

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



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# Outline

- 1. Introduction**
- 2. CEGRN 2017 Campaign**
- 3. The CEGRN Network confirmation**
- 4. Conclusions**

## Introduction: the CEGRN – EUREF MoU

### 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.*

## Introduction: the CEGRN Network – review

Historically, the CEGRN Network has not been very large:

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)

## Introduction: the CEGRN – review

However, 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 the new files being received in:

### **RINEX files:**

- Albania: IGEWE contributes with 6 additional stations in Albania (2003, 2005, 2007 and 2015, 2017).
- Croatia: CROPOS contributes with 33 additional stations in Croatia (starting from 2009).
- Czech Republic: CZEPOS contributes with 25 new stations (starting in 2005).
- Lithuania: LitPOS contributes with 29 stations (starting from 2009) until 2015.
- Macedonia: contributes with 13 stations (in 2017).
- Romania: contributes with 5 additional stations in Romania starting from 2015.
- Slovenia: contributes with 20 stations (2017) and provides data since 2003 (not for all sites!).

### **SINEX files:**

- ASG (Poland): solutions from 2009 to 2015.
- GKU (Slovakia): solutions from 2007 to 2017.
- LIT (Lithuania): solutions starting from 2017.
- MAO (Ukraine): solutions from 2001 to 2015.
- EUR: all available SINEX files at the CEGRN campaigns (including 2017).

Data from **Hungary**, one of the founders of CEGRN, are missing. Hopefully, in the spirit of free data exchange stated by the MoU, we would like to include them as soon as they are made available

**We still expect more data to be available.**

## Introduction: the CEGRN – review

This continuous data receiving implies constant computing including the new files received:

### A) RINEX level:

- Compute the new RINEX files using EPN A class sites to align the solutions (solution UP1),
- Stack this solution with the former one (called UP0) to get the  $UPA\{\text{WWWW}\}7.NQ0$  combined solution,

### B) SINEX level:

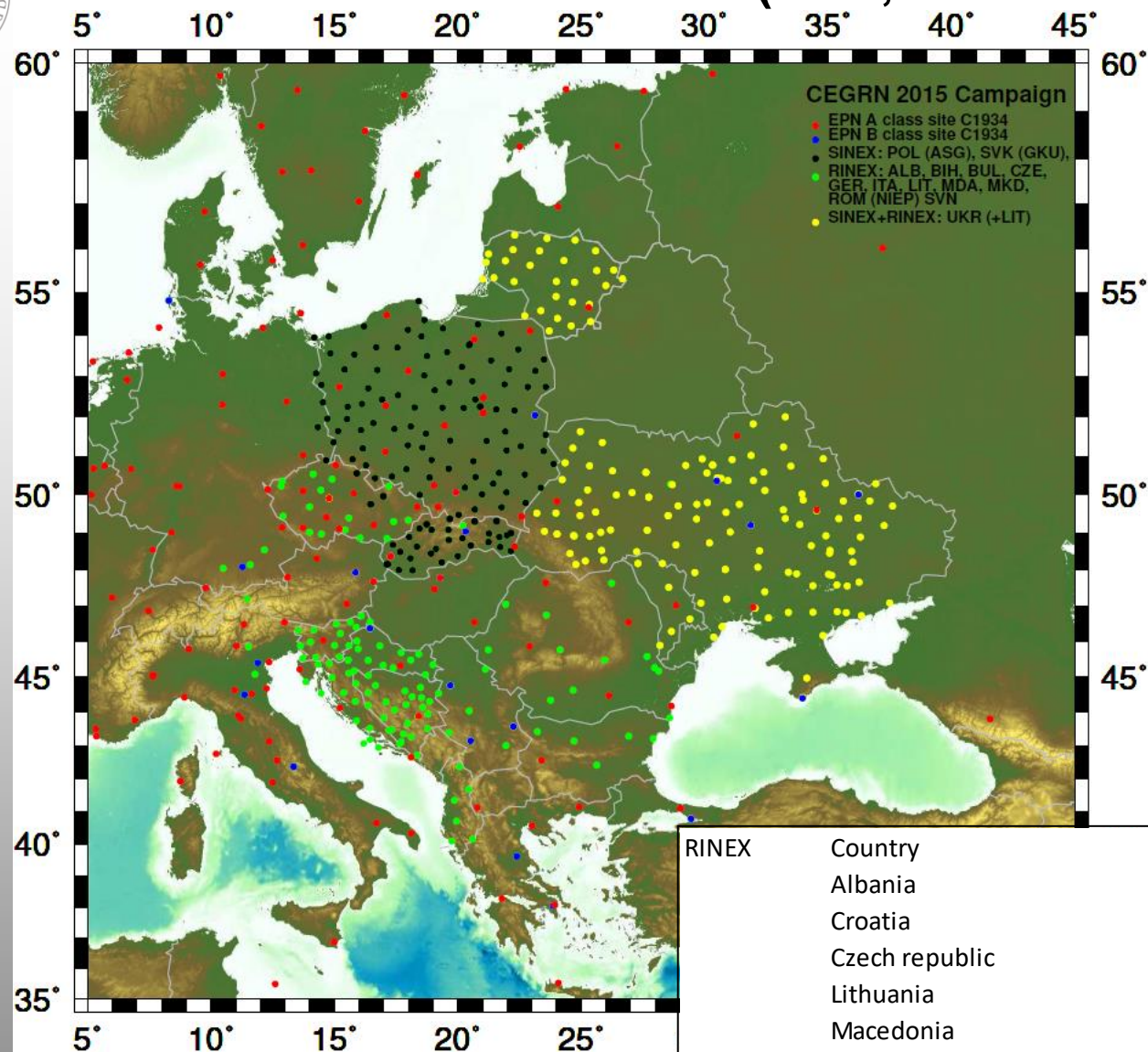
- Convert all SINEX (ASG, GKU, MAO and EUR) into BSW52 NQ0 format (SNX2NQ0),
- Stack the NQ0 files to a weekly  $CEG\{\text{WWWW}\}7.NQ0$  file:

