Cold heavy ion composition in the deep plasmasphere estimated from ion cyclotron whistlers observed by the Van Allen Probes

Shoya Matsuda[1]; Yoshiya Kasahara[1]; Craig A. Kletzing[2]
[1] Kanazawa Univ.; [2] Department of Physics and Astronomy, UoI

Ion cyclotron whistlers are electromagnetic ion cyclotron (EMIC) wave generated by mode conversion from R-mode lightning whistler waves. Their propagation processes strongly depend on the dispersion relationship of EMIC. In our previous study, we statistically studied ion cyclotron whistlers observed by the Akebono satellite around L=2-4. We found that various species of cold ions (e.g. H^+, M/Q=2 ion, He^+, M/Q=8 ion, O^+, and heavier ion than O^+) affect to the generation and propagation processes of ion cyclotron whistlers. We examined spatial distributions of such cold ions by analyzing observed ion cyclotron whistlers.

In this study, we examine a spatial occurrence distribution and characteristic frequency variation of ion cyclotron whistlers observed by the EMFISIS instrument onboard the Van Allen Probe A. The EMFISIS instrument measures waveforms of full components of electric and magnetic fields. We analyzed the waveform data obtained by the EMFISIS-WFR during 16 months, and detected over 3000 H^+ band ion cyclotron whistlers at L inside 2. We found that the normalized crossover frequencies of observed ion cyclotron whistlers are around 0.8 at about 600 km altitude and they decrease with altitude. Under the simple cold plasma approximation, crossover frequency of H^+ band EMIC strongly depends on the local heavy ion composition. This result seems to reflect realistic heavy ion density gradient around the Earth.