Geophysical Research Abstracts
Vol. 20, EGU2018-11442, 2018
EGU General Assembly 2018

How stratospheric gravity wave observations of AIRS and HIRDLS complement each other

Catrin I. Meyer (1), Lars Hoffmann (1), Manfred Ern (2), Quang Thai Trinh (2), and M. Joan Alexander (3)

(1) Forschungszentrum Jülich , Jülich Supercomputing Centre (JSC), Jülich, Germany (cat.meyer@fz-juelich.de), (2) Forschungszentrum Jülich, Institut für Energie- und Klimaforschung (IEK-7), Jülich, Germany, (3) NorthWest Research Associates, Inc., CoRA Office, Boulder, CO, USA

Stratospheric gravity wave observations by the Atmospheric InfraRed Sounder (AIRS) aboard NASA's Aqua satellite and the High Resolution Dynamics Limb Sounder (HIRDLS) aboard NASA's Aura satellite are investigated. AIRS is a nadir sounder and thus more sensitive to short-horizontal-wavelength gravity waves, while HIRDLS as a limb sounder is more sensitive to short-vertical-wavelength gravity waves. The AIRS temperatures discussed here are from a dedicated high-resolution temperature retrieval that provides stratospheric temperature profiles for each individual satellite footprint and therefore has nine times better horizontal sampling than the operational data. Different from this, HIRDLS provides temperatures only in a single measurement track, but with better vertical resolution.

AIRS and HIRDLS temperature variances due to stratospheric gravity wave activity are compared on a statistical basis. The analysis covers time series for the HIRDLS measurement time period (January 2005 - March 2008). AIRS and HIRDLS seasonal and latitudinal patterns of gravity wave activity agree well. A strong annual cycle at mid- and high-latitudes is found at 42km, which has its maxima during wintertime and its minima during summertime. Largest variability is found at 60°S during austral wintertime. Variations in the zonal wind are one of the main reasons for the strong variability in gravity wave variances.

We calculated a momentum flux factor, which indicates that the waves seen by AIRS contribute significantly to the total amount of gravity wave momentum flux, even if the AIRS temperature variance may be small compared to HIRDLS. Although the sensitivity functions of the two instruments for gravity waves are very different, the stratospheric wave structures observed by AIRS and HIRDLS often agree very well. The three-dimensional temperature fields from AIRS allow us to derive the horizontal orientation of the phase fronts, which is a limiting factor for gravity wave analyses based on limb measurements today.

Altogether, gravity wave variances of AIRS and HIRDLS are complementary to each other. In spite of differences in the sensitivity functions, large parts of the gravity wave spectrum are covered by joint observations. This offers an exciting perspective for future gravity wave research.