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Survey of upper band chorus and ECH waves: Implications for the diffuse aurora

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The origin of the diffuse aurora has been a source of controversy for many years. More recently the question has taken a new significance in view of the associated changes in atmospheric chemistry which may affect the middle atmosphere. Here we use CRRES data to assess the importance of upper band chorus and electron cyclotron harmonic (ECH) waves in the production of the diffuse aurora. Both wave modes increase with increasing geomagnetic activity, suggesting they are related to periods of enhanced convection and/or substorm activity. They are confined to the near-equatorial region which excludes the pre-noon sector from the wave survey. During active conditions intense ECH waves and upper band chorus, with amplitudes exceeding 1 mVm^{-1}, are observed in the region $4 < L < 7$ from 2100 to 0600 MLT approximately 20% and 6% of the time respectively. This suggests that both wave modes can put electrons on strong diffusion, but only during active conditions and not at all local times. Scattering rates fall below the strong diffusion limit at other times when the wave amplitudes are weaker. Fluxes of low energy electrons (100 eV $< E <$ 30 keV) also increase with increasing geomagnetic activity in approximately the same region of geospace as the waves, suggesting that these electrons are responsible for the generation of the waves. The patterns of the upper band chorus, ECH waves and low energy electrons are similar to the global morphology of the diffuse aurora, suggesting that both wave modes play significant roles in the production of the diffuse aurora.