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Recent observations of dropouts of the electron radiation belt and their implications

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Predicting losses or enhancements of relativistic electron fluxes during storm time has proven difficult, with only ~50% of Dst storms showing a net increase in fluxes and about 20% showing a net decrease. Under high-speed stream driving the predictability of net flux increases is enhanced by the Russell-McPherron effect but substantial variability is still observed. High-speed solar wind streams, which have their origins in the out?ow from coronal holes, form a large-scale repeatable driver for Earth's magnetosphere and the parts of geospace coupled to it. Up to 13 on-orbit dosimeters in the GPS constellation can be used to monitor the global state and evolution of the electron radiation belt at unprecedented temporal and spatial resolution. Recent observations using the GPS constellation have shown that dropouts extending to $L*$~4 are a consistent response to high-speed streams, irrespective of whether the stream drives a geomagnetic storm. Case studies have shown that these dropouts can occur on time scales of less than 3 hrs and recovery to pre-event count levels can take in excess of two weeks. Combining these observations with the modeling framework provided by the Dynamic Radiation Environment Assimilation Model (DREAM) gives additional capabilities to understand the variability of the radiation belt and the dominant processes. In particular, we focus on results of a statistical study of a set of prolonged electron dropouts observed with GPS, combined with insight from detailed case studies and modeling. What we have learned, and how we can extend this work, will be discussed.

Keywords: radiation belt, magnetosphere, space weather