Statistical properties of wave vector directions of whistler-mode waves in the radiation belts based on measurements of the Van Allen probes and Cluster missions

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Abstract

Wave-particle interactions in the Earth's Van Allen radiation belts are known to be an efficient process of the exchange of energy between different particle populations, including the energetic radiation belt particles. The whistler mode waves, especially chorus, can control the radiation belt dynamics via linear or nonlinear interactions with both the energetic radiation belt electrons and lower energy electron populations. Wave vector directions are a very important parameter of these wave-particle interactions. We use measurements of whistler-mode waves by the WAVES instrument from the Electric and Magnetic Field Instrument Suite and Integrated Science (EMFISIS) onboard the Van Allen Probes spacecraft covering the equatorial region of the Earth's magnetosphere in all MLT sectors, and a large database of measurements of the STAFF-SA instrument onboard the Cluster spacecraft, covering different latitudes for a time interval of more than one solar cycle. Multicomponent measurements of these instruments are a basis for the determination of statistical properties of the wave vector directions defined by two spherical angles with respect to the direction of the local magnetic field line. We calculate the probability density functions and probability density functions weighted by the wave intensity for both these angles. This work receives EU support through the FP7-Space grant agreement no 284520 for the MAARBLE collaborative research project.

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