EUREF MAKPOS 2010
Version 2.0

Final version of the processing and analysis of the EUREF MAKPOS 2010 campaign, presented at the EUREF symposium and TWG meeting in Chişinău, Moldova in May 2011

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Responsibility for this document

Christina Lilje and Lotti Jivall, Lantmäteriet (the Swedish mapping, cadastral and land registration authority), have written this document with support from Mile Varoshlieski, Swedesurvey (located in Republic of Macedonia) and Saso Dimeski, Head of the sector for Geodetic Works at AREC (Agency for Real Estate Cadastre in Republic of Macedonia). The processing and analysis of the campaign have been performed by Christina Lilje and Lotti Jivall, Lantmäteriet.

Change history

Version	Date	Summary of changes
1.0	May 2011	Preliminary version presented at the EUREF TWG meeting in May 2011
2.0	May 2011	Information about the origin of the antenna model for LEIATX900GG NONE added.
Final	Feb 2012	Minor changes

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Summary

The EUREF MAKPOS 2010 campaign, observed from August 1 2010 to September 4 2010, is the basis for the new realization of ETRS 89 in the Republic of Macedonia. The campaign spans over the same time period and includes the same EPN-stations as EUREF Serbia 2010, but EUREF MAKPOS includes more stations in Republic of Macedonia and also stations in Albania. EUREF Serbia 2010 on the other hand includes more stations in Republic of Serbia as well as stations in Hungary and more stations in Bulgaria. The same processing strategy, including the choice of fiducial stations and reference co-ordinates, has been used to ensure a good agreement between the two ETRS 89 realizations. The largest difference between the final solutions of EUREF MAKPOS 2010 and EUREF Serbia 2010 is 0.3 mm in horizontal and 1 mm in height.

The field points in Republic of Macedonia were observed 2-5 days / 24 hour sessions during GPS-week 1597, which is the middle week of the campaign. The field points E803 and MJ34 had an observation period lasting only two days.

The internal quality of the EUREF MAKPOS 2010 solution is around 1 to 2 mm in N and E and around 3 to 5 in U. This quality level is estimated by daily co-ordinate repeatabilities.

The co-ordinate recoveries of fiducial stations indicate that ITRF2005 for EUREF MAKPOS 2010 is realized to around 2 mm in all three components (in the frame of EPN_A_ITRF2005_C1600).

The results from an elevation cut off test show different level of accuracy depending on antenna type used and site dependent effects. The Serbian station BOSI equipped with a non-geodetic antenna has a large value in the test which indicates that the height estimation is uncertain. The stations BUJA , E807 and TETO also have quite large values which indicate that the heights of these stations might be degraded.

Comparison with an earlier determination of MAKPOS, computed by Leica Geosystems in 2010, agrees at 3-4 mm level in ETRF2000. Comparison with the ALBPOS co-ordinates, also determined in 2010, agrees on the 10 mm level in ETRF2000. Comparison with the EUREF FYROM 96 campaign based on ITRF94 is at the 20 mm level, except a shift of c 3 cm in north. Comparison is done in ETRF2000.

During the processing of the EUREF Serbia 2010 campaign the MAKPOS station in Negotino was called NEGM as well as in the intermediate soultion of the EUREF MAKPOS 2010 campaign. The official name of this station is however NEGO, which is used in this report and in the final solution of the EUREF MAKPOS 2010 campaign.

Final ITRF2005 epoch 2010.631 co-ordinates

STATION NAME	X (M)	Y (M)	Z (M)	Latitude	Longitude	Height
AUT1 12619M002	4466283.3489	1896166.9967	4126096.8102	40 34 00.547687	23 00 13.390297	150.0855
BACA 11405M001	3917524.8678	1988524.1932	4608585.6671	46 33 43.421172	26 54 43.979563	219.1401
BAIA 11406M001	3945839.6842	1720428.3589	4691082.7666	47 39 06.436857	23 33 27.782153	270.8610
BERO	4395120.9715	1852322.3943	4221827.0193	41 42 19.314622	22 51 10.712216	900.2732
BITO	4489050.3436	1753409.8897	4164880.8692	41 01 26.765213	21 20 07.694246	667.3126
BLAG	4365251.5207	1861898.8226	4247667.1915	42 01 16.904918	23 05 58.451322	448.6262
BOSI	4352527.1080	1800358.4702	4287320.0030	42 30 03.028822	22 28 18.155844	793.9132
BUCU 11401M001	4093760.7780	2007793.9086	4445130.0395	44 27 50.203748	26 07 32.672151	143.2293
BUJA	4377012.2461	1747681.3830	4283713.2944	42 27 34.490494	21 45 58.151286	459.0967
BZRG 12751M001	4312657.4088	864634.7504	4603844.5125	46 29 56.488824	11 20 12.473462	329.1387
DEBA	4479215.5164	1677228.1082	4206430.7280	41 31 17.225407	20 31 41.714472	715.6270
DEVA 11408M001	4097210.4065	1731870.4812	4556026.8117	45 52 42.307064	22 54 48.740529	246.6232
DUBR 11901M001	4465939.9548	1460594.5695	4299291.4963	42 38 59.943489	18 06 37.569561	454.2908
E801	4463274.7711	1671913.7468	4228341.1622	41 46 09.370064	20 32 08.244750	2727.2842
E802	4406166.0811	1730874.0115	4262576.7817	42 11 31.746952	21 26 46.992139	1691.0731
E803	4374796.2366	1844718.6471	4246577.2230	42 00 05.559878	22 51 49.229086	1264.1510
E804	4417684.7506	1785923.6619	4226698.7229	41 45 53.804929	22 00 42.670386	799.4150
E805	4423592.2437	1857674.4496	4190768.2369	41 19 37.333918	22 46 47.373915	1517.8070
E806	4482706.2696	1791780.5954	4158330.1829	40 55 52.196344	21 47 13.426315	2563.0745
E807	4512027.1446	1715804.3487	4158251.7538	40 55 56.344650	20 49 13.738140	2295.7447
E818	4367029.8786	1792313.1094	4277612.8300	42 22 24.733041	22 18 51.085125	1877.9194
GRAZ 11001M002	4194423.7252	1162702.7919	4647245.4755	47 04 01.670765	15 29 36.534577	538.2933
GSR1 14501M001	4292609.4189	1113639.3271	4569215.6886	46 02 53.284169	14 32 37.381750	351.6758
ISTA 20807M001	4208830.2096	2334850.4053	4171267.3001	41 06 16.013059	29 01 09.630925	147.2514
KICE	4467287.8390	1711204.9303	4205358.6776	41 30 32.307947	20 57 34.032913	663.8559
KORC	4533390.7756	1719613.6529	4131397.7450	40 37 25.900594	20 46 22.170673	904.2061
KRPA	4377110.8616	1798385.3274	4263084.7254	42 12 22.880144	22 20 09.103297	706.9300
KUMA	4400896.0003	1752888.9200	4257110.3331	42 08 10.902116	21 43 03.099593	391.5011
LIBR	4508692.9883	1669107.7216	4177626.4286	41 10 45.506055	20 18 51.969125	296.3200
MATE 12734M008	4641949.4586	1393045.5276	4133287.5503	40 38 56.877517	16 42 16.059224	535.6575
MJ03	4496359.5329	1726602.6190	4168555.1075	41 03 57.575909	21 00 24.464274	918.6986
MJ14	4447732.8253	1702157.5774	4229409.5580	41 47 57.779897	20 56 31.068093	586.7937
MJ34	4425137.7662	1768692.8177	4225576.4003	41 45 16.125747	21 47 10.327744	416.4098
MJ41	4413335.0313	1823969.5430	4214481.2044	41 37 14.595218	22 27 16.640116	416.1980
MJ54	4396232.4881	1794046.3288	4245129.1711	41 59 22.388615	22 11 59.078247	579.6568
NEGO	4434095.2764	1799508.5851	4202961.7083	41 29 01.467410	22 05 20.430859	214.4807
ORID 15601M001	4498451.6159	1708267.0970	4173591.9223	41 07 38.323963	20 47 38.586682	773.0207
OROS 11207M001	4110946.7723	1551048.7609	4608010.0832	46 33 18.814047	20 40 16.865045	146.0050
OSJE 11902M001	4237753.1399	1432791.8003	4531310.3377	45 33 38.762695	18 40 49.748825	153.8836
PADO 12750S001	4388881.9364	924567.5663	4519588.7988	45 24 40.156105	11 53 45.828706	64.6984
PENC 11206M006	4052449.3771	1417681.2203	4701407.1678	47 47 22.573939	19 16 53.509358	291.7363
PES2	4470863.3268	1665038.7665	4220035.1932	41 41 07.061760	20 25 34.807248	709.1532
PRIL	4460456.1703	1762386.1061	4191613.9117	41 20 36.843316	21 33 34.708551	710.7323
SKOP	4419733.5584	1732736.0436	4245785.8198	41 59 58.856100	21 24 26.756174	311.1700
SOFI 11101M002	4319371.9899	1868687.8846	4292063.9827	42 33 21.942786	23 23 41.043455	1119.5289
SRJV 11801S001	4370292.8853	1454980.2327	4397965.3959	43 52 04.273679	18 24 50.024296	645.7794
TETO	4432296.9056	1698764.4963	4246736.0121	42 00 33.988723	20 58 13.107636	527.3252
VALA	4430249.6787	1840818.6872	4189158.6120	41 19 05.731508	22 33 48.367638	189.0946
VELE	4427995.6391	1768429.9186	4222455.1441	41 43 05.480666	21 46 13.882413	246.1715
VINI	4393777.0941	1820368.8639	4236330.3421	41 53 02.632477	22 30 16.299944	456.6032
WTZR 14201M010	4075580.4624	931853.8937	4801568.1905	49 08 39.117250	12 52 44.080776	666.0255
ZIMM 14001M004	4331296.9902	567555.9811	4633134.0044	46 52 37.554035	7 27 55.001714	956.3421

Final ETRF2000 epoch 2010.631 co-ordinates

STATION NAME	X (M)	Y (M)	Z (M)	Latitude	Longitude	Height
AUT1 12619M002	4466283.7759	1896166.6444	4126096.5291	40 34 00.535381	23 00 13.369418	150.0966
BACA 11405M001	3917525.3266	1988523.8825	4608585.4155	46 33 43.409257	26 54 43.956806	219.1420
BAIA 11406M001	3945840.1250	1720428.0448	4691082.5114	43 58 06.446456	19 34 14.126380	306.7276
BERO	4395121.3997	1852322.0470	4221826.7416	41 42 19.302303	22 51 10.691184	900.2823
BITO	4489050.7608	1753409.5350	4164880.5857	41 01 26.752759	21 20 07.673609	667.3224
BLAG	4365251.9510	1861898.4776	4247666.9154	42 01 16.892620	23 05 58.430192	448.6349
BOSI	4352527.5352	1800358.1259	4287319.7271	42 30 03.016470	22 28 18.134761	793.9209
BUCU 11401M001	4093761.2302	2007793.5847	4445129.7789	44 27 50.191746	26 07 32.649988	143.2348
BUJA	4377012.6688	1747681.0366	4283713.0168	42 27 34.478080	21 45 58.130347	459.1041
BZRG 12751M001	4312657.7745	864634.4055	4603844.2311	46 29 56.475721	11 20 12.454232	329.1347
DEBA	4479215.9294	1677227.7539	4206430.4444	41 31 17.212885	20 31 41.693917	715.6356
DEVA 11408M001	4097210.8415	1731870.1557	4556026.5487	45 52 42.294765	22 54 48.718773	246.6251
DUBR 11901M001	4465940.3545	1460594.2152	4299291.2117	42 38 59.930783	18 06 37.549324	454.2964
E801	4463275.1847	1671913.3936	4228340.8794	41 46 09.357545	20 32 08.224157	2727.2923
E802	4406166.5013	1730873.6628	4262576.5024	42 11 31.734510	21 26 46.971303	1691.0808
E803	4374796.6654	1844718.3013	4246576.9463	42 00 05.547561	22 51 49.208005	1264.1596
E804	4417685.1736	1785923.3126	4226698.4435	41 45 53.792536	22 00 42.649505	799.4237
E805	4423592.6708	1857674.1002	4190767.9577	41 19 37.321591	22 46 47.352956	1517.8168
E806	4482706.6896	1791780.2413	4158329.9001	40 55 52.183931	21 47 13.405606	2563.0846
E807	4512027.5583	1715803.9921	4158251.4688	40 55 56.332154	20 49 13.717614	2295.7544
E818	4367030.3046	1792312.7639	4277612.5533	42 22 24.720677	22 18 51.064092	1877.9271
GRAZ 11001M002	4194424.1177	1162702.4568	4647245.2028	47 04 01.657906	15 29 36.514305	538.2903
GSR1 14501M001	4292609.8035	1113638.9845	4569215.4103	46 02 53.271240	14 32 37.361834	351.6741
ISTA 20807M001	4208830.6750	2334850.0745	4171267.0360	41 06 16.001355	29 01 09.608853	147.2635
KICE	4467288.2547	1711204.5770	4205358.3949	41 30 32.295462	20 57 34.012276	663.8646
KORC	4533391.1883	1719613.2948	4131397.4589	40 37 25.888092	20 46 22.150202	904.2163
KRPA	4377111.2874	1798384.9812	4263084.4482	42 12 22.867780	22 20 09.082285	706.9381
KUMA	4400896.4221	1752888.5718	4257110.0543	42 08 10.889697	21 43 03.078711	391.5091
LIBR	4508693.3992	1669107.3651	4177626.1434	41 10 45.493515	20 18 51.948661	296.3291
MATE 12734M008	4641949.8444	1393045.1600	4133287.2559	40 38 56.864705	16 42 16.039520	535.6660
MJ03	4496359.9480	1726602.2636	4168554.8234	41 03 57.563428	21 00 24.443693	918.7081
MJ14	4447733.2415	1702157.2255	4229409.2763	41 47 57.767411	20 56 31.047415	586.8019
MJ34	4425138.1877	1768692.4678	4225576.1203	41 45 16.113332	21 47 10.306910	416.4185
MJ41	4413335.4568	1823969.1943	4214480.9255	41 37 14.582862	22 27 16.619177	416.2072
MJ54	4396232.9127	1794045.9812	4245128.8928	41 59 22.376236	22 11 59.057297	579.6652
NEGO	4434095.6993	1799508.2347	4202961.4281	41 29 01.455022	22 05 20.410009	214.4900
ORID 15601M001	4498452.0298	1708266.7414	4173591.6380	41 07 38.311464	20 47 38.566133	773.0301
OROS 11207M001	4110947.1950	1551048.4336	4608009.8180	46 33 18.801559	20 40 16.843664	146.0049
OSJE 11902M001	4237753.5490	1432791.4630	4531310.0649	45 33 38.750044	18 40 49.728050	153.8845
PADO 12750S001	4388882.3028	924567.2159	4519588.5139	45 24 40.143023	11 53 45.809465	64.6965
PENC 11206M006	4052449.7934	1417680.8969	4701406.9046	47 47 22.561351	19 16 53.488088	291.7336
PES2	4470863.7395	1665038.4127	4220034.9100	41 41 07.049231	20 25 34.786686	709.1614
PRIL	4460456.5896	1762385.7536	4191613.6298	41 20 36.830880	21 33 34.687825	710.7416
SKOP	4419733.9779	1732735.6939	4245785.5398	41 59 58.843655	21 24 26.735375	311.1780
SOFI 11101M002	4319372.4230	1868687.5431	4292063.7091	42 33 21.930517	23 23 41.022181	1119.5368
SRJV 11801S001	4370293.2895	1454979.8855	4397965.1163	43 52 04.261001	18 24 50.003827	645.7831
TETO	4432297.3224	1698764.1455	4246735.7312	42 00 33.976240	20 58 13.086920	527.3331
VALA	4430250.1043	1840818.3373	4189158.3323	41 19 05.719161	22 33 48.346724	189.1043
VELE	4427996.0604	1768429.5685	4222454.8640	41 43 05.468251	21 46 13.861589	246.1802
VINI	4393777.5204	1820368.5166	4236330.0642	41 53 02.620126	22 30 16.278952	456.6119
WTZR 14201M010	4075580.8435	931853.5669	4801567.9221	49 08 39.104255	12 52 44.060868	666.0179
ZIMM 14001M004	4331297.3328	567555.6340	4633133.7196	46 52 37.540770	7 27 54.983362	956.3356

1. Introduction

The current realization of ETRS89 in the Republic of Macedonia dates back to 1996. In 1996, the State Authority for Geodetic Works, in co-operation with IFAG (Institute for Applied Geodesy) from Germany, organized the campaign EUREF FYROM 1996 with the objective to connect the Republic of Macedonia to the ETRS 89 network.

