investigation of these images reveals a considerably dynamic auroral oval, with the promise of some clear correspondences with upstream Cassini data that will provide unique insight into Saturn's magnetospheric dynamics. The results will also provide impetus to interpretation of in situ field and plasma data once we arrive in Saturn orbit.

SM33A-15 1330h POSTER

A Self-Consistent Approach to Modeling Ion Outflows Associated with Electromagnetic Ion Cyclotron Waves

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Energetic heavy ion outflows detected by satellites in the auroral region are commonly associated with electromagnetic ion cylotron wave activity (1-100Hz) observed by the same spacecraft. Because the Poynting flux of the waves is into the ionosphere, the waves can provide an energization source for the concomitant ion heating. One difficulty with relating the ion outflows to the wave activity is the nonlocality of the heating process—much of the heating occurs between the ionosphere (where the ions originate) and the spacecraft. A common approach is to obtain a heating rate based on the assumption that the wave spectral density is invariant along the auroral field lines, which provides an estimate of the local ion heating rate. However, wave propagation and dissipation depends strongly on the heavy ion concentrations in the topside ionosphere as well as the collisional ionospheric model, and therefore the wave spectrum—and heating rate—at a given altitude is also strongly dependent on the plasma model. Thus, the plasma background modifies the wave propagation and heating rate. However, the heating rate determines the background plasma profiles. To account for this feedback, we successively iterate (1) a wave propagation code based on background plasma profiles (which solves the full electromagnetic equations including a realistic ionospheric model) and (2) a Monte Carlo simulation code to obtain the ion profiles based on heating rates obtained from the results of the wave propagation code. The method converges rapidly to a stable state, and the results suggest that temporal evolution of the plasma profiles would involve a two-step process where helium is first heated then oxygen. The results also suggest that helium is typically preferentially heated compared with oxygen as is observed.

SM33A-16 1330h POSTER

A One-dimensional Ionosphere Solution with Self-consistent Neutral Motion

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We take a systematic approach to study the coupling from the solar wind and the magnetosphere to the ionosphere and thermosphere, based on three-fluid treatment: electrons, ions, and neutrals, with collisions among the three species. The momentum equations of the three species are converted into the generalized Ohm's law and the plasma momentum and neutral momentum equations. By allowing the collision frequencies and the densities to vary as functions of height, this formulism continuously and smoothly describes the plasma conditions from the collisionless solar wind and magnetospheric plasma to the partially ionized ionosphere/thermosphere gases. We solve this equation set in one-dimension to model the magnetosphere-ionosphere/thermosphere coupling at high latitudes near the poles where Birkeland (field-aligned) currents and precipitating particles are not important. Since the solution is self-consistent, the neutral wind speed is a function of height and time and thus cannot be taken as specifying a single frame of reference. In the ionosphere, the plasma velocity is also a function of height and cannot be treated as a constant. The results show that the F- and E-layers of the ionosphere may behave differently. For example, when the IMF reverses its direction after a long period of steady state, there is a transient enhancement of Pedersen current in the F-layer.

SM33A-17 1330h POSTER

Modeling the Direct Penetration of Electric Fields to the Equatorial Ionosphere

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The interplanetary electric field has been observed to penetrate directly to the equatorial region where it affects the generation of plasma bubbles which, in turn, cause the scintillation of transionospheric electromagnetic signals. We use the approach of Nopper and Caravillano [1978] to model the effect of the Region I and Region II currents on the global electric field. We find, consistent with observations, the well-known shielding of the equatorial region by Region II currents. Numerically, two approaches are taken. The first approach is to solve N-squared simultaneous linear algebraic equations for each of the grid points. The second approach is to use the Multigrid technique, which allows a rapid convergence of the SOR (successive over- relaxation) iterations. The advantage of the algebraic approach is accuracy , while the advantage of the second approach is speed. Further comparisons between these two approaches will be made. Effects of the magnetic dipole tilt relative to the polar cap, the presence of a sub storm current wedge, the saturation of the transpolar potential, and seasonal effects will be discussed . Nopper R.W. and R. L. Carovillano, Geophys. Res. Ltrs., 5, 699, 1978.

SM33A-18 1330h POSTER

Monte Carlo Study of Secondary Electrons and X Rays Produced by Vertical vs. Horizontal Arrival of Precipitating Electrons at the Top of the Atmosphere

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Electron precipitation from the outer belt is an important input of energy and electric charge to the atmosphere. The ionization profile (ionization rate vs. altitude) may be affected by the direction at which electrons enter the top of the atmosphere. Definitive measurements of the angular distribution of precipitating electrons at the top of the atmosphere have not been made; studies of the problem have made a number of assumptions in this regard. Consideration of the mechanism by which electrons in the drift loss cone enter the atmosphere due to eastward drift suggests horizontal entry: an electron in the process of mirroring near the top of the atmosphere encounters a region where its gyro-circumference is equal to its mean-free- path and it collides with an atmospheric molecule. In order to study whether horizontal entry at the top of the atmospere could have a significant effect, we have investigated this question by comparing horizontal to vertical entry with a Monte Carlo study using the FLUKA code. Assuming an energy spectrum typical of outer belt electrons up to 10 MeV at entry, both electrons and X rays were followed down to energies of 100 keV. The Monte Carlo results are compared to measurements in the atmosphere of electrons made below 80 km on rocket-boosted, parachute-deployed payloads, and to measurements of X rays made on balloon payloads at altitudes of about 35 km.

SM33A-19 1330h POSTER

Energy transfer through the LFM MHD model

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We present analyses of energy transfer through the solar wind-magnetosphere-ionosphere system using the Lyon-Fedder-Mobarry global magnetohydrodynamic model. We define magnetospheric regions based on plasma parameters or locations (plasma sheet, magnetic lobes, magnetopause), and calculate the thermal, magnetic, and kinetic energy content of those regions as a function of time during a simulation of an isolated substorm on December 10, 1996. We will compare the model results to previous energy budget analyses based on multipoint spacecraft observations.

SM34A CC: 517 A Wednesday 1530h

Parker Lecture *(joint with SA, SH)*

Presiding: **D N Baker,** Laboratory for Atmospheric and Space Physics

SM34A-01 1540h INVITED

The Sun and Heliosphere as Revealed by Suprathermal Electrons

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Solar wind electron distributions near 1 AU are generally well described as a superposition of two distinct components: a cool core or thermal component and a relatively hot suprathermal component. The breakpoint between these two populations commonly occurs at about 60 eV at 1 AU. The suprathermal component carries the solar wind electron heat flux, is almost always nearly collisionless, behaves largely as a test particle population streaming freely through the solar wind along the heliospheric magnetic field, and is commonly highly anisotropic in the solar wind rest frame. In this lecture I demonstrate some of the remarkable spatial and temporal intensity and pitch angle variability of the suprathermal electron component at energies below about 1.4 keV, relate that variability to different solar and heliospheric processes, and illustrate aspects of the large-scale magnetic topology of the heliosphere revealed by suprathermal electron observations.

SM41A CC: 220 C-E Thursday 0830h

Relativistic Electrons in the Earth's Inner Magnetosphere: Observations, Models, and Space Weather Implications III Posters

Presiding: **S G Kanekal,** Catholic University of America**; X Li,** University of Colorado

SM41A-01 0830h POSTER

Long-Term Prediction of MeV Electrons in Geostationary Orbit

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The flux of MeV electrons at geostationary altitude represents a gauge of the radiation levels associated with severe solar and geomagnetic disturbances. Several techniques have been developed to forecast MeV electron flux, mostly aiming at giving a one to three