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Faculty of Civil Engineering and Geodesy

Homogeneous products of dense Polish GNSS networks

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EUREF Analysis Centres Workshop, 25-26 October 2017, Brussels, Belgium

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Background

- Official realization of the ETRS89 in Poland is PL-ETRF2000
- The ASG-EUPOS network is responsible for maintenance the PL-ETRF2000
- MUT uses ASG-EUPOS data since 2009, MUT's products were used as external information about the coordinates stability
- In 2012 private companies start to build their own network
- MUT AC has started to monitor their coordinates since 2013
- Our activities was stopped for one year (2016.5 – 2017.5)

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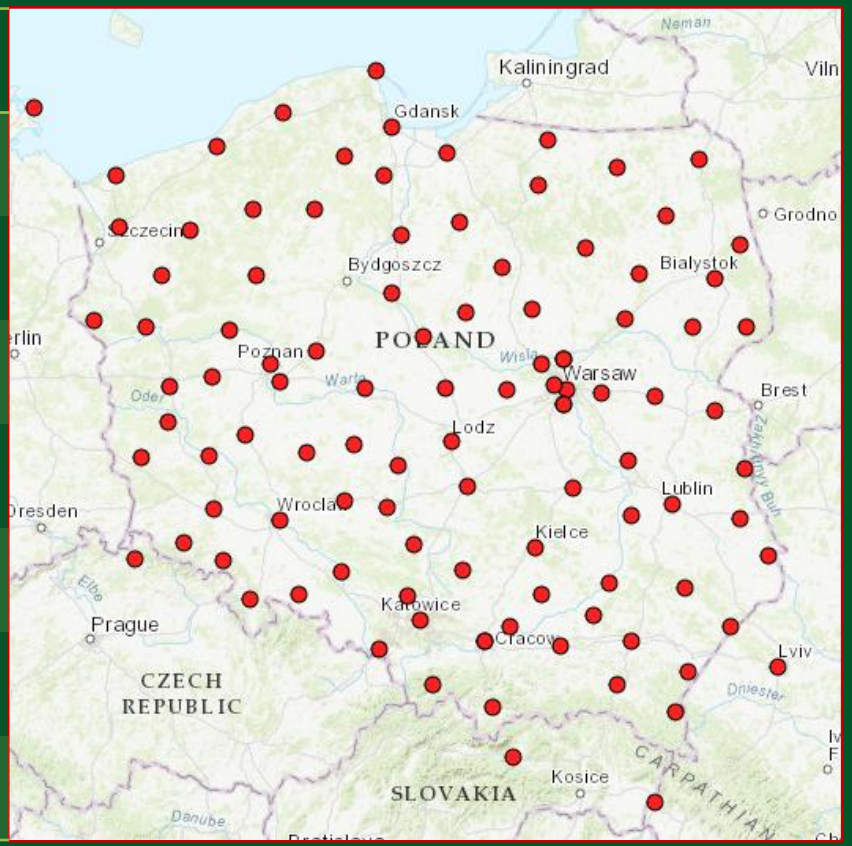
Networks processed by MUT

Name	ASG-EUPOS
No. stations	100
Operated by	GUGiK.
Operated since	2007
Equipment	Mixed manufacturers
GNSS obs.	G, R and E, B (in 80%)
RINEX vers.	2.11, 3.02
Sitelogs	YES



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Networks processed by MUT

Name	SmartNet Poland
No. stations	169 (still growing)
Operated by	Leica Geosystems Sp. z o.o.
Operated since	2012
Equipment	Leica GR10 mostly
GNSS obs.	G, R and E, B (in 90%)
RINEX vers.	2.11
Sitelogs	NO