GPS observations were performed in August 1996 in five 24 hour sessions on 25 points in the 1st order triangulation network and two points at Skopje and Ohrid airports. Amongst the 1st order triangulation points, seven were intended to realize ETRS 89 in Republic of Macedonia and the other 20 to give a good connection to the old 1st order triangulation network.

Processing of the data was completed using Bernese software at the Federal Agency for Cartography and geodesy (BKG). The network solutions were computed in the ITRF 94, epoch 1996.6 and final co-ordinates by fixing the co-ordinates of four IGS stations. Transformation to ETRS 89 epoch 1989.0 was performed according to EUREF specifications.

This campaign was presented at the EUREF symposium in Bad Neuenahr-Ahrweiler in 1998. ITRF94 epoch 1996.6 has been used for GNSS related works but the official national reference frame is based on triangulation. The reference frame presented in this report will replace the current official reference frame but first amendments of the existing Law on Real Estate Cadastre are required.

Since July 20, year 2000 a permanent reference station is running in Ohrid. It was established by BKG and operates in both the EPN and the IGS network.

Within the JICA (Japan International Cooperation Agency) project (1996) for production of the digital maps on the scale 1:25000, a GPS network of 54 points was established throughout the whole country. This network had two objectives: to serve as control points for photogrammetric works and to be used as a passive network. Therefore the location of the points, their monumentation and the measurement plan, was adjusted to satisfy both sides.

This network was connected with four of the seven stations and with five of the 20 stations in the network from the EUREF FYROM 1996 campaign and also with the permanent station in Ohrid. The network solution was done in ITRF 94 epoch 1996.6 and afterwards transformed into ETRS 89.

In June 2007 the Agency for Real Estate Cadastre (AREC) started to establish a network of permanent reference stations for GNSS (MAKPOS). MAKPOS network was completed in September 2009 and consists of 14 permanent stations which cover the entire territory of the

Republic of Macedonia with an average distance between the stations of 50-70 km. Distribution of the stations is shown in Figure 1.

13 of the MAKPOS stations are monumented with steel pillars on the roof of the local cadastral offices of AREC (type B). The station ORID 15601M001 is monumented with a concrete pillar on a concrete block on bedrock (type A).

The reasons for a new implementation of ETRS 89 realization in 2010 in the Republic of Macedonia were:

- the seven stations in the EUREF FYROM 1996 campaign are not so easy to occupy
- the permanent station in Ohrid are not directly connected to those stations
- the other permanent stations are not connected to the stations in the EUREF FYROM 1996 campaign
- the JICA network should be better included

Figure 1. *MAKPOS – station distribution*

2. Acknowledgments

The campaign and this document is a result of collaboration with the Republic Geodetic Authority (RGA) in the Republic of Serbia. The field points in Republic of Serbia and Republic of Macedonia were surveyed during the same period. Zoran Veljković at the Republic Geodetic Authority (RGA) of the Republic of Serbia made the processing of the implementation of ETRS 89 in the Republic of Serbia with support from Lotti Jivall, Lantmäteriet. All the Macedonian stations, except five field stations were included in the EUREF Serbia 2010 campaign. The same processing strategy, including the choice of fiducial stations and reference co-ordinates, as in the Serbian solution has been used to ensure a good agreement with the ETRS 89 realization in Serbia. For testing of different processing strategies we refer to the Serbian report "EUREF Serbia 2010" [Veljović, Lazić 2011], which also has been used as a model for this document.

Not only data from stations in the Republic of Macedonia and Republic of Serbia has been used but also from EPN stations and stations at permanent networks in neighboring countries. Special thanks for co-operation and data sharing to the following colleagues and facilities:

- Zoran Veljković, the Republic Geodetic Authority (RGA) of the Republic of Serbia
- Ivo Milev, BULiPOS, Bulgaria
- Armir Çani, director of AGMI (The Albanian Military Geographic Institute)

3. Description of the densification project

3.1 The campaign

The campaign included totally 52 stations of which 20 were EPN stations, 19 were stations in national permanent networks (Macedonia, Serbia, Albania and Bulgaria) and 13 were field points. Seven of the field points were included in the EUREF FYROM 1996 campaign, five field points were included in the JICA network and one of the points was included in the Serbian part of the EUREF Balkan 98 campaign, which was presented at the EUREF symposium in Prague in 1999. The distribution of the stations is shown in Figure 2 and Figure 3. Table 1 shows which national network each station belongs to.

Observation period was 5 weeks, from 00:00:00 GMT, August 1 2010 (Day of year 213, GPS week/day 1595/0) till 23:59:30, September 4. 2010 (Day of year 247, GPS week/day 1599/6).

The field points were observed 2-5 days / 24 hour sessions during GPS-week 1597. The field point E803 had rejected observation because of low quality data and in the final solution this point had an observation period lasting only two days. The field point MJ34 was only surveyed two days. Table 2 shows observation period for each station. Table 6 shows GNSS equipment for each station, antenna eccentricities and monument description.

The same choice of fiducial stations and reference co-ordinates as in the EUREF Serbia 2010 solution has been used to ensure a good agreement with the ETRS 89 realization in Serbia. The same observation data was used for the processing of the EUREF MAKPOS 2010 campaign. All the stations in the Republic of Macedonia, except the JICA points were included in the EUREF Serbia 2010 campaign.

All IGS/EPN stations, MAKPOS stations, old EUREF points in Republic of Macedonia and some other stations close to the Republic of Macedonia (BOSI, BUJA, E818, BLAG) were included in a first process of the EUREF MAKPOS 2010 campaign to check if similar result could be achived as in the EUREF Serbia 2010 solution. Besides the addition of the JICA points, three permanet stations in Albania (ALBPOS) were included in the final process of the EUREF MAKPOS 2010 campaign.

During the processing of the EUREF Serbia 2010 campaign the MAKPOS station in Negotino was called NEGM as well as in the intermediate solution of the EUREF MAKPOS 2010 campaign. The official name of this station is however NEGO. There is a station in AGROS (the Serbian permanent network) which is also called NEGO. Therefore the station in the Republic of Macedonia was renamed to NEGM in the Serbian solution. In this report and in the final solution of the EUREF MAKPOS 2010 campaign the station in Negotino is called NEGO.

The EPN class A stations were used as fiducial stations for the constraint to ITRF2005. The latest cumulative EPN solution available at the time for processing,

EPN_A_ITRF2005_C1600 was used.

The raw time series at http://www.epncb.oma.be/_dataproducts/timeseries/ were examined for the selected EPN stations. Seasonal variations with amplitude on 1 cm level were noticed for the following stations: BAIA, BUCU, DEVA, ISTA. These stations were not excluded from the processing due to the lack of EPN class A stations in the vicinity of the Republic of Macedonia.

EPN class A stations MOP2 and SRJV have noisy structure resulting in non linear patterns. MOP2 was excluded from the campaign but SRJV was kept.

SOFI and WTZR have antenna replacements that introduced shifts in the raw time series, which has not been taken into account in the EPN_A_ITRF2005_C1600. These stations were included in the processing but not used as fiducial stations.

Table 1 *List of EUREF MAKPOS 2010 stations (fiducial stations are highlighted)*

Stn ID	Domes No.	Name	Type
BERO		Berovo	MAKPOS, the Macedonian permanent network
BITO		Bitola	MAKPOS, the Macedonian permanent network
DEBA		Debar	MAKPOS, the Macedonian permanent network
KICE		Kicevo	MAKPOS, the Macedonian permanent network
KRPA		Kriva Palanka	MAKPOS, the Macedonian permanent network
KUMA		Kumanova	MAKPOS, the Macedonian permanent network
NEGO		Negotino	MAKPOS, the Macedonian permanent network
PRIL		Prilep	MAKPOS, the Macedonian permanent network
SKOP		Skopje	MAKPOS, the Macedonian permanent network
TETO		Tetovo	MAKPOS, the Macedonian permanent network
VALA		Valandovo	MAKPOS, the Macedonian permanent network
VELE		Veles	MAKPOS, the Macedonian permanent network
VINI		Vinica	MAKPOS, the Macedonian permanent network
BOSI		Bosilegrad	AGROS, the Serbian permanent network
BUJA		Bujanovac	AGROS, the Serbian permanent network
BLAG		Blagoevgrad	BuliPos, the Bulgarian permanent network
KORC		Korce	ALBPOS, the Albanian permanent network
LIBR		Librazhd	ALBPOS, the Albanian permanent network
PES2		Peshkopi	ALBPOS, the Albanian permanent network
E801		Korab	EUREF point in Macedonia
E802		Ramno	EUREF point in Macedonia
E803		Borova cuka	EUREF point in Macedonia
E804		Bogoslovec	EUREF point in Macedonia
E805		Visoka cuka	EUREF point in Macedonia
E806		Kajmakcalan	EUREF point in Macedonia
E807		Galicica	EUREF point in Macedonia
E818		Bele Vode	EUREF point in Serbia
MJ03		Resen	JICA point in Macedonia
MJ14		Gostivar	JICA point in Macedonia
MJ34		Veles	JICA point in Macedonia
MJ41		Radovis	JICA point in Macedonia
MJ54		Probistip	JICA point in Macedonia
AUT1	12619M002	Thessaloniki	EPN A fiducial station, Processed data
BACA	11405M001	Bacau	EPN A fiducial station, Processed data
BAIA	11406M001	Baia Mare	EPN A fiducial station, Processed data
BUCU	11401M001	Bucuresti	EPN A fiducial station, Processed data
BZRG	12751M001	Bolzano-Bozen	EPN A fiducial station, Processed data
DEVA	11408M001	Deva	EPN A fiducial station, Processed data
DUBR	11901M001	Dubrovnik	EPN A fiducial station, Processed data
GRAZ	11001M002	Graz-Lustbuehel	EPN A fiducial station, Processed data
GSR1	14501M001	Ljubljana	EPN A fiducial station, Processed data
ISTA	20807M001	Istanbul	EPN A fiducial station, Processed data
MATE	12734M008	Matera	EPN A fiducial station, Processed data
ORID	15601M001	Ohrid	EPN A fiducial station, Processed data
OROS	11207M001	Oroshaza	EPN A fiducial station, Processed data
OSJE	11902M001	Osijek	EPN A fiducial station, Processed data
PADO	12750S001	Padova	EPN A fiducial station, Processed data
PENC	11206M006	Penc	EPN A fiducial station, Processed data
SOFI	11101M002	Sofija	EPN A, Processed data
SRJV	11801S001	Sarajevo	EPN A fiducial station, Processed data
WTZR	14201M010	Bad Koetzting	EPN A, Processed data
ZIMM	14001M004	Zimmerwald	EPN A fiducial station, Processed data

Figure 2. *Station distribution during EUREF MAKPOS 2010, all stations*

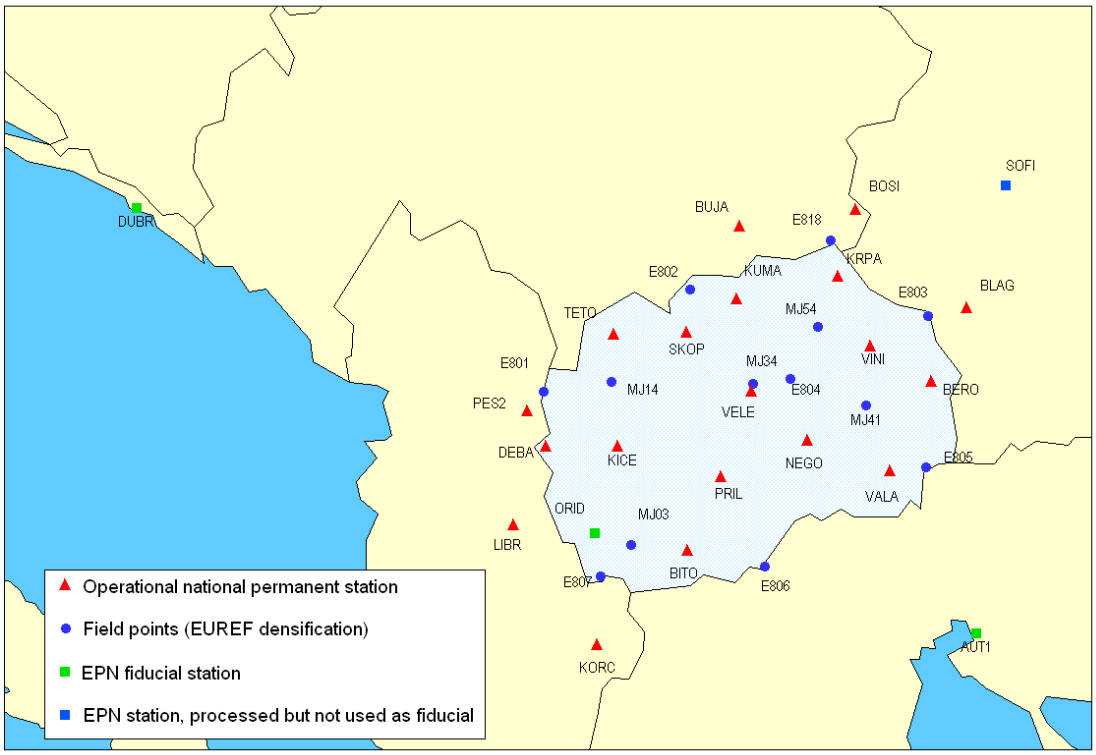

Figure 3. *Station distribution during EUREF MAKPOS 2010, stations in and close to the Republic of Macedonia*

Table 2 *Observation period for all stations, GPS week 1595-1599*

Station	Days	Day of the week						
		0	1	2	3	4	5	6
AUT1	34	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
			X	X	X	X	X	X
BACA	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
BAIA	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
BERO	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
BITO	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
BLAG	21							
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
BOSI	23							
							X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
BUCU	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
BUJA	34	X	X	X	X	X	X	X
			X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
BZRG	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
DEBA	34	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X		X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
DEVA	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
DUBR	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X

Station	Days	Day of the week						
		0	1	2	3	4	5	6
E801	3							
					X	X	X	
E802	4							
				X	X	X	X	
E803	2							
						X	X	
E804	4							
				X	X	X	X	
E805	4							
				X	X	X	X	
E806	4							
				X	X	X	X	
E807	4							
				X	X	X	X	
E818	5							
			X	X	X	X	X	
GRAZ	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
GSR1	34	X	X	X	X	X	X	X
		X	X	X		X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
ISTA	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
KICE	34	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
			X	X	X	X	X	X
		X	X	X	X	X	X	X
KORC	7							
		X	X	X	X	X	X	X

Station	Days	Day of the week						
		0	1	2	3	4	5	6
KRPA	34	X	X	X	X	X		X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
KUMA	34	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X		X	X	X
LIBR	7							
		X	X	X	X	X	X	X
MATE	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
MJ03	4							
				X	X	X	X	
MJ14	4							
				X	X	X	X	
MJ34	2							
					X	X		
MJ41	4							
				X	X	X	X	
MJ54	4							
				X	X	X	X	
NEGO	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
ORID	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
OROS	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
OSJE	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X

Station	Days	Day of the week						
		0	1	2	3	4	5	6
PADO	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
PENC	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
PES2	7							
		X	X	X	X	X	X	X
PRIL	34	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X		X
		X	X	X	X	X	X	X
SKOP	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
SOFI	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
SRJV	19		X		X	X		X
					X	X	X	X
			X	X	X	X	X	X
			X	X	X	X	X	X
TETO	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
VALA	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
VELE	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
VINI	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
WTZR	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
ZIMM	35	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X

3.2 Other data used in the processing

All external data used in the processing is shown in Table 3.

