Geophysical Research Abstracts
Vol. 19, EGU2017-4133-2, 2017
EGU General Assembly 2017

Idealized numerical studies of gravity wave alteration in the tropopause region

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When travelling through the tropopause region, characterised by strong gradients in static stability, wind shear and trace gases, the properties of gravity waves often change drastically.

Within this work, the EULAG model (Prusa et al., 2008) is used to provide an idealized setup for sensitivity studies on these modifications.

The characteristics of the tropopause are introduced by specifiying environmental profiles for Brunt-Väisälä frequency and horizontal wind speed, partly extracted from measurement and reanalysis data.
Tropospheric and stratospheric wave spectra extracted for flows under varying tropopause sharpness are analysed, respectively.
In particular, different regimes for transmission behaviour are classified for a series of Brunt-Väisälä frequency profiles showing a tropopause inversion layer (TIL, see e.g. Birner et al., 2002).

Furthermore, this study focusses on the comparison of transmission coefficients deduced from numerical simulations with values derived from asymptotical analysis of the governing equations and investigates where the threshold of linear behaviour are for the respective setups,

The wave generation is implemented in the model both through topography at the lower model domain and through the prescription of wave packets at initialization of the simulations.

References:

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