WUT EPN analysis centre report

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Contents

This report contains EUREF and EUREF-related activities of the Warsaw University of Technology (WUT) Analysis Centre (AC) during the last 2 years.
The following topics are presented:

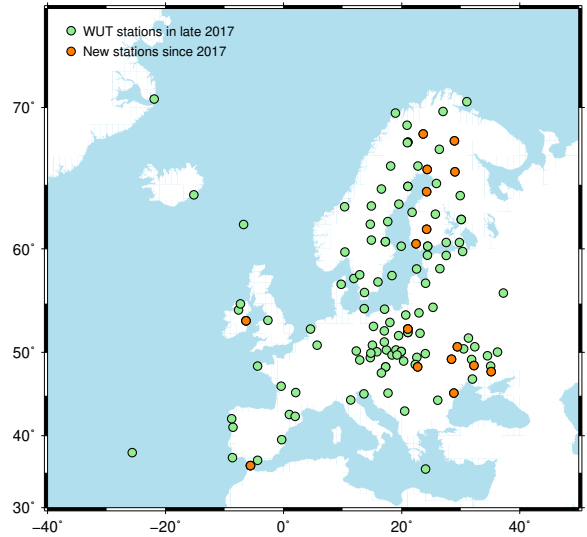
1. Operational analysis:
   - Network characteristics
   - Products
2. Galileo analysis
3. Processing of the WUT subnetwork with global IGS stations
4. Summary and outlook

WUT Products

Currently WUT Analysis Centre (AC) contributes to EPN with the following products:

- Final (since GPS week 861, July 1996)
  - weekly coordinate solutions
  - daily coordinate solutions
  - daily troposphere zenith delays and horizontal gradients
- Rapid (since GPS week 1565, January 2010)
  - daily coordinate solutions

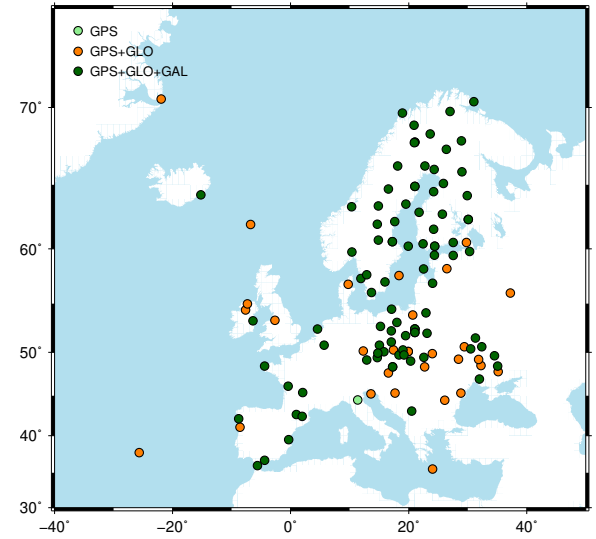
WUT Subnetwork



Network status:

- Presently, 133 EPN stations
- During last 2 years:
  - 17 new stations
  - 3 discontinued

GNSS tracking



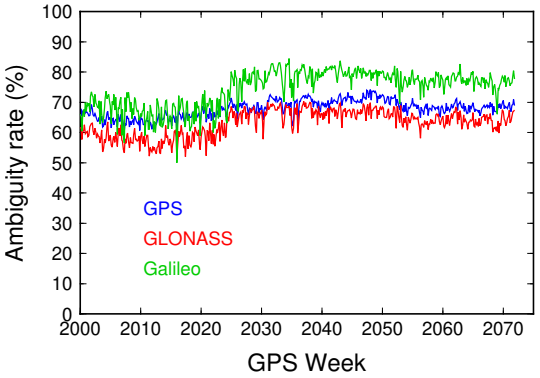
Network status:

