Energy density distribution in the inner magnetosphere associated with magnetic storms: POLAR measurements

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Development of the equatorial proton energy density in the inner magnetosphere has statistically been investigated by using proton spectra (1-200 keV) observed by POLAR/CAMMICE/MICS during the period between 1997 and 2000. The visualization of the equatorial proton energy density is useful to verify the hypotheses that have been tested by numerical simulations in terms of ring current developments. The total of 28850 spectra was selected and sorted by Dst values, phases of a magnetic storm and solar wind conditions. The energy density is found to enhance restrictedly in the night and afternoon sectors, and reach 10x10^-9 J m^-3 and more during a main phase of magnetic storms. No enhancement in the prenoon sector is apparent. Our numerical simulation, which traces particles in the dipole magnetic field and the Volland-Stern type convection electric field, gives quite reasonable results with respect to the spatial distribution and their intensity of the energy density when the polar cap potential drop follows the estimated one that is based on solar wind parameters instantaneously measured. This agreement likely suggests that the proton ring current primarily responds to the solar wind parameters.