Helmholtz Centre Potsdam
GFZ German Research Centre for Geosciences

GFZ Global GNSS Network

M. Ramatschi, M. Bradke, B. Männel

Contact: markus.ramatschi@gfz-potsdam.de

Helmholtz Centre Potsdam - GFZ German Research Centre for Geosciences, Telegrafenberg, 14473 Potsdam, Germany
Department 1: Geodesy

Ever since the foundation of the IGS, GFZ contributes to the IGS not only by a large number of GNSS receiving sites. This effort is carried out by the working group "GNSS Infrastructure and Analysis" within Section 1.1 – Space Geodetic Techniques. It covers the full spectrum from hardware development, station commissioning, data management, to data analysis and evaluation.

Global GNSS Tracking Network

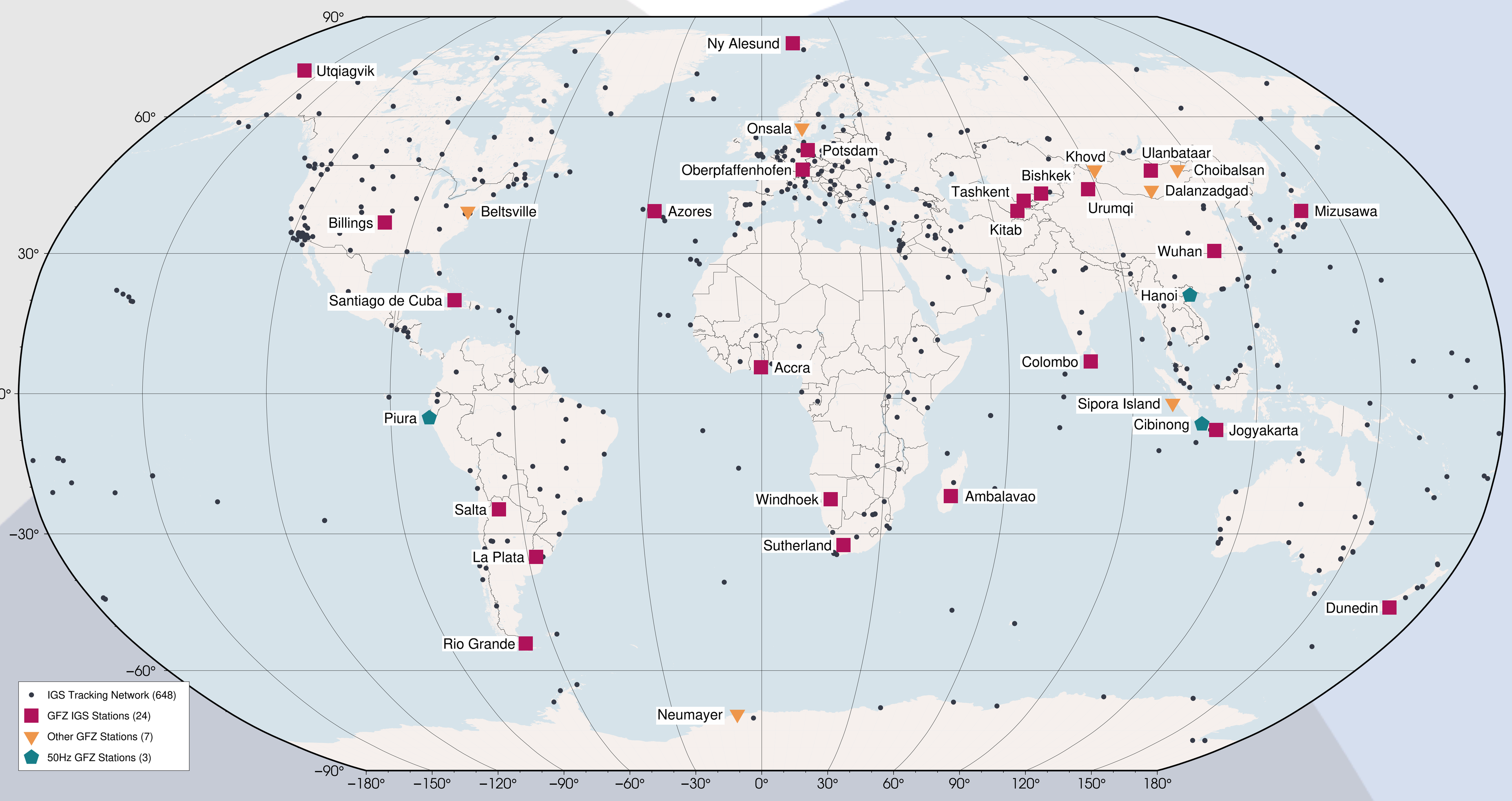

Fig. 1 *GFZ operated GNSS Tracking Network*

Furthermore, we maintain a comprehensive instrumentation pool consisting of 50 tinyBlack receivers, strategically deployed for widespread use across GFZ and within the research field Earth & Environment. These resources will be easily accessible through the Geophysical Instrument Pool Potsdam (GIPP), facilitating efficient utilization and collaboration.
For citation of GFZ GNSS data please use: doi.org/10.5880/GFZ.1.1.2020.001

