Multi-Satellite ionosphere-plasmasphere Electron density reconstruction (MuSE) – project overview and first results

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The ionosphere is the ionized upper part of the Earth's atmosphere that merges into the plasmasphere. The ionization is mainly caused by the solar radiation and by energetic particles originating from the solar wind. The Earth's atmosphere reacts to the variable solar energy input in a very complex manner including processes in the magnetospheres, plasmasphere, ionosphere, thermosphere and their mutual coupling. The reconstruction of the ionosphere-plasmasphere is an important step towards a comprehensive understanding of this coupled system. Moreover, the mitigation of ionospheric effects on radio waves is a critical issue for applications exploiting trans-ionospheric signals such as GNSS navigation, GNSS related augmentation systems (e.g. EGNOS and WAAS) and remote sensing. Within this scope, especially the description of the topside ionosphere and plasmasphere could be improved.

The project MuSE is part of the special priority program 1788 DynamicEarth (http://gepris.dfg.de/gepris/projekt/255388522?language=en) of the German Research Foundation (DFG) and aims at the better understanding of the structure and the dynamics of the ionosphere-plasmasphere system. The main goal of the project is the development of a topside ionosphere-plasmasphere model, which is capable to assimilate various measurements and exploits especially the measurements of the low Earth orbiters of the SWARM mission. A significant part thereby is the application of a plasmapause location index within the reconstruction procedure as a constraint for an appropriate initial guess of the ionosphere-plasmasphere state vector.

This presentation gives an overview about the MuSE project and the first achieved results. In particular, different possible 3D data assimilation procedures are discussed and initial test results are shown. Further, the plasmapause location index is outlined, which was developed on the basis of the magnetic field data of the SWARM satellites. Finally, open issues and next steps of the project are pointed out.