Table 3 *External data used for the processing*

Products	**Sources**
Final, precise GPS orbits	ftp://igscb.jpl.nasa.gov/pub/product/wwww, igswwwwd.sp3
Earth rotation parameters	ftp://igscb.jpl.nasa.gov/pub/product/wwww, igswwwwd.erp
Satellite clocks	ftp://igscb.jpl.nasa.gov/pub/product/wwww, igswwwwd.clk
Global Ionosphere maps	ftp://ftp.unibe.ch/aiub/CODE/wwww, CODwwwwd.ION
Differential code biases for satellites and receivers	ftp://ftp.unibe.ch/aiub/CODE/wwww, P1C1yymm.DCB and P1P2yymm.DCB
Antenna phase center variations file	ftp://epncb.oma.be/pub/station/general/epn_05_1604.atx
Ocean tides loading	http://froste.oso.chalmers.se/loading//, Ocean tide model FES2004, without correction for the centre of mass motion of the Earth, BLQ format
RINEX files of EPN fiducial stations	ftp://olggps.oeaw.ac.at/pub/outdata/%site% (%site% is the marker name) All RINEX files from fiducial stations are downloaded from the ftp server of the Austrian Academy of Sciences Space Research Institute (Agency acronym: OLG)
Co-ordinates of EPN fiducial station	ftp://epncb.oma.be/pub/station/coord/EPN, co-ordinates are extracted from the file EPN_A_ITRF2005_C1600.SNX by program SNX2NQ0.
EPN weekly SINEX solutions	ftp://igs.bkg.bund.de/EUREF/products/wwww/, eurwwww7.snx files

3.3 Co-ordinate reference frame

ITRF2005, epoch 2005.0, co-ordinates of fiducial stations (EPN class A) and corresponding velocities in the current campaign were extracted from file EPN_A_ITRF2005_C1600.SNX, see Table 4.

Table 4 *ITRF2005 (e2005.000) co-ordinates and velocities of fiducial stations from EPN_A_ITRF2005_C1600*

Geodetic datum: ITRF2005 Epoch: 2005-01-01 00:00:00							
Stations ID	Domes' numbers	X	Y	Z	V_X	V_Y	V_Z
		[m]	[m]	[m]	[m/yr]	[m/yr]	[m/yr]
AUT1	12619M002	4466283.4322	1896166.8797	4126096.7886	-0.0149	0.0205	0.0034
BACA	11405M001	3917524.9735	1988524.1063	4608585.6144	-0.0185	0.0153	0.0095
BAIA	11406M001	3945839.7852	1720428.2657	4691082.7121	-0.0179	0.0165	0.0097
BUCU	11401M001	4093760.8698	2007793.8088	4445129.9782	-0.0165	0.0173	0.0105
BZRG	12751M001	4312657.4873	864634.6533	4603844.4421	-0.0137	0.0173	0.0128
DEVA	11408M001	4097210.4958	1731870.3904	4556026.7563	-0.0157	0.0159	0.0096
DUBR	11901M001	4465940.0622	1460594.4784	4299291.4299	-0.0191	0.0168	0.0115
GRAZ	11001M002	4194423.8223	1162702.6963	4647245.4155	-0.0168	0.0176	0.0109
GSR1	14501M001	4292609.5175	1113639.2307	4569215.6190	-0.0176	0.0171	0.0123
ISTA	20807M001	4208830.3061	2334850.2974	4171267.2527	-0.0177	0.0193	0.0082
MATE	12734M008	4641949.5541	1393045.4253	4133287.4609	-0.0177	0.0188	0.0155
ORID	15601M001	4498451.6985	1708266.9822	4173591.8663	-0.0151	0.0201	0.0095
OROS	11207M001	4110946.8804	1551048.6706	4608010.0302	-0.0192	0.0159	0.0095
OSJE	11902M001	4237753.2389	1432791.7011	4531310.2748	-0.0176	0.0174	0.0108
PADO	12750S001	4388882.0297	924567.4671	4519588.7393	-0.0167	0.0176	0.0109
PENC	11206M006	4052449.4791	1417681.1251	4701407.1142	-0.0177	0.0170	0.0099
SOFI	11101M002	4319372.0904	1868687.7826	4292063.9363	-0.0169	0.0185	0.0090
SRJV	11801S001	4370292.9832	1454980.1308	4397965.3286	-0.0182	0.0183	0.0114
WTZR	14201M010	4075580.5583	931853.8004	4801568.1397	-0.0157	0.0168	0.0103
ZIMM	14001M004	4331297.0649	567555.8810	4633133.9340	-0.0132	0.0179	0.0123

Co-ordinates of fiducial stations were propagated with given velocity field to the epoch in the middle of the campaign – 12:00:00, on Wednesday, August 18. 2010 (day of year 230, GPS Week / day 1597/3), epoch 2010.631. Results for epoch 2010.631 are given in Table 5.

Table 5 *ITRF2005 (e2010.631) co-ordinates of fiducial stations*

Geodetic datum: ITRF2005 Epoch: 2010-08-18 12:00:00				
Stations ID	Domes' numbers	X [m]	Y [m]	Z [m]
AUT1	12619M002	4466283.3489	1896166.9950	4126096.8092
BACA	11405M001	3917524.8697	1988524.1927	4608585.6689
BAIA	11406M001	3945839.6847	1720428.3578	4691082.7669
BUCU	11401M001	4093760.7778	2007793.9065	4445130.0381
BZRG	12751M001	4312657.4105	864634.7508	4603844.5143
DEVA	11408M001	4097210.4081	1731870.4800	4556026.8120
DUBR	11901M001	4465939.9552	1460594.5719	4299291.4951
GRAZ	11001M002	4194423.7273	1162702.7943	4647245.4766
GSR1	14501M001	4292609.4190	1113639.3276	4569215.6890
ISTA	20807M001	4208830.2071	2334850.4054	4171267.3001
MATE	12734M008	4641949.4553	1393045.5303	4133287.5491
ORID	15601M001	4498451.6143	1708267.0955	4173591.9207
OROS	11207M001	4110946.7728	1551048.7599	4608010.0844
OSJE	11902M001	4237753.1403	1432791.7989	4531310.3365
PADO	12750S001	4388881.9367	924567.5665	4519588.8001
PENC	11206M006	4052449.3791	1417681.2209	4701407.1698
SOFI	11101M002	4319371.9941	1868687.8860	4292063.9871
SRJV	11801S001	4370292.8814	1454980.2331	4397965.3941
WTZR	14201M010	4075580.4699	931853.8950	4801568.1978
ZIMM	14001M004	4331296.9903	567555.9818	4633134.0035

A priori-co-ordinates and velocities for the rest of the stations were taken from a preliminary (PPP) processing and from Nuvel1A velocity field, respectively.

3.4 Receivers and antennas

Receiver types, antenna types and antenna eccentricities are shown in Table 6. All receivers, antennas and antenna heights were constant during the whole campaign.

Program PHCCNV was used for converting epn_05_1604.atx to Bernese format. Absolute antenna model for antenna phase centre variations was used for the processing. The EPN stations Bucuresti (BUCU 11401M001), Ohrid (ORID 15601M001), Penc (PENC 11206M006), Sofia (SOFI 11101M002) and Bad Koetzting (WTZR 14201M010) have individual antenna calibrations.

A relative antenna model for LEIATX900GG NONE was delivered by eqipment supplier from LEICA Geosystems and converted to absolute antenna model with the program PHCCNV and added to the file used in the processing.

Table 6 *GNSS equipment for all stations in EUREF MAKPOS 2010 campaign*

Station	Receiver	Antenna	Radome	Antenna height	Antenna model used in processing	Monument type
AUT1 12619M002	LEICA GRX1200PRO	LEIAT504	LEIS	0.1824	ROBOT; Geo++ GmbH	Steel mast on the roof
BACA 11405M001	LEICA GRX1200PRO	LEIAT504	LEIS	0.0000	ROBOT; Geo++ GmbH	Steel mast on the roof
BAIA 11406M001	LEICA GRX1200PRO	LEIAT504	LEIS	0.0000	ROBOT; Geo++ GmbH	Steel mast on the roof
BERO	LEICA GRX1200+GNSS	LEIAR25	LEIT	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
BITO	LEICA GX1230GG	LEIAR25	LEIT	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
BLAG	TPS NETG3	TPSCR.G3	TPSH	0.0000	ROBOT; Geo++ GmbH	Stable pillar on the roof
BOSI	TRIMBLE 5700	TRM39105.00	NONE	0.0000	Converted from relative NGS antenna calibrations	Steel mast on the roof
BUCU 11401M001	LEICA GRX1200GGPRO	LEIAT504GG	LEIS	0.0970	Individual antenna calibration; ROBOT; Geo++ GmbH	Concrete pillar on the roof
BUJA	TRIMBLE 5700	TRM41249.00	TZGD	0.0000	Converted from relative antenna calibration done	Steel mast on the roof
BZRG 12751M001	LEICA GRX1200GGPRO	LEIAT504GG	LEIS	0.2120	ROBOT; Geo++ GmbH	Steel pillar on the roof
DEBA	LEICA GRX1200+GNSS	LEIAR25	LEIT	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
DEVA 11408M001	LEICA GRX1200PRO	LEIAT504	LEIS	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
DUBR 11901M001	TRIMBLE NETR5	TRM55971.00	NONE	0.0580	ROBOT; Geo++ GmbH	Steel tripod
E801	LEICA GS09	LEIGS09	NONE	0.1865	Copied from LEIATX1230+GNSS NONE; Geo++ GmbH	Concrete pillar
E802	LEICA GS09	LEIGS09	NONE	0.5930	Copied from LEIATX1230+GNSS NONE; Geo++ GmbH	Concrete pillar
E803	LEICA ATX1230	LEIATX1230GG	NONE	0.1870	Converted from relative NGS antenna calibrations	Concrete pillar
E804	LEICA ATX900	LEIATX900GG	NONE	0.1935	Converted from relative antenna calibration done	Concrete pillar
E805	LEICA ATX900	LEIATX900GG	NONE	0.1890	Converted from relative antenna calibration done	Concrete pillar
E806	LEICA GS09	LEIGS09	NONE	0.5960	Copied from LEIATX1230+GNSS NONE; Geo++ GmbH	Concrete pillar
E807	LEICA ATX1230	LEIATX1230GG	NONE	0.1900	Converted from relative NGS antenna calibrations	Concrete pillar
E818	TRIMBLE 5700	TRM55971.00	NONE	0.2842	ROBOT; Geo++ GmbH	Concrete pillar
GRAZ 11001M002	LEICA GRX1200+GNSS	LEIAR25.R3	LEIT	1.9640	ROBOT; Geo++ GmbH	Steel pyramide
GSR1 14501M001	LEICA GRX1200GGPRO	LEIAT504GG	LEIS	0.0650	ROBOT; Geo++ GmbH	Steel mast on the top of a building
ISTA 20807M001	ASHTECH Z-XII3	ASH700936D M	SNOW	0.0610	ROBOT; Geo++ GmbH	Concrete pillar on the roof
KICE	LEICA GX1230GG	LEIAX1202GG	NONE	0.0000	Converted from relative NGS antenna calibrations	Steel pillar on the roof
KRPA	LEICA GRX1200+GNSS	LEIAR25	LEIT	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
KORC	TRIMBLE NETR5	TRM55971.00	TZGD	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
KUMA	LEICA GX1230GG	LEIAX1202GG	NONE	0.0000	Converted from relative NGS antenna calibrations	Steel pillar on the roof
LIBR	TRIMBLE NETR5	TRM55971.00	TZGD	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
MATE 12734M008	LEICA GRX1200GGPRO	LEIAT504GG	NONE	0.1010	ROBOT; Geo++ GmbH	Steel pillar on the roof
MJ03	LEICA GS15	LEICA GS15	NONE	0.1950	ROBOT; Geo++ GmbH	Concrete pillar
MJ14	LEICA GS15	LEICA GS15	NONE	0.1980	ROBOT; Geo++ GmbH	Concrete pillar
MJ34	LEICA GS15	LEICA GS15	NONE	0.1880	ROBOT; Geo++ GmbH	Concrete pillar
MJ41	LEICA GS15	LEICA GS15	NONE	0.1878	ROBOT; Geo++ GmbH	Concrete pillar
MJ54	LEICA GS09	LEICA GS09	NONE	0.1920	Copied from LEIATX1230+GNSS NONE; Geo++ GmbH	Concrete pillar
NEGO	LEICA GX1230GG	LEIAX1202GG	NONE	0.0000	Converted from relative NGS antenna calibrations	Steel pillar on the roof
ORID 15601M001	LEICA GRX1200GGPRO	LEIAT504GG	LEIS	0.0640	Individual antenna calibration; ROBOT; Geo++ GmbH	Concrete pillar on concrete block on bedrock
OROS 11207M001	LEICA GRX1200PRO	LEIAT504	LEIS	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
OSJE 11902M001	TRIMBLE NETR5	TRM55971.00	NONE	0.0635	ROBOT; Geo++ GmbH	Steel mast on the roof
PADO 12750S001	TRIMBLE NETRS	TRM29659.00	NONE	0.0000	ROBOT; Geo++ GmbH	Concrete block on the roof
PENC 11206M006	LEICA GRX1200GGPRO	LEIAT504GG	LEIS	0.0300	Individual antenna calibration; ROBOT; Geo++ GmbH	Concrete pillar on the roof
PES2	TRIMBLE NETR5	TRM55971.00	TZGD	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
PRIL	LEICA GRX1200GGPRO	LEIAT504GG	LEIS	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
SKOP	LEICA GRX1200+GNSS	LEIAR25	LEIT	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
SOFI 11101M002	LEICA GRX1200GGPRO	LEIAR25.R3	LEIT	0.2200	Individual antenna calibration; ROBOT; Geo++ GmbH	Concrete pillar on the roof
SRJV 11801S001	TRIMBLE 4000SSI	TRM22020.00+GP	NONE	0.1740	ROBOT; Geo++ GmbH	Steel rods on the concrete
TETO	LEICA GRX1200+GNSS	LEIAR25	LEIT	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
VALA	LEICA GRX1200+GNSS	LEIAR25	LEIT	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
VELE	LEICA GRX1200+GNSS	LEIAR25	LEIT	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
VINI	LEICA GRX1200+GNSS	LEIAR25	LEIT	0.0000	ROBOT; Geo++ GmbH	Steel pillar on the roof
WTZR 14201M010	LEICA GRX1200GGPRO	LEIAR25.R3	LEIT	0.0710	Individual antenna calibration; ROBOT; Geo++ GmbH	Steel plate on concrete
ZIMM 14001M004	TRIMBLE NETRS	TRM29659.00	NONE	0.0000	ROBOT; Geo++ GmbH	Steel mast on concrete block

3.5 Ocean tide loading

Ocean tide loading used for the processing was achieved from the free ocean loading provider on the web address http://froste.oso.chalmers.se/loading//. Values were interpolated from the FES2004 model, without correction for the centre of mass motion of the Earth. Co-ordinates for the interpolation of ocean tide loading correction were results of preliminary processing of the GPS week of the field campaign.

3.6 Processing strategy

The same processing strategy as in the Serbian solution has been used to ensure a good agreement with the ETRS 89 realization in Serbia. The processing was carried out with the Bernese Software version 5.0, update February 18, 2010, following the "Guidelines for EPN Analysis Centers" [EPN Coordination group 2010].

Each of the 35 daily sessions in the GPS weeks 1595 to 1599 were processed separately. Each daily solution generated a minimally constrained normal equation file.

A summary of the steps in the daily processing is given in Table 7. Explanations about important parts are described in the following chapters.

An elevation cut off angle of 3° and "cos z" elevation dependent weighting was used throughout the processing, except for the ambiguity resolution where 10° cut off angle was used and in a test solution with 25° cut off.

