Occurrence of EMIC waves and plasmaspheric plasmas derived from THEMIS observations in the outer magnetosphere

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We have statistically studied the relationship between electromagnetic ion cyclotron (EMIC) waves and cold plasmaspheric plasma (N_{sp}) in the L range of 6-12 using the Time History of Events and Macroscale Interactions during Substorms (THEMIS) data for 2008-2011. The important observational results are as follows: (1) Under quiet geomagnetic conditions (Kp = 0-1), the maximum occurrence rate of the hydrogen (H) band EMIC waves appears in the early morning sector (0600-0900 MLT) at the outermost region (L = 10-12). (2) Under moderate and disturbed conditions (Kp > 2), the H-band occurrence rate is higher in the morning-to-early afternoon sector for L > 10. (3) The high occurrence region of helium (He) band waves for Kp = 0-1 varies from L = 7 to 12 in radial distances along the local time (i.e., at L ~ 7 near noon and at L = 8-12 near late afternoon). (4) The He-band waves for Kp > 2 are mainly localized between 1200 and 1800 MLT with a peak around 1500-1600 MLT at L = 8-10. (5) N_{sp} is much higher for the He-band intervals than for the H-band intervals by a factor of 10 or more. The He-band high occurrence appears at a steep N_{sp} gradient region. (6) The morning-afternoon asymmetry of the normalized frequency seen both in H and He bands is similar to the asymmetric distribution of Nsp along the local time. These observations indicate that the cold plasma density plays a significant role in determining the spectral properties of EMIC waves. We discuss whether a morning-afternoon asymmetry of the EMIC wave properties can be explained by the spatial distribution of cold plasmaspheric plasma.

Keywords: EMIC waves, Plasmaspheric plasma

