TGCM RESULTS FOR GISMOS JANUARY 18-19, 1984

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The NCAR thermospheric general circulation model (TGCM) was used to simulate thermospheric dynamics for the GISMOS period of January 18-19, 1984. Ground-based magnetometer data were used in a new electrodynamic mapping procedure to derive high latitude potential patterns. These patterns were used to specify magnetospheric convection ion drifts in the TGCM. Global auroral particle precipitation was determined using hemispheric power input estimates from NOAA satellite measurements. The time-dependent TGCM simulation will be described and the results compared with various observations.

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ELECTRON/ION PRECIPITATION DIFFERENCES IN RELATION TO REGION 2 FIELD-ALIGNED CURRENTS

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Prior to the small (maximum AE = 206 nT), isolated substorm on 18 January 1984 at ~0900 UT, there was a long period of magnetospheric quiet. At the end of the quiet period, no large-scale Region 1 and 2 Birkeland currents are seen in the pre-noon/midnight auroral region covered by the DMSP F7 satellite. As the energy transport into the magnetosphere increases during the growth and expansion phases of the small substorm, the Birkeland currents strengthen, and clear Region 1 and 2 systems are observed. The field-aligned currents weaken after the substorm. We have examined the particle precipitation data to determine if there are any differences between times when there are and are not large-scale Region 1 and 2 currents. We find that the latitudinal separation of the auroral zone electron and ion equatorward boundaries is constant both for the presence and absence of Region 2 currents. By contrast, the energy flux peaks of the auroral zone electrons and ions are separated in latitude when Region 2 currents are seen, but are coincident when they are not. These observations are compared with two possible mechanisms for the generation of Region 2 field-aligned currents: 1. charge separation at the inner edge of the central plasma sheet and 2. a pressure gradient between the plasmasphere (and/or ring current particles) and the inner edge of the central plasma sheet.

Joule Heat, Field-Aligned Currents, and Particle Precipitating During Quiet Times.

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We have been investigating the input of energy into the high latitude ionosphere by two methods. The first is a statistical survey of magnetic field and precipitating electron data from the Defense Meterological Satellite Program (DMSP) F7 spacecraft. We have started the survey with the 17-19 Jan 84 Gismos period. The geomagnetic environment during this period varied from extremely quiet to minor substorm level. During the extremely quiet times, the field-aligned currents in the auroral zone died away after a few hours, but the cusp /cleft currents continued. Without field-aligned currents there is no ionospheric current or Joule heating. With the slightest increase in activity the currents and heating return. The second investigation is to combine the survey maps created from the statistical survey of the DMSP particle data and the map of the convection electric field done by Heppner and Maynard from the DE electric field experiment. Preliminary results indicate that regardless of the configuration of the electric field due to the IMF By component, the majority of Joule heat input is in the afternoon/evening sector.

SUBSTORM SURGES OBSERVED AT CHATANIKA AND SONDRESTROM

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Incoherent scatter radar measurements have been made of auroral surges both at Chatanika, Alaska and Sondre Stromfjord, Greenland. Because of the difference in the magnetic latitude of these two sites, this enables us to examine the electrodynamic properties of different parts of the surge. In this paper we show measurements made by both radars during several surge events. All-sky imaging data show the variations in auroral form that accompany the surges and ground-based magnetometer data are used to study the electric currents. At Chatanika, meridional cross sections of electron density and electric fields exhibited a characteristic temporal and spatial behavior during the passage of a surge. Initially, the aurora moves southward and arcs become rayed. Several to tens of minutes later the main part of the surge is observed with aurora spreading poleward. The surge is associated with intense, hard particle precipitation and westward electric fields. Recent measurements of auroral surges as observed from Sondre Stromfjord indicate a similar behavior. A comparison of the ionization and electric fields in the surges as measured from the two radar sites will be made.

Convection in the Inner Magnetosphere: Model Predictions and Data

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The linear, semi-analytical and time-dependent magnetospheric convection model of *Senior and Blanc* (1984) was adapted to the predictions of the time variation of midlatitude electric fields induced by known variations of the electrostatic potential drop generated by the solar wind/magnetosphere dynamo across the polar cap. Simulations were conducted for two GISMOS periods and the CDAW-6 event, for which a large amount of data were available. The cross-polar-cap potential Φ_O, which constitutes the source of the large-scale convection, was calculated from the IMF data, using a formula given by *Reiff and Luhmann* (1986), and the input parameters of the model were adjusted to available high-latitude data. The model was tested against the observed midlatitude electric field disturbances. For the days studied, the apparent absence of a strong contamination of these electric fields by the ionospheric disturbance dynamo creates good conditions for this test. In fact, the agreement between observations and model was found to be excellent for two of the three days studied. This constitutes a very positive test of the capacity of our model to predict electric fields generated at midlatitudes by the closure of high-latitude currents through the ionospheric conductor. This means that the component of the magnetospheric convection electric fields which is directly driven by the solar wind, via the electrostatic potential difference it imposes across the tail of the magnetosphere and the polar caps, rather than generated by processes internal to the magnetosphere, seems to be the main contribution to magnetospheric convection electric fields at midlatitudes , for at least two of the three periods studied.

HIGH-LATITUDE LOWER-THERMOSPHERIC NEUTRAL WINDS AND GEOMAGNETIC ACTIVITY: CHATANIKA RADAR RESULTS

R. M. Johnson, V. B. Wickwar, R. G. Roble, and J. G. Luhmann

Observations made of the high-latitude E region with the Chatanika, Alaska, incoherent-scatter radar facility during the summer months of 1976 to 1982 are presented. Fourteen 24-hour experiments were performed with altitude resolution between 9 and 24 km. Ion drifts measured during these experiments have been analyzed to obtain neutral winds at lower-thermospheric heights. The figures shown here emphasize the importance of lower-thermospheric tides, as well as the sensitivity of the neutral wind velocities to the level of magnetospheric forcing. Tidal oscillations are the predominant feature of the neutral winds from 90 to 125 km. The semidiurnal oscillation is particularly strong, attaining peak amplitudes of 50 m/s at 110 km. Average diurnal and semidiurnal tidal phases are in good agreement with previous mid- to high-latitude observations. Average neutral winds were determined for three different levels of geomagnetic activity. During geomagnetically active experiments, the average neutral wind circulation pattern was altered from its normal quiet-time behavior above 100 km. The changes observed in the neutral winds are generally consistent with the predictions of the NCAR TGCM for three different levels of steady-state magnetospheric input that reflect increasing levels of geomagnetic activity.

'LOBAL IONOSPHERIC SIMULATIONS OF SUBSTORMS: THE JANUARY, 1984 QUIET PERIOD

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The Global Ionospheric Simultaneous Measurement of Substorms (GISMOS) experiment of January 16-19, 1984 is studied by a 3-dimensional ionospheric model. The first phase of the modelling focuses on the quiet period of January 17-18. Here the standard model inputs of ionospheric convection, auroral particle precipitation and neutral wind are used to compare with measurements of ionospheric parameters from Sondrestromfjord, Millstone Hill, EISCAT and St. Santin. A future study using time dependent parameterizations of the model inputs will be pursued to investigate the active period on January 18-19.

Participants in Poster Session:

B. Fejer (not presented here)
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