



Current topic for a Master's Thesis

FORMOSAT-3 / COSMIC (F/C) observations for modeling the ionospheric vertical electron density profile

The ionosphere is defined as the ionized region of the upper Earth atmosphere between around 50 and 1000 km height. In this area the solar radiation together with charged particles from outside the atmosphere produces charged molecules and atoms from different chemical elements. Beneath the ionosphere the neutral atmosphere is located. This layer is not reached by enough solar photons to produce ionized particles. Above the ionosphere – in the plasma sphere – the molecule density rapidly declines, and as a consequence almost no interaction with solar radiation is possible.

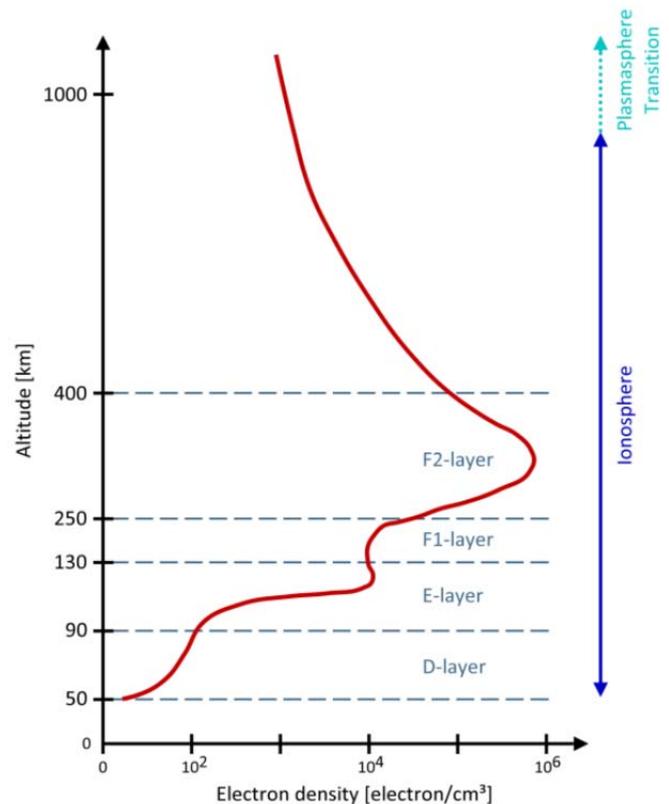
Due to recombination the vertical distribution of the electron density within the ionosphere is not equal but shows a clear maximum at about 300 km height (see figure at the right). In dependence on the source of ionization the ionosphere is usually subdivided into different layers known as D, E, F1 and F2.

Almost all space-geodetic measurements (e.g. GNSS) are affected by the ionosphere. Especially single-frequency measurements have to be corrected for ionospheric delay. Consequently, the electron density distribution has to be known as good as possible.

Within the Master Thesis, the Chapman function often used for modelling the electron density shall be extended or replaced by a mathematical formulation which describes the vertical profile and its spatial and temporal variations more appropriately. The chosen approach shall be adapted to real electron density profiles derived from occultation measurements of the F/C mission.

References:

- García-Fernández M.: Contributions to 3D ionospheric sounding with GPS data. *PhD thesis*, Univ. Catalonia, 2004.
- Liang W., et al.: Regional modeling of ionospheric peak parameters using GNSS data - an update for IRI. *Advances in Space Research*, doi: 10.1016/j.asr.2014.12.006, 2014



Electron density profile: the shape depends mostly on the geographical position, the time, the solar cycle and the season. The figure shows a profile during daytime.

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