GFZ operates more than 100 GNSS tracking stations in Germany and worldwide. 24 stations of them are contributing to the network of the International GNSS Service (totally 515 stations). Each of our stations is equipped with state-of-the-art geodetic instruments, including industry-standard components such as GNSS receivers, single-board computers, and GSM/VPN routers, all housed within a custom-built enclosure (*tinyPC/4*, Fig. 2).

In pursuit of continuous innovation, we have incorporated a new advancement utilizing cost-effective and geodetic GNSS receivers. The *tinyBlack* (Fig. 3) offers remarkable precision in determining coordinates, making it ideal for applications like monitoring dams and volcanoes, serving as a reference station for post-processing, and assessing atmospheric water vapor content. This development led to the spin-off 'maRam UG' (www.maram-ug.de).

Fig. 2 *tinyPC/4, developed at GFZ*

Fig. 3 *tinyBlack, developed at GFZ*

Data Management

Since the early 1990s, GFZ has been at the forefront of GNSS data management with its Operational Data Centre (ODC). The primary function of the ODC is to meticulously prepare and ensure the quality of all GNSS observation data received from GFZ's extensive station network. Beyond GFZ-operated stations, the ODC currently handles data from over 1,000 additional stations, all collected and processed seamlessly through automated procedures.

The ODC provides appropriate tools (Fig. 4) for the smooth operation of the station network. Data availability and data quality as well as housekeeping data can be visualized here.

Furthermore, GFZ employs the metadata platform *Stationeer* to streamline the management of GNSS station metadata. This platform offers centralized, format-independent, and validated storage of metadata. *Stationeer* comes equipped with a User Interface (UI), facilitating intuitive maintenance of relevant station metadata. Additionally, it provides a RESTful API for seamless machine-to-machine exchange, ensuring efficient data sharing and integration across platforms. (Details see poster P1: 005)

