Fine Structure Interactions with Gravity Waves in the Mesosphere and Lower Thermosphere

*Tyler Mixa[1,2], David Fritts[2], Katrina Bossert[2], Brian Laughman[2], Ling Wang[2], Thomas Lund[3], Lakshmi Kantha[1]

1. University of Colorado Boulder, CO, USA, 2. GATS-inc Boulder, CO, USA, 3. NorthWest Research Associates Boulder, CO, USA

An anelastic numerical model is used to characterize the influences of fine layer structures on gravity wave propagation in the Mesosphere and Lower Thermosphere (MLT). Recent lidar observations identify persistent layering structures in the MLT that have sharp stratification and vertical scales below 1 km. Gravity waves propagating through finely layered environments can trigger the evolution of small scale instabilities that significantly enhance the layering in these regions. Such layers in turn promote ducting or reflection, hasten the onset of self-acceleration dynamics, encourage wave/mean-flow interactions, and filter the outgoing wave spectra, defining the wave's influence as it propagates to higher altitudes. Using high resolution simulations of a localized gravity wave packet in a deep atmosphere, we identify the impacts of various wave and mean flow parameters to determine the major mechanisms driving these dynamics and complement recent state-of-the-art observations.

Keywords: Gravity Wave, Wave Mean-Flow Interactions, Mesosphere and Lower Thermosphere

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