

Geomagnetically induced currents in the ground beneath our feet: The view from outer space

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Unusual electrical currents measured below our feet that are identified as geomagnetically induced currents (GICs) are driven by a source, hundreds of millions of kilometers away –The Sun. Understanding this entire chain of events from the Sun to mud is complex and requires studies that span over eight orders of magnitude from an astronomical unit to meters. Current forecast methodologies ultimately rely on interplanetary measurements of space at the L1 point upstream of the Earth's magnetosphere as their source data (giving a maximum ~1 hour forecast). These methodologies usually use combinations of empirical relationships and coupled simulations to nowcast and forecast GICs. However, the economic driver by electrical power grids to develop predictions with more than 24-hours lead-time is strong. Therefore, we describe practical and relevant technological solutions of how to use solar and interplanetary data to assist with improving the long lead-time predictions of GICs. We describe how arrival time prediction of shocks driven by coronal mass ejections are of significant importance to the GIC issue and especially the plasma characteristics just behind the shock. We describe some first steps of how to create proxy-L1 data from solar imagery – which can then be used as inputs into near space GIC prediction methodologies.