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Detached proton auroral arcs are a newly discovered phenomenon at Earth by the IMAGE satellite. These events are characterized by IMAGE-FUV observations of subauroral arcs separated from the main oval and extending over several hours of local time in the afternoon sector. The emissions have been related to the precipitation of 20-30 keV protons measured by the FAST electrostatic analyzers and plasmaspheric plumes observed by the IMAGE-EUV instrument. We simulate the proton precipitation during two subauroral arc events which occurred on 23 January 2001 and 18 June 2001. During these periods the inner magnetospheric conditions were moderately disturbed with minimum $Dst = -25$ nT and $Dst = -61$ nT, and maximum $Kp = 5^-$ and $Kp = 5^+$, respectively. We use our global physics-based model, which calculates the temporal evolution of ring current H^+, O^+, and He^+ ion distributions including losses due to charge exchange, Coulomb collisions, and wave-particle interactions along adiabatic drift paths. Measurements from the geosynchronous Los Alamos satellites are used to simulate the time-dependent plasma inflow on the nightside and to compare with model results on the dayside. The growth rate of EMIC waves is self-consistently calculated and global images of precipitating ions are obtained and compared with IMAGE observations. The characteristics of the EMIC waves induced ion precipitation are investigated as a plausible mechanism for generation of the detached proton auroral arcs.

SM14A CC: 518 A Monday 1530h

Ground-Based Arrays for the 21st Century I *(joint with SA)*

Presiding: **M Connors,** Athabasca University**; B J Fraser,** Cooperative Research Centre for Satellite Systems

SM14A-01 1530h INVITED

The Application of Multiple Ground-Based Magnetic Observatories for Nowcasting and Forensic Analysis of Geomagnetic Disturbance Conditions

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Ground-based geomagnetic observatories have historically been used to derive local and planetary geomagnetic storm indices such as the K, Kp, Ap and various other indices which can cover broad 3 hour or longer time windows and broad geographic regions. Impacts to ground based infrastructures occur due to variations in geomagnetic field intensity which can exhibit rapid and complex regional and spatial variations. As a result, traditional geomagnetic storm indices do not provide sufficient details to interpret the severity of the environment and the storms ability to produce geomagnetically-induced currents in ground-based infrastructures. The application of multiple ground-based magnetic observatories when used with data assimilation modeling techniques can provide detailed spatial and temporal characterization of geomagnetic field disturbances caused by geomagnetic storms.

SM14A-02 1550h INVITED

MAGDAS/CPMN Observations for Space Weather Study

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An objective of the STP (Solar Terrestrial Physics) researches is to support human activities in the geospace in the twenty-first century from an aspect of fundamental study. In order to understand the Sun-Earth system and effects to human lives, the international LWS (Living With Star) and CAWSES (Climate and Weather of Sun-Earth System) programs start from 2004. The objective of CAWSES-WG 2 & 3 in Japan for the region from the solar surface through the solar wind, the magnetosphere, the ionosphere, and the thermosphere, to the atmosphere is a creation of new physics; (1) couplings of the complex and composite systems and (2) macro-and-micro-scale couplings in the Solar-Terrestrial system. The goals of CAWSES-WG 2 & 3 in Japan are to construct space weather stations (for observations) and modeling stations (for simulation/empirical modeling) during the period (2004-2008) of the international CAWSES program. Japanese STP groups will coordinate a research network to reach these goals for the space weather study. In order to study the complexity in the solar wind-magnetosphere-ionosphere-Earth's surface system, the Space Environment Research Center (SERC), Kyushu University, Fukuoka, Japan will carry out coordinated ground-based network observations for space weather studies, in cooperation with about 30 organizations in the world during the international CAWSES period (2004-2008). In the present paper, we will introduce a real-time MACnetic Data Acquisition System of Circumpan Pacific Magnetometer Network, i.e. MAGDAS/CPMN system in Kyushu University. By using this system, we will conduct the real-time monitoring and modeling of (1) the global 3-dimensional current system and (2) the plasma density variations for space weather researches and applications, in order to understand electromagnetic and plasma environment changes in the geospace.

