A global account of thermal gradients in the mesosphere and their impact on gravity wave propagation

*Kim Nielsen[1], Samuel Otero[1]

1. Department of Physics, Utah Valley University

The mean vertical temperature state of the atmosphere defines the atmospheric layers known as the troposphere, stratosphere, mesosphere, and thermosphere. Superimposed upon this background temperature are perturbations due to atmospheric waves exhibiting a broad spectrum of spatial and temporal scale sizes as well as vertical structures due to wave-wave interactions and wave breaking. Large-scale waves such as planetary and atmospheric tidal waves exhibit spatial variability in both latitude and longitude as well as temporal variability on the scales of several hours to days. Smaller scale waves known as atmospheric gravity waves are more localized and exhibit wave periods from a few minutes to several hours. These smaller-scale waves have been shown to be major contributors to energy and momentum transfer across atmospheric layers from the troposphere and well into the thermosphere. The upward propagation of these waves is strongly affected by the background temperature field through reflection and change in the atmospheric stability condition for supporting the propagation of these waves. Mesospheric inversion layers (MIL) are large scale features exhibiting strong thermal gradients capable of altering the wave propagation. MILs fall into two categories: Lower (~75 km) and upper (~95 km) MILs, and can be generated by planetary wave breaking as well as wave interactions. Several studies of the lower mesospheric inversion layers exist while few studies have focused on the upper mesospheric phenomena. Furthermore, the Polar regions have eluded these studies. This presentation will detail the existence and variability of strong vertical thermal gradients in the lower and upper mesosphere utilizing 15 years of SABER data. The presentation will also include a discussion on how the observed gradients impact the propagation of atmospheric gravity waves with a focus on the Polar regions.

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