Federal Agency for
Cartography and Geodesy

EPN Real-Time Special Project – Status Report

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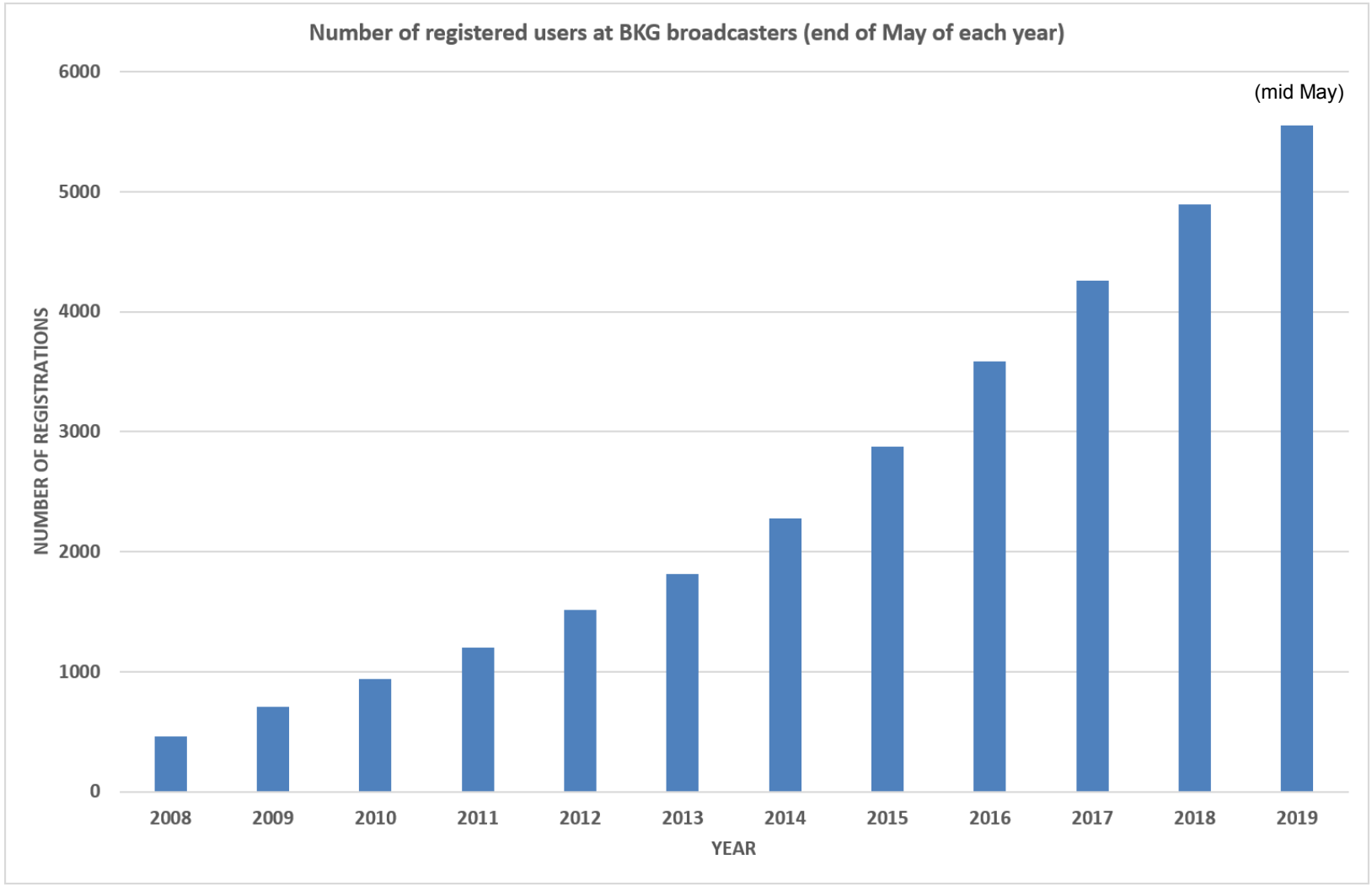
Content

- Usage of RT data and products
- What‘s new in the IGS RTWG?
- Real-Time Data
  - Long mountpoint names (observations)
- Real-Time Products
  - Long mountpoint names (products)
- Real-Time applications
  - Troposphere parameter estimation
  - Maritime kinematic application

BKG regional and global broadcaster - registration



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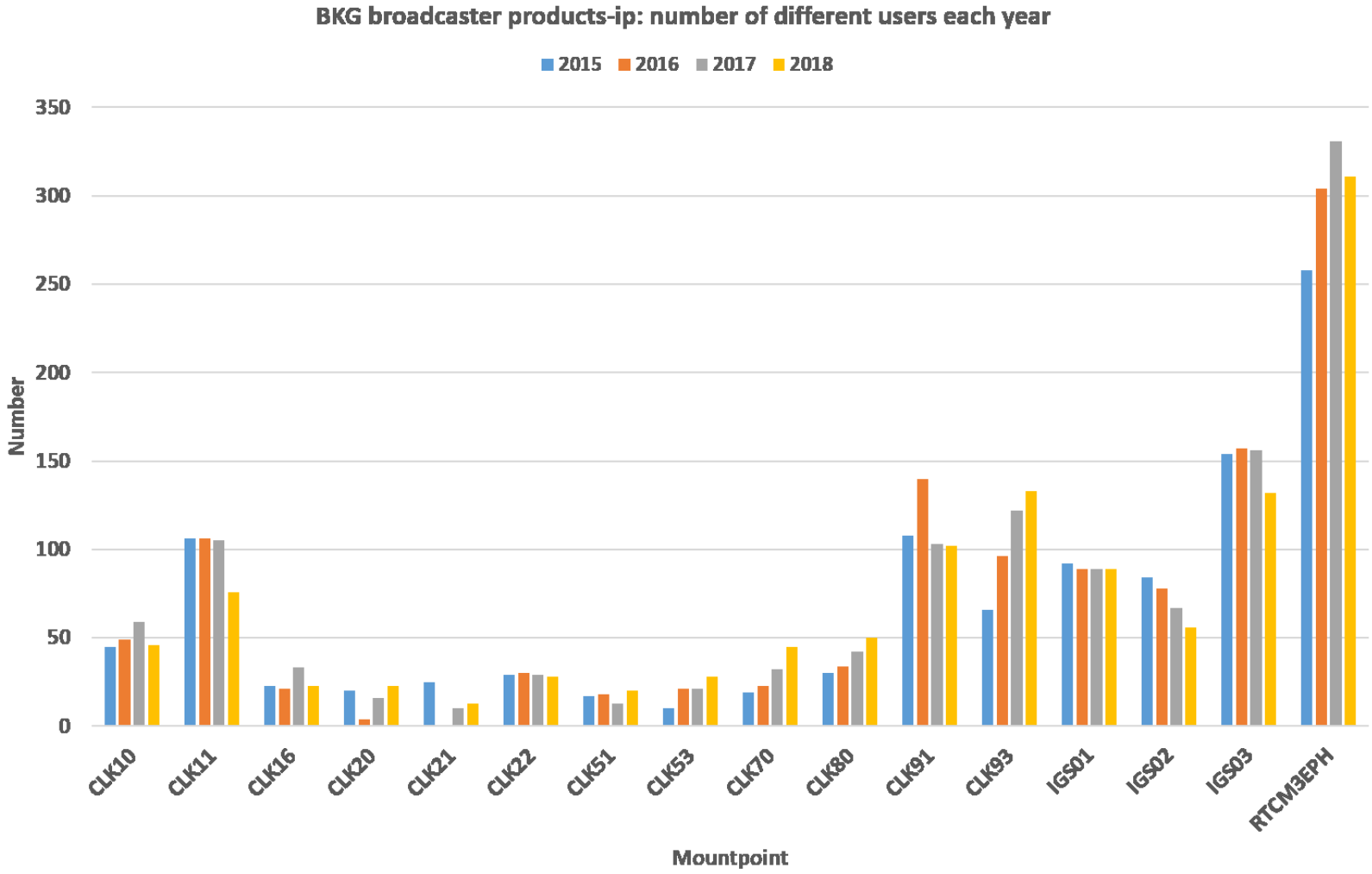
BKG regional and global broadcaster - usage



