Geophysical Research Abstracts
Vol. 19, EGU2017-11213, 2017
EGU General Assembly 2017

Gravity Wave Interactions with Fine Structures in the Mesosphere and Lower Thermosphere

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An anelastic numerical model is used to probe the influences of fine layering structures on gravity wave propagation in the Mesosphere and Lower Thermosphere (MLT). Recent lidar observations confirm the presence of persistent layered structures in the MLT that have sharp stratification and vertical scales below 1km. Gravity waves propagating through finely layered environments can excite and modulate the evolution of small scale instabilities that redefine the layering structure in these regions. Such layers in turn filter the outgoing wave spectra, promote ducting or reflection, hasten the onset of self-acceleration dynamics, and encourage wave/mean-flow interactions via energy and momentum transport. Using high resolution simulations of a localized gravity wave packet in a deep atmosphere, we identify the relative impacts of various wave and mean flow parameters to improve our understanding of these dynamics and complement recent state-of-the-art observations.