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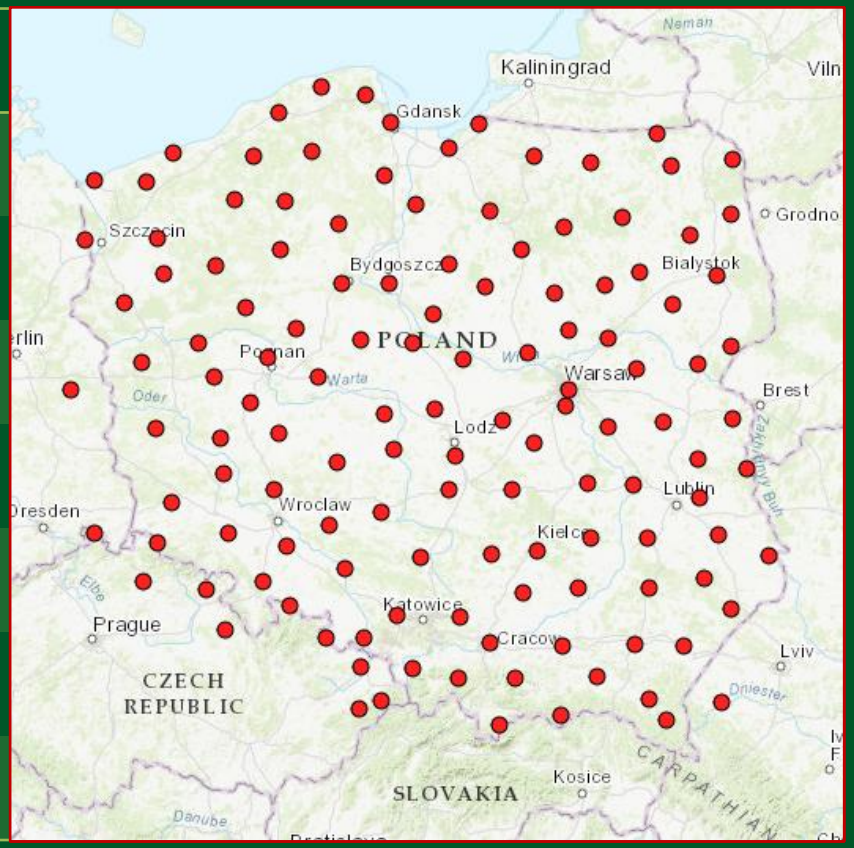
Networks processed by MUT

Name	TPI NETpro
No. stations	136
Operated by	TPI Sp. z o.o.
Operated since	2013
Equipment	TPS NET-3GA
GNSS obs.	G, R
RINEX vers.	2.11
Sitelogs	NO



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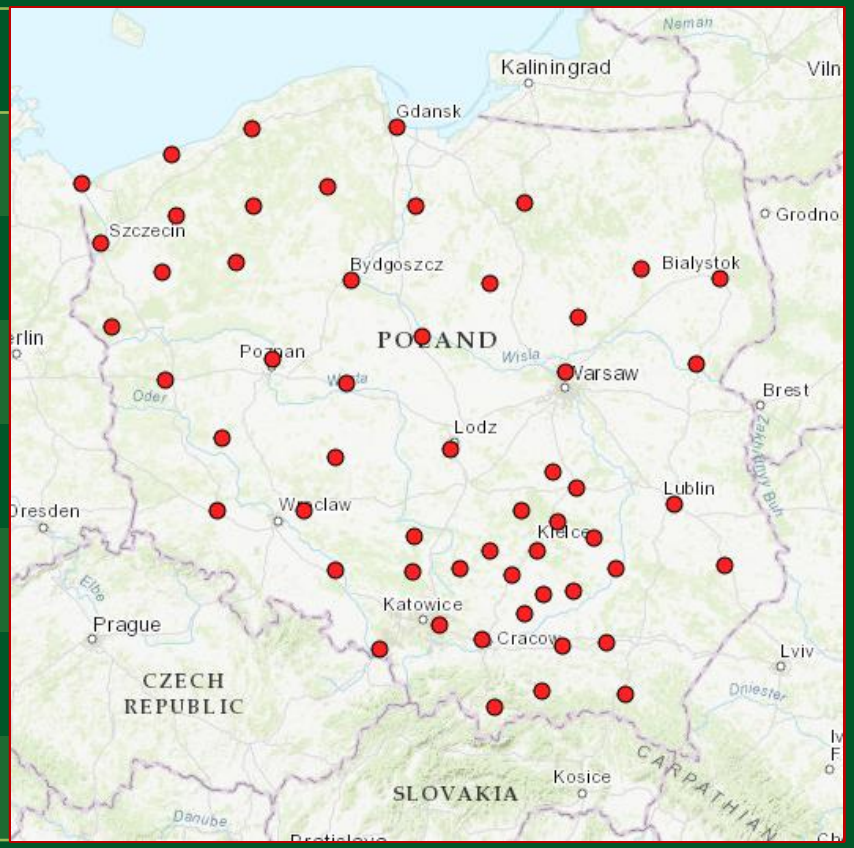
Networks processed by MUT

