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CONTRIBUTED POSTER

# Magnetospheric cut-off rigidity variations recorded by Neutron Monitors during the events of November 2004

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**Abstract:** The cosmic ray intensity variations during the magnetic storms of November 8 and 10, 2004 were analyzed, using data from the worldwide Neutron Monitor network. The corresponding variations of the geomagnetic indices and the geomagnetic cut-off rigidity changes of each station were calculated by the global survey method. The latitudinal distribution of the stations shows maximum changes at the geomagnetic cut-off rigidities around 6.5-9.0 GV.

## 1 Introduction

Disturbances in the Earth's magnetic field during magnetic storms can cause essential changes in the charged particle trajectories in the magnetosphere. This has two main consequences for ground-level observations, the effective cut-off thresholds and the effective asymptotic directions of the particles changing. Both of these consequences are important for cosmic rays (CR). During these events an increased amount of energy is transferring into the magnetosphere [2]. In this work the connection between Dst-index, cosmic ray intensity variations and cut-off rigidity changes dRc during the two severe magnetic storms observed on November 8, 2004 (Dst=-373nT), and November 10, 2004 (Dst=-289nT) were studied. It was confirmed once again that the Athens Neutron Monitor station observed these events with the maximum intensity, is placed in a unique, geographically, position for observing this kind of magnetic storms [3].

## 2 Data and Method

Hourly data of cosmic ray intensity from about thirty Neutron Monitor stations located around the world were used (http://www.nmdb.eu). The Dst-index data were taken from http://swdcwww.kugi.kyoto-u.ac.jp/dstdir/ (WDC (Fig.1). The global survey method (GSM) which is conceptually a version of spherical analysis has been utilized for calculations of the rigidity changes dRc of each station. Different versions of this method have been evolved and improved at different stages of data processing [1], [3]. The observed cosmic ray intensity I at i point, with rigidity Rc located at level h can be written as following:

$$\frac{\delta I^i}{I_o} = \delta^i_{mag} + \delta^i_{izot} + \delta^i_{anizot} + \delta^i_{err} \quad (1)$$

Where $\delta_{izot}$ and $\delta_{anizot}$ are the mean isotropic and anisotropic cosmic ray variations out of the magnetosphere and $\delta_{err}$ is the residual variations.

## 3 Conclusions

The maximum dRc values were recorded in Athens (37.58$^o$N, 23.47$^o$E, 8.53 GV) and in Potchefstroom (-26.68$^o$S, 27.10$^o$E, 6.85 GV) Neutron Monitor stations. This indicates that NMs in the zone of 6.50

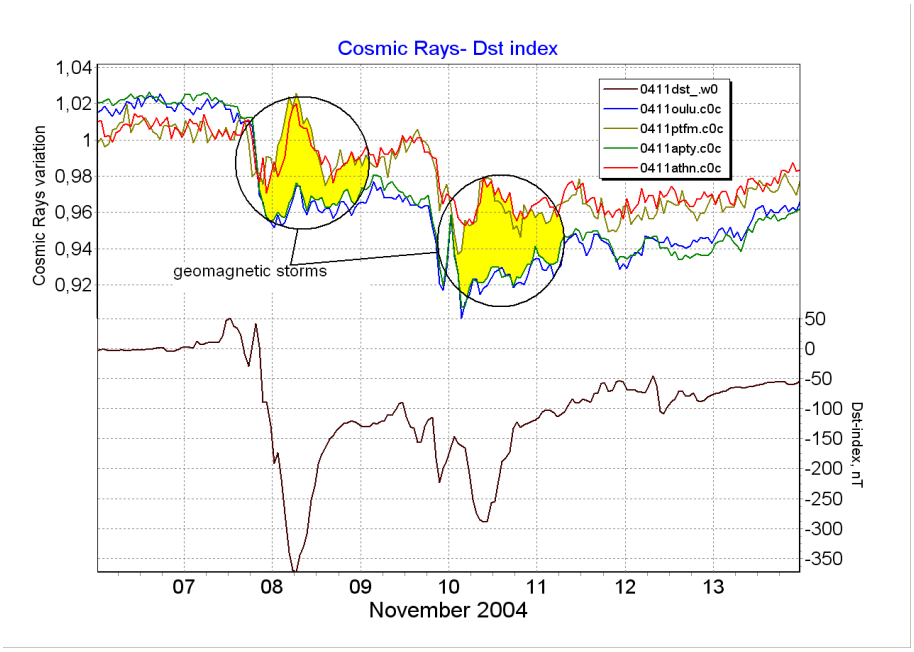


Figure 1: Time profiles of the cosmic ray intensity for middle latitude (Athens, Potchefstroom) and polar (Oulu, Apatity) stations (upper panel) and of the geomagnetic index Dst (lower panel) for the time period November 6-13, 2004

| $DD/MM/YYYY$ | 08/11/2004 | 10/11/2004 |
|---|---|---|
| $Forbush\ Effect\ Tstart$ | $7/11/2004\ 22:00UT$ | $9/11/2004\ 13:00UT$ |
| $Magnetic\ storm\ Tmax$ | $8/11/2004\ 6:00UT$ | $10/11/2004\ 9:00UT$ |
| $Cosmic\ ray\ intensity\ Imax(\%)$ | $4.9 \pm 0.5$ | $2.8 \pm 0.5$ |
| $Dst-index\ Tmin$ | $8/11/2004\ 6:00UT$ | $10/11/2004\ 9:00UT$ |
| $Dst-index\ maximum$ | $-373.00nT$ | $-289.00nT$ |
| $Kp-index$ | $8^-$ | $8^-$ |
| $Cut-off\ rigidity\ changes\ dRc\ max$ | $-0.57GV$ | $-0.42GV$ |
| $Stations\ with\ dRc\ max$ | $PTFM(6.85GV)$ $ATHN(8.53GV)$ | $ATHN(8.53GV)$ $PTFM(6.85GV)$ |

to 9.00 GV is really important in the recording of strong geomagnetic events. The results of this work are in good agreement to those ones obtained from the study of the magnetic storm of November 20, 2003 which was the largest magnetospheric effect in the history of neutron monitor stations citearn2005.

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