

Progresses in the Central European densification of the 3D velocity field: the CEGRN2017 Campaign



J. Zurutuza (1), A. Caporali (1), O. Khoda (2), G. Stangl (3), P. Mitterschiffthaler (3), M. Becker (4), M. Bertocco (5), L. Gerhatova (6), M. Mojzes (6), J. Papčo (6), M. Mulic (7), Yu. Stopkhay (8), C. Nagorneac (9), A. Mihailov (9), S. Lazić (10), B. Stopar (11), M. Figurski (12), B. Droscak (13), Artur Malczewski (14), E. Parseliunas (15), J. Reznicek (16), J. Nagi (16), J. Kaplon (17), S. Wajda (18), S. Berk (19), K. Medved (19), S. Dimeski (20), G. Grenerczy (21), M. Marjanović (22), J. Simek (23), P. Pihlak (24), T. Srechko (25), N. Fabiani (26), G. Milev (27), K. Vassileva (27), Z. Veljkovic (10)

- (1) University of Padova (Department of Geosciences), Padova, Italy;
- (2) Main Astronomical Observatory National Academy of Sciences of Ukraine, Kiev, Ukraine;
- (3) Space Research Institute, Austrian Academy of Sciences, Graz, Austria;
- (4) Technical University of Darmstadt, Germany;
- (5) Centro di Ateneo di Studi e Attività Spaziali "Giuseppe Colombo" - CISAS, Padova, Italy;
- (6) Slovak University of Technology, Bratislava, Slovakia;
- (7) University of Sarajevo, Bosnia and Herzegovina;
- (8) System Solutions, Kiev, Ukraine;
- (9) Institute of Geodesy, Engineering Research and Cadastre "INGEOCAD", Chisinau, Moldova;
- (10) Republic Geodetic Authority, Belgrade, Serbia;
- (11) University of Ljubljana, Slovenia;
- (12) Military University of Technology. Faculty of Civil Engineering and Geodesy, Centre of Applied Geomatics, Warsaw, Poland;
- (13) Geodetic and Cartographic Institute, Bratislava, Slovakia;
- (14) TPI NETPro Poland;
- (15) Vilnius Gediminas Technical University. Department of Geodesy and Cadastre, Vilnius, Lithuania;
- (16) State Administration of Land Surveying and Cadastre, Czech Republic;
- (17) Institute of Geodesy and Geoinformatics, Wrocław University of Environmental and Life Sciences, Wrocław, Poland;
- (18) ASG-EUPOS Management Center in Warsaw, Department of Geodesy, Cartography and Geographic Information Systems, Warsaw, Poland;
- (19) Surveying and Mapping Authority of the Republic of Slovenia;
- (20) Sector for Geodetic Works at Agency for Real Estate Cadastre, Macedonia;
- (21) Satellite Geodetic Observatory, Institute of Geodesy Cartography and Remote Sensing, Hungary;
- (22) CROPOS – CROatian Positioning System;
- (23) Geodetic Observatory Pecný and Department of Geodesy and Geodynamics of the Research Institute of Geodesy, Topography and Cartography, Czech Republic;
- (24) Maa-amet/Estonian Land Board Mustamäe, Tallinn, Estonia;
- (25) Agency for Real State Cadastre. Republic of Macedonia;
- (26) Geodetic Institute of Slovenia, Jamova cesta 2, 1000 Ljubljana, Slovenia;
- (27) Bulgarian Academy of Sciences, Central Laboratory for Geodesy, Bulgaria, 1113 Sofia - Acad. G. Bonchev Str., Bl. 1.

Outline

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CEGRN Motivation and Goals (extract from the EUREF CEGRN MoU signed in Chisinau, 2011)

3. Objectives

The objective of this Memorandum of Understanding is, in general, to create the conditions to facilitate the data exchange and to promote the increase in the co-operation between the two parties, for the benefit of both, and in particular, to facilitate the densification of the European GNSS network for reference frame definition and geokinematical applications.

It is expected that a closer co-operation between EUREF and CEGRN will increase the level of support to the IAG Dense Velocity Field Project, and the availability of a combined solution with respect to a denser network.