Name	VRSnet.pl
No. stations	57 (77 by the end of 2017)
Operated by	TRIMTECH Sp. z o.o.
Operated since	2012
Equipment	Trimble NETR9 mostly
GNSS obs.	G, R and E, B (in 90%)
RINEX vers.	2.10, 3.02
Sitelogs	NO



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Types of data

- Data format and sampling
  - ✓ 1 sec. or 30 sec. data
  - ✓ 15-minute, 1-hourly or daily files
  - ✓ RINEX 2.xx or 3.xx (short and long names)
- Metadata
  - ✓ still incorrect entries in RINEX header in some cases
  - ✓ sitelogs available only for ~120 stations
  - ✓ missing sitelogs are created by us (~75% are ready)

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What's new ?

- A completely new processing schema since August, 2017.

  Announcement: MUT EPN AC will go the same direction this year

- Before it was:
  - ✓ Networks were processed independently
  - ✓ Bernese 5.2 (GPS + GLONASS)
- Now is:
  - ✓ New approach: all stations are processed together
  - ✓ Gamit/Globk 10.61 (GPS only)

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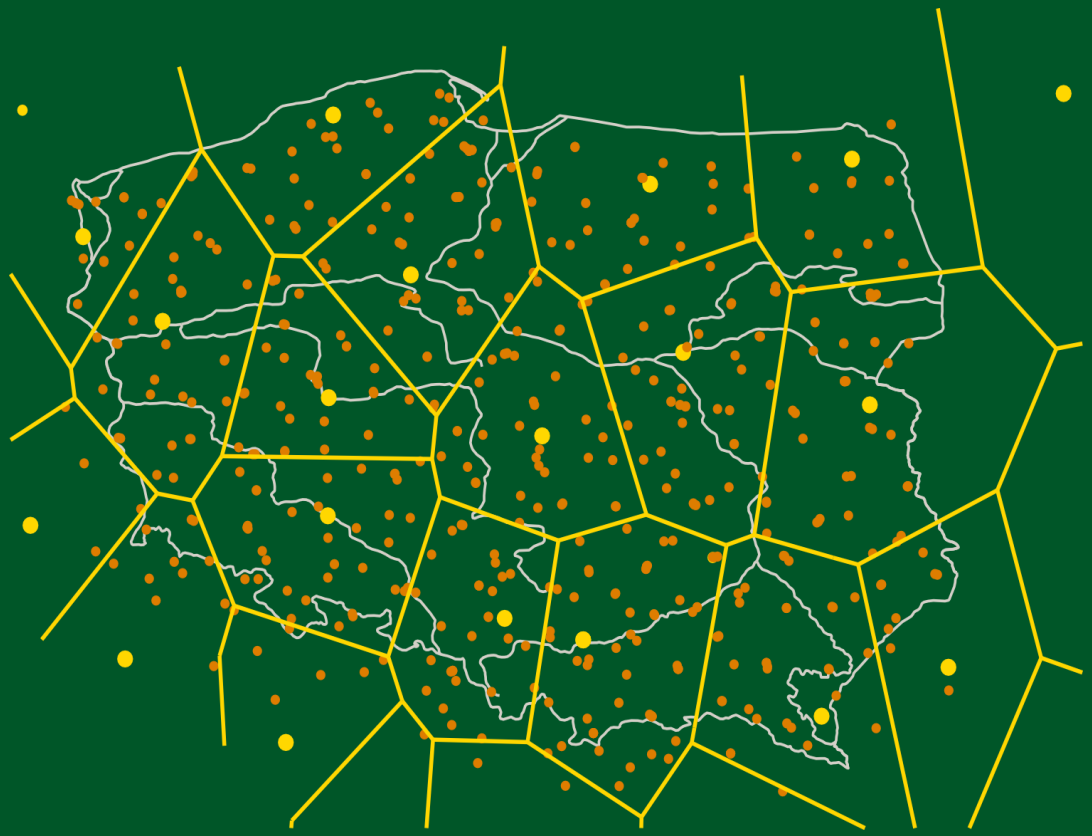
Standarisation of clustering rules

