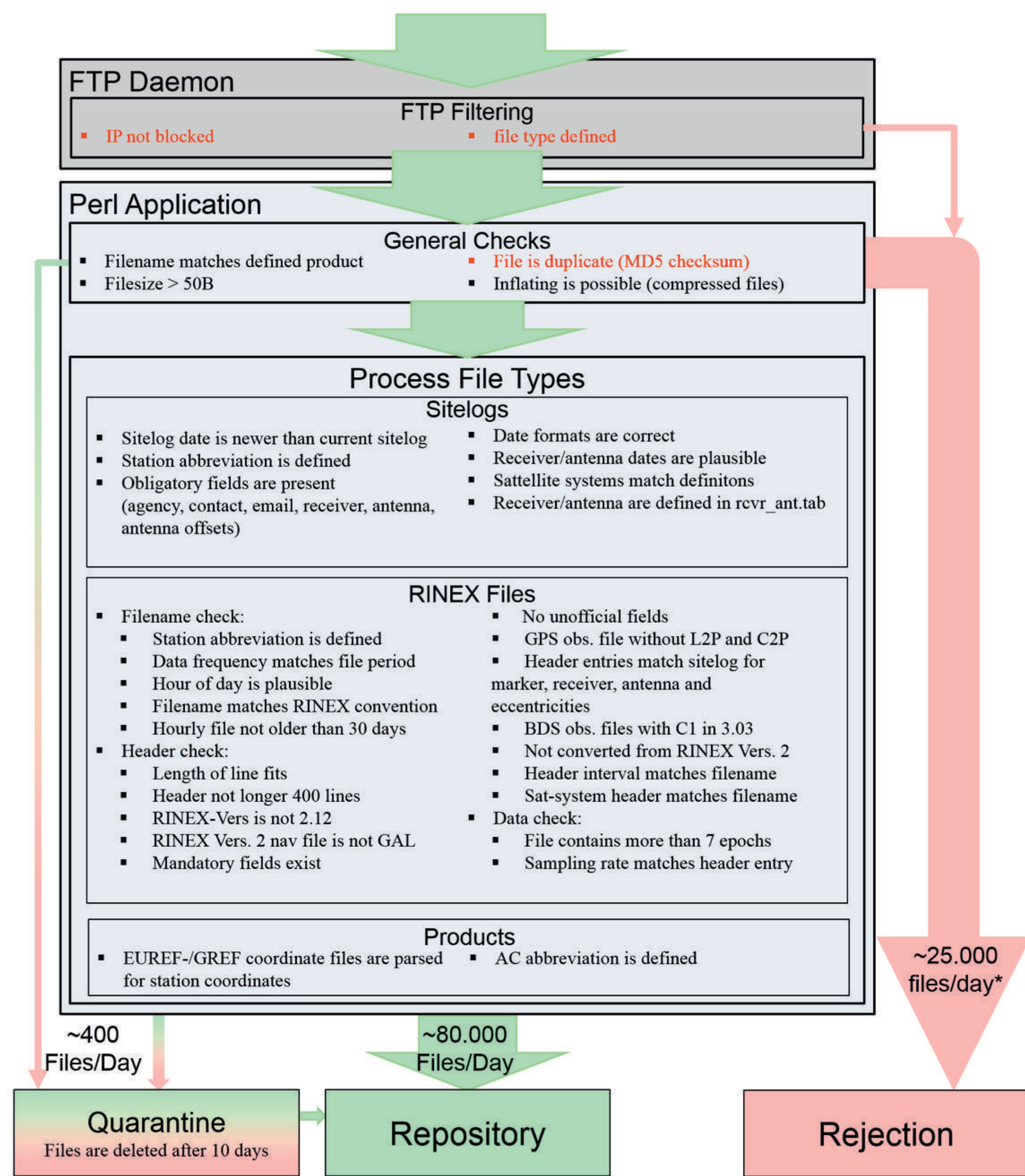




File-Based Processing Workflow

Since 25 years, the Federal Agency for Cartography and Geodesy (BKG) is operating a GNSS Data Center (GDC) for global, regional and national purposes. The aim is to provide reliable and non-restricted access to GNSS observational and navigational data. Access is possible via ftp (80.000 uploads, 600.000 downloads daily) and via http (~450 visitors per day).

To provide a viable basis of data for Analysis Centers and other clients BKG-GDC routinely performs data-checks for all incoming files (referring to filename, file type, size and content, see flowchart below). Files are filtered through several steps before being stored, quarantined or totally excluded.



* On 26th of May 2017 we had 105.000 duplicates, with one station uploading 87075 duplicates!

Fig. 1: Scheme of Data Processing

Fig. 2: Format example for CHECK_IMPORT RN2/3

Information about files and processing errors is available via file download or web interfaces. For processing errors, emails are generated automatically and forwarded after individual crosscheck.

