3rd AOSWA, Fukuoka
3 March 2015

The geoeffectiveness of ICMEs

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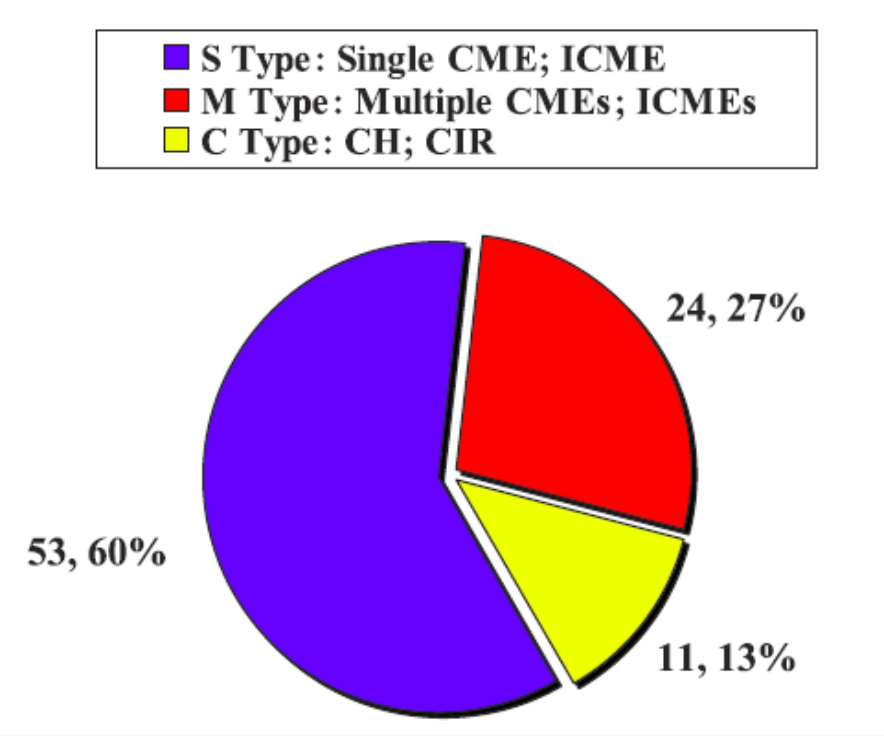
1.Introduction

ICMEs and their complex structures are most important sources of geomagentic storm[e.g *Yermolaev and Yermolaev*, 2006, Zhang et al., 2008]



Zhang et al., 2008

Questions:

