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Cosmic Ray Intensity increases detected by ASEC monitors during 23rd solar activity cycle in correlation with Geomagnetic storms

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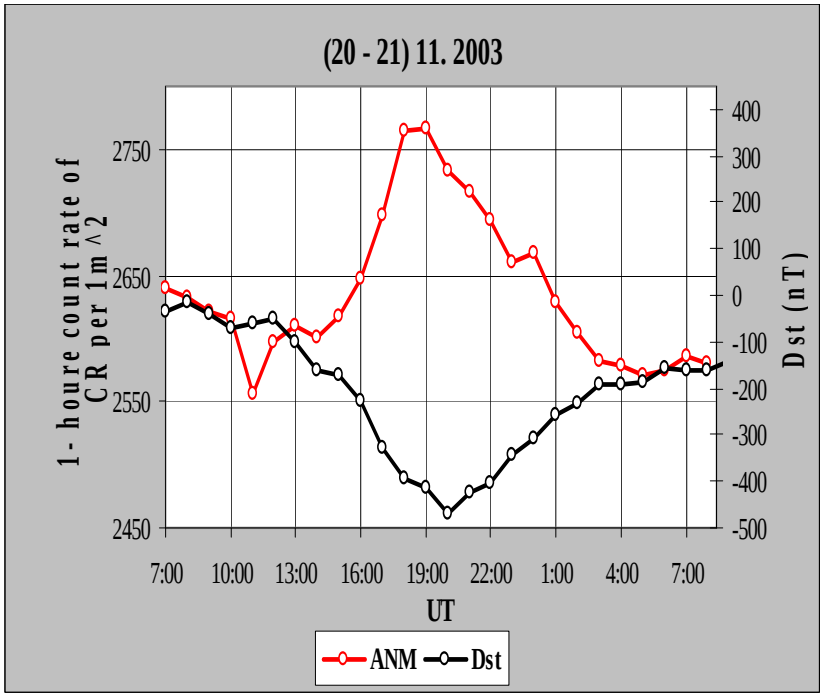
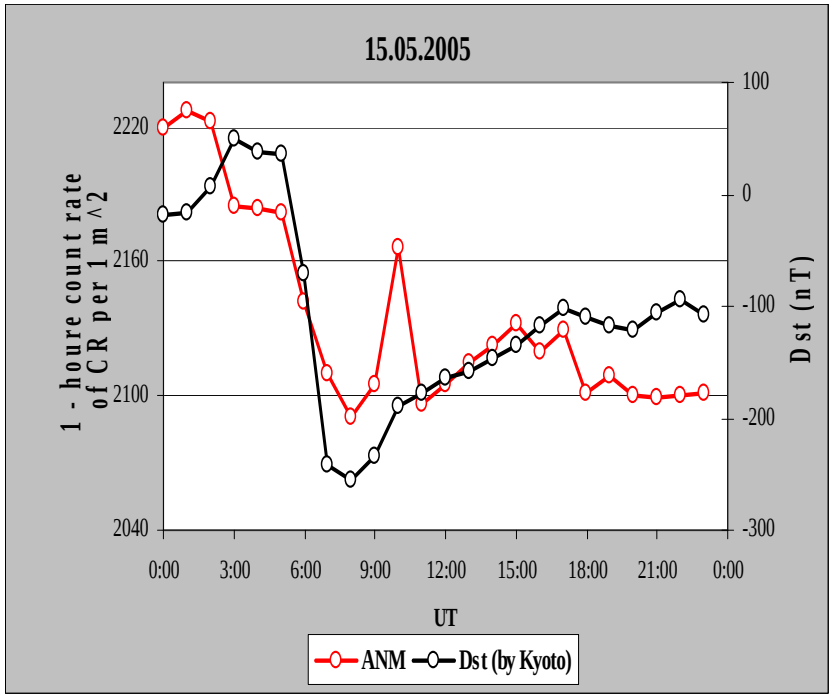
Outline

- The aim of the presentation is to get some insight on the correlations of ICME parameters with geospace parameters, including Dst index and variations of secondary cosmic rays.
- Information on flux changes for different secondary particles helps to “test” IMF and magnetosphere for understanding of the level of disturbance and specific mechanisms leading to cutoff rigidity reduction.

