velocities of over 500 m s^{-1}. At the same time downward fluxes at the higher latitudes reach unusually high values of 10^8–10^9 cm^{-2}s^{-1}. As the storm continues the topside ionosphere number density is depleted in regions of upward motion and the upward fluxes fall back to more typical values even though the vertical velocities remain elevated.

SH53A-14 1330h POSTER

Observations of Ionospheric Effects During the October-November 2003 Storms

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During the October-November 2003 magnetic storm events, DMSP satellites which orbit the Earth at altitudes of 840 km detected some of the largest electric fields, field-aligned currents (FACs) and highest ionospheric densities ever seen with these spacecraft. The F-layer in the ionosphere within 15 degrees of the equator was lifted up above 800 km repeatedly due to penetration electric fields which alternately intensified and were shielded over the course of the very extended main phase. At times unshielded Region 1 FACs exceeded 1 A/m, the equatorial boundary of the auroral zone moved to geomagnetic latitudes below 55 degrees, and sub-auroral polarization stream (SAPs) speeds approached 1 km/s. We will discuss the consequences of energy dissipation represented by the large electric and magnetic field perturbations, the source in the magnetosphere to which the measured fields map, and place this superstorm in the context of other major storms we have studied.

SH53A-15 1330h POSTER

THE NEUTRAL WIND FIELD AT SONDRESTROM (KANGERLUSSUAQ), GREENLAND DURING THE SUPER-STORMS OF OCTOBER AND NOVEMBER, 2003

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The thermospheric neutral wind field at Sondrestrom (Kangerlussuaq), Greenland is routinely monitored at two independent altitudes by a Fabry-Perot interferometer. Routine synoptic observations have been conducted since 1983, including the storms of March 1989, and the recent events in October and November 2003. The location of the aeronomical observatory places it under the auroral oval during dusk and dawn and within the polar cap during the midnight sector. During all of these storm periods, severe modifications to the upper thermosphere have been observed. These include significant heating and enhanced horizontal wind flow. Neutral temperature in the upper thermosphere has been observed to increase above 2000K, while zonal winds have increased from a few hundred to as high as 700 m/s. This paper will describe the neutral wind field during these storm events. Measurements of the local wind field will be placed into the global context as observed by the TIDI instrument aboard the TIMED satellite. It is unclear that current general circulation modeling can succeed at predicting the horizontal wind flow without resorting to finer time steps in their calculations.

SH53A-16 1330h POSTER

Thermospheric Infrared Emission Response to Major Geomagnetic Disturbances From SABER Data: High Latitude Aurora and X-ray Flares

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TIMED/SABER data indicate an intense response of infrared emission from the Earth's upper atmosphere to geomagnetic disturbances. This is especially true for nitric oxide in the 5.3-μm band, where there is a dramatic enhancement in response to major geomagnetic storms. The emission rate increases by more than a factor of 10 and the enhancement extends equatorward into the subtropics far from the auroral zone. Accompanying the large storms are large X-ray flare events. These short-lived events are often embedded in periods of increased auroral activity. We will examine strong flare events to extract any signature in the nitric oxide emission. In order to separate flare response from the larger and more extended auroral enhancement, we bin data from various latitudes and local times before and immediately after large flares. The large flares of October and November 2003 provide a clear enhancement in nitric oxide that is smaller than, but distinct from, the aurorally induced nitric oxide enhancement.

