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Dynamic Responses of the Earth's Radiation Belts during Periods of Solar Wind Dynamic Pressure Pulse Based on Normalized Superposed Epoch Analysis

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Radiation belt electron flux dropouts are a kind of drastic variation in the Earth's magnetosphere, understanding of which is of both scientific and societal importance. This study involves processing and analyzing the electron data obtained from five satellites (including GOES-15 and POES 15, 16, 18, and 19) to investigate the flux variation of radiation belt during solar wind dynamic pressure pulses. During the period from September 2012 to December 2014, we have carefully identified forty solar wind dynamic pressure events. By utilizing the mean duration of the pressure pulses as the epoch timeline and stretching or compressing the time phases of individual events to it upon linear interpolation, we have performed normalized superposed epoch analysis to evaluate the dynamic responses of Earth's radiation belts during periods of solar wind dynamic pressure pulse. The pressure pulse events are further selected to set up five group sets for quantitative comparisons, using the following criteria: (1) 10 events with largest northward IMF Bz vs. 10 events with largest southward IMF Bz; (2) 10 events with highest magnetopause position vs. 10 events with lowest magnetopause position; (3) 10 events with largest Dst index vs. 10 events with smallest Dst index; (4) 10 events with largest electron flux drop vs. 10 events with smallest electron flux drop; (5) 10 events with longest Pdyn rise time vs. 10 events with shortest Pdyn rise time. Our results indicate that the adopted timeline normalization can result in reasonable reproduction of the average features of radiation belt electron dynamics under the impact of solar wind dynamic pressure pulses, for which the new insights into the relative roles of various solar wind / magnetospheric parameters are discussed.