Federal Agency for Cartography and Geodesy

BKG Ntrip Client (BNC) Version 2.7 – Recent Developments and Results

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Abstract

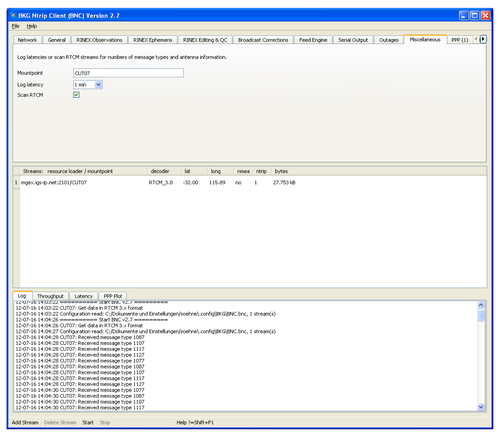
The BKG Ntrip Client (BNC) was originally designed for collecting, synchronising and streaming real-time GNSS data from real-time broadcasters to real-time users. During the last years, BNC evolved to a very efficient tool in the real-time world, mainly because of its Precise Point Positioning (PPP) module. Being open source software, important features already implemented or under development are: multi GNSS encoding/decoding, real-time GNSS orbit & clock combination, post-processing capability, editing and quality control elements, especially for RINEX 3.

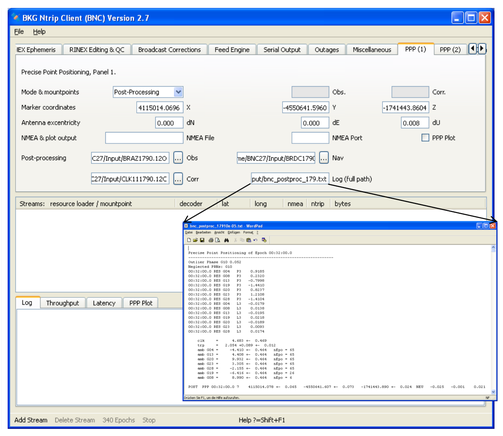
This poster presentation is reviewing the basic tags and tools of BNC and is highlighting several of the new features. Current results using the PPP module, e.g. from BKG's monitoring webpage, are completing the presentation.

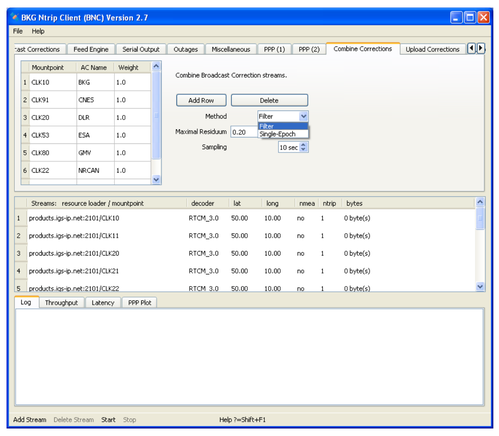
BNC features at a glance

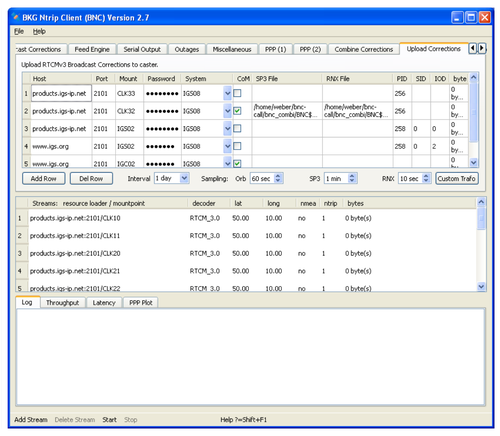
The following options of BNC have been implemented or improved in the latest version:

- Quality control and editing features, e.g. concatenation of hourly files, multipath visualisation (see poster Habrich et al.)
- Post processing capability using RINEX files (beside the already existing option of using files in an internal raw data format (amount of approx. 2.5GB each day storing ~70 streams, top right)
- Provision of multi GNSS observations (GPS, GLONASS, Galileo, COMPASS, SBAS), either as RTCM3 stream or in RINEX3 file format (top left)
- Precise Point Positioning, e.g. tuning filter parameter via configuration file
- Real-time orbit and clock combination, either with Kalman filter approach or with least square adjustment (bottom left and right)
- Several example configuration files are provided with each release



