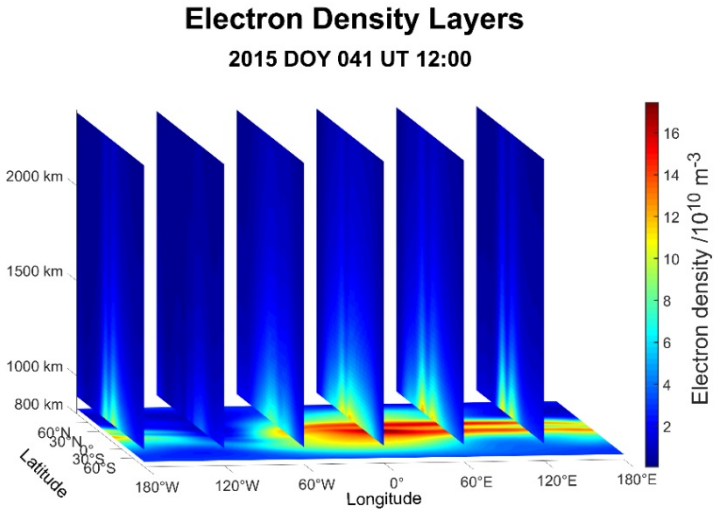
# Current topic for a Master's Thesis

## Analysis and filtering of ionospheric and plasmaspheric measurements

The ionosphere and plasmasphere have a significant influence on applications dealing with trans-ionospheric radio waves, like GNSS navigation, GNSS related augmentation systems (e.g. EGNOS) and remote sensing. Thus, the modelling of ionospheric key parameter is very important. At DGFI-TUM, methods for modelling ionospheric parameters by the utilisation of measurements from various geodetic space observation techniques has been developed and validated for years. Within the DFG funded project 'Multi-Satellite ionosphere-plasmasphere Electron density reconstruction' (MuSE) the work is focused on the development of a method for the reconstruction of the electron density content of the ionosphere and plasmasphere by the assimilation of Low Earth Orbit satellite Slant Total Electron Content (STEC) measurements and electron density data from several satellite missions; cf. Gerzen et al. (2020).




*Estimated electron density distribution above 800 km altitude at February 10, 2015 at 14:00 UT, visualized by one horizontal layer at an altitude of 800 km and six vertical layers at different fixed longitudes*

The results of such data assimilations depend essentially, especially under solar or geomagnetically perturbed conditions, on the quality and accuracy of the measurements. Errors and inconsistencies in the data from different sources can dramatically decrease the quality of the modelled results; cf. Gerzen et al. (2015). This reflects a serious problem for all data driven approaches. We treat this problem by putting special attention on the data filtering methods. Three different STEC data filtering methods are developed at DGFI-TUM. For more details we refer to DGFI-TUM's Annual Report 2019, cf. https://mediatum.ub.tum.de/doc/1545821/1545821.pdf.

Within this master thesis, the developed filter methods shall be further developed and combined to one sophisticated filtering method. The developed filtered method shall be validated and tested. The findings shall finally be put into the context of modelling ionospheric key parameters.

**Main tasks:**

- Analysis of the ionospheric data sets and filtering methods already available at DGFI-TUM
- Development and validation of a sophisticated filtering method for STEC data.

**References:**

Gerzen, T., D. Minkwitz, M. Schmidt, E. Erdogan: Analyses of different propagation models for the estimation of the topside ionosphere and plasmasphere with an Ensemble Kalman Filter, Ann. Geophys. Discuss., https://doi.org/10.5194/angeo-2020-39, 2020.

Gerzen, T., D. Minkwitz, S. Schlüter: Comparing different assimilation techniques for the ionospheric F2 layer reconstruction. Journal of Geophysical Research, doi:10.1002/2015JA021067, 2015.

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