Conjugate observation of EMIC waves by Arase and RBSP with associated POES and AARDDVARK detected electron precipitation

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We present a remarkable case study of strong EMIC wave emissions observed simultaneously by instruments on board the ARASE and RBSP-B satellites, as well as by ground-based observatories, during a period of significant geomagnetic activity. These waves coincided with strong substorm activity (AE>1000 nT) during a southward IMF Bz shift, corresponding to the initial phase of an intense geomagnetic storm (peak Dst < -170 nT). At the time of this observation, the ARASE and RBSP-B satellites were co-located in L and MLT, showing simultaneous observation of the same wave emission, but were significantly separated in magnetic latitude. This separation allows us to examine the evolution of the wave parameters as the wave propagates down the field-line to the Earth.

During this period of wave activity, we also see evidence of energetic electron precipitation into the ionosphere. At the time of the RBSP and ARASE observations, the POES METOP-02 satellite passed through the footprint of the source region and observed bursts of energetic ion and electron precipitation into the ionosphere, matching known signatures of EMIC-driven particle precipitation. This precipitation was then in turn observed from the ground as AARDDVARK-detected sub-ionospheric VLF perturbations. Through analysis of these ground-based observations, we are able to estimate the extent of the EMIC source region.

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