Void structure of O^+ ion observed by the Van Allen Probes in the inner magnetoshpere

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The Van Allen Probes Helium Oxygen Proton Electron (HOPE) instrument measures charged particles with an energy range from ~eV to ~50 keV. The observation shows that the energy flux of the particles increases inside the geosynchronous orbit during substorms. For some night-side events, the observed H^+ flux and O^+ flux spectrogram showed injections of energetic ions (tens of keV), but only the O^+ flux spectrum has a gap in the low energy range at high-L shells. The purpose of this study is to investigate the generation mechanism of the structure by using numerical simulations. By applying the same simulation model introduced by Nakayama et al. (2015, JGR), we simulated the substorm-time injection of O^+ ions in the global MHD electromagnetic fields and reconstructed the flux in the inner magnetosphere. Our simulation successfully reconstructs the structure of O^+ flux observed by Van Allen Probes. After analysis of test particle simulation, we concluded that the generation mechanisms of the structure are (1) the longitudinally and radially confined flow channel of O^+ ions and (2) the intensive non-adiabatic acceleration of O^+ ions in the nightside tail region.

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