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日本における地磁気誘導電場のモデリング
Modeling of the geomagnetically induced electric field in Japan

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The geomagnetically induced current (GIC) happens to damage transformers of electrical power line systems in high-latitude countries like Canada and Sweden where the geomagnetic disturbances are enhanced. Thus, since it is important to evaluate the GICs associated with geomagnetic disturbances in these countries, there have been many works about GIC [Pulkkinen et al., 2005]. On the other hand, the low-latitude countries like Japan seem to be regarded to be free from dangers of the GIC disasters [Pulkkinen et al., 2008]. Indeed, Watari et al. [2009] revealed that the GICs measured along the power line in Hokkaido (the northernmost part of Japan) are as small as several Ampere. These values are negligibly small compared with the permissible current of a transformer. It is noted that the measurements by Watari et al. [2009] were carried out in the period of extremely quiet solar activity.

The result by Watari et al. [2009] seems to indicate that Japan is safe from the GIC disasters. However, it should be noted that the ground conductivity structure is quite different between Hokkaido and other Japanese areas like the most industrialized and highly-populated Kanto plain. This difference invokes the following geoelectric characters in Japan; the geomagnetically induced electric field at Kakioka in Kanto plain is sometimes about 10-times larger than that at Memambetus in Hokkaido. This difference probably comes from difference in the ground conductivity structure. As a result, we have to employ a realistic 3D ground conductivity model to present a reliable conclusion on the GIC.

In the talk, we will present the first numerical result of the geomagnetically induced electric field in Japan based on the 3D electric conductivity in the Earth. The conductivity is compiled after the resistivity suitable to the characteristic layers based on the crustal layer structure after the database on the bathymetry and that on the thickness of the sediment layer together. Our initial results reveal several localized enhancements of the induced electric field in the coastline regions when the induced electric current tends to converge into a bay-shaped area. The enhanced electric field appears in the different areas depending on the direction of the external source current in the magnetosphere. Combination of the induced electric field calculated and quantities of the severe space weather event yields the info for evaluation of the extreme severe GIC in Japan.

References
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