SH53B CC: 519 A Friday 1330h

Solar Wind III

Presiding: **M E Hill,** University of Maryland**; A Szabo,** NASA Goddard Space Flight Center

SH53B-01 1330h

Solar Wind Plasma Composition Variations Associated With Interplanetary Coronal Mass Ejections

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We summarize the variations in solar wind plasma composition observed by the ACE/SWICS instrument during the near-Earth interplanetary coronal mass ejections (ICMEs) in 1996-2002 identified by *Cane and Richardson* [2003], and compare these with variations in the composition of the ambient solar wind, for example dividing the ICMEs into those with and without "magnetic cloud" signatures, or by whether they are preceded by halo/partial halo CMEs observed by the LASCO coronagraphs. We also develop a set of simple criteria that characterize the compositional anomalies associated with ICMEs, and assess their success in identifying ICMEs from the composition data. The CR03 survey of the occurrence rate and properties of ICMEs during solar cycle 23 will also be updated. H. V. Cane and I. G. Richardson, *J. Geophys. Res., 108*, A4, 1156, doi:10.1029/2002JA009817, 2003.

SH53B-02 1345h

Magnetic Loop Topologies in the Vicinity of the Heliospheric Current Sheet

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Suprathermal electron observations obtained in the vicinity of the heliospheric current sheet (HCS) suggest that, in addition to open magnetic field lines, limited intervals of closed and/or disconnected field lines (inferred from counterstreaming electron beams and strahl dropouts respectively) are often present there. Further, the observations show that the suprathermal electron flow polarity (parallel or anti-parallel to the magnetic field) reversals and magnetic field polarity reversals do not always occur simultaneously. Using observations from the solar wind experiment on ACE obtained in the vicinity of the HCS, we find that the intervals of inferred closed and/or disconnected field lines commonly are observed either immediately before or immediately after the magnetic field polarity reversals. We interpret these observations in terms of small-scale magnetic loops propagating through and displacing the HCS. The loops are inclined relative to the ecliptic plane and can be doubly or singly connected to the Sun or entirely disconnected from it. The one-sided aspect of the closed and disconnected intervals relative to the field reversal arises because the spacecraft typically samples only one leg of a given magnetic loop. Our model also provides a natural explanation for timing offsets between electron flow reversals and magnetic field polarity reversals. Although the small-scale HCS-related magnetic loops considered here would not nominally be identified as coronal mass ejections (CMEs) in the solar wind, our discussion pertains equally well to topological aspects of magnetic loops associated with CMEs. For example, our simple model indicates that CMEs do not typically form occlusions in the HCS, contrary to previous suggestions.

SH53B-03 1400h

Correlation of Solar Wind Parameters Between SOHO and Wind

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The solar wind is a turbulent plasma in which shocks, waves, and discontinuities are observed to propagate away from the sun. Comparing data from several spacecraft in different places can yield information about the nature of these disturbances and their development. Among others, the present authors have studied correlations between Wind and SOHO plasma data for the period 1996 to 1999. In this paper we extend this work to cover the maximum of solar cycle 23 in the years 2001 and 2002. The observations are spaced 96 seconds apart and are correlated over 2-hour periods. We confirm a dependence of the mean value of the correlation coefficient upon solar activity, decreasing from 0.54 in 1996 to 0.47 in 2000. Using a list of shocks observed during the period 2000 and 2001, we find their directions of propagation to be distributed about the radial direction in a cone with a half angle of about 20 degrees, and a tendency for discontinuities to occur at angles grouped about the Parker spiral direction, as also earlier demonstrated by Coplan et al. and by the MIT group. In order to emphasize short time scale disturbances the data have been prewhitened. Correlations of these prewhitened data provide additional information about the evolution of solar wind stuuctures.

SH53B-04 1415h

Nature of the Solar Wind Electron Distribution Functions in the Slow and Fast Solar Wind at 1 AU

