Loss of radiation belt electrons by precipitation into the ionosphere

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Since the discovery of the belts more than four decades ago, it has proved difficult to confirm the principal source and loss mechanisms that control radiation belt particles due to the complex processes taking place. Above L~1.5 losses of energetic electrons from the radiation belt driven by whistler mode waves appear to be very important. This is particularly true for the highly disturbed conditions associated with geomagnetic storms, during which there can be rapid decreases and increases in the trapped population of energetic electrons.

In this study we focus on ground-based observations of energetic precipitation into the lower ionosphere. Energetic precipitation leads to localized ionospheric modifications produced by secondary ionisation just below the D-region of the ionosphere. This can be detected at long range through variations in fixed frequency very low frequency (VLF) transmissions from powerful communication transmitters.

The interpretation of wave amplitude and phase variations can lead to an understanding of the flux and energy spectrum of the electron precipitation, thus allowing estimates to be made of radiation belt losses and the energy deposition into the ionosphere.