International Session (Oral) | Symbol P (Space and Planetary Sciences) | P-EM Solar-Terrestrial Sciences, Space Electromagnetism & Space Environment

[P-EM06_30PM2]Study of coupling processes in Sun-Earth system with large radars and large-area observations

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Wed. Apr 30, 2014 4:15 PM - 6:00 PM 312 (3F)

The Earth accepts huge input of energy and material from the Sun. The Earth's environment is maintained by the balance between their inputs and outputs. It is important to study energy and material transport of the Earth. This is an international session that discusses studies of the coupling processes in the Sun-Earth system based on the projects of large radars and large-area observation network. The facilities and networks included are the Equatorial MU Radar (EMU) in Indonesia to study the whole equatorial atmosphere, the EISCAT_3D radar system to study detailed structures and elementary processes of the magnetosphere-ionosphere in the polar region, and global observation networks of magnetometers and radio and optical instruments to study the coupling processes with the global scale. We will show outline of the project and discuss sciences by soliciting variety papers. This session is open to the world, and we strongly encourage submission of papers related to other facilities and projects, i.e., atmospheric or incoherent-scatter radars, observation networks, satellites, and simulation or theoretical studies, etc.

5:15 PM - 5:30 PM

[PEM06-P11_PG]The spatial and temporal evolution of equatorial plasma bubble observed using ground based GPS TEC measurement.

3-min talk in an oral session

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The equatorial plasma bubble (EPB) commonly occurs near the equatorial region after post sunset period. The generation process of EPB has been well understood where it is commonly developed near the magnetic equator and elongated along magnetic field lines through Rayleigh-Taylor instability mechanism. However, the source of seeding perturbation leads to the generation of Rayleigh-Taylor instability is still unknown. The temporal and spatial properties of EPB have been well studied using airglow imager. However, the observation using airglow imager is impossible during sunset time where the EPB starts to develop due to light from the sun while the observation during night time is always interfered by moon and clouds. In this study, we obtain the GPS data from Malaysia Real-Time Kinematics GNSS Network (MyRTKnet), International Ground Station (IGS) network and Sumatera GPS Array (SUGAR) network. The networks contains 127 receivers in South East Asia (SEA) region covers 8^{o}N to -8^{o} S latitude and 92^{o}E to 120^{o}E longitude geographic coordinates. In this study, we detected the structure of EPB using two-dimensional map of rate of TEC index (ROTI) calculated from ground based GPS TEC

measurement in. The average ROTI value for all visible satellites at 300 km altitude is binned into 0.45^{o} x 0.45^{o} grid in geographic latitude and longitude. The advantage of this technique is the GPS data is always available and we are able to observe the spatial and temporal properties of EPBs continuously without distracted by light.On the 17th March 2011, we observed the appearance of EPB structure pass through the SEA territory for 5 hours from 1300 UT (2100 LT) - 1900 UT (0200 LT). The initial ROTI-enhancement region is at 1300 UT is propagating to eastward direction and the information of the structure is lost due to the limited coverage of GPS receiver. At 1340 UT, a new ROTI-enhancement region appeared as a point source at geographic coordinate 2^{o}N and 98^{o}E as shown in Figure (a). After 20 minutes, the point source of ROTI-enhancement region expand to ~600 km in the North and ~200 km South direction as shown in Figure (b) while the zonal size ~50 km remains the same. The perturbation region is expanding faster towards dip magnetic equator might associated with field-aligned irregularities. The structure travelled in eastward direction with velocity ~133 ms^{-1} until the development process stopped. After 60 minutes, we assumed the structure is fully developed as illustrated in Figure (c) when no development in zonal size and ROTI value is observed anymore. The developed structure has 200 km zonal size continuously moves to eastward directions with slower velocity ~111 ms^{-1}. The slower velocity incidentally with no development in zonal size and ROTI value might indicates the "fossil" bubble where the plasma density is equal with background density and the structure velocity following the background plasma density. At 1440 UT the second structure is coming ~600 km away from the first structure with velocity ~111 ms^{-1} and zonal size 200 km same as the previous structure as shown in Figure (d). The first and second structure has the same zonal sizes and velocities might due to the same temporal and spatial evolution during the generation process.The two-dimensional structure of EPB has been presented using GPS networks in SEA region is an alternative tool to observe the temporal and spatial properties of EPB structure from the initial perturbation until the decaying process without being distracted by light. The temporal and spatial properties of EPB can contribute towards understanding the generation mechanism of the Rayleigh-Taylor instability process.