$$UPA\{\text{WWWW}\}7.NQ0 + ASG\{\text{WWWW}\}7.NQ0 + GKU\{\text{WWWW}\}7.NQ0 + MAO\{\text{WWWW}\}7.NQ0 + EUR\{\text{WWWW}\}7.NQ0 \rightarrow CEG\{\text{WWWW}\}7.NQ0$$

### C) SINEX level: multiyear stacking.

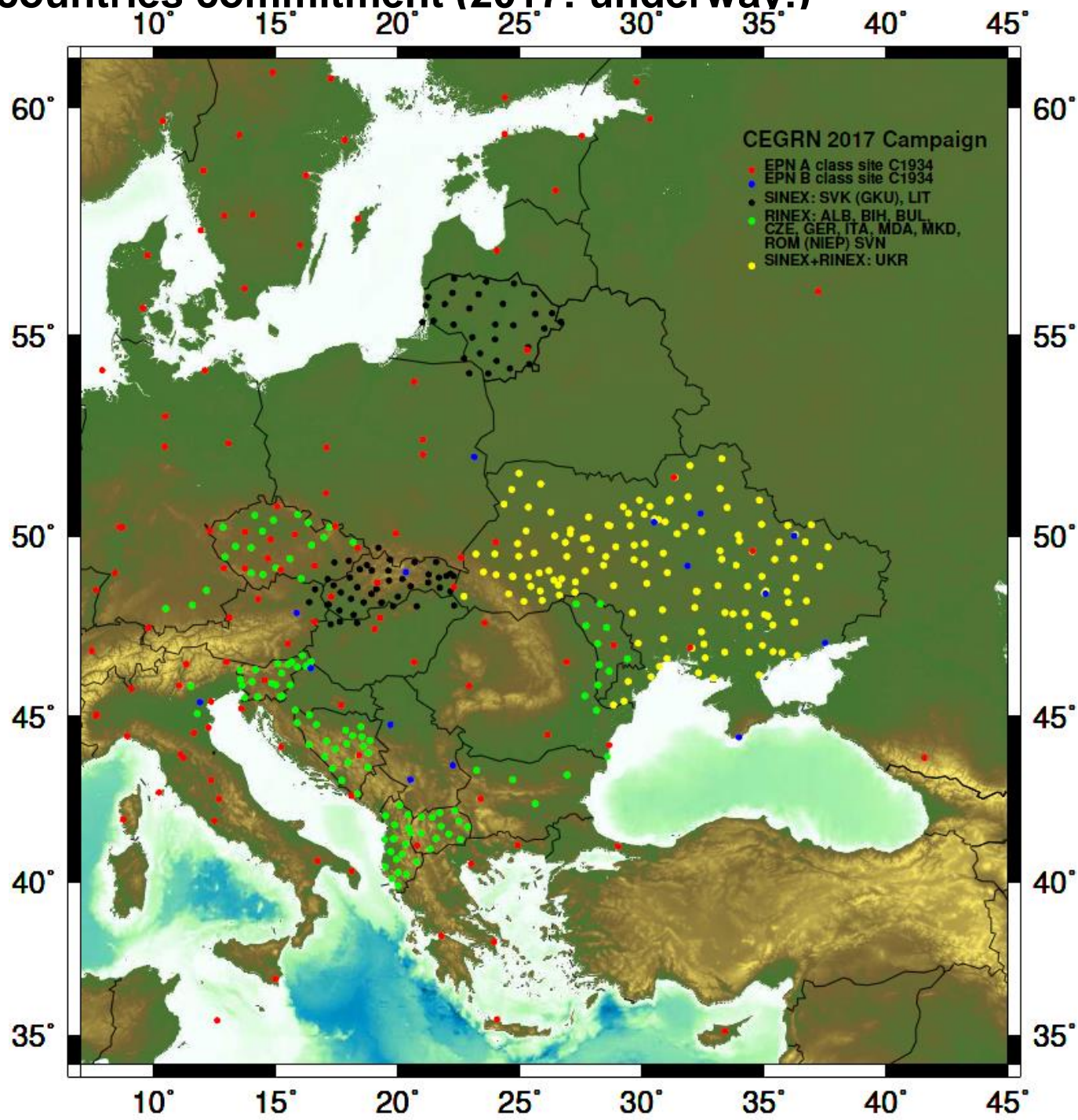


# CEGRN countries commitment (2015, includes EPN SINEX)



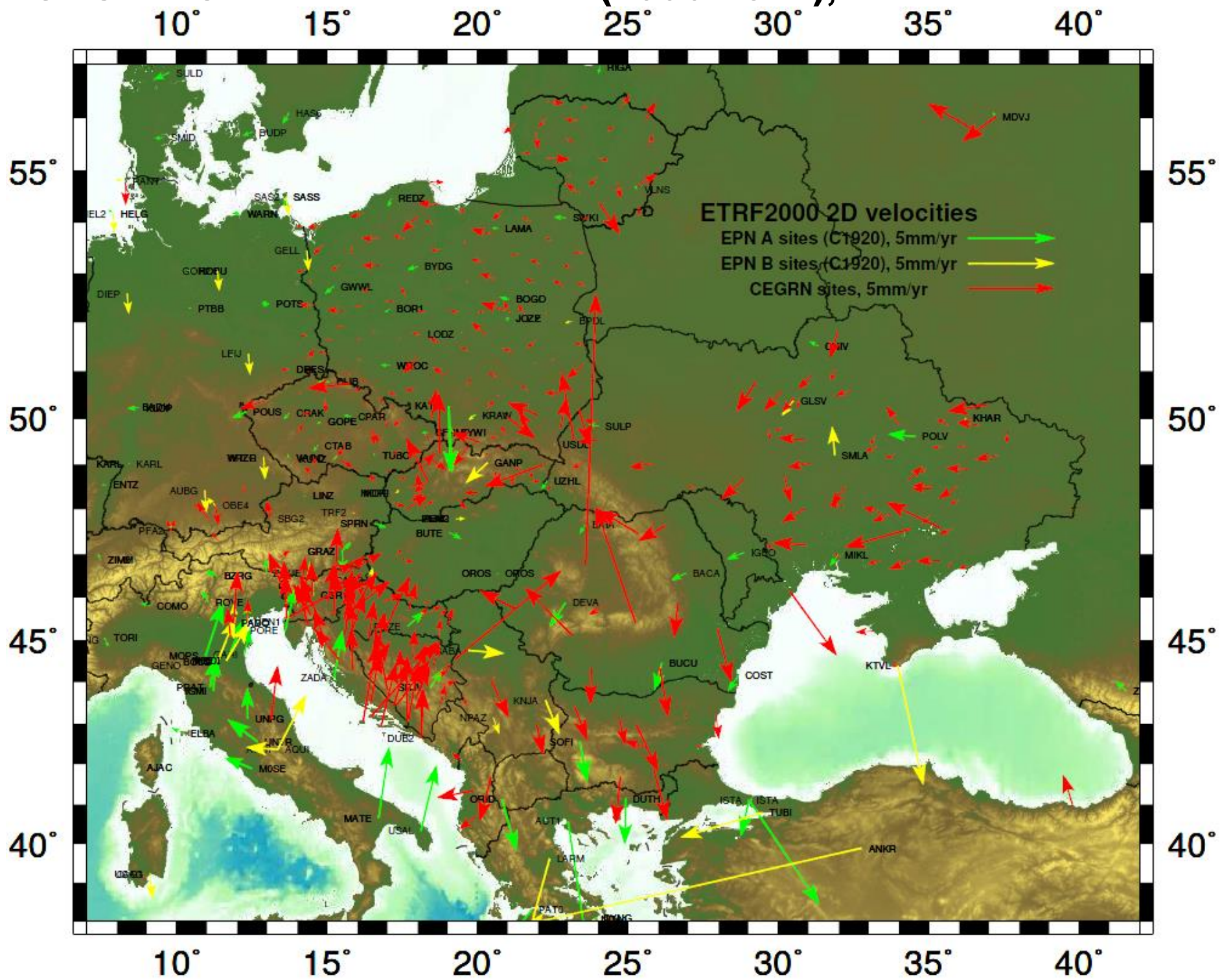
	Country	<2013 (2003-2007)	2015	2017
RINEX	Albania		YES	YES (6)
	Croatia	YES	YES	YES (33)
	Czech republic	YES	YES	YES (25)
	Lithuania	YES	YES	NO
	Macedonia	NO	NO	YES (13)
	Romania	NO	YES	YES (5)
	Ukraine	YES	YES	YES
	Slovenia	SOME	SOME	YES (20)
SINEX	Country (Agency)			
	Poland (ASG)	YES	YES	YES
	Slovakia (GKU)	YES	YES	YES
	Lithuania (LIT)	NO	NO	YES
	Ukraine (MAO)	YES	YES	YES
	EUREF (EPN)	YES	YES	YES

