[EE] Evening Poster | P (Space and Planetary Sciences) | P-EM Solar-Terrestrial Sciences, Space Electromagnetism & Space Environment

[P-EM12]Space Weather, Space Climate, and VarSITI

convener:Ryuho Kataoka(National Institute of Polar Research), Antti A Pulkkinen (NASA Goddard Space Flight Center), Kanya Kusano(名古屋大学宇宙地球環境研究所, 共同), Kazuo Shiokawa(Institute for Space-Earth Environmental Research, Nagoya University)

Thu. May 24, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

Past, Present, and Future of Solar-Terrestrial Environment is the keynote of this session. We share the latest scientific papers to understand how the solar-terrestrial environment changes in various time scales, and discuss the necessary international collaboration projects associated with VarSITI. More specifically, welcomed papers include space climate studies using tree rings and ice cores; cutting-edge observational and modeling studies of geospace, heliosphere and the sun; simulation and statistical studies to predict the future space weather and space climate.

[PEM12-P09]Simulation study on the generation of geomagnetically induced current (GIC) in terms of ground-transmission line coupling

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Keywords:Solar flare, GIC, FDTD method

During geomagnetically disturbed conditions, geomagnetic induced currents (GICs) can cause severe damages on the power grid. Recent observation has revealed that extreme solar flares may occur in our Sun. If such an extreme solar event occurs, the impact on our life would be catastrophic. Under this circumstance, the need for GIC research is increasing for better understanding of the cause of the GIC. Previously, many researches have calculated the GICs for given geomagnetically induced electric field (GIE) by assuming an equivalent electrical circuit. The GIE is often calculated by the temporal variation of the magnetic field, and is assumed to be independent of the existence of the transmission line. However, the existence of the transmission line may alter the ambient electric field including GIE because the conductance of the transmission line is extremely high in comparison with the ground conductivity. We calculated both the GIE and GIC simultaneously by using 3-D Finite-Difference Time-Domain (FDTD) method to investigate the interaction between the ground and the transmit line. A plane of the uniform electric field is placed at 100 km altitude, and the amplitude of the source electric field varies sinusoidally with a period of 1 sec. Due to the limitation of the computational resource, the thickness of the transmission line is set to be 2 km. For this particular study, we tested (1) different conductance of the transmission line, (2) different conductance of the ground, (3) different thickness of the transmission line, and (4) different distance of the transmission line. In our simulation, when the conductivity of the transmission line increases, GIC increases linearly until a particular threshold. When the conductivity of the transmission line exceeds the threshold, GIC is saturated, and is less sensitive to the conductivity of the transmission line. We discuss the relationship between GIE and GIC in terms of the interaction between the ground and the transmission line on the basis of the simulation results.