Moreover, the co-operation will contribute to:

- ✓ provide better and more consistent data for geokinematics, by the optimization of guidelines for approval of networks with position and velocities and the improvement of offset treatment in time series;
- ✓ stimulate reprocessing of old EPN data, taking into account the foreseen realization of CEGRN 2011 and the completion of the reprocessing of the EPN;
- ✓ involve more nations into the INSPIRE initiative, in particular with the CRS (Coordinate Reference Systems) Implementing Rules.

In-progress CEGRN Network

CAMPAIGN	PERIOD	COUNTRIES	SITES
CEGRN'94	2–6 May, 1994	10	30
CEGRN'95	29 May – 3 June, 1995	11	36+5
CEGRN'96	10–15 June, 1996	11	35+6
CEGRN'97	4–10 June, 1997	12	35+10
CEGRN'99	14–19 June, 1999	13 (extended network)	57 (29P+28E)
CEGRN'01	17–23 June, 2001	13 (extended network)	51 (28P+23E)
CEGRN'03	16–21 June, 2003	13 (extended network)	51 (28P+23E)
CEGRN'05	20–25 June, 2005	14 (extended network)	94
CEGRN'06	12–18 June, 2006	only CGPS	44
CEGRN'07	18–23 June, 2007	14 (extended network)	95
CEGRN'09	22–27 June, 2009	14 (extended network)	85
CEGRN'11	20–25 June, 2011	14 (extended network)	74
CEGRN'13	16–22 June, 2013	14	96
CEGRN'15	14–20 June, 2015	23	183 (UPA+MAO)

CEGRN 2017: (11-17 June, 2017) consists of + 400 RINEX files + SINEX files from 5 Agencies.

In-progress CEGRN Network

During 2015 and 2016, several Agencies were contacted to ask about their willingness to getting involved in the CEGRN Project.

The answer was excellent, and we can summarize it in:

