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GRACILE: A comprehensive climatology of atmospheric gravity wave parameters based on satellite limb soundings

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Gravity waves are one of the main drivers of atmospheric dynamics. Their wavelengths are in the range of tens to a few thousand kilometers horizontally, and a few ten kilometers to <1 km vertically. These scales are too small to be properly resolved by most global circulation models (GCMs) and chemistry climate models (CCMs). Therefore in GCMs/CCMs the effect of gravity waves on the global circulation is usually parametrized. These parametrizations are very simplified, and comparisons with global observations of gravity waves are needed for an improvement of parametrizations and an alleviation of model biases.

We present a gravity wave climatology based on atmospheric infrared limb emissions observed by satellite (GRACILE). GRACILE is a global data set of gravity wave parameters observed in the stratosphere and the mesosphere by the infrared limb sounding satellite instruments High Resolution Dynamics Limb Sounder (HIRDLS) and Sounding of the Atmosphere using Broadband Emission Radiometry (SABER). We provide various gravity wave parameters (for example, gravity wave variances, potential energies, absolute momentum fluxes, vertical wavelengths, and horizontal wavenumbers). This comprehensive climatological data set can serve for comparison with other instruments (ground based, airborne, or other satellite instruments), as well as for comparison with gravity wave distributions, both resolved and parametrized, in GCMs and CCMs. Multiple parameters are provided to make our data set useful for different applications and to overcome limitations of other observation techniques, or of models, that may be able to provide only one of those parameters.

We will present typical average global distributions and zonal averages, as well as their natural range of variations. In addition, we will discuss seasonal variations of the global distribution of gravity waves, as well as limitations of our method of deriving gravity wave parameters from satellite data.

The GRACILE data set is available open access at: https://doi.org/10.1594/PANGAEA.879658.