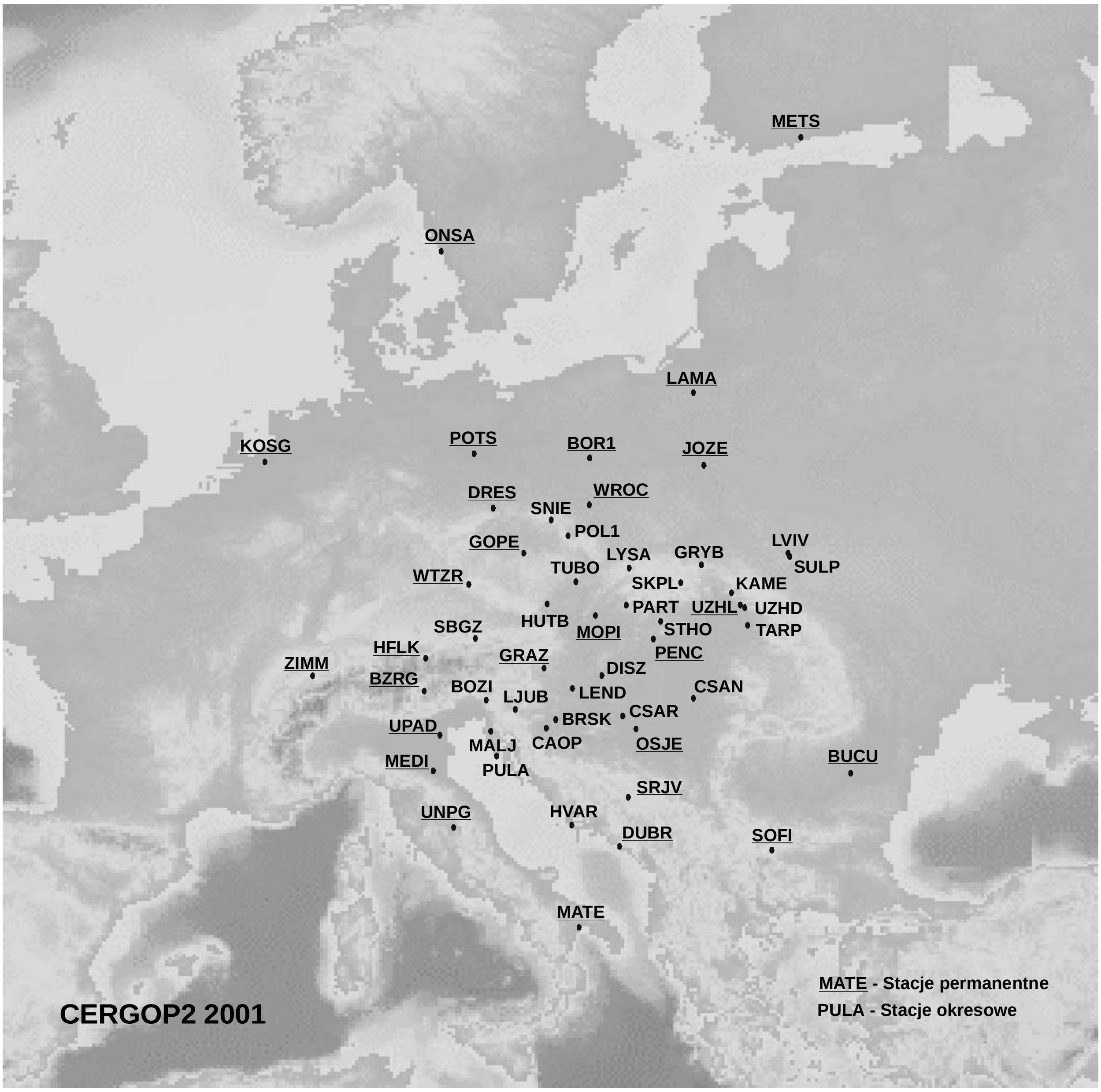


Figure 2: Stations participated in CERGOP-2 campaign in 2001.