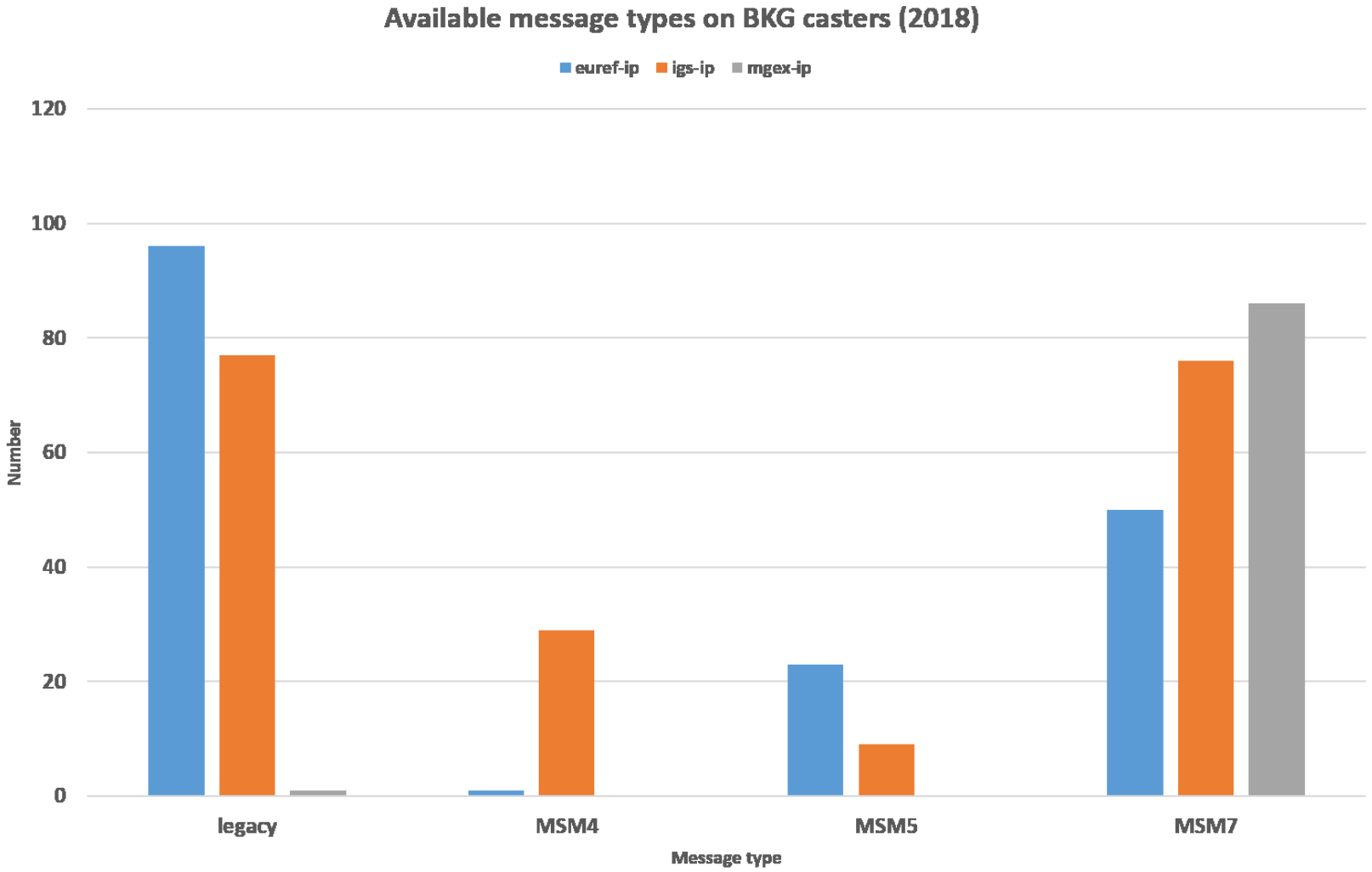
IGS Real-Time WG

- Since 12/2018: new WG chair André Hauschild (DLR)
- Main topics
  - Receiver-generated RTCM MSM streams
  - Long vs. short mountpoint names (observations)
  - Long mountpoint names (products)
  - Update of sourcetable elements
  - Progress concerning SSR
  - Validation of ephemerides
  - Structure of IGS broadcasters
  - RT aspects in site logs
  - Long-term preservation of RT orbit and clock corrections in file formats
  - Multi-GNSS ultra-rapid products

