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Energetic Electron Flux Variation around the Yushu Earthquake on April 14, 2010

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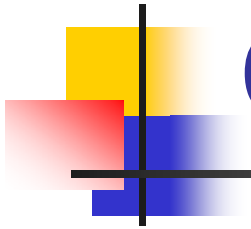

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- Variation of electron flux and magnetism
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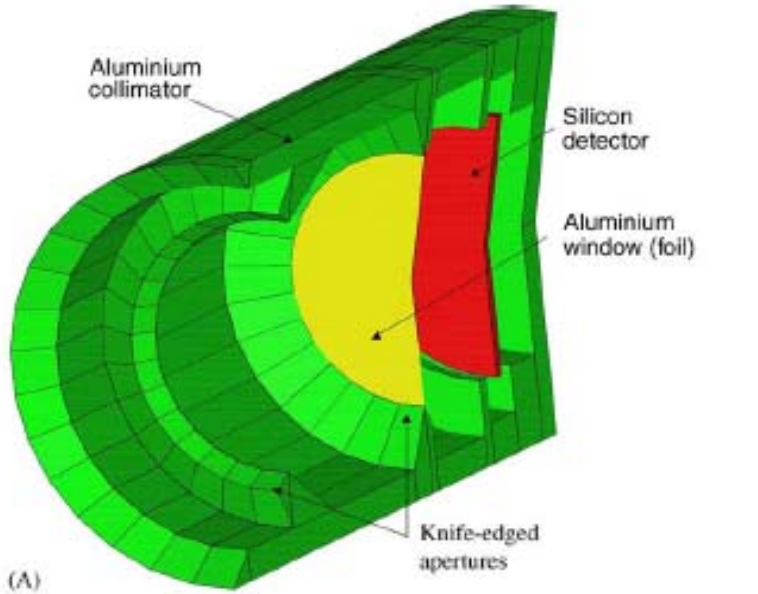
Introduction to IDP, DEMETER

- http://demeter.cnrs-orleans.fr/
- http://smsc.cnes.fr/DEMETER/
- J.A.Sauvaud, T.Moreau, R. Maggiolo, et al., high-energy electron detection onboard DEMETER: the IDP spectrometer, description and first results on the inner belt. Planetary and Spance Science, 2006, 54, 502-511



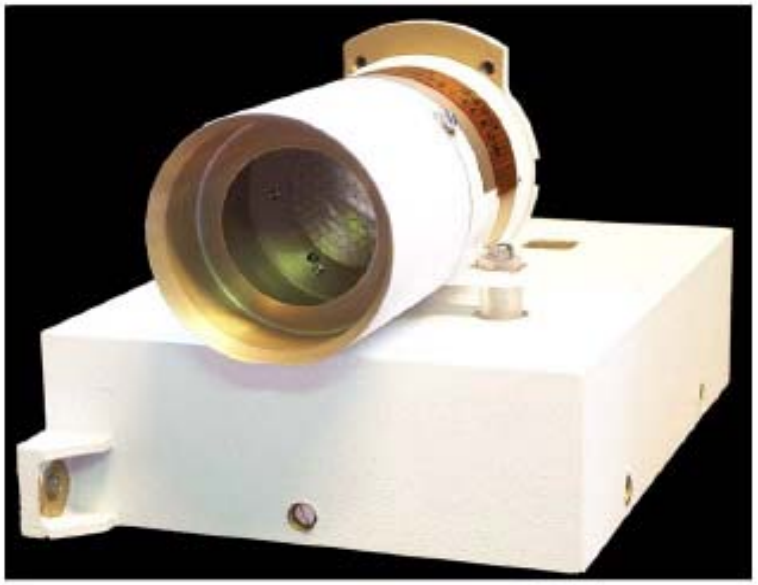


Table 1
Principal characteristics of IDP

Detector	Implanted silicon, Thickness: 1 mm Active surface 490 mm^2 ($\varnothing$ 25 mm)
External shielding	2 mm Al
Foil for protons and photons rejection	6 μm Al
Mass	525 gr
Power	895 mW
Energy range, e^-	70–1000 (2500) keV, 256 channels
Maximum geometrical factor	1.2 cm^2 sr

Fig. 1. (A) Cross-sectional view of IDP: the collimator in aluminum (green), the Al foil aimed to stop UV photons and protons with energies lower than 500 keV, and the silicon detector (red) and (B) the sensor head and the electronic box before integration onboard the satellite.