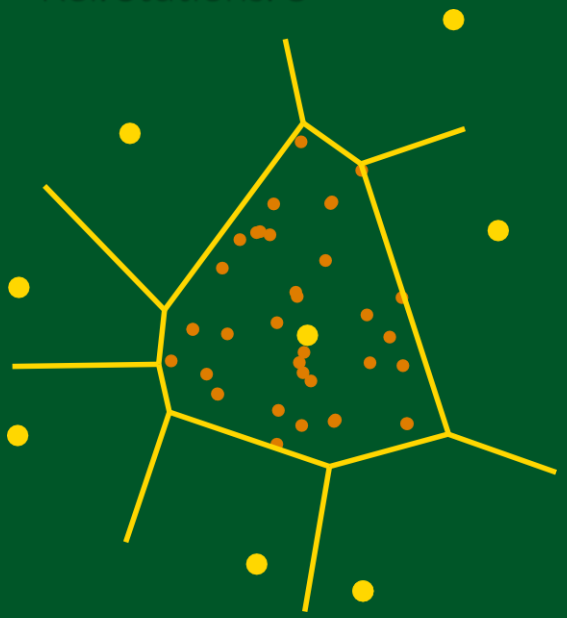
All stations divided initially into clusters corresponding to Thiessen polygons based on the local EPN/IGS stations used as reference.



Cluster PL05: LODZ

No .stations: 41

Ref. Stations: 8



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Problems (?)

- Repeated names (4-char ID)
  - ✓ 65 double; 11 triple; 2 quadruple
  - ✓ artificial names for processing purpose
  - ✓ new names in products (SNX)
  - ✓ original names in all reports

Name	DOMES	Network	City	Lat.	Long.	Time span
BIAL	12235M001	ASG-EUPOS	Białystok	52.9472	23.1387	> 9 years
BIAL	-	SmartNet Poland	Białobrzegi	51.4637	20.9514	> 4 years
BIAL	-	TPI NETpro	Białystok	52.9735	23.1350	> 4 years
BIAL	-	VRSnet.pl	Białystok	52.9468	23.1720	> 3 years

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Processing strategy for routine analysis

	Rapid	Final
Software	GAMIT 10.61	
GNSS	GPS	
Elevation mask	3 °/5°	
Orbits	IGS14 (R)	IGS14 (F)
Antennas	igs14.atx + indiv. calib. (EPN, ASG)	
Troposphere	GPT2 + GMF	VMF1
Ionosphere	HOI (CORG)	HOI (CODG)
EOP	IERS2010	
Tides	IERS2010	
Loadings	FES2004	+ atmospheric (for trop.)
Reference	31 EPN Class A sites (IGS14)	

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Processing schema

Four shell scripts to organize everything:

- **sh_start_r.sh** to check the status of each cluster, wait or run each task
- **sh_gamiciak.sh** to prepare the structure and global data (grids, orbits etc.), copy and rename the appropriate RINEX files and finally run the GAMIT
- **sh_start_comb.sh** to make the combination, prepare the SINEX files and run the final script
- **sh_gen_web.sh** to prepare the time series, calculate the residua, prepare the reports, update the web page

