Characteristic of Storm-time Pc5 Observed at Ground Stations on Relativistic Electron Enhancement

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Relativistic Electron Enhancement (REE) in the outer radiation belt occasionally damages spacecraft and leads to terrestrial communication outages during magnetic storms. The above phenomenon brings hazards to our life, so we need to clarify the acceleration mechanisms of REE during magnetic storms.

ULF waves are believed to contribute to REE. Previous studies indicate that high solar wind velocity and high long-duration Pc5 power in the storm recovery phase are closely associated with the production of relativistic electrons. However, no one has proven with hard evidence (i.e., observational data) the mechanism of how electrons accelerate to relativistic velocities. Particularly with ground-based observation, the power intensity of Pc5 pulsation associated with REE has been discussed, but where and which type of Pc5 modes has not been clarified. So our research motivation is to clarify how Pc5 modes are associated with relativistic electron enhancement.

In our previous study, we compared: (1) magnetic data from the CPMN (the Circum-pan Pacific Magnetometer Network) and other networks, (2) Electron Flux's data greater than 2MeV at the GOES geosynchronous orbit, and (3) solar wind data of ACE satellite. We found that Electron Flux greater than 2MeV becomes over 10^4 [/cm^2/sec/str] when the amplified Pc5 lasts several tens of hours during the storm recovery phase, regardless of the storm type (CME,CIR). We found that it takes between half-a-day and several days to reach the above threshold value of 10^4 [/cm^2/sec/str]. In addition, long-duration Alfvenic variations are found to be enhanced during the recovery phase.

In this paper, we will describe local-time and latitudinal dependence of storm-time Pc5 associated with REE in detail. At high latitude stations, we can see a local-time dependence, i.e. during dawn-noon time, narrow-band long-duration Pc5 is enhanced, while sporadic Pc5 occurs during dusk-midnight time. On the other hand, at mid-latitude stations global Pc5 is observed in all local-time.

We will discuss which of above Pc5 waves can be related to relativistic electrons enhancement during magnetic storm.