UNIVERSITÄT BERN

Universität Bern

Astronomisches Institut

Bern, 7. December 2016

Bachelor/Master Thesis

Combination of Precise Orbit Solutions of Low Earth Satellites computed at different Analysis Centers

MOTIVATION

The Sentinel-1A satellite, ESA's first satellite of a new fleet of Earth observation satellites belonging to Europe's Copernicus programme, was launched on April 3, 2014 into a sun-synchronous orbit. It is equipped with an 8-channel, dual-frequency Global Positioning System (GPS) receiver used for precise orbit determination (POD) and geolocation of the radar instrument to provide an all-weather, day-and-night supply of imagery of the Earth's surface. Sentinel-1A precise orbit solutions are computed by the Astronomical Institute of the University of Bern (AIUB) and at five other analysis centers during the entire mission in the frame of ESA's Sentinel POD Quality Working Group (QWG). In the frame of ESA's Sentinel POD Quality Working group it is currently discussed how the different solutions could be combined such that orbit solutions of superior quality can be created.

DESCRIPTION

- The Sentinel-1A orbit solutions, meanwhile covering a period of almost three years, as well as the Sentinel-2A and -3A solutions are all based on different processing strategies and software packages. A rigorous comparison shall therefore be performed to first assess the systematic differences between the individual solutions. Use can be made of existing programs of the Bernese GNSS Software. Own tools shall then be created in Matlab to reduce the systematic differences between solutions to the extent possible.
- Based on this, a Matlab prototype shall be established to combine the individual solutions using the iterative framework of variance component estimation. In a first step the orbit positions may be treated as independent input data to simplify the task. This already results in a generalization of the combination of GPS satellite orbits as done in the International GNSS Service (IGS). In a second step the stochastic behavior of the orbit positions shall be established and taken into account for the combination. Careful evaluations of the combined solutions are needed to verify that systematic errors of individual solutions are not affecting the combination and that individual solutions, e.g. following different modeling techniques, are not punished for this in the combination.

Prof. Dr. Adrian Jäggi
Sidlerstrasse 5
CH-3012 Bern

+41 (0)31 631 8596
adrian.jaeggi@aiub.unibe.ch
www.aiub.unibe.ch