

## Simulation of GIC flowing through the power transmission network (187 kV-500 kV) in Japan

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The energy released from the sun can enhance electric currents in Earth' s magnetosphere, which induces an electric field on the ground surface. This electric field, called a geomagnetically induced electric field (GIE), gives rise to geomagnetically induced current (GIC) flowing in a transmission line. Japan is situated at geomagnetically low latitudes, but the potential risk is probably non-zero because a large-amplitude of GIC, as high as 129 A, was recorded in the Japanese power grid during the Halloween storm in October 2003. To evaluate the potential risk of the Japanese power grid properly, we modeled the Japanese power grid with high voltage class over 187 kV on the basis of publicly available data. The model consists of 602 nodes and 763 paths. The uniform GIE imposed on Japan was estimated on the basis of the geoelectric field observed in April 2018 at Kakioka Magnetic Observatory. We applied the uniform GIE on the model. The calculated GIC is roughly in agreement with that measured at 4 substations in Japan. For the westmost substation, a disagreement was found when we considered only the highest class of the power grid (500 kV), which may imply that the lower voltage class of the grid (<500 kV) may have some contribution to the GIC in Japan. We discuss the general tendency of the GIC flowing in the Japanese power grid, and prediction capability of the currently available model.

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### **Abstract**

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