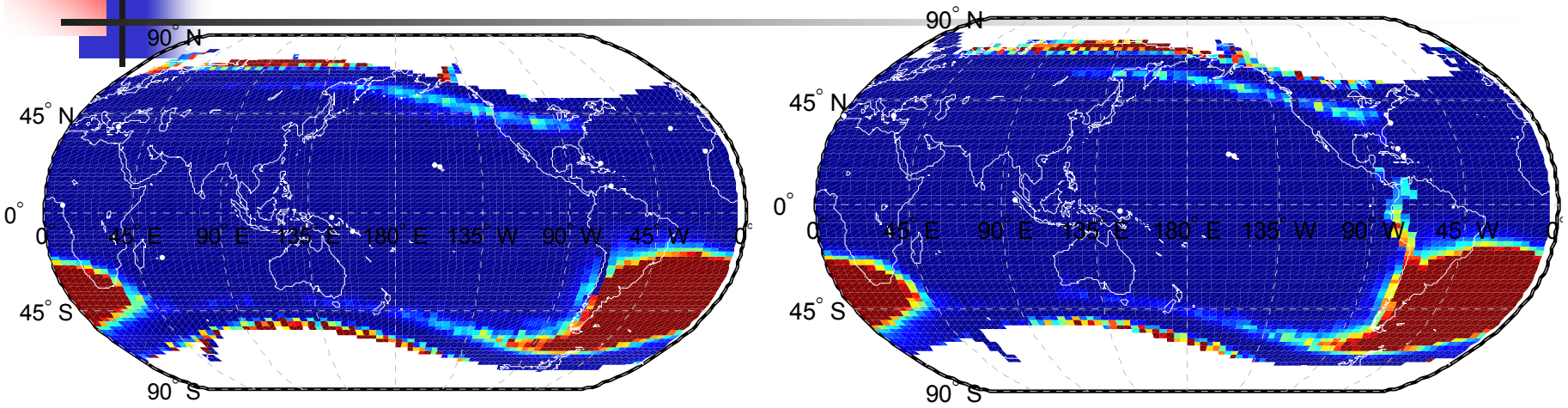
Background about the Yushu Earthquake

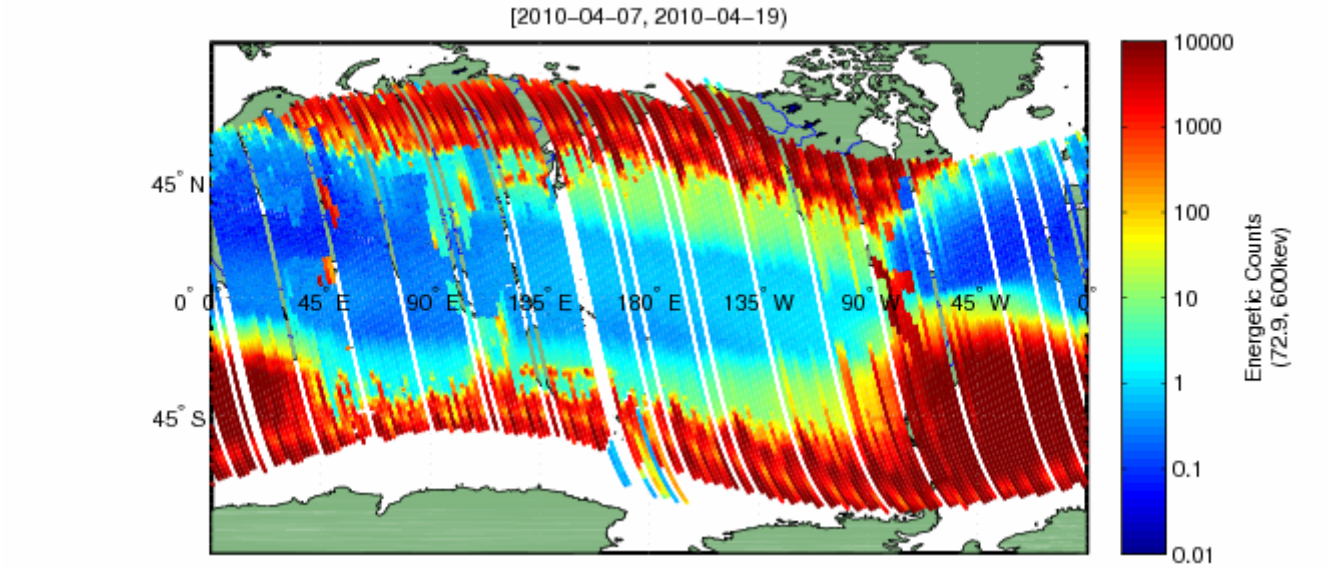
- Earthquake
- Distribution of energetic electrons
- Space Index

