



# GNSS ANALYSIS AT GFZ

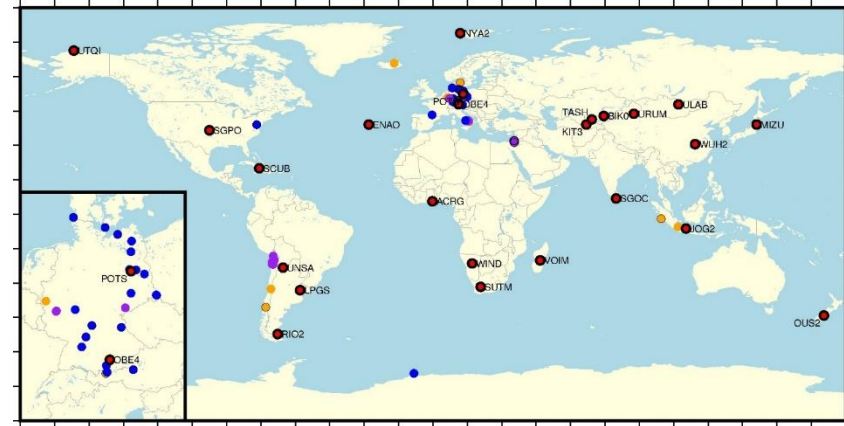
Benjamin Männel

German Research Centre for Geosciences, Potsdam

# Contribution to the IGS

Station network (25 stations with global coverage)

-  All data and products are referenced via DOIs
-  distribution via GFZ ISDC, FTP, external data centers



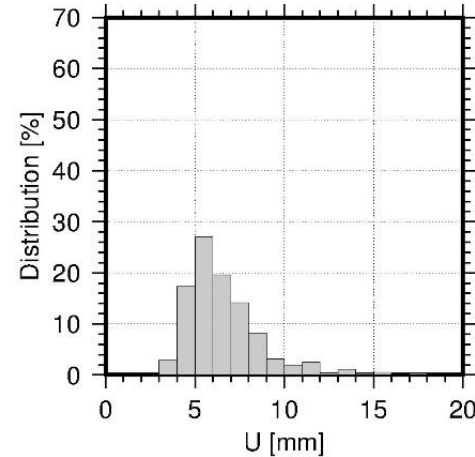
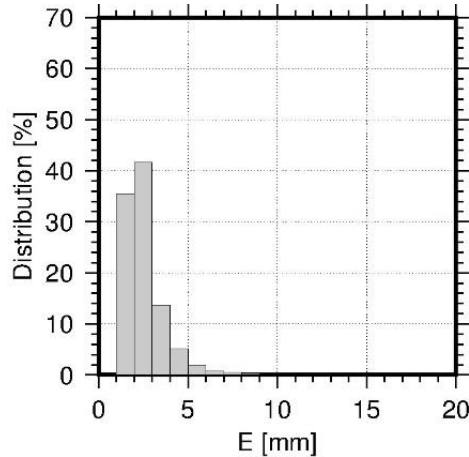
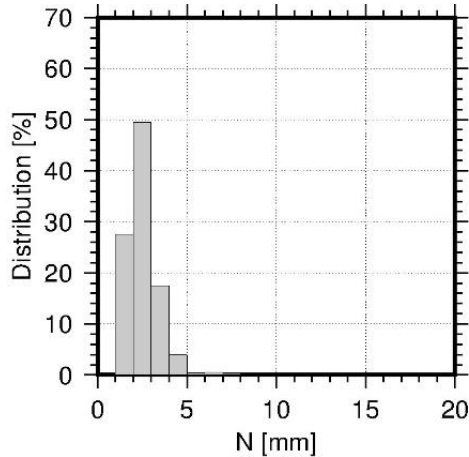
Operational GNSS products provided to the International GNSS Service

| Product                     | Ultra-rapid line | Rapid line | Final line | MGEX  | Repro3       |
|-----------------------------|------------------|------------|------------|-------|--------------|
| Availability                | every 6h         | daily      | weekly     | daily | reprocessing |
| Systems                     | GRE              | GRE        | GR         | GRECJ | GRE          |
| Satellite orbits            | X                | X          | X          | X     | X            |
| Satellite clock corrections |                  | X          | X          | X     | X            |
| Station coordinates         |                  |            | X          |       | X            |

