Study on the Geosynchronous Relativistic Electron Events

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Relativistic electron fluxes in the outer radiation belt are highly dynamic, sometimes exhibiting events of the long-duration of high electron intensities. In this paper, we examine the characteristic solar wind dynamics and magnetospheric conditions associated with such relativistic electron event at the geosynchronous orbit. Statistical analysis of a number of solar wind and magnetospheric parameters shows that the occurrence of an event is accompanied by the prolonged solar quiet periods and thereby stable and more dipole-like magnetospheric configurations. For a typical relativistic event, the electron flux abruptly increases by orders of magnitude when the solar wind parameters drop to the low values (e.g., n_{sw} ~5 cm^{-3}, $|B_{IMF}|$ ~5 nT) after their sharp peaks. The elevated electron flux then stays at the high level during the prolonged solar quiet period. The occurrence of a geosynchronous relativistic event could be a matter of the balance between the effects of electron acceleration and loss. In addition, due to the strong dependence of the events on solar wind conditions, predicting the solar wind variations would be as important as understanding the electron acceleration mechanism(s) in the forecast of a relativistic event.