Earthquake

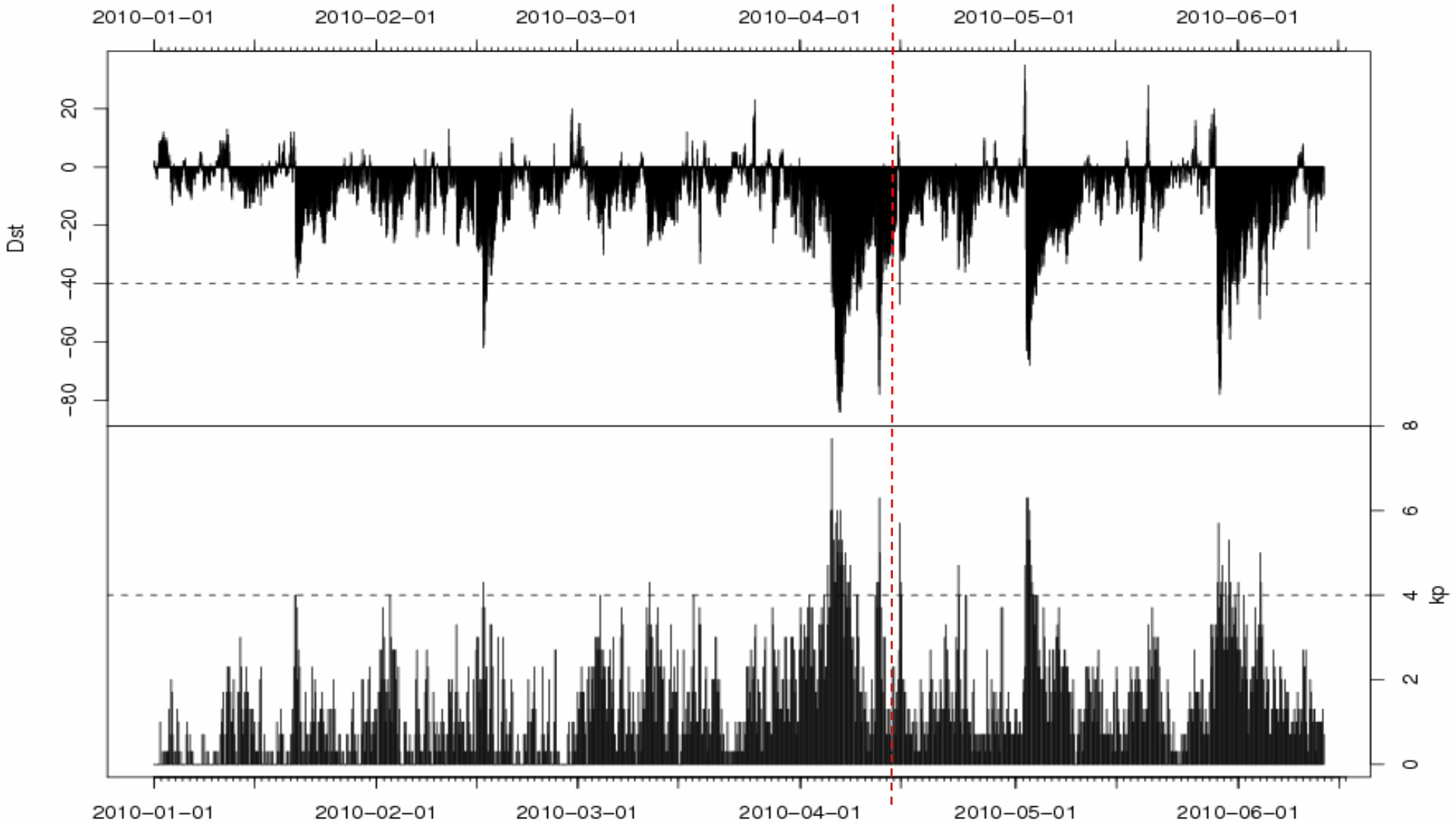
- Time□2010-04-13-23□UT□
  2010-04-14-07□BJ□
- Epicenter□Yushu county, Qinghai Province, China
- Magnitude□7.1

