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Preliminary validation efforts of GRAS radio occultation data recorded in raw-sampling mode

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Atmospheric remote soundings of tropo-/stratospheric temperature profiles by the GNSS (Global Navigation Satellite System) radio occultation (RO) method provide valuable input for numerical weather prediction models and climate change studies. The RO-instrument GRAS (GNSS Receiver for Atmospheric Sounding) on-board of EUMETSAT's (European Organisation for the Exploitation of Meteorological Satellites) MetOp satellite has been designed for observing setting and rising occultations from the GPS (Global Positioning System) satellite constellation. A dedicated ESA (European Space Agency, contract 21995/08/NL/FM) funded study was set up to investigate the potential of RO data recorded in RS (raw-sampling) mode.

First results from GRAS RO data recorded in RS mode processed at the GFZ are presented. The experimental processing software POCS-X includes full spectrum inversion in order to cope with multi-path regions and enables (in connection with RS data) to retrieve bending angle/refractivity profiles down to the Earth's surface. The retrievals are validated against co-located ECMWF (European Centre for Medium-Range Weather Forecasts) profiles. The focus is on data from October 2007 provided by EUMETSAT. The intercomparison indicates good quality of the retrieved profiles: The global mean fractional refractivity deviation from 0 to 5 km varies between -1.8% to +0.4%. The meridional distribution of the fractional refractivity deviation at low altitudes shows that the observed negative/positive bias mainly stems from the tropical lower troposhere. This feature can be probably attributed to the presence of superrefraction/subrefraction. From 10 to 35 km we notice an increasing bias with altitude in the global mean fractional refractivity ranging from -0.1% to -0.8%. Sensitivity tests indicate that the climatology (MSIS), which is used in the statistical optimization at high altitudes, contributes to this bias. However, excluding the climatology from the processing, at the expense of an increased standard deviation at high altitudes, does not completely remove the bias. Though the current GPS constellation yields about 650 occultations per day, our software currently fails to process about 50% of the measurements (e.g. due to insufficient global coverage with navigation data bits collected by GFZ's ground station network). An increased yield of the retrievals, the profile-to-profile intercomparison with other teams participating in the GRAS RS study and the fine-tuning of the processing system is work in progress.