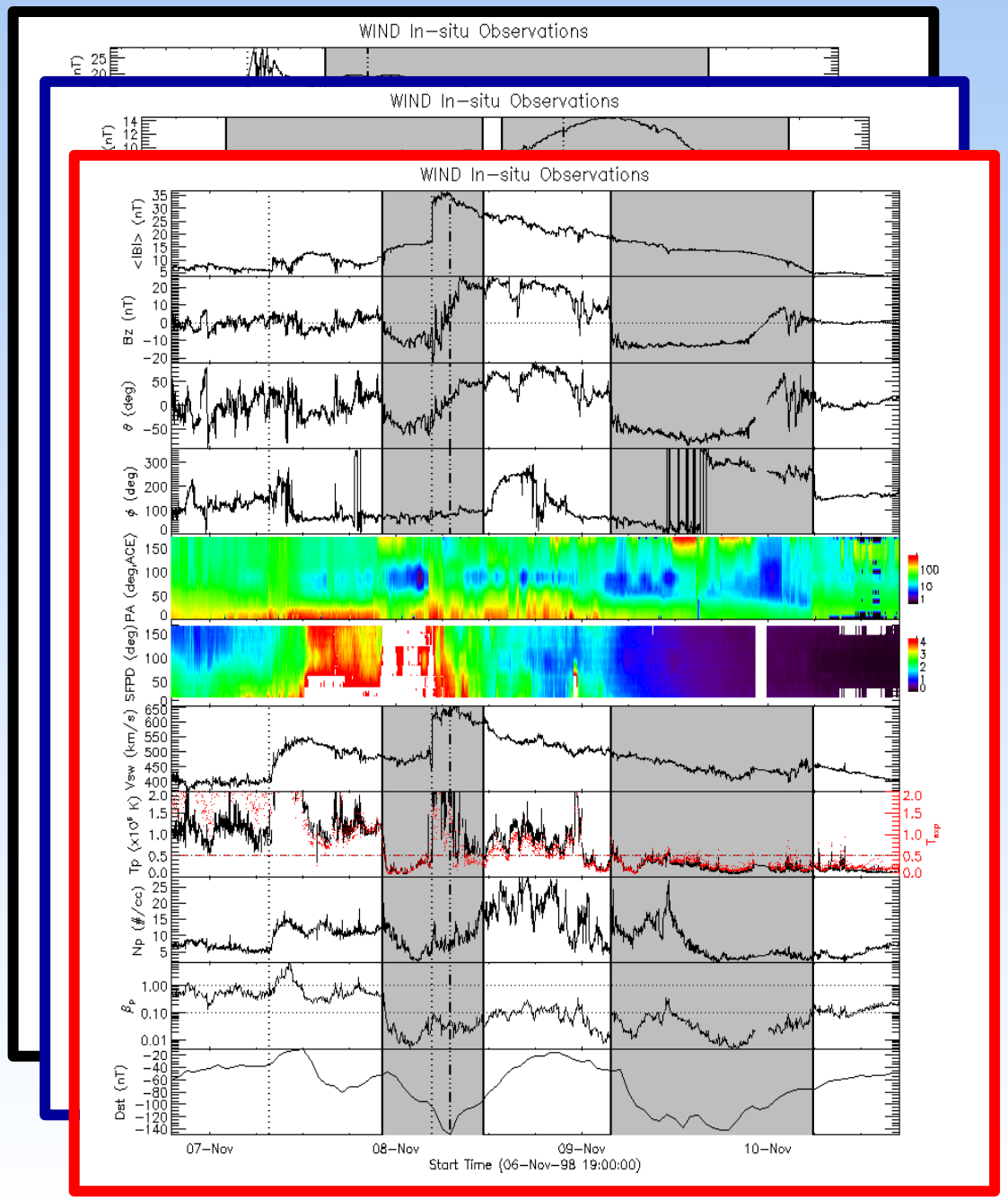
- Which ICMEs are most geoeffectiveness?
- Which parameters of ICMEs are most important in determination of their geoeffectiveness?
- Is there any difference between the geomagnetic storm caused by ICME in solar cycle 23rd and 24th ?