- 133 stations:
  - 25% GPS+GLONASS
  - 70% GPS+GLONASS+Galileo

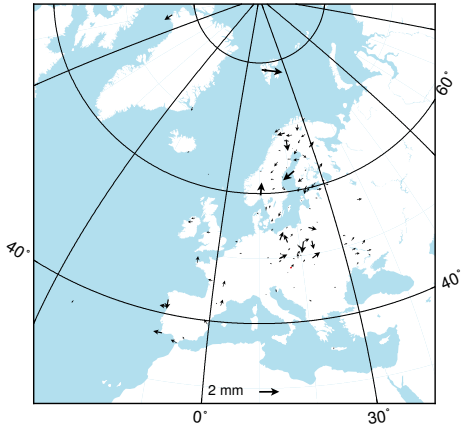
Galileo processing

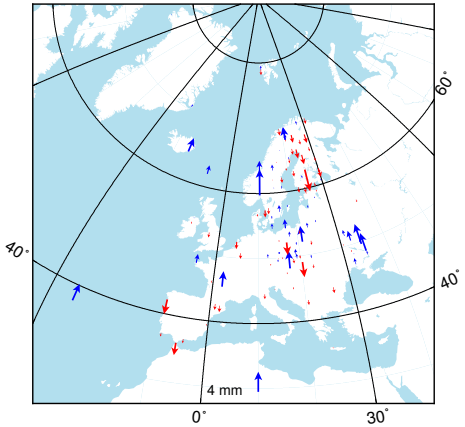
- Galileo processing started at WUT in November 2018,
- Test solutions generated for the period 2000–2043,
- Since week 2044, Galileo observations are included in WUT operational solutions to the EPN.

Ambiguity resolution rate



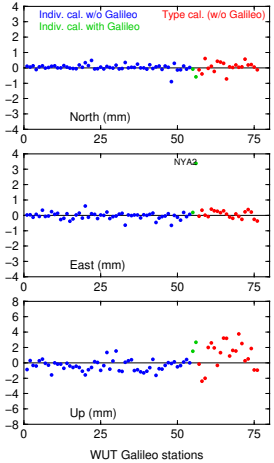
Coordinate differences, example for week 2035, day 0





Mean position differences

Mean position differences between test solutions with Galileo and operational (GPS+GAL) solutions.



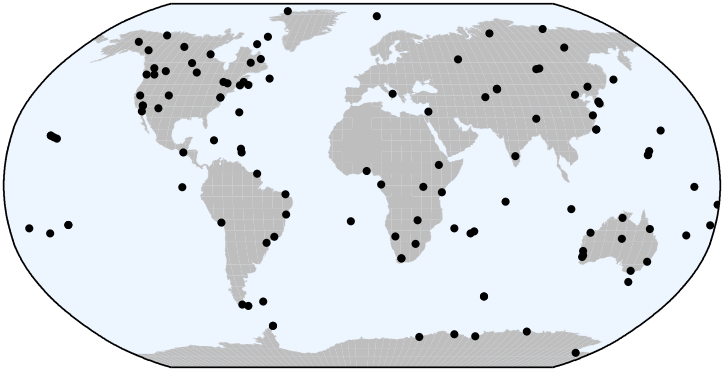
Extension of WUT subnetwork with global stations

- The activities on processing of our subnetwork with global IGS stations has been started.
- The purpose of this work is to analyze the impact of adding global stations on station coordinates of our subnetwork.

Global analysis

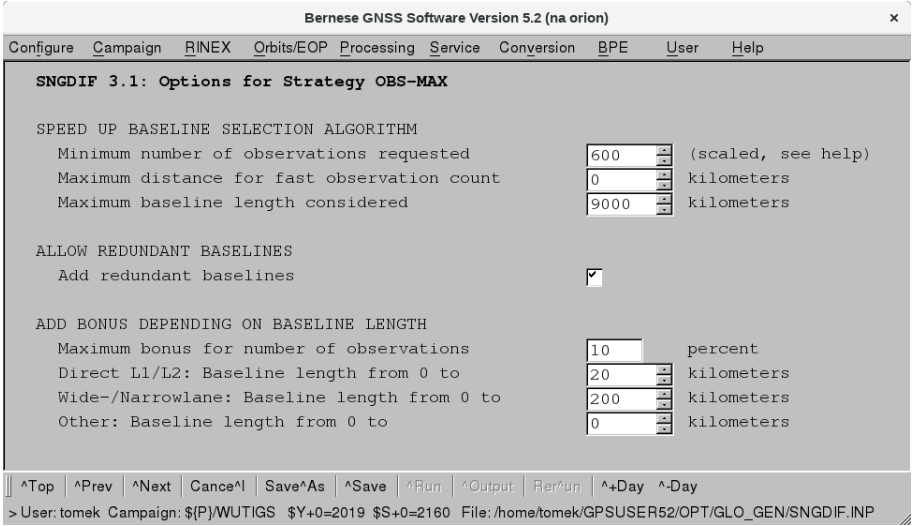
- 118 global IGS stations added to the WUT subnetwork ($\sim$ 250 stations processed in total)
- processing performed using Bernese GNSS Software
- processing basically based on RNX2SNX.PCF, but some changes done:
  - redundant baselines added
  - Helmert tranformations in global frame
- no orbit determination, EOPs not estimated
- stations divided into 3 clusters (the same as CODE uses for IGS analysis)
- only GPS and GLONASS observations used
- up to now, WUT global daily solutions were computed for the period 1980–2057 (78 weeks).

