

Loss of geosynchronous relativistic electrons by EMIC waves during quiet geomagnetic conditions

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We have examined relativistic electron flux losses at geosynchronous orbit under quiet geomagnetic conditions. Two 3-day periods, from 11 to 13 October and from 29 November to 1 December, in 2007 were chosen for analysis because geomagnetic conditions were very quiet (3-day average of Kp < 1) and significant losses of geosynchronous relativistic electrons were observed. During both intervals, there were no geomagnetic storm activities. Thus, the loss processes associated with geomagnetic field modulations caused by ring current buildup can be excluded. The flux of geosynchronous relativistic electrons with energy > 2 MeV shows typical diurnal variations with a maximum near noon and a minimum near midnight for each day. The flux level of the daily variation gradually decreased from first day to third day for each 3-day period. The total magnetic field strength (Bt), however, is relatively constant for each day. Unlike electron flux decreases, the flux of protons with energy between 0.8 and 4 MeV adiabatically responds to the daily variation of Bt. That is, there is no significant decrease of the proton flux when the electron flux decreases. During both 3-day periods, well-defined electromagnetic ion cyclotron (EMIC) waves were detected at geosynchronous spacecraft. Low-altitude polar orbiting spacecraft observed the precipitation of energetic electrons and protons in the interval of EMIC waves enhancement. From these observations, we suggest that the EMIC waves are a major factor to control the electron flux decrease under quiet geomagnetic conditions.

Keywords: Relativistic electron flux, geosynchronous orbit, EMIC waves