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Variability of radiation belt electrons at Earth's magnetosphere

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Abstract

In contrast to Jovian magnetosphere, the solar wind controls Earth's magnetospheric dynamics to a very large extent. Thus measurements of the solar wind upstream of the Earth can be used to predict the characteristic variations of the magnetosphere. We have developed models to predict the variations of daily averaged radiation belt electron fluxes and the Dst index, a major geomagnetic storm index, based on available solar wind measurements, demonstrating that the magnetosphere indeed has an organized way to respond solar wind variations. Based on the rather regular variations of Earth's radiation belt electrons, we have also developed a model to predict the MeV electrons at geosynchronous orbit without solar wind input. The model is based on the strong correlation between the behaviour of low-energy (tens to hundreds of keV) and high-energy (>1 MeV) electron fluxes measured at geosynchronous orbit. The time delay between similar features in low- and high-energy electron fluxes makes it possible to forecast the high-energy electron flux days in advance, based on the current and previous days' fluxes of low- and high-energy electrons.

Similarly, relativistic electrons trapped in both Earth's magnetosphere and Jovian magnetosphere, albeit much more ultra-relativistic electrons in the latter. It will be interesting to compare the known fundamental acceleration mechanisms.