Systematic Measurements of Whistler-Mode Waves in the Outer Radiation Belt by Van Allen Probes

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One of the important physical processes in the domain of space weather investigations concerns the wave-particle interactions in the Earth's Van Allen radiation belts. These interactions play a key role in the physics of the outer electron radiation belt, leading to local acceleration of energetic electrons but also to their precipitation. These processes can strongly affect the operation and security of space assets.

The role of whistler-mode chorus waves in the dynamics of radiation belts has been demonstrated for both losses and local acceleration of relativistic electrons. These waves can cause pitch-angle or energy diffusion of electron populations at different energies. Wave propagation directions are a crucial parameter of the underlying microphysics of wave-particle interactions.

We use new measurements of whistler-mode waves by the Electric and Magnetic Field Instrument Suite and Integrated Science (EMFISIS) onboard the Van Allen Probes spacecraft. More than two years of multicomponent data which were recorded and processed by this instrument allow us to systematically estimate the wave propagation parameters. The results show that the waves most often propagate with wave vectors at small angles with respect to the terrestrial magnetic field.