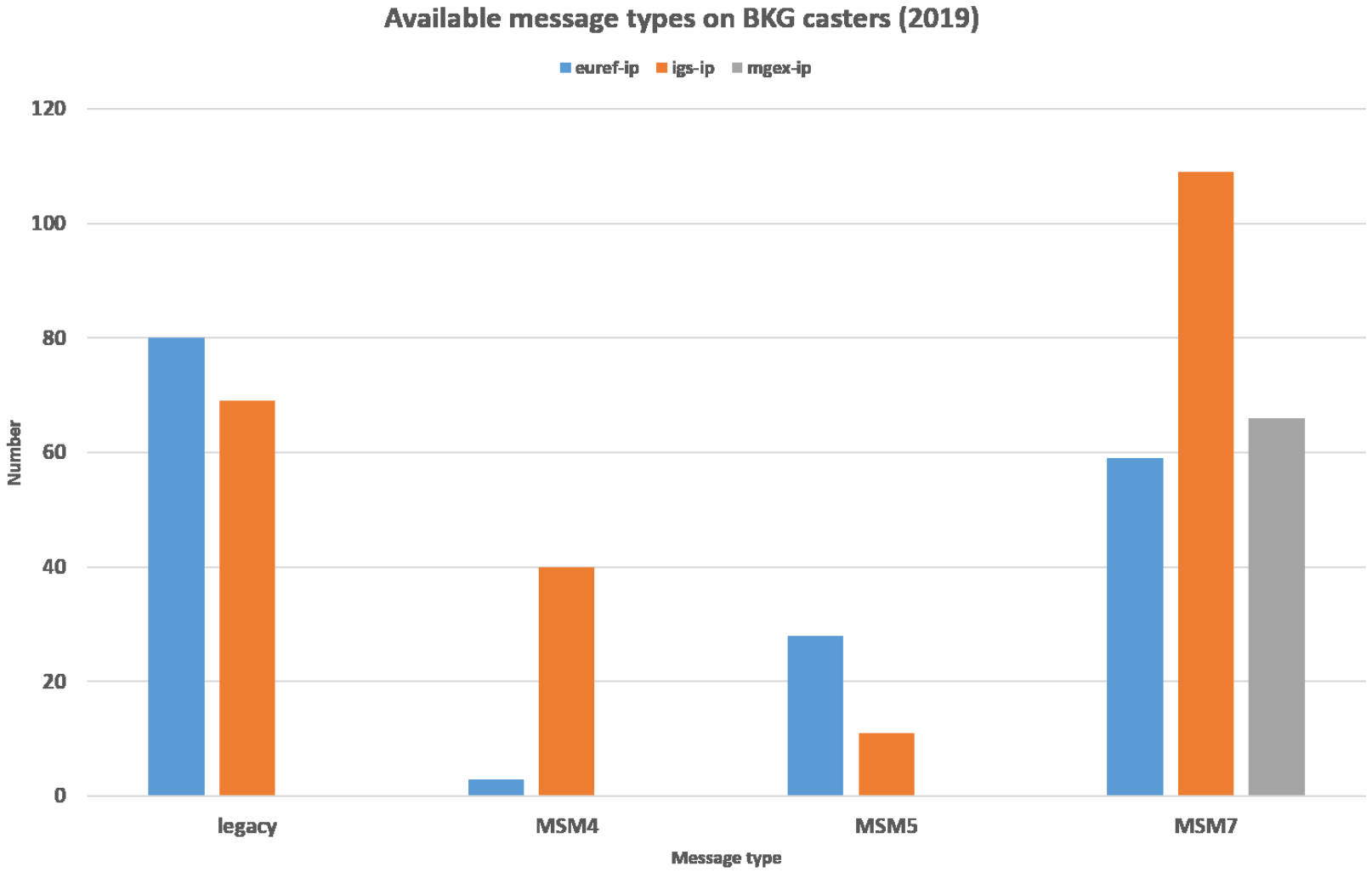
Long mountpoint names (observations)

- long (9 char) station names – decision independent from real-time
- mountpoints with 10 char → 10th char ‚0‘ indicating RTCM stream
- euref-ip broadcasters: completely switched to long names
- http://www.epncb.oma.be/_networkdata/data_access/real_time/status.php
- 182 mountpoints – 70 not consistent between the three EPN broadcasters
- Some short (5 char) mountpoints still available (17 stations on BKG‘s euref-ip caster, 3 on igs-ip caster) → need to contact station provider again

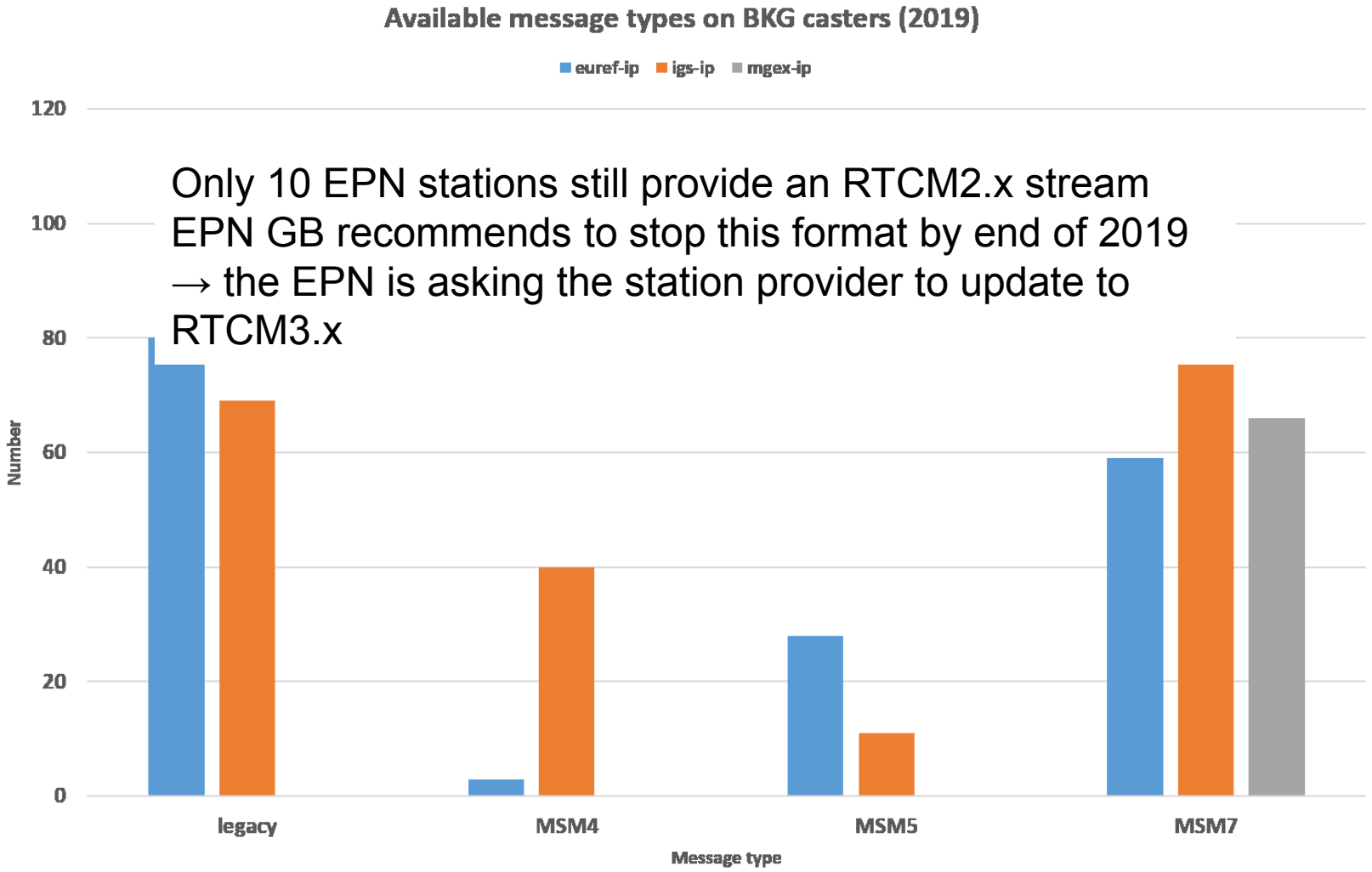
BKG regional and global broadcaster - messages