Table 7 *Summary of daily processing strategy*

Step	Subroutine	Details
1	COOVEL	getting a priori co-ordinates; propagate co-ordinates with given velocity field to the epoch of observation
2	POLUPD	creating Bernese formatted ERP file from precise IGS ERP file
3	PRETAB	getting orbit and clock information in tabular files from IGS precise ephemeris and Bernese formatted ERP file (step 2)
4	ORBGEN	generating standard orbits file
5	RNXGRA	creating pseudo-graphics from RINEX observation file and rejection of bad files
6	RXOBV3	importing RINEX files into Bernese format, only for GPS observations

Step	Subroutine	Details
7	CODSPP	single point positioning for each station, using orbit and clock information from step 3.
8	CODXTR	bad station detection and removal from further processing
9	SNGDIF	creating single differences observation files using the OBSMAX strategy
10	MAUPRP	preprocessing single differences and marking of observations before cycle slip detection: elevation mask 3°, minimum time interval for continuous observation 361 seconds and max gap 181 seconds identification of data without cycle slips and in remaining data find if possible repair cycle slips
11	GPSEST	solving ambiguity float double differences solution with corrected cycle slips detected in step 10, clusters with three baselines troposphere estimation, saving normalized residuals, saving normal equations
12	RESRMS SATMRK	screening and marking high residuals from saved residuals in step 11.
14	GPSEST	the same as step 11, but input files have marked observations from step 12.
15	ADDNEQ2	Combining clusters from step 14, output preliminary co-ordinates and troposphere estimation
16	GPSEST	solving ambiguities with QIF strategy baseline by baseline
17	GPSEST	computing final loosely constrained network solution with ambiguities fixed from step 16, saving normal equations
18	ADDNEQ2	computing a minimal constraint solution on fiducial stations, troposphere estimates and troposphere SINEX files from normal equations saved in step 17, saving normal equations
19	HELMR1	verification of fiducial stations, iteration on step 18 if outliers exist
20	ADDNEQ2	size reduced NEQ information and SINEX generation
21	GPSEST	computing a test solution with ambiguities fixed from step 16, cut off angle 25°

Step	Subroutine	Details
22	ADDNEQ2	the same as step 20 but for cut off angle 25°
23	HELMR1	Elevation cut off test for all stations, comparison between the 3° and 25° solutions from step 18 and 22, respectively

3.7 Modeling troposphere and ionosphere

A simple troposphere strategy was implemented for programs CODSPP and MAUPRP (steps 7 and 10 in Table 7). Tropospheric refraction was modeled by using the Saastamoinen model in CODSPP. The Niell model was used in MAUPRP i.e., the Saastamoinen zenith path delay together with the Neill mapping functions (dry and wet) [Niell 1996].

In the double difference float solution using GPSEST (step 11 and 14 in Table 7), the Dry Niell a priori model was used in combination with the estimation of the partial derivatives of the troposphere zenith path delay every second hour using the wet-Niell mapping function. The troposphere model from the double difference float solution was introduced in the QIF-ambiguity resolution (step 16). In the fixed ambiguity double difference solution (step 17) the Dry Niell a priori model was used in combination with estimation of troposphere zenith path delay parameters (wet Niell mapping function) every hour and gradient parameters using the tilting model and 24 hours interval. Absolute and relative a priori constraints on the values of the tropospheric zenith path delay parameters were applied with a priori sigma of 5 m for troposphere parameter estimations.

The ionosphere is not modeled. Ionosphere-free L3 linear combination of dual-band measurements was used in processing which nearly completely eliminates the ionospheric refraction effects in program GPSEST.

For the Quasi-Ionosphere-Free (QIF) ambiguity resolution strategy the L1+L2 observable was used in the program GPSEST and to improve QIF ambiguity resolution CODE global ionosphere models were used.

3.8 Handling of ambiguities

A priori co-ordinates for the ambiguity resolution were taken from step 15 in Table 7 (float double differences solution with marked outliers and corrected cycle slips).

Ambiguity resolution was done baseline by baseline (step 16 in Table 7). The QIF ambiguity resolution strategy was used to resolve L1 and L2 ambiguities without using the code measurements and with implemented CODE global ionosphere model.

Cut off angel used for this purpose was 10°.

3.9 Elevation cut off test

A test solution with a cut off angle of 25° was produced. This solution was compared to the final 3° solution. A large difference between the two is an indication that there are shortcomings in the used antenna model, i.e. that the antenna model is not describing the real situation. Site dependent effects could be the reason for this. The result of this test can be found in Appendix 1.

3.10 Daily network solutions

Final daily loosely constrained network solutions were produced by program GPSEST (step 17 in Table 7). Preliminary co-ordinates from float double differences solution with marked outliers and corrected cycle slips were taken as apriori co-ordinates in this step in the processing (step 17 in Table 7). The mathematical correlations between the double-difference observations were handled correctly in processing baselines. Sampling interval was 180 seconds. Normal equations were saved for later use in the final combined solution of the campaign.

Daily network solutions were minimal constrained on EPN class A stations.

3.11 Final combined network solution

All of the 35 daily solutions were combined into a common adjustment using the program ADDNEQ2. For the final combined network solution just translation minimum constraint was imposed on the fiducial stations, as this is the recommendation for regional networks according to the Bernese manual [Dach et. Al. 2006].

In the EUREF Serbia 2010 campaign different types of minimal constraints to the ITRF 2005 reference co-ordinates in EPN_A_ITRF2005_C1600 were tested.

3.12 Co-ordinate transformation to ETRS89

After completing the final solution, the co-ordinate transformation was done from reference frame of the campaign – ITRF2005 e2010.631 to ETRS89, using tools and services on EPN web site http://www.epncb.oma.be/_dataproducts/coord_trans/.

Co-ordinate transformation to ETRS89 was done only to ETRF2000, e2010.631, i.e. no intra-plate velocities have been taken into account. Co-ordinate comparisons with previous ETRS89 densifications were analyzed in ETRF2000.

4. Results from the processing

4.1 Daily mean ambiguity resolution percentages

Average percentage of daily ambiguity resolution was 83.9 %. Daily mean percentages can be found in Figure 4.

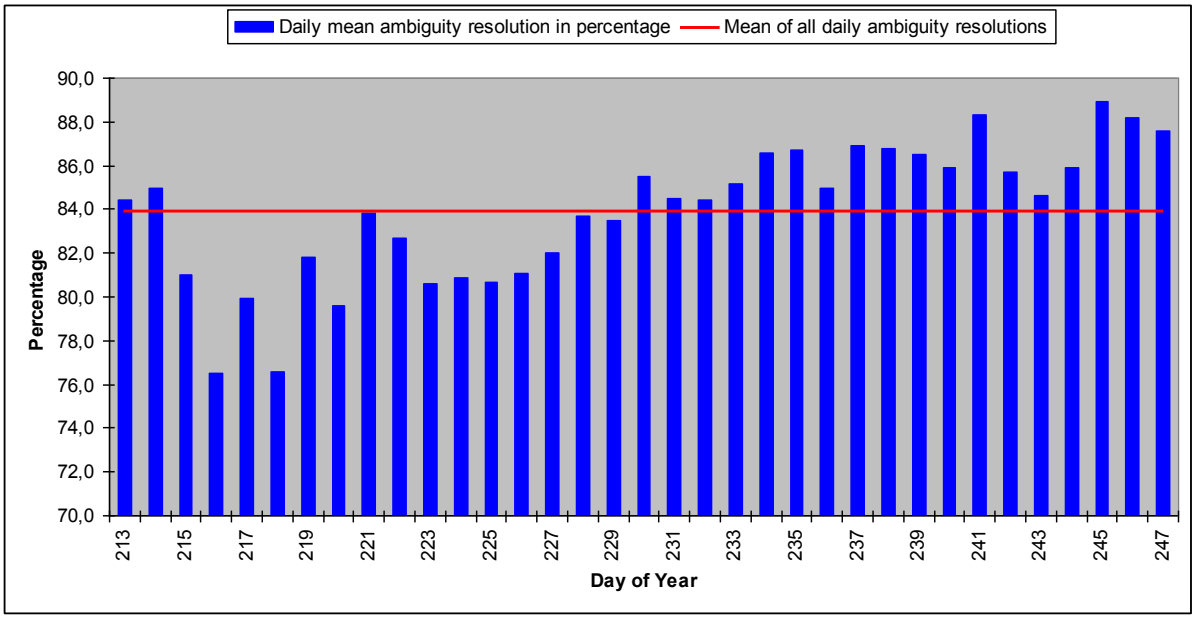

Figure 4. *Daily mean ambiguity resolution percentages*

4.2 Comparison of the daily co-ordinates solutions

Daily network solutions, minimal constrained on fiducial stations, were used for checking daily repeatability of co-ordinates for all stations. Comparison of co-ordinates was done with estimated ITRF2005 co-ordinates. Daily repeatability is presented in Figure 5 and Table 8. All stations showed good repeatability with typical values around 1 mm per horizontal component and 3-5 mm in height.

Figure 5. *Daily repeatability for all stations in the EUREF MAKPOS 2010 campaign presented with RMS in [mm] by North, East and UP components*

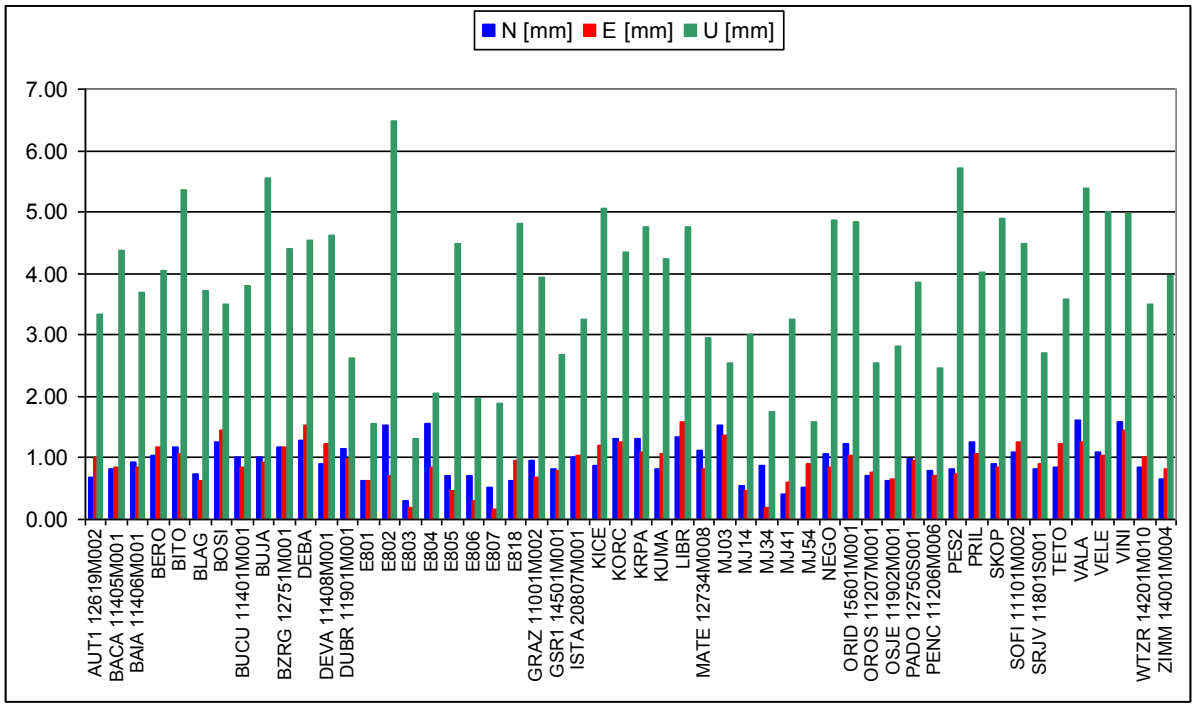

Table 8 *Repeatability of daily solutions compared to final network solution presented with RMS in [mm] by North, East and UP components*

Station	RMS / components [mm]		
	N	E	U
AUT1 12619M002	0.69	1.00	3.33
BACA 11405M001	0.81	0.85	4.37
BAIA 11406M001	0.94	0.86	3.70
BERO	1.05	1.17	4.06
BITO	1.17	1.07	5.37
BLAG	0.75	0.63	3.73
BOSI	1.27	1.46	3.50
BUCU 11401M001	1.00	0.86	3.79
BUJA	1.02	0.92	5.55
BZRG 12751M001	1.18	1.18	4.40
DEBA	1.29	1.52	4.53
DEVA 11408M001	0.89	1.23	4.63
DUBR 11901M001	1.16	0.98	2.63
E801	0.64	0.64	1.55
E802	1.53	0.70	6.49
E803	0.30	0.20	1.32
E804	1.56	0.84	2.04
E805	0.71	0.47	4.49
E806	0.72	0.31	1.98
E807	0.51	0.17	1.89
E818	0.64	0.97	4.80
GRAZ 11001M002	0.95	0.67	3.93
GSR1 14501M001	0.83	0.79	2.69
ISTA 20807M001	1.01	1.04	3.25
KICE	0.88	1.20	5.06
KORC	1.31	1.25	4.34
KRPA	1.31	1.10	4.75
KUMA	0.83	1.07	4.24
LIBR	1.33	1.58	4.76
MATE 12734M008	1.12	0.83	2.96
MJ03	1.53	1.38	2.54
MJ14	0.55	0.47	3.02
MJ34	0.88	0.20	1.75
MJ41	0.41	0.60	3.26
MJ54	0.53	0.90	1.58
NEGO	1.08	0.85	4.86
ORID 15601M001	1.24	1.04	4.85
OROS 11207M001	0.70	0.76	2.55
OSJE 11902M001	0.63	0.66	2.82
PADO 12750S001	0.99	0.96	3.86
PENC 11206M006	0.80	0.71	2.47
PES2	0.81	0.75	5.72
PRIL	1.25	1.07	4.02
SKOP	0.89	0.86	4.90
SOFI 11101M002	1.10	1.26	4.48
SRJV 11801S001	0.81	0.89	2.72
TETO	0.84	1.23	3.58
VALA	1.62	1.27	5.39
VELE	1.10	1.03	5.01
VINI	1.58	1.46	4.99
WTZR 14201M010	0.84	1.01	3.50
ZIMM 14001M004	0.65	0.83	3.97
Total	**1.04**	**1.03**	**4.12**

4.3 Elevation cut off test

The result from the cut off test is presented in Appendix 1. It shows different level of accuracy depending on antenna type used and site dependent effects. Three stations have differences above the limit 30 mm, which indicates that the estimated heights of these stations might be more uncertain.

The most alarming station in this test is BOSI (a Serbian permanent station) with a height residual of 83 mm. This station is equipped with the non-geodetic antenna, Trimble Zephyr (TRM39105.00 NONE). In this solution BOSI is the only one with this antenna type, but in the Serbian solution there are several stations with this antenna type and all of them are rejected in the elevation cut off test with a limit of 30 mm [Veljović, Lazić 2011]. Besides BOSI there are just three other stations with differences larger that 30 mm; E807 (42 mm, LEIATX12030GG NONE), TETO (36 mm, LEIAR25 LEIT) and BUJA (37 mm, TRM41249.00 TZGD). Note that the differences in the elevation cut of test not could be directly translated to height errors.

4.4 Comparison between estimated ITRF2005 co-ordinates and latest EUREF densification of ITRS

Co-ordinate recoveries on EPN class A fiducial stations were computed by comparing the final network solution with co-ordinate set extracted from EPN file EPN_A_ITRF2005_C1600.SNX. Two EPN A stations were not controlled because they have not been used in the datum definition in the final solution. The comparison was done by program HELMR1. Co-ordinate recoveries from the plain comparison are presented in Table 9 and shown in Figure 6 and Figure 7.