2. Selection of events during which, increases of GCR count rates are observed due to magnetospheric effects.

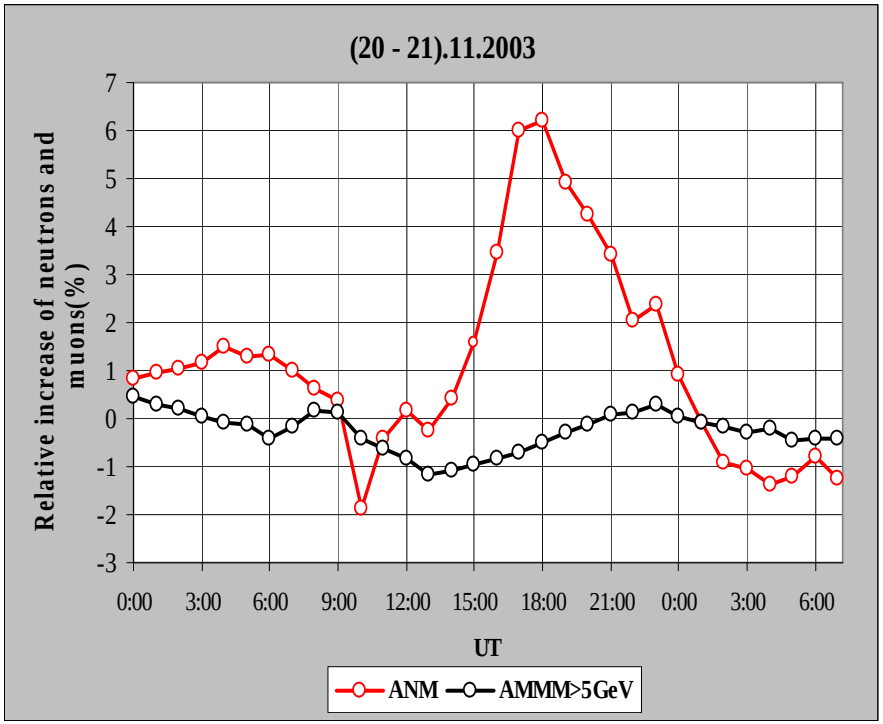


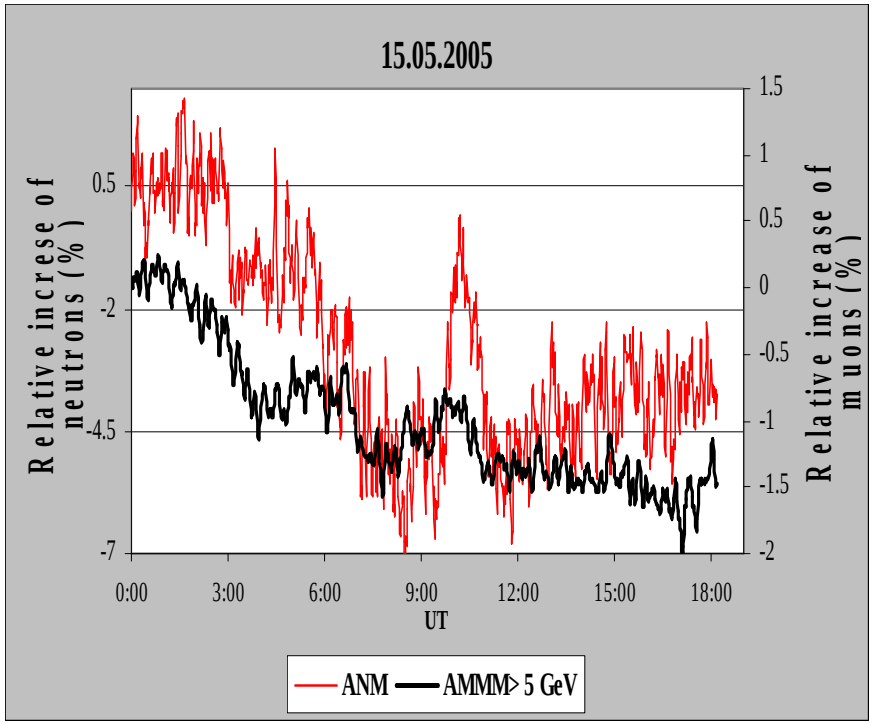
Example of the GMS anti-correlated with changes of neutron .