3 strategies were tested for CERGOP-2 campaign.

Here is description of strategy A:

- orbits and EOP: IGS final,
- WTZR coordinates constrained to ITRF97 (X, Y, Z 0.1 mm),
- a priori model: Saastamoinen,
- ambiguity resolution : QIF,
- elevation mask: 10/,
- antenna phase eccentricities: IGS model 01,
- troposphere parameters estimated every 2 hours for each station,

Additions/differences concerning solution B:

- no tropospheric model, Dry-Niell as mapping function was used,
- elevation dependent weighting of observations,

Additions/differences concerning final solution C:

- RAZ constrained to ITRF97,
- ropospheric parameters estimated every hour for each station,
- wo additional stations were added: FUN3, VRN1.

Comparisons with previous campaigns

Coordinates from available campaigns ('94, '96, '97, '99, '01) have been expressed in ITRF97 frame at epoch 1997.0 using their velocities (ITRF97 or NUVEL 1A).

Coordinates of solutions 1994-1999 are combinations of minimum two solutions from different analysis centres. Those solutions are performed by OLG Analysis Centre in Graz.

Stations, which were included in all above campaigns, have been used for comparison.

Table 2 shows residuals for permanent stations and their RMSs.

Values given in tables 1, 2 are related to solution B.

Table 1: Residuals of several CERGOP epoch stations in millimeters.

Station		CEGRN94	CEGRN96	CEGRN97	CEGRN99	CEGRN01	RMS
GRYB	N	-3,0	-3,1	1,7	2,4	2,0	2,8
GRYB	E	1,2	-0,7	1,6	1,0	-3,4	2,1
GRYB	U	1,5	11,6	-4,7	-9,4	0,8	7,9
SNIE	N	8,1	5,7	6,4	-9,8	-10,6	9,3
SNIE	E	10,5	4,7	2,5	-6,5	-11,0	8,7
SNIE	U	6,5	5,9	2,4	-7,6	-7,4	7,0
LJUB	N	-3,9	-1,7	-5,5	-0,6	11,9	6,9
LJUB	E	2,0	-1,0	1,7	-1,3	-1,6	1,7
LJUB	U	-0,4	12,0	-5,7	0,3	-6,2	7,3
STHO	N	-1,8	-4,3	-0,5	2,1	4,7	3,5
STHO	E	1,4	-3,0	2,0	-1,3	0,8	2,1
STHO	U	2,3	5,1	7,7	-14,3	-0,7	8,6
CSAR	N	-0,3	-2,1	-3,1	2,2	3,3	2,7
CSAR	E	9,7	-4,6	-2,6	-2,5	-0,1	5,7
CSAR	U	1,0	10,7	-0,8	-9,1	-1,7	7,1
DISZ	N	-1,7	-2,2	-0,4	-0,2	4,7	2,7
DISZ	E	-1,7	-3,6	1,8	1,7	1,9	2,5
DISZ	U	4,9	11,6	-1,1	-10,8	-4,7	8,6
BRSK	N	-3,0	-4,1	1,1	-0,5	6,7	4,2
BRSK	E	-0,7	-6,2	-0,3	6,3	0,9	4,5
BRSK	U	2,8	15,0	0,1	-6,2	-11,6	10,1
UZHD	N	5,7	-2,1	0,8	0,0	-4,3	3,7
UZHD	E	1,8	-0,7	1,5	-1,2	-1,3	1,5
UZHD	U	-6,1	-0,9	-8,2	-7,3	22,6	12,9
SKPL	N	-4,4	-1,7	4,9	-0,9	2,0	3,6
SKPL	E	-0,5	-3,7	10,1	-3,1	-2,7	5,8
SKPL	U	0,2	6,6	-10,5	-3,3	6,8	7,3
HUTB	N	-0,5	-1,5	0,0	-0,7	2,7	1,6
HUTB	E	0,2	-2,8	0,2	2,7	-0,1	2,0
HUTB	U	11,0	4,3	1,1	-2,5	-13,6	9,1

Table 2: Residuals of permanent stations in CERGOP campaigns (millimeters).

