AGU: Geophysical Research Letters

Keywords

F layer

HSS

ionosphere

Index Terms

Space Weather: Ionospheric storms

Solar Physics, Astrophysics, and Astronomy: Solar activity cycle

Interplanetary Physics: Corotating streams

Ionosphere: Ionosphere/magnetosphere interactions

Abstract

Modification of midlatitude ionospheric parameters in the F2 layer by persistent high-speed solar wind streams

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High-speed solar wind streams (HSSs) are periods of persistently high solar wind, which emanate from coronal holes and may recur with a frequency related to the solar rotation period of 27 days. On arrival at the Earth's magnetopause, such streams cause a series of events which ultimately lead to changes in the ionospheric F layer. We present a superposed epoch analysis of parameters in the midlatitude F2 layer for a collection of 124 high-speed solar wind streams which occurred between 1993 and 2006. Clear changes in the critical frequency (foF2), density (NmF2), and height (hmF2) are found to occur after the onset of magnetospheric convection associated with HSS arrival at the Earth's magnetosphere. A fall in foF2 occurs immediately following convection onset accompanied by a sudden decrease in NmF2 and an increase in hmF2. During the events under study, the height of the F2 layer is found to increase by ~20 km at convection onset. A period of more than 4 days is required for the ionosphere to return to preevent levels. This behavior is explained as the occurrence of ionospheric F region storms following HSS arrival. The results raise the possibility of improved predictions for ionospheric parameters on the basis of upstream solar wind conditions and prior identification of stream interfaces.

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