Military University of Technology

Faculty of Civil Engineering and Geodesy

MUT Analysis Centre report

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Military University of Technology

OUTLINE

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CURRENT STATUS OF MUT AC

2

IMPACT OF GALILEO OBSERVATION ON THE REGIONAL SOLUTIONS

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OTHER ACTIVITIES

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CURRENT STATUS OF MUT AC

PROCESSING STRATEGY

- **2017-12-20 (GPS WEEK 1980)**

  SWITCH TO GAMIT/GLOBK 10.61

- **2019-03-10 (GPS WEEK 2044)**

  UPGRADE TO GAMIT/GLOBK 10.70

  ADD GAL OBSERVATIONS

PROCESSING STRATEGY

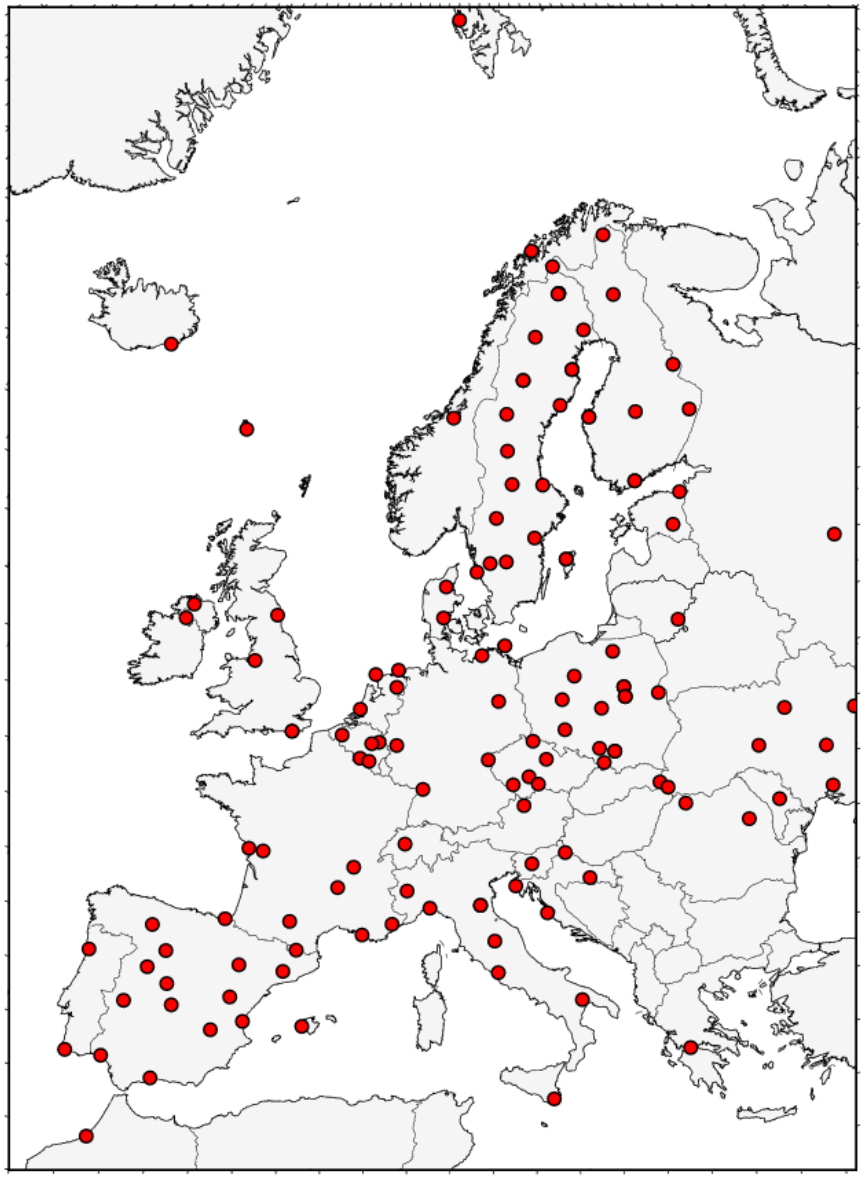
System	GPS	Galileo
Frequencies	L1, L2	E1, E5a
Observations	Ionosphere-free code and phase combination	
Cutoff elevations	3 deg.	
Orbits	CODE MGEX	
Transmitter PCC	igs14.atx	
Receiver PCC	individual calibration from epncb.atx data sets and igs14.atx	
Troposphere delay	VMF1, 1-hourly ZTD and 24-hourly gradients	
Clock errors	Estimated	
EOP	IERS2010	
Tide displacements	IERS2010, FES2004	
Attitude model	Kouba’s eclipse routine (Feb. 2017)	
Earth radiation	BERNE	

PROCESSING STRATEGY

- INDEPENDENTLY PROCESSED GPS AND GALILEO OBSERVATIONS;
- TROPOSPHERE PARAMETERS ESTIMATED FOR GPS AND GALILEO SEPARATELY;
- COMBINATION OF THE COORDINATE DAILY SOLUTIONS;
- FINAL PRODUCTS:
  - ✓ GPS+GAL COORDINATE SOLUTIONS
  - ✓ GPS TROPOSPHERE SOLUTIONS

