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Space Weather Effects in the Earth's Ionosphere and Below: An Overview of the NASA ICON Mission and Recent Insights on Geomagnetic Disturbances

Farsad Kamalabadi

ECE Illinois, 1308 W. Main St., Urbana Illinois, AK 61801, USA

farzadk@illinois.edu

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Space weather phenomena appear throughout the solar system, but their geo-effective manifestations are exhibited in the region of space close to the Earth and near its surface. The sporadic occurrence of enhanced electromagnetic radiation and charged particles emitted by the Sun can affect human activity and technology in a multitude of forms. Coronal mass ejections at the Sun interact with the solar wind and the Earth's magnetic field to cause geomagnetic disturbances that are characterized by induced electric fields and geomagnetically induced currents. In this work, we provide an overview of new insights in unraveling the causal connections of solar wind conditions, Earth's magnetic field, and electric drivers of geomagnetically induced currents. Furthermore, we provide an overview of an upcoming NASA mission, the Ionospheric Connection Explorer (ICON), capable of investigating signatures of geomagnetic storms in the Earth's ionosphere through characterizing the ionospheric composition changes as a proxy for geomagnetic storm response.