WHISTLER-MODE WAVES DETECTED BY THE VAN ALLEN PROBES SATELLITES INSIDE DENSITY DUCTS IN THE MAGNETOSPHERE

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Dynamics of the very-low frequency (VLF) whistler-mode waves (whistlers) in the earth's magnetosphere belong to the class of the most important and interesting problems of modern geophysics. One particularly important property of the whistler-mode waves is their interactions with relativistic, "killer" electrons populating the earth's radiation belts. The resonant interactions between these electrons and VLF waves can change particle's pitch angle and precipitate them out of the magnetosphere making the radiation environment there safer for satellites and humans. Because the problem of remediating of energetic particles from the radiation belt has received significant attention from governmental and scientific communities in many countries, many new studies, including very complex and expensive space- and ground-based experiments, have been proposed.

The success of these experiments strongly depends on comprehensive, detailed numerical models describing in quantitative details dynamics of whistler-mode waves in the inhomogeneous, strongly magnetized plasma. Recently we developed 2D, time-dependent numerical algorithm to model these phenomena and used it to make significant progress in understanding the spatiotemporal properties of whistler-mode waves in the magnetosphere.

In this paper we present results from our modeling efforts reproducing spatiotemporal properties of whistler-mode waves detected by Van Allen Probes satellites in the density ducts formed by the extended along the ambient magnetic field enhancements of the plasma density (so-called, high-density ducts or HDD). The particular interest in this phenomena came from the fact that according to the classical, linear ducting theory, whistlers are supposed to leak from such ducts, except some very special cases. Our simulations allow us to identify parameters of these waves and provide a solid quantitative explanation of the observed behavior of these waves.