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## The characteristic features of the midlatitude ionospheric D-region associated with the dawn terminator during the November 8–11, 2004 storm

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Studies of the Geospace environment are of central importance to numerous research and development programs. The response of the midlatitude D region to storms evolves in a complicated way, and the data collected so far do not permit either an accurate empirical specification of the response or the development of physics-based models, because each space storm shows a rich assortment of phenomena that are not repeatable from one storm to another. To begin deriving specifications of D region parameters during storms, the Kharkiv V. Karazin National University has initiated long-term database containing polarimeter MF radar data collected at the Radiophysical Observatory (49°38'N, 36°20'E). We have restricted our study to the November 8–11, 2004 storm period when the Dst index showed a decrease of 400. The electron density profiles in the ionospheric D region across the dawn terminator were subjected to the proton precipitation fluxes, which were enhanced by a factor of 2 to 4 orders of magnitude, and the electron fluxes that increased by 3 to 4 orders of magnitude during the entire storm interval. One of the five solar optical flares observed during this interval was rated as a 3B flare, and one of the three solar x-ray bursts was a class X2.5 event. The results obtained are compared with the data collected with the same radar during the May 30–31, 2003 and September 17, 2003 storms, and on November 3, 17, and 24, 2004 during undisturbed conditions.

We summarize our main results as follows.

1. An enhancement of the electron density,  $N$ , in the midlatitude ionospheric D region is observed to occur for approximately 50–60 min in 5–10 min after the passage of the dawn terminator after a solar x-ray burst. Specifically, an increase in  $N$  of 800% – 1700% above the undisturbed values is observed at 78- and 81-km altitude, and 450% – 550% at 84 km and 87 km.
2. During storms, the electron densities in the D region increase by a factor of 2 – 4 above the  $N$  enhancements observed for tens of minutes across the dawn terminator under quiet conditions.
3. Assuming energetic electron precipitation stimulated by the termi-



nator to occur from the magnetosphere during storms, the energetic electron fluxes are estimated. The electron fluxes are observed to be in the range  $(0.6-8.8) \times 10^9 \text{ m}^{-2}\text{s}^{-1}$ , while the flux inferred from the measurements taken after the X2.5 event during the November 10, 2004 storm is by a factor of several times larger than that during other storms. These inferred electron fluxes are in good agreement with theoretical predictions and the precipitating flux data collected during disturbed conditions and published in the literature.

### **The display of solar activity in seismic and atmospheric series of the Earth**

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The seismic (NEIC) and atmospheric (NCEP) database were used for investigation of statistical dependences of temporal structural features of seismic and atmospheric series on solar activity. Following A.D.Sytinsky (1987) the atmosphere was supposed as a transmission mechanism of this interaction. There were researched the structural features as seismic events time distribution (persistency  $H$  and seismic swarms) as atmospheric series of surface pressure, percent of cloud cover.

There is revealed that the variety of global seismic activity decreases with growth of solar activity. Character of intensity of seismic process have a quasi-harmonic oscillations at a level of 5–10%, approximately in counterphase to solar activity. The distribution of global seismic events changes more significant than intensity of seismic process (e.g., parameter  $H$  changes from 0.75 in minimum solar activity to 0.5 in maximum), i.e. structuredness of seismic series increases when sun is quiet.

For global atmospheric time series the results are not so simple. Only the noise performance of atmospheric series (standard deviation of data for time averaging in 0.05 year) is weakly dependent on solar activity. To intend the atmosphere as intermediary between solar and seismic activity there is need additional research of spatial distributed atmospheric and seismic series.