

The science of geomagnetically induced currents

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Geomagnetically induced currents (GIC) phenomenon impacting long conductor systems on the ground can be considered as the end link of chain of complex physical processes comprising the Sun-Earth system. In this paper I briefly review the current status of our understanding of the physics of GIC and novel applications enabled by the new understanding. More specifically, I will demonstrate how we can follow the chain of physical processes from the solar corona down to the upper mantle of the Earth and to GIC. Further, I will show how state-of-the-art models enable predictive modeling of the entire chain of complex processes.

The potential for severe societal consequences has been driving recent increasing interest in extreme GIC events. I will show how we have addressed the issue by generating 100-year GIC event scenarios. These scenarios are of substantial power grid industry interest and have been fed directly into further engineering analyses. I will review the results of our of 100-year geomagnetically induced current scenarios work and discuss some of the future directions in the field.

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