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Improving GOMOS High Resolution Temperature validation by discriminating atmospheric gravity waves

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Atmospheric gravity waves play an important role in the thermodynamic processes of the atmosphere. The gravity waves, once generated in the upper troposphere and lower stratosphere, propagate upward and deposit their energy and momentum when dissipating. These atmospheric waves can cause strong fluctuations in the thermal structure of the middle and upper atmosphere.
The satellite temperature retrievals, together with innovative analysis methods, are often used to provide constraints for model parameterization, which can improve the treatment of these phenomena in climate-prediction models, as the temperature profiles are expected to present wave-like structures due to the global distribution of the gravity-wave momentum flux.
The analysis of temperature variability as a function of spatial and temporal separation indicates that gravity wave activity has impacts also on validation study site selection.
The aim of this study is to analyse the characteristics of the atmospheric gravity waves detectable in the GOMOS (Global Ozone Monitoring by Occultation of Stars) High Resolution Temperature Profiles (HRTP). These are collected over altitudes ranging from 18 to 35 km, in the 2002 to 2012 time period. The GOMOS instrument is a medium-resolution star-occultation spectrometer operating in the ultraviolet–visible–near-infrared (UV-VIS-NIR) spectral range, onboard of the ESA/ENVISAT platform. The HRTP products are the result of the analysis of the two fast photometer measurements, and the retrieval is based on a GPS-like inversion scheme (Kyrola et al., 2010).
Following our new approach, based on the use of the "Morlet" wavelet transform (Torrence and Compo, 1998), it is possible to capture the vertical amplitude and phase of waves of very different size along the temperature profile. The wavy signal is estimated and subtracted to the original profile, thus providing a "wave-free" profile.
Comparison of wave-free temperature profiles and gravity wave structures with those estimated from collocated ozonesonde data (SHADOZ, http://croc.gsfc.nasa.gov/shadoz) in the 40S to 40N latitude range will be discussed in detail. Preliminary results demonstrate that the proposed approach is very effective, particularly for the study of gravity waves, which are by nature non stationary and highly localised in space and time.

References

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