[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-P23]GAIA simulations of the ionospheric response to successive X-class solar flares on September 6, 2017

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Solar flares enhance EUV and X-ray radiation to promote the ionization of the Earth's atmosphere, which increases the plasma density on the dayside ionosphere. Higher plasma density in the ionospheric F region degrades the Global Navigation Satellite System (GNSS), and in the E and D region can cause HF radio communication blackouts. The plasma density variation depends on the wavelength spectrum and temporal variation of the flare irradiance. They vary from flare to flare, and it is important to understand the various types of the ionospheric flare response. In this paper we focus on the two successive X-class flares that occurred on September 6, 2017: X2.2 peaking at 9:10 UT and X9.3 at 12:02 UT.

To understand how the ionosphere responded to the flares, we carried out numerical simulations using the Ground-to-topside model of Atmosphere and Ionosphere for Aeronomy (GAIA) [Jin et al., 2011]. We used the Flare Irradiance Spectral Model (FISM) [Chamberlin et al., 2007, 2008] to drive the GAIA. Model simulations showed that on the sunlit side, molecular ion density, which dominates the ionospheric E region, increased in several minutes and decayed in several hours in the same way as the two flare irradiances. The simulations also showed that atomic oxygen ion density, which dominates the ionospheric F region, increased with the first flare and sustained the enhancement until the second flare. Consequently, the density further increased with the second flare and the decay time was longer than that for single flare. When the molecular ion density was higher in the model, HF radio signals of ionosonde observations were under blackout. To further validate the model simulation, we will compare the simulated ion density with Total Electron Content (TEC) measured by ground GNSS receivers. We will also compare the simulated magnetic field variations with ones measured by ground magnetometers.

In addition, we will report another GAIA simulation with a physics-based flare irradiance model [Imada et al., 2011] instead of the FISM, an empirical model. We tuned the parameters of the physics-based irradiance model with statistical data of satellites so that the model can predict the irradiance spectra without measurement. We will compare preliminary results using the model with ones using the FISM.