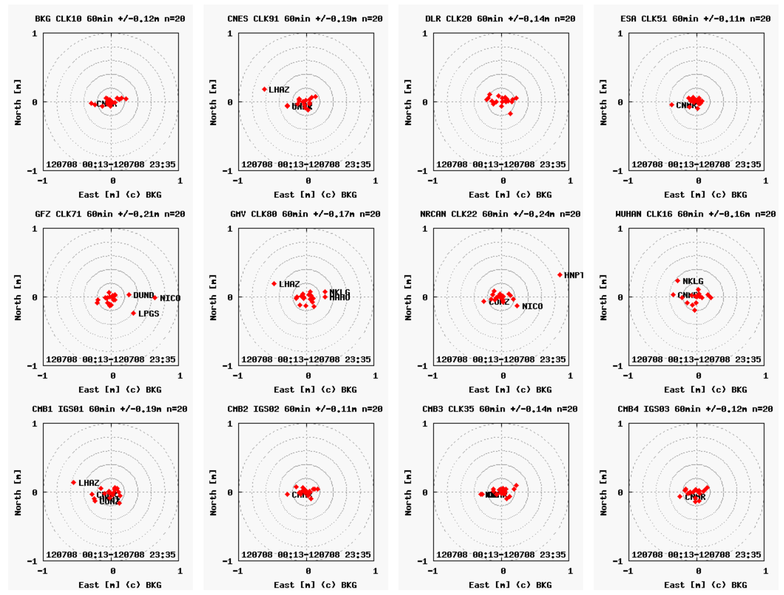






Orbit & clock correction monitoring with PPP

One method of orbit & clock correction validation is using them for real-time PPP. At BKG, 20 globally distributed reference stations are processed consecutively for one hour each day. The differences to the reference coordinates after 60 minutes are visualized and summarized in a table.



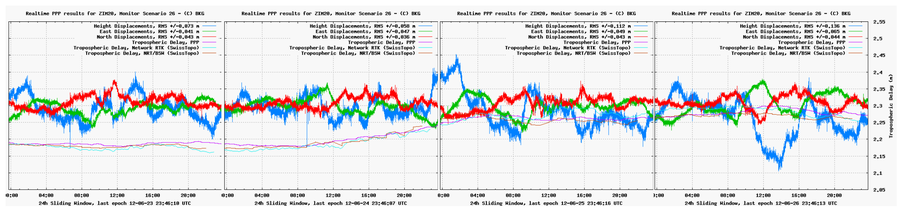
RMS of N/E/U 2D/3D displacements (m) from 60 min PPP tests:

Source	Correctors	N-RMS	E-RMS	U-RMS	2D-RMS	3D-RMS	n
BKG	CLK10	0.04	0.12	0.10	0.12	0.16	20
CNES	CLK91	0.06	0.18	0.10	0.19	0.22	20
DLR	CLK20	0.06	0.12	0.11	0.14	0.18	20
ESA	CLK51	0.04	0.10	0.08	0.11	0.14	20
GFZ	CLK71	0.08	0.19	0.23	0.21	0.31	20
GMV	CLK80	0.07	0.16	0.09	0.17	0.20	20
NRCAN	CLK22	0.09	0.22	0.11	0.24	0.27	20
WUHAN	CLK16	0.08	0.14	0.21	0.16	0.26	20
CMB1	IGS01	0.07	0.17	0.11	0.19	0.22	20
CMB2	IGS02	0.04	0.10	0.11	0.11	0.15	20
CMB3	CLK35	0.04	0.13	0.10	0.14	0.17	20
CMB4	IGS03	0.06	0.10	0.10	0.12	0.15	20

The most recent results of scenario 15 and the other monitoring scenes can be found at http://igs.bkg.bund.de/ntrip/ppp

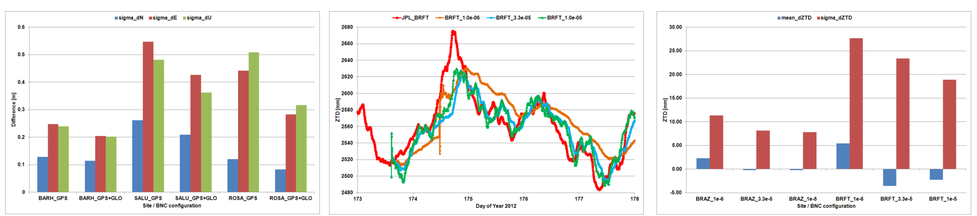
Permanent position & ZTD monitoring

Permanent monitoring of IGS station ZIM2 using the combined stream EUREF02 (related to ETRS89) is shown below (see http://igs.bkg.bund.de/ntrip/ppp#Scene26). Thanks to swisstopo, ZTD estimates of NRT solution using BSW5.0 and RT solution from Trimble network solution are included showing a good overall agreement.



Positioning & ZTD processing

Results of PPP (consecutive runs over 30 minutes convergence time) and ZTD processing over one week for mountpoints in USA and Brasil are shown below. Correction stream CLK11 was used. JPL's PPP solution used as ZTD reference. Positioning results show slightly better results for GPS+GLONASS vs. GPS only (left figure). ZTD estimation for stations in Brasil fits better if a larger variation of the tropospheric effect is allowed than, e.g., for European stations.



Further Information

http://igs.bkg.bund.de

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