The model of outer radiation belt electron lifetimes based on combined Van Allen Probes and Cluster VLF wave measurements

Homayon Aryan$^{1,3}$, Oleksiy Agapitov$^2$, Anton Artemyev$^3$, Michael Balikhin$^1$, Didier Mourenas$^4$, and Richard Boynton$^1$

$^1$University of Sheffield, ACSE, Silver Spring, United Kingdom of Great Britain and Northern Ireland (aryan.homayon@gmail.com)
$^2$Space Sciences Laboratory, University of California Berkeley Berkeley, CA, United States.
$^3$University of California Los Angeles, Earth, Planetary, and Space Sciences, CA, United States.
$^4$CEA/DAM-ILE DE FRANCE, Arpajon, Bruyères-le-ChâTEL, France.

The flux of highly energetic electrons in the outer radiation belt show a high variability during geomagnetically disturbed conditions. Wave-particle interaction with VLF chorus waves play a significant role in the flux variation of these particles, and quantification of the effects from these interactions is crucially important for accurately modeling the global dynamics of the outer radiation belt and for providing a comprehensive description of electron flux variations over a wide energy range (from the source population of keV electrons to the relativistic core population of the outer radiation belt). In this study, we use the synthetic model based on the combined database from the Van Allen Probes and Cluster spacecraft VLF measurements (including the recent findings of wave amplitude dependence on geomagnetic latitude, wave normal angle distribution, and variations of wave frequency with latitude) to develop a comprehensive parametric model of electron lifetime in the outer radiation belt as a function of geomagnetic activity, L-shell, and magnetic local time. Results show high local scattering rates during moderate and active conditions, local scattering is higher on the dawn and night side compared to day side, and electron lifetime is short during active conditions.