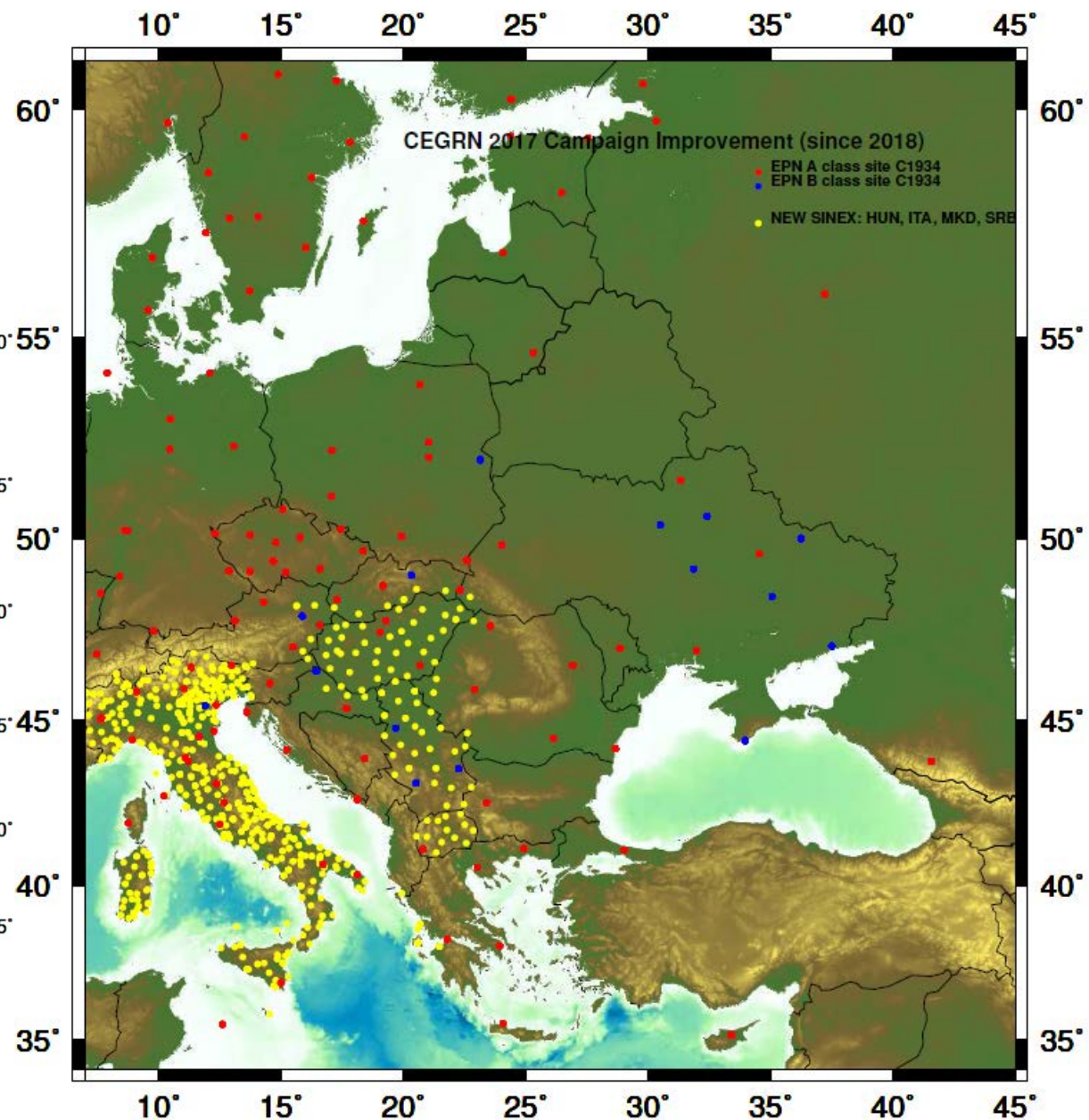
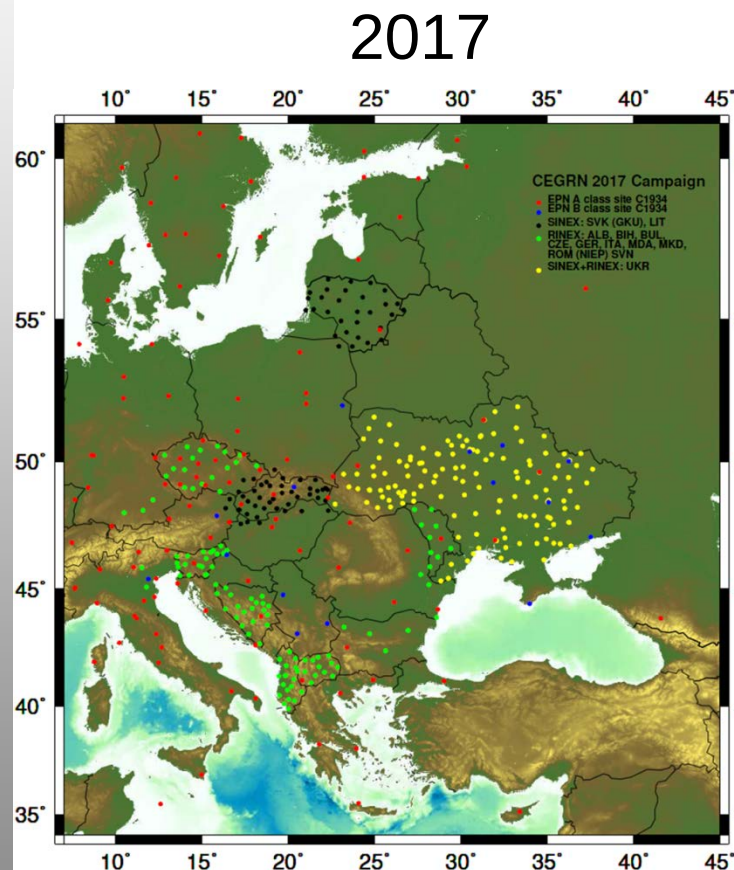
RINEX files:

- Albania: ALBPOS contributes with 6 additional stations in Albania (2003, 2005, 2007 and 2015),
- Romania: contributes with 5 additional stations in Romania starting from 2015,
- Croatia: CROPOS contributes with 33 additional stations in Croatia (starting from 2009),
- Czech Republic: CZEPOS contributes with 25 new stations (starting in 2005),
- Lithuania: contributes with 29 stations (starting from 2009),
- Macedonia: contributes with 6 stations (2015).

