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A new diffusion model for plasmaspheric hiss and lightning-generated whistlers and its effect on radiation belt dynamics

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The flux of relativistic electrons in the Earth's radiation belts is highly variable and can change by orders of magnitude on timescales of a few hours. Understanding the drivers for these changes is important as energetic electrons can damage satellites. Several models of the high-energy electron population now exist where the electron phase-space density is modelled using a 3-D Fokker-Planck equation incorporating the effects of radial transport, wave-particle interactions and collisions. Wave-particle interactions are incorporated into the models as pitch-angle and energy diffusion coefficients. Here we present results from the BAS radiation belt model, using new diffusion coefficients for plasmaspheric hiss and lightning-generated whistlers which are calculated using a representation of the wave power that decreases as the resonance cone is approached. The new diffusion coefficients are derived using the BAS wave database and are functions of L shell, energy, pitch-angle and geo-magnetic activity. Several wave-normal angle models are considered including one where the peak wave-normal angle varies with latitude. Our results show that radiation belt dynamics are reproduced better when the AE index, rather than Kp, is used to drive the wave-particle interactions and that the model best reproduces the observed data when the wave-normal angle distribution has a peak that varies with latitude and a wide angular spread. We show a comparison between the model and CRRES data for selected events.