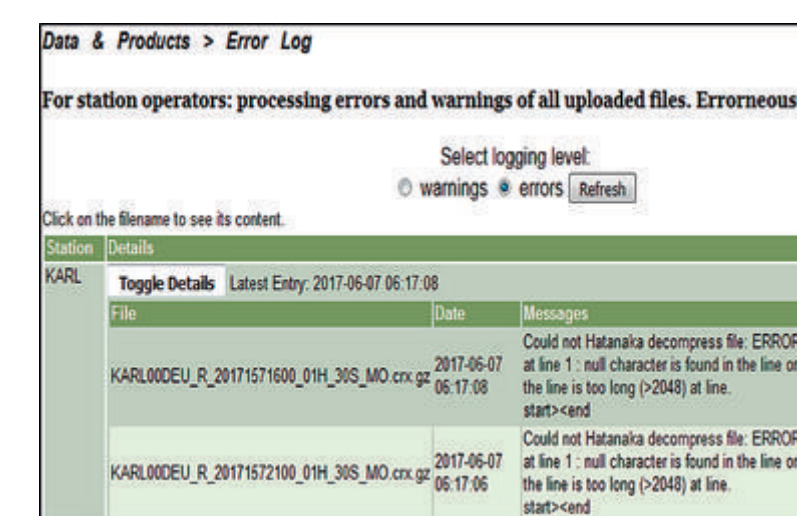


Fig. 3: Error Reporting

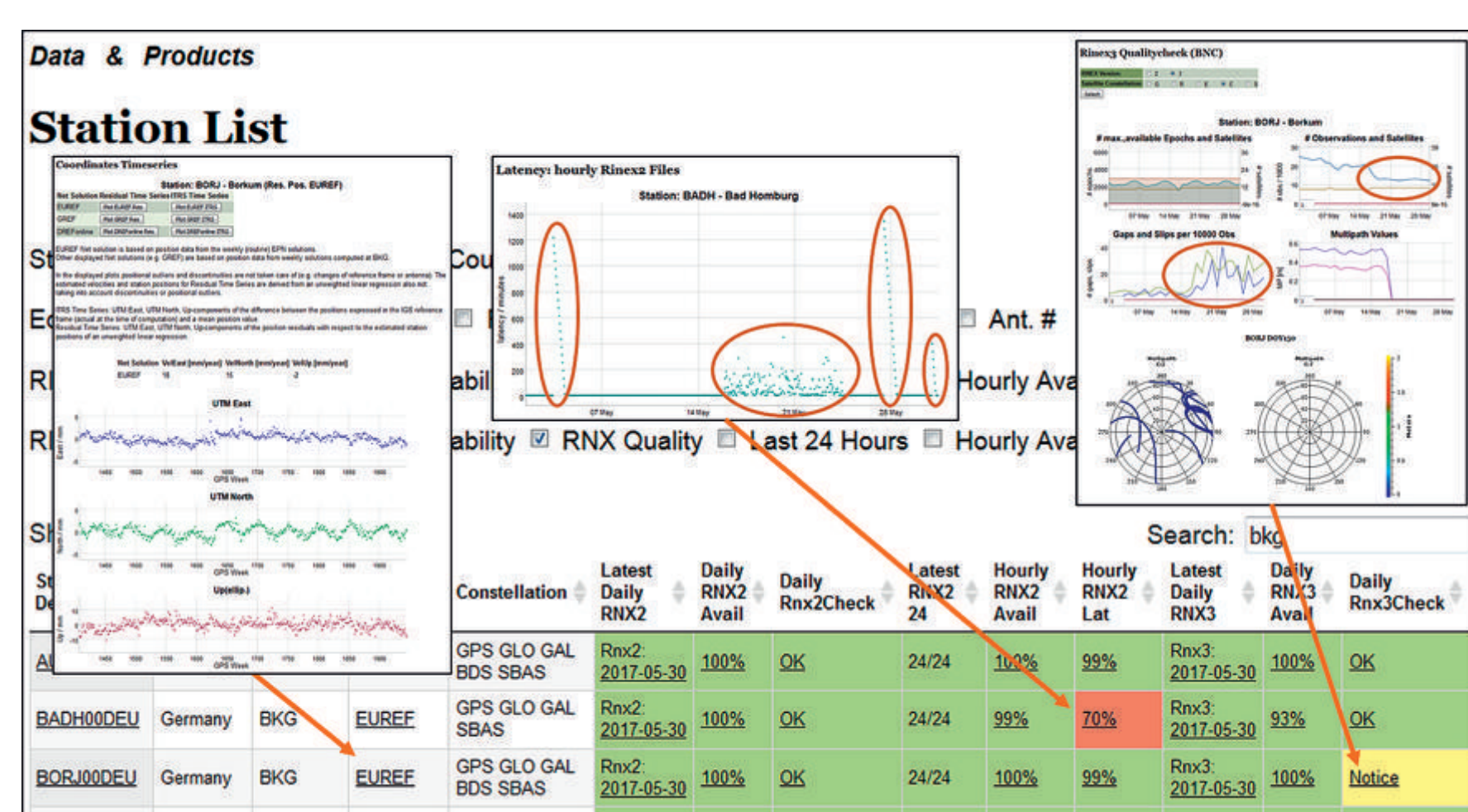


Fig. 4: Examples for metadata accessible in menu „Station List“

Quality of RINEX files is monitored and documented for stored files on a daily basis. BKG-GDC checks RINEX2 files using teqc¹, for RINEX3 files Anubis² and BNC³ are default. The extracted metadata is stored in the database and key performance indicators are available for each station in a public station list. The metadata is only used for monitoring and documentation; no automated reporting to station operators is currently foreseen. Station operators can filter the list by e.g. “bkg” as agency to get relevant information.

Real-time Monitoring Overview

Since 2004, BKG is operating various entities for the global, regional and national real-time GNSS infrastructure. The operation of a real-time GNSS service demands a much higher level of monitoring than it is necessary in the post-processing world, where for example RINEX files can be reprocessed the next day in case of an error. While we use Opsview⁴ to monitor our hardware and most important processes on various hosts, we apply InfluxDB⁵ as central storage unit for our metrics and Grafana⁶ for visualization. In detail

Opsview⁴ monitors:

- Hardware + Network: disk space, load, memory, FTP + HTTP to other DCs,...
- Status of most important processes and files
- Accumulation of files in specific directories
- Warnings or errors in logfiles
- NtripCaster installations: number of client connections and data streams, availability of products, etc.

InfluxDB⁵ is used for storage of events and metrics. We use mostly Perl scripts for processing logfiles and for shipping the extracted data to InfluxDB. We store metrics from:

- BNC³ logfiles: general logfiles incl. combination, PPP logfiles
- RTNet⁸ logfiles
- All kind of timestamped data