SINEX files:

- ASG (Poland): solutions from 2009 to 2015
- GKU (Slovakia): solutions from 2007 to 2017
- MAO (Ukraine): solutions from 2001 to 2017
- **2018: RGZ (Serbia): solutions from 2011 to 2015+RINEX 2017**
- **2018: SGO (Hungary): solutions from 2011 to 2017**
- **2018: UPA (Italy): solutions from 2011 to 2017**
- EUR: all available SINEX files at the CEGRN campaigns

CEGRN Increased Network: 2017-2018



CEGRN 2011-2017 multi-year solution: results

The CEGRN cumulative solution is computed using 8 multiyear normal equations:

- 1 per Center (ASG, GKU, MAO, RGZ, SGO, UPA-Italian, EUR): 7
- 1 cumulative UPA's CEGRN RINEX analysis.

All the NQ0 files are stacked individually to get the cumulative solution (normal equations). In order to avoid singularities, all the stations span at least over 2 years of data.

The stacking is done considering (frame definition: release C1934, IGB08-compliant):

Coordinates:

- o Datum: A class sites, MC applied to A class (only translations are solved).
- o Other sites: a priori values obtained from previous solutions.

Velocities

- o Datum: A class sites, heavy constraints (10^{-7}) to the a priori values.
- o Other sites: a priori values obtained from previous solutions (Euler Pole).

This means, in practice, that the velocities of the A class sites are kept fixed.

CEGRN 2011-2017 multi-year solution: results

In the cumulative solution we find 7 stations that exceed the 10 mm threshold (in any component in geocentric coordinates).

LIST OF REJECTED STATIONS			

STATION	RESIDUALS (MILLIMETERS)		
	N	E	U
BISK111520M001	2.25	-1.14	-11.07
MDVJ112309M005	3.37	2.82	14.75
QAQ1343007M001	-5.31	-4.58	-12.15
REDZ312227M001	0.42	0.96	14.21
SCOR143006M002	-0.14	-3.97	-13.04
TUC2212617M003	-2.32	-0.41	34.75
VACO211516M001	2.67	-1.18	-11.19

Therefore, we remove them from the datum sites' list and get the following statistics (summary) for the A Class sites (C1934 release):