SUBNETWORK

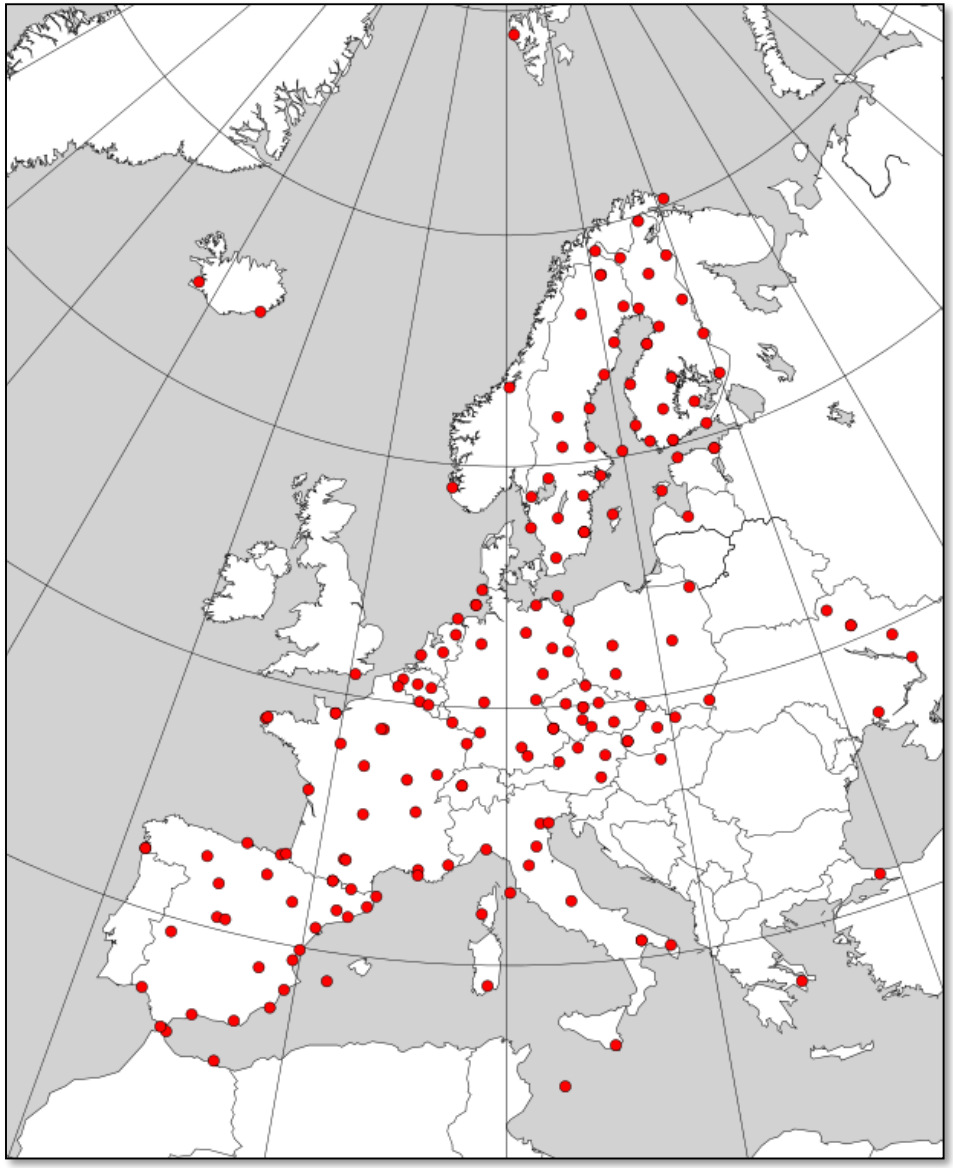
- 148 STATIONS
- CAPABILITY FOR MORE



2

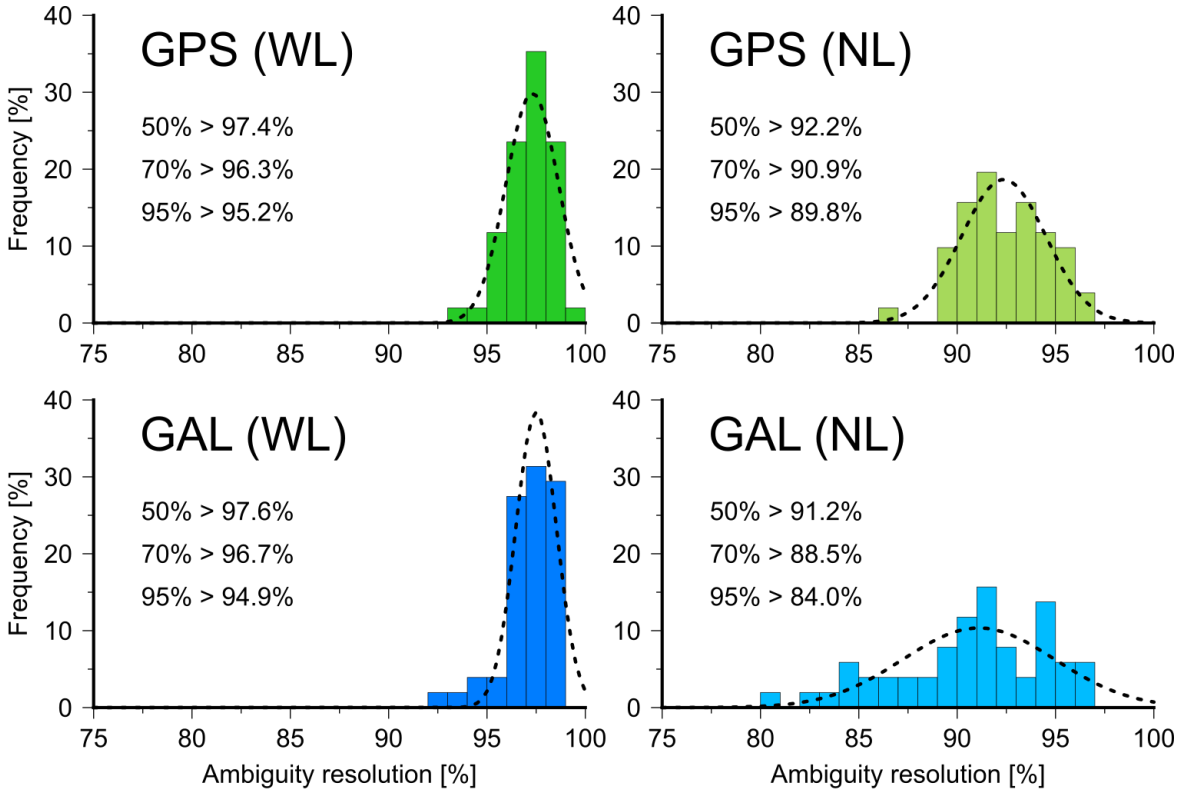
IMPACT OF GALILEO OBSERVATIONS

- 2018.01.01 – 2018.12.31
- NUMBER OF STATIONS: 136-181
- RNX3 DATA
- TWO SOLUTIONS:
  - GPS ONLY (GPS)
  - GALILEO ONLY (GAL)

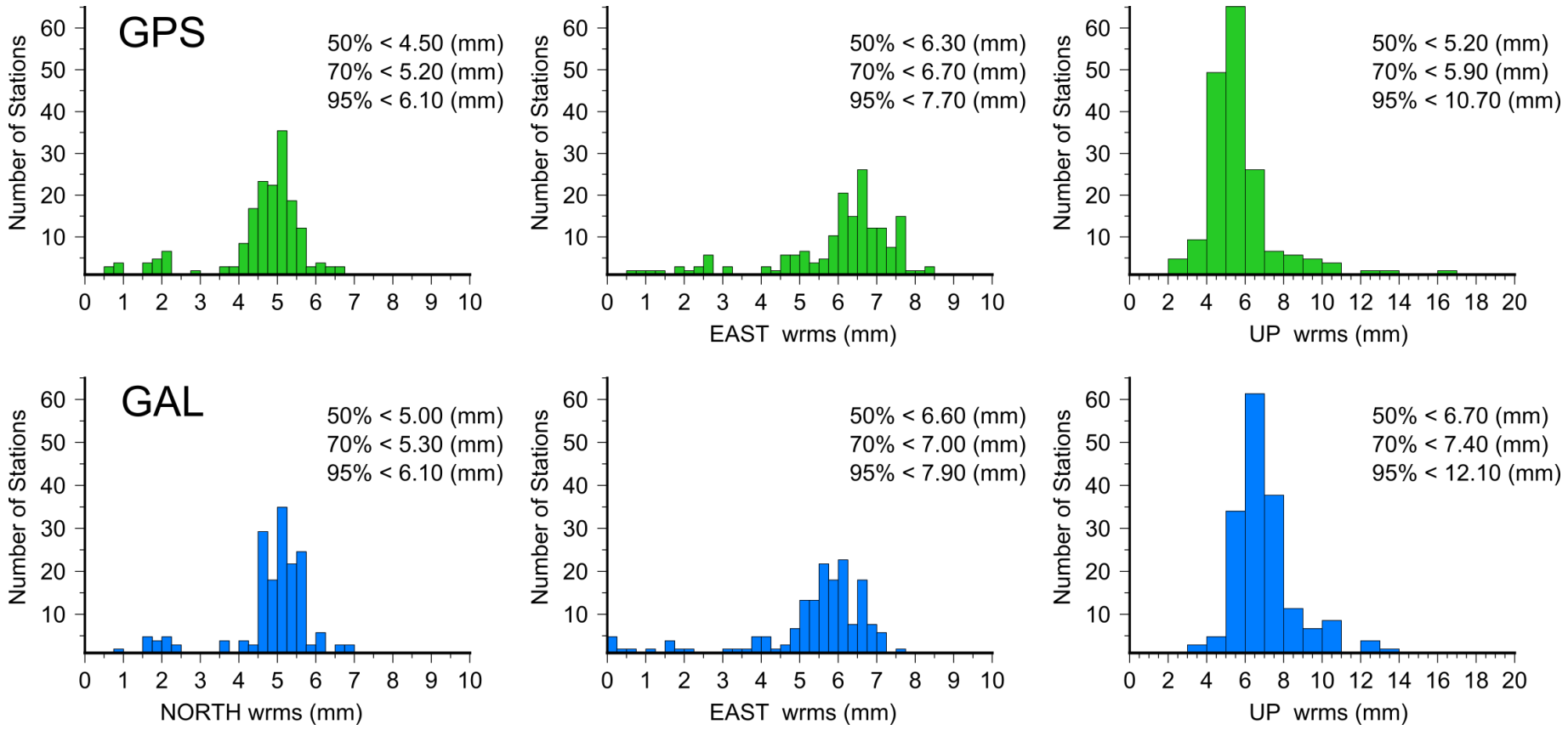


AMBIGUITY RESOLUTION

- OVER 93% **WL** AMBIGUITIES RESOLVED FOR BOTH SOLUTIONS;
- RESOLUTION OF **NL** AMBIGUITIES FOR GAL ARE STILL WORSE ~1-5%.



