Geophysical Research Abstracts
Vol. 16, EGU2014-13615, 2014
EGU General Assembly 2014

Systematic Errors in GNSS Radio Occultation Data - Part 2

Ulrich Foelsche (1,2), Julia Danzer (2,1), Barbara Scherllin-Pirscher (2,1), Marc Schwärz (2,1)

(1) Institute for Geophysics, Astrophysics, and Meteorology/Institute of Physics (IGAM/IP), University of Graz, Graz, Austria., (2) Wegener Center for Climate and Global Change (WEGC), University of Graz, Graz, Austria

The Global Navigation Satellite System (GNSS) Radio Occultation (RO) technique has the potential to deliver climate benchmark measurements of the upper troposphere and lower stratosphere (UTLS), since RO data can be traced, in principle, to the international standard for the second. Climatologies derived from RO data from different satellites show indeed an amazing consistency of (better than 0.1 K). The value of RO data for climate monitoring is therefore increasingly recognized by the scientific community, but there is also concern about potential residual systematic errors in RO climatologies, which might be common to data from all satellites. We have analyzed different potential error sources and present results on two of them.

(1) If temperature is calculated from observed refractivity with the assumption that water vapor is zero, the product is called “dry temperature”, which is commonly used to study the Earth’s atmosphere, e.g., when analyzing temperature trends due to global warming. Dry temperature is a useful quantity, since it does not need additional background information in its retrieval. Concurrent trends in water vapor could, however, pretend false trends in dry temperature. We analyzed this effect, and identified the regions in the atmosphere, where it is safe to take dry temperature as a proxy for physical temperature. We found that the heights, where specified values of differences between dry and physical temperature are encountered, increase by about 150 m per decade, with little differences between all the 38 climate models under investigation.

(2) All current RO retrievals use a "classic" set of (measured) constants, relating atmospheric microwave refractivity with temperature, pressure, and water vapor partial pressure. With the steadily increasing quality of RO climatologies, errors in these constants are not negligible anymore. We show how these parameters can be related to more fundamental physical quantities (fundamental constants, the molecular/atomic polarizabilities of the constituents of air, and the dipole moment of water vapor). This approach also allows to compute sensitivities to changes in atmospheric composition, where we found that the effect of the CO_2 increase is currently almost exactly balanced by the counteracting effect of the concurrent O_2 decrease.