GAPS: A New GPS Data Analysis and Positioning Tool

Rodrigo F. Leandro[1,2], Richard B. Langley[1], and Marcelo C. Santos[1]

[1]*University of New Brunswick and* [2]*Trimble Terrasat GmbH*

1. Introduction

GAPS, an acronym for GPS Analysis and Positioning Software, is a software package developed at the University of New Brunswick. The word "Analysis" is used due to the GAPS' data analysis capabilities, i.e., the software has other applications than positioning. GAPS is available on the internet for use via a Web interface at the address http://gaps.gge.unb.ca/ .

GAPS' applications can be summarized as follows:

- Precise Point Positioning;
- Ionospheric delay estimation;
- Differential code biases estimation;
- Code multipath estimation.

Because of the variety of applications, GAPS is not only a precise point positioning tool, but a GPS analysis tool. GAPS' data processing is essentially based on a very complete error handling. This is done by means of the use of precise products (such as satellite orbits, clocks, and antenna information) and a detailed implementation in terms of observation modelling.

2. Application Descriptions

Precise Point Positioning (PPP) is one of the existing techniques to determine point coordinates using a GPS receiver. In this technique observations realized by a single receiver are used in order to determine the three components of the coordinates, as well as other parameters, such as the receiver clock error and total neutral atmosphere delay. The technique is said to be "precise" because precise information, such as satellite orbits and clock errors, is used in the data processing.

The ionospheric delay estimation is based on carrier-phase observations only, which are processed using a filter capable of decorrelating ambiguities and biases from the delay, in order to provide reliable estimations.

GAPS is capable of providing differential code biases, which are useful quantities when processing pseudoranges for positioning. The innovation in this approach is that these biases are estimated in a positioning like filter (very similar to the model of the biases - positioning - user), rather than as a clock estimation by-product.

One of GAPS outputs is an estimate of code multipath (MP). This estimate can be used as an alternative for multipath quantification, where the uniqueness of this approach lies in the fact that the estimation doesn't rely directly on carrier-phase measurements, which makes possible the estimation of unbiased MP values.

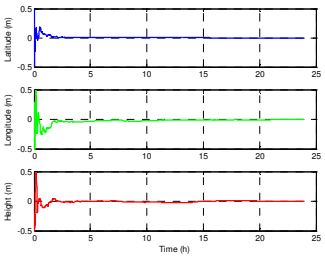

Figure 1 – Static PPP positioning.

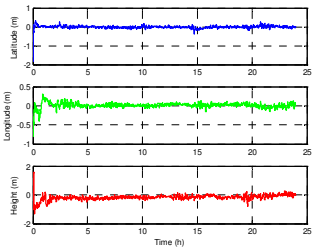

Figure 2 – Kinematic PPP positioning.

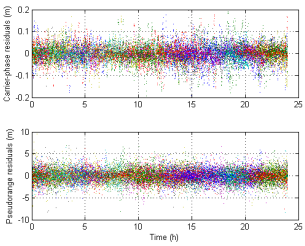

Figure 3 – PPP residuals.

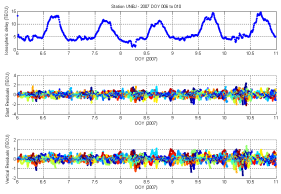

Figure 7 (left) – Ionospheric delay estimation.

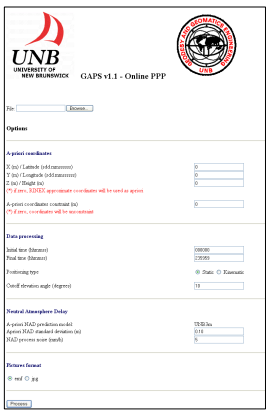

Figure 4 – Online GAPS submission screenshot.

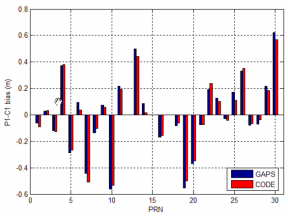

Figure 5 – P1-C1 code bias estimation.

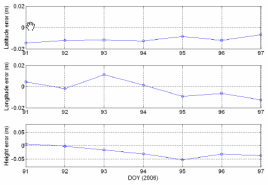

Figure 6 – GAPS 24h PPP solution error.

Acknowledgments

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