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Group 3 Interactive Study of Solar-Terrestrial Environment

The two year project of a interactive study of the energy flow from the heliosphere into the earth's magnetosphere by using network system has been supported by a Grant for Specified Research from Ministry of Education, Science and Culture. In the first year, a gateway processor to join the Interuniversity Network (N1 network) was introduced and a test to use TSS (NVT) and N1 mail through the N1 network has been successfully carried out. Such a test is necessary to send or receive a computer file for observations and computer simulations. Moreover, a personal computer graphic system was introduced in order to analyze auroral video data which was obtained from the "Global Aurora Dynamics Campaign". The auroral image can be quickly displayed by choosing a proper colour code. The computer graphic system will need a further development in program, procedure and network to systematically study auroral dynamics.

Construction of data base of a wide variety of solar-terrestrial observations in February-March 1986 has been continued. Watanabe and Iwata organized an STE (solar-terrestrial environment) workshop on solar-terrestrial events in February-March 1986, which was held at Nagoya University on 19 January 1989. This was the first trial in Japan to make coordinated data analysis on the basis of a machine-readable data base. More than 20 papers were presented. They will be published in a special issue of Proc. Res. Inst. Atmospherics, Nagoya University. A data base relevant to PROMIS-CDAW interval (April-May, 1986) is also being constructed. This data base will be accessible through computer networks. A data book will be published.

A three-dimensional time-dependent global magnetohydrodynamic (MHD) simulation of the interaction between the solar wind and the earth's magnetosphere has been carried out to study magnetic reconnection at the magnetopause and magnetotail dynamics. In magnetic reconnection, two different mechanisms for the formation of magnetic flux tubes at the dayside magnetopause which depend on the orientation of the interplanetary magnetic field (IMF) were found. The dayside magnetic flux tubes occur only when the IMF has a southward component. A strongly twisted and localized magnetic flux tube similar to magnetic flux ropes appears at the subsolar magnetopause when the IMF has a large By component. When the By component is small, twin flux tubes appear at the dayside magnetopause. These flux tubes are similar to the usual configuration proposed for flux transfer events. Both types of magnetic flux tube are consistent with several observational features of flux transfer events and are generated by antiparallel magnetic reconnection.

In the magnetotail, plasmoids appear due to the formation of near-earth magnetic neutral line during a southward IMF. When the IMF has a finite By component, magnetic field lines have a helical structure connected from dawn to dusk. In particular the helical field lines near the center of plasmoid are bundled at both edges of plasmoid and form a structure similar to magnetic flux ropes. The magnetic field enhances whereas the plasma pressure decreases inside the flux rope. When the southward IMF was initially imposed, a structure like magnetic flux ropes immediately appears due to tail reconnection.

Relationships between auroral and concurrent magnetic activities have been studied. Short-lived local expansions of dayside auroras are related with characteristic magnetic impulses around the dayside cusp. The movements of auroral structures during the local expansions are usually dominant in the east-west direction, in agreement with the earlier results of radar measurements in ionospheric drift velocity so far reported. An importance of the local conductivity enhancement is suggested in understanding the relationship between the drift of auroral structures and the ground magnetic field deflections. Based upon the auroral and magnetic data of the Global Aurora Dynamics Campaign (1985-1986), relationships between local auroral expansions in the night sectors and magnetic field changes both at conjugate synchronous satellites and on the ground have also been examined. Field-aligned electric currents associated with a local auroral expansion are spatially limited in the vicinity of the relevant flux tube linked with the expansion part of the aurora. Long-period magnetic pulsations (Pc4-5 range) on the ground are associated with concurrent auroral pulsations, also suggesting that effects of the local enhancement in conductivity cannot be neglected in the magnetic field deflection on the ground.

Oguti visited the Polar Geophysical Institute, Murmansk, U. S. S. R. in September 1988, gave a lecture talk on pulsating auroras, and discussed the future possible collaboration in auroral and magnetic observations in the cusp region. He attended to the NATO advanced research workshop on electromagnetic coupling in the polar clefts and caps, Lillehammer, Norway, on September 20-24, 1988, and gave an invited talk on the relationships between auroral and magnetic activity in the polar cusp/cleft. In this paper he shows that the so-called cusp field-aligned currents are most likely accounted for in terms of the motional induction effects within the outermost magnetospheric region, and subsequently presents a question on the efficiency of the dayside reconnection in driving the global magnetospheric convection.

Ogino attended the Spring AGU Meeting at Baltimore, U.S.A. in May, 1988 and the Fall AGU Meeting at San Francisco in December. He also organized a STE Meeting on "Interaction between the solar wind and the magnetosphere" in June 23, 1988.

Watanabe gave an invited paper in 17th Plenary meeting of the Committee on Space Research (COSPAR), which was held at Espoo, Finland, during 18-19 July 1988. The principal subject of this paper was to review current studies on lati-

tude/longitude distribution of the solar wind speed revealed from IPS (interplanetary scintillation) observations. It is shown in this paper that the heliospheric current sheet plays an important role to determine large-scale propagation properties of an interplanetary disturbance; strong deceleration of the disturbance will take place in the radial direction of the current sheet. Previous studies concerning large-scale propagation properties of interplanetary disturbances has been reviewed by Watanabe and Schwenn. An interplanetary disturbance apparently in association with a disappearing solar filament on late 22 April 1979 was selected as an example to check previous deductions from IPS observations. All of three-station IPS observations, spacecraft observations, and spacecraft CME (coronal mass ejection) observations suggest the presence of an associated interplanetary disturbance which had the center near the sun-earth line. This result is not consistent with the deduction from single-station IPS observations (g-value observations); the center of the disturbance was located in the eastern hemisphere of interplanetary space, at about $43°E$. The reason of the discrepancy is not clear at present. Watanabe et al. (1989) discussed large-scale propagation properties of an interplanetary disturbance in association with a halo CME which was detected by the Solwind coronagraph at 08:22 UT on 27 November 1979. Detailed model-fitting showed that a dip of the propagation speed of the disturbance was situated in the direction of the heliospheric current sheet.

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