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Session 1B Paper 1

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Should countries under the Equatorial Electrojet belt worry about Geomagnetically Induced Currents?

The arrival of interplanetary shocks drives magnetosphere and ionosphere current systems, which then can cause magnetic field variability at ground. The strength of these currents can be detected by the time derivation of the magnetometer observation (dB/dt) on the ground. The stronger dB/dt magnetic spikes at the arrival of interplanetary shocks may be able to cause significant geomagnetically induced currents (GIC) and electric fields that may have damaging effects on modern ground-based technological infrastructures. Although significant attention has been given to the impact of GICs at high-latitude regions, mainly in the auroral region where it gets amplified by the auroral electrojet (AE), its impact at the geomagnetic equator has been largely overlooked until recently. It is well known that the interplanetary shock-driven magnetopause current penetrates into the inner-magnetosphere and almost instantaneously extends down to the equatorial ionosphere through the TMO (zero order transverse magnetic) mode waves in the Earth-ionosphere waveguide. These currents, which get amplified by the equatorial electrojet (EEJ) in the same way the AE does to it, can cause bursts of GIC onto the power lines that are located in the vicinity of geomagnetic equator. At the same time, modern infrastructures in the vicinity of EEJ region is booming, and the GIC could be a concern for countries under the EEJ belt. In this paper, using ground- and space-based observations, we demonstrate that the interplanetary shocks driven GIC bursts have potential effects at the equatorial region both during geomagnetically quiet and storm periods.