Delayed correlation of hourly time series of ANM and Dst index.

The AMMM detector registering muons > 5 GeV is not sensitive to Magnetospheric changes

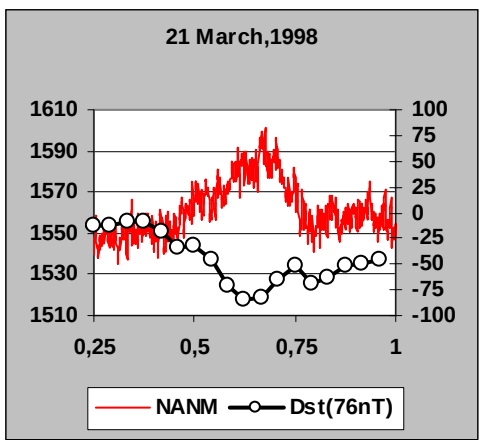


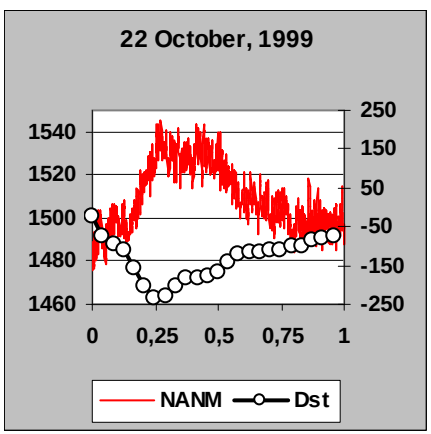


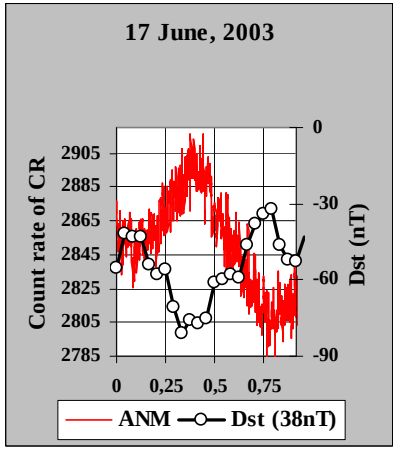
During severe GMS the flux of secondary neutrons in ANM is affected, while AMMM (μ > 5GeV) is insensitive to it.

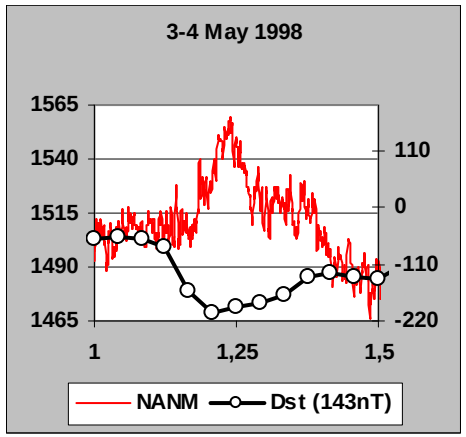
In this event both ANM and AMMM (neutrons and μ > 5 GeV) demonstrate coherent peaks during minimum of Fd.

