Geophysical Research Abstracts
Vol. 21, EGU2019-2943, 2019
EGU General Assembly 2019

Quantifying the impact of 'missing' hiss wave properties on diffusive models of radiation belt dynamics

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Observations from the Van Allen Probes mission have revealed that the properties of whistler-mode hiss in the inner magnetosphere are significantly more diverse than previously understood.

While different types of whistler mode hiss have been documented (including low frequency hiss, exohiss, lightning generated hiss, plasmaspheric plume hiss, and plasmaspheric hiss), the relative impact of each hiss type for radiation belt dynamics is not well understood. With Van Allen Probes' data, detailed statistical studies of each hiss type are now possible, and they reveal that each hiss type has unique distributions in wave amplitude, frequency, and in location (magnetic local time, distance from Earth, organization by plasmapause location).

Most predictive models of inner magnetospheric dynamics use only one hiss type or lump all types together. With these approaches, the diversity of hiss wave properties is missed, and therefore the full range of wave-particle interactions between hiss and radiation belt particles is not being explicitly included in these models.

The goal of this study is to quantify the impact of each hiss type on inner magnetospheric dynamics. In this on-going study, we will (1) build statistical models for each hiss type, (2) calculate diffusion coefficients for each hiss type, and (3) implement these diffusion coefficients within the Versatile Electron Radiation Belt (VERB) code and perform modeling. Each hiss type will be included one by one, then all together, comparing each time with more traditional hiss wave models. In this way, this study will quantify the impact of 'missing' hiss wave properties on diffusive models of radiation belt dynamics.