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Swarm observations of High-Amplitude Pc1 Waves During Intense Geomagnetic Storms: Towards Use of Swarm for Radiation Belt Science

In recent years an active debate has developed within the radiation belt community on the role of electromagnetic ion cyclotron (EMIC) waves in radiation belt dynamics. High-profile radiation belt studies may invoke EMIC wave scattering without being able to observe the instability in situ. There is now an increased understanding that EMIC waves may be intense but spatially and temporally localized, and traditional observation platforms for this wave type, e.g. Van Allen probes, Cluster and MMS, cross L-shells relatively slowly and may miss the instability. The Swarm mission, in polar 90-minute period LEO, scans the entire L-shell range far more rapidly, making it more likely to observe these transient phenomena. It can thus provide the key to solve the puzzle of the role of EMIC waves in radiation belt dynamics, assuming that spatio-temporal ambiguity is resolved, allowing the observations to be taken near the auroral zone which contains both waves and field-aligned currents. With the use of the unprecedented 16 Hz dataset delivered by the Canadian Electric Field Instrument in the form of the Thermal Ion Imager, as well as magnetic field data and ground conjunctions, and using the methodologies refined by this team in the past several years in published works, we are now able to address this spatio-temporal ambiguity and present new results demonstrating the presence of high-amplitude Pc1 waves in conjunction with intense geomagnetic storms. The results show that Swarm can play a key role in addressing the unknowns in this active research area.

radiation belts, swarm, EMIC waves