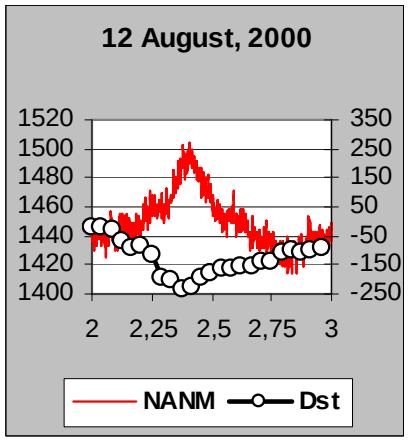
Examples of correlated changes in Cosmic Rays and Dst index during GMS events

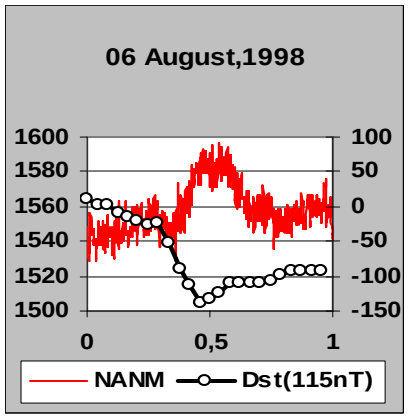






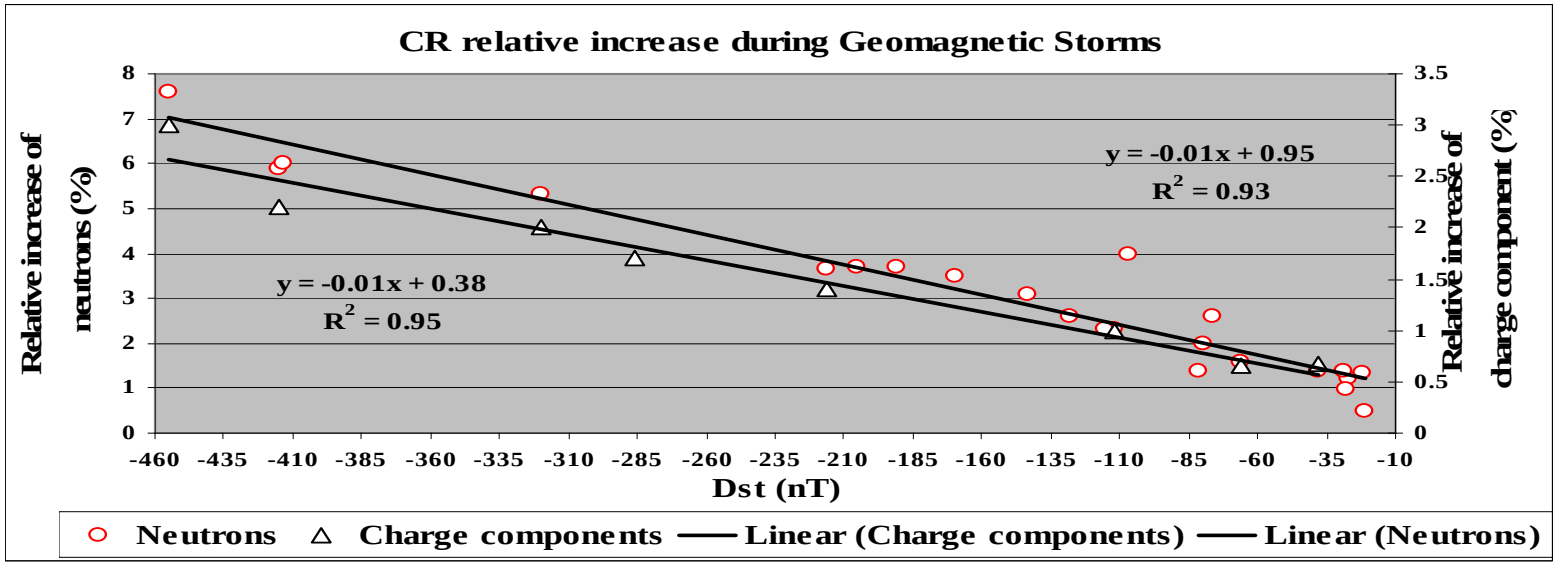


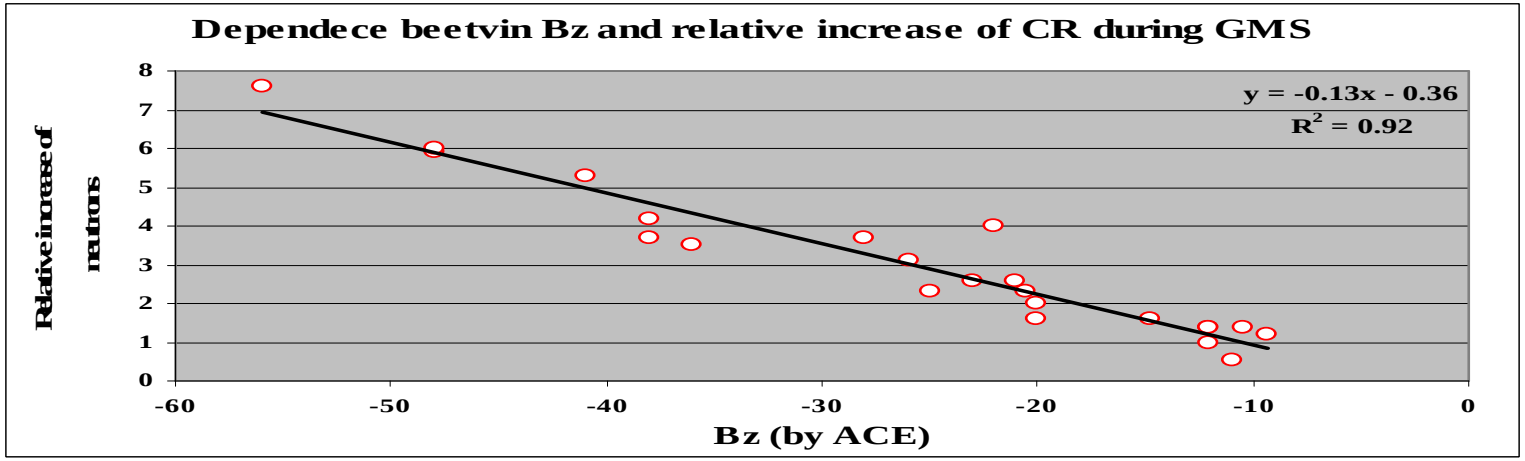




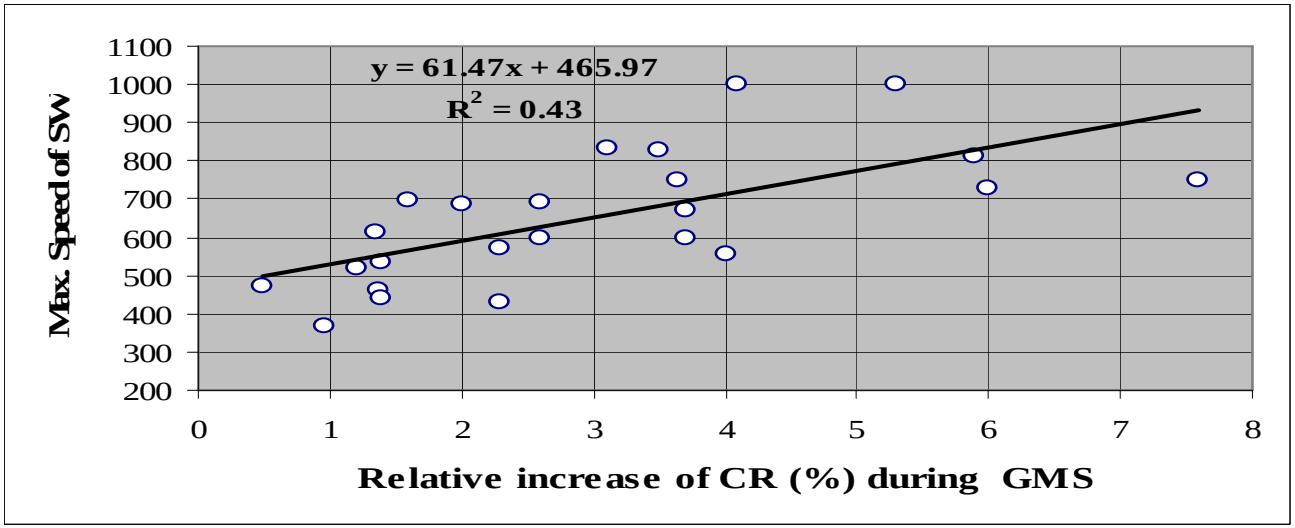
Characteristics of enhancements of the neutral and charged fluxes during GMS