Chosen IGS14 stations

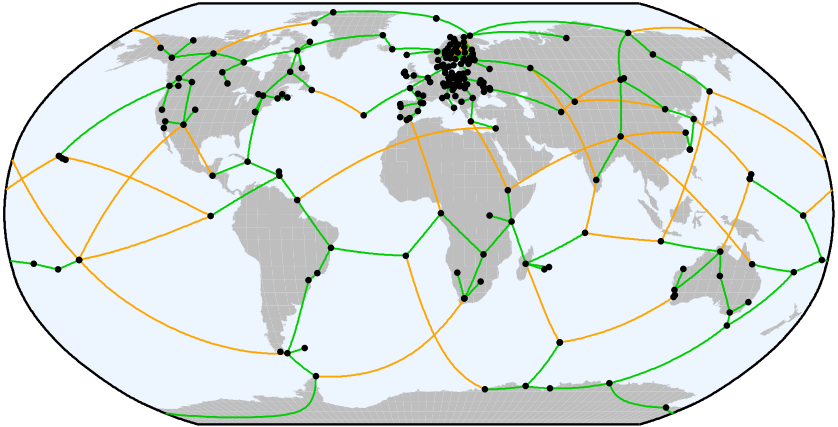


118 IGS14 reference stations added to the WUT subnetwork

Baselines creation – redundant baselines



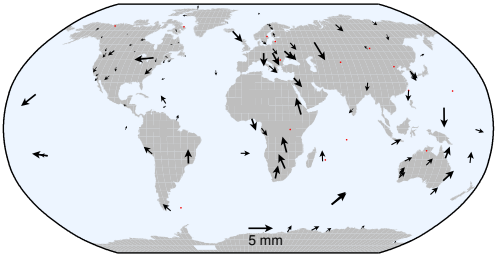
Baselines creation

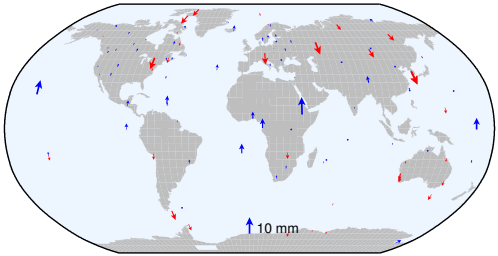


in orange: redundant baselines

Comparison with CODE solutions – position differences

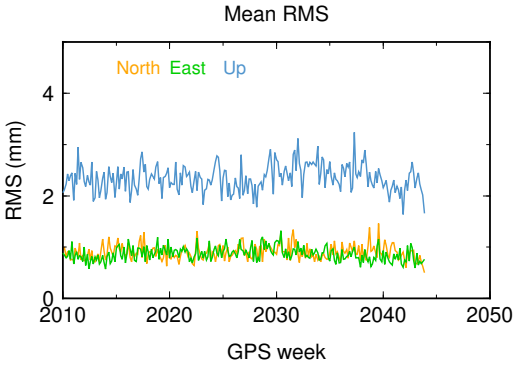
Station position differences between CODE solution and WUT solution with global stations (week 2034, day 5)





RMS: $N = 1.07$ mm, $E = 0.76$ mm, $U = 2.51$ mm

Comparison with CODE solutions – RMS of position differences



Mean RMS: $N = 0.90$ mm, $E = 0.86$ mm, $U = 2.34$ mm

Summary

- Galileo observations have been included in WUT operational solutions since week 2044
  - mean position differences were below 1 mm for horizontal components, and up to 4 mm for the vertical component,
- New solutions with global IGS stations were generated to analyze the impact of adding global stations on station positions
  - good consistency with CODE IGS solutions (1 mm for horizontal components, 2–3 mm for the vertical component).