Solar-cycle variations of >30 keV proton flux enhancements under the inner radiation belt

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Upper atmosphere is continually affected by intense fluxes of energetic electrons and protons penetrating from the magnetosphere to low altitudes. The energetic particles ionize and excite neutral species altering local characteristics of the ionosphere. Continuous monitoring of energetic particles at low heights of ~850 km with the MEPED instrument onboard the NOAA/POES satellites allows studying of particle flux variations with geomagnetic activity and solar cycle. The instrument measures precipitating/trapped electrons and protons in the wide energy range. In the previous study, we revealed enhancements of electrons with energies 30 - 300 keV at low latitudes in a so-called forbidden zone. It was established that the electrons were injected from the inner radiation belt probably due to a mechanism of fast radial transport in the crossed electric and magnetic fields. In the current work, we study fluxes of >30 keV protons in the forbidden zone. We distinguish two types of proton enhancements, which have different spatial-temporal characteristics. One type of proton enhancements occurs due to the charge-exchange mechanism of the ring current and is always observed during magnetic storms. Another type is due to injections from the inner radiation belt. The last enhancements are similar to the electron enhancements. Results of long-term analysis of proton injections will be presented.

Keywords: magnetosphere-ionosphere, energetic protons, low latitudes, solar cycle

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