BKG regional and global broadcaster - messages



BKG regional and global broadcaster - messages



Only 10 EPN stations still provide an RTCM2.x stream
EPN GB recommends to stop this format by end of 2019
→ the EPN is asking the station provider to update to RTCM3.x

Long mountpoint names (observations)

- RTCM: discussion to use the last field of the STR string in a modified way (JSON), i.e. extension of the most recent Ntrip standard (but downwards compatible)
- EUREF: discussion on the coordinates used in the real-time observation string
  - Many requests for registration indicate that these colleagues are going to use the data in a RTK solution
  - Differentiate between ‘scientific’ and ‘surveying’ users
  - Users are trusting the correctness of our coordinates
  - Approx. 55 % of the EPN streams contain coordinates fitting better than 5 cm to the ETRS89 coordinates maintained by EUREF
  - 11 % have coordinates with differences larger than 1 m
  - → Update of / maintaining the correct coordinates by the station provider is highly recommended!

Long mountpoint names (products)

- IGS: proposal for long product names (draft from January 2019)
- Orbit and clock correction streams CLKmn – not self-explaining
- IGS RT WG: discussion on proposal for long mount-point names (10 char)

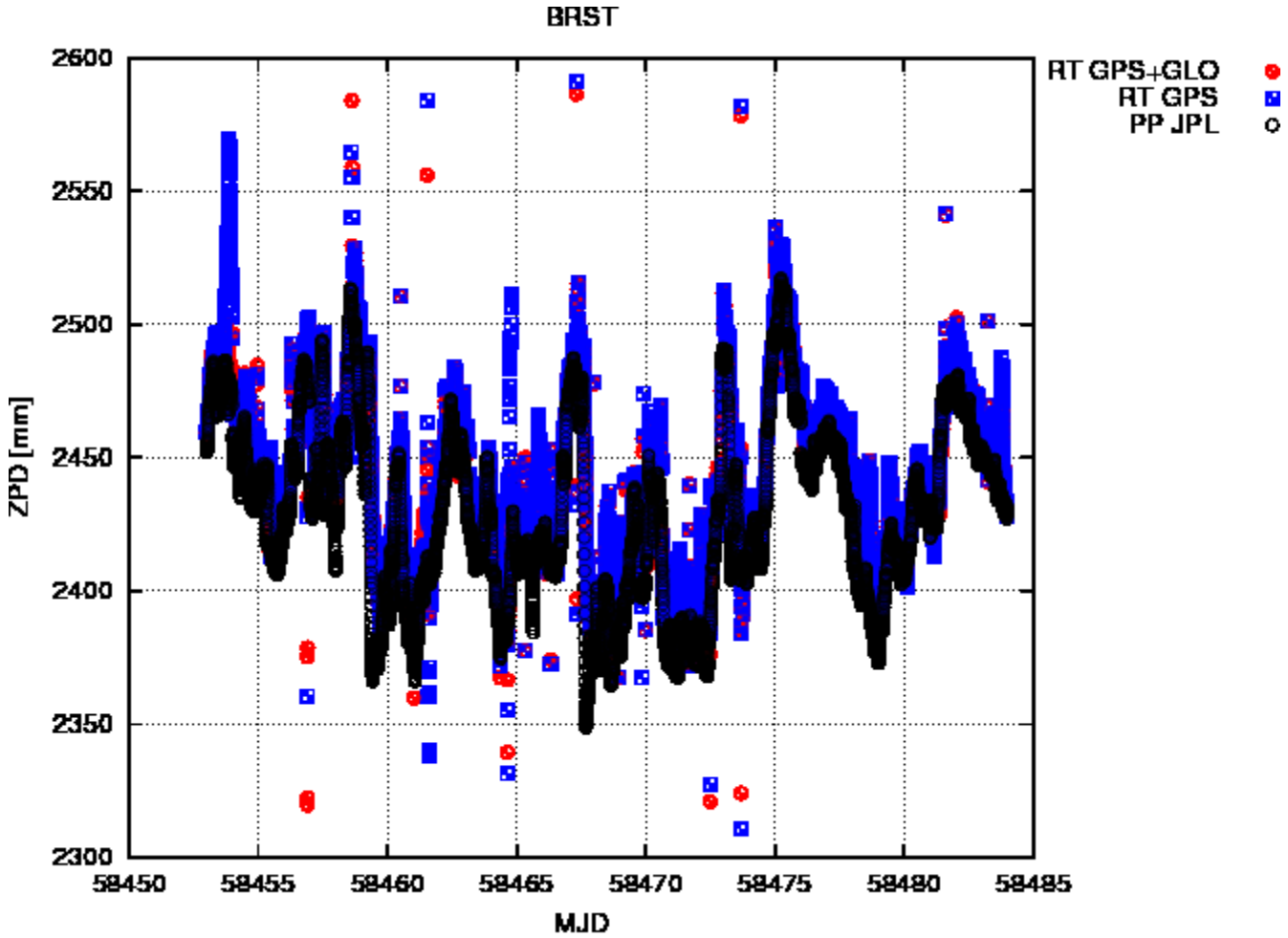
Long mountpoint names (products)

- "TTTTXXAAAF" where
  - TTTT: stream type (SSRA, SSRC, IONO, BCEP, etc.)
  - XX: 2 digit solution ID
  - AAA: 3 letter agency code
  - F: 1 digit format ID (0: RTCM3, 1: SAPA, 2-9: reserved)
  - SSRA: state space correction stream (orbits, clocks, ...), orbits refer to APC
  - SSRC: state space correction stream (orbits, clocks, ...), orbits refer to COM
  - DCBS: state space correction stream (DCBs only)
  - IONO: ionospheric correction stream
  - TROP: tropospheric correction stream
  - BCEP: broadcast navigation data (ephemeris) stream
  - SSRA and SSRC may also contain DCBs, iono corrections, tropo corrections and phase-bias corrections

Applications: troposphere (continuing COSTES1206)

