SPACE AND COSMIC RAY PHYSICS SEMINAR

University of Maryland
Computer & Space Sciences Building, Rm 2400
4:30 PM Monday, March 8, 2004
Tea & cookies 4:00-4:30 PM

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Simultaneous Inter-hemisphere Comparison of Birkeland Current Magnetic Perturbations: Quantitative Tests of Conductivity Control

Magnetometer data from the Iridium constellation are used to study hemispheric differences in Birkeland currents. The Iridium constellation consists of 70 satellites in 780 km circular polar orbits configured in six orbit planes spaced equally in longitude. The constellation provides global coverage in both the northern and southern hemispheres. By comparing globally distributed data in the north and south obtained for exactly the same times, the effects of variability in the solar wind and magnetospheric dynamos can be removed to study inter-hemispheric differences with unprecedented accuracy. Using data for all of 2000, 2001 and 2002 we study the seasonal and diurnal variation of currents by comparing the ratio of perturbations between the north and south. These results show 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. The success of ionospheric conductivity in explaining the observations shows that the impedance of solar wind/magnetosphere dynamos on large scales is much smaller than the ionospheric impedance. A systematic bias for 10 percent larger magnetic perturbations in the north than in the south is attributed to hemispheric differences in the auroral oval geometry and magnetic field. The results imply that there is strong diurnal and seasonal variation in thermospheric heating and that there is systematically more thermospheric heating in the north than in the south.

Sponsored by: Department of Physics, University of Maryland, and the Institute for Physical Science and Technology, University of Maryland. For information call Matthew Hill at (301) 405-6209 or go to the following website: http://space.umd.edu/seminars/Spring_2004_Seminar.html (A PDF file of this abstract is available for download at this URL.)

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