M-GEX data monitoring with G-Nut/Anubis software

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Abstract
The G-Nut/Anubis QC tool is developed at Geodetic Observatory Pecný (GOP) using core G-Nut software library together with applications for precise point positioning, troposphere monitoring and numerical weather field processing. The G-Nut/Anubis aims at quality and quantity monitoring of GNSS observation and navigation data stored in RINEX 2.x and 3.x formats support of all global navigation satellite systems (GPS, GLONASS, Galileo, BeiDou) and regional augmentations (SBAS and QZSS).

G-Nut/Anubis - main characteristics and functionalities

Purpose:
- Quantitative analysis
- Qualitative analysis
- Meta data check
- Positioning

Basic characteristics:
- Derived from the G-Nut software library
- Designed for Linux command-line environment
- Developed in C++ (object-oriented)
- Supports all GNSS constellations and augmentations

Processing approaches:
- Sequential processing in a single period
- Parallel processing in a single period
- Verbose modes for individual sections

Specific algorithms:
- Cycle-slip detection (geometry-free, Melbourne-Wuebben LC)
- Clock-jump detection and observation synchronization
- Code multipath - all bands/frequencies, constellations, signals

Inputs/Outputs:
- Configuration: via XML file
- Input: observation and navigation RINEX 2.x/3.x
- Output (detected): plain text (easy-to-grasp, non-redundant)
- Output (summary): XML summary (initial CODE format)

Availability:
- Current version: 1.1.2
- Next release: 1.2 (Jul/Aug 2014)
- Open-source (GNU GPLv3)

Outputs/Inputs:
- Meta data check
- Verbose modes for individual sections
- Cycle-slip detection (geometry-free, Melbourne-Wuebben LC)
- Clock-jump detection and observation synchronization
- Code multipath - all bands/frequencies, constellations, signals

Quantitative analysis
- Independent of specific algorithms, nav. messages
- Statistics on observations, satellites, freq. bands
- Statistics on data gaps and small data content
- Comparison of RINEX header and file data content

Qualitative analysis
- Requires specific algorithms and nav. messages
- Pre-processing: cycle slip and clock jump detection
- Multipath detection (independent of pre-processing)
- Skyplot: sampled elevation and azimuth

Standard positioning
- Stand alone single-epoch GNSS standard positioning
- Ver 1.1: GPS + GLONASS
- Ver 1.2: GPS + GLONASS + Galileo + BeiDou
- GNSS means and uncertainties over all epochs
- Multi-GNSS estimates with all biases (near future)
- Observation + SP3 data (near future)
- Pre-selected multi-freq observ. (flexible in future)
- Pre-selected navigation data (flexible in future)

Meta data control
- Foreseen in future (2015)
- RINEX editing/cutting/splicing
- RINEX header control and editing
- External input from station definition file

QC Navigation messages
- Foreseen in future (still 2014)
- Quality control, editing/cutting/splicing
- GPS maneuver detections
- Comparison to SP3 (potential function)

RINEX 2.xx/3.xx monitoring examples (IGS/M-GEX and EUREF/RNXv3)

Summary
The G-Nut/Anubis is ready to support new observations in a multi-GNSS world. The software is written using object oriented approach and is thus flexible for future extensions and enhancements, e.g. data editing/splicing, meta-data control/editing, QC of real-time streams, QC of navigation message, editing/splicing navigation messages, support of precise orbits (SP3) and others. Users interested in the software can download the source code from the http://www.pecny.cz (GNSS – software – Anubis) and join the G-Nut mailing list at this website.

References:
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