Current topic for a Master's Thesis

Development of global ionosphere models with regional densification areas from data of different latencies by means of B-spline series expansions

The ionosphere which includes the highest density of free electrons in the Earth's atmosphere has a crucial impact on many Earth observation systems, on radio communication systems as well as satellite based navigation and positioning. In geodetic applications, the ionospheric delay is usually corrected by the information from global ionospheric maps (GIM).

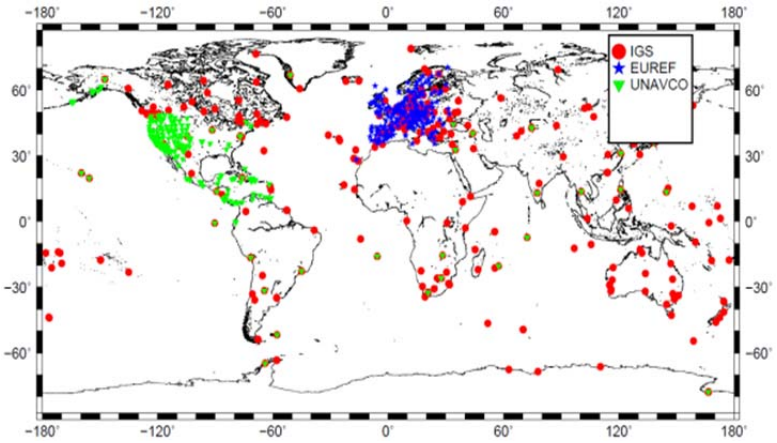

Figure 1: Global and regional GNSS networks, IGS (red), EUREF (blue) and UNAVCO (green).

However, most of the current GIMs are based on globally distributed GNSS observations which are usually provided by stations from the IGS (International GNSS Service) network. The stations are distributed rather unevenly over the globe, with dense clusters over Europe and North America and a naturally poor coverage over the oceanic regions, see Fig. 1. Furthermore, data is provided with different latencies, thus observations can be downloaded in real-time, near real-time or with latencies between hours to days.

In order to take advantage of dense clustered observations a two-step modelling (TSM) is suggested. This procedure consists in the first step of a global model for the long-period signal parts, combined with one or more regional model parts to cover the mid- and short-period signal parts in the second step. Consequently, a data separation procedure is required in order to avoid correlations between the two steps of the TSM.

In this thesis, regional GNSS networks such as EUREF or UNAVCO should be used to set up the TSM in two manners: it should (1) be applied to continental regions (with available regional networks) with high spatial resolution and (2) to improve the temporal resolution by using preferably the real-time observations from regional networks

Main tasks:

- Development of a download routine for available GNSS observations with different latencies, provided by global and regional networks
- Investigation on an appropriate data selection method for GNSS observations supporting the two steps of the TSM and considering the different latencies
- Modelling global and regional VTEC maps in (near) real-time by means of the available TSM, based on B-spline series expansions
- Development of the software packages in Python or Matlab

Institute	Deutsches Geodätisches Forschungsinstitut der TUM (DGFI-TUM)
Supervisors	Prof. Dr. Michael Schmidt / M. Sc. Andreas Goss
Contact:	Email: mg.schmidt@tum.de; Phone: 089/23031-1123