

MST-15 Session M6: Oral presentation

Nonlinear Gravity Waves Dynamics in the Mesosphere and Lower Thermosphere

Dave Fritts, Brian Laughman, and Ling Wang – GATS, Boulder, CO

and

Tom Lund – NWRA, Boulder, CO

This talk will describe high-resolution modeling of nonlinear gravity wave (GW) dynamics occurring primarily in the mesosphere and lower thermosphere (MLT). Gravity waves having large vertical scales and group velocities readily reach high altitudes and attain large amplitudes. Large vertical scales and amplitudes imply large momentum fluxes, strong wave and mean-flow interactions, instabilities, and turbulence. Large GW momentum fluxes can lead to strong self-acceleration dynamics, stalling of vertical propagation, and radiation of secondary GWs. These dynamics can precede “GW breaking” instabilities. Self-acceleration dynamics of GW packets localized in 2 or 3 dimensions cause strong generation of secondary GWs, often at larger scales, that readily attain much higher altitudes. GW-tidal interactions lead to strong dissipation, momentum flux divergence, and secondary GW radiation. Similarly, GWs encountering mesospheric inversion layers, or similar features due to lower-frequency motions, exhibit strong reflections, and instabilities and dissipation at large amplitudes. Surprisingly, such dynamics yield very weak mixing and heat transport, despite broad expectations for strong mixing and creation of near-adiabatic layers in the literature.