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A global climatology of stratospheric gravity waves from Atmospheric Infrared Sounder observations

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We present the results of a new study that aims on the detection and classification of 'hotspots' of stratospheric gravity waves on a global scale. The analysis is based on a nine-year record (2003 to 2011) of radiance measurements by the Atmospheric Infrared Sounder (AIRS) aboard NASA's Aqua satellite. We detect the presence of stratospheric gravity waves based on 4.3 micron brightness temperature variances. Our method is optimized for peak events, i.e. strong gravity wave events for which the local variance considerably exceeds background levels. We estimated the occurrence frequencies of these peak events for different seasons and time of day and used the results to find local maxima of gravity wave activity. In addition, we use AIRS radiances at 8.1 micron to simultaneously detect convective events, including deep convection in the tropics and mesoscale convective systems at mid latitudes. We classified the gravity waves according to their sources, based on seasonal occurrence frequencies for convection and by means of topographic data. Our study reproduces well-known hotspots of gravity waves, e.g., the mountain wave hotspots at the Andes and the Antarctic Peninsula or the convective hotspot during the thunderstorm season over the North American Great Plains. However, the high horizontal resolution of the AIRS observations also helped us to locate several smaller hotspots, which were partly unknown or poorly studied so far. Most of these smaller hotspots are found near orographic features like small mountain ranges, in coastal regions, in desert areas, or near isolated islands. This new study will help to select the most promising regions and seasons for future observational studies of gravity waves.

Reference:

Hoffmann, L., X. Xue, and M. J. Alexander, A global view of stratospheric gravity wave hotspots located with Atmospheric Infrared Sounder observations, J. Geophys. Res., 118, 416-434, doi:10.1029/2012JD018658, 2013.