RADIO OCCULTATION SOUNDINGS IN IONOSPHERE AND SPACE WEATHER APPLICATIONS: ACHIEVEMENTS AND PROSPECTS

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It is well known that GNSS (Global Navigation Satellite System) signals are affected by the dispersive ionosphere, when the signals pass through it on their way from the transmitter to the receiver. The impact of the ionosphere is an error source that is usually eliminated both in GNSS navigation applications and in the retrieval of the characteristics of the neutral atmosphere from the RO (Radio Occultation) soundings. However, in both measurement types the retrieval of the characteristics of the ionosphere and the plasmasphere along the signal propagation path is also feasible. In RO soundings the measurement data can be used to retrieve slant profiles of the electron density. This measurement was for the first time demonstrated by the GPS/MET mission. Recently the FORMOSAT-3/COSMIC mission has already provided over 800 000 ionospheric soundings during the first 14 months of the mission.

Most RO missions perform also navigation measurements with a zenith pointing antenna for POD (Precise Orbit Determination) of the receiving satellite. These measurements can be used to retrieve the STEC (Slant Total Electron Content) along the signal propagation path. Depending on the satellite orbit, the retrieved STEC contains information about the plasmasphere or about the combined plasmasphere and ionosphere above the receiving satellite orbit height. These measurements can be used e.g., for development and validation of ionosphere-plasmasphere models. They can also be combined with RO soundings of the ionosphere to create 3D maps of the ionosphere-plasmasphere electron density either by using tomographic calculation techniques or by assimilating the observations into numerical ionosphere-plasmasphere models. The most accurate 3D electron density maps are usually retrieved by combining spaceborne GNSS observations with ground based GNSS STEC observations.

This presentation will give an overview of the ionosphere-plasmasphere monitoring with spaceborne and ground based GNSS observations, current achievements with data from the GPS/MET, CHAMP, GRACE, and FORMOSAT-3/COSMIC missions, and discuss the prospects of the GNSS "space weather" applications in respect to the current and near future RO missions.