# Processing software

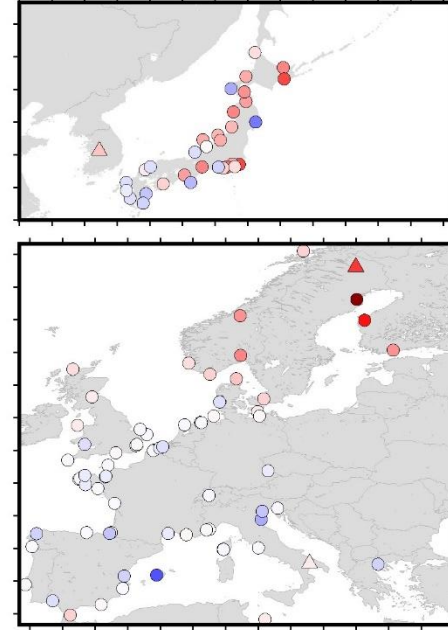
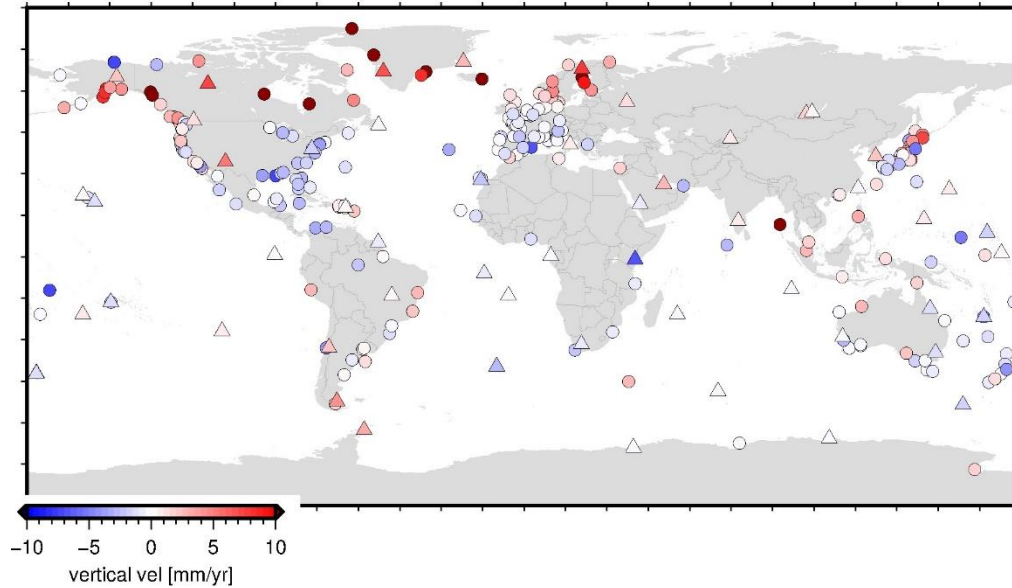
- GNSS processing package EPOS.P8 developed at GFZ (Potsdam)
- Used for all operational processing
  - IGS legacy, IGS MGEX, IGS TIGA, Galileo-related projects
  - GNSS processing for GFZ observatories + geodynamic investigations
- Capable to handle GPS, GLONASS, Galileo, BeiDou, QZSS
- Consistent with current IERS 2010 Conventions / repro3 models
- Software core is programmed in Fortran 77 / 90 and Perl
- Processing modes:
  - Network with and without orbit determination
  - PPP
  - SLR orbit validation
- RINEX toolbox: gfzrnx (<https://gnss.gfz-potsdam.de/services/gfzrnx>)

- Full reprocessing of GNSS data 1994 and 2020 including GPS, GLONASS, Galileo
- Consistent set of satellite orbits and clocks, station coordinates, Earth rotation parameters
- Advanced set of products troposphere delay and gradients, satellite attitude, biases
- 332 stations, 132 satellites (G:67, R:39, E:26), extended for 2021 + 2022



 Männel et al., 2020 (IAGS), data are available via <https://doi.org/10.5880/GFZ.1.1.2021.001>

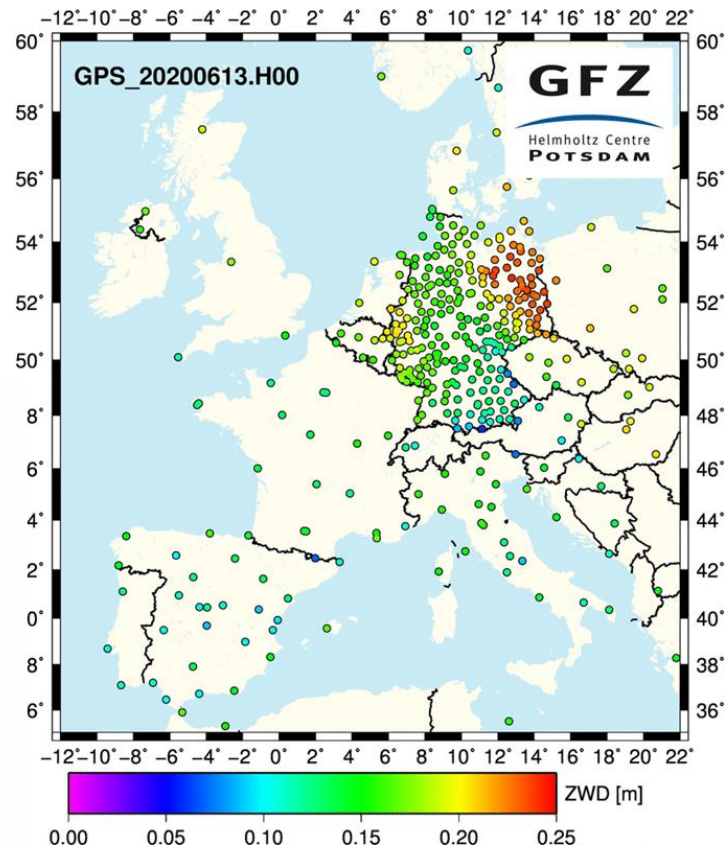
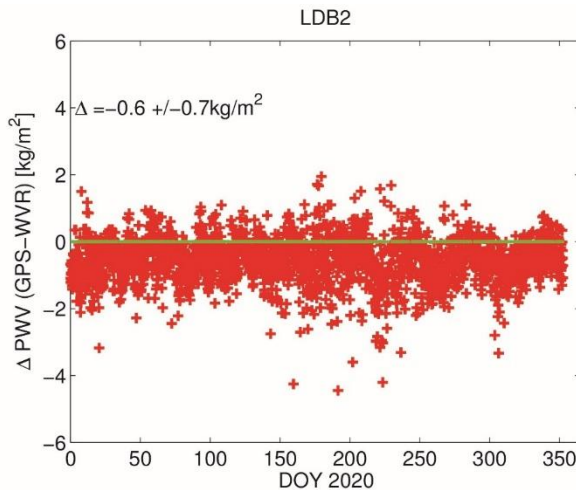
# TIGA3 repro: vertical land motion