## CEGRN countries commitment (2017: underway!)



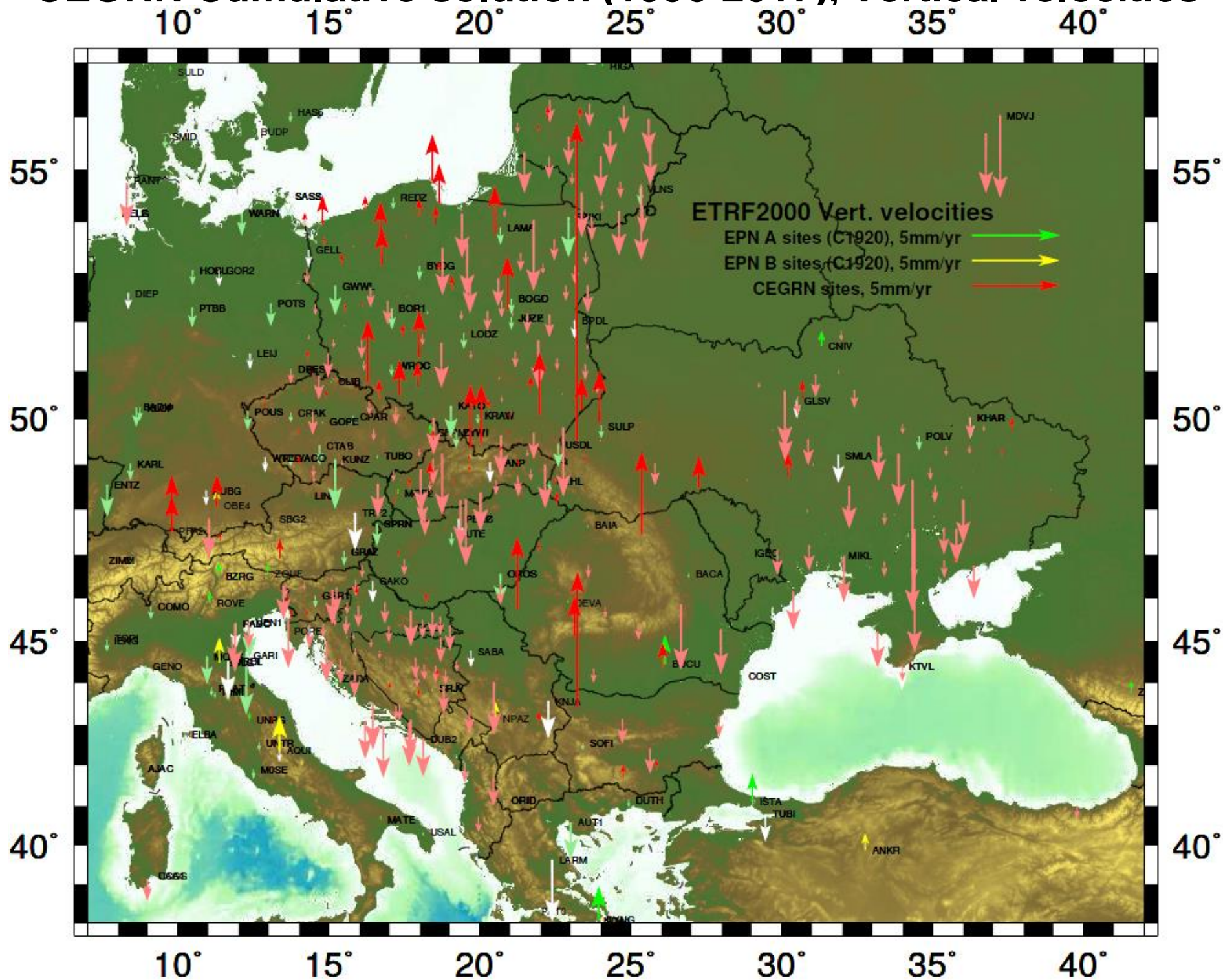


## CEGRN Cumulative solution (1996-2017), 2D velocities

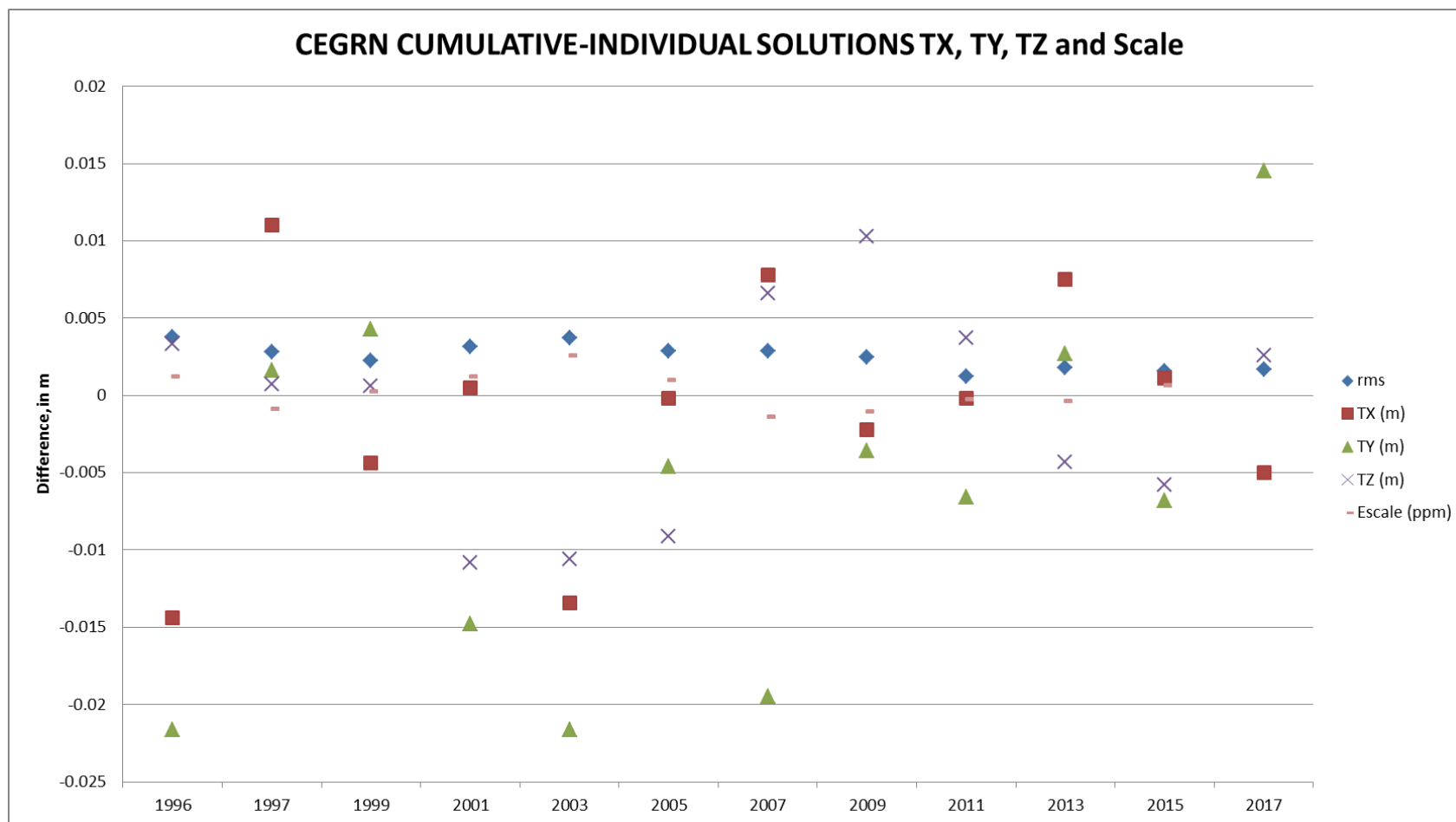




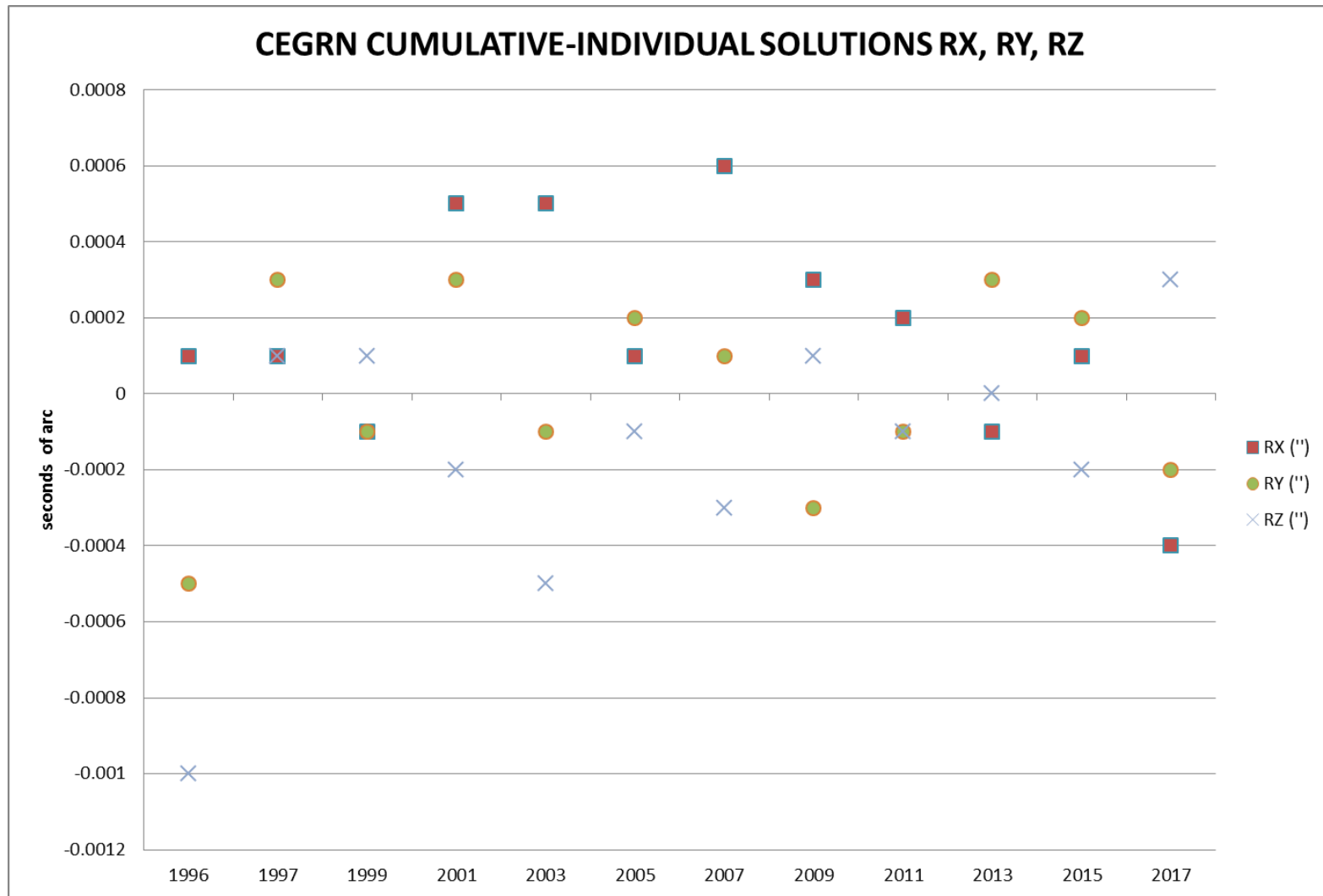
## CEGRN Cumulative solution (1996-2017), Vertical velocities



# CEGRN Cumulative solution (1996-2017), Helmert parameters, individual vs combined solution.



# CEGRN Cumulative solution (1996-2017), Helmert parameters, individual vs combined solution.



## CEGRN, final remarks (I)

- With CEGRN2017 the time span of the cumulative solution is  $> 20$  years.
- CEGRN, thanks to all the Analysis Centres providing data, is now more than ever a very active Network.
- We expect to have all the files for the next EUREF symposium, where the CEGRN cumulative solution, including all missing 2017 data, will be presented.
- We look forward to supporting, with the CEGRN cumulative solution, the EPN Working Groups active in the field of densification (specially EPN D and the WG on dense velocities) and deformation studies.
- The velocity of the EPN B class sites is at the same level of accuracy as the CEGRN Stations. Therefore, EPN B class sites can be used for deformation analysis.



## CEGRN, final remarks (II)

- After all these years hosted at FOMI (thanks!!), now the new server has been moved to:
  - Website: <http://cegrn.cisas.unipd.it> (contact: [Prof. Alessandro Caporali](#))
  - Ftp server (credentials needed): <ftp://gnss.bev.gv.at> (contact: [Philipp Mitterschiffthaler](#))
- We look forward receiving observations, SINEX files,..., no matter how old they are. Just get in touch with [Prof. Alessandro Caporali](#), and he will give you the needed instructions.
- Again, thanks to all the ACs that have provided data.

Thank you for your attention