Station		CEGRN94	CEGRN96	CEGRN97	CEGRN99	CEGRN01	ITRF97	RMS
JOZE	N	1.2	-2.4	3.2	-1.3	-1.2	0.4	2.0
JOZE	E	1.7	-1.0	0.9	-0.2	-2.1	0.9	1.4
JOZE	U	-6.8	-8.4	-5.1	10.5	9.9	0.0	8.4
GOPE	N	1.7	1.7	0.2	-2.2	-2.0	0.9	1.8
GOPE	E	3.2	-0.3	-1.0	-2.9	1.2	-0.5	2.1
GOPE	U	5.6	1.2	-7.6	2.3	-4.8	3.1	5.1
PENC	N	8.6	-2.4	-1.1	-3.0	-0.9	-1.2	4.3
PENC	E	3.5	-3.6	1.6	-1.3	-1.0	0.7	2.5
PENC	U	8.7	-0.6	-4.1	1.1	-8.1	3.0	5.8
ZIMM	N	-2.1	3.8	-2.9	0.6	1.3	-1.0	2.5
ZIMM	E	4.5	-6.1	-3.9	3.9	4.0	-2.4	4.7
ZIMM	U	10.0	15.0	1.5	-14.0	-16.4	3.9	12.7
METS	N	2.6	-0.4	2.9	-1.2	-5.5	1.4	3.1
METS	E	-3.4	6.2	-0.1	1.5	-4.4	-0.2	3.8
METS	U	-15.2	-16.2	1.1	6.0	21.6	2.7	14.2
LAMA	N	3.1	0.2	3.2	-2.1	-5.6	1.2	3.4
LAMA	E	-1.2	2.3	2.6	1.3	-6.8	1.5	3.6
LAMA	U	-14.1	-6.4	2.8	7.4	3.3	6.9	8.5
MOPI	N	3.6	-5.5	-0.3	0.3	2.3	-0.4	3.1
MOPI	E	0.5	-0.7	2.4	-1.9	-1.8	1.5	1.8
MOPI	U	-7.5	-3.5	-9.3	4.8	18.1	-2.7	10.1

Tropospheric Studies

Network of permanent GPS station is perceived as a tool for Zenith Total Delay and Integrated Precipitable Water Vapour (IPWV) estimation since nearly 10 years. Systematic monitoring of IPWV becomes standard product of GPS networks, some of them are created specially for this purposes.

Total Zenith Delay above all stations in the network became one of the standard products of IGS (1998) and EPN (2001). It is created as a combination of individual AC solutions.

Figure below shows quality of WUT LAC troposphere product (Total Zenith Delay) with respect to EPN combined solution.