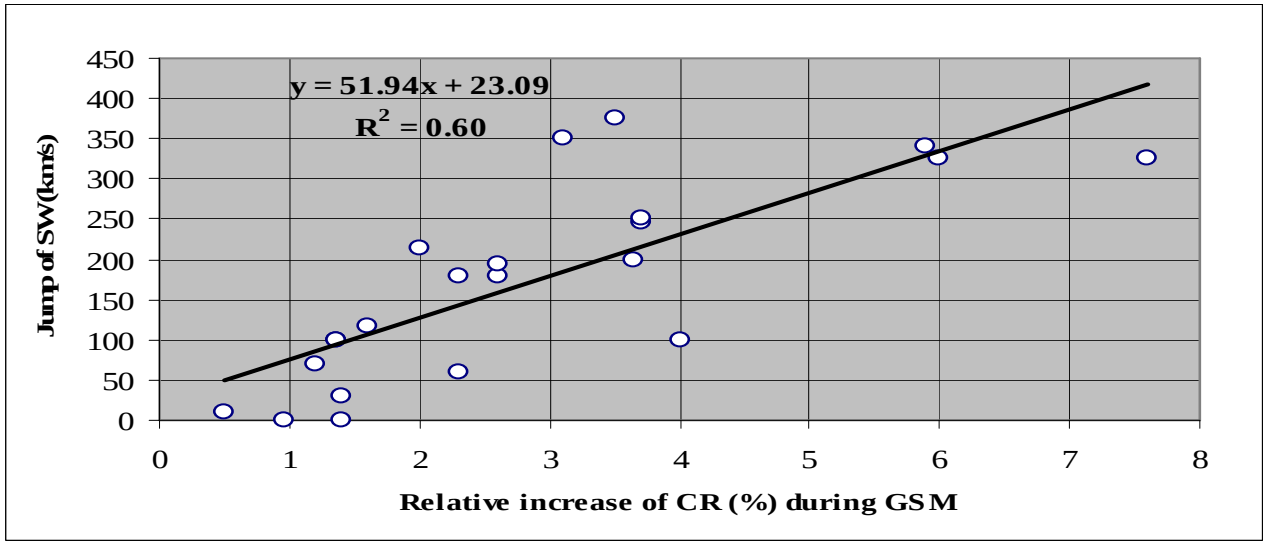
24 GMS-es from 23th cycle have been investigated by NM, e+μ>7MeV, AMMM (μ> 5GeV)