Complete run (1 day) takes < 1.5 hour

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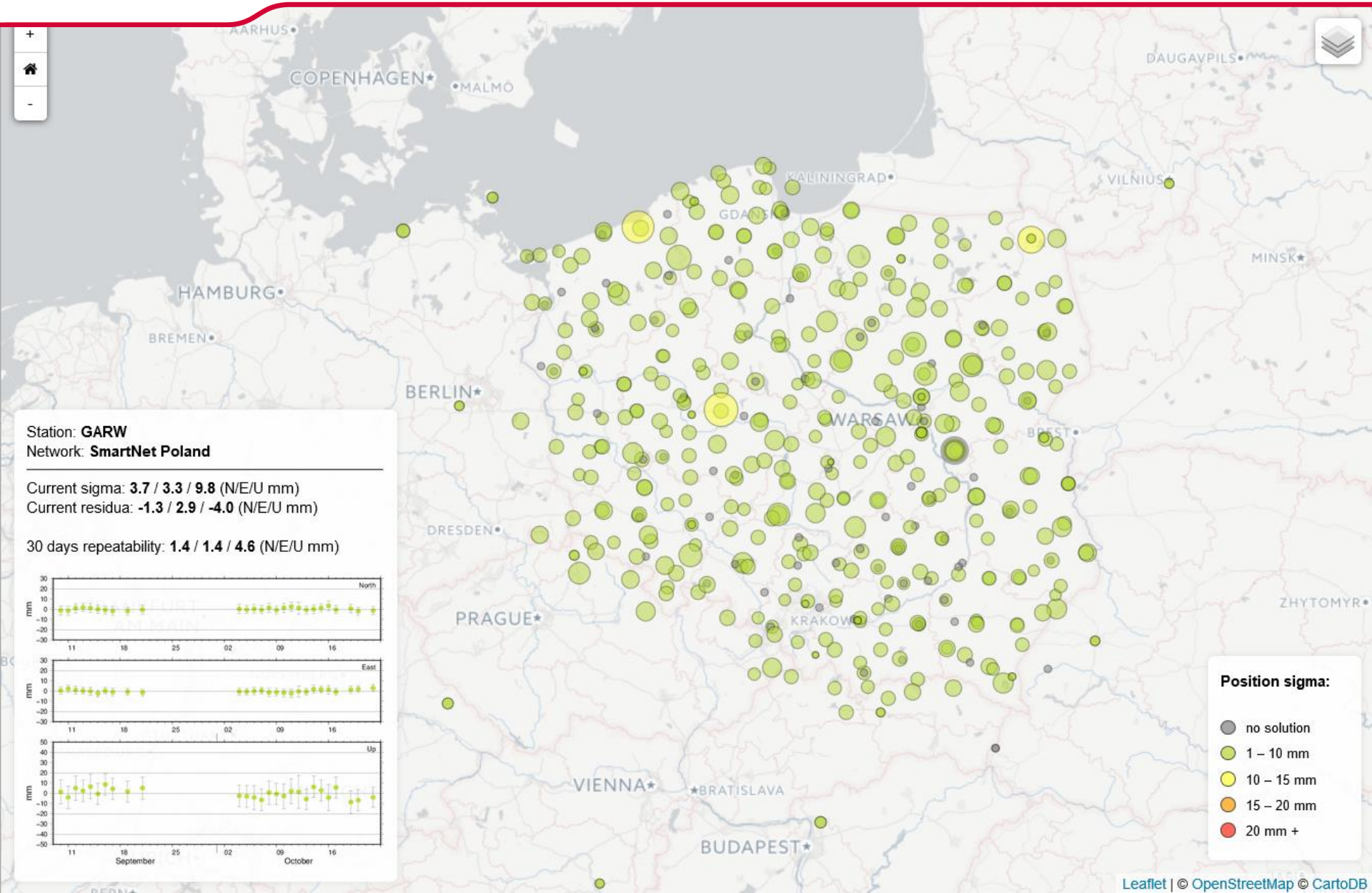
Daily updated reports for rapid solution (1)