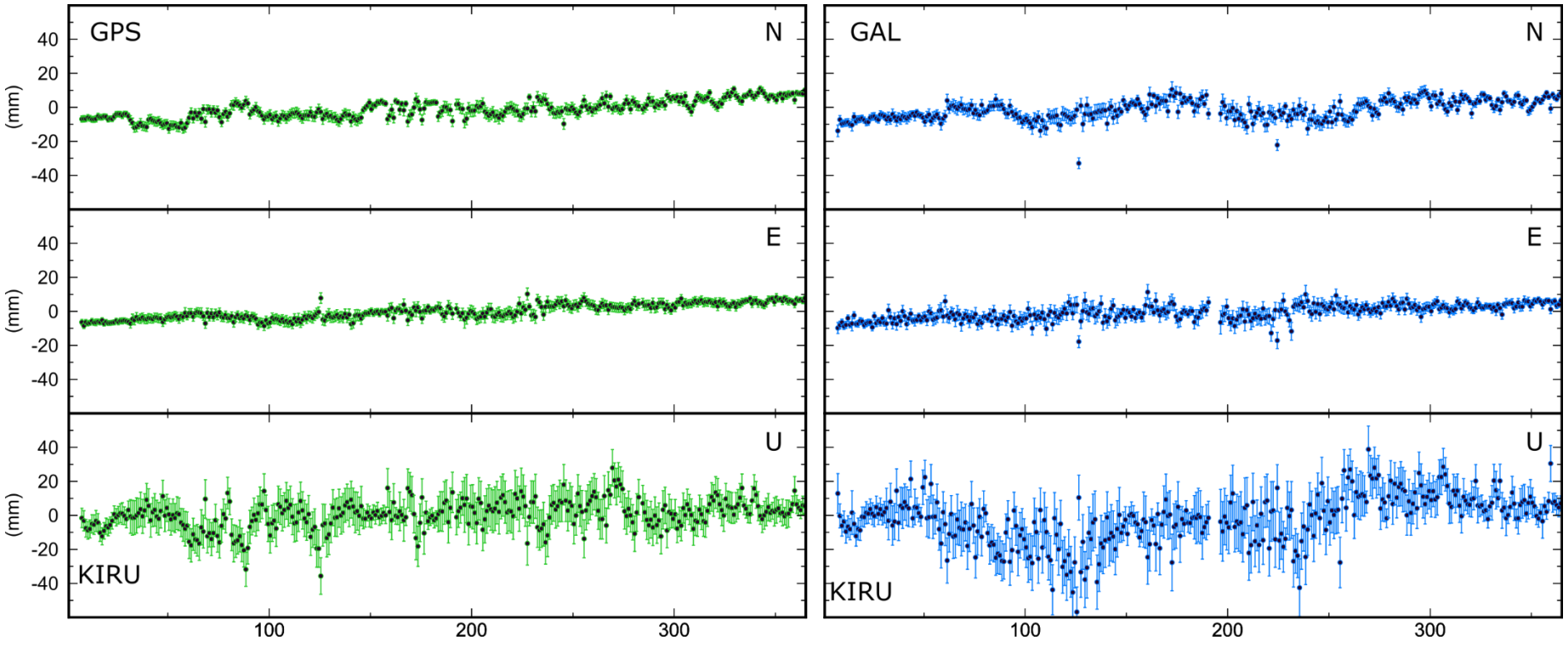
COORDINATE REPEATABILTY



VERTICAL REPEATABILTY 15-20% (1.5 mm) WORSE FOR GAL

COORDINATE REPEATABILTY

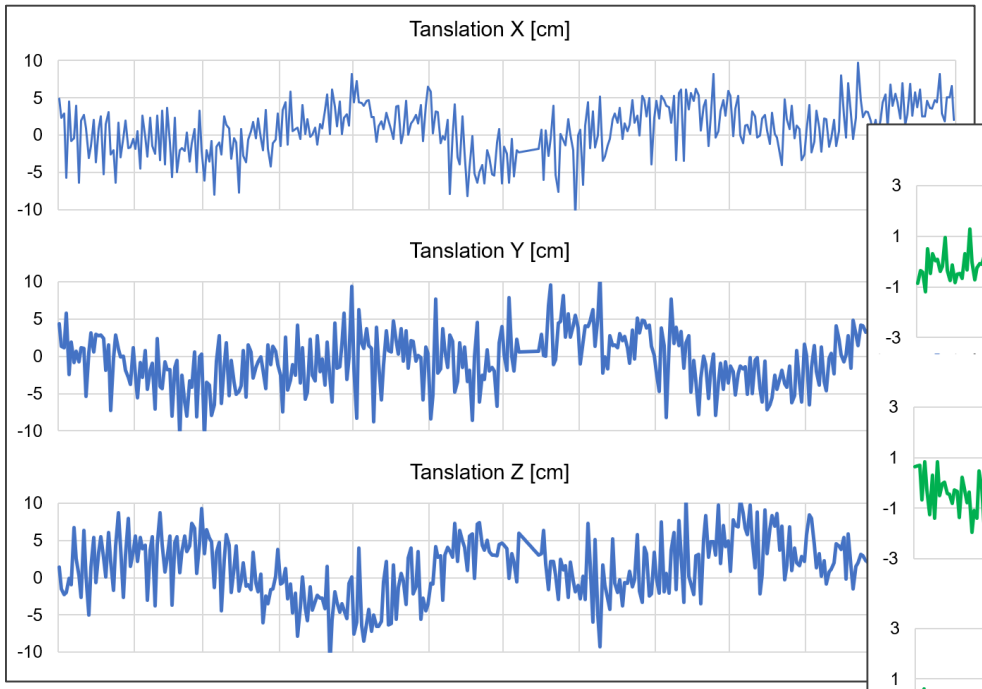
COORDINATE TIME SERIES FOR KIRU00SWE STATION

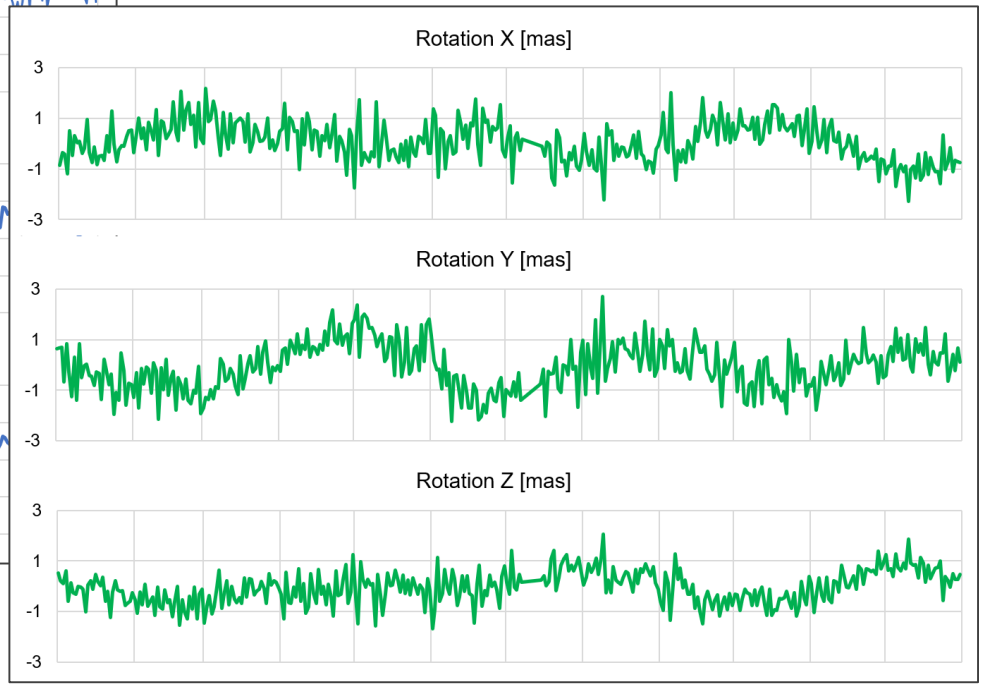


VISIBLE 3CPY TERM IN THE COORDINATE TIME SERIES FOR GAL ...

