

Comparison of particle observations by NOAA and LANL during the magnetic storms of November 2004

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A comparison of particle fluxes observed simultaneously by the NOAA satellites (altitudes ~ 800 km) and LANL geosynchronous satellites reveals that the proton fluxes at low altitudes and near the equator at $6.6 R_e$ did not change coherently during the Nov. 2004 storm event. The discrepancy in the proton fluxes between NOAA and LANL shows up most clearly in their general trend on the time scale comparable to the entire time interval of a storm. Basically, the proton fluxes of 30-80 keV at $L \sim 6.6$ observed by NOAA enhance rapidly during the storm main phase and decay when the storm enters its recovery phase. On the other hand, the proton flux in the same energy range at the geosynchronous orbit rises rapidly as the storm main phase starts and does not decay significantly even after the main phase ceases. Difference in the variation of proton fluxes between the two different locations can also be seen in terms of their local time dependence. For example, during the early main phase, the NOAA proton fluxes beyond L of 5 rise first at the evening to premidnight sector and the flux enhancement at the postmidnight to morning sector follows with a time delay of several hours. As the storm enters its late main phase, the proton fluxes drop first at the evening to premidnight sector, even though the main phase has not ended yet. Finally, the proton fluxes at the postmidnight to morning sector decay as well at the end of the main phase. It is found that such a local time shift of proton precipitation toward NOAA is closely associated with the change in the intensity of the southward IMF component. In contrast to the local time dependence in the NOAA fluxes, the enhancement of proton fluxes during the main phase is fairly coherent all over the nighttime sector at the geosynchronous orbit, showing little difference between the above local time sectors. These results suggest that the enhanced proton fluxes associated with the storm main phase persist at the equator from the beginning of the storm main phase through the late recovery phase but the pitch angle scattering processes at equator, which cause equatorially trapped protons to precipitate into the NOAA altitudes, are activated only during the main phase, resulting in a significant difference in proton fluxes at NOAA between the main phase and the recovery phase. Considering the local time dependence of proton fluxes beyond L of 5 observed by NOAA, it is also suggested that the region of the enhanced pitch angle scattering shifts from the dusk side to the dawn side at the nighttime sector during the main phase. The close correlation with the southward IMF suggests that the local time sector of the enhanced activity of pitch angle scattering is controlled by the intensity of the southward IMF component.