SM23A-05 1440h

Near-Simultaneos Observations of Low-Altitude ENA Emissions from Northern and Southern Hemispheres

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During 2003, the IMAGE orbit has evolved such that the orbit perigee has passed across the equator from south to north. This orbital configuration has provided opportunities to view low altitude ENA emissions sequentially in the northern, and then southern hemispheres from intermediate to low altitudes. At these times, structured ENA emission signatures are observed. These signatures are peaked in invariant latitude. Their distribution in magnetic local time seems to depend both on the instantaneous viewing geometry and on the current state of geophysical activity (i.e.: storm phase). Operating under the assumption that these low altitude emissions emanate from the Oxygen exobase at an altitude near 650 km, we look at their spatial distribution, with a focus on comparison of near simultaneous observations from the northern and southern hemispheres.

SM24A CC: 518 A Tuesday 1530h

What Controls the Degree of Conjugacy in Auroral Phenomena? II *(joint with SA)*

Presiding: **N Ostgaard,** University of California, Berkeley**; J F Spann,** NASA Marshall Space Flight Center

SM24A-01 1530h INVITED

Interhemispheric conjugacy of ionospheric convection and field-aligned currents

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The Assimilative Mapping of Ionospheric Electrodynamics (AMIE) procedure has proved to be a very useful tool to estimate the large-scale instantaneous patterns of ionospheric conductance, electric potential, and other related quantities by combining simultaneous measurements from satellites, radars, and ground magnetometers. In this paper we apply the AMIE procedure to investigate the conjugacy of the large-scale high-latitude ionospheric convection and field-aligned current patterns between the northern and southern hemispheres under various solar wind and IMF conditions. The different magnetospheric drivers for the convective flows and their quantitative contributions to the total cross-polar-cap potential drop will be examined. We also investigate the possible seasonal effects on such interhemispheric conjugacy.

SM24A-02 1550h

Hemispheric asymmetries in the location and intensity of the auroral ovals and their association with ionospheric convection and IMF

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As the orbit of the Polar spacecraft has precessed over time, the VIS Earth camera has been able to capture simultaneous images of the aurora in both the northern and southern hemispheres. The angular resolution of these images is sufficient to be able to determine the accurate location and intensity of the two ovals. Preliminary studies have revealed that while the auroras seem to be mirror images of one another on a broad scale, there are a number of fine scale features which are not conjugate in both hemispheres. The mapping of the auroras has revealed that there are longitudinal differences in the onset locations. In this paper, we use the radars of the northern and southern SuperDARN network to investigate whether the convection patterns match the longitudinal differences in the onset locations of the auroral features in the two hemispheres. Differences in the auroral intensity detected in the two hemispheres were found and we determined their association with the electric field strength and convection speeds. The IMF data were studied to determine if these hemispheric asymmetries were due to variations in the IMF direction

SM24A-03 1605h INVITED

Simultaneous Global-scale Observations of Field Aligned Currents in the Northern and Southern Hemispheres

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We present observations of magnetic perturbations due to Birkeland currents from the Iridium constellation of satellites. The Iridium constellation consists of 70 satellites in 780 km circular polar orbits configured in six orbit planes spaced equally in longitude. The constellation therefore provides global coverage in both the northern and southern hemispheres. Engineering magnetometer data are used to study two aspects of hemispheric differences in Birkeland currents. Using key parameters statistics of the perturbations for 2000, 2001 and 2002 we first study the seasonal and diurnal variation of currents by comparing the ratio of perturbations between the north and south. These results show clear seasonal and diurnal variations in the relative current with approximately equal magnitude, amounting to a variation in relative current of a factor of two for each of seasonal and diurnal effects. The seasonal and diurnal amplitude as well as the seasonal variation of the diurnal currents are explained by variations in Pedersen conductivity due to solar EUV, auroral precipitation, and structure in Earth's main field at auroral latitudes. These results show that comparisons of Birkeland current intensities must properly account for differences in conductivity. We then examine the distribution of Birkeland currents for specific events for a range of IMF orientations. The dayside distribution is determined principally by the IMF. The northern and southern hemisphere distributions display mirror symmetry about the noon-midnight meridian, consistent with a reconnection driven dynamo. This symmetry is broken somewhat by the day-night gradient in Pedersen conductivity which favors (inhibits) current for dusk-to-dawn (dawn-to-dusk) convection at noon. In contrast to the dayside, currents at night have the same distribution in magnetic coordinates in the northern and southern hemispheres.

SM24A-04 1625h

Seasonal Variations of Large-scale Field-aligned Currents

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Auroral electron acceleration is closely related to upward-flowing field-aligned currents (FACs), and therefore interhemispherical comparison of FACs should provide important clues for understanding (the lack of) auroral conjugacy. In the present study we statistically examine the seasonal dependence of large-scale FACs. We previously developed an automatic procedure to identify the structures of large-scale FACs [Higuchi and Ohtani, JGR, 105, 25,305, 2000], and the present study is based on 185,000 FAC crossings we identified by applying this procedure to magnetometer data from the DMSP-F7 and F12-15 spacecraft. The result confirms that the dayside FAC tends to be more intense in the summer hemisphere and weaker in the winter hemisphere showing annual variations of its intensity. It is also found that the average latitude of midday FAC systems is higher in summer than in winter; the difference can reach as much as 5 degrees at solstices. This displacement can be explained in terms of asymmetric magnetospheric configurations. The degree of the winter-summer asymmetry diminishes away from the midday sector. On the nightside, the average FAC intensity tends to be larger around equinoxes and smaller around solstices, which is consistent with the well-known semiannual variations of geomagnetic activity. It is therefore concluded that the primary cause of the seasonal variation of large-scale FACs depends on local time. It is the ionospheric conductance owing to the solar illumination for dayside FAC systems, whereas for nightside FAC systems, it is the efficiency of energy coupling between the solar wind and the magnetosphere.

SM24A-05 1640h

Seasonal Variation of Substorm Characteristics and the Implications for Auroral Conjugacy

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The hypothesis that ionospheric conductivity plays a major role in the global-scale dynamics of the aurora is further evaluated in this study. The rate of energy deposition by electron precipitation (hemispheric power), substorm expansion and recovery time scales, and the total electron energy input to the ionosphere/thermosphere during auroral intensifications are computed for over three hundred substorms observed by the Polar Ultraviolet Imager (UVI) in the northern hemisphere. Each substorm parameter is then sorted according to season. Substorm intensity, measured by the peak hemispheric power for each substorm, is greatest during the equinoxes but otherwise showed only minor seasonal variation. Substorm expansion time scales are shortest during the summer but also do not exhibit significant seasonal variations. On the other hand, the substorm recovery times are well ordered by whether or not the nightside auroral region is sunlit: substorms occurring in the winter and equinox periods have similar recovery time scales which are both roughly a factor of two longer than that for summer when the auroral oval is sunlit. These results strongly suggest that simultaneous auroral intensifications in the northern and southern hemispheres develop differently during solstitial conditions. We expect the auroral breakup in the dark (winter) hemisphere to be more intense and longer lived than that observed in the sunlit (summer) hemisphere. This also implies that more energy is deposited by electron precipitation in the winter hemisphere than in the summer one during a substorm. Conjugate auroral substorm observations by Polar UVI and the IMAGE FUV instrument are used to confirm this behavior. The observed hemispheric asymmetry and non-conjugacy of auroral substorms is consistent with the suppression of discrete aurora in sunlight and highlights the importance of this effect in magnetosphere-ionosphere coupling.