Geophysical Research Abstracts
Vol. 15, EGU2013-4576, 2013
EGU General Assembly 2013

Characteristics of convectively generated gravity waves in ECMWF

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The general circulation model of ECMWF explicitly resolves part of the gravity wave (GW) spectrum. Accordingly, GW structures in ECMWF temperatures and winds are used, for instance, for campaign analysis and interpretation of measurements like satellite data. Previous global comparison of one year of ECMWF-modeled GWs with SABER satellite observations indicate good agreement for mountain waves but rather moderate agreement for regions where convection is the dominant source. We here analyze GWs in ECMWF temperature fields at 25 km altitude and determine the 3D wave vector and momentum flux of the waves. Backward ray-tracing based on these results reveals the sources of these GWs globally. For instance, mountain waves above Greenland, South-America and the Antarctic peninsula as well as a storm approaching the Norwegian coast are important sources for the global budget. It is found that due to oblique propagation waves spread several thousand km from narrow source regions. Gravity waves originating in the vicinity of convection are found to have low phase velocities, low vertical group velocities, and are excited frequently around the tropopause. This characteristic of the waves in ECMWF contrasts to numerical model simulations and observations. Possible reasons why ECMWF misses an important part of the spectrum of convectively excited waves are discussed. The results are an example that sufficient resolution to resolve a process in e.g. a weather forecast model is not sufficient for realistic simulation of this process, if e.g. non-linear interaction to non-resolved source processes is important.