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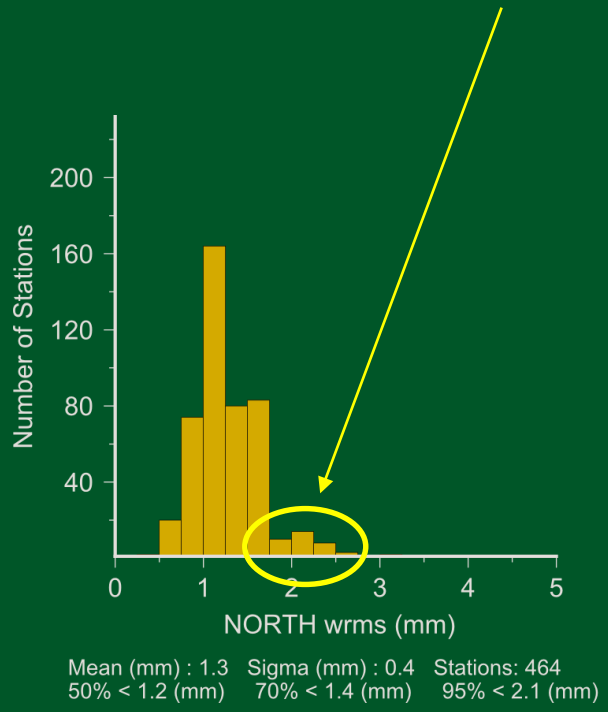
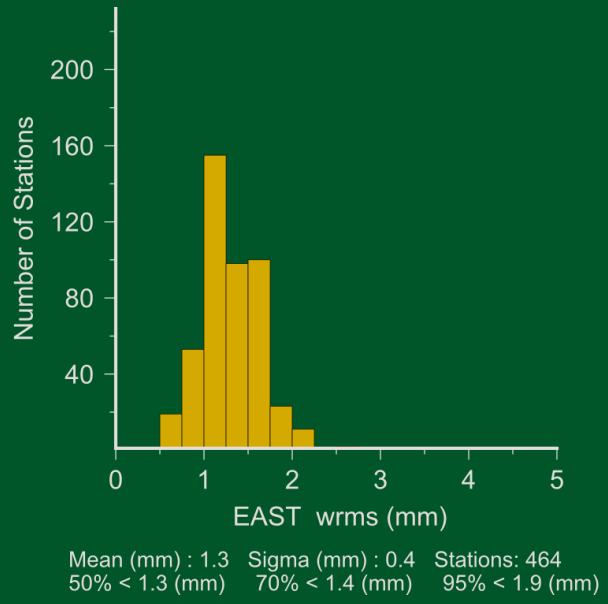
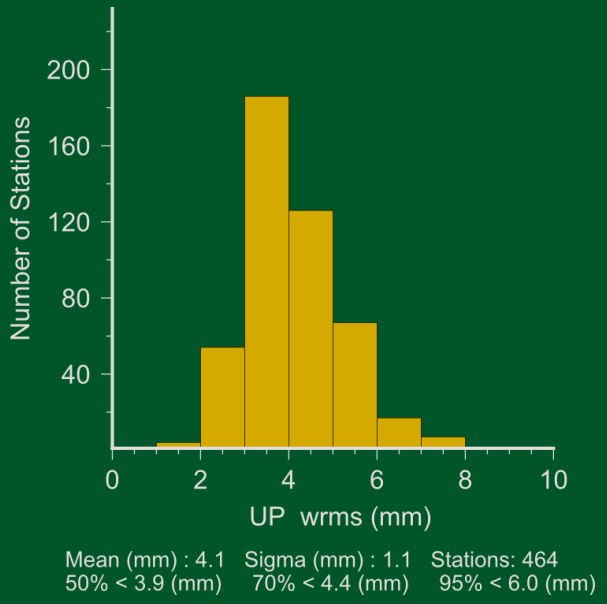
Quality of solutions

- Monthly (18.09.2017 – 18.10.2017) repeatability at level 2.1 mm / 1.9 mm / 6.0 mm for 95% of analysed stations (464)
- The same stations that have the „worst” sigmas







