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Observations and Modeling of Space Weather Impacts on the Earth

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“Space weather” refers to conditions in the solar wind, magnetosphere, ionosphere, and upper atmosphere, that influence space-borne and ground-based technological systems and can endanger human space exploration. These effects are caused by variations in solar photon and particle radiation due to flares and coronal mass ejections, and changes in the solar/interplanetary magnetic field, that impact the magnetosphere and ionosphere. Space weather can initiate satellite failures, interfere with radio communications, cause navigation errors, disrupt electrical power distribution systems, and expose astronauts to dangerous levels of radiation. Mitigation requires both a better understanding of the space environment, and developing the ability to forecast conditions in space. The development of first-principles numerical models of the solar-terrestrial system gives us insight into the causes and nature of these phenomena, and holds the promise of ultimately being able to acquire a short-term predictive capability for some of them. This presentation will describe what we do and don’t understand about the basic physics behind space weather, discuss some of its aspects and effects, and describe the latest observational and modeling efforts