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The non equilibrium characteristics of the solar wind electron distribution functions (EDF) at 1 AU are of great importance in many aspects, for instance in understanding heat conduction, plasma microinstabilities and transport in weakly collisional plasma, as well as in the scenario at the origin of the solar wind. It has been known for a long time that, in the free solar wind, EDF display both thermal ("core") and suprathermal ("halo" and "strahl") populations; more recently a super-halo population has also been identified. The usual model used to characterize the observed solar wind EDF is a sum of two bi-Maxwellians, the core-halo model, with a core-halo drift velocity oriented along the interplanetary magnetic field. Other recent works have emphasized the Lorentzian nature of EDF, i.e. the importance of their suprathermal tails, which should play a crucial role in the exospheric expansion of the slow and fast solar wind. Based on either the core-halo or Lorentzian (or Kappa) models, kinetic instabilities in space plasma have been discussed in the literature and wave growth rates have ben calculated. However both models are not appropriate to accurately characterize the solar wind EDF because they do not account properly for some important features of observed EDF. It is therefore important to characterize more precisely the nature of the EDF in the two typical solar winds. The 3DP experiment on the WIND spacecraft provides measurements of the full 3D electron distributions from energies of few ev to above 100 Kev, with a high-sensitivity, wide dynamic range, good energy and angular resolutions, and high time resolution. WIND's in-ecliptic orbits cover prolongated periods in the ambient, slow and fast, solar wind near L1, during the last minimum of solar activity. New characteristics of EDF are established and their consequences in different field of space plasma processes are discussed.

SH53B-05 1430h

Low Density Anomalies and Sub-Alfvénic Events in the Solar Wind

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Spacecraft observations show that solar wind near Earth orbit is usually highly super-Alfvénic with an average Alfvén Mach number of 8.4. *Gosling et al.* (JGR, *87*, 239, 1982) showed that during the low density events of July 4, July 31, and November 22, 1979 the solar wind became sub-Alfvénic. We use the recently released OMNI 2 spacecraft data compilation for 1963-2003 to select 23 intervals with abnormally low densities of 0.3 cm^{-3} or less and among them 9 events with Alfvén Mach number less than unity. We discuss a correlation between minimum Alfvén Mach numbers and minimum densities for the selected events. Using a time-dependent MHD simulation, we show that a very strong rarefaction with an embedded sub-Alfvénic region can develop on the trailing edge of a fast flow.

SH53B-06 1445h

Cross-Field Energy Transfer of a Planar Alfvén Wave Propagating Along and Across a Pressure-Balanced Structure

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We present hybrid numerical simulation results with particle protons and fluid electrons of a low-frequency, planar (body) and shear Alfvén wave located within a smoothly varying cross-field pressure-balanced structure which provides a wave-speed gradient. We consider wave propagation directions starting at 90^o, which resembles the case of a surface wave on an interface, and less than 90^o with respect to the gradient direction. We find that the planar Alfvén wave undergoes resonant absorption. When the propagation direction is less than 90^o, we show that there are resonant field lines which can actually give wave energy to other neighboring resonant field lines, which is a situation that has not been encountered in previous work with surface waves. A consequence of this process is an overall faster development time for smaller scales perpendicular to the magnetic field through phase mixing and potentially faster dissipation of these generated scales in coronal and solar wind plasma. In these collisionless simulations, dissipation of the small scales occurs via the Landau resonance.

SH54A CC: 519 A Friday 1530h

Solar Wind IV

***Presiding:* M E Hill,** University of Maryland**; A Szabo,** NASA Goddard Space Flight Center

SH54A-01 1530h

Transport of cross helicity and the radial evolution of Alfvenicity in the solar wind

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A transport theory for cross helicity is described, including both scale-separated spatial transport and a phenomenological description of nonlinear effects associated with magnetohydrodynamic turbulence. The formalism is applied to the radial evolution of the solar wind, where driving effects of shear and pickup ions are included. It is found that the radial decrease of cross helicity observed in the equatorial solar wind can be accounted for when sufficient driving is included to overcome dynamic alignment, i.e., the inherent tendency for MHD turbulence to produce Alfvenic states. For the high latitude wind, which evolves under influence of a lower mean shear stregnth, the theory predicts a closer balance between dynamic alignment and shear strength effects, so that the normalized cross helicity, which generally decreases with increasing heliocentric radial distance, changes very little between 2 and 4 AU. This accounts well for Ulysses observations. This research supported in part by NSF grant TM-0105254, NASA grants NAG5-8134, NAG5-11603, NAG5-6570 and NAG5-10911, and the NZ Marsden Fund (02-UOW-050 MIS).