- Coordinate RMS: N= 2.9 mm, E= 3.3 mm, U= 5.6 mm
- ALTIGAPS/ULR5 solution: offset  $0.04 \pm 0.1$  mm/yr, RMS 1.7 mm/yr (137 stations)
- ULR6a solution: offset  $0.1 \pm 0.1$  mm/yr, RMS 1.7 mm/yr
- doi Männel et al., 2022 (IAGS); data available via <https://doi.org/10.5880/GFZ.1.1.2022.001>

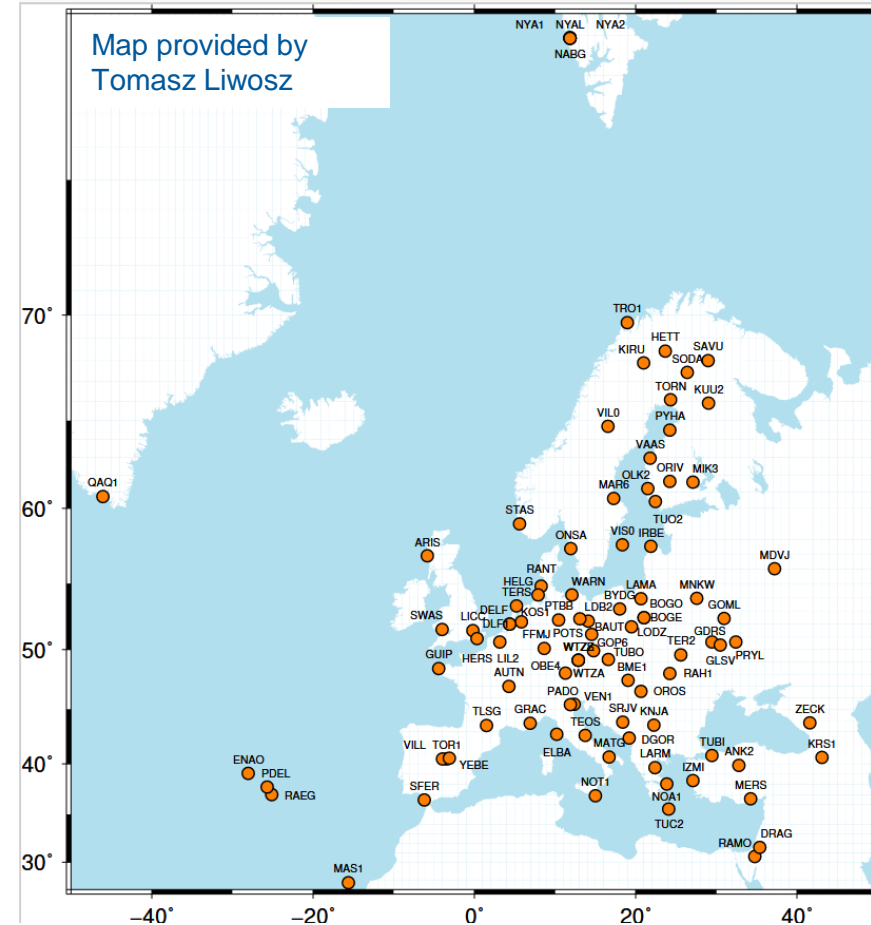
# GFZ troposphere products

- Operational PPP setup (every hour, sliding window of 24h): estimation of ZTD/IWV, STD, gradients
- Germany: SAPOS, BKG, GFZ stations (including stations at DWD sites)
- Global: selected IGS, EPN, GRUAN stations
- GRUAN: GCOS Reference Upper-Air Network: 30 meteorological sites including frequent radiosonde measurements and GNSS



# GFZ as EPN Analysis Center

- GFZ as upcoming EPN AC (repro + operational)
- EPOS.P8 will be used for GNSS processing
- Setup of configuration for weekly solutions started, test solutions will be submitted during November







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