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A climatology of gravity wave parameters based on satellite limb soundings

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Gravity waves are one of the main drivers of atmospheric dynamics. The resolution of most global circulation models (GCMs) and chemistry climate models (CCMs), however, is too coarse to properly resolve the small scales of gravity waves. Horizontal scales of gravity waves are in the range of tens to a few thousand kilometers. Gravity wave source processes involve even smaller scales. Therefore GCMs/CCMs usually parametrize the effect of gravity waves on the global circulation. 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.

In our study, we present a global data set of gravity wave distributions 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 variances, potential energies and absolute momentum fluxes). 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. The purpose of providing various different parameters is to make our data set useful for a large number of potential users and to overcome limitations of other observation techniques, or of models, that may be able to provide only one of those parameters. We present a climatology of typical average global distributions and of zonal averages, as well as their natural range of variations. In addition, we 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.