- ES1206 „GNSS4SWEC“ running 2013 - 2017
- COST real-time PPP demonstration campaign as part of WG1
- Started mid 2015
- Two solutions: GPS and GPS+GLO
- Approx. 32 stations
- IGS RT correction stream IGS03
- Product update rate 60 min, delivered sampling rate 5 min
- Upload of results in COST format to GOP for comparison and visualisation

Applications: troposphere (continuing COSTES1206)



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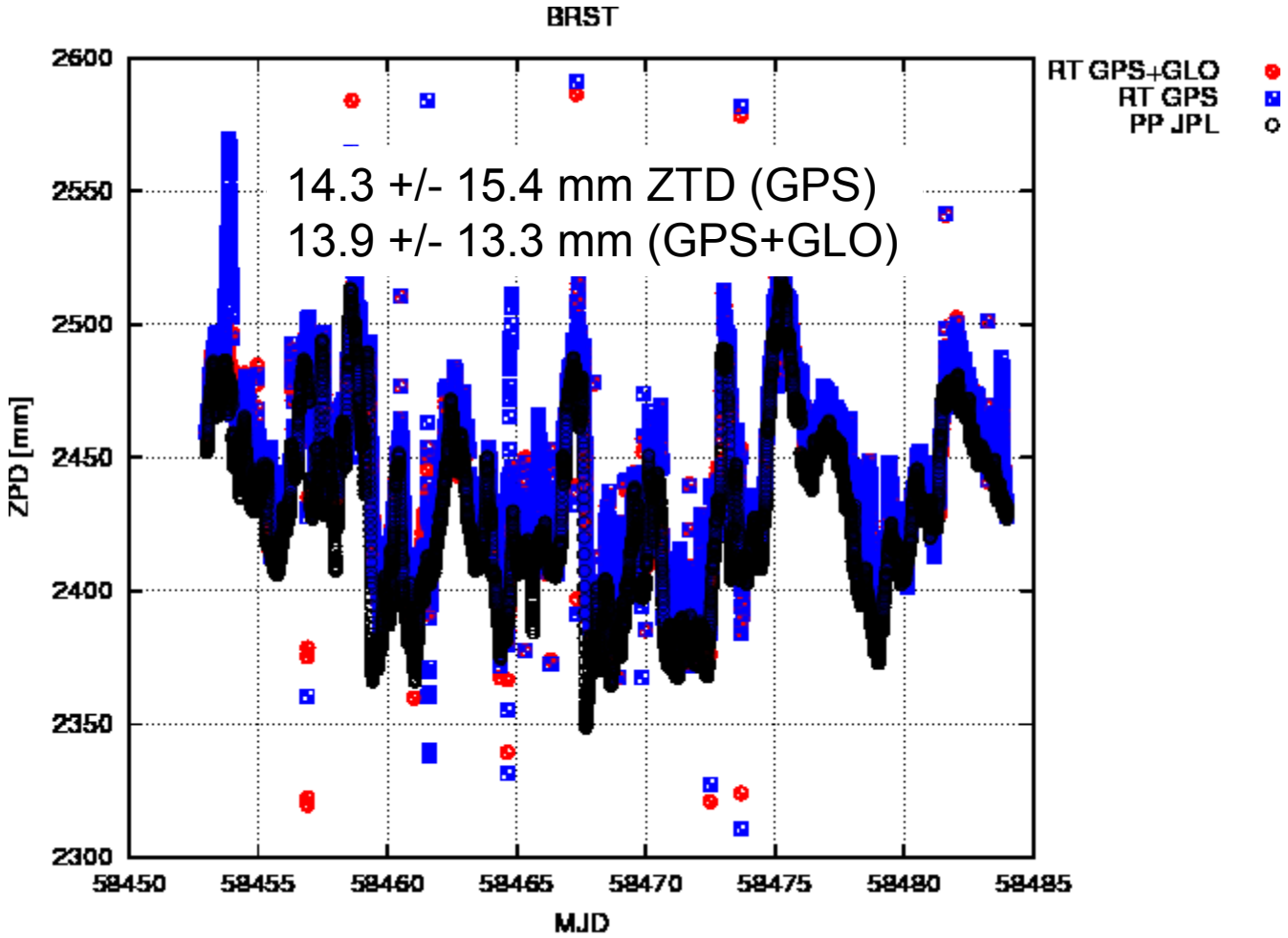

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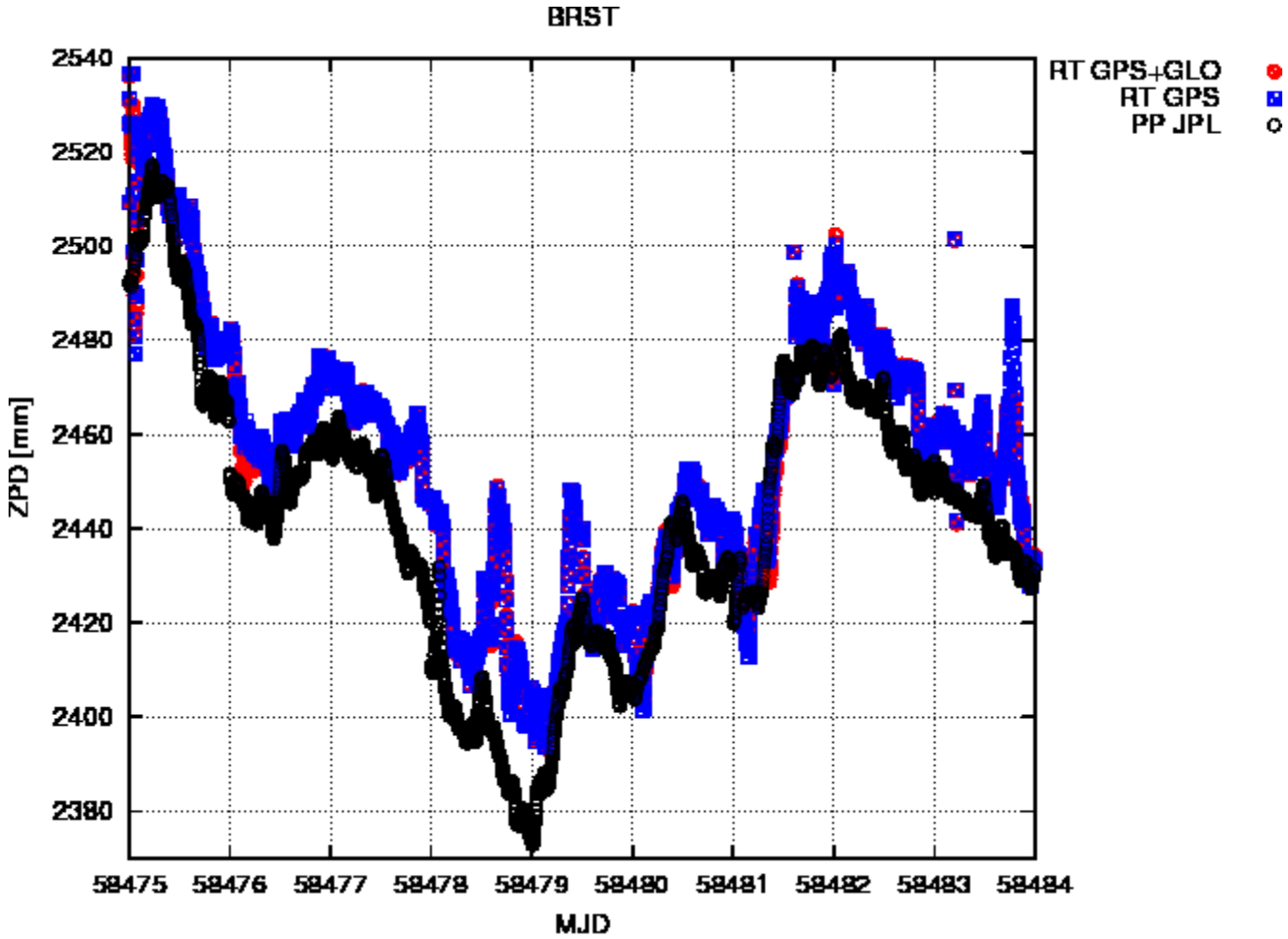


