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Comparison of topside ionospheric profilers for use in modelling and monitoring applications

Tobias Verhulst and Stan Stankov
Royal Meteorological Institute (RMI), Brussels, Belgium (tobias.verhulst@meteo.be)

Ground-based ionosonde measurements can be used to determine the electron density profile up to the ionospheric density peak, hmF2, only. In order to reconstruct a complete, full-height electron density profile, a model is usually needed for the shape of the topside ionospheric density. Different shapes have been used over the years, most frequently the so-called Chapman- and Epstein-layers. We use topside sounder data to evaluate the quality of the fit obtained by using profiles with different shapes and determine which profile provides the best fit. While the topside sounder database available at the US National Space Science Data Center is quite extensive, it is also very inhomogeneous. Data availability varies widely with local time, day of year, latitude and longitude. Measurements have been obtained over a period spanning more than a full solar cycle but the data coverage is irregular during different levels of solar activity. All these issues cause difficulties in correctly interpreting the results of the data analyses. Also, it must be taken into account that the provided data comes from different satellites, which orbited at different heights. This, too, can cause some biases in the results. These complications are investigated and, if necessary, compensated for. The correlations between the shape of the topside electron density profile and several possible factors that might influence this shape are also investigated. This includes geomagnetic indices (Kp and Dst), solar activity (indicated by F10.7), time of day, day of year and magnetic longitude and latitude. Finally, also the interdependencies of different characteristics of the ionosphere are discussed. For example, if the boundary between the ionosphere and plasmasphere is lower it could be expected that not only the scale height of the topside density changes, but also the shape of the density profile. Results are applied into further improving the RMI ionospheric monitoring service LIEDR (Local Ionospheric Electron Density profile Reconstruction).