The Response of the HF Radar Spectral Width Boundary to a Switch in the IMF By Direction: Ionospheric Consequences of Transient Dayside Reconnection?

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Abstract

In the high-latitude dayside ionosphere, the movement of the HF radar spectral width boundary (SWB) provides a good proxy for the movement of the open-closed field line boundary around magnetic local noon. By studying the dynamics of the spectral width boundary we can investigate features of the dayside ionospheric response to changes in the Interplanetary Magnetic Field (IMF). The high temporal and spatial resolution of the SuperDARN HF radars make them good tools to study these features. In this paper, we use the Halley HF radar in Antarctica to study the equatorward motion of the SWB which appears to occur in response to a large change in the direction of IMF By. The spectral width boundary initially moves equatorward in the form of a U-shaped bulge close to magnetic local noon. This bulge then expands longitudinally to earlier and later magnetic local times. Merged velocity vectors from two Antarctic HF radars describe the flow velocity variation in the boundary region. The flow equatorward of the boundary follows the contours of the boundary as it expands. The flow poleward of the boundary is directed at more oblique angles to the boundary. This study represents the first clear two-dimensional observation of the formation of an equatorward bulge on the polar cap boundary which may be associated with changes in dayside reconnection and also presents a unique observation of the variation of the ionospheric flow in the locality of the boundary. We discuss the possible interpretations of this event and the possible consequences to our present understanding of the ionospheric response to changes in the IMF.

Paper Details

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