Table 9 Co-ordinate recoveries for fiducial stations

Station	a plain comparison		
	N	E	U
	[mm]	[mm]	[mm]
AUT1 12619M002	-0.3	-1.6	-1.2
BACA 11405M001	0.2	-1.3	2.3
BAIA 11406M001	0.2	-1.2	0.2
BUCU 11401M001	-0.2	-1.8	-1.8
BZRG 12751M001	0.0	0.1	2.5
DEVA 11408M001	-0.5	-1.7	0.9
DUBR 11901M001	-1.6	2.2	0.0
GRAZ 11001M002	-1.2	1.8	2.6
GSR1 14501M001	0.1	0.5	0.4
ISTA 20807M001	1.4	1.3	-1.6
MATE 12734M008	0.6	3.5	-2.6
ORID 15601M001	0.1	-0.8	-2.6
OROS 11207M001	0.7	-1.1	1.0
OSJE 11902M001	-0.8	-1.5	-0.9
PADO 12750S001	0.7	0.1	1.2
PENC 11206M006	-0.2	-0.1	2.9
SRJV 11801S001	1.2	1.6	-3.8
ZIMM 14001M004	-0.8	0.7	-0.5
RMS / COMPONENT	**0.8**	**1.6**	**2.0**

A small tilting trend is noted in Figure 7 . In the Serbian solution a test was made to constrain both the translations and rotations because of this tilting trend. This test revealed some undesired effects on the internal geometry of the network, which is the reason for just constraining the translations even though there is a significant rotation between the GPS solution and the reference co-ordinates. [Vejlković, Lazić, 2011]

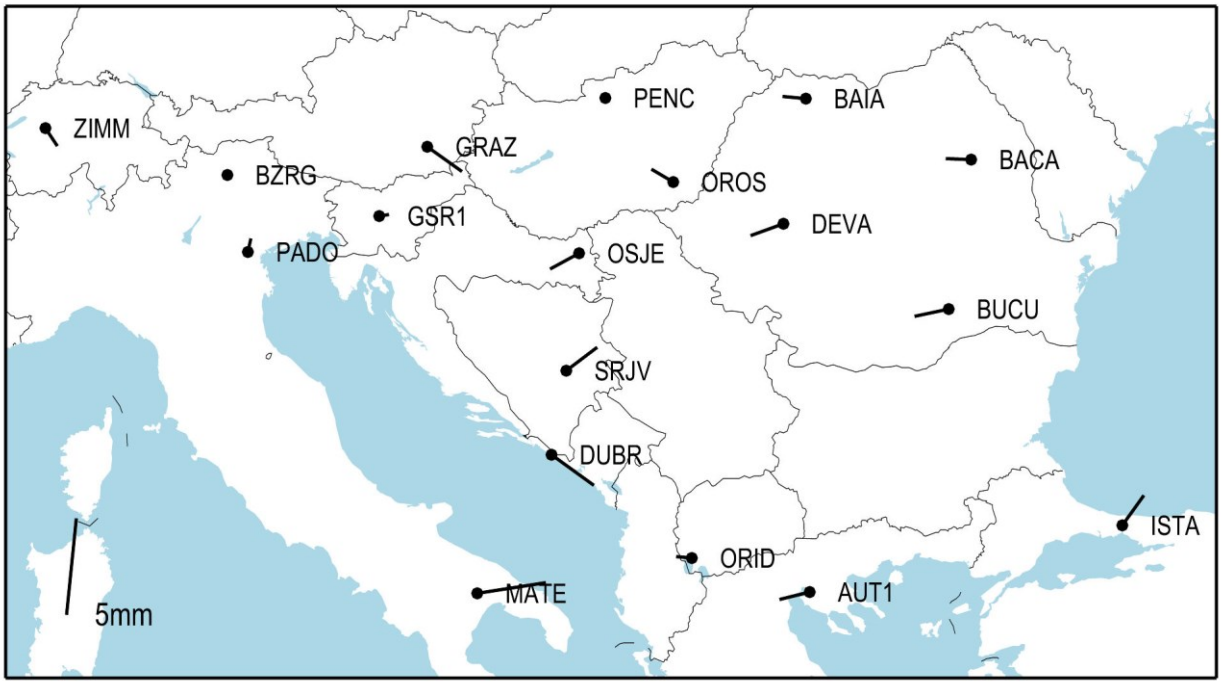

Figure 6. Horizontal residuals from fiducial station co-ordinate recoveries

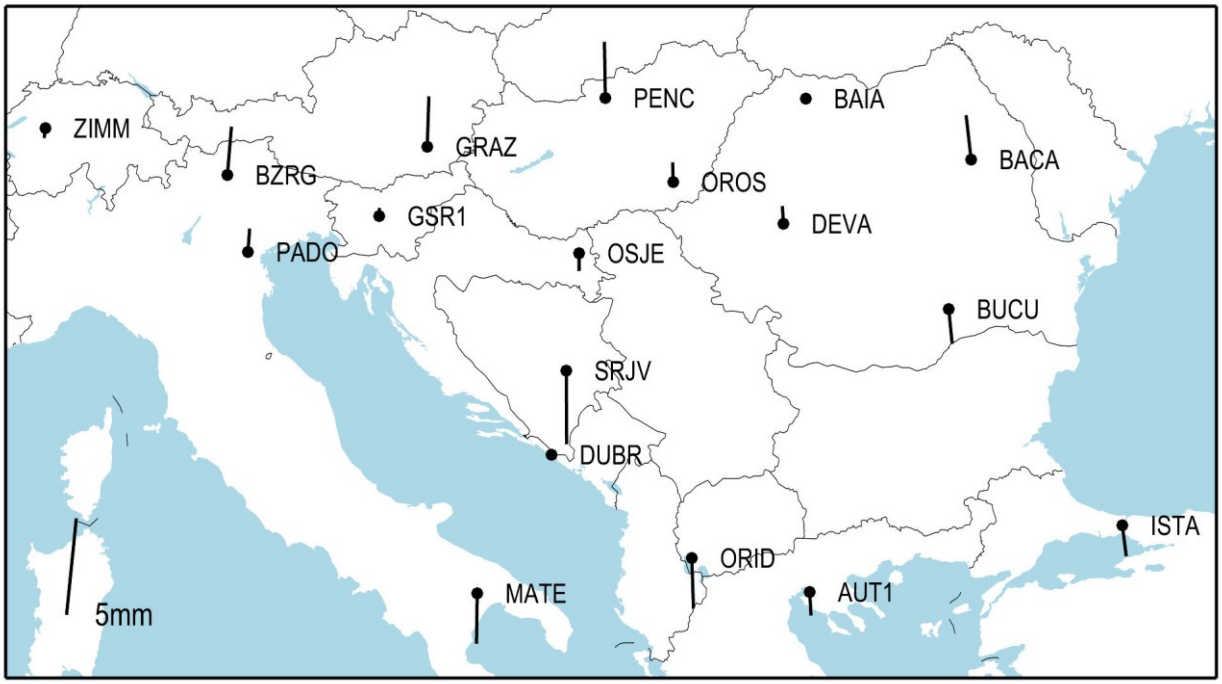

Figure 7. Vertical residuals from fiducial station co-ordinate recoveries

4.5 Transformation to ETRS89

Transformation to the ETRS89 is done by tools and services on EPN web site http://www.epncb.oma.be/_dataproducts/coord_trans/. The final network solution in ITRF2005 epoch 2010.631 is transformed to ETRF2000 epoch 2010.631. The final results are given at the beginning of this report.

5. Comparisons with and other realizations of ETRS89

5.1 EUREF Serbia 2010

The comparison of the final ITRF2005 co-ordinates in EUREF MAKPOS 2010 and EUREF Serbia 2010 can be found in Table 10. The largest difference between the final solutions of EUREF MAKPOS 2010 and EUREF Serbia 2010 is 0.3 mm in horizontal and 1 mm in height.

Table 10 *EUREF Serbia 2010 minus* EUREF MAKPOS 2010

Station	N [mm]	E [mm]	U [mm]
AUT1 12619M002	-0.2	0.1	0.3
BACA 11405M001	0.0	0.1	0.4
BAIA 11406M001	0.0	0.1	0.2
BERO	0.0	0.1	-0.1
BITO	-0.1	0.0	0.2
BLAG	-0.2	0.0	0.8
BOSI	-0.2	0.2	0.5
BUCU 11401M001	0.0	0.0	-0.1
BUJA	-0.1	-0.1	-0.2
BZRG 12751M001	0.2	-0.1	-0.1
DEBA	-0.1	0.1	0.1
DEVA 11408M001	0.0	0.1	0.2
DUBR 11901M001	0.0	-0.1	-0.2
E801	-0.1	0.2	1.0
E802	0.0	-0.1	0.1
E803	-0.1	0.2	0.3
E804	0.2	0.1	-0.2
E805	-0.1	0.0	0.8
E806	-0.1	0.0	0.9
E807	-0.1	0.0	0.2
E818	0.0	0.0	0.7
GRAZ 11001M002	0.1	-0.2	-0.4
GSR1 14501M001	0.0	-0.1	0.0
ISTA 20807M001	-0.3	0.1	0.4
KICE	0.0	-0.1	0.3
KRPA	-0.1	-0.1	0.3
KUMA	-0.2	0.1	0.1
MATE 12734M008	-0.1	0.0	-0.1
NEGO	-0.1	0.0	0.1
ORID 15601M001	0.0	0.1	-0.3
OROS 11207M001	0.1	0.0	0.2
OSJE 11902M001	0.0	0.0	-0.3
PADO 12750S001	0.1	-0.1	-0.1
PENC 11206M006	0.0	0.0	0.3
PRIL	-0.1	0.0	0.1
SKOP	0.0	0.0	-0.1
SOFI 11101M002	-0.1	0.1	0.3
SRJV 11801S001	-0.2	0.0	-0.3
TETO	-0.1	0.1	0.8
VALA	0.0	0.0	0.0
VELE	0.0	-0.1	-0.2
VINI	-0.2	-0.1	-0.1
WTZR 14201M010	0.1	-0.3	-0.2
ZIMM 14001M004	0.1	-0.2	-0.1
RMS / COMPONENT	**0.1**	**0.1**	**0.4**

5.2 EUREF FYROM 1996

The final ETRF2000 co-ordinates were compared with the co-ordinates from the EUREF FYROM 1996 campaign transformed by EPN tools and services from ITRF94 epoch 1996.6 to ETRF2000 in the same epoch.

Those ETRF2000 co-ordinates sets were compared in program HELMR1. Residuals are

presented in Table 11. Different types of comparison were performed, 6 parameters estimation (3 translations and 3 rotations), 3 parameters estimation (translations) and plain comparison. The EUREF MAKPOS 2010 campaign agrees with the EUREF FYROM 1996 at the 20 mm level, except a shift of approximately 3 cm.

Table 11 *Comparison of final ETRF2000 and co-ordinates from previous EUREF FYROM 1996 campaign calculated in ETRF2000 epoch 1996.6*

Station	6 par			3 translation par			a plain comparison		
	N	E	U	N	E	U	N	E	U
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
E801	0.0	4.2	8.5	0.0	4.2	8.5	-36.6	4.3	-1.6
E802	22.4	2.0	-24.0	22.4	2.0	-24.0	-14.1	1.9	-34.4
E803	8.0	-2.1	12.8	8.0	-2.1	12.8	-28.6	-2.7	2.5
E804	-4.5	4.1	-3.1	-4.5	4.1	-3.1	-41.1	3.8	-13.3
E805	-27.7	-2.2	-11.4	-27.7	-2.2	-11.4	-64.4	-2.7	-21.3
E806	2.7	4.6	-14.9	2.7	4.6	-14.9	-34.1	4.4	-24.5
E807	-0.8	-10.6	32.5	-0.8	-10.6	32.5	-37.6	-10.6	22.9
RMS /component	14.2	5.2	17.7	15.1	5.5	19.3	42.4	5.5	22.2

5.3 Previous determination of the MAKPOS stations

The permanent stations in Republic of Macedonia, MAKPOS, were determined by Leica Geosystems in 2010 [Leica Geosystems, 2010] in ITRF2005 in epoch 2010-04-28. The ETRF2000 co-ordinates in epoch 2010-04-28 were compared with the final ETRF 2000 co-ordnates of this campaign. Residuals are presented in Table 12. The EUREF MAKPOS 2010 campaign agrees with the previous determination of the MAKPOS stations at the 3-4 mm level.

Table 12 *Comparison of final ETRF2000 and co-ordinates determined in Leica Geosystems calculated in ETRF2000 epoch 2010-04-28 for the MAKPOS stations*

Station	6 par			3 translation par			a plain comparison		
	N	E	U	N	E	U	N	E	U
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
BERO	0.3	-0.7	-2.5	0.0	-0.6	-4.4	-1.3	-0.8	-4.1
BITO	1.1	2.4	0.5	1.2	2.1	1.6	-0.2	2.0	1.9
DEBA	0.3	0.2	-2.5	0.6	0.2	-0.6	-0.7	0.0	-0.4
KICE	-1.9	-3.3	-1.4	-1.7	-3.3	-0.2	-3.0	-3.5	0.1
KRPA	1.6	-0.7	-0.5	1.4	-0.5	-2.0	0.1	-0.6	-1.7
KUMA	-1.2	0.8	0.3	-1.2	1.0	-0.2	-2.5	0.8	0.1
NEGO	1.0	-0.3	-1.3	0.9	-0.3	-1.8	-0.4	-0.5	-1.5
ORID 15601M001	1.7	2.6	2.7	1.9	2.5	4.5	0.6	2.3	4.8
PRIL	-1.5	-0.3	-3.1	-1.5	-0.4	-2.7	-2.8	-0.5	-2.4
SKOP	-0.1	0.3	0.9	0.0	0.4	1.0	-1.4	0.3	1.2
TETO	0.4	2.7	2.6	0.6	2.8	3.3	-0.8	2.6	3.5
VALA	-1.5	-3.9	3.5	-1.7	-4.0	2.4	-3.0	-4.2	2.7
VELE	-0.5	1.0	-0.8	-0.5	1.0	-1.0	-1.9	0.8	-0.8
VINI	0.4	-0.9	1.4	0.2	-0.8	-0.1	-1.1	-1.0	0.2
RMS /component	1.2	1.9	2.1	1.2	1.9	2.4	1.8	2.0	2.4

5.4 ALBPOS ETRF2000 co-ordinates

The permanent stations in Republic of Albania, ALBPOS, were determined in 2010 [Stangl 2010] in ITRF2005. The ETRF2000 co-ordinates in epoch 2008.0 were compared with the final ETRF 2000 co-ordnates of this campaign. Residuals are presented in Table 13. The EUREF MAKPOS 2010 campaign agrees with the official co-ordinates at the ALBPOS stations at around 10 mm level.

Table 13 *Comparison of final ETRF2000 and official co-ordinates at ALBPOS stations calculated in ETRF2000 epoch 2008.0*

Station	6 par			3 translation par			a plain comparison		
	N	E	U	N	E	U	N	E	U
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
KORC	6.0	0.3	0.0	5.8	-0.1	-1.2	8.1	-7.4	-0.1
LIBR	-2.3	-4.0	0.0	-2.2	-4.0	-0.1	0.0	-11.3	1.0
PES2	-3.7	3.8	0.0	-3.7	4.2	1.2	-1.4	-3.0	2.4
RMS /component	5.3	3.9	0.0	5.1	4.1	1.2	5.8	9.8	1.8

6. Conclusions

The internal quality of the solution is around 1 to 2 mm in N and E and around 3 to 5 in U. This quality level is estimated by daily co-ordinate repeatabilities.

The co-ordinate recoveries of fiducial stations indicate that ITRF2005 for EUREF MAKPOS 2010 is realized to around 2 mm in all three components (in the frame of EPN_A_ITRF2005_C1600).

The results from an elevation cut off test show different level of accuracy depending on antenna type used and site dependent effects. The Serbian station BOSI equipped with a non-geodetic antenna has a large value in the test which indicates that the height estimation is uncertain. The stations BUJA, E807 and TETO also have quite large values which indicate that the heights of these stations might be degraded.

The comparison to the solution of EUREF Serbia 2010 shows an agreement of typically a few tenth of mm, the largest difference is 1 mm in height (station E801). The largest horizontal difference is 0.3 mm.

Comparison with an earlier determination of MAKPOS, computed by Leica Geosystems in 2010, agrees at 3-4 mm level in ETRF2000.

Comparison with the ALBPOS co-ordinates, also determined in 2010, agrees on the 10 mm level in ETRF2000.

Comparison with the EUREF FYROM 96 campaign based on ITRF94 is at the 20 mm level, except a shift of c 3 cm in north. Comparison is done in ETRF2000.

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Appendix 1 Elevation Cut Off Test

The elevation cut-off test presented here is based on a comparison between the final combined solution (3°) and the corresponding combined solution with 25° cut-off angle – see Table 14.

Four stations have differences larger than 30 mm BOSI (83 mm, TRM39105.00 NONE), BUJA (37 mm, TRM41249.00 TZGD), E807 (42 mm, LEIATX12030GG) and TETO (36 mm, LEIAR25 LEIT).

