

Evaluation of Geomagnetically Induced Currents in Midlatitude Regions

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Large currents, so called Geomagnetically Induced Currents (GICs) are induced at the surface of Earth by magnetospheric-ionospheric current system. It is known that GICs have an impact on many electronic equipment connected to Earth such as power grid in the polar region. For example in Northern Europe and North America, there are many studies about GICs based on observation of GICs and calculating electromagnetic field induced by ionospheric currents. At midlatitudes, especially in Japan, there are few researches on GICs because usually ionospheric currents over Japan are much weaker than the auroral region. However, recent research shows that a super flare could happen and have damage on electrical equipments located in the midlatitudes. In that case, the ionospheric current with large amplitude is expected to flow over Japan. To estimate GICs in Japan or midlatitude area, we need to consider the following three points; (1) magnetospheric-ionospheric currents system, (2) 3D structure of ground to calculate electromagnetic wave reflection, (3) geometry of electric equipments. We focused on the reflection of electromagnetic wave by using Häkkinen's(1986) method [1], and estimated how the parameters of ionospheric currents and ground strata have an influence on electromagnetic field on Earth. In this presentation, we will show the results and those calculated by the FDTD method that can take into account arbitrary ionospheric current system and the ground structure.

Reference: [1] Lasse Häkkinen and Risto Pirjola, (1986), Calculation of Electric and Magnetic Fields Due to an Electrojet Current System Above a Layered Earth, Geophysica, 22, 31-34