END-TO-END SIMULATION OF ATMOSPHERIC SOUNDING BY OCCULTATION SENSORS - EGOPS4 AND BEYOND

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EGOPS4 (End-to-end GNSS Occultation Performance Simulator, Version 4) is the most recent version of the EGOPS software tool developed as an international European effort over the last years since 1996. EGOPS4 is capable of integrated simulation of Global Navigation Satellite System (GNSS) based radio occultation in an end-to-end manner - from the GNSS satellites transmitting the signals down to final data products like temperature and water vapor profiles. The tool can also be used to process real occultation data, such as GPS/MET and CHAMP/GPS data, and has some functionality involved also for GNSS scatterometry (ocean-reflected signals). A brief overview on concept and capabilities of EGOPS is given, with focus on most recently added capabilities, as well as an indication of the many scientific and technical studies EGOPS has supported so far.

Beyond EGOPS4, the major next step is extension to an End-to-end Generic (rather than GNSS only) Occultation Performance Simulator of which the first version, EGOPS5, is scheduled to be ready late 2003. The main objectives of EGOPS5 and successors - directly generalized from the objectives of EGOPS4 and predecessors - are: (i) Mission analysis and planning for low Earth orbit (LEO) satellites equipped with GNSS, LEO-crosslink, stellar, or solar/lunar occultation sensors (geometry of events, coverage by events, various spatio-temporal statistics for given GNSS/LEO/star/sun/moon/ground-station constellations), (ii) Simulation of time-tagged transmission/phase delay/bending angle profiles as seen by a sensor (forward modeling through the atmosphere-ionosphere system from signal source to sensor, based on a hierarchy of atmosphere/ionosphere models from simple smooth climatologies to high-resolution 3D weather analysis fields), (iii) Simulation of observed occultation data involving realistic errors (observation system modeling using forward-modeled profiles as input, such as modeling of signal detection/tracking and of relevant sensor system errors), (iv) Processing of simulated or observed occultation data (inversion of transmission/phase delay/bending angle observables to atmospheric/ionospheric profiles by a range of different processing chains), and (v) integrated post-processing, visualization, validation, and documentation of all simulator results (interactive exploration in form of statistics, geographic maps, profiles, volume data mining, data animation).

EGOPS5 work is outlined and various prototype algorithms and related results are discussed. A major initial focus is extension to LEO-crosslink capability, in view of upcoming performance studies for the ESA satellite mission ACE+. Major driver at the optical occultation side is the ENVISAT/GOMOS (Global Ozone Monitoring by Occultation of Stars) sensor. Finally, information is provided on the availability of EGOPS to the scientific and technical communities.