2. Data selection

- Time Period
  1996 to 2013
- Observations:
  WIND
- Totally *412* ICMEs

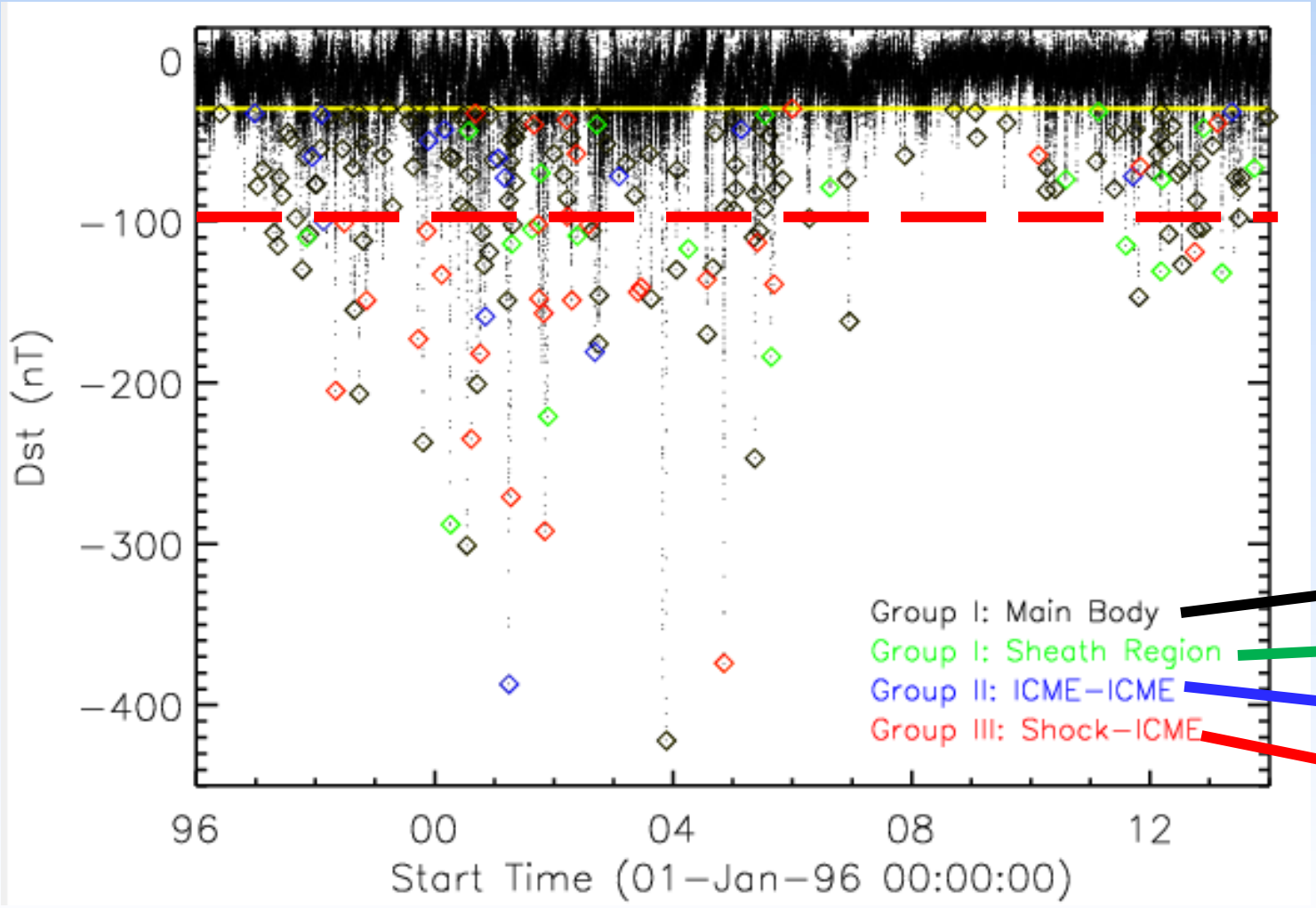
- Three types of ICMEs:
  - Single ICME
  - Multiple ICMEs
  - Shock-ICMEs