URL: http://www.serc.kyushu-u.ac.jp/

SM14A-03 1610h

A Ground-Based Array to Observe Geospace Electrodynamics During Adverse Space Weather Conditions

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Geomagnetic Storms occur with surprising frequency and create adverse space weather conditions. During these periods, our knowledge and ability to specify or forecast in adequate detail for user needs is negligible. Neither experimental observations nor theoretical developments have made a significant new impact on the problem for over two decades. Although we can now map Total Electron Content (TEC) in the ionosphere over a continent with sufficient resolution to see coherent long-lived structures, these do not provide constraints on the geospace electrodynamics that is at the heart of our lack of understanding. We present arguments for the need of a continental deployment of ground-based sensors to stepwise advance our understanding of the geospace electrodynamics when it is most adverse from a space weather perspective and also most frustrating from an understanding of Magnetosphere-Ionosphere coupling. That a continental-scale deployment is more productive at addressing the problem than a realizable global distribution is shown. Each measurement is discussed from the point-of-view of either providing new knowledge or becoming a key for future real-time specification and forecasting for user applications. An example of a storm database from one mid-latitude station for the 31 March 2002 is used as a conceptual point in a ground-based array. The presentation focuses on scientific questions that have eluded a quantitative solution for over three decades and view a ground-based array as an "IGY" type of catalyst for answering these questions.

SM14A-04 1625h

Global and local equatorward expansion of the ion auroral oval before substorm onsets

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The temporal variation of the equatorward boundary of the proton aurora/high energy ion precipitation is a manifestation of diurnal, and seasonal (i.e., dipole tilt) effects as well as magnetic activity. In particular, during the substorm growth phase this boundary moves equatorward, an effect due primarily to thinning and Earthward motion of the cross-tail current in the inner magnetosphere as the field evolves towards a more stretched topology. Recent advances in monitoring this boundary using ground-based instruments have opened up the possibility of following its temporal evolution across several hours in local time. This in turn allows one to explore whether this magnetotail stretching is a global or local phenomenon. We have examined this boundary evolution during the growth phases of 68 substorms over the Canadian sector. We use the equatorward boundary of SuperDARN E-region echoes as a proxy for the proton auroral boundary as described in Jayachandran et al [10.1029/2001GL01484, 2002]. We find that in 21 of the 68 substorms the equatorward motion of the auroral boundary is restricted to only several hours of local time in the evening sector. In the remaining 47 substorms, the equatorward motion was global so that the boundary retained its shape throughout the growth phase. Our results indicate dramatically different growth phase phenomenology in two classes of substorms. In one, the growth phase involves stretching in the inner magnetosphere that is most pronounced around the onset meridian. In the other, the stretching extends many hours in local time away from the onset meridian.

SM14A-05 1640h

Multi-Satellite Studies of ULF Waves in the Outer Magnetosphere: GOES Results

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The GOES series of geosynchronous satellites offers an unique opportunity to study the azimuthal/local time spatial and temporal properties of Pc3-5 ULF waves in the outer magnetosphere. Since late 2001 four and sometimes five NOAA GOES satellites have been operating at geosynchronous orbit. For example, in September 2001 GOES 8 was located at 74.9 degrees West, GOES 12 at 89.9 degrees West, GOES 11 at 108.7 degrees West and GOES 10 at 134.5 degrees West. Other longitudinal spacings are also available since September 2003, including two spacecraft at 200-210 degrees West. This varying range in longitudinal coverage with adjacent satellite pair spacing varying over 15-125 degrees provides a unique geosynchronous satellite chain of magnetometers, ideal for the study of the azimuthal properties of Pc3-5 (1-100mHz) ultra-low frequency (ULF) waves. At synchronous orbit these waves may be observed as field line resonances, compressional cavity or waveguide mode resonances, or as propagating waves for the higher frequency Pc3 waves. Results will be presented on the spatial extent and azimuthal properties of various wave types seen, including harmonics, in order to identify modes seen at both storm and quiet times, and their relationship to cold plasma variability in the outer magnetosphere.

SM21A CC: 220 C-E Tuesday 0830h

Space Weather: Linking Research and User Needs I Posters *(joint with SA, SH)*

Presiding: **M W Liemohn,** University of Michigan**; C R Clauer,** University of Michigan

SM21A-01 0830h POSTER

Challenges in modeling the Sun-Earth System

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