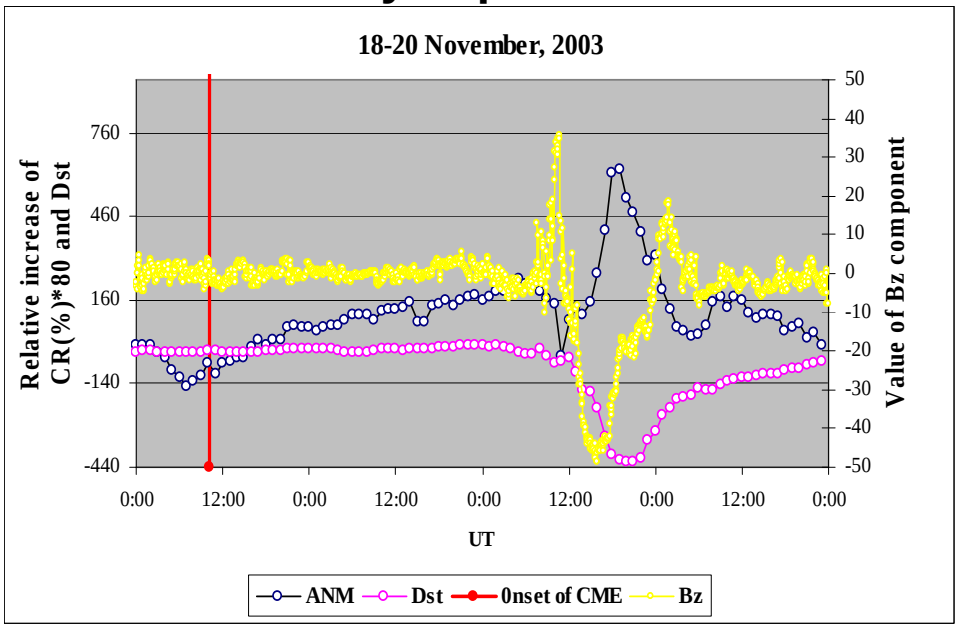
Correlations of peak significance abd ICME speed



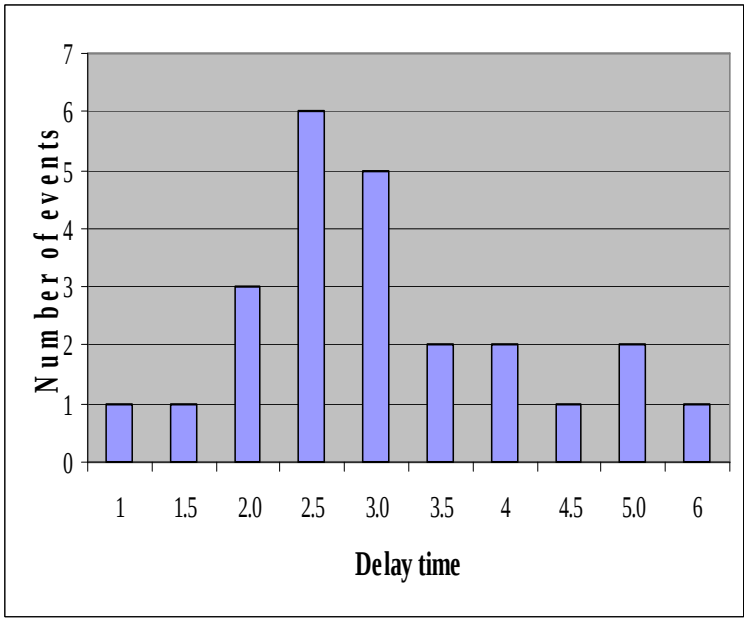


Some methods for GMS prediction and their comparison.

- **N. Gopalswamy et al. 2007 ”Large fraction (75%) of disk halos are geoeffective ”.**
- **Yurchyshyn et al., 2005 “For CMEs originating from the central part of the solar disk, it is found that the intensity of Bz is correlated with the projected speed of the CME (r = 0.78)”.**
- **GMS intensity depend on Bz value.**



The graphs shows, that the Bz minimum happens several hours before the minimum of Dst



The Bz and Dst time difference distribution for 24 events.

Average delay time is 3 hours.

Conclusions

- ACE data is heavily used to forecast both the timing and intensity of magnetic storm. Therefore, the changing fluxes of secondary cosmic rays measured at Earth surface can be used as proxies of ICME parameters when measurements at L1 Lagrangian point are disrupted due to severe radiation storms.
- Simultaneous registration of neutral and charged GCR fluxes gives information on the disturbance of IMF and magnetosphere.
- There are ideas to predict GMSs strengh by remate sensing of ICME magnetic field and orientation. However additional work needed to make a comprehensive model incorporating all known factors and develop models with better prediction quality.