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Validating Satellite Observations of Thermodynamic Variables by Reference Datasets from GPS Radio Occultation

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In the frame of calibration and validation activities of the European Space Agency (ESA), the WEGC prepares and provides long-term GPS radio occultation (RO) reference data from a variety of RO missions (in total up to about 2500 profiles per day) in Generic Earth Observation Metadata Standard (GEOMS) format. Applications of the data include use in the long-loop monitoring of trends related to other spaceborne instruments but also to climate change and variability. Further uses include validation of diverse atmospheric satellite data products and of geophysical retrieval algorithms or also support to scientific evaluation of atmospheric processes. Specifically, we ensure the provision of correlative RO data suitable for in-depth examination of tropospheric and stratospheric fundamental state profiles, such as of temperature, humidity and pressure as function of altitude, from other (satellite) observations. This is highly worthwhile since the unique combination of global coverage, high accuracy and vertical resolution, long-term stability, and virtual all-weather capability makes, in the free atmosphere, the validation with RO data preferable to other methods.

The presentation will introduce this project on multi-mission validation by RO, its setup at the WEGC, and the quality and convenient availability of the RO datasets. It will then focus on the discussion of example results of the multi-year validation of temperature, pressure, and density profiles over the upper troposphere and lower stratosphere (UTLS) from Envisat MIPAS and GOMOS data against collocated RO data from CHAMP, Formosat-3/COSMIC, and MetOp-A/GRAS. These validations provide valuable hints for future improvements in the processing of the Envisat data. In addition, the RO dataset is inter-validated with profiling data from ground-based sites defined in the Multi-TASTE and VALID projects (Lidars, etc.), which are related to Envisat validation, and against a high-quality radiosonde dataset (RAOBCORE) available from the Univ. of Vienna, Austria. We show how these results help to obtain quantitative estimates on the quality of RO data (e.g., systematic error bounds) and on their utility to serve as reference data for the targeted climate monitoring and validation applications.