Coupling of the lower atmosphere to the thermosphere via gravity waves

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The intermittent coupling of gravity waves from the lower atmosphere to the thermosphere can alter the local structure of the thermosphere. Some of the GWs from the lower atmosphere, such as from deep convection in the troposphere and from wave breaking in the mesosphere, can propagate into the thermosphere. Those waves having large vertical wavelengths and relatively high frequencies can propagate into the middle thermosphere before dissipating, depending on solar conditions. Using a new dissipative, anelastic GW dispersion relation within a ray trace model, and convection and wave breaking models of the lower atmosphere, we describe the intermittent and spatially localized production of GWs from the lower atmosphere, their propagation into the thermosphere, and the dissipative filtering which alters the GW spectra within the thermosphere as a function of altitude. For a range of solar conditions, we discuss the spectral characteristics and amplitudes of the GWs from these coupled lower atmospheric sources which survive dissipation. We find that some of these GWs have appropriate characteristics in the thermosphere that may lead to seeding of plasma instabilities and spread-F bubbles commonly observed in the thermosphere. Additionally, the dissipation of GWs in the thermosphere yields thermospheric body forces, which may result in the generation of thermospheric neutral winds and upgoing and downgoing secondary GWs within the thermosphere.