Applications: permanent GNSS installation on sea

Kinematic GNSS - Reference Station

- Vessel — DENEB - surveying ship of BSH
- GNSS-Receiver — Alberding A10
- Internet — satellite communication (2 x VSAT)
- Installation — end of March 2019

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Access

- Receiver solution: NMEA – Logging the realtime stream
- Observations and broadcast ephemerides (RTCM)
- Remote access for configurations (SSL)

Modes

- Permanent configuration
- „virtual“ measurement campaign

Objectives

- Positioning Accuracy
- Robustness and failure behaviour
- Performance

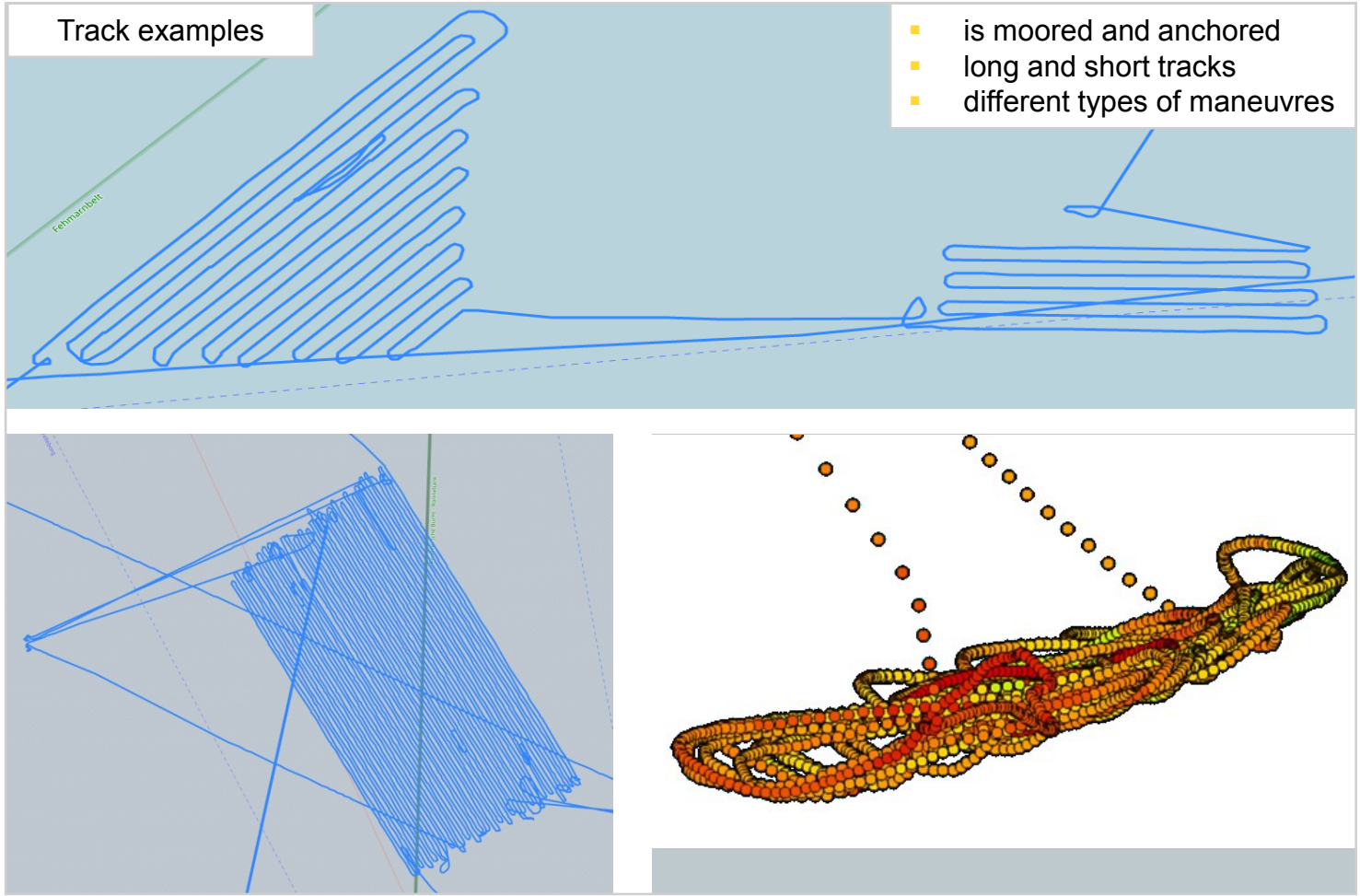
?

