Association of chorus waves and source/seed electrons with the enhancement of relativistic electrons in the outer Van Allen belt

Afroditi Nasi\textsuperscript{1}, Ioannis A. Daglis\textsuperscript{1}, Christos Katsavrias\textsuperscript{1}, and Wen Li\textsuperscript{2}

\textsuperscript{1}Department of Physics, National and Kapodistrian University of Athens, Athens, Greece
\textsuperscript{2}Center for Space Physics, Boston University, Boston, USA

Local acceleration driven by whistler-mode chorus waves is fundamentally important for the acceleration of seed electrons in the outer radiation belt to relativistic energies. This mechanism strongly depends on substorm activity and on the source electron population injected by the substorms into the inner magnetosphere. In our work we use Van Allen Probes data to investigate the features of source electrons, seed electrons and chorus waves for events of enhancement versus events of depletion of relativistic electrons in the outer Van Allen belt. To that end we calculate the electron phase space density (PSD) for five values of the first adiabatic invariant corresponding to source and seed electrons, and we perform a superposed epoch analysis of 28 geomagnetic disturbance events, out of which, 20 result in enhancement and 8 in depletion of relativistic electron PSD. Our results indicate that events resulting in significant enhancement of relativistic electron PSD in the outer radiation belt are characterized by statistically stronger and more prolonged storm and substorm activity, leading to more efficient injections of source but mostly seed electrons to the inner magnetosphere, and also to more pronounced and long-lasting chorus and Pc5 wave activity. The effect of these parameters in the acceleration of electrons seems to be determined by the abundance of seed electrons at the region of $L^* = 4-5$.