Global gravity wave distributions from limb-sounding satellites, ECMWF and ray-tracing modelling

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Gravity waves (GWs) are an important coupling process in the atmosphere, they need to be well understood for weather forecast and climate projection. In particular, it is important to understand the global distribution of GW momentum flux (GWMF). Climatologies of the absolute values of GWMF are obtained from infrared limb sounding observations. However, with current day instruments the direction cannot be determined and the observational filter of the instrument introduces substantial uncertainties. Numerical weather forecast models which are employed for example by the European Centre for Medium-Range Weather Forecasts recently reached a horizontal resolution allowing to resolve a large part of the GW spectrum. We will compare the global distributions of absolute GW momentum flux from GWs resolved by the ECMWF model with values from the satellite instruments HIRDLS and SABER. Distributions are discussed with respect to different sources and modulation by the background wind. The ECMWF data can help to infer missing quantities, such as the direction. At higher altitudes, GWs are not well represented in ECMWF. We will show that by combining GW analyses from ECMWF with ray-tracing modeling, it is possible to study GW – background flow interaction up to the mesosphere-lower thermosphere (MLT).

Key words: gravity waves, remote sensing, numerical weather prediction, ray-tracing