Characteristics of plasma supply and energization in the inner magnetosphere: Arase long-term observations

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This study investigates the supply and energization of near-Earth magnetospheric plasma, which originate from solar wind or the upper ionosphere. It is well known that the magnetospheric plasma is predominantly of solar wind origin during quiet times, while ionospheric plasma can make a comparable or dominant contribution particularly to the plasma pressure in the inner magnetosphere when a magnetic storm occurs. The plasma pressure is contributed mostly from ions with energies of ~1 to a few hundreds of keV. The energetic ions are primarily transported from the near-Earth plasma sheet and energized during the transport. The spatial distribution of the energetic ions and its temporal evolution play important roles in a drastic change of the global plasma transport and current system during magnetic storms.
This study primarily (1) examines the temporal and spatial variations of phase space densities of the energetic ions, namely H+, He+, He++, and O+, during the entire period of a magnetic storm including the initial, main, and recovery phases, and (2) performs a statistical study of the energetic ion characteristics for >50 magnetic storms observed by the Arase spacecraft in 2017 to present. These analyses aim to determine (a) the dependence of the dominant transport process on the adiabatic invariants and ion mass and (b) the location and timing of the supply of the ionospheric plasma to the near-Earth plasma sheet.

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