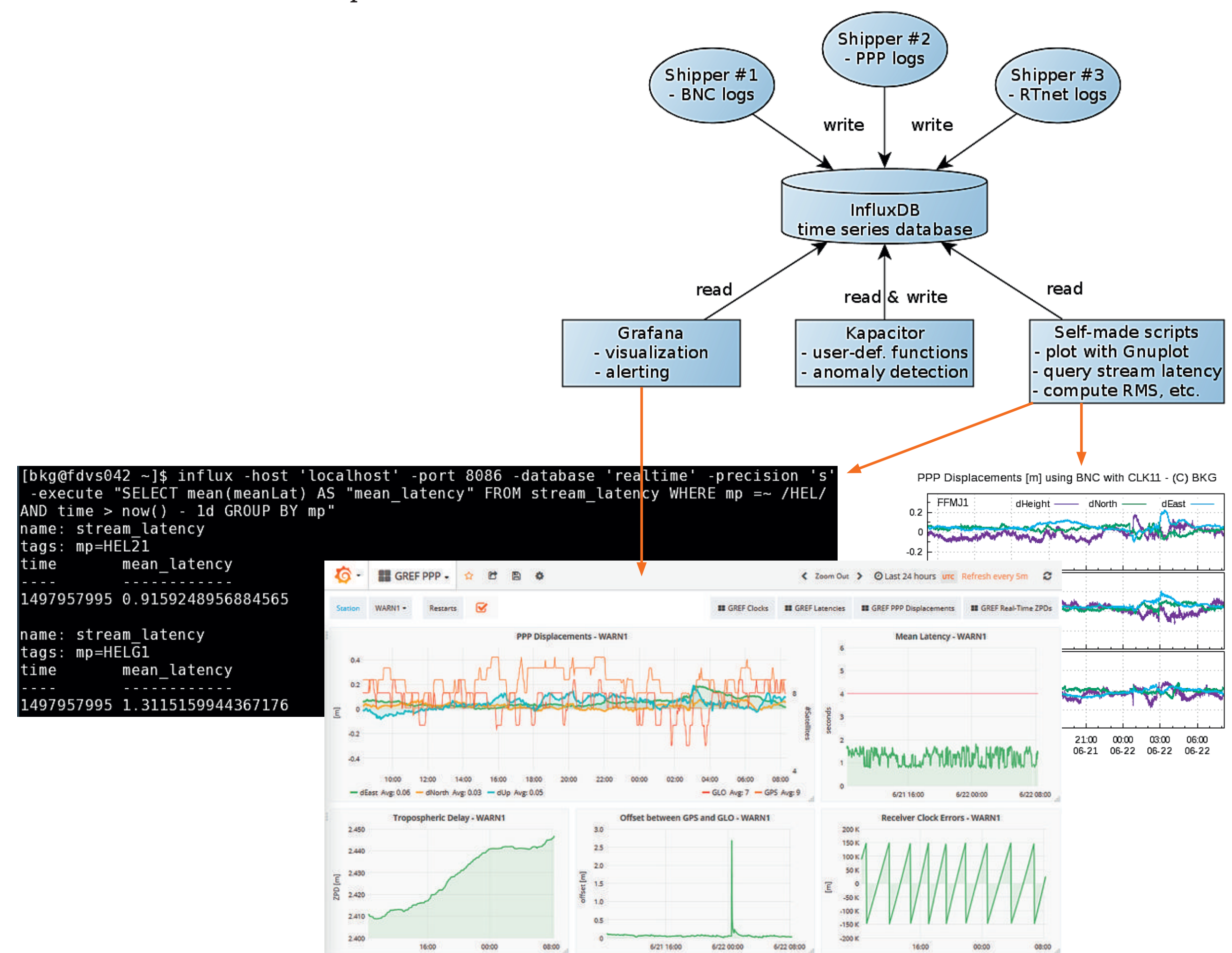


Fig. 5: Extract, Transform, Load (ETL) and visualization workflow

Many processes are necessary for the generation of our real-time products as well as for monitoring those products. PM2⁷ is helping us to not lose overview of all that continuously running jobs. With PM2 it is easy to start and stop jobs, it restarts jobs automatically in case of a crash and provides useful information about every managed job like CPU and memory usage, number of restarts and uptime.

```
[bkg@dvs042 ~]$ pm2 l
```

App name	id	mode	pid	status	restart	uptime	cpu	mem
BNC-PPP-11	5	fork	30542	online	0	7D	0%	12.8 MB
BNC-PPP-17	6	fork	30545	online	0	7D	0%	12.5 MB
BNC-PPP-24	7	fork	30549	online	0	7D	0%	14.4 MB
BNC-PPP-5	9	fork	4467	online	1	25h	0%	12.7 MB
BNC-PPP-11	10	fork	31277	online	0	7D	0%	59.3 MB
BNC-PPP-52	11	fork	14991	online	0	7D	0%	12.9 MB
Bnc-COST1	0	fork	30525	online	0	7D	0%	77.8 MB