Totally 340 Groups



3. Statistical analysis

340 groups caused 195 Geomagnetic storms



Almost all large geomagnetic storms were caused by ICMEs and their complex structures

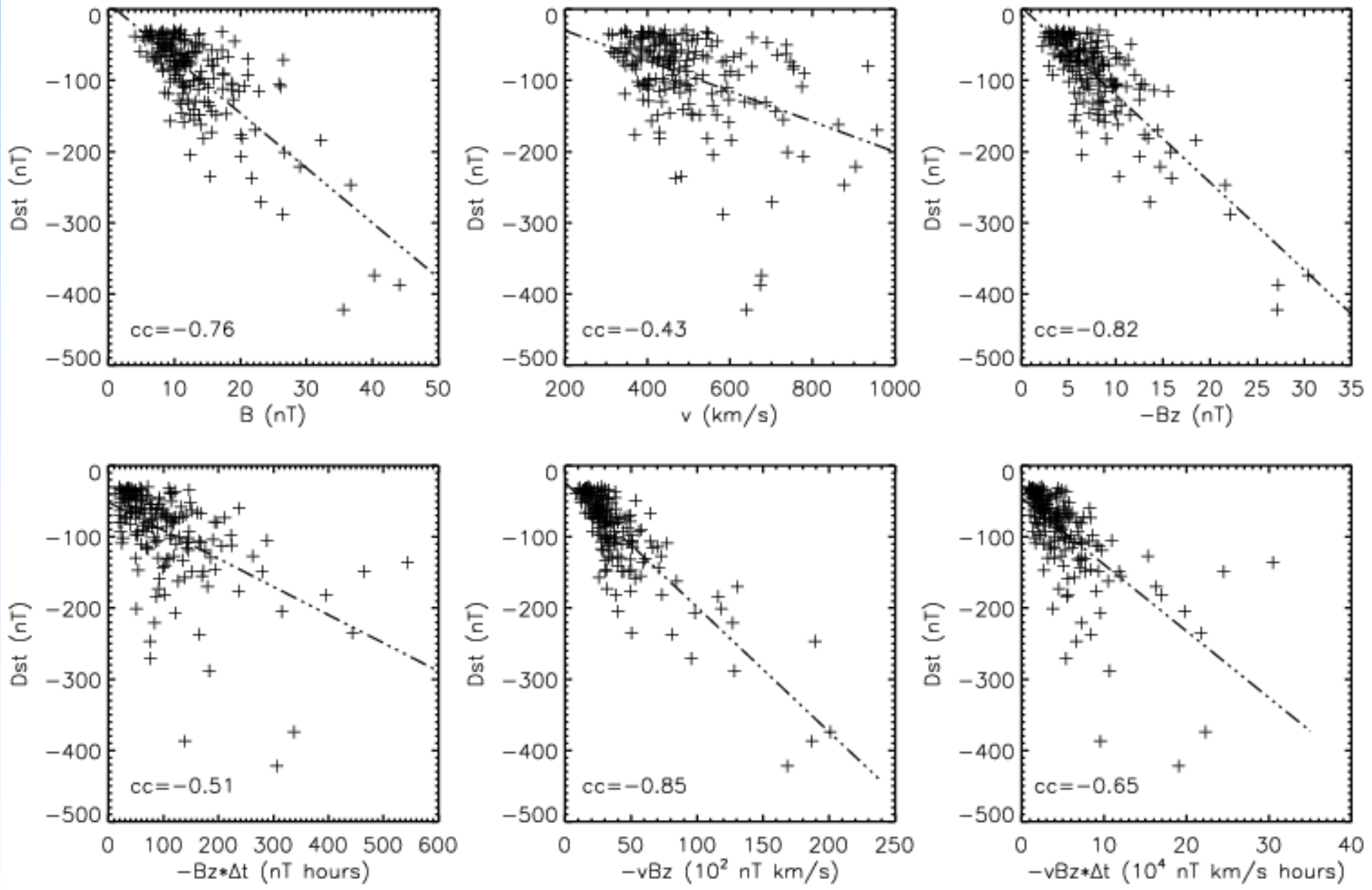
128

21

15

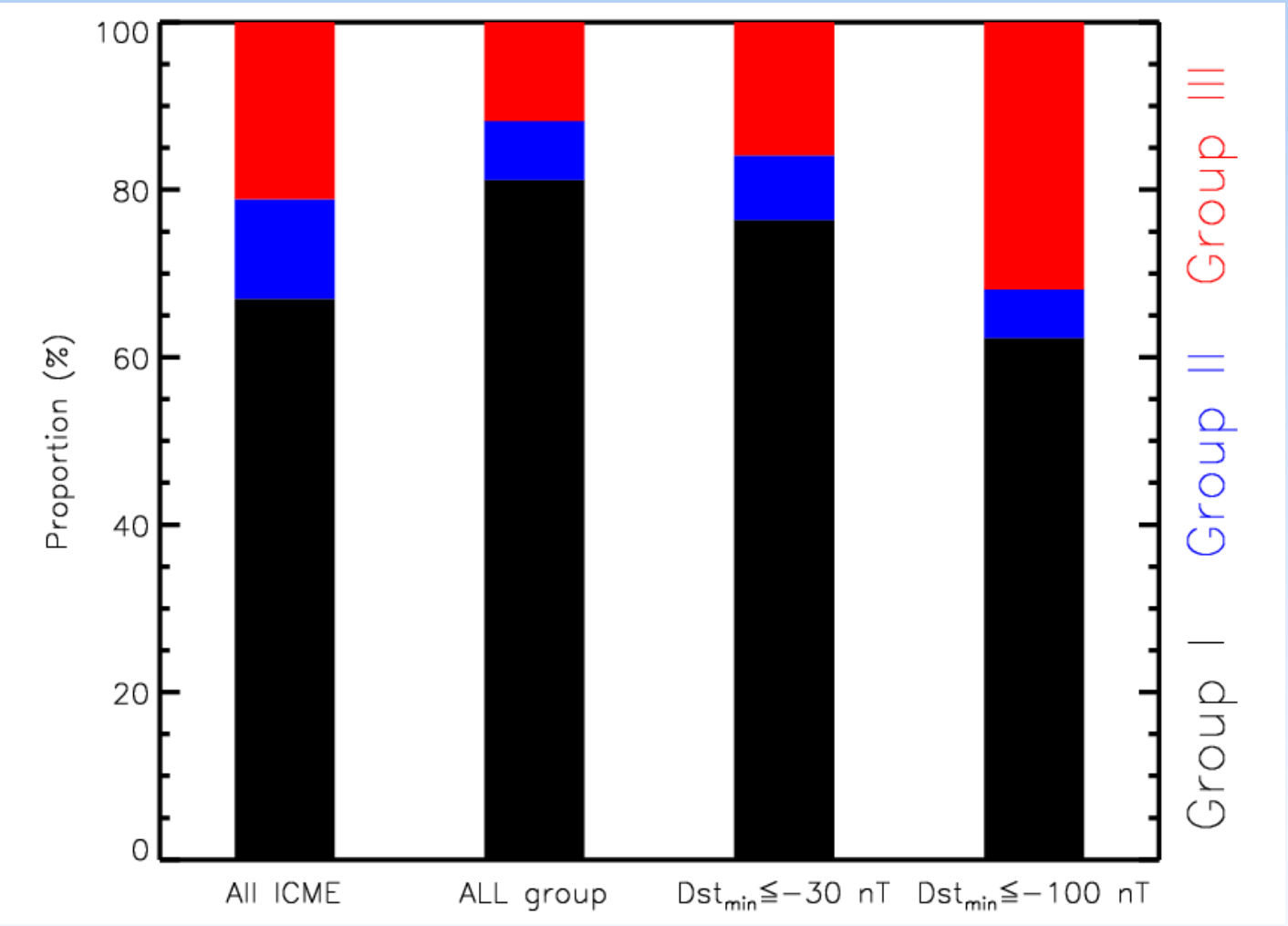
31

Number



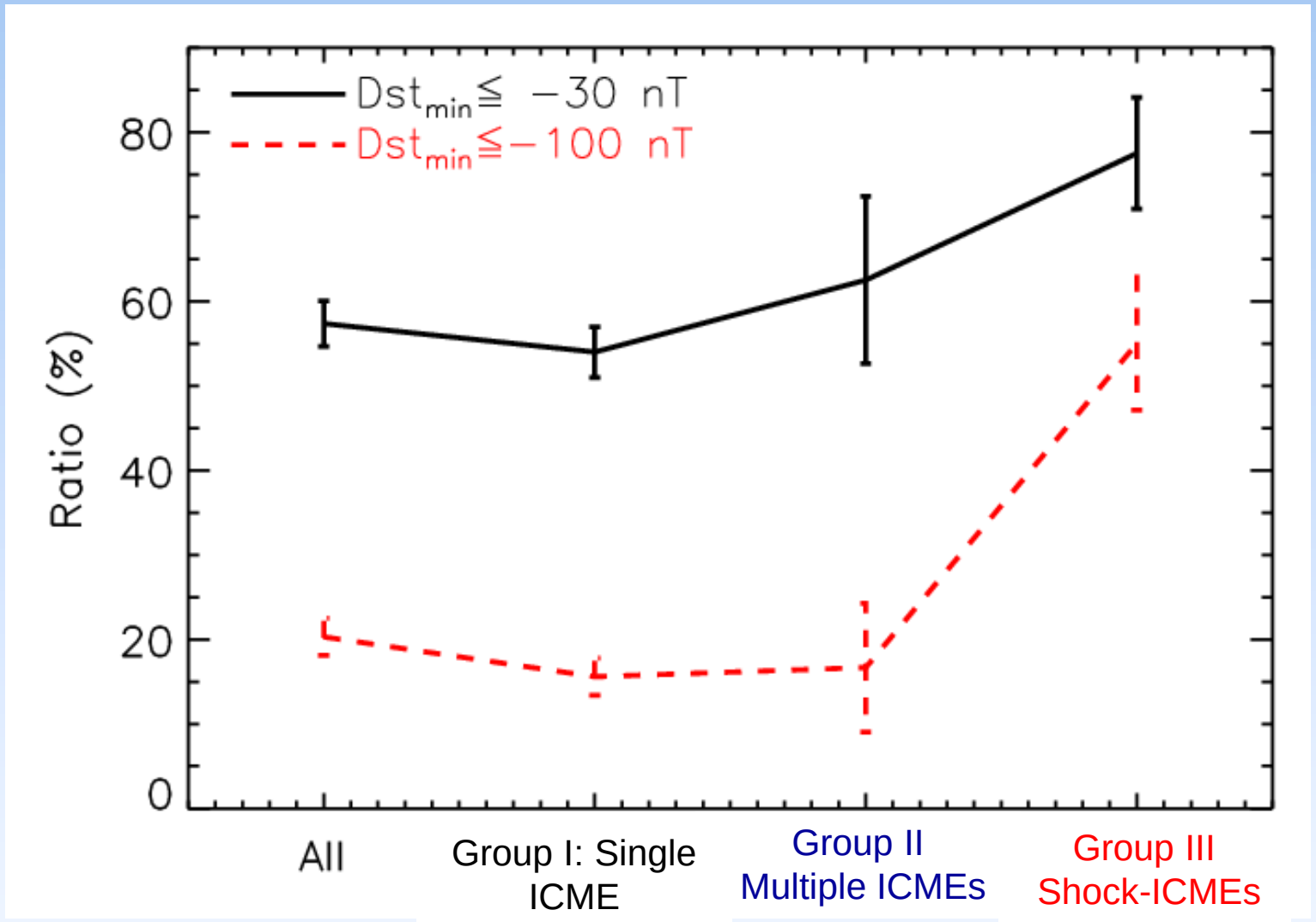
vB_s is best correlated with the Dst_{min}