Applications: permanent GNSS installation on sea

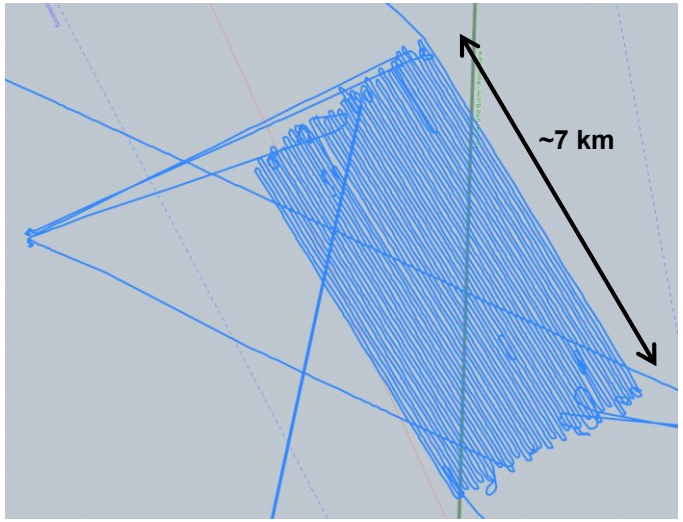
DENEB Realtime Tracker v0.1

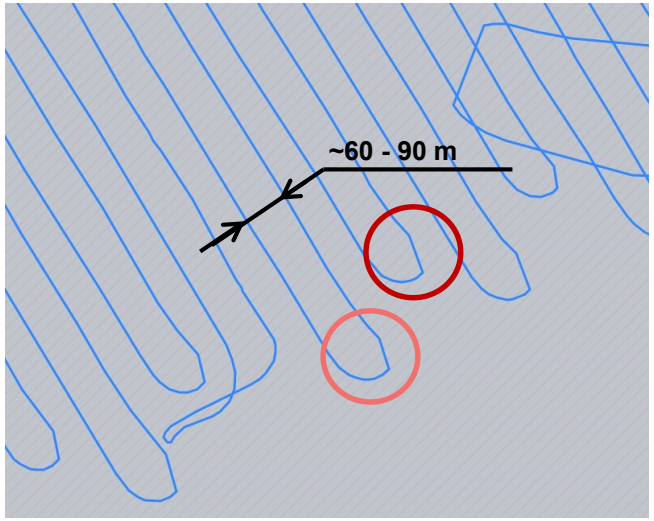
Track examples

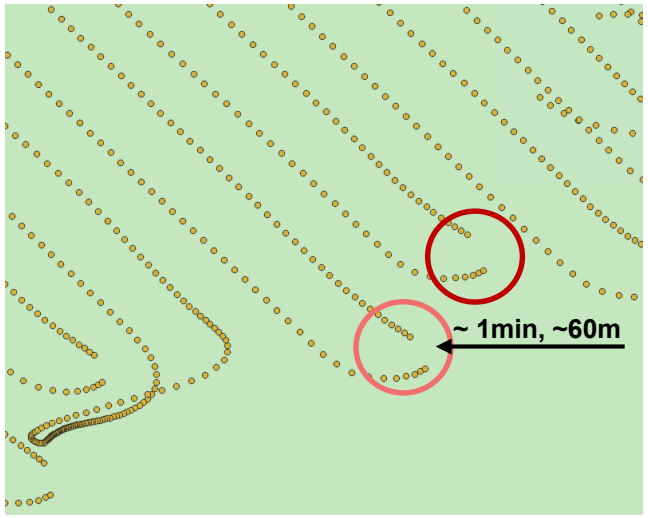
- is moored and anchored
- long and short tracks
- different types of maneuvres

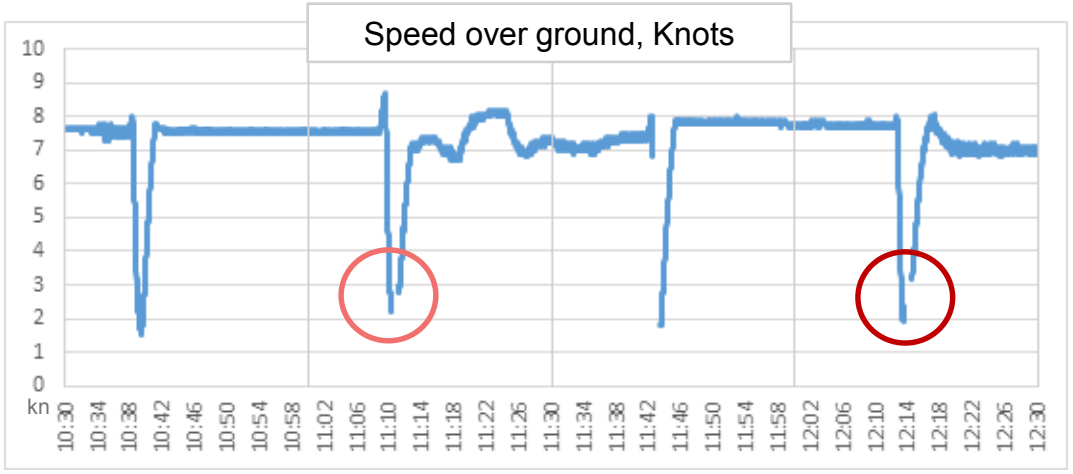


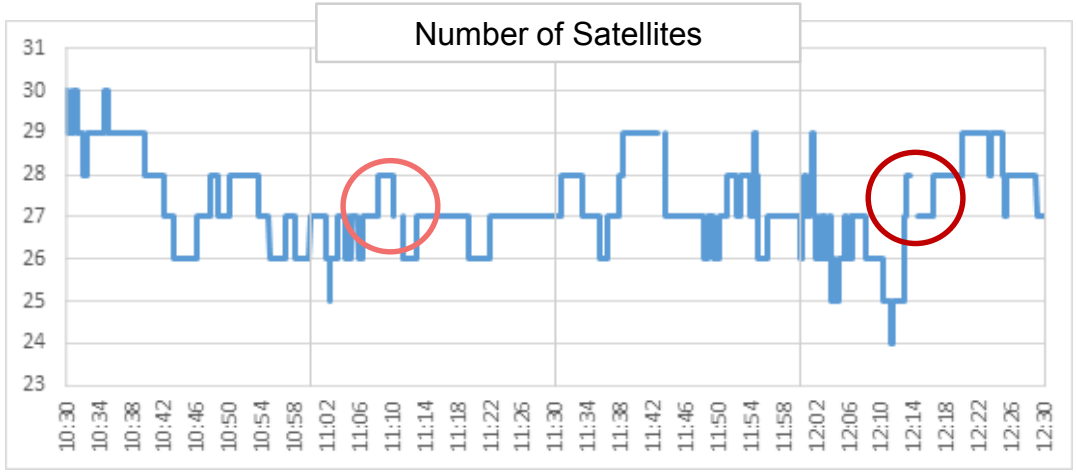
Applications: permanent GNSS installation on sea



