Global models of the inner electron radiation belt and slot region investigating the effects of VLF transmitter waves

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Signals from man-made very low frequency (VLF) transmitters can leak from the Earth-ionosphere wave guide into the inner magnetosphere, where they propagate in the whistler mode and contribute to electron dynamics in the inner radiation belt and slot region through wave-particle interactions. These inner regions of the magnetosphere are becoming increasingly important from a satellite perspective. For instance, the newly populated Medium Earth Orbits pass though the slot region, and satellites launched via electric orbit raising are exposed to the inner belt and slot region for extended periods of time.

We have calculated diffusion coefficients associated with wave-particle interactions between radiation belt electrons and waves from each of the strongest VLF transmitters using Van Allen Probe observations. These coefficients are included into global models of the radiation belts to assess the importance of the effects of VLF transmitters individually and collectively on electron populations.