Comparison of storm-time local time dependences between ring current proton precipitation and ground magnetic field disturbance

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Since July 2002, combined data from the polar orbiting satellites, NOAA/POES N15, N16, N17, and N18 shows local time dependence of the ring current (RC) proton precipitation at the low altitudes of about 850 km. Storm time local time dependence of the RC proton precipitation has been compared with that of ground geomagnetic field variation given from middle latitudes observatories of INTERMAGNET.

The local time dependence of the RC protons can be called as a pre-noon-pre-midnight or day-night asymmetry. In addition, the RC proton flux in the pre-noon sector is smaller over one order than that in the nightside sector.

In comparison, concurrent depression of ground magnetic H component shows dawn-dusk asymmetry which is associated with field aligned currents expected from the variation of the D components. The largest depression of H component in the dusk sector is a few times larger than the smallest value in the dawn to pre-noon sectors.

Furthermore, it is found that the temporal peaks of RC proton energy and the H depression are a few hours different in average.

It is confirmed that the energy density estimated from the proton precipitation is over an order smaller than expectation from depression of the geomagnetic H component. This is explained by the equatorial pancake distribution in which equatorial parallel component is smaller about one order than perpendicular one, as shown by in-situ observations of AMPTE or POLAR. In spite of such small amount, the local time dependence of RC proton precipitation is similar to those of the in-situ observations. This implies that the RC proton precipitation quantitatively reflects the local time dependence of equatorial RC energy.

The results expect existence of particles producing global H depression, particularly in the pre-noon sector of the equatorial magnetosphere. In addition, it is propounded that the geomagnetic indices provided from low- and middle-latitude ground H perturbation should be carefully used as an index of magnetospheric or space storms.