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

[P-EM15]Dynamics in magnetosphere and ionosphere

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Mon. May 21, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

This session provides an opportunity to present recent results from satellite and ground-based observations and theoretical and simulation studies on the magnetosphere, ionosphere, and their coupling system. We invite contributions dealing with various phenomena related to the magnetosphere-ionosphere system: solar wind-magnetosphere interaction, magnetosphere-ionosphere convection, field-aligned current, magnetic storms/substorms, neutral-plasma interaction, ionospheric ion inflow and outflow, aurora phenomena, and so forth. Discussions on planetary and satellite ionosphere and magnetospheres, future missions and instrument developments are also welcome.

[PEM15-P01]Energy conversion by slow mode waves as the driving source of large-scale Birkeland currents

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Any magnetohydrodynamic (MHD) disturbance can be decomposed into the basic three modes: the Alfvén mode, fast mode, and slow mode. Recent global MHD simulations indicate that the energy source of large-scale field-aligned current (FAC) systems (like the so-called region 1 and region 2) is universally the plasma gas pressure. That is, plasma thermal energy is converted to electromagnetic energy in the magnetospheric dynamo sustaining the FAC system. This energy conversion is possible only in the slow mode disturbance, because the Alfvén mode is irrelevant to the gas pressure, and because in the fast mode, thermal energy annihilation and electromagnetic energy creation do not concur. In general, there are four phases in the slow mode wave cycle. Of the four, two act as dynamo in which plasma thermal energy is converted to electromagnetic energy, and the other two act as "load" in which electromagnetic energy is converted to plasma thermal energy. The two dynamo phases may be called "expanding slow dynamo" and "contracting slow dynamo" according as flux tube expansion or contraction. Thus, there are two types of magnetospheric dynamo driving large-scale FAC systems. The expanding slow dynamo must be quasi-stationary, while the contracting slow dynamo allows time variations. The magnetic field intensity gradient plays the dominant role in the expanding slow dynamo, while the magnetic field curvature is indispensable in the contracting slow dynamo. An example of expanding slow is the region 1 dynamo in the cusp/mantle region, while an example of contracting slow is the region 2 dynamo in the plasma sheet inner edge on the nightside. These slow wave dynamo disturbances are then coupled to Alfvén mode disturbances by the background magnetic field inhomogeneity, with FACs being generated form the field-perpendicular currents associated with the dynamo. In a specific geometry, the above slow-Alfvén coupling occurs naturally and forms a basic pattern of the FAC source (coupled voltage and current generators) of large-scale FAC systems.