



## Variations of the ionosphere and thermosphere

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The semi-annual, annual, inter-annual and solar cycle variations of the ionosphere and thermosphere are compared with the corresponding variations of the solar forcing on the upper atmosphere. The solar activity variations of the ionospheric electron density, and thermospheric meridional wind velocity and tidal amplitudes and phases obtained from 18 years of the incoherent scatter observations made using the MU radar (36°N, 135°E) are studied further. As known, the electron density increases with solar activity. However, the mean wind velocity and tidal amplitudes are found to decrease with solar activity, with the absolute rate of decrease being faster for stronger tides. These anti-correlations between the thermospheric variations and solar forcing seem to be due to ion drag and thermospheric inertia. The mean wind velocity, and tidal amplitudes and phases obtained from the theoretical global scale wave model (GSWM), empirical horizontal wind model (HWM93), and Millstone Hill IS radar data show similar solar activity dependencies as those obtained from the MU radar though there are significant quantitative differences.