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Global gravity wave simulations with the GROGRAT ray tracer

P. Preusse (1), S.D. Eckermann (2), M. Ern (1)

(1) ICG-I, Forschungszentrum Juelich, Germany (p.preusse@fz-juelich.de) (2) E. O. Hulburt Center for Space Research, Naval Research Laboratory, Washington DC, USA

Simulations performed with General Circulation Models show that a realistic wind and temperature structure of the mesosphere and lower thermosphere can only be reproduced if gravity waves are taken into account. In most of these models, however, gravity waves are parameterized and observational constraints are sparse. Therefore a long standing problem remains unresolved: which part of the gravity wave spectrum conveys which fraction of momentum into the MLT region? Beyond being puzzling, the question is interesting for two reasons. First, long horizontal wavelengths gravity waves are likely to propagate long distances horizontally from their sources on their way to higher altitudes. This could cause larger deviations from GW parameterizations in GCMs assuming purely vertical propagation. Second, no instrument can cover the whole range of the wave spectrum but only a certain part. In particular, optically-thin limb sounding observes only waves with horizontal wavelengths larger than 100-200 km. Shorter horizontal wavelength waves carry larger momentum and propagate faster into the higher altitudes, but very short waves are evanescent and cannot propagate at all. These questions are investigated by global ray tracing studies employing the GROGRAT model. First, ray tracing studies guided by satellite observations are used to investigate the contribution of long horizontal wavelength waves. Second, a minimum horizontal wavelength for effective upward propagation is determined by global ray tracing of short horizontal wavelengths.