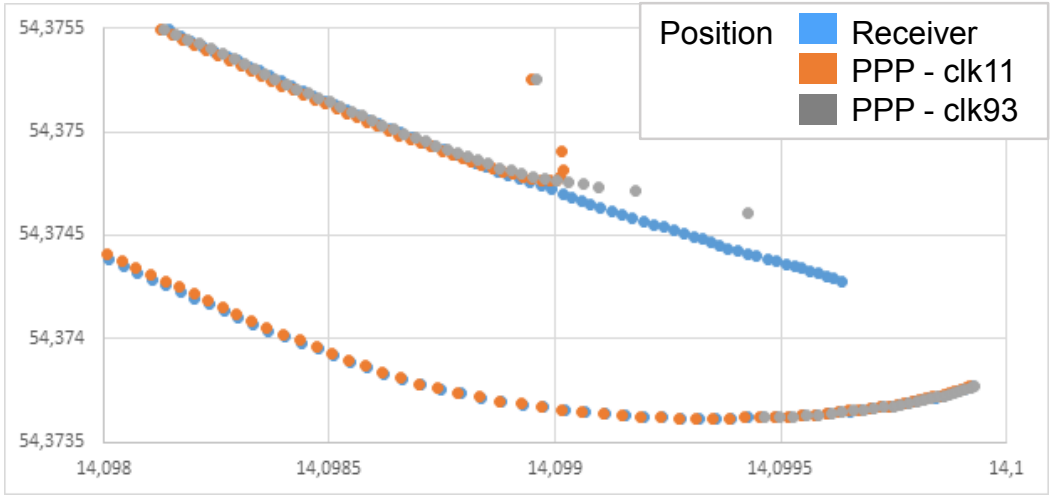


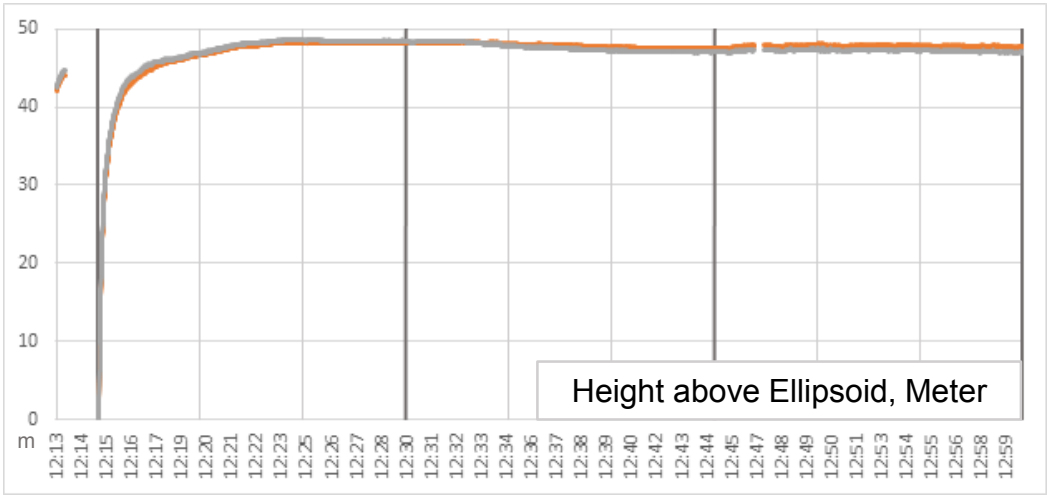


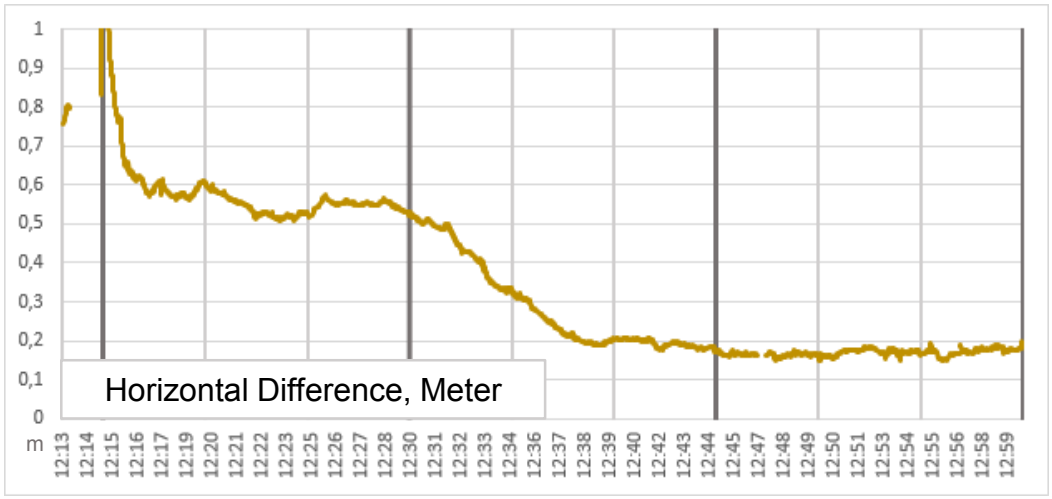


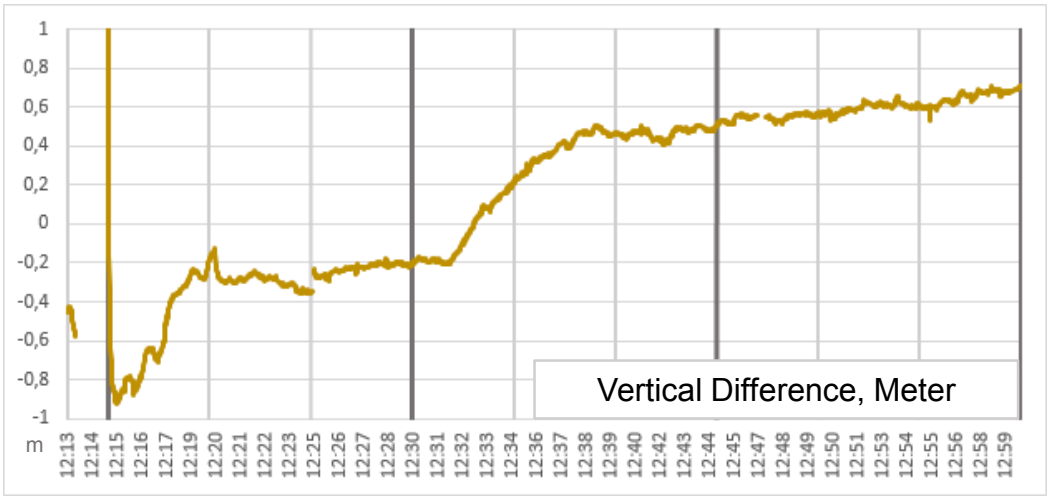


Applications: permanent GNSS installation on sea









Summary

- Real-Time Data
  - Long mountpoint names (observations) almost complete
  - EPN broadcaster to continue efforts in homogenization
  - Remaining EPN station provider with short mountpoint names to update
  - Stopping RTCM2.x in the mid-term
  - Keeping coordinates in streams up-to-date
- Real-Time Products
  - Long mountpoint names (products) under discussion
- Towards multi-GNSS in real-time?
  - Multi-GNSS ultra-rapid orbit product as one key element
- Real-Time applications
  - Troposphere parameter estimation – based on one combination stream only
  - Maritime kinematic application under reality conditions

Thank you for your kind attention!

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