



Earthquake related VLF activity and Electron Precipitation as a Major Agent of the Inner Radiation Belt Losses

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The radiation belt electron precipitation (RBEP) into the topside ionosphere is a phenomenon which is known for several decades. However, the inner radiation belt source and loss mechanisms have not still well understood, including PBEP. Here we present the results of a systematic study of RBEP observations, as obtained from the satellite DEMETER and the series of POES satellites, in comparison with variation of seismic activity. We found that a type of RBEP bursts lasting for $\sim 1-3$ min present special characteristics in the inner region of the inner radiation belt before large ($M > \sim 7$, or even $M > \sim 5$) earthquakes (EQs), as for instance: characteristic (a) flux-time profiles, (b) energy spectrum, (c) electron flux temporal evolution, (d) spatial distributions (e) broad band VLF activity, some days before an EQ and (f) stopping a few hours before the EQ occurrence above the epicenter. In this study we present results from both case and statistical studies which provide significant evidence that, among EQs-lightnings-Earth based transmitters, strong seismic activity during a substorm makes the main contribution to the long lasting ($\sim 1-3$ min) RBEP events at middle latitudes.