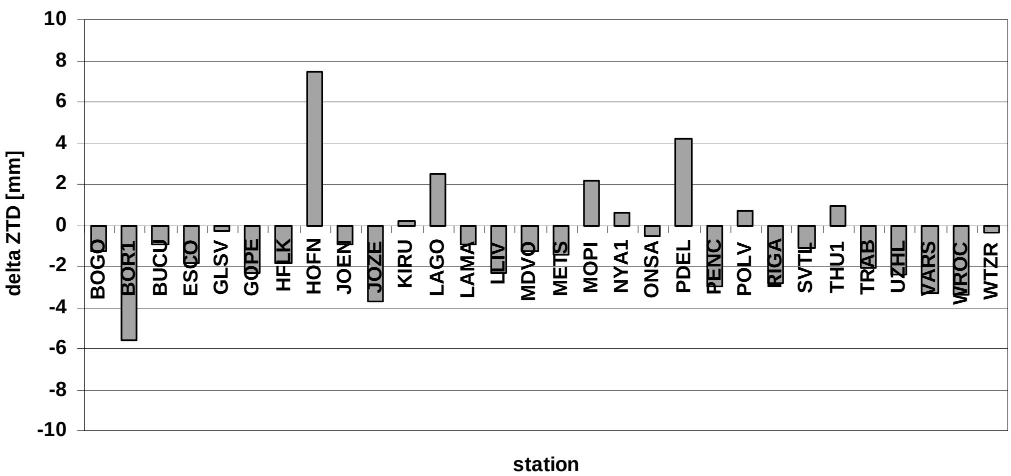


Figure 3: Differences of WUT LAC tropospheric solution and EPN tropospheric combination (GPS week 1134)

To demonstrate value of IPW as climatologic parameter (e. g. global warming indicator) we have calculated daily averaged values of IPWV in the course of 4 years for JOZE.

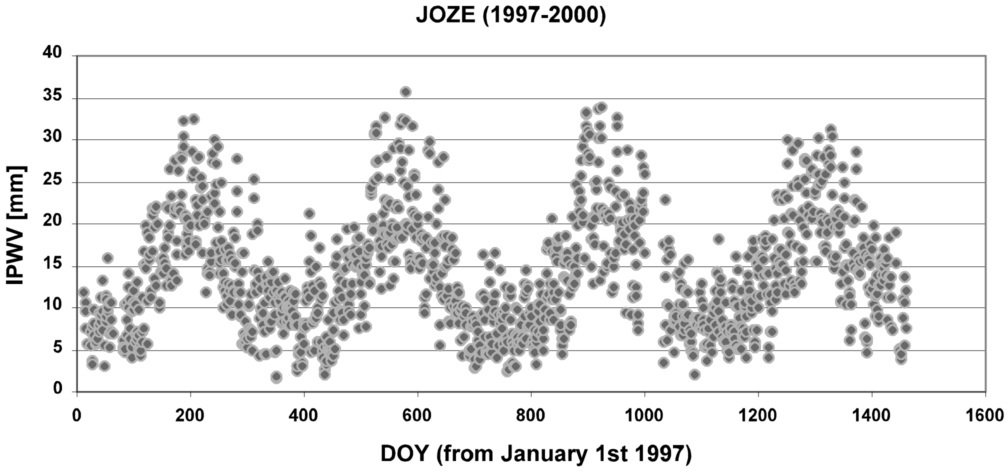


Figure 4: Integrated Water Vapour for JOZE from average daily values.

Epoch campaigns offers possibility to test solution parameters in denser networks. Below you see the map of average IPW differences between two CERGOP-2 2001 tropospheric solutions. First (A solution) utilizes Saastamoinen mapping function, without elevation dependent weighting, the second (B solution) includes weighting, and dry Niell MF. We got IPW average difference 0.7 mm (51 stations, the whole campaign length).