		X	Y	Z

RMS / COMPONENT		1.12	0.97	2.31
MEAN		0.17	0.16	0.14
MIN		-4.18	-3.80	-9.37
MAX		3.67	8.05	9.27

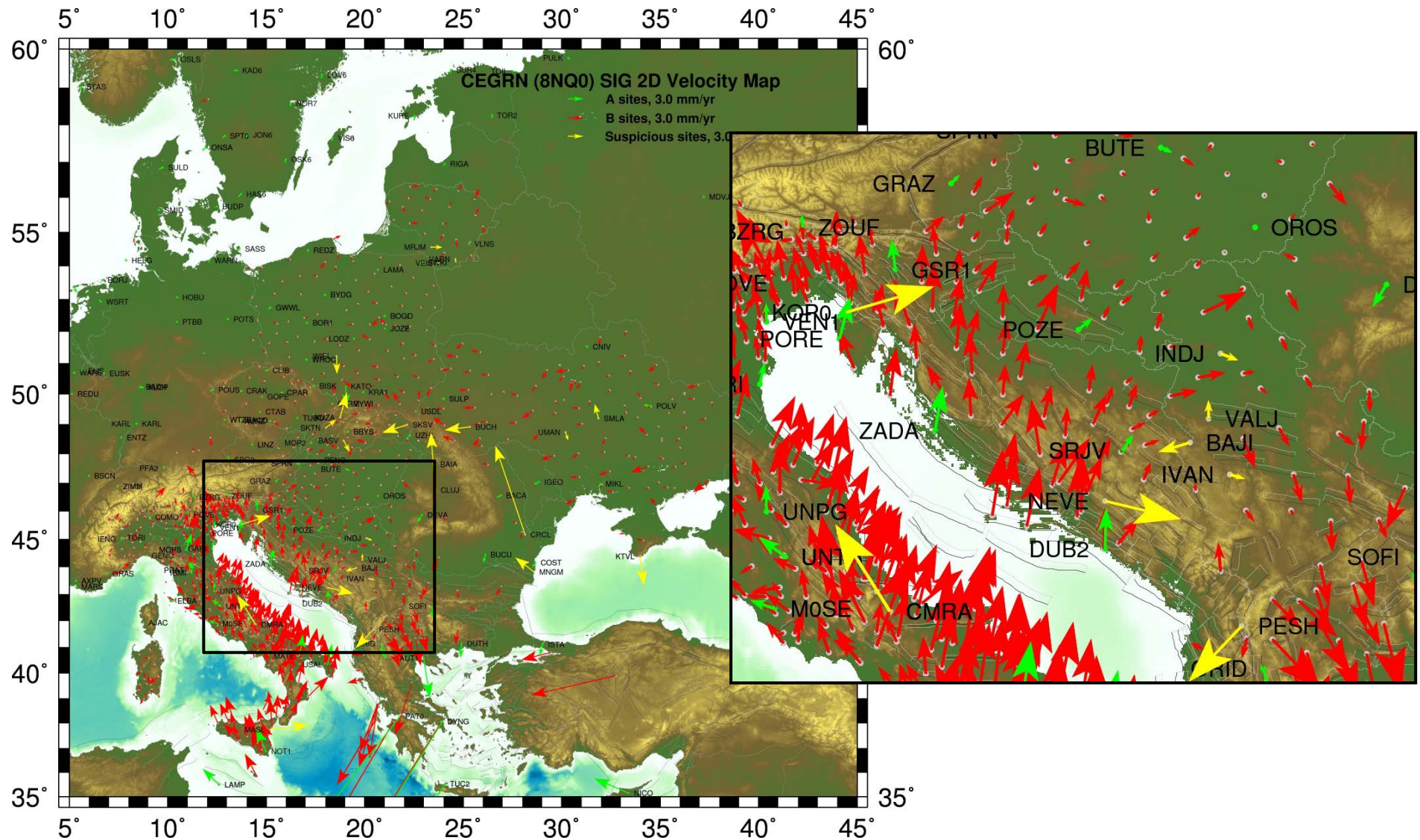
NUMBER OF PARAMETERS : 3
 NUMBER OF COORDINATES : 1008
 RMS OF TRANSFORMATION : 1.59 MM

PARAMETERS:

