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Storm-time response of the Van Allen radiation belts organized by the large-scale solar wind drivers, energy and distance

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We study the response of the Van Allen radiation belts during geomagnetic storms. A combination of the long-term geosynchronous observations from GOES (> 2.5 MeV) and energy (tens of keV to 2 MeV) and L-shell (2.5 < L < 6.0) resolved Van Allen Probe observations are used. We demonstrate that the radiation belt response (depletion, no-change, increase) is organized by the large-scale solar wind driver (coronal mass ejection ejecta/sheath, slow-fast stream interface region, fast stream) and that the response is highly dependent on both the electron energy and the L-shell.

In addition, we show detailed Van Allen Probe observations from two geomagnetic storms that occurred during two consecutive Carrington rotations of the solar maximum year 2015. Both of these storms involved a slow-fast stream interaction region and a fast stream originating from the same coronal hole. However, the first storm also included a large-scale coronal mass ejection. We study in particular how the added presence of this coronal mass ejection affected the dynamics of the radiation belts.