4. Comparison between different groups



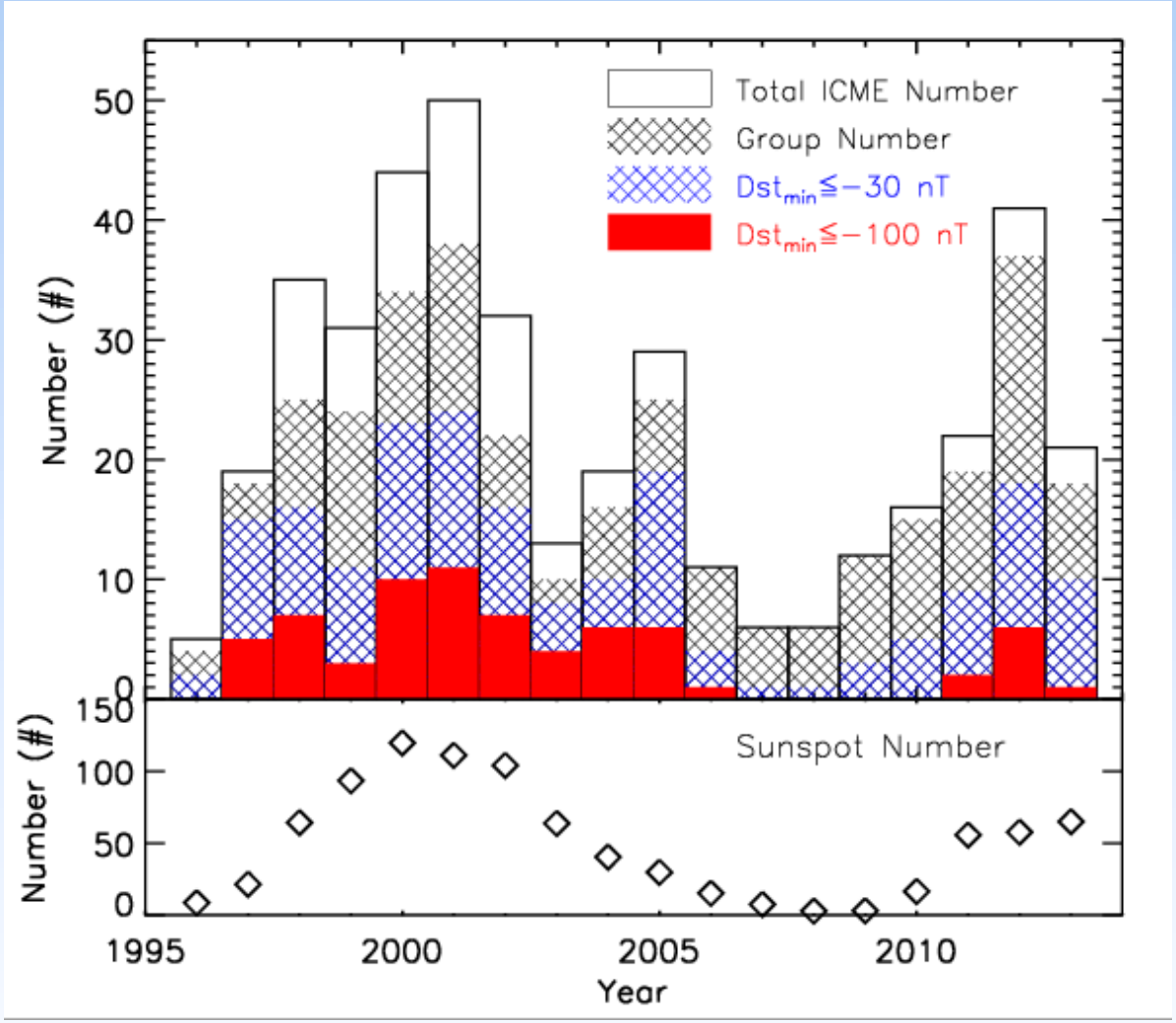
- Group III: Shock-ICMEs
- Group II: Multiple ICMEs
- Group I: Single ICME

Big geomagnetic storm are more likely to be caused by Shock-ICME interaction events!



