

Analysis of geomagnetically induced current measured in Japan

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It is known that there is a possibility of failure of power grids caused by geomagnetically induced currents associated with intense geomagnetic storms. It is believed that effect of GIC is small in Japan because Japan locates low geomagnetic latitude comparing with its geographical latitude. Damage of transformer is reported from the Republic of South Africa associated with the October, 2003 storm. The Republic of South Africa locates in similar geomagnetic latitude with that of Japan. We made GIC measurements of a transformer of the Memanbetsu substation between 2005 and 2007. Those data are compared with geoelectric data observed by the Memanbetsu geomagnetic observatory of Japan Meteorological Agency. We estimated GICs associated with past intense geomagnetic storms using the geoelectric field data based on the result of the comparison. The result of our analysis will be reported.

Keywords: Geomagnetically Induced Current, geomagnetic storm, earth current, power grids, space weather

Global MHD simulation of the magnetospheric response to large and sudden enhancement of the solar wind dynamic pressure

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A large and sudden enhancement of the dynamic pressure in the solar wind generates a geomagnetic sudden commencement (SC). The magnetic field variation of SC at auroral latitudes shows a bipolar change which consists of preliminary impulse (PI) and main impulse (MI). Fujita et al. [2003a, 2003b] reproduced the PI/MI magnetic field variation using a magnetosphere-ionosphere coupling simulation and clarified the fundamental mechanisms. Interestingly, Araki et al. [1997] reported an anomalously large-amplitude SC of more than 200 nT with an unusually spiky waveform at low latitude, which occurred when the magnetopause was pushed inside geostationary orbit. Such a super SC is the target of this study. We investigate the large-amplitude SC at auroral latitudes when a large solar wind dynamic pressure impinges on the magnetosphere using a newly developed magnetosphere-ionosphere coupling simulation which has advanced robustness. We simulate two SC events of dynamic pressure enhancement of 16 times larger than the standard value, caused by the density enhancement and velocity enhancement, respectively. As an initial result of the comparison with the SC events, it is found that magnetic field variation of PI/MI is larger and sharper in the case of velocity rise than the case of density rise. It is therefore suggested that high-speed solar wind may be needed to create large and sharp SC. It is also found that a magnetic field variation similar to so-called Psc appears after PI/MI only in the case of velocity rise. When the high-speed solar wind impinges on magnetosphere, vortices are repeatedly formed at the equatorial magnetopause, probably due to the K-H instability. It seems that the high pressure of the vortices play an essential role as a current generator to drive the field-aligned currents and the magnetic field oscillation. In this presentation, we discuss the mechanisms of super SC in more detail, combining the other interesting simulation results.