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Behaviors of Plasma and High Energy Electron Distributions During Magnetic Storms

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By analyses of plasma density distribution detected from upper hybrid wave data of PWS instruments onboard the Akebono satellite, dynamical behavior of plasma motions and distributions associated with magnetic storms are verified. That is, during main phase, the plasma distributions show signatures of outward flows that are called exodus while plasma distributions show the inward flows that are called immigration. The origin of these behaviors of plasma is attributed to occurrence of ring feature electric fields raised by induction effects due to time varying geomagnetic fields. During the main phase of the magnetic storm, the plasmas make outward ExB drift due to existing eastward sense ring feature electric field while plasmas make inward ExB drift due to westward sense ring feature electric fields.

The present study is further developed to investigate the effects of the ring feature electric field by analyzing summary plots of GOSAT satellite data of high energy electrons, and proposes the drifts motions of high energy electrons that are not responsible to ring current formation by raised ring feature electric fields during storm times. In main phase of the storm, the electrons with energy higher than 400keV show the effects of outward drift while these are clearly concentrated inside region during recovery phase of the magnetic storm. These behaviors show characteristics features depending on the time varying rates of the magnetic fields. For the case of gradual variation with a rate of 80nT/20hour the limiting energy of non-contributing electrons is about 600keV while the limiting energy becomes low to be about 300keV for the case of severe time variation of the magnetic field intensity as a case of 170nT/3hour.

Keywords: Plasmaspheric Plasam, Induction Electric Field, High Energy Electrons, Ring Feature Electric Field, Main Phase of Magnetic Storm, Recovery Phase of Magnetic Storm