Bern, 1ˢᵗ April 2021

u^b

Bern Data Science Day 2021 - April 23

Science with GNSS: a multi-disciplinary challenge

DS and high-performance computing, e.g. work using the UBELIX cluster

Rolf Dach and the Satellite Geodesy Team

Astronomical Institute; University of Bern

rolf.dach@aiub.unibe.ch

Abstract

GNSS stands for Global Navigation Satellite Systems with the American GPS as the most prominent representative. We provide an overview on how these satellite systems are used for scientific purposes. This includes the estimation of various influences affecting the signal on its way from the satellite to the receiver and relevant effects acting on the satellites and receivers. Many of these influences are interesting for numerous scientific applications.

The focus of research in the AIUB group in this context is the orbit modelling for these complex satellites. This is an essential task because potential orbit modelling deficiencies will degrade the obtained results provided to the community. Basis for the successful orbit determination is a global tracking of the satellites.

AIUB hosts the Center for Orbit Determination in Europe, one of the global analysis centers of the International GNSS Service. This is a voluntary, scientific organization supporting the community with best possible GNSS-based products. This includes the regular daily processing of measurements from about 250 tracking stations from up to 120 satellites of different global and regional satellite systems.

In numbers this means for instance: from more than 2 million individual observations about 120.000 parameters are determined each day within several iteration steps. There are applications, where the orbit results are required within one hour only, e.g., to support real-time or near-real time applications. In other cases, 25 years of daily solutions shall be consistently reprocessed with the latest data modelling aspect in order to derive long time series of the solution (e.g. monitoring global crustal deformations). Both tasks ask for an efficient data handling and for a significant computational effort.

We discuss selected aspects from the computational side and demonstrate the quality of the obtained results.