

STRUCTURED ELECTRON PRECIPITATION ASSOCIATED WITH MAGNETIC IMPULSE EVENTS

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Large scale impulsive transients in the geomagnetic field termed Magnetic Impulse Events (MIEs) are a common feature of the polar ionosphere. The importance of these transient polar phenomena lies in their likely role as markers of an interaction between the Earth's magnetosphere and the IMF and/or solar wind. In an effort to understand the formation mechanism of MIEs, we have studied their associated electron precipitation signature. The SHIRE imaging riometer (Davis, Antarctica - 74.48° ILAT) was used to investigate the time-varying morphology of the precipitation, which was then related to the large-scale current structures resolved by a network of high-latitude magnetometers.

Five MIEs are presented in detail. Each had the characteristics of a Travelling Convection Vortex (TCV). In four of the events, the precipitation region showed an elongated arc-like structure, with an apparent antisunward and poleward motion. The poleward motion was interpreted in terms of the azimuthal propagation of a tilted arc-like structure. The tilt of the elongated precipitation region closely matched that of the multiple vortices, and the azimuthal velocities of the precipitation and convection vortices were consistent, suggesting the precipitation source tracked the motion of the vortical flow generator in the magnetosphere for these events.

In general, the precipitation was poorly correlated with the upward field-aligned current (FAC) cell of the TCV. Instead, the absorption arc occurred consistently before the upward FAC, and appeared better correlated in time with the region of strong plasma flow between the two convection vortices. This may indicate a highly distorted Hall current loop, or an electron acceleration mechanism more closely associated with the edge of the upward FAC cell.

This work contributes to the understanding of the formation mechanism of large impulsive transients in the polar ionosphere through identification of the source location and structure of the associated energetic electron precipitation.