3CPY TERM IN GALILEO SOLUTIONS

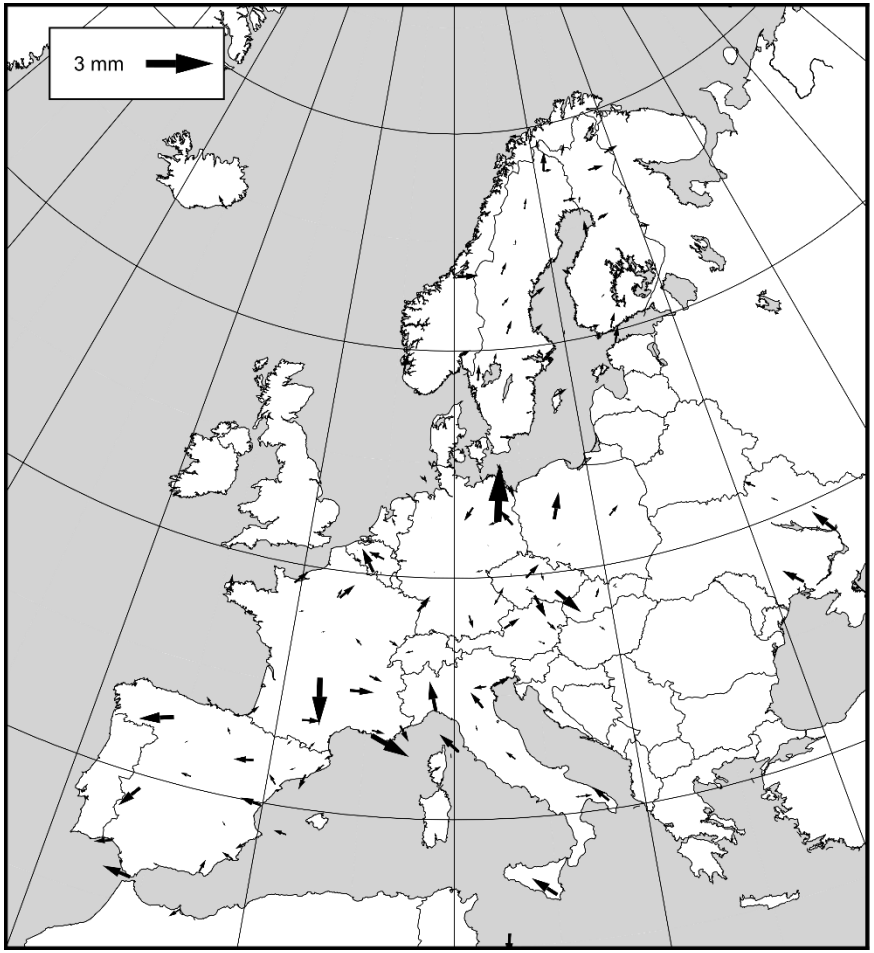
HELMERT TRANSFORMATION PARAMETERS BETWEEN GPS AND GAL

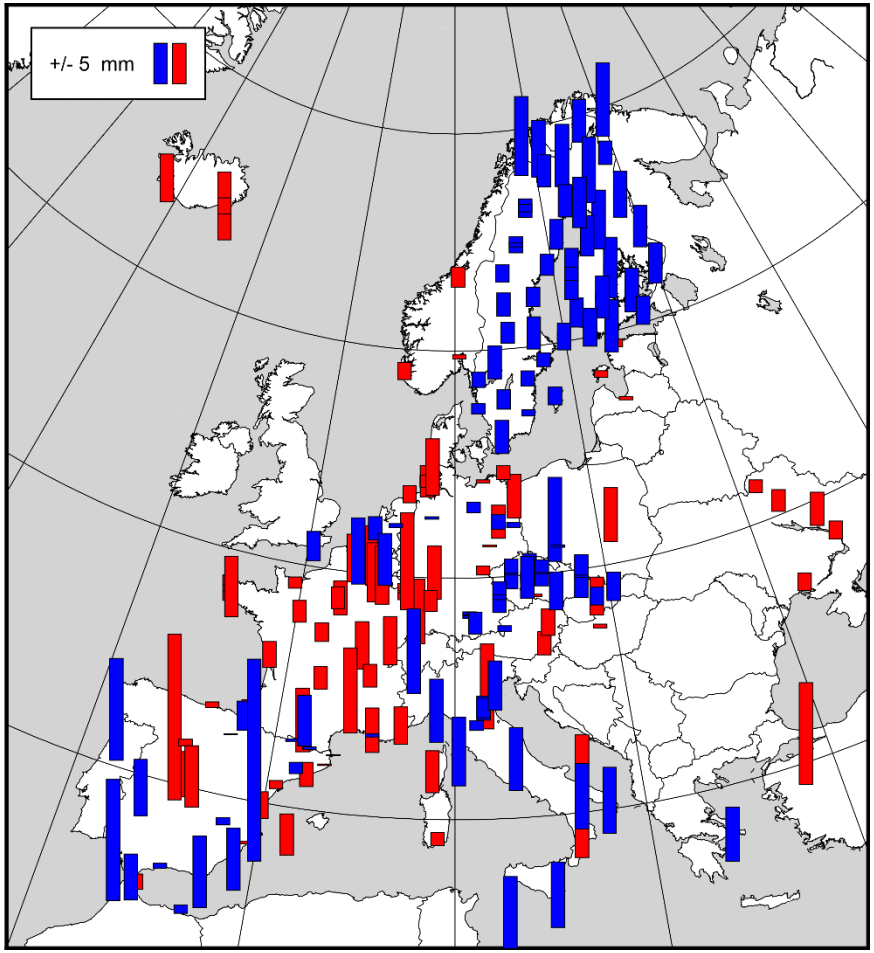




... MORE CLEAR AFTER COMPARISON GPS VS GAL SOLUTIONS

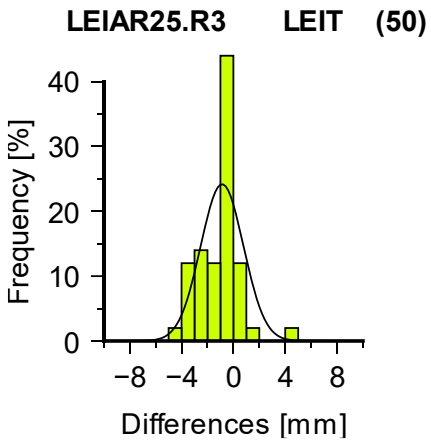
COORDINATE DIFFERENCES BETWEEN **GPS** AND **GAL**

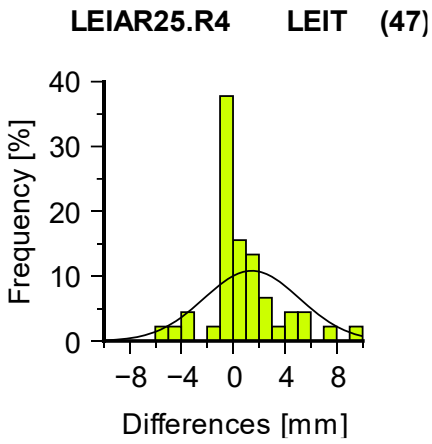


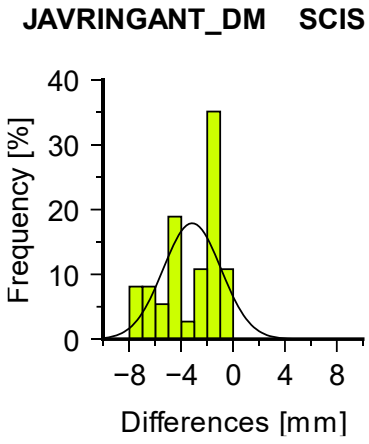


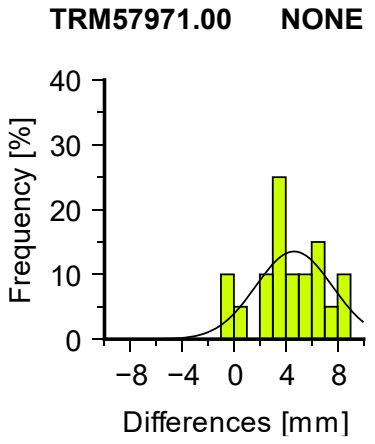
SYSTEMATIC DIFFERENCES SIGNIFICANT ONLY FOR HEIGHTS

COORDINATE DIFFERENCES BETWEEN **GPS** AND **GAL**









- VERTICAL DIFFERENCES RELATED TO THE TYPES OF THE ANTENNA
- E5A SIGNAL MODELLED BY L2 CORRECTION IN ~85% STATIONS MAY CAUSE THIS INCONSISTENCE

ANTENNA DEPENDENT BIAS?