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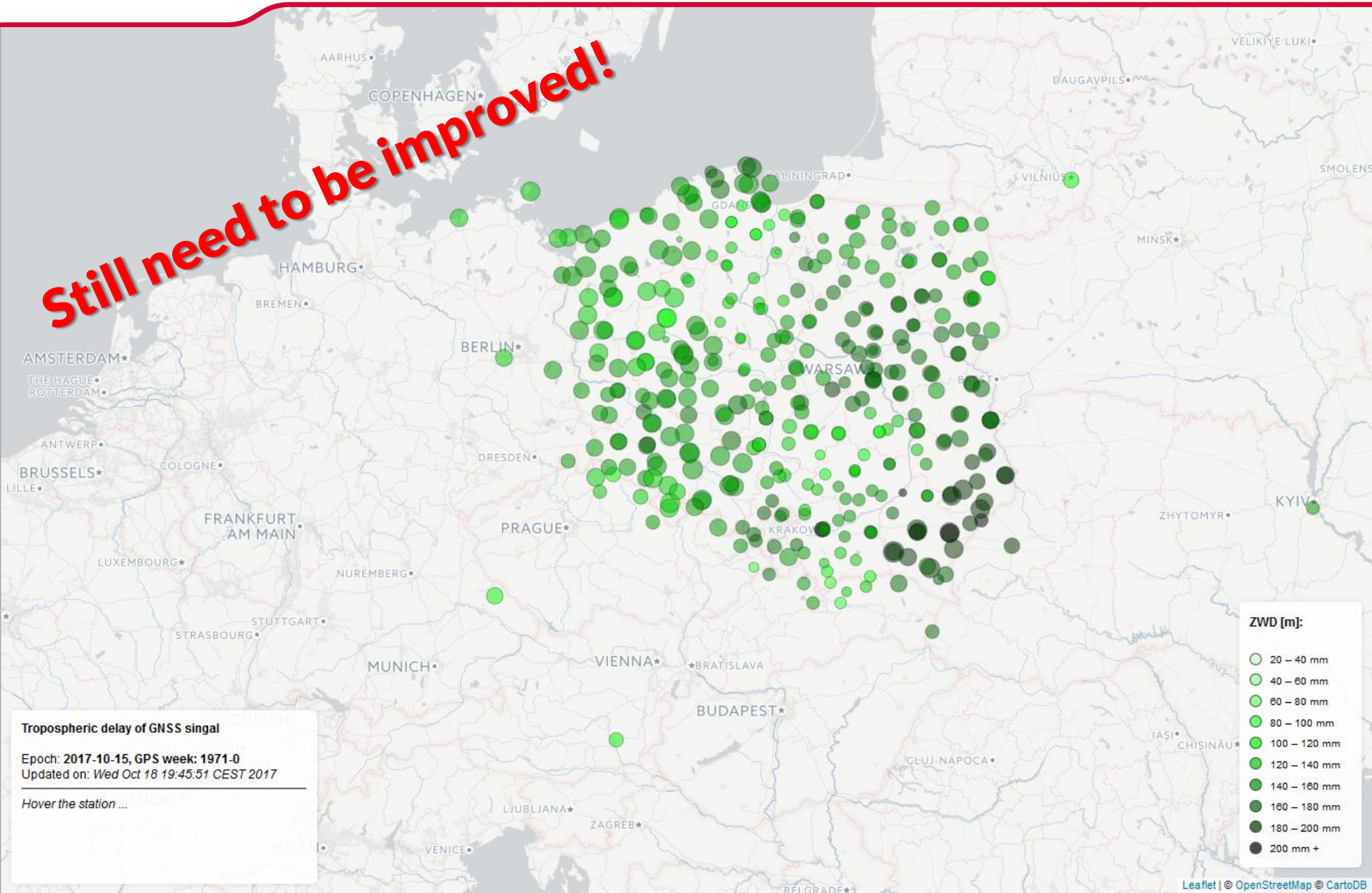
Daily updated reports for rapid solution (2)



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Summary

- Still some problems with the data sharing
- New products are GPS only
- Reports of rapid solutions already available at

  www.cgs.wat.edu.pl/gnss/mut_gnssr.html

  www.cgs.wat.edu.pl/gnss/mut_zpdr.html - no decision about presentation style

- Reports of final solutions not yet published

  www.cgs.wat.edu.pl/gnss/mut_gnssf.html

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What's next ?

- Update the metadata for routine processing ASAP
  - ✓ if needed
  - ✓ still waiting for sitelogs/metadata validation
- Start the Repro2018PL
  - ✓ it will be launched by the end of this year
  - ✓ it will cover period from 2008 to 2018 (IGS08/IGS14)
  - ✓ first results should be ready for EUREF Symposium 2018
  - ✓ products for the purposes of EPN Densification if needed and EPOS programme

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Acknowledgements

GNSS data providers: *Head Office of Geodesy and Cartography,*
Leica Geosystems Sp. z o.o.,
TPI Sp. z o.o.,
Trimtech Sp. z o.o.

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The research was conducted partly within statutory research at the Institute of Geodesy, Faculty of Civil Engineering and Geodesy, Military University of Technology (PBS/854/2013,).

Created Polish GNSS data base is co-financed from the founds of the European Regional Development Found (POIR.04.02.00-14-A0003/16)

European Funds Smart Growth

European Union
European Regional Development Fund