Principles of airborne data postprocessing

Our experience in postprocessing software development for stable platform gravimeters (Graviton/AGK/GT1A/GT2A) allows us to highlight the following basic principles:

- ❑ Data QC (quality control) is urgently important.
- ❑ Decomposition of navigation and gravity estimation tasks is preferable.
- ❑ GNSS postprocessing software developed exclusively for airborne gravimetry is highly required.

We follow these principles also in strapdown airborne gravimetry.

Importance of GNSS quality control (QC)

It is very important that an operator can quickly check quality of experimental data.

QC software requirements:

- should be very simple in use
- should contain a small number of tuning parameters
- provide an adequate GNSS solution “in the field” (without using base stations)

QC software answers the questions regarding:

- data integrity
- presence of warning flags in data

Principles of GNSS software development

Input data:

- code pseudoranges
- Doppler pseudorange rates
- single or dual carrier phase observables
- precise ephemeris data provided by IGS (International GNSS Service) (optionally)

Options of the GPS solutions:

- several Base Stations option
- several combinations of sampling frequency
- multi-frequency, multi-system receivers
- PPP – Precise Point Positioning technique

Principles of software for gravity estimation

Software is based on:

1) processing the vertical channel separately
2) using results of the initial and final alignments for determining bias and linear bias drift of the vertical accelerometer
3) using attitude estimates from IMU-GNSS for gravity estimation
4) taking into account gravimeter instrumental errors (scale factor error, residual attitude errors, residual bias drifts of accelerometers)
5) estimating gravity using Kalman filtering and smoothing

Important assumptions:

- IMU has a temperature stabilization box (variation < 0.1 C)
- gravity tie value at the aerodrome is known. *Any other external gravity data is not assumed.*

Our cooperation with GT company

- **2000.** The Laboratory started the first airborne gravity project with GT.
- **2000-2001.** Preparation for the first flight test of the GT1A prototype.
- **2001.** Tests flight in Vologda region (Russia) on a AN-26 plane.

Our cooperation with GT company (2)

- **2002.** GT1A was approved for commercial use after flight test in Australia in November-December.