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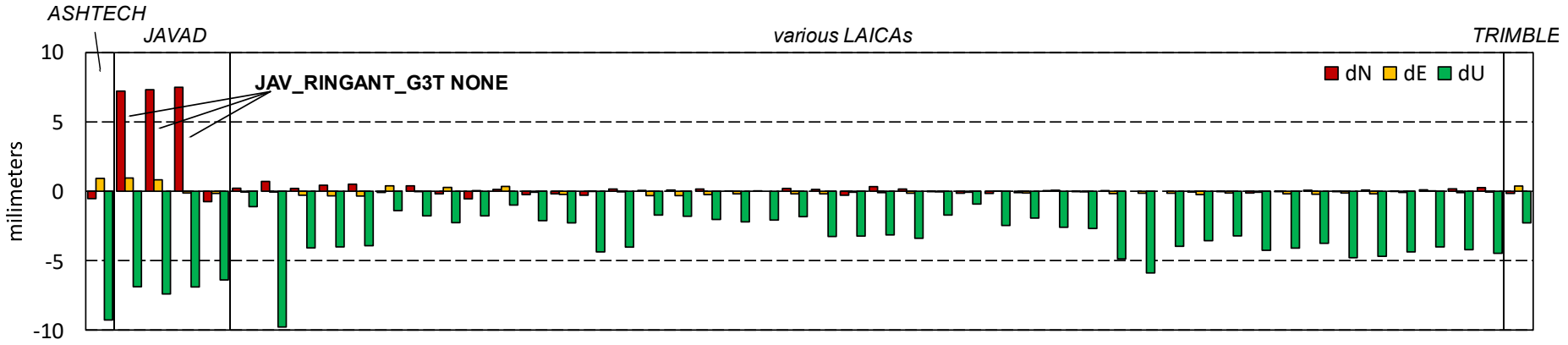
PCO DIFFERENCES BETWEEN G02 AND E05 FOR SELECTED ANTENNAS (IGG UNIV. BONN)

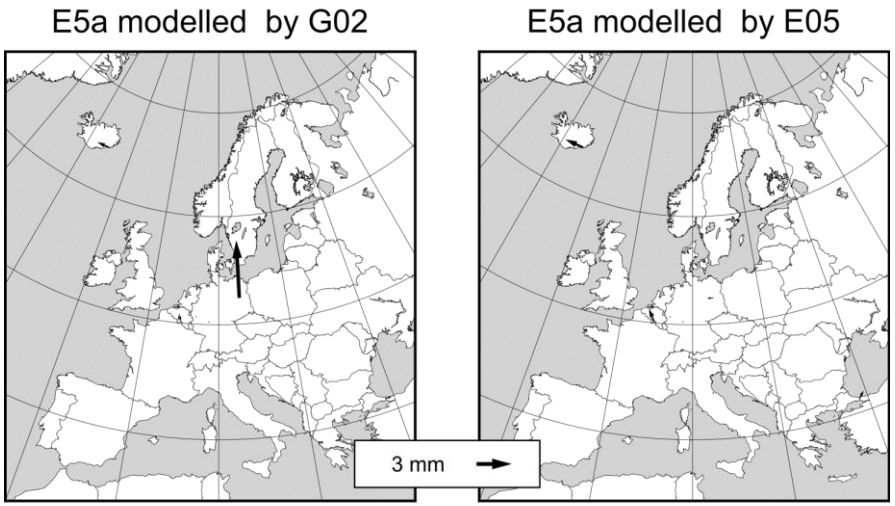


BENCHMARK: TWO GAL SOLUTIONS USING G02(GAL1) OR E05(GAL5) PCO/PCV FOR SELECTED STATIONS (GPS WEEKS 2000-2002)

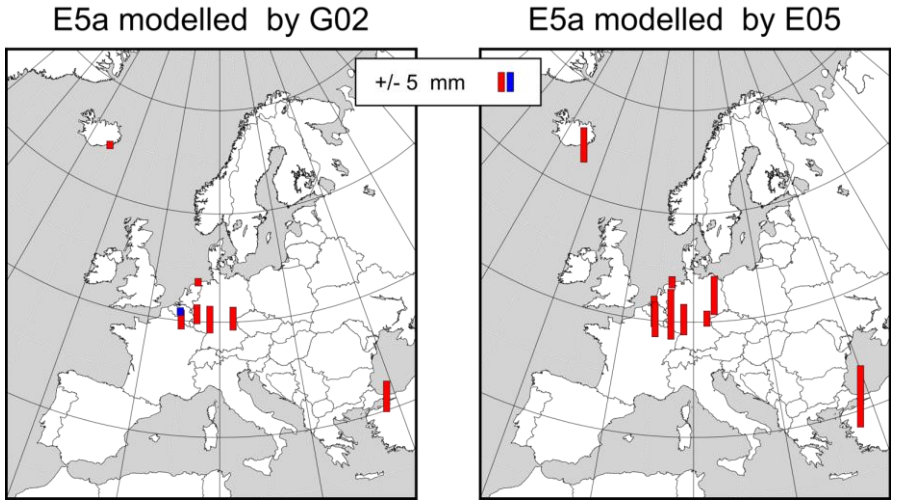
WHAT IS THE IMPACT OF USING G02 INSTEAD OF E05 CORR. FOR E5a?

ANTENNA DEPENDENT BIAS?

COORDINATE DIFFERENCES BETWEEN GPS AND GAL1 AND GAL5 SOLUTIONS



HZ BIAS REMOVED WHEN E05 IS USED



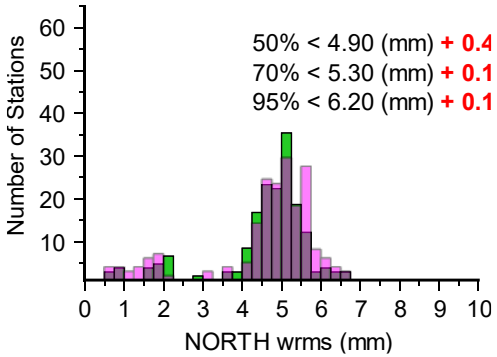
*UP BIASES **INCREASED** WHEN E05 IS USED*

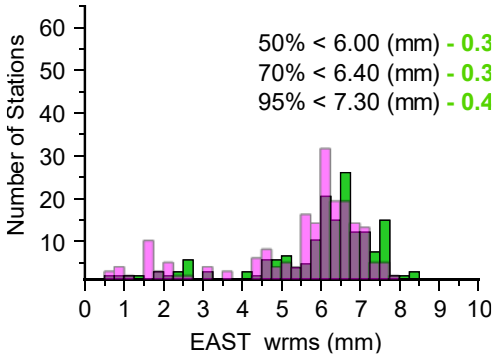
IS IT A GENERAL FEATURE OR RELATED TO SPECYFIC CHAMBER CALIBRATION?

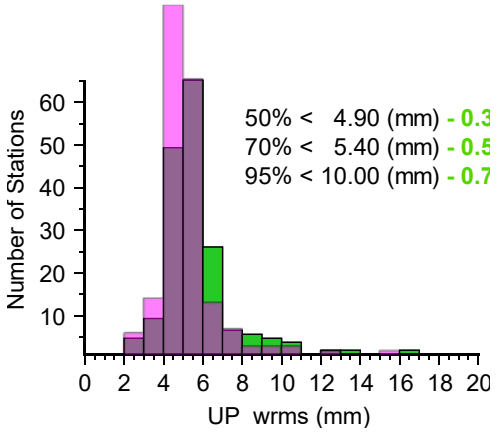
SUMMARY

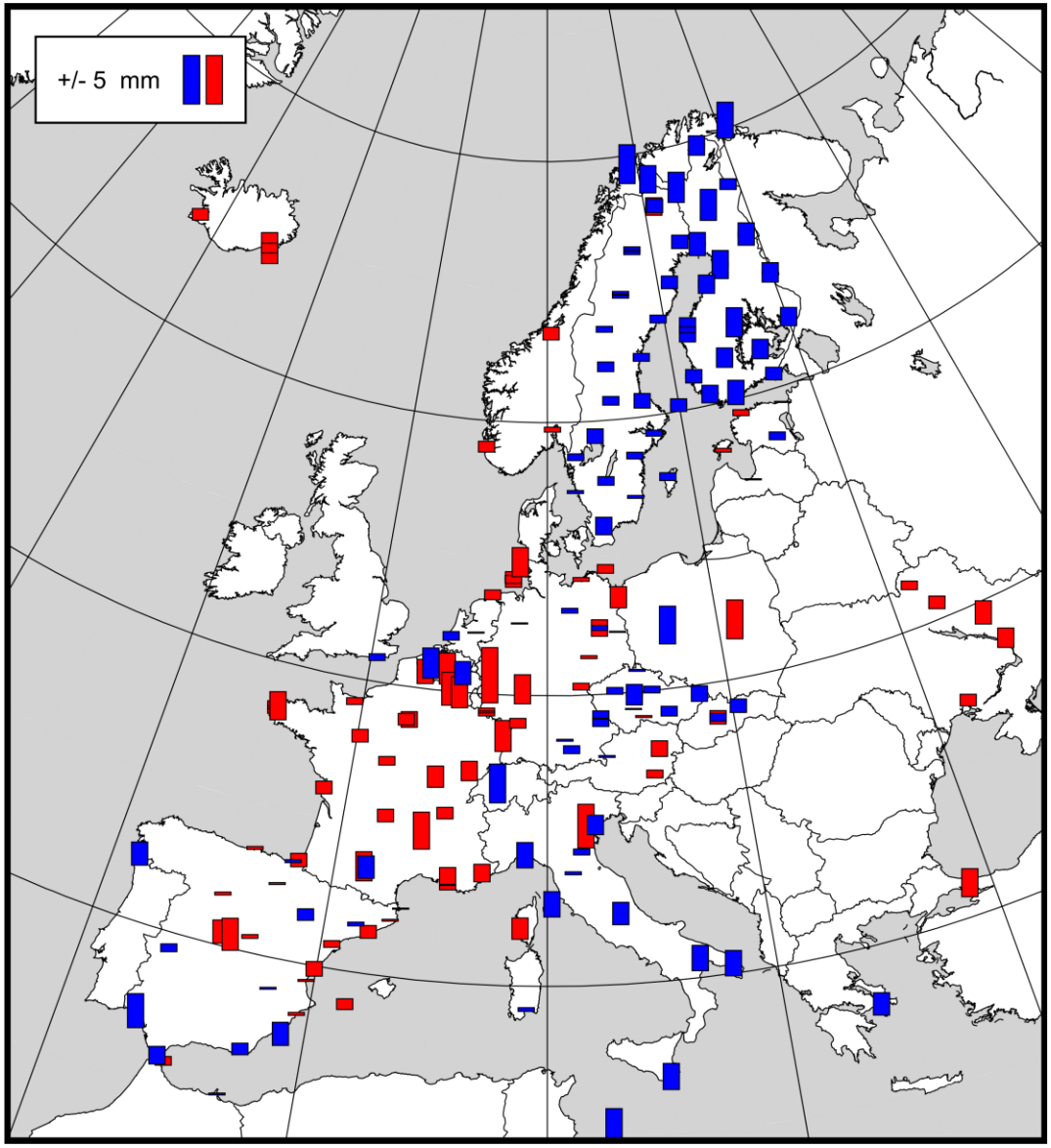
- The quality of the GPS and GAL solutions in term of ambiguity resolution or coordinates repeatability is on the similar good level.
- The agreement in horizontal components between GPS and GAL solutions is very good.
  - Vertical differences vary from **-15.5 to 24.2 mm (std. 4.9 mm)**
  - Better vertical consistency between GPS and GAL solutions when G02 are used instead of E05 for correction E5a signal.
  - Galileo observations introduce 3cpy term to the coordinate time series (under investiation).