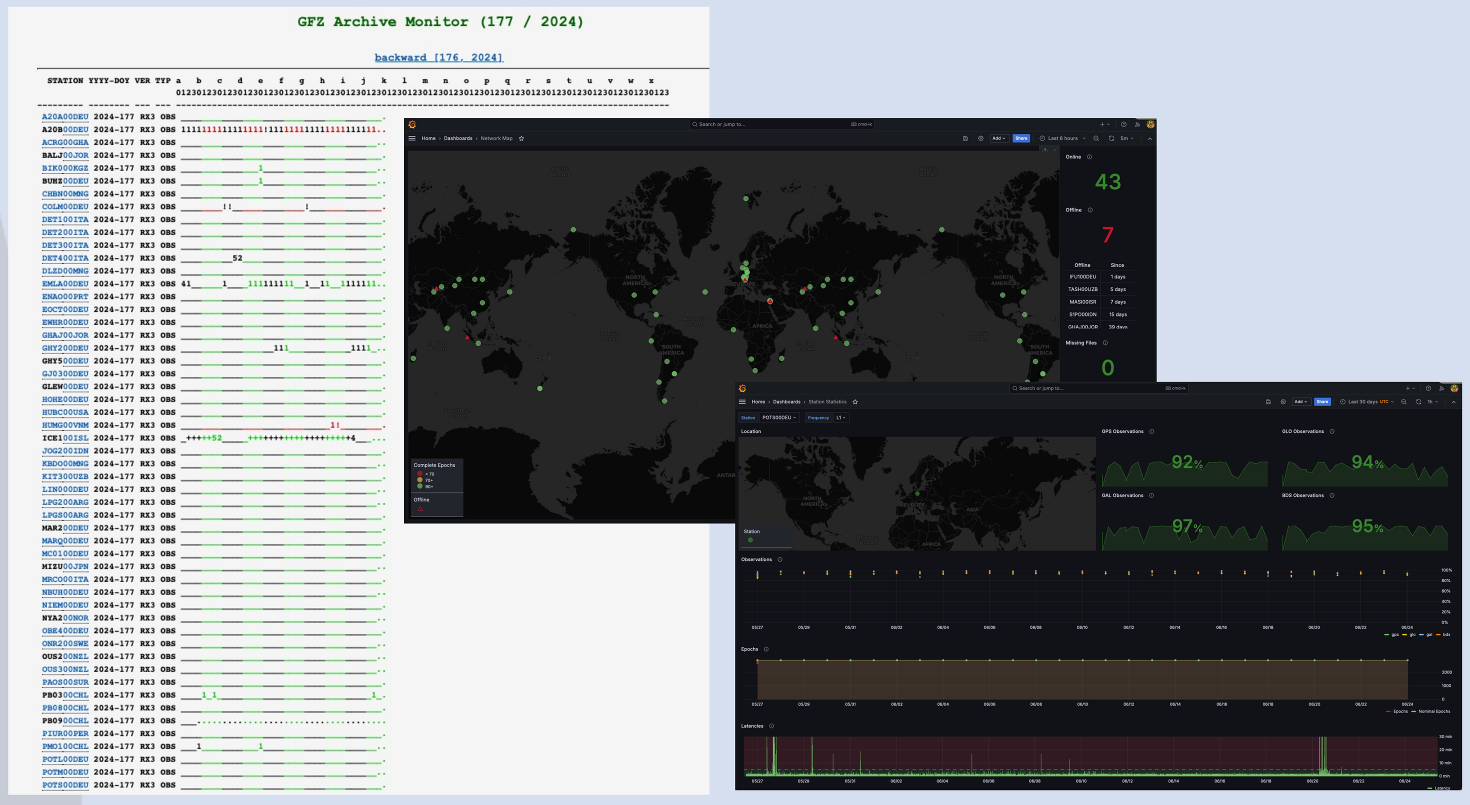

Fig. 4 *Monitoring tools: legacy archive monitor (left), upcoming Grafana visualisation (middle, right)*

Data Transfer Statistics

For most of our sites we stream GNSS data in receiver dependent binary format, converting those data at GFZ into RTCM using the 'euronet' tool from Alberding GmbH.
At the same time we generate raw-data files out of the binary data stream and comparing them to the raw data files accumulated at the site. Only if these files differ an additional file transfer is necessary. This mechanism results in minimal bandwidth consumption and low file latencies. RINEX files are generated at GFZ using vendor specific raw to RINEX Converter.

