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Electron Diffusion by Magnetosonic Waves in the Earth's Radiation Belts

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1 Extended Abstract

We conduct a global survey of magnetosonic waves and compute the associated bounce and drift averaged diffusion coefficients, taking into account local plasma conditions in the form of co-located measurements of f_{pe}/f_{ce}, to assess the role of magnetosonic waves in radiation belt dynamics. The average magnetosonic wave intensities increase with increasing geomagnetic activity and decreasing relative frequency with the majority of the wave power in the range $f_{cp} < f < 0.3 f_{LHR}$ during active conditions. In the region $4.0 \leq L^* \leq 5.0$, the bounce and drift averaged energy diffusion rates due to magnetosonic waves never exceed those due to whistler mode chorus, suggesting that whistler mode chorus is the dominant mode for electron energisation to relativistic energies in this region. Further in, in the region $2.0 \leq L^* \leq 3.5$, the bounce and drift averaged pitch angle diffusion rates due to magnetosonic waves can exceed those due to plasmaspheric hiss and very low frequency (VLF) transmitters over energy-dependent ranges of intermediate pitch angles. We compute electron lifetimes by solving the 1D pitch angle diffusion equation including the effects of plasmaspheric hiss, lightning generated whistlers, VLF transmitters and magnetosonic waves. We find that magnetosonic waves can have a significant effect on electron loss timescales in the slot region reducing the loss timescales during active times from 5.6 days to 1.5 days for 500 keV electrons at $L^* = 2.5$ and from 140.4 days to 35.7 days for 1 MeV electrons at $L^* = 2.0$, bringing the modelled values into closer agreement with empirical values.