Table 14 Co-ordinate differencies from elevation cut off test (3° - 25°)

Station	N [mm]	E [mm]	U [mm]
AUT1 12619M002	-0.9	0.1	-3.4
BACA 11405M001	-1.2	-0.7	22.6
BAIA 11406M001	2.3	1.3	5.8
BERO	-2.4	0.4	-26.0
BITO	2.1	-0.4	-23.1
BLAG	-0.8	0.6	-6.2
BOSI	-3.1	2.7	-83.8
BUCU 11401M001	0.3	1.0	13.6
BUJA	-3.2	1.2	36.7
BZRG 12751M001	0.2	0.1	-14.8
DEBA	-2.1	-0.3	-15.1
DEVA 11408M001	1.6	0.1	8.2
DUBR 11901M001	-0.7	-1.7	-9.4
E801	-4.6	-1.5	-1.1
E802	-3.9	1.5	8.9
E803	-1.7	-0.1	-22.5
E804	-1.6	2.2	-18.8
E805	-0.5	1.7	-20.0
E806	-2.2	1.8	1.3
E807	3.9	-1.3	-41.7
E818	-1.6	0.9	6.3
GRAZ 11001M002	0.6	-0.3	-14.3
GSR1 14501M001	1.8	-1.3	-3.2
ISTA 20807M001	-0.4	0.2	12.5
KICE	-2.3	-1.1	-4.8
KORC	-2.7	1.9	8.9
KRPA	-1.0	0.8	-20.8
KUMA	-3.5	1.7	-6.4
LIBR	-4.8	0.5	-2.2
MATE 12734M008	-2.4	-0.6	-1.2
MJ03	-0.1	1.5	-25.2
MJ14	-0.6	2.0	-19.3
MJ34	-1.1	4.7	-18.7
MJ41	3.0	0.6	-28.7
MJ54	-0.6	1.8	2.3
NEGO	-2.9	1.6	-6.6
ORID 15601M001	-0.2	0.8	-5.3
OROS 11207M001	2.7	0.0	-7.8
OSJE 11902M001	-0.1	-1.1	-4.9
PADO 12750S001	-0.5	-1.4	-22.5
PENC 11206M006	1.7	-1.3	-13.4
PES2	-0.6	1.3	1.3
PRIL	-0.7	0.4	7.5
SKOP	-0.5	2.0	-20.1
SOFI 11101M002	-1.5	1.2	-10.2
SRJV 11801S001	-1.9	-0.6	24.8
TETO	0.2	0.0	-35.6
VALA	-1.5	1.4	-26.0
VELE	-3.1	1.0	-15.4
VINI	-0.1	0.4	-19.5
WTZR 14201M010	3.7	-2.7	-29.1
ZIMM 14001M004	-2.4	-1.6	14.1

Appendix 2 Complete list of individual station comparison

Station	Comp.	RMS	Day						
			213	214	215	216	217	218	219
			220	221	222	223	224	225	226
			227	228	229	230	231	232	233
			234	235	236	237	238	239	240
			241	242	243	244	245	246	247
AUT1	N	0.69	-0.05	-0.38	0.35	-0.92	-1.16	-0.19	0.21
			0.17	0.78	0.62	1.96	0.63	-0.4	-0.55
			0.14	0.59	0.8	0.73	0.55	0.58	-0.06
			-0.42	-1.05	-0.35	-0.08	-0.55	-0.35	-0.54
				0.32	-1.68	-0.52	-0.18	0.26	-0.26
AUT1	E	1	-1.45	0.84	1.3	2.97	0.77	0.58	0.22
			-1.05	-0.42	-1.35	-1.13	-0.88	0.72	-0.43
			-0.26	0.54	0.68	0.98	0.74	-0.71	-1.17
			-0.61	-1.28	0.3	-0.27	-0.28	1.55	-0.08
				0.03	1.09	-0.62	-1.12	-0.91	-0.6
AUT1	U	3.33	-1.05	2.25	-1.71	-2.64	-2.7	2.99	0.94
			-2.08	-0.8	6.37	8.83	-1.62	-8.92	3.22
			4.35	0	-1.85	0.65	2.13	-2.97	-2.46
			3.54	0.07	-4.13	-1.91	-0.66	-3.08	-0.09
				1.6	-2	0.32	-0.71	0.54	4.94
BACA	N	0.81	1.58	1.24	0.08	-1.05	-0.29	0.06	-0.19
			-1.04	0.13	0.76	0.29	-0.94	-0.19	1.18
			1.5	0.01	-0.03	1.25	-0.07	0.52	-0.67
			-0.14	0.09	-0.8	-0.15	1.03	-1.65	-0.27
			0.44	-0.91	0.21	-1.06	-0.93	-0.86	-0.61
BACA	E	0.85	1.28	0.67	-0.2	0.17	0.51	0.32	0.31
			-0.56	-1.08	-0.74	-0.52	-0.04	-0.51	0.3
			0.26	0.96	0.68	-0.59	-1.28	-0.78	-1.35
			0.58	1.18	0.71	0.95	1.18	1.93	-0.1
			-0.46	-0.26	-0.02	-0.83	-0.87	-1.52	-1.08
BACA	U	4.37	5.18	-6.04	-7.79	-8.62	-2.2	2.74	-7.9
			-2.9	6.32	1.53	-3.71	3.73	3.14	-1.8
			1.71	4.23	2.71	2.27	5.2	-2.38	-1.1
			-1.14	-2.67	-1.73	-7.96	-4.49	1.78	7.35
			3.71	1.56	6.8	0.87	-0.74	0.11	-0.54
BAIA	N	0.94	-0.25	0.6	-2.81	1.33	0.92	-0.19	-1.29
			0.3	0.24	0.15	0.46	0.05	0.04	-0.86
			-0.42	-1.84	0.61	-1.03	-0.03	-0.35	0.49
			0.24	-0.04	-1.04	-0.95	-0.63	0.92	1.31
			0.82	0.61	0.21	-1.03	1.72	0.95	-0.36
BAIA	E	0.86	-1.47	0.3	0.84	1.22	0.6	-0.93	0.4
			0.76	-0.75	-0.09	-0.26	0.31	0.53	2.63
			-0.99	-0.49	-0.91	-0.41	0.83	-0.89	-0.17
			0.05	1.16	0.53	0.33	-0.08	0.32	0.43
			-0.58	-0.98	-1.15	-0.71	-0.96	-0.9	0.03
BAIA	U	3.7	6.48	-7.58	5.53	2.77	5.35	6.39	0.75
			-3.56	-2.51	-7.3	-2.31	3.71	-1.16	1.2
			0.03	-3.67	1.15	1.04	-3.81	-0.67	2.33
			1.45	-4.5	2.26	0.28	0.04	7.28	1.15
			-0.68	-1.57	3.75	-0.82	-2.88	-2.6	-3.48
BERO	N	1.05	-0.29	0.98	2.58	0.03	-0.02	0	0.78
			-0.41	0.2	1.03	-0.65	-0.47	-2.61	0.82
			-1.64	0.34	0.53	-1.66	0.68	0.83	1.19

			0.72	0.92	-0.9	-1.58	-0.09	0.18	-0.09
			-0.78	-0.49	0.75	1.64	-1.45	-0.46	-0.38
BERO	E	1.17	2.41	-0.19	-0.09	0.32	-0.1	1.01	-4.6
			-0.32	0.15	0.56	0.22	-1.74	1.5	-0.84
			0.79	1.17	-0.73	0.33	-0.39	0.81	-0.33
			-0.54	0.07	0.64	1.15	0.24	-0.34	0.24
			-0.65	-0.07	1.13	-1.04	-1.44	-1.07	-0.39
BERO	U	4.06	-8.17	0.49	5.25	-3.35	1.78	6.34	8.92
			-1.11	-2.05	-4.73	1.18	0.7	0.88	3.71
			-1.52	-1.33	0.57	-1.54	-1.96	-2.56	4.62
			0.13	-7.47	-3.31	-0.84	1.37	-5.14	-4
			2.98	5.47	3.31	-3.9	0.64	5.24	6.71
BITO	N	1.17	-0.05	0.41	2.07	0.98	-0.3	-0.21	2.52
			0.52	0.47	0.72	-0.45	0.23	-0.63	1.46
			-1.99	-1.2	2.18	-0.77	-1.63	0.43	1.25
			0.05	-0.18	-2.52	-0.11	-0.12	-1.69	0.15
			0.82	-1.96	0.01	-0.35	-0.02	-1.15	0.88
BITO	E	1.07	0.4	0.21	-0.32	0.03	1.89	-1.17	-0.35
			1.09	-0.69	-0.19	0.06	-2.04	-2.27	-1.4
			-2.21	0.5	0.96	-0.8	-0.98	-0.38	0.91
			-0.98	0.17	0.08	0.24	-0.38	0.89	2.38
			0.19	-0.45	1.85	0.35	0.5	-0.39	0.35
BITO	U	5.37	-0.7	-2.21	-4.9	4.23	0.6	-4.26	6.26
			3.81	-1.03	2.21	-2.26	-12.23	-7.67	-5.66
			-3.53	-1.44	4.8	7.07	1.4	-0.36	-0.54
			-0.54	-3.27	-3.36	1.3	-3.97	-2.2	-0.11
			2.88	6.79	19.47	-2.88	-1.35	4.9	2.88
BLAG	N	0.75							
			-0.61	-0.17	-0.42	-0.3	-0.27	0.29	0.72
			0.18	-0.18	0	-0.45	-0.8	-1.72	0.37
			-1.01	1.24	1.58	-0.01	-0.51	0.67	0.5
BLAG	E	0.63							
			-0.33	0.68	-0.4	-1.05	0.05	0.14	-0.82
			-0.22	0.57	0.06	0.86	0.74	-0.07	-0.71
			-1.29	-0.16	0.14	0.51	-0.93	-0.25	0.53
BLAG	U	3.73							
			-0.2	-7.59	4.26	-2.52	2.47	-2.08	-1.46
			-0.32	3.03	-5.13	0.19	-3.27	0.96	-3.5
			6.15	6.9	3.54	4.42	0.35	2.33	1.08
BOSI	N	1.27							
								-2.55	-0.55
			-1.46	-0.46	-0.87	-0.95	0.16	-0.15	-1.28
			0.62	0.55	0.19	-1.35	1.63	-1.06	2.54
			-0.4	-1.08	0.69	2.37	0.31	-0.07	1.61
BOSI	E	1.46							
								-0.3	-1.28
			-1.95	0.55	0.29	1.08	-0.8	0.25	1.48
			0.74	0.51	-0.52	2.03	-1.49	-0.31	-0.1
			2.11	0.82	-0.43	-4.36	0.71	0.35	-2.12
BOSI	U	3.5							
								-4.85	0.23
			-0.82	-4.11	4.49	0.03	-1.28	-1.22	4.73
			4	-3.04	1.69	3.66	2.87	-2.7	-4.92
			3.64	6.86	4.76	-1.47	-1.99	-2.99	1.6
BUCU	N	1	-2.22	0.3	3.36	-1.05	0.17	0.84	-1.94

			-0.25	-0.15	0.08	0.29	0.16	0.96	0.92
			-0.16	-0.63	-0.5	-0.04	-0.42	1.69	0.55
			0.74	-0.75	-0.03	0.65	0.27	-0.13	0.12
			-0.89	-1.48	-0.62	-0.83	-0.53	0.43	-0.02
BUCU	E	0.86	-0.82	-0.9	-1.82	1.21	-0.55	-0.38	-0.58
			-0.76	-0.37	-0.12	-0.06	-0.36	-1.04	-0.73
			0.99	0.19	-0.39	1.03	0.8	-0.16	0.21
			-0.07	1.04	0.31	1.58	0.86	1.12	1.56
			-0.03	0.45	-0.61	-0.6	-0.73	-0.85	-1.59
BUCU	U	3.79	2.17	-5.1	4.31	3.42	-7.01	-1.56	3.3
			11.63	3.04	0.53	-3.19	2.19	4.21	-1.11
			4.97	0.7	0.6	-0.62	-0.54	-3.36	2.11
			0.27	-2.05	-5.07	-4.99	-0.87	-2.68	1.13
			4.22	0.2	5.41	-4.11	-1.57	-3.83	0.16
BUJA	N	1.02	-0.52	0.12	1.63	-0.24	0.73	-0.05	-0.34
				1.01	-0.08		-0.15	-1.24	2.18
			0.96	-1.87	0.14	-1.05	0.38	-0.16	0.92
			1.45	-0.09	-1.28	-0.95	-0.87	0.37	0.31
			1.84	-1.76	-1.85	0.15	-0.02	-0.26	-0.62
BUJA	E	0.92	0.2	0.35	-1.23	2.02	-0.06	-1.07	0.63
				-0.07	-0.95		1.59	1.18	0.7
			0.16	0.75	-0.16	-0.79	0.36	0.8	-1.16
			-1.57	-0.29	0.65	1.5	-0.21	0.04	-0.64
			-2.01	-0.54	-0.61	-0.68	0.06	-0.46	0.39
BUJA	U	5.55	4.32	2.44	-7.9	-4.41	-3.1	-0.42	-8.76
				5.76	2.59		-9.1	-5.11	-10.72
			-3.53	-1.83	1.81	-0.49	4.89	-0.71	9.06
			-0.96	-5.02	-4.45	2.31	1.07	-2.16	7.83
			0.39	7.8	14.64	-1.35	0.88	2.36	0.67
BZRG	N	1.18	-1.15	-1.75	-0.19	-0.79	1.9	-0.74	0.42
			0.49	-0.67	-0.71	-3.06	0.06	0.47	0.81
			-0.92	1.6	1.05	1.25	-0.72	0.68	-0.74
			-1.72	0.32	-0.86	-0.06	0.66	-2.12	1.38
			0	1.7	1.62	0.51	1.15	-1	0.11
BZRG	E	1.18	1.31	-0.62	0.13	0.36	-0.59	-0.41	0.01
			-0.01	0.71	3.26	-0.25	0.34	-0.93	-0.17
			2.28	-0.5	0.29	-1.27	-0.35	0.33	1.07
			-0.84	-0.33	-0.3	-0.44	-1.64	-1.89	-2.17
			0.76	-0.29	-2.2	0.46	0.27	2.4	0.04
BZRG	U	4.4	-1.78	1.51	9.63	3.17	2.36	7.65	6.68
			-4.28	-2.91	-0.71	-4.18	4.2	3.46	-0.77
			-0.79	-3.33	1.9	-0.97	-5.6	-2.75	-8.3
			-5.31	-7.26	-5.48	1.07	-4.17	7.36	3.51
			0.07	-0.61	-1.28	5.38	0.27	0.93	3.9
DEBA	N	1.29	-0.7		-1.34	-2.57	-0.11	1.26	-3.39
			1.07	0.74	0.85	1.22	-1.28	-2.32	0.02
			-0.14	-0.97	-0.36	-0.64		-0.6	-0.71
			3.03	1.09	-0.18	1.24	-0.61	0.53	-0.06
			0.1	-0.03	2.2	-0.15	0.14	0.49	0.54
DEBA	E	1.52	1.5		-0.32	4.55	-1.31	-1.8	1.78
			-0.53	1.14	-0.76	-0.92	-0.09	-4.52	-2.15
			0.21	1.86	-0.99	0.74		1	0.26
			0.1	0.97	0.1	-0.57	-0.51	-0.8	-0.62
			-0.21	-0.23	-1.91	0.55	1.26	-0.26	-0.3
DEBA	U	4.53	-1.24		1.02	1.78	-3.36	12.01	-0.74
			-6.9	-1.04	-9.07	-1.99	-0.02	-5.22	6.95
			1.48	4.76	0.5	0.31		-0.51	-1.73
			0.58	1.35	1.5	-7.28	-5.33	-0.7	7.87

			6.47	-0.13	2.96	3.99	0.86	1.82	-6.06
DEVA	N	0.89	-0.7	0.52	0.13	1.16	-0.81	-0.37	1.09
			0.51	0.8	0.18	1.15	0.09	0.23	-0.54
			-0.02	-0.2	0.44	-0.7	0.74	0.37	-0.81
			0.68	0.51	0.66	1.75	0.64	-0.94	0.79
			-0.43	-1.59	-0.11	-1.44	-2.29	-1.03	-0.9
DEVA	E	1.23	0.73	0.5	0.94	-1.04	-0.42	-0.26	-1.16
			1.87	-0.05	0.38	1.4	1.65	1.55	1.3
			0.28	0	-1.65	0.55	-0.02	-0.85	0.11
			0.38	0.23	0.38	-0.68	0.92	0.93	1.74
			-2.27	0.14	-2.43	-2.87	-2.2	-1.02	-0.32
DEVA	U	4.63	-4.74	0.67	1.42	-1.62	15.54	-3.69	13.85
			-2.37	0.31	2.63	-3.37	-1.01	0.86	6.82
			0.5	3.08	0.43	-0.3	-1.02	-3.25	-3.93
			0.37	-1.06	2.79	-8.4	2.13	2.32	-1.38
			-3.98	3.06	-0.47	-1.67	-4.5	-2.03	-0.04
DUBR	N	1.16	-0.88	-1.47	-1.19	-2.29	-1.7	-2.18	-0.96
			-1.71	-0.04	-0.55	-0.78	-0.59	-1.12	-0.24
			-0.79	0.21	-0.24	0.07	0.29	0.47	1.04
			0.38	-0.11	0.98	0.72	0.5	-0.09	1.89
			0.41	1.03	1.45	2.33	1.14	1.51	1.49
DUBR	E	0.98	0.1	-0.66	-1.19	-0.95	0.63	-0.02	-0.16
			0.07	-1.1	-0.59	0.14	-0.61	-0.62	-0.43
			-1.78	-0.78	0.03	0.32	-0.4	-0.27	0.25
			0.7	0.19	-0.8	-0.45	0.12	-0.78	-1.94
			0.66	0.28	2.16	2.67	1.59	0.4	1.38
DUBR	U	2.63	-0.43	-0.08	-1.22	1.64	-0.62	-4.01	-2.18
			7.26	2.87	1.07	1.44	-4.02	1.92	3.12
			0.45	0.8	-0.63	-1.89	0.05	-1.38	7.38
			0.68	-3.11	0.68	-3.94	-0.05	1.23	-1.26
			-2.4	2.17	-2.62	-0.16	1.58	0.84	-2.22
E801	N	0.64							
						0.59	-0.68	0.13	
E801	E	0.64							
						-0.78	0.44	-0.12	
E801	U	1.55							
						-1.8	0.87	-0.89	
E802	N	1.53							
					-2.18	-0.66	1.24	0.59	
E802	E	0.7							
					-0.1	-0.41	-0.67	0.92	
E802	U	6.49							