GPS+GAL vs GPS ONLY

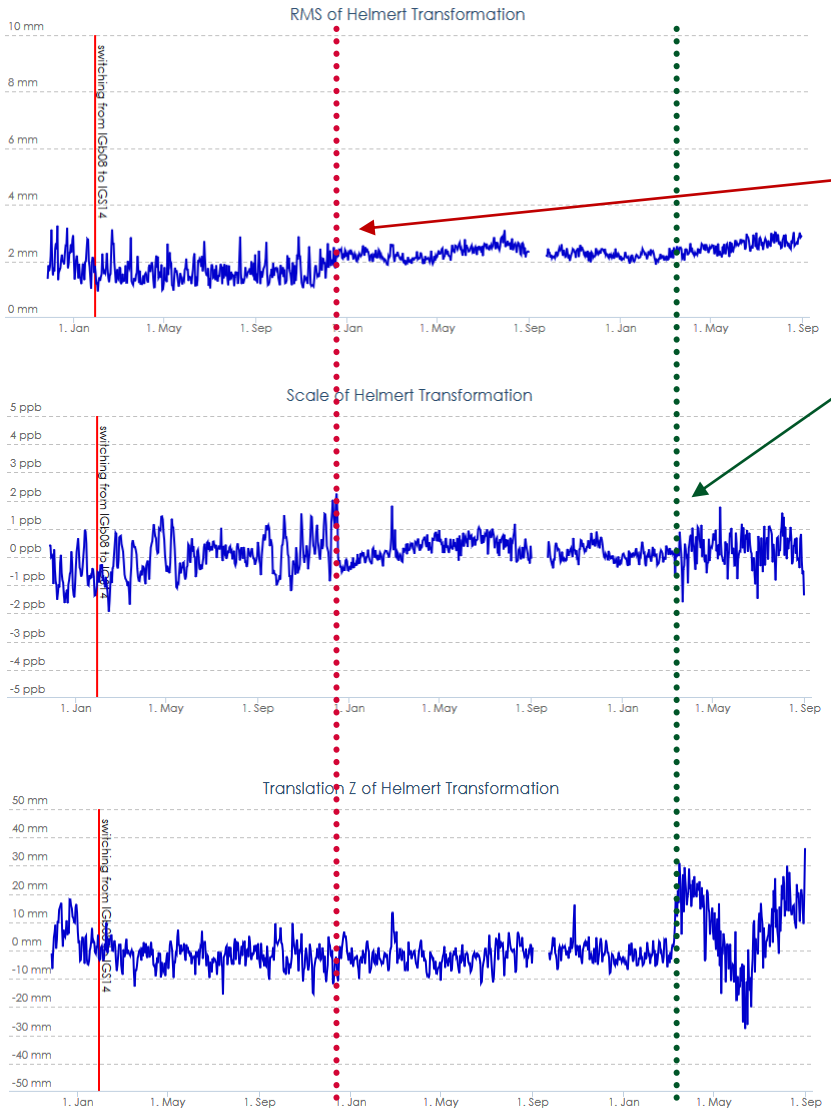








PROCESSING STRATEGY

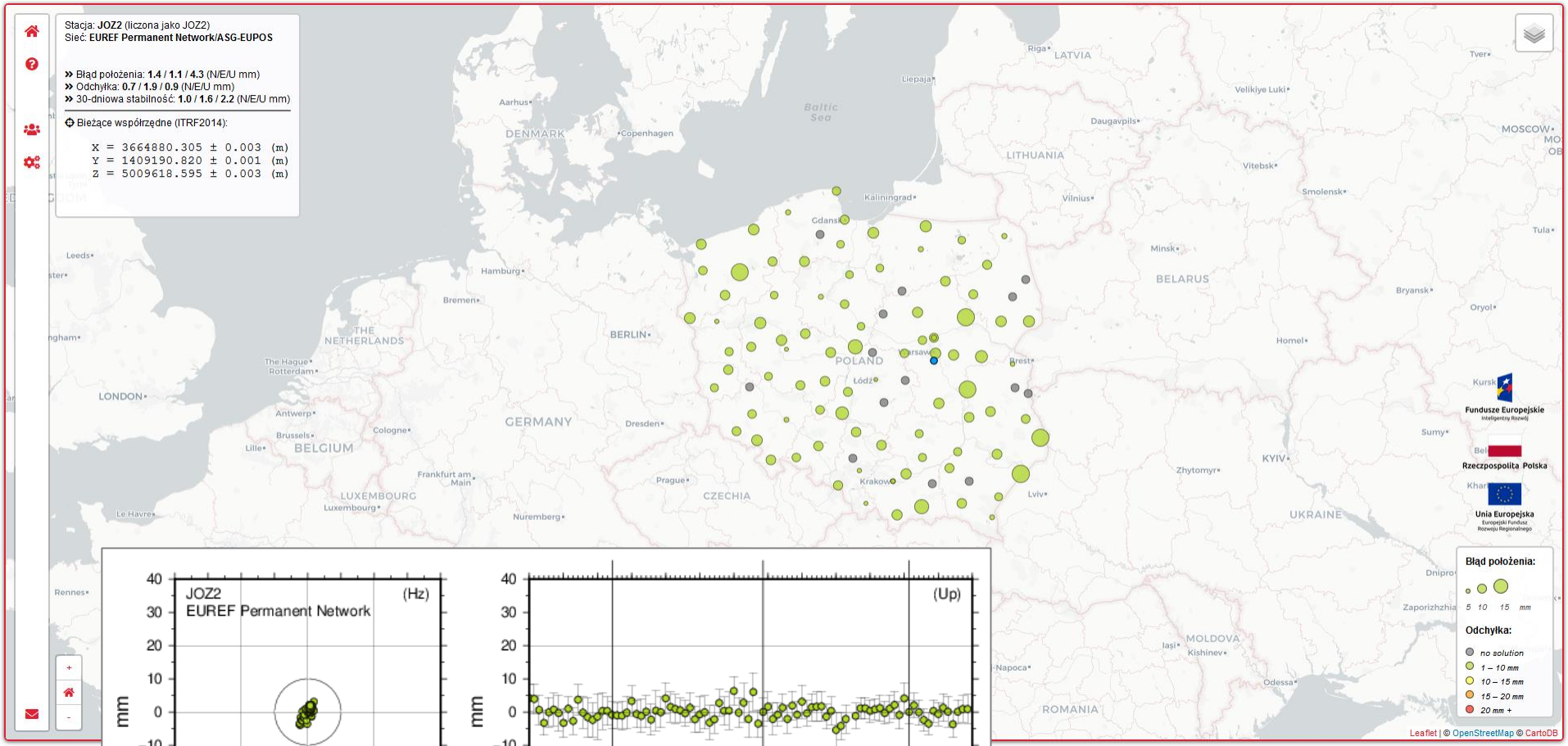


- GAMIT 10.60
- \+ GALILEO (GAMIT 10.71)

