RESIDUAL IONOSPHERIC ERRORS IN RADIO OCCULTATION DATA AND LATEST NEWS ON TWO CORRECTION TECHNIQUES

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Radio occultation (RO) data show high quality from the upper troposphere to the middle stratosphere (about 5 km to 35 km altitude). Above about 35 km, the impact of residual errors in the data rises due to measurement noise and an increasing impact of the ionosphere. While the measurement noise is handled in the RO retrieval by using a high-altitude initialization and some lowpass filtering of the data, the contribution of the ionosphere is corrected to first order by a dual-frequency linear combination of RO bending angles.

In the past years, the RO community has put significant effort into improving the quality of RO data towards higher altitudes including the upper stratosphere. In this respect, higher-order ionospheric correction techniques have played an increasing role in research. The residual ionospheric errors in bending angles can vary with the solar activity cycle between about 0.01 μrad up to more than 0.1 μrad, at altitudes near 35 km. This can amount to temperature biases of more than 0.5 K at these altitude levels.

After introducing the topic along the lines above, I will focus in this presentation on the two latest correction techniques, the kappa-correction and the bi-local correction. A main advantage of the kappa-correction is that it is easy and fast to apply, depending only on the solar radio flux index as external auxiliary information. So far, it was tested in simulation studies and more recently on real observed RO data. The bi-local correction, on the other hand, includes not only effects of the ionosphere in a more comprehensive manner, but also geomagnetic information, for modeling the higher-order geomagnetic term.

A comparison study has shown that the large-scale ionospheric variations were captured about equally well by both corrections, while the smaller geomagnetic impact played a somewhat increased role in low-orbit RO missions, such as CHAMP or GRACE, and in particular for regional averages, where it may contribute systematic bias effects. Ongoing research focuses on a more detailed profile-to-profile intercomparison based on extended time periods, more refined study of the impact of the geomagnetic term, as well as of the inbound and outbound electron density asymmetries along the RO ray paths.