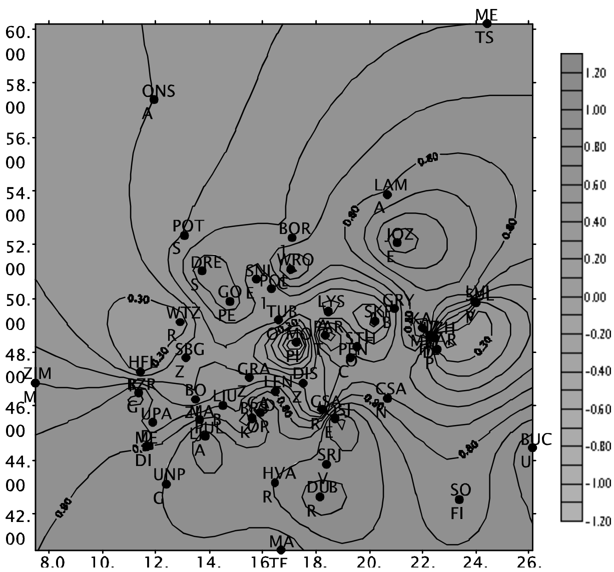
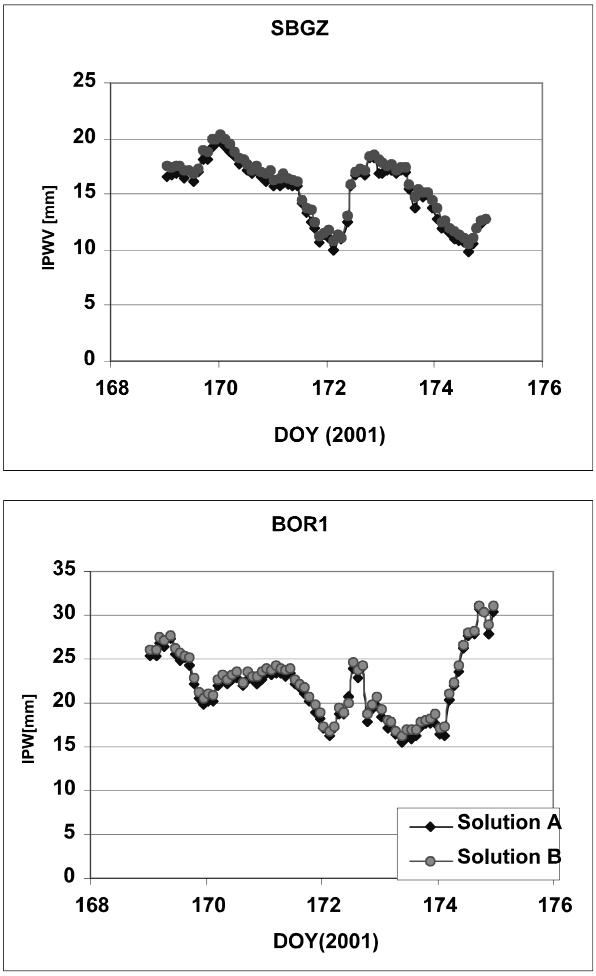


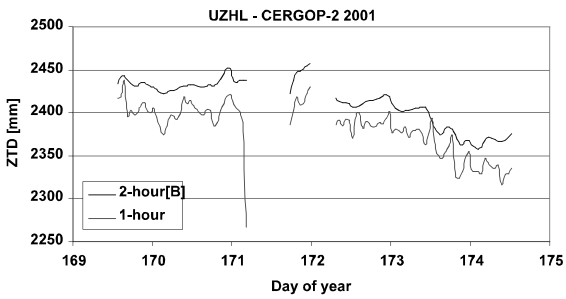
Figure 5: Differences of IPW between solutions A & B

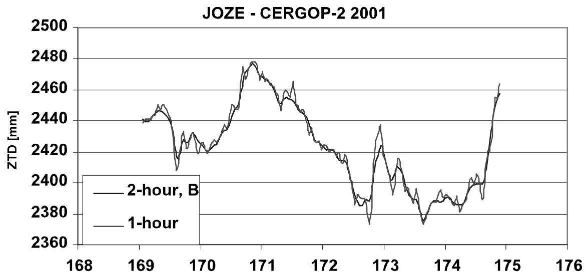


Figures 6a & 6b: IPW from two tropospheric solutions of CERGOP-2 campaign (BOR1 and SBGZ).

Next we show example of Zenith Total Delay obtained from solutions A&C for two stations.

We can observe significant shift beetwen those solutions in case of UZHL station.





Figures 6a & 6b: Comparison of Zenith Total Delay for two stations JOZE & UZHL from solutions B & C (2h vs 1h)

Literature

KRUCZYK M., ROGOWSKI J.B., LIWOSZ T.: *On Accuracy of IPWV Determined from GPS Networks EUREF Permanent Network 3rd Loacal Analysis Centers* Workshop, 31 May – 1 June 2001 Warsaw, Poland, Reports on Geodesy No. 3 (58) 2001

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