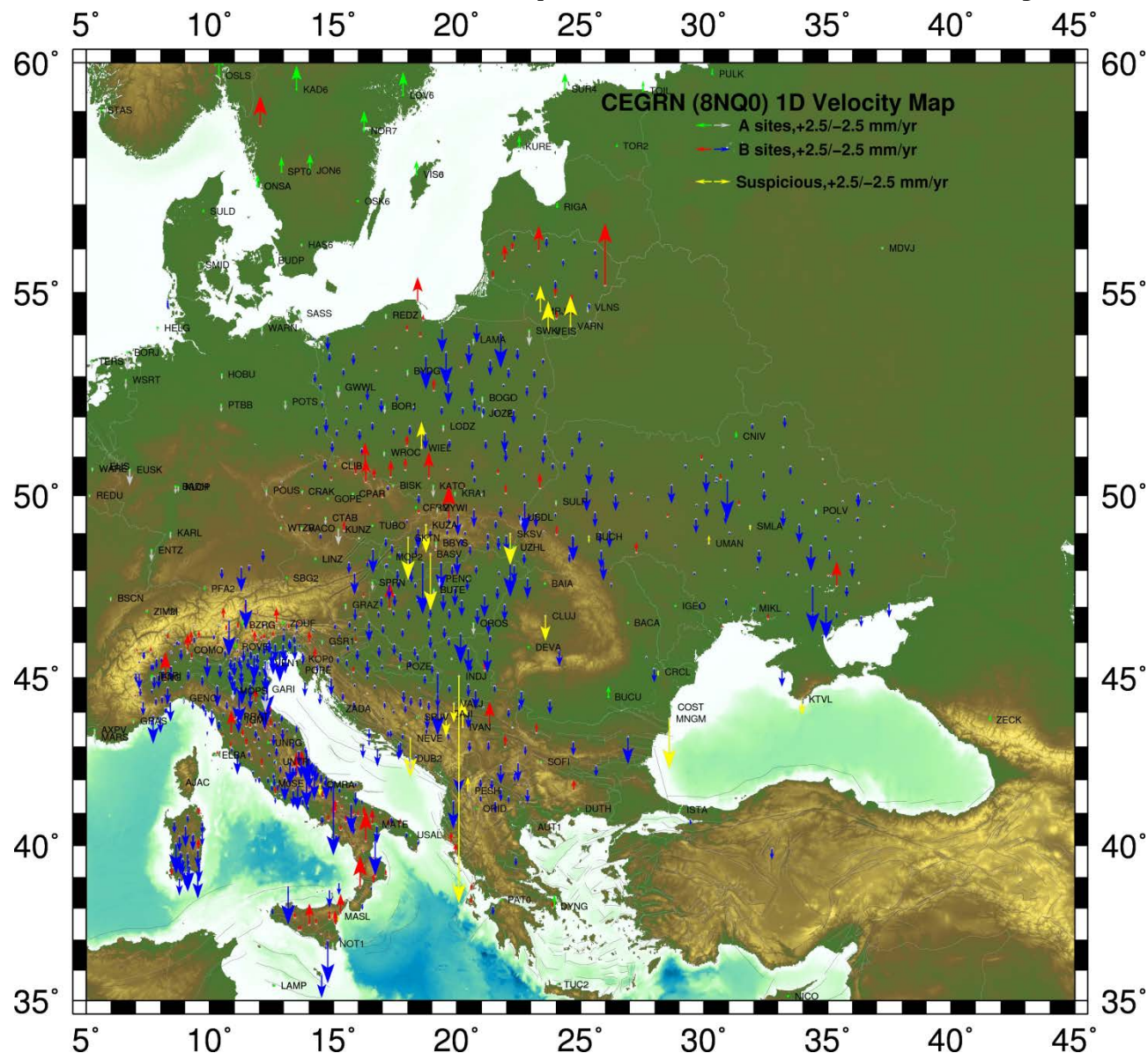
TRANSLATION IN X	:	0.18	+-	0.09	MM
TRANSLATION IN Y	:	0.21	+-	0.09	MM
TRANSLATION IN Z	:	1.29	+-	0.09	MM

We find no biases in the translations.

CEGRN 2011-2017 multi-year solution (based on 8 cumulative NQ0s): Horizontal velocity field



CEGRN 2011-2017 multi-year solution (based on 8 cumulative NQ0s): Vertical velocity field



New CEGRN website

After being hosted at the Geodesy Cartography and Remote Sensing (FÖMI), that ceased to exist on 1st of January 2017 (now Department of Geodesy, Remote Sensing and Land Offices, under the Government Office), the CEGRN website has moved to:

- web server at the University of Padova:
<http://cegrn.cisas.unipd.it>
- ftp (ANONYMOUS) server of [BEV - Bundesamt für Eich- und Vermessungswesen](#), Vienna, Austria:
<ftp://gnss.bev.gv.at>

If any AC wants their data not be public, an ftp account away from the BEV will be provided.

