Nitrogen and oxygen ions from the Earth's ionosphere observed by the Arase satellite

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Various ion species originating from the Earth's upper ionosphere have been observed by the ERG (Exploration of energization and Radiation in Geospace)/Arase satellite. Among them, heavy ions such as O+ are used as markers to monitor ionospheric ion outflow, and their correlation with solar activity and magnetic activity has been investigated. The Arase satellite has successfully observed not only O+ but also molecular ions (N2+, NO+, and O2+). However, there have been a few reports of observations of N+ due to its close mass number to that of O+. In this presentation, we report on the extraction of N+ from the Arase observation data, which has been rarely observed due to its close mass number.
We used the TOF (Time-of-flight) mode data obtained by the MEP-i onboard the Arase satellite. The two types of ions were separated from the TOF spectra at each energy by fitting the TOF profiles of N+ and O+. On the other hand, calibration curves of the TOF profile were also prepared from the data obtained in the pre-launch calibration experiments. This calibration curves were calculated from a comprehensive model calculation by incorporating the TOF dispersion caused by the passage of ultra-thin carbon in the TOF mass spectrometer and the energy resolution of the energy analyzer. It was confirmed that the TOF profiles used in the fitting of the observation data analysis and the calibration curves obtained from the calibration data were in good agreement. From the Arase MEP-i data, the counts necessary for the separation of N+ and O+ were obtained from about 30 minutes of data.
The N+/O+ ratio obtained from the Arase data is expected to provide information on the ionospheric region where the outflow originates and its mechanism. Here we report the details of the N+ extraction method and the results.

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