Bnc-COST2	1	fork	30530	online	0	7D	0%	63.6 MB
Bnc-COST3	2	fork	0	stopped	0	0	0%	0 B
BncLog2Influx	12	fork	0	stopped	0	0	0%	0 B

Fig. 6: PM2 manages BNC-, RTNet- and many other jobs

Information about the availability of real-time streams of all BKG casters (summary or verbose mode), as well as station maps can be found at <https://bkgmonitor.gnssonline.eu>.

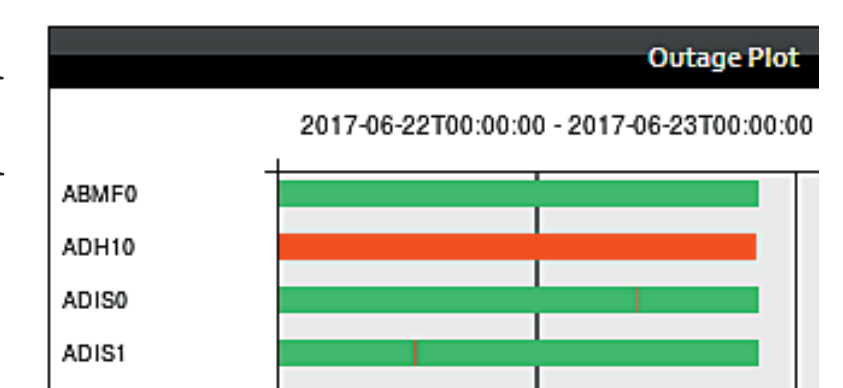


Fig. 7: Stream outages

References and links:

- ¹teqc <https://www.unavco.org/software/data-processing/teqc/teqc.html>
- ²Anubis <http://www.pecny.cz/gop/index.php/gnss/sw/anubis>
- ³BKG Ntrip Client (BNC) <https://igs.bkg.bund.de/ntrip/bnc>
- ⁴Opsview community version <https://www.opsview.com/>
- ⁵InfluxDB <https://www.influxdata.com/>
- ⁶Grafana <https://grafana.com/>
- ⁷PM2 Process Manager <https://github.com/Unitech/pm2>
- ⁸Real Time NETWORK Processing Engine (RTNet) http://www.gps-solutions.com/rtnet_software

