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Attenuation of gravity waves and kinetic viscosity in the ionosphere

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Gravity waves (GW) couple various atmospheric layers and influence dynamics of the region in which they dissipate their energy. Attenuation of GW is in this contribution calculated from the ratio of GW kinetic energies observed at different heights by multi-frequency and multi-point continuous Doppler sounding that allows three-dimensional (3D) analysis of GW propagation in the ionosphere. It is shown that the attenuation of GWs increases with height, which is consistent with the hypothesis that mainly viscous damping and losses due to thermal conductivity are responsible for the wave attenuation in the thermosphere/ionosphere. The kinematic viscosity of the highly rarefied air at the height of observation is estimated from the observed attenuation with altitude and complex dispersion relation for GWs that includes viscosity and thermal conductivity, which is linked with the viscosity via Prandtl number. The intrinsic (wind rest frame) characteristics of GW that enter the dispersion relation are obtained after subtracting the neutral wind velocities from the observed phase velocities using HWM-14 wind model. A more detailed modelling of GW attenuation will be done in the future.