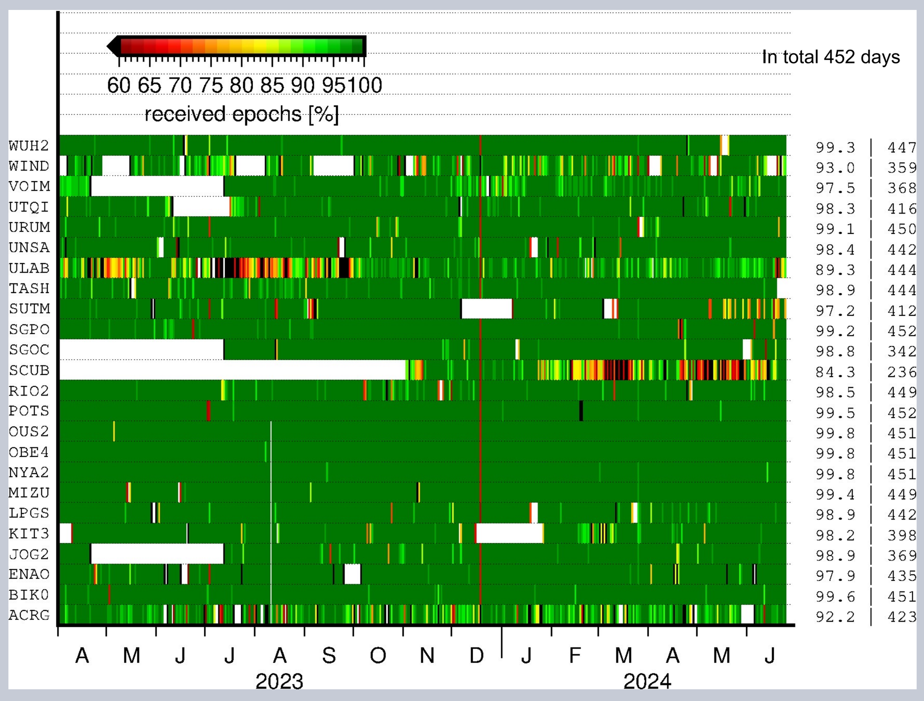

Fig. 5a *Completed epochs from real-time stream*

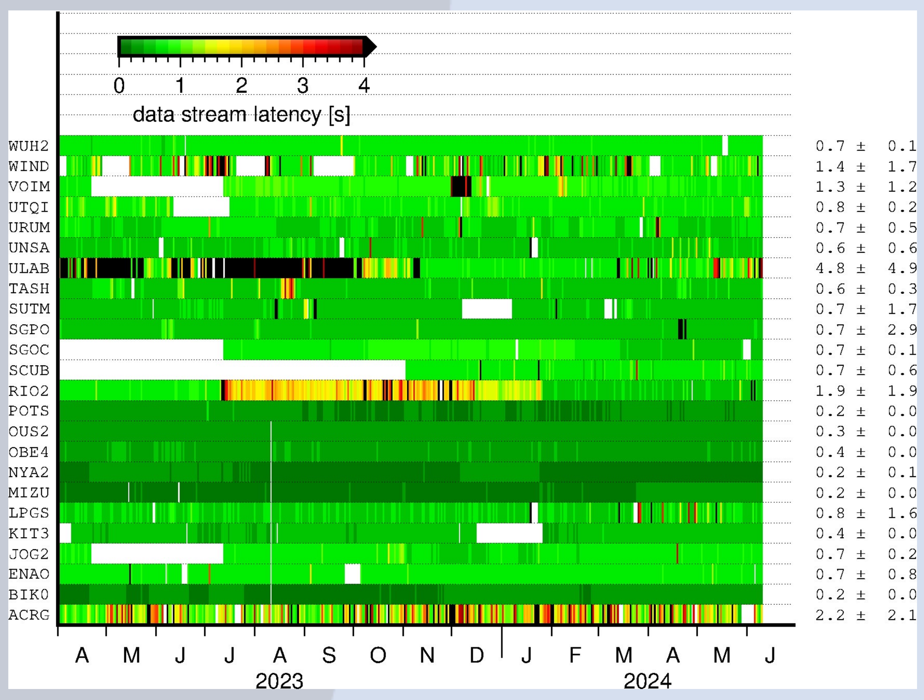

Fig. 5b *Delay of real-time data*

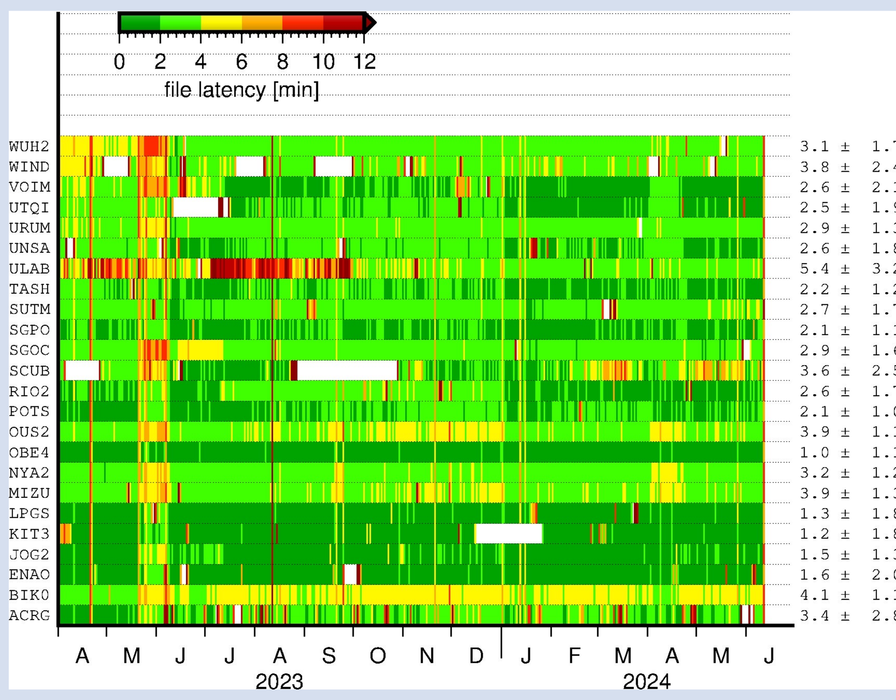

Fig. 5c *Latency of data files*

Some of our sites are equipped with a 'off the shelf' Septentrio Polarx5 receiver (e.g.: OUS2, NYA2, MIZU, BIK0). They have similar results in the ratio of received real-time epochs (Fig. 5 a) but show different pattern in data stream (faster, see Fig. 5b) and file latency (slower, see Fig. 5c) compared to sites using the GFZ approach of combined raw data streaming.