DEVIATIONS FROM A HYDROSTATIC ATMOSPHERE IN RADIO OCCULTATION DATA

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Measurements of bending angles based on the radio occultation method generally do not provide a vertical scan through the atmosphere. Thus the actual pressure profile along the tangent point trajectory might deviate from a hydrostatic pressure profile. These deviations can lead to errors in 1DVar retrievals of temperature and water vapor profiles from radio occultation measurements. The errors are caused by the assumption of a hydrostatic atmosphere in the retrieval process: One usually retrieves a reference pressure at a certain altitude which is used to generate the complete pressure profile by employing the hydrostatic equation, together with the retrieved temperature and water vapor profiles.

We investigate the effects of this non hydrostatic atmosphere on 1DVar retrievals by first simulating bending angle measurements using the EGOPS 3D ray tracing tool and ECMWF T511 atmospheric fields. The EGOPS tool provides information about the tangent point trajectory, which allows to determine the temperature, pressure, and water vapor profile following this trajectory. We then compare the pressure profile along the tangent point trajectory with a hydrostatic pressure profile. Deviations larger 1% can be found for selected cases, usually for mid-latitude occultations. Finally we run 1DVar retrievals with a measurement generated from a non hydrostatic atmosphere. Within the 1DVar process, the hydrostatic equation is applied to generate the pressure profile. Retrieval errors can be larger than 0.5K for temperature and larger than 20% for water vapor for severe non hydrostatic cases.