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Losses in the radiation belts caused by EMIC waves

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Electromagnetic Ion Cyclotron (EMIC) waves are electromagnetic waves at frequencies below the local proton cyclotron frequency. EMIC waves can cause electron loss in the radiation belts, if their frequency is Doppler shifted to the electron cyclotron frequency by the relative motion of the waves and electrons along the field line. This enables the EMIC waves to resonate with high energy electrons at energies greater than about 500keV and thereby causing losses due to pitch angle scattering into the loss cone. To determine how effective EMIC waves are in causing losses, we calculate bounce averaged pitch angle diffusion rates for a nominal model based on our analysis of data from the fluxgate magnetometer on the CRRES satellite, which sampled EMIC waves in the equatorial region from about L=4.0 up to about L=7.0 for latitudes up to 30°. The diffusion rates are calculated for 5 levels of kp between 12-18MLT. We find that EMIC waves can diffuse electrons into the loss cone very effectively at energies greater than about 2MeV for pitch angles up to about 60°. To determine the overall effect of the waves on the particles we include the diffusion rates due to EMIC waves in the BAS radiation belt model together with lower and upper band chorus waves. Using the model we show that EMIC waves cause a significant reduction in the electron flux for high energies for a range of L-shells from L=4.0 – 9.0 but only for pitch angles lower than 60°.