

SENSITIVITY OF GNSS OCCULTATION PROFILES TO HORIZONTAL VARIABILITY IN THE TROPOSPHERE

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We investigated the sensitivity of atmospheric profiles retrieved from Global Navigation Satellite System (GNSS) radio occultation data to atmospheric horizontal variability in a threefold way. First, the error given a horizontally variable atmosphere relative to a spherically symmetric atmosphere was quantified based on an ensemble of about 300 occultation events. The investigation was based on using a representative European Centre for Medium-Range Weather Forecasts (ECMWF) T511L60 analysis field with and without horizontal variability. Such a high-resolution analysis, with horizontal sampling denser than 40 km x 40 km globally, realistically represents also the components of horizontal variability smaller than the occultation-event resolution of about 200-300 km. In this context, the impact of either assuming the "true" profile vertically at a mean event location (the common practice) or more precisely along the estimated 3D tangent point trajectory traced out during the event was assessed as well. Second, we inspected by how much the standard deviation and bias errors decrease, relative to the mean-event-location approach, if the data are exploited along a tangent point trajectory deduced purely from observed data, mainly satellite position and bending angle data. Third, the sensitivity of retrievals to the angle-of-incidence of occultation rays relative to the boresight direction of the receiving antenna (aligned with the orbit plane of the Low Earth Orbit satellite) was analysed based on the same ensemble of events for three different angle-of-incidence classes (0-10 deg, 20-30 deg, 40-50 deg; ensembles of about 100 events in each class). This provided insights into how much the errors, and the climate monitoring utility, of GNSS occultation data depend on occultation event geometry. The core tool of the study was the End-to-end GNSS Occultation Performance Simulator (EGOPS) software. Results for all the analysed aspects of influence of horizontal variability are discussed and areas of best and most degraded performance clearly identified.