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 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.

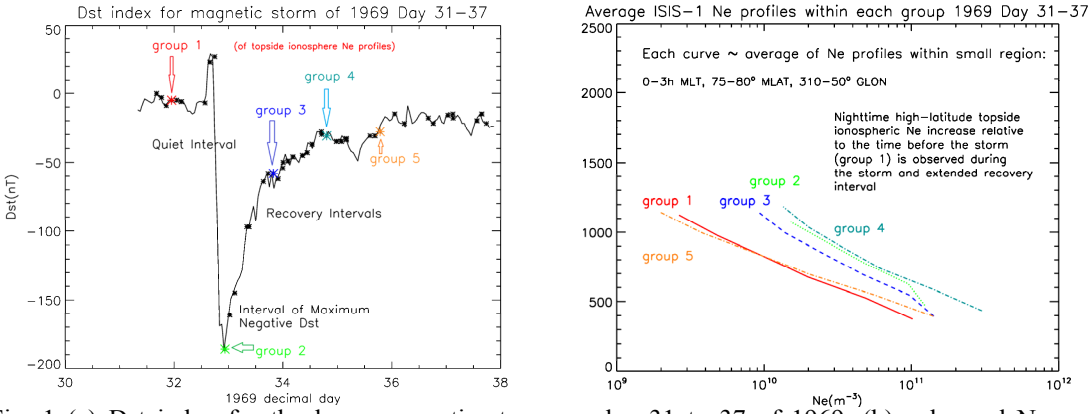

Fig. 1 (a) Dst index for the large magnetic storm on day 31 to 37 of 1969, (b) enhanced Ne profiles observed during the large magnetic storm (maximum Dst ≈ -190 nT during group 2) that persisted for at least two days (groups 3 & 4). The average Ne profiles prior to the magnetic storm are show in group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

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.

1. D. Bilitza, X. Huang, B. W. Reinisch, R. F. Benson, H. K. Hills, and W. B. Schar (2004), "TOPIST: Automated processing of ISIS topside ionograms," *Radio Sci.*, **39**, RS1S27, 2004.

2. R.F. Benson and D. Bilitza, "New satellite mission with old data: Rescuing a unique data set," *Radio* Solar-wind data were available for this storm. Difference in the ionospheric responses likely due to an extended solar-wind velocity streamer. *Sci.*, **44**, RS0A04, doi:10.1029/2008RS004036, 2009.