

Ionospheric signature of flow bursts in the magnetotail: Geotail-SuperDARN conjunction study

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Ionospheric convection signatures associated with flow bursts in the magnetotail are examined statistically on the basis of the simultaneous observations made by the Geotail spacecraft and the SuperDARN radars covering the footprint of Geotail. Our statistical study shows that most of the flow bursts in the magnetotail, which have been recognized as bursty bulk flows (BBFs), are accompanied by ionospheric flow enhancements as a counterpart. Both the spatial and temporal correspondence between them suggests that BBFs take place as a M-I coupled process. While the ionospheric convection often shows an overall enhancement of the nightside part of the dawn or dusk convection cell, the most significant enhancement tends to occur at or near the foot point of the corresponding BBFs, causing a drastic change in convection flow pattern around the BBF footprint. Some theoretical works suggested that BBFs may induce an equatorward flow channel sandwiched by a pair of small vortex-like convection cells at the ionospheric foot point. In regard to that, some past studies showed that a vortex-like flow or, more generally, a flow shear having a local maximum in vorticity is actually seen at the conjugate point of BBFs. However, the present observation shows that the enhanced ionospheric flow channels associated with BBFs are sometimes accompanied by a vortex/shear-like flow and sometimes not. Our statistics reveal that those with and without the vortex/shear-like flow are found with roughly the same probability. A detailed examination of the simultaneously observed auroral signatures shows that both types of the ionospheric flow enhancement can emerge regardless of whether the BBFs are associated with substorm activity or not. How a flow burst in the magnetotail can have those different counterparts on the ionospheric side will be discussed by considering the spatial characteristics of the flow bursts as well as the ionospheric condition.