

Solar Variability Impacts on Thermosphere-Ionosphere Weather and Climate

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The effects of solar ultraviolet irradiance and geomagnetic storms on upper atmosphere of the Earth increase with increasing altitude, and become dramatic above about 100 km. Problems associated with tracking and predicting the trajectories of the thousands of objects currently in Earth orbit have received recent attention, especially with regard to the drag force applied by thermospheric atoms and molecules. In order to calculate and predict thermospheric density and composition, numerical models are employed, using solar irradiance and magnetospheric currents, together with lower atmosphere processes, to create a dynamical description of the coupled thermosphere and ionosphere. In addition to the challenges associated with applying realistic external inputs, the upper atmosphere is evolving, due to changes in thermodynamics associated with anthropogenic increases in radiatively active gases. Understanding these long-term changes is, in turn, complicated by recent developments in the solar cycle, with the last solar minimum particularly long and quiet, and the current cycle very weak. This presentation will give an overview of these developments, present some modeling and measurement results, and discuss new opportunities for global observations of the thermosphere and ionosphere.