3

OTHER ACTIVITIES

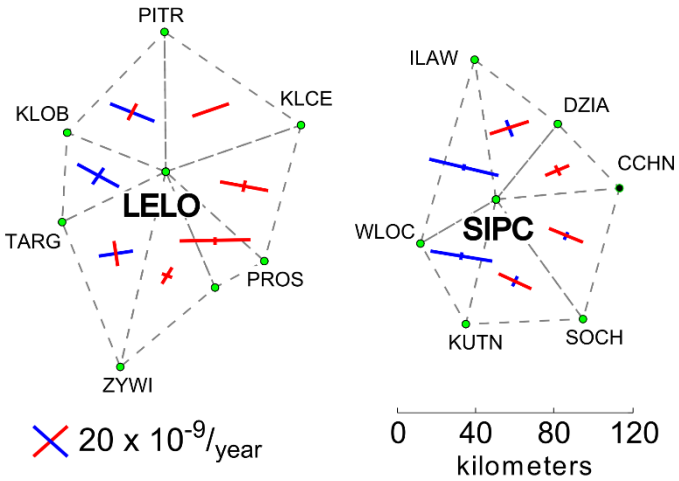
MONITORING THE STABILITY OF THE LOCAL CORS



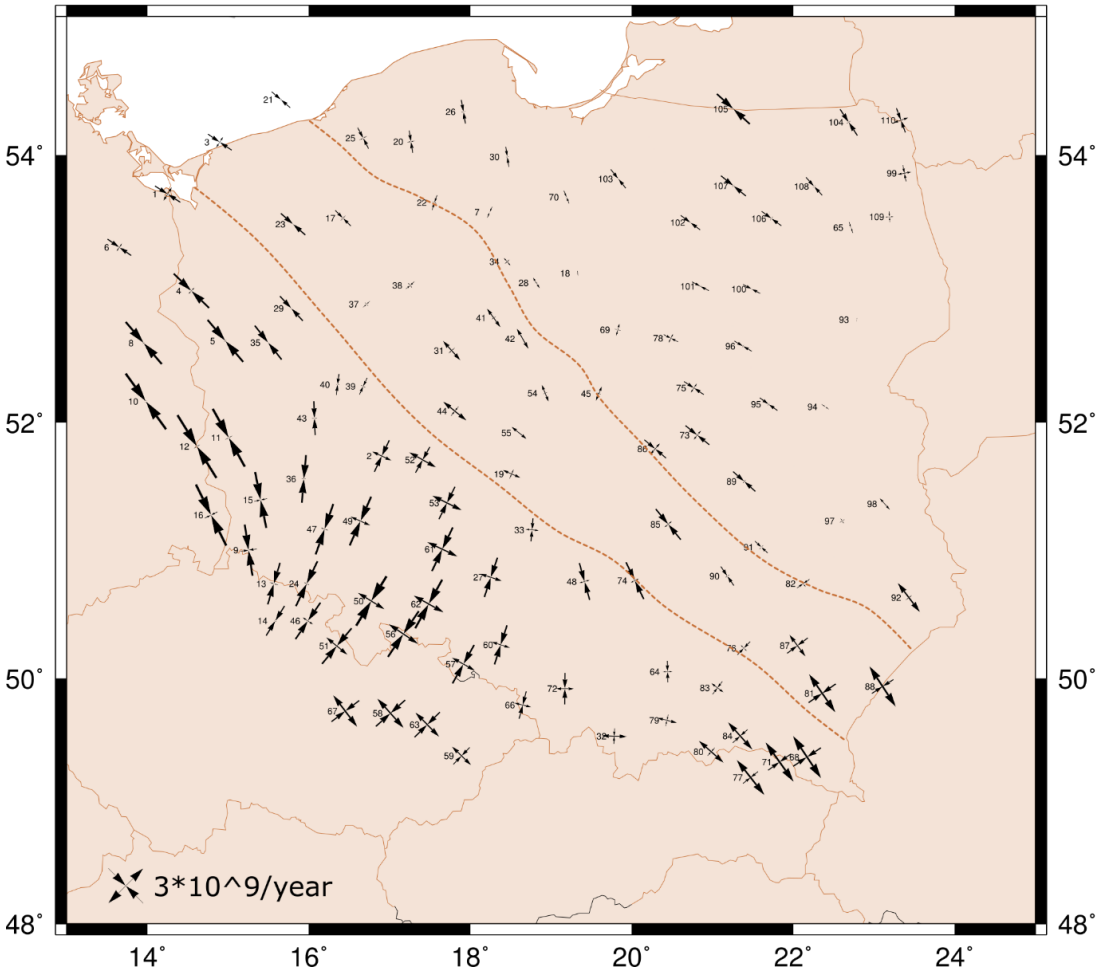
MONITORING THE STABILITY OF THE LOCAL CORS

- 500 STATIONS SO FAR
- PROCESSING STRATEGY IS THE SAME AS FOR EPN CONTRIBUTION;
- ASG-EUPOS REPROCESSING (GPS WEEK 1600-2045) IS DONE;
  - CLEANING IS STILL IN PROGRESS;
  - ROUTINE ANALYSIS READY TO START IN NOV, 2019;
- FIRST REPROCESSING OF ALL DATA SET IS IN PROGRESS (~50%);

GNSS STRAIN RATES FOR STABLE AREA: IS IT WORTH?