SH54A-02 1545h

Semi-Empirical Model of Electron Heat Flux: SOHO and Ulysses Data

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We have developed a semi-empirical model of the electron heat conduction which is based on both theoretical and observational considerations. Most specifically we are most interested in applying this model to the polar regions of the Sun during solar minimum where suprathermal tails may form. This model is a 'local model' which uses the Krook's anzatz in the Boltzmann equation using the collision term $(\delta f^*/\delta t)_{coll} = -(f^* - f_0^*)/\tau$ where $\tau = (\lambda_w/w_c)(u^3/(u^4 + \lambda_w/\lambda_{coul}))$ is the collision time, λ_w is a characteristic 'local' scattering length due to waves, λ_{coul} is a characteristic collision length 'local' due to coulomb collisions, $u = (w/w_C)$, w_c is the thermal speed of the core electrons, w is the electron speed in the electron proper frame, and $f^* = f_0^* + f_1^*$, where f^* is the proper frame electron distribution function, f_0^* is the unperturbed electron distribution function and f_1^* is the perturbed correction term due to plasma gradients and collisions. Assuming a kappa distribution function for f_0^* we can compute an expansion of the Boltzmann equation and derive an expression for f_1^* with some undetermined parameters. Then by imposing constraint of particle conservation $\int f_{e1}^* d^3w = 0$, the zero current condition $j_{ll}^* = -e \int f_{e1}^* w_{ll} d^3w = 0$ to give us a relationship for the interplanetary potential, and we can then reduce the number of free parameters. Then by specifying the logarithmic derivative of the electron density, core electron temperature and the magnetic field from the base of the corona to 1 AU using SOHO and Ulysses data we can derive a relationship for κ and thus f_1^* with λ_w as a free parameter. Once this is done we can use the relationship $q_{ell}^* = \frac{1}{2} m_e \int f_{e1}^* w^2 w_{ll} d^3w$ to give us the electron heat flux along **B** and then set it equal to q_{eff} from the semi-empirical MHD model by Sittler and Guhathakurta (1999,2002) to constrain λ_w which tell us how important waves are (i.e., whistler mode waves) with respect to coulomb collisions as a function of radial distance from the Sun. Preliminary results were presented by Sittler et al. (2001). Our most results have been improved from that previously presented and will use a comprehensive analysis of Ulysses solar wind electron data.

SH54A-03 1600h

Pickup ion transport in the inner heliosphere, a statistical study

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Statistical studies of high time resolution in situ measurements of interstellar helium pickup ions using SOHO/CELIAS/CTOF and ancillary data are reported. These singly charged helium ions act as test particles in the solar wind due to their low relative density in the inner heliosphere. These studies have shown new correlations to solar wind parameters such as proton density, magnetic field direction & magnitude, and MHD wave power. Statistical analysis enables quantitative analysis of pitch angle scattering rates and also shines new light on stochastic acceleration and wave-particle interactions. Also reported are the effects of changing ionization rates on the interstellar pickup ion velocity distributions.

SH54A-04 1615h

Temporal Variations of Low-Energy Helium Observed by Voyager1 in 2002-2003

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During the enhanced intensities at low energies observed by Voyager 1 at >85 AU in 2002, the helium appears to have two distinct components. Above 10 MeV/nucleon, it is consistent with that of modulated anomalous cosmic rays, while it is a power law at lower energies indicating no energy-dependent modulation. The two components exhibit distinctly different time dependent variations which may provide clues as to their differing origins.

SH54A-05 1630h

Reappearance of Enhanced Intensities of Low-Energy Particles at Voyager 1 in mid-2003

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