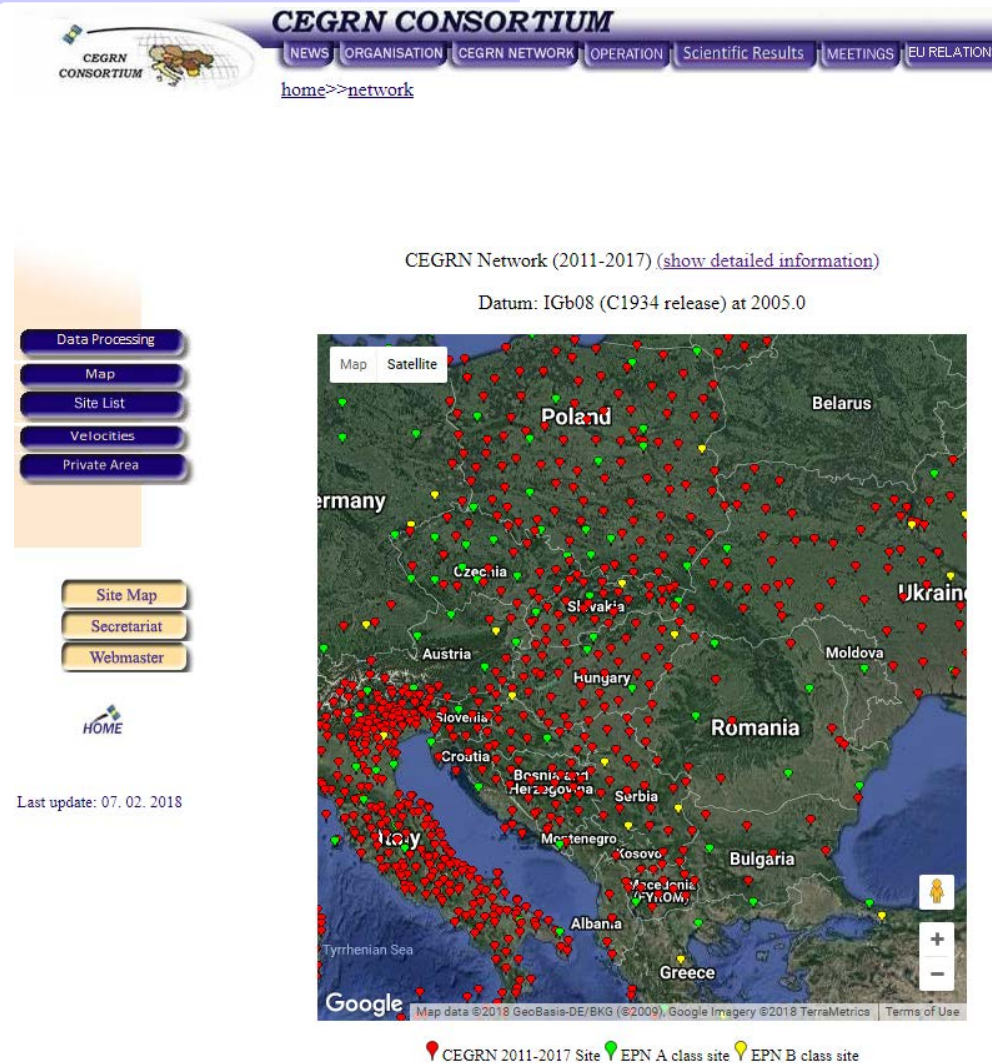
Contact person: Prof. Alessandro Caporali (alessandro.caporali@unipd.it)

The website is intended to be way to communicate with all the data providers. The former layout has been kept, but new sections with additional information have been added.

New CEGRN website

A “private area” has been also created to share data (only downloads). All the information is provided via website (velocities, logsheets,...)

<http://cegrn.cisas.unipd.it/CEGRN/index3.htm>



Conclusions

- ✓ The CEGRN is only possible thanks to the effort of many people/agencies.
- ✓ We think that the CEGRN is now, more than ever, in a very good shape.
- ✓ We have completed 4 CEGRN campaigns bringing data spanning 2011-2017: all IGB08 compliant (except 2017: IGS14).
- ✓ Collaboration with several Central European NMA's has increased considerably.
- ✓ This is why we are so encouraged to keep on adding solutions to the CEGRN and increase the quality of the results.
- ✓ We still await for more data, so we will keep on updating the CEGRN results.

Many thanks to our colleagues of all the Agencies providing data.

The results and information of the stations can be freely downloaded from:

<http://cegrn.cisas.unipd.it>

Thank you for your attention