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Dynamics of Relativistic Electrons in the Earth's Slot Region During Geomagnetically Quiet Times: Losses due to Various Wave-Particle Interactions Versus Source from Cosmic Ray Albedo Neutron Decay(CRAND)

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Relativistic electrons near the inner edge of the inner radiation belt were measured and identified by the Colorado Student Space Weather Experiment (CSSWE) CubeSat as CRAND-produced. More recently energy spectrum investigations and numerical simulations also suggest that CRAND is a main source of >300 keV quasi-trapped electrons at L<2 and L≈3. To quantify the relative contribution of different sources and losses, the relativistic electron flux evolution in Earth's slot region (2<L<3.3) during an extended quiet time period was simulated based on a 2-D Fokker-Planck diffusion equation and compared with observations from the Van Allen Probes. The Full Diffusion Code is implemented to evaluate quasi-linear bounce-averaged diffusion coefficients by various waves: plasmaspheric hiss, lightning generated whistler mode, and man-made VLF emissions, and elastic collisions with atmospheric neutrals (based on NRLMSISE-00 model and IRI 2012 ionospheric model). The wave parameters and ambient plasma properties were determined based on measurements from the Van Allen Probes. The electron source rate due to CRAND with pitch angle distribution is based on recently renewed understanding of the CRAND contribution [Xiang et al., 2019]. The simulation results including a single and/or combination of various loss mechanisms reveal the relative contribution of different waves in the slot region. Comparison between simulation results and measurements from the Van Allen Probes suggest that during geomagnetically quiet times the contribution of CRAND has a significant impact on the balance of >300keV trapped electron flux in the slot region.

[Xiang et al., 2019] Xiang Z., X. Li, et al. (2019), Modeling the quasi-trapped electron fluxes from Cosmic Ray Albedo Neutron Decay (CRAND), GRL, under review.