



## Bachelor/Master Thesis

### Impact of GPS Pseudo-Range Observations on Precise Orbit Determination of Low Earth Orbiters

#### MOTIVATION

The orbits of many low flying (200-2'000 km altitude) satellites can be computed to cm accuracy by using the data of on-board GPS receivers. To reach such high accuracies the processing of the phase observations of the GPS carrier signal is mandatory. Even if this is computationally more demanding than using the pseudo-range measurements based on the code imprinted on the GPS signal, this is successfully done for many satellites at the Astronomical Institute of the University of Bern (AIUB) using the in-house developed Bernese GNSS Software. The pseudo-range measurements are roughly two orders of magnitude less accurate than the carrier phase measurements and are currently not used for the Precise Orbit Determination (POD). There are, however, indications that inclusion of this additional data with appropriate weighting may be beneficial for the quality of the computed satellite orbits. Due to interference and multipath effects both the carrier phase and the pseudo-range measurements show systematic errors depending on the direction of measurement. For carrier phase measurements these variations are taken into account by using so called Phase Center Variation (PCV) maps. The variations of the pseudo-range measurements are much larger and in order to use this data it is of utmost importance to create and apply analogous variation maps.

#### DESCRIPTION

- Experience in the procedures for the POD of low flying satellites shall be gained using the Bernese GNSS Software.
- Empirical pseudo-range variation maps shall be established for one or several satellites by analyzing and accumulating the pseudo-range residuals resulting from a POD.
- The impact of the pseudo-range data on the quality of the satellite orbits shall be studied in terms of standard validation methods.