Modelling the Rebuilding the Radiation Belt Following a Drop-out Event from Acceleration of the Seed Population

Hayley Allison¹, Yuri Shprits¹,²,³, Sarah Glauert⁴, Richard Horne⁴, and Dedong Wang¹

¹GFZ, Potsdam, Germany (haylis@gfz-potsdam.de)
²Institute of Physics and Astronomy, University of Potsdam, Potsdam, Germany
³Department of Earth, Planetary, and Space Sciences, University of California, Los Angeles, CA, USA
⁴British Antarctic Survey, Cambridge, UK

The Earth's electron radiation belts are a dynamic environment and can change dramatically on short timescales. From Van Allen Probes observations, we see storm time drop-out events followed by a rapid recovery of the electron flux over a broad range of energies. Substorms can supply a seed population of new electrons to the radiation belt region, which are then energised by a number of processes, rebuilding the belts. However, how the electron flux is replenished across energy space, and the sequence of events leading to flux enhancements, remains an open question. Here we use a 3-D radiation belt model to explore how the seed population is accelerated to 1 MeV on realistic timescales, comparing the output to Van Allen Probes observations. By using a low energy boundary condition derived by POES data we encompass the whole radiation belt region, employing an open outer boundary condition. This approach isolates the contribution of seed population changes and allows electron flux variations over a broad range of L* to be studied. Using the model, we explore the contribution of both local acceleration and radial diffusion and demonstrate that the timing and duration of these two processes, particularly in relation to one another, is important to determine how the radiation belt rebuilds.