Shock-ICME interaction events are more likely cause geomagnetic storms especially for big storms!

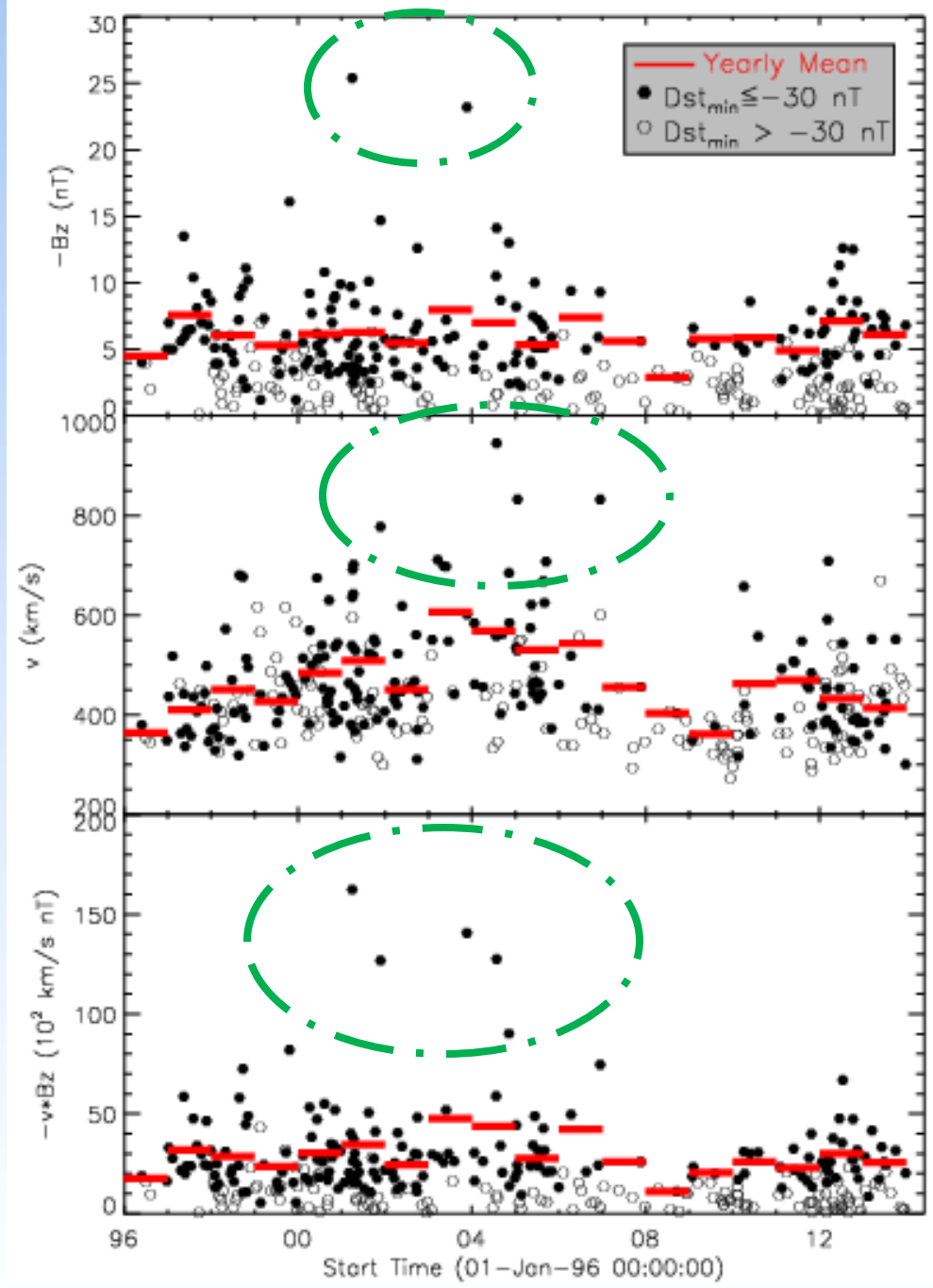
5. Comparison between solar cycle 23rd and 24th



