Does the Dayside Equatorial Ionosphere Respond to Substorm Events?

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Magnetospheric substorms are an important element of the interaction between solar wind and magnetosphere during disturbed periods. It has repeatedly been suggested that the prompt penetration effect of a substorm sets up an ionospheric eastward electric field (EEF) on the dayside. Here we want to test this hypothesis based on a large database. Using the well defined substorm onsets from the substorm catalog (Frey and Mende, 2007) as observed by the IMAGE satellite and the equatorial EEF derived from the JULIA radar during 2000-2005, we estimated the average response of EEF by means of a superposed epoch analysis to substorm onsets. We find a significant peak in the average EEF curve, but that precedes the substorm onset by 10 min. However, the average magnetic response outside of the equatorial belt shows variations only after the substorm onset. When we restrict the substrom events to only cases when the IMF Bz was flat, the typical day-side signature of EEF disappears. These results suggest that the substorm related dayside signature in EEF is a result of prompt penetration from solar wind variations triggering the onset. Using a transfer function approach (Manoj et al., 2008), we also investigate whether we can separate the effect of the solar wind from substorm-related variations caused by penetrating electric fields in the dayside EEF records.

References

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