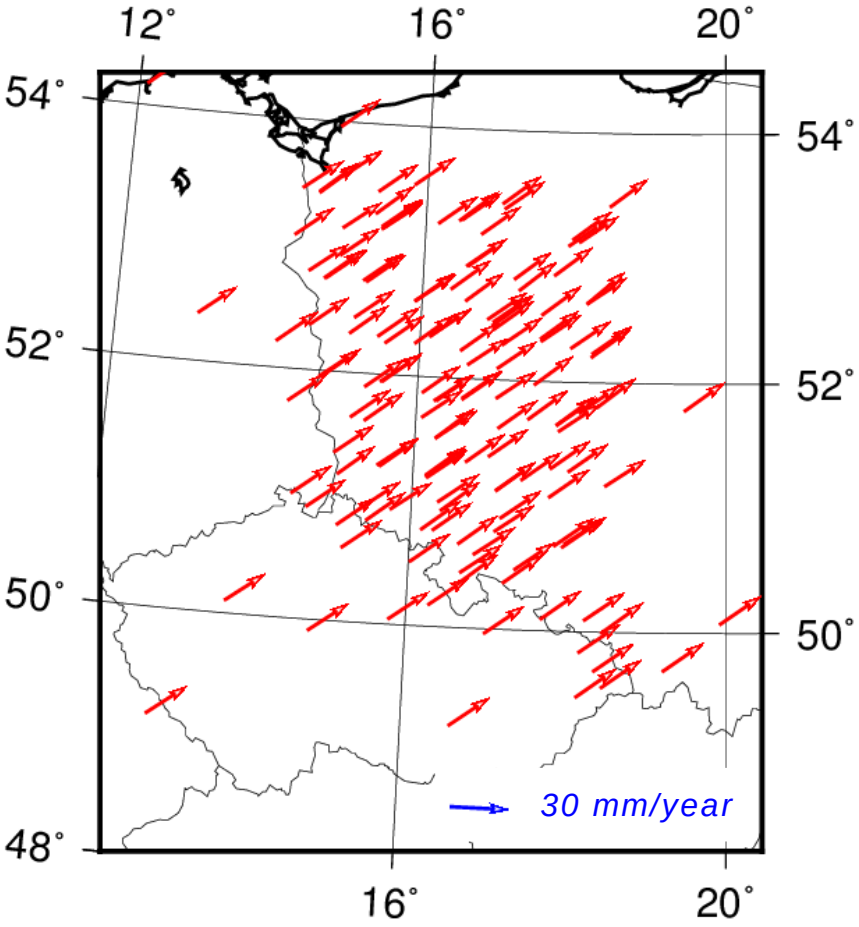


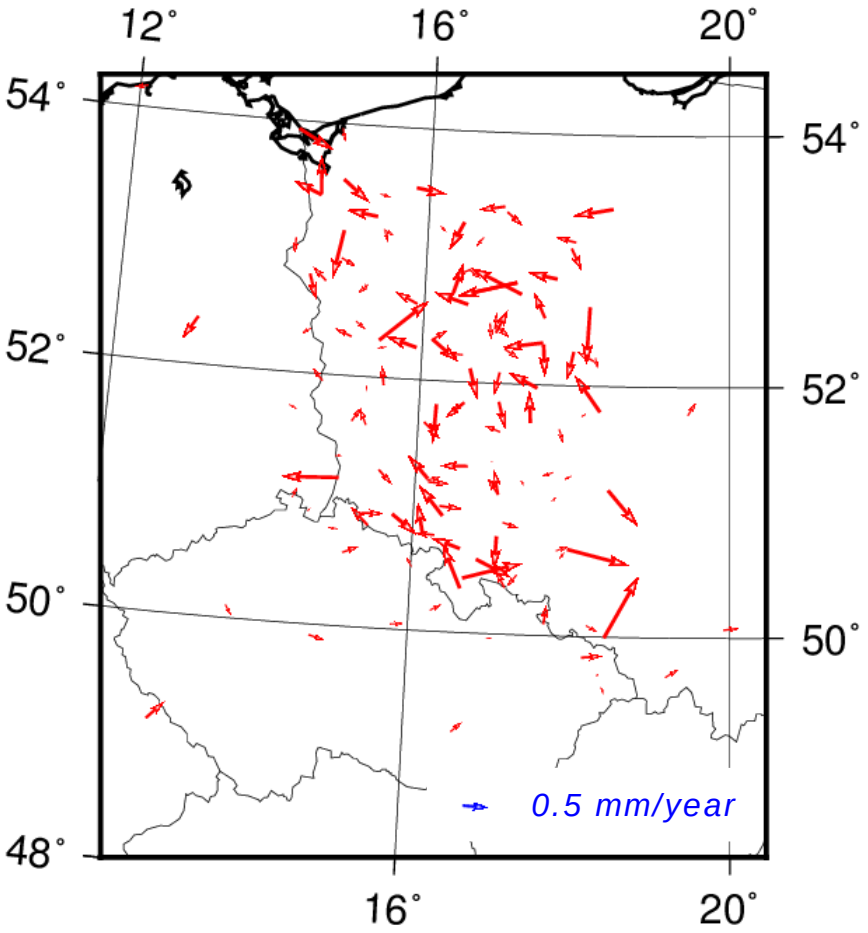
SPECIAL FILTRATION METHOD
FOR STATION ELIMINATION



ARASZKIEWICZ ET AL. (2016)

GNSS STRAIN RATES FOR STABLE AREA: IS IT WORTH?



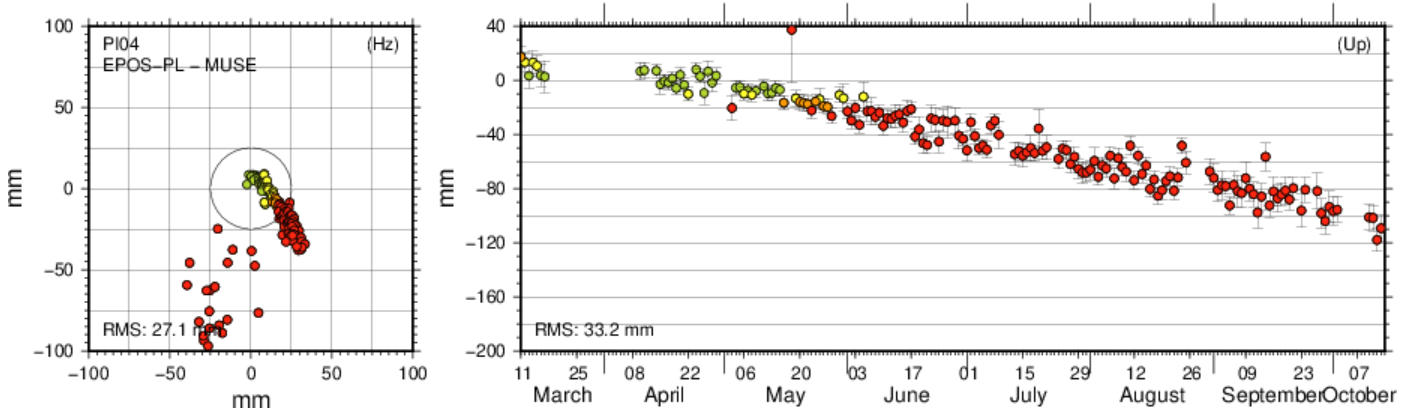


NEW DATA SINCE 2013

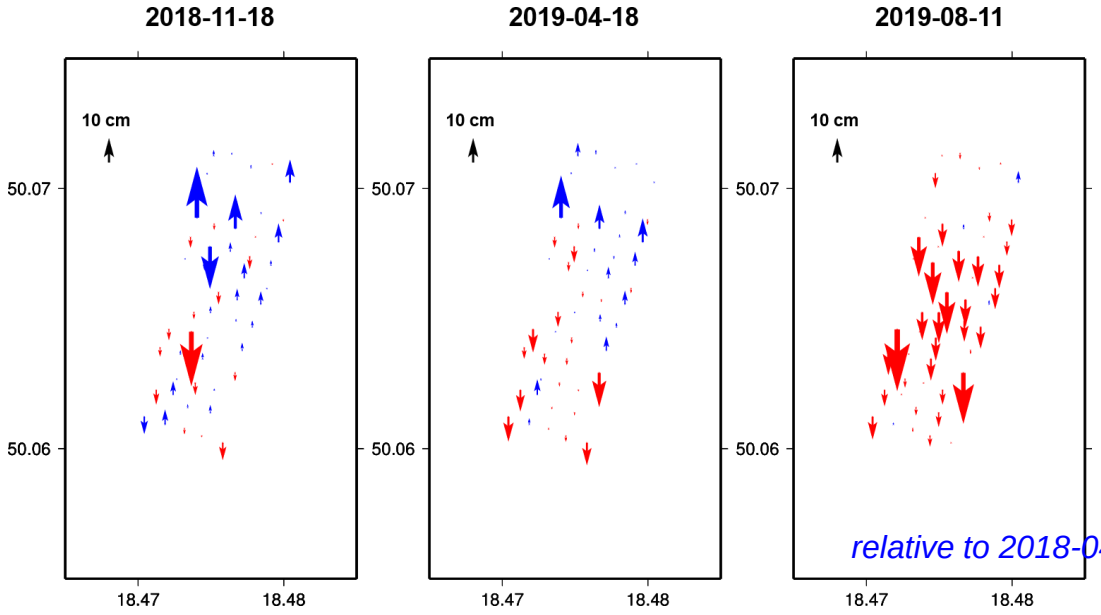
MORE DATA MORE PROBLEMS ...

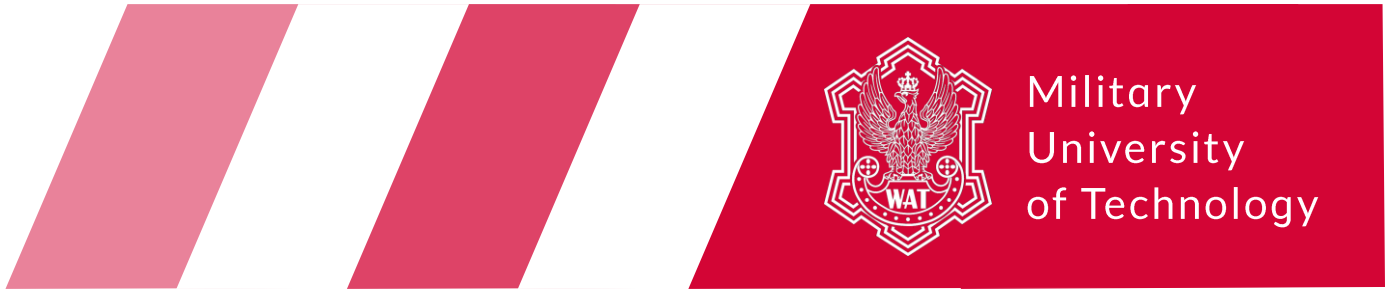
MONITORING THE SUBSIDENCE AT MINING DISTRICT

CONTINUOUS MEASUREMENT:



CAMPAIGNES:





THANK YOU!

The maintenance of MUT AC is financed by the statutory funds (28525/E-410/SPUB/2017/1).

The infrastructure is developed as part of the EPOS-PL project (POIR.04.02.00-14-A003/16-00) co-financed by European Regional Development Found.