ICME and geomagnetic storm number correlated with the sunspot number

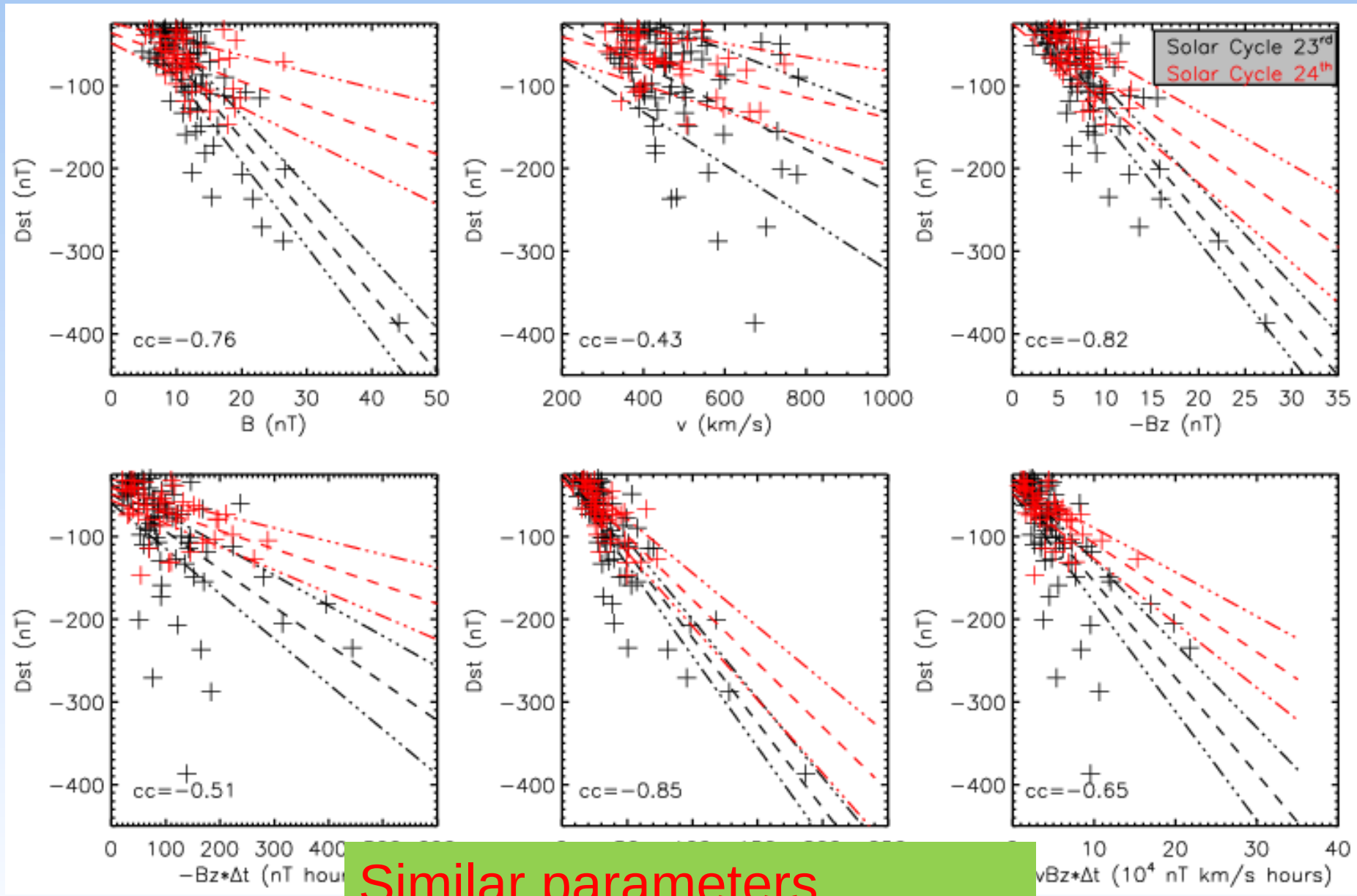
More sunspot number → More and large geomagnetic storm

The geomagnetic storm number in solar cycle 24th is much smaller than solar cycle 23rd .



Solar Cycle 24th

- The mean magnetic field is smaller.
- The mean solar wind speed in solar cycle 24th is much smaller
- The mean vB_s is smaller.
- Lack of large events in solar cycle 24th



Similar parameters, different geoeffectiveness!

Solar cycle 23rd: May 2008 to Jan. 2014

6. Conclusions

- ✓ vB_s is the most useful parameters to forecast the intensity of the geomagnetic storm.

  Space Weather: How to forecast the vB_s?

- ✓ The compressed magnetic fields are more geoeffective.

  Space Weather: The CME interaction events especially the shock-ICME interaction events are important.

- ✓ The same parameters have different geoeffectiveness in different solar cycle.

  Space Weather: Different forecasting model parameters in different solar cycles?


Thanks!