					10.41	-1.14	-2.72	-3.03	
E803	N	0.3							
							0.27	-0.13	
E803	E	0.2							
							0.07	-0.19	
E803	U	1.32							
							0.7	-1.12	
E804	N	1.56							
					0.65	0.85	0.91	-2.31	
E804	E	0.84							
					-1.32	0.51	-0.29	0.24	
E804	U	2.04							
					1.21	-1.63	2.3	-1.73	
E805	N	0.71							
					0.86	-0.67	0.45	-0.38	
E805	E	0.47							
					-0.26	-0.51	-0.22	0.54	
E805	U	4.49							
					-6.77	2.91	1.85	-1.69	
E806	N	0.72							
					0.81	-0.25	-0.86	0.33	
E806	E	0.31							
					-0.12	-0.16	-0.37	0.33	

E806	U	1.98							
					2.27	-2.08	1.29	-0.78	
E807	N	0.51							
					0.77	-0.39	-0.13	-0.15	
E807	E	0.17							
					0.16	-0.2	-0.14	-0.02	
E807	U	1.89							
					-0.25	-2.53	0.31	2.05	
E818	N	0.64							
				0.51	-0.27	-0.9	0.58	-0.42	
E818	E	0.97							
				1.56	0.29	-0.79	-0.67	-0.42	
E818	U	4.8							
				-7.19	2.86	4.95	-2.32	1.5	
GRAZ	N	0.95	0.74	0.53	-0.52	-0.85	0.16	-0.35	-1.04
			-0.15	-1.31	-1.3	0.2	-0.61	-0.49	-0.43
			1.52	-0.42	1.01	-0.14	0.52	-1.13	0.76
			1.21	-1.11	1.48	-0.1	0.32	1.18	1.23
			-0.04	0.94	-2.93	0.24	-0.13	-0.5	-0.13
GRAZ	E	0.67	-0.04	-0.2	-0.76	0.28	-0.99	0.06	-0.41
			0	-0.04	-0.87	0.53	-0.57	0.55	-0.65
			0.04	0.16	-0.76	-0.08	-0.63	0.94	0.37
			-0.26	-0.52	-0.63	0.28	-0.58	-0.84	-0.47
			1.01	-0.31	1.95	0.07	1.1	-0.09	1.07
GRAZ	U	3.93	-1.91	5.38	3.3	4.45	1.52	1.93	-3.57
			-6.13	0.45	-0.32	4.22	1.28	6.95	-5.34
			8.22	-0.44	-2.56	0.06	1.45	2.7	-0.52
			-0.16	3.58	8.23	3.17	-0.69	0.27	-5.33
			-0.9	-6.62	-6.41	-0.79	-2.48	-2.14	-3.01
GSR1	N	0.83	0.6	0.74	2.03	-0.19	-0.23	-0.47	-0.11
			-0.49	-0.38	-0.31		0.55	0.3	-0.97
			-1.99	1.42	0.09	0.34	0.19	1.18	-0.12
			-0.12	-0.19	-1.36	-0.23	0.33	0.18	0.82
			0.24	-0.06	-2.06	-0.63	0.21	-0.57	-0.52
GSR1	E	0.79	-0.45	0.19	0.12	0.14	-1.59	-1.43	0.35
			0.3	0.32	1.6		-0.4	0.11	-0.14

			0.22	1.05	-0.11	-0.48	0.07	1.56	0.01
			0.08	-0.47	0.21	0.1	-0.36	-2.15	-0.54
			0.13	-0.99	0.32	1.15	1.01	-0.13	-0.33
GSR1	U	2.69	1.74	2.07	0.21	3.44	1.93	-0.74	-0.07
			-0.88	-2.16	-2.96		-1.11	-1.82	-2.12
			0.98	-5.38	-1.27	4.09	0.7	-2.2	-3.93
			0.9	1.63	4.26	5.46	3.46	-1.2	3.01
			2.73	-4.6	3.14	-0.07	-3.33	-0.41	-0.44
ISTA	N	1.01	-0.21	-0.13	-0.53	-0.04	-0.3	0.85	0.73
			-0.69	-0.39	-0.13	-1.75	0.04	0.52	-1.65
			-1.83	-2.08	-0.02	0.08	0.13	-0.47	0.18
			-1.35	1.06	1.35	0.41	-0.44	0.47	-0.79
			-0.92	0.01	0.52	1.06	0.96	1.35	2.7
ISTA	E	1.04	0.12	1.38	1.09	0.59	1.61	0.38	0.35
			0.19	0.95	0.24	-0.02	0.11	-0.15	-0.87
			0.49	-0.01	-0.02	1.8	-0.48	-0.64	-1.41
			-1.32	0.33	-0.35	0.86	0.16	1.62	0.72
			-1	-1.32	-1.36	0.63	-1.92	-1.86	-2.14
ISTA	U	3.25	2.3	2.61	-2.88	-7.79	1.09	-0.8	-3.29
			2.61	3.32	-1.78	-0.36	0.25	-7.69	-0.01
			-4.92	-1.13	-0.98	-0.37	-1.61	2.42	4.27
			-0.84	2.07	-0.63	0.14	-2.7	-4.96	-1.38
			4.58	4.21	4.18	2.62	3.91	1.63	3.36
KICE	N	0.88	0.05	0.65	-0.13	0.75	0.45	0.97	2.15
			0.82	-0.07	1.32	0.34	-0.03	-0.45	-0.49
			-0.26	-1.71	-0.16	-0.7	-1.01	0.04	-2.12
				0.25	-1.28	-0.79	0.06	-0.67	-0.3
			-0.47	-0.52	1.7	0.37	0.02	0.65	0
KICE	E	1.2	0.68	1.16	2.21	1.34	0.16	0.17	0.05
			0.69	0.68	0.32	-0.83	1.98	0.14	0.52
			0.11	0.48	0.39	-1.45	-1.53	-1.05	-0.58
				-1	-1.72	-0.72	-2.22	0.11	-0.08
			-1.37	-1.96	-2.37	2.06	1.04	-0.44	0.76
KICE	U	5.06	-5.26	-2.22	-1.07	-3.29	-4.4	0.36	-8.83
			-4.87	0.48	-0.77	-6.49	-0.45	4.22	-1.83
			-0.02	-1.45	4.66	-3.83	1.85	2.93	1.02
				-5.01	-0.91	-1.36	4.34	0.96	5.74
			9.86	8.68	-11.7	10.34	5.83	5.33	2.35
KORC	N	1.31							
			-1.01	-0.4	2.6	-1.33	-0.51	-0.57	0.26
KORC	E	1.25							
			-0.75	-0.28	-2.47	0.97	1.12	0.52	0.42
KORC	U	4.34							
			-5.59	4.03	7.56	-1.04	-0.33	-2.18	-1.51
KRPA	N	1.31	0.64	-2.49	-0.53	1.47	1.84		2.39
			0.55	-0.19	0.58	0.72	-0.11	1.78	1.77
			-2.5	-2.97	-0.39	-0.46	-1.24	1.41	0.79
			1.66	-0.97	-1.06	-0.69	-0.19	0.38	-0.83
			-0.28	-1.1	0.58	-1.84	-0.12	0.72	0.3

KRPA	E	1.1	0.84	1.08	-0.44	-2.34	-0.02		-1.99
			-0.81	0.04	-1.15	-2.41	1.73	-1.35	-1.02
			-0.04	1.66	0.15	-0.01	0.47	-0.42	-0.23
			0.25	0.16	-0.17	0.67	-0.58	0.46	0.68
			-0.33	-1.49	0.44	2.62	0.1	0.88	0.3
KRPA	U	4.75	-6.15	-0.34	-3.77	3.74	-5.66		-5.2
			-1.82	-0.5	-4.14	4.22	-1.26	-1.47	3.94
			4.2	1.39	1.02	-1.59	-7.26	-1.57	-4.92
			-11.64	1.26	-0.41	6.52	8.15	-5.84	1.65
			5.37	5.61	8.4	-1.33	5.09	3.74	1.61
KUMA	N	0.83	0.04	-0.48	-0.55	0.3	-0.64	-0.87	1.09
			-0.52	-0.3	0.25	0.43	0.45	-0.26	0.9
			-1.44	-1.16	0.36	-1.36	-0.23	0.86	1.43
			0.5	0.44	-0.24	0.59	-0.79	-1.34	-0.89
			0.55	-0.8	1.52		-0.83	0.85	0.93
KUMA	E	1.07	0.51	1.4	-0.52	2.86	-0.33	-0.94	-1.11
			1	0.65	-1.03	-0.77	-0.5	1.83	1.11
			-0.71	-2.04	0.38	0.29	0.15	0.09	-1.07
			-0.14	0.76	0.85	0.5	0.96	-0.23	0.12
			-1.03	-1.84	-1.03		0.91	-0.92	-0.99
KUMA	U	4.24	-0.5	2.33	-1.49	1.83	-0.63	6.69	-10.99
			7.13	-0.62	-1.37	-5.92	-7.97	-3.79	-6.9
			3.27	4.66	2.57	3.35	1.2	-5.54	0.01
			5.71	-4.04	2.36	2.53	3.22	-0.95	-1.47
			5.74	2.65	-1.74		0.99	1.44	0.77
LIBR	N	1.33							
			1.05	-0.5	-2.47	0.14	1.48	-0.9	0.29
LIBR	E	1.58							
			0.6	-2.48	-2.12	-0.03	1.03	0.33	1.69
LIBR	U	4.76							
			-6.3	-2.73	0.24	-2.97	4.11	6.79	4.11
MATE	N	1.12	-2.24	-0.55	0.45	1.19	-1.98	1.91	0.64
			-0.94	-0.46	-0.21	1.33	-0.51	-0.35	1.19
			-0.45	0.15	-0.99	-0.04	-0.9	-0.93	0.56
			0.42	-0.11	0.94	1.45	-0.7	0.08	-3.49
			0.97	0.49	0.38	0.17	0.71	1.47	0.02
MATE	E	0.83	0.25	-0.2	-1.68	0.69	-0.25	-0.74	0.01
			0.09	0.19	0.99	0.34	-0.32	-0.68	-0.23
			-0.88	-0.79	-0.65	-0.14	-0.66	-0.34	-0.51
			0.17	-0.35	-0.68	-0.14	-0.6	-1.32	2.39
			-0.51	0.3	-0.48	1.03	1.17	1.46	1.27
MATE	U	2.96	-0.64	0.09	1.53	-1.9	3.24	0.16	0.95
			0.98	-3.61	-3.58	1.39	1.44	-0.45	-1.48
			-6.03	2.5	6.18	-3.74	5.65	1.24	-1.92
			-0.59	0.26	1.93	0.79	-2.3	-5.66	0.89
			0.03	6.72	-3.84	-1	2.25	2.41	-0.83
MJ03	N	1.53							
					-1.87	-1.09	1.13	1	

MJ03	E	1.38							
					1.96	0.29	-1.06	-0.8	
MJ03	U	2.54							
					0.41	2.71	0.48	-3.42	
MJ14	N	0.55							
					0.3	-0.73	0.5	-0.15	
MJ14	E	0.47							
					-0.77	-0.02	-0.09	0.26	
MJ14	U	3.02							
					0.09	-0.03	-4.16	3.16	
MJ34	N	0.88							
						0.39	-0.78		
MJ34	E	0.2							
						0.02	-0.2		
MJ34	U	1.75							
						-1.52	0.86		
MJ41	N	0.41							
					-0.16	-0.22	-0.4	0.52	
MJ41	E	0.6							
					0.63	-0.51	-0.58	0.32	
MJ41	U	3.26							
					-1.45	-4.12	1.96	2.98	
MJ54	N	0.53							

					0.39	-0.66	-0.33	0.39	
MJ54	E	0.9							
					-0.82	0.29	0.94	-0.91	
MJ54	U	1.58							
					1.17	0.49	-2.33	0.71	
NEGO	N	1.08	-0.75	-0.06	-0.09	0.02	-1.63	-1.21	-0.74
			0.49	-0.9	0.52	0.6	-0.86	-1.08	0.69
			-1.41	1.19	0.26	-0.4	1.26	1.04	1.17
			0.09	-0.97	-0.07	-0.07	0.14	0.76	4.19
			0.31	0.5	-1.2	-0.21	-0.73	-1	-0.47
NEGO	E	0.85	1.18	0.49	0.34	0.15	0.34	-1.34	0.81
			-0.78	0.44	0.75	0.15	-1.07	1.26	0.06
			-1.45	1.39	0.98	0.69	0.82	0.6	-0.19
			-0.39	0.67	-0.34	-0.26	0.04	0.8	-1.29
			-1.12	-0.77	-0.38	-1.24	-1.1	-1.09	-0.76
NEGO	U	4.86	-6.16	-2.48	-8.27	-2.48	-4.16	5.03	0.28
			-0.96	2.43	4.67	-0.99	0.32	4.9	-3.53
			2.97	4.33	7.37	0.49	-6.84	1.79	-4.2
			2.21	-10.15	-10.3	0.05	2.63	-4.88	2.78
			6.59	7.53	6.3	2.04	-0.46	1.86	4.98
ORID	N	1.24	0.23	1.22	-3.58	1.01	-1.45	-1.66	0.42
			1.19	1.2	2.9	1.44	1.19	-0.33	0.06
			-0.2	-0.61	-1.49	-0.55	-0.12	-0.23	0.68
			-0.47	0.21	-0.62	-0.94	-1.9	-0.06	-2.17
			-0.34	-0.04	1.14	1.12	0.02	0.9	0.74
ORID	E	1.04	0.4	0.09	1.9	-0.6	1.33	0.69	-0.95
			-1.83	1.27	-1.02	-1.41	-0.25	-0.75	-1.5
			0.25	0.33	-0.11	-0.18	-0.37	0.73	-0.15
			1.04	1.03	1.49	0.73	0.53	0.28	-1.14
			-0.02	0.36	-3.12	-1	0.02	0.14	-0.38
ORID	U	4.85	-1.23	-6.29	-9.17	-9.59	-6.77	-2.19	-2.39
			2.61	0.56	-8.96	3.69	10.19	3.33	3.33
			-1.35	4.01	6.28	-2.29	3.13	4.69	2.2
			-1.41	-2.15	-1.47	0.09	-0.86	-7.35	6.8
			0.04	0.15	6.65	-1.42	3.77	5.52	-0.86
OROS	N	0.7	0.94	-0.63	-0.21	-0.09	-0.19	-0.53	0.49
			0.2	0.4	0.31	-0.22	1.27	1.02	0.87
			1.44	0.46	0.86	-0.48	-0.57	-0.13	0.64
			0.49	0.16	-0.74	-0.23	-0.01	-0.26	-0.92
			-0.31	-0.58	-0.52	-1.17	-0.98	-0.14	-1.4
OROS	E	0.76	-0.37	-0.32	-0.27	-0.56	0.57	-1.48	-0.86
			-0.43	-0.86	-0.93	0.38	-0.5	1.1	-2.13
			-1.02	-0.33	-0.02	-0.59	-0.84	-0.58	0.01
			0.45	0.55	0.51	0.38	0.97	1.09	0.56
			0.46	-0.31	0.8	0.37	0.83	0.14	0.45
OROS	U	2.55	1.88	1.19	2.88	1.53	-3.79	7.45	-0.45
			-3.05	1.69	2.74	-2.45	-2.13	6.93	-2.97
			2.75	-1.84	-1.24	-1.48	1.34	0.64	1.45
			1.06	0.18	-0.23	1.83	2.15	0.79	-1.25

