Variation of the Electron Density in the High-Latitude Topside Ionosphere During Large Magnetic Storms

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We investigate the response of the high-latitude topside ionosphere to large geomagnetic storms. For our study we employ electron-density profiles, derived from the Alouette and ISIS topside sounder satellites, available from \url{http://nssdc.gsfc.nasa.gov/space/isis/isis-status.html} which also describes a recent data restoration project that will enable this work to be expanded [1,2]. The focus is on the 20-yr interval from 1965 to 1985 when both solar-wind and Alouette/ISIS topside-sounder data are potentially available. Several case studies were investigated and some showed significant Ne enhancements in the high-latitude topside ionosphere. One of these cases is shown in detail in Figure 1.

![Fig. 1 (a) Dst index for the large magnetic storm on day 31 to 37 of 1969, (b) enhanced Ne profiles observed during the large magnetic storm (maximum Dst $\approx$ -190 nT during group 2) that persisted for at least two days (groups 3 & 4). The average Ne profiles prior to the magnetic storm are show in group 1. One Ne profile available after the magnetic storm is shown in group 5.](image-url)

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Figure 1a shows the Dst index for the storm event and Figure 1b shows the ionospheric response to the storm during different phases of the storm event (groups 1 to 5). Solar-wind data are available for this storm (but not shown here).

Our systematic work also includes an investigation of the impact of the magnetic-field model on the topside-ionogram inversion procedure to produce Ne(h) profiles and an investigation of additional events by:
- including a search of 35-mm film ionograms during selected intervals
- expanding the Alouette-2 and ISIS-1 & ISIS-2 topside digital ionogram database
- employing modern analysis methods on these digital ionograms
The final goal is to establish links between variations in solar-wind parameters and variations in high-latitude topside-ionospheric electron-density \( (N_e) \) values during large magnetic storms.
