Scientific advances and administrative activities on geomagnetically induced current (GIC) in Japan

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Large-amplitude geomagnetically induced currents (GICs) are the consequences of solar eruptions, and hazardous to power grids, in particular, at high latitudes. Many high-latitude countries have taken measures to prevent the hazard. For example, vulnerability assessment of power transformers has been suggested to perform in the United States of America on the basis of the magnetic storm of March 1989. For low-latitude countries including Japan, the power grids have been thought to be safe against GIC because of a great distance from the auroral oval. Recent studies have overturned conventional wisdom. The GIC with amplitude of 129 A was recorded at a Japanese power facility during the October 2003 magnetic storm. Fortunately, no damage was reported in association with the large-amplitude of GIC. It has been estimated that if the extremely large magnetic storm of September 1859 (Carrington event) occurs again, the electric field of ~2.5 V/km would appear on the surface of the ground at Kakioka Magnetic Observatory, Japan (Ebihara et al., 2021, Earth, Planets and Space), resulting in several hundreds of A of GIC at the same power facility. This estimation suggests that the low-latitude countries may have to care about the Carrington-class event. To prevent the potential risk associated with the GIC, the Ministry of Internal Affairs and Communications of Japan has initiated the discussion on the prediction of GIC with a power company, other ministries, NICT that provides space weather conditions and forecast. Having a common awareness based on scientific evidence would be the first step. We overview the recently achieved scientific advances and administrative activities on GIC in Japan.

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