Distribution of the energetic electrons





Space Index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2010–04–01
2010–05–01
2010–06–01
Dst
20
0
−20
−40
−60
−80
kp
0
2
4
6
8

Variation of electron flux and magnetism

- Electron flux

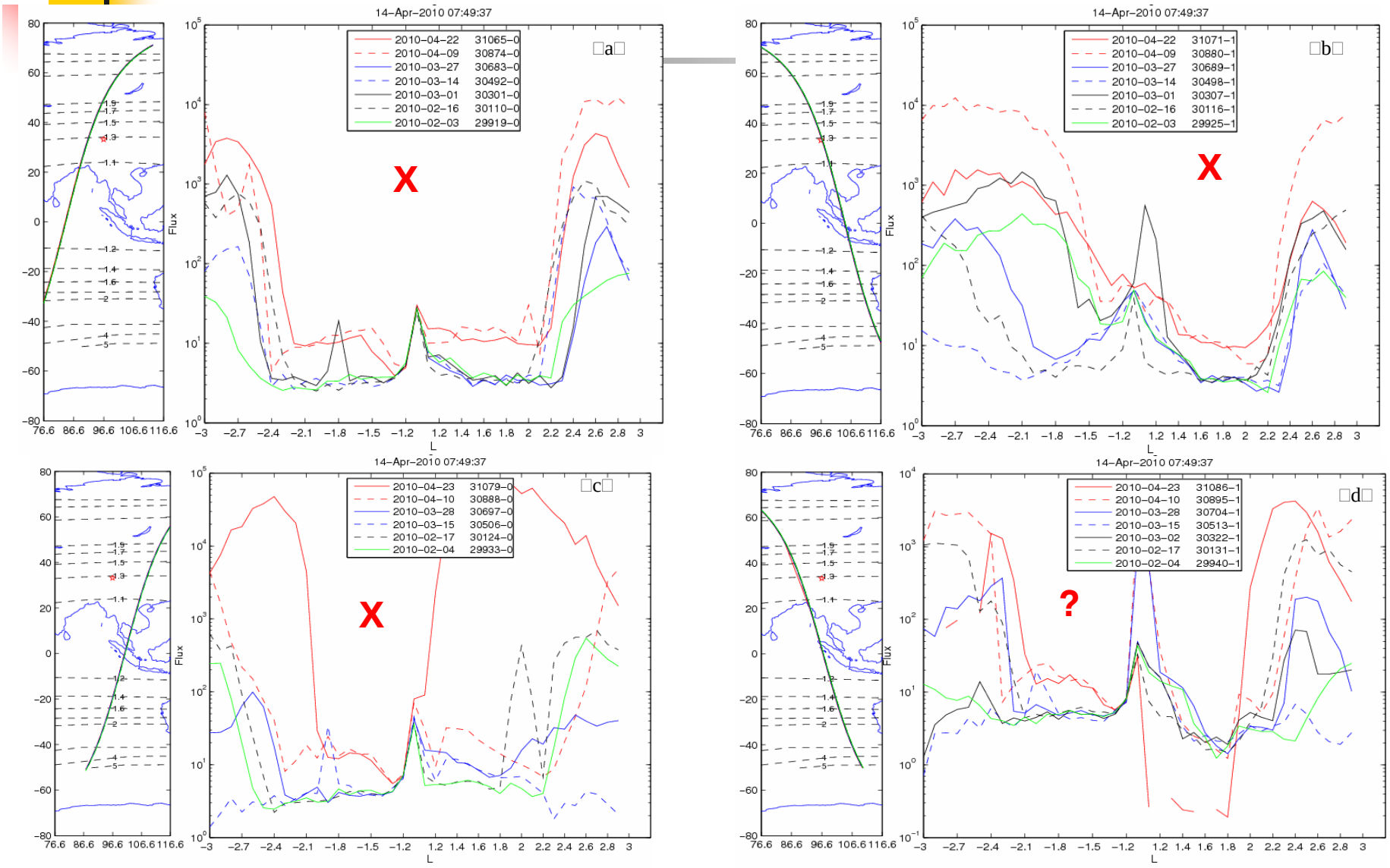
  ----revisited orbits

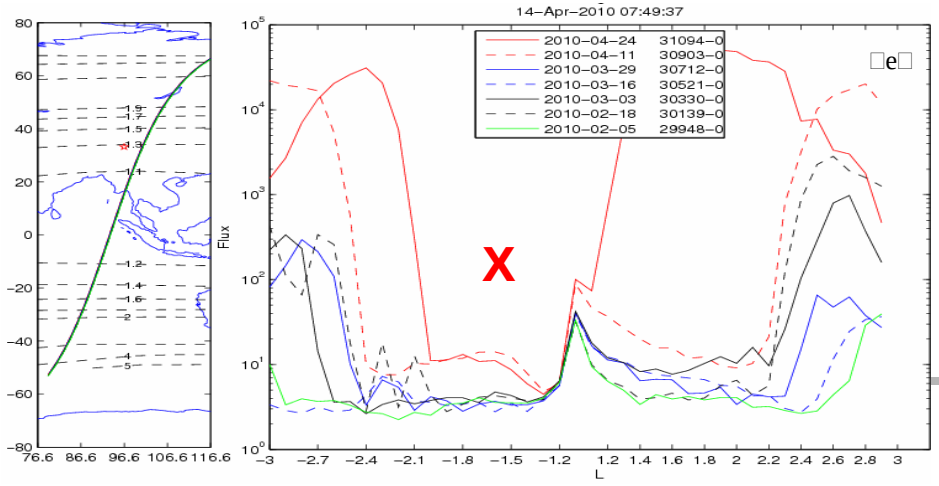
  ----spatial-temporal serials

- Magnetism

Flux along orbits 4 days before the earthquake within the 10° region around the epicenter

Precursor: appeared some time before the EQ and disappeared after the EQ

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2010–04–11 30903–0
2010–03–29 30712–0
2010–03–16 30521–0
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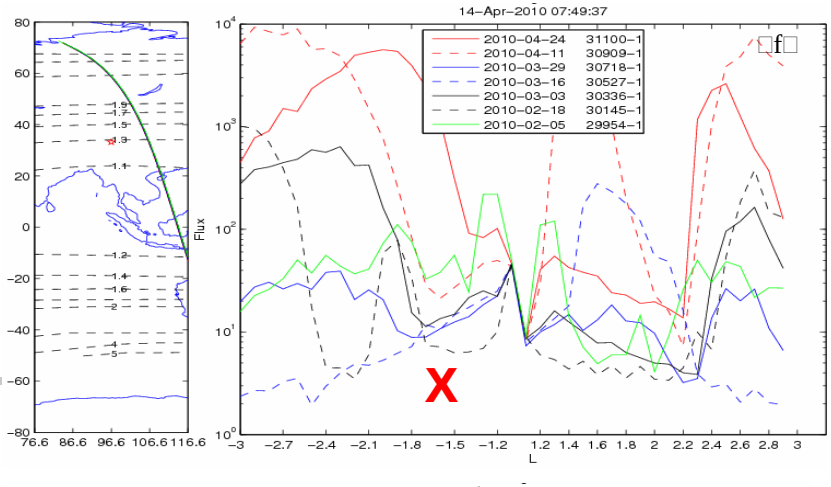
2010–02–05 29948–0
□e□
X
Flux
L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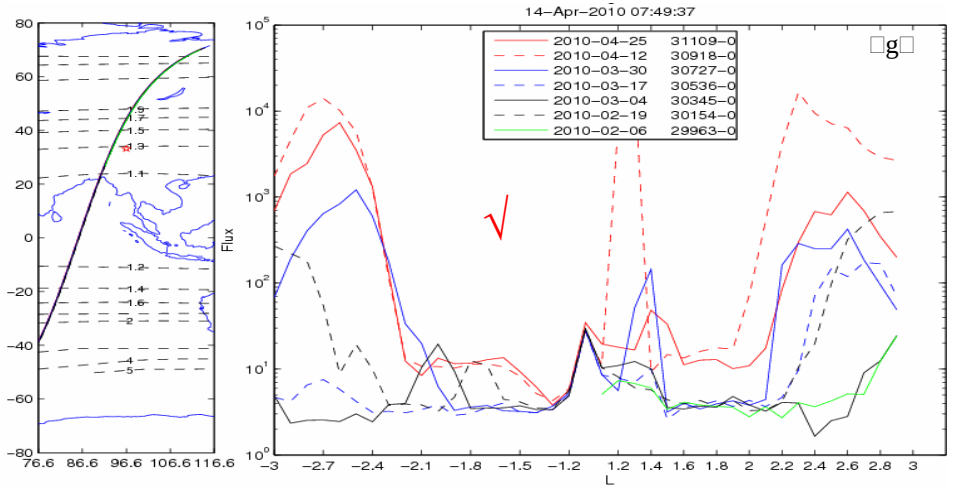
2010–02–18 30145–1
2010–02–05 29954–1
□f□
X
Flux
L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2010–02–06 29963–0
□g□
√
Flux
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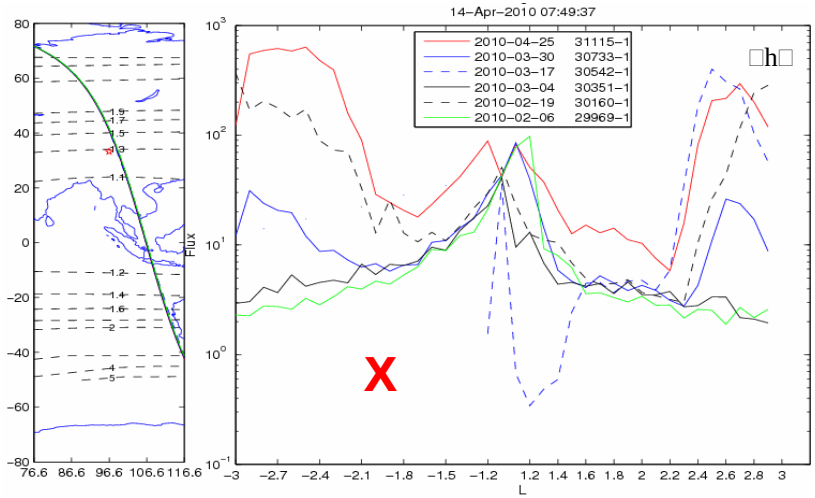
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2010–02–06 29969–1
□h□
X
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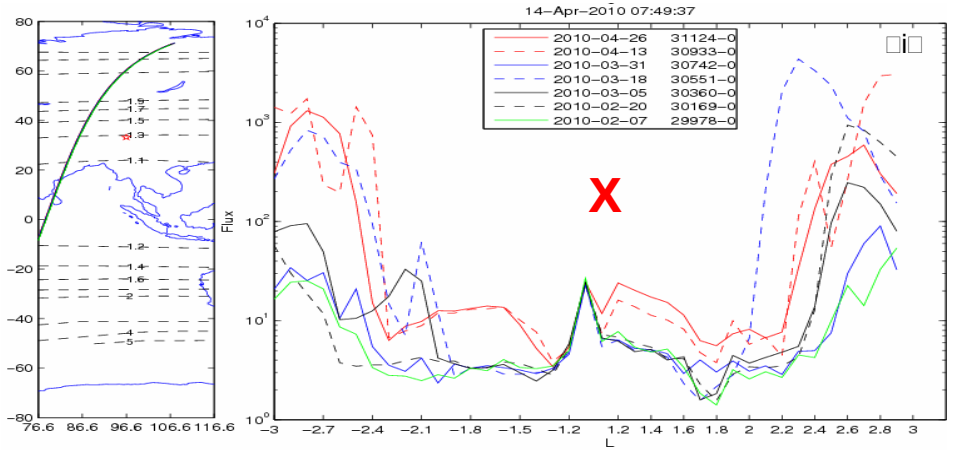
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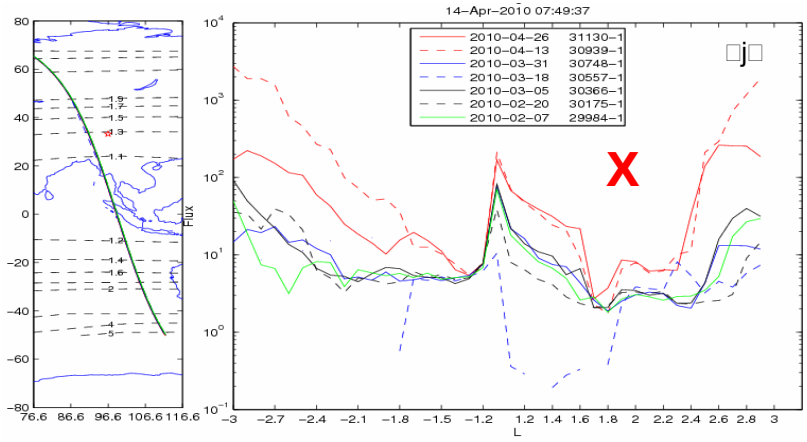
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