Van Allen Probes衛星の観測に基づく高エネルギー酸素イオンの深内部磁気圏への動径方向輸送の研究

三谷 憲司 [1]; 関 華奈子 [2]; 桂華 邦裕 [3]; Gkioulidou Matina[4]; Lanzerotti Louis J.[5]; Kletzing Craig A.[6]; Mitchell Donald[4]
[1] 名大 ISEE; [2] 東大理・地球惑星科学専攻; [3] 東大・理; [4] JHU/APL; [5] ニュージャージー工科大学; [6] Department of Physics and Astronomy, UoI

Radial transport of high-energy oxygen ions into the deep inner magnetosphere observed by Van Allen Probes

Kenji Mitani[1]; Kanako Seki[2]; Kunihiro Keika[3]; Matina Gkioulidou[4]; Louis J. Lanzerotti[5]; Craig A. Kletzing[6]; Donald Mitchell[4]
[1] ISEE, Nagoya Univ.; [2] Dept. Earth & Planetary Sci., Science, Univ. Tokyo; [3] University of Tokyo; [4] JHU/APL; [5] NJIT; [6] Department of Physics and Astronomy, UoI

It is known that proton is main contributor of the ring current and oxygen ions can make significant contribution during major magnetic storms. Ions are supplied to the ring current by radial transport from the plasma sheet. Convective transport of lower-energy protons and diffusive transport of higher-energy protons were reported to contribute to the storm-time and quiet-time ring current respectively [e.g., Gkioulidou et al., 2016]. However, supply mechanisms of the oxygen ions are not clear. To characterize the supply of oxygen ions to the ring current during magnetic storms, we studied the properties of energetic proton and oxygen ion phase space densities (PSDs) for specific magnetic moment (mu) during the April 23-25, 2013, geomagnetic storm observed by the Van Allen Probes mission. We here report on radial transport of high-energy (mu is over 0.5 keV/nT) oxygen ions into the deep inner magnetosphere during the late main phase of the magnetic storm. Since protons show little change during this period, this oxygen radial transport is inferred to cause the development of the late main phase. Enhancement of poloidal magnetic fluctuations is simultaneously observed. We estimated azimuthal mode number less than 5 by using cross wavelet analysis with ground-based observation of IMAGE ground magnetometers. The fluctuations can resonate with drift and bounce motions of the oxygen ions. The results suggest that combination of the drift and drift-bounce resonances is responsible for the radial transport of high-energy oxygen ions into the deep inner magnetosphere. We also report on the radial transport of the high-energy oxygen ions into the deep inner magnetosphere during other magnetic storms.

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