

Contribution ID: **82** Type: **Poster**

The Role of Hiss Waves in Electron Precipitation over the South Atlantic Magnetic Anomaly

Monday, August 17, 2026 11:00 AM (10 minutes)

Energetic electron precipitation over the South Atlantic Magnetic Anomaly (SAMA) is strongly influenced by wave–particle interactions occurring in the inner magnetosphere, especially during disturbed geomagnetic conditions. These precipitation processes can modify the ionization of the upper atmosphere and affect atmospheric chemistry. In this work, a case study of the geomagnetic storm on 22 June 2015, associated with the arrival of an interplanetary coronal mass ejection (ICME), is presented to investigate the role of hiss waves in driving electron precipitation over the Brazilian sector. Measurements from the Van Allen Probes are used to examine wave activity and energetic electron dynamics in the inner radiation belt, while particle precipitation signatures are identified using observations from the Proba-V satellite during its passages across the SAMA region. The analysis focuses on electrons in the energy range of 500–600 keV. Results indicate enhanced precipitation during the storm main phase, accompanied by a significant expansion of the precipitation region to latitudes outside the typical SAMA boundaries. Enhanced plasmaspheric wave activity, particularly magnetospheric hiss and magnetosonic emissions, is observed simultaneously with the precipitation signatures. Preliminary analysis suggests that hiss waves play a major role in pitch-angle scattering of inner radiation belt electrons, contributing to the observed precipitation patterns. Ongoing investigations include resonance analyses between waves and particles, as well as the identification of the magnetospheric conditions favorable for hiss wave generation during ICME-driven storms.

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Session Classification: Poster Session

Track Classification: Machine Learning and AI: Heliophysics & Space Weather