			-1.41	-0.56	-2.29	-1.13	0.02	-2.03	-2.24
OSJE	N	0.63	0.6	-0.48	-0.12	0.04	0.2	0.22	-0.32
			1.2	1.15	-0.86	-0.85	0.54	-0.72	-0.37
			-0.87	-0.44	-0.84	0.21	0.9	-0.98	-0.11
			-0.45	0.2	-0.62	-0.37	0.49	0.26	0.81
			0.57	0	1.07	-0.5	-0.67	-0.06	0.21
OSJE	E	0.66	-1.02	-0.31	0.48	-0.24	0.7	1.65	0.47
			-1.09	-1.04	0.72	-0.11	-0.45	-0.14	0.67
			-0.12	-1.08	0.67	-0.4	-0.69	0.55	-0.75
			0.23	0.27	1.33	0.44	0.14	-0.5	-0.06
			-0.55	-0.59	-0.22	0.31	-0.25	-0.45	0.04
OSJE	U	2.82	-4.16	2.03	-0.5	-1.22	-1.86	-0.07	-2.14
			-3.58	0.44	1.86	-1.9	-0.9	-2.03	2.72
			2.17	5.59	-0.38	-0.82	2.44	4.67	2.86
			-1.3	1.7	2.65	5.17	2.87	3.02	-1.87
			-1.96	-4.1	-4.91	-5.36	-0.44	0.33	-0.61
PADO	N	0.99	0.83	0.2	0.03	0.31	1.98	0.31	0.73
			0.48	-1.27	-0.72	0.1	-0.76	-0.88	-0.06
			1.52	1.06	0.23	-0.8	-0.01	-0.47	-1.38
			-0.74	-1.18	-1.57	-2.23	-0.61	-1.32	-0.53
			-0.18	1.27	1.37	-0.02	0.56	1.43	0.65
PADO	E	0.96	-0.64	0.9	-1.19	0.77	-0.38	-0.06	0.22
			-0.53	0.87	0.38	0.42	-1.36	-1	-0.32
			-2.82	-0.96	-0.3	-1.13	-0.57	0.31	0
			-0.47	-0.25	0.25	0.85	0.13	0.5	-0.91
			1.09	0.14	-0.56	0.64	0.54	2.53	1.36
PADO	U	3.86	-0.85	4.97	3.75	0.77	-0.38	-6.14	-0.9
			0.32	-5.7	6.96	6.24	-5.65	3.39	-0.28
			-3.04	1.19	-4.08	0.71	-2.25	5.57	-1.76
			4.58	5.92	3.11	1.46	-2.57	-0.51	-8.3
			-0.29	1.49	-4.74	2.8	1.03	-3.01	3.25
PENC	N	0.8	0.45	0.43	-0.41	0.13	0.35	-0.71	-0.43
			-0.17	-0.38	-1.77	-0.14	-0.89	-0.58	0.43
			0.6	0.14	-0.99	-0.27	-0.31	-0.78	-0.88
			0.66	1.74	1.18	-0.07	0.47	0.4	-0.52
			-0.56	-0.38	-0.44	2.35	0.59	-0.81	0.04
PENC	E	0.71	-0.45	-0.02	-0.12	-0.33	-1.19	-1.05	0.04
			-0.16	-1.23	-0.7	-0.09	0.03	0.59	-0.14
			0.34	-0.37	0.11	1.08	1.98	0.68	0.08
			-0.46	-0.28	-1.39	0.04	0.17	0.27	0.84
			0.06	-0.46	1.14	-1.05	0.62	-0.23	-0.38
PENC	U	2.47	0.43	1.61	2.07	4.46	-2.28	2.35	0.6
			-0.19	0.17	0.37	1.76	-0.12	-5.04	-0.98
			-3.62	-4.22	-2.71	5.25	-2.31	0.9	0
			1.06	1.1	-4.55	2.93	4.61	2.54	-0.21
			0.64	0.72	-2.28	-0.9	-0.61	0.51	-0.44
PES2	N	0.81							
			-0.64	-1.11	0.97	-0.73	-0.54	0.69	0.28
PES2	E	0.75							
			-0.11	-0.65	1.07	-0.75	-0.11	-0.96	0.53
PES2	U	5.72							

			-1.49	10.18	-2.19	-8.93	0.92	0.63	2.22
PRIL	N	1.25	-0.11	0.62	0.51	0.75	-0.25	0.1	0.41
			2.07	0.58	1.64	2.95	-0.16	-4.73	-0.34
			-0.43	-1.01	0.36	-0.44	0.01	0.64	-1.66
			0.77	0.98	-1.09	-0.81	0.58		-0.53
			-0.02	-1.48	0.14	0.11	0.14	0.55	-0.28
PRIL	E	1.07	0.67	0.16	-1.42	-1.32	0.61	-0.25	-0.2
			0.45	-0.7	0.29	-0.96	0.4	4.22	0.24
			-0.32	-0.11	-0.37	0.87	0.53	-1.23	0.63
			-0.33	-0.56	0.73	-1.54	0.13		1.83
			-0.33	-0.59	-0.73	-0.77	0.04	-1.28	-0.31
PRIL	U	4.02	-3.84	-3.06	-9.1	6.94	-8.77	3	-0.84
			-2.96	2.17	-6.27	-2.45	1.02	5.46	2.22
			-3.67	5.87	-1.47	-0.11	-2.17	-0.45	0.47
			-3.79	-0.98	0.37	-0.46	1.05		-2.21
			7.24	5.12	4.16	1.33	1.63	3.61	2.49
SKOP	N	0.89	-0.3	-0.6	-0.52	1.01	-0.5	-1.61	0.74
			-0.14	-0.13	1.01	1.03	-2.08	-0.7	-0.1
			-1.42	-1.26	0.31	-1.63	-0.08	0.13	1.38
			0.38	0.16	1.31	-0.68	-0.61	0.49	-0.11
			-0.4	-0.12	0.17	1.45	0.61	0.6	0.77
SKOP	E	0.86	0.11	0.34	-0.02	-2.32	0.15	-1.63	0.58
			-1.55	0.25	0.34	-0.11	1.86	0.17	0.49
			-0.63	0.27	0.14	1.17	1.48	-0.64	-0.71
			-0.18	0.8	0.92	-0.51	0.57	-0.29	-0.98
			-0.11	0.38	0.02	-0.57	0	-0.5	-1.07
SKOP	U	4.9	-1.31	-0.23	-6.13	0.9	-14.03	3.45	-5.15
			-0.55	0.03	-1.41	12.09	0.45	6.86	10.35
			-0.15	1.2	1.59	3.75	-6.72	4.38	4.38
			2.64	-3.75	-3.88	1.73	4.18	-1.17	-1.02
			5.21	-3.5	-0.2	-6.11	0.44	1.14	-0.19
SOFI	N	1.1	0.54	-0.39	-1.57	-0.37	-0.75	-0.06	1.19
			-0.45	1.47	0.23	1.41	0.44	0.34	-1.24
			0.97	-0.53	0.44	-0.39	0.24	1.16	2.01
			-0.34	-0.54	0.24	0.37	0.69	-0.43	0.4
			-0.17	-2.59	-3.45	1.42	-0.59	-0.19	-0.4
SOFI	E	1.26	0.5	1.71	-0.82	-0.5	1.62	-1.17	0.55
			0.65	-0.64	-0.73	-0.12	-0.04	-2.87	-0.3
			-0.73	0.78	2.01	0.38	-1.51	-0.51	-2.7
			0.69	0.77	-0.02	-0.43	-1.13	-0.5	1.45
			2.28	-1.54	-1.94	2.01	0.63	0.09	-0.42
SOFI	U	4.48	-3.23	0.14	-0.94	0.96	-4.25	-1.01	-3.22
			-10.06	-1.31	0.05	-8.76	-6.87	5.11	1.76
			-2.49	-4.22	1.5	2.83	-1.15	-3.88	-2.23
			8.84	-2.18	1.29	4.19	-3.19	-0.27	3.16
			2	-0.78	2.23	3.15	11.52	5.06	5.31
SRJV	N	0.81		-1.23		0.08	-0.32		
						-0.87	0.55	0.64	0.29
				-0.79	1.15	0.03	-1.79	1.03	0.69
				-0.03	0.63	0.49	0.44	-0.69	-0.71
SRJV	E	0.89		0.76		-0.3	-0.95		
						0.84	0.61	0.31	0.81
				1.04	-0.8	-0.43	-0.43	-1.34	-2.22
				0.05	0.55	1.03	0.68	0.21	0.31

SRJV	U	2.72		-0.96		2.88	-0.95		
						-3.33	-3.11	-4.01	4.55
				0.43	-1.95	3.89	1.76	4.84	3
				0.09	-0.76	-1.38	-1.48	-1.22	-2.25
TETO	N	0.84	-0.31	0.42	2.49	0.07	-0.73	-0.33	-0.55
			-0.1	0.12	0.63	-0.17	0.1	0.53	-0.55
			0.88	0.67	0.54	1.22	-0.27	1.02	0.12
			-0.69	-0.76	0.28	-0.09	0.74	-1.06	-0.12
			-0.86	0.01	-1.95	0.18	-1.6	-0.05	-1.23
TETO	E	1.23	1.02	0.32	-1.15	1.16	-0.88	0.35	0.64
			0.48	0.33	0.36	0.11	-0.19	-2.57	-1.81
			0.84	3.59	0.84	-0.12	1.93	-0.17	-0.18
			-0.58	0.33	-0.92	0.27	1.02	0.72	0.5
			-1.04	1.07	-0.66	-1.58	-0.46	-2.12	-2.23
TETO	U	3.58	-0.19	-1.84	-6.47	1.42	-5.32	-2.88	-5.02
			0.57	-1.58	-0.78	2.37	0.52	-1.59	2.99
			-1.24	5.11	7.13	4.91	-0.72	4.71	-0.44
			2.43	-6.01	-1.85	0.44	0.7	-2.68	-1.56
			7.37	6.21	-5.01	0.78	0.14	2.46	-0.1
VALA	N	1.62	0.63	-0.53	0.42	1.08	-0.27	0.2	-1.81
			1.5	3.73	1.51	0.49	1.3	-3.34	-2.72
			-2.9	-1.84	-0.42	-2.14	-0.1	0.72	0.36
			0.06	-0.77	-1.64	-1.26	0.73	-1.45	1.62
			-0.12	-0.11	2.9	2.77	-0.82	0.34	0.51
VALA	E	1.27	0.1	-0.62	-0.71	0.11	1.3	1.29	1.96
			0.45	-0.62	0.48	-0.41	2.24	3	1
			1.48	1.04	-3.25	-1.04	-0.23	-0.31	-2.6
			-0.71	-1.24	0.28	-1.43	-0.52	0.2	-0.49
			-1.7	-0.28	0.42	0.39	-0.56	-0.41	-0.25
VALA	U	5.39	-0.91	0.01	-0.78	1.38	-4.67	-7.85	1.85
			-2.24	-0.27	0.46	3.03	2.4	16.43	6.2
			-0.71	3.56	4.35	-5.19	-6.67	-8.95	0.84
			-4.06	-2.99	-2.41	-1.1	8.37	1.16	1.96
			-4.43	7.7	11.12	-4.47	0.03	-0.27	-7.33
VELE	N	1.1	2.28	0.08	-0.07	-0.42	-0.14	-0.76	1.6
			-0.37	2.19	0.5	0.32	-0.17	-0.85	0.08
			-1.7	-1.16	-1.24	-1.32	-1.64	1.43	1.47
			0.67	0.25	-0.57	-0.78	1.37	-1.37	-0.54
			-0.97	1.63	-1.41	-0.45	-0.45	0.59	0.52
VELE	E	1.03	-0.44	0.65	0.07	0.33	-0.13	1.69	-0.81
			-1.47	-0.46	-1.56	-1.63	0.49	3.28	-0.47
			-0.79	1.05	0.53	1.02	1.06	0.47	-0.85
			-0.96	0.77	-0.56	-0.08	-0.41	0.29	0.82
			-0.56	-0.21	1.04	0.07	-1.48	-0.86	-0.94
VELE	U	5.01	-7.35	0.06	3.14	2.56	-0.88	8.98	-1.44
			-2.03	1.96	-6.66	-4.51	3.61	-8.74	-16.49
			2.73	4.23	-0.39	4.54	3.12	-2.41	1.27
			0.37	-3.32	-1.22	6.6	-2.4	-0.88	0.86
			7.52	-0.7	6.76	-5.14	0.53	1.62	2.19
VINI	N	1.58	2	0.25	0.48	0.67	0.08	-5.01	2.71
			-0.18	-0.54	-0.15	0.85	-2.16	1.15	-2.23
			-2.2	0.49	-1.12	2.19	-0.43	-1.54	-0.32
			1	0.76	0.06	-0.67	-1.44	-1.24	-0.79
			-0.3	-1.34	1.22	1.49	1.22	2.34	1.58
VINI	E	1.46	-0.49	2.56	-0.05	1.37	1.07	4.05	-0.13
			-1.05	-2.03	0.31	-1.82	2.56	-0.15	-2.4
			-1.4	-0.69	-0.11	-1.77	-1.54	-1.06	-1.93

			-1.56	0.13	0.09	1.78	-0.19	-0.01	-0.02
			-0.3	0.62	2.05	0.78	-0.02	0.44	1.12
VINI	U	4.99	5.56	-5.4	-1.19	0.29	-6.93	0.54	11.56
			-3.23	7.17	-9.64	0.84	4.86	0.37	3.17
			0.83	1.76	-2.62	-6.17	-4.39	3.09	4.43
			-2.44	-12.33	2.58	0.71	8.69	-1.66	-3.62
			4.85	5.46	-0.4	-0.04	-1.81	0.82	1.13
WTZR	N	0.84	-0.75	0.52	0.72	-0.33	1.23	-1.28	-1.09
			0.13	-0.67	-0.69	0.16	-0.01	-0.84	-0.26
			-0.89	0.13	0.1	-0.37	1.55	0.21	-0.8
			0.64	1.31	1.41	0.57	0.27	1.44	0.48
			0.58	-0.32	-1.49	-1.15	-0.22	-1.22	-0.2
WTZR	E	1.01	0.51	-0.21	-0.25	-0.37	-1.15	-0.26	1.08
			1.22	0.92	-0.33	-0.15	-0.64	-0.62	0.71
			-1.11	0.77	-1.47	-1.82	-1.69	0.28	-0.79
			-0.34	-0.44	-1.75	0.09	-0.7	-1.48	0.05
			1.04	0.62	1.74	1.63	1.45	1.19	0.64
WTZR	U	3.5	0.87	3.12	-4.77	-3.08	-2.4	-0.07	-2.12
			-3.09	0.77	-1.99	-1.67	4.89	-0.29	1.56
			8.42	1.38	-0.25	-0.53	2.81	-0.88	-0.06
			0.66	5.37	4.4	-0.1	8.24	4.66	-7.79
			-2.83	-3.88	0.85	-1.53	0.81	-3.58	-0.45
ZIMM	N	0.65	0.09	0.52	0.32	-0.28	1.51	1.2	0.12
			0.93	-0.75	0.19	-0.4	-1.19	-0.89	-0.3
			-1.03	-0.23	-0.38	-0.73	0.17	0.12	1.05
			-0.79	0.22	-0.39	-0.45	0.75	-0.59	0.05
			-0.05	0.54	0.48	-0.72	-0.02	-0.51	0.42
ZIMM	E	0.83	-0.41	0.11	-0.32	-1.12	-0.12	-0.1	0.41
			0.97	-0.41	-1.4	-0.7	0.02	0.31	0.42
			0.54	-0.66	0.34	-1	0.39	0.54	0.41
			-1.16	-1.92	0.21	-1.33	-0.65	-0.24	-0.63
			-0.03	1.41	1.45	0.74	0.52	1.29	0.92
ZIMM	U	3.97	0.76	2.04	-7.15	5.24	-1.37	-8.64	-0.69
			7.47	2.08	4.73	-3.05	-6.62	-3.19	0.34
			-2.29	2.16	0.4	2.44	-1.83	-0.41	-3.92
			0.99	6.68	-0.7	1.24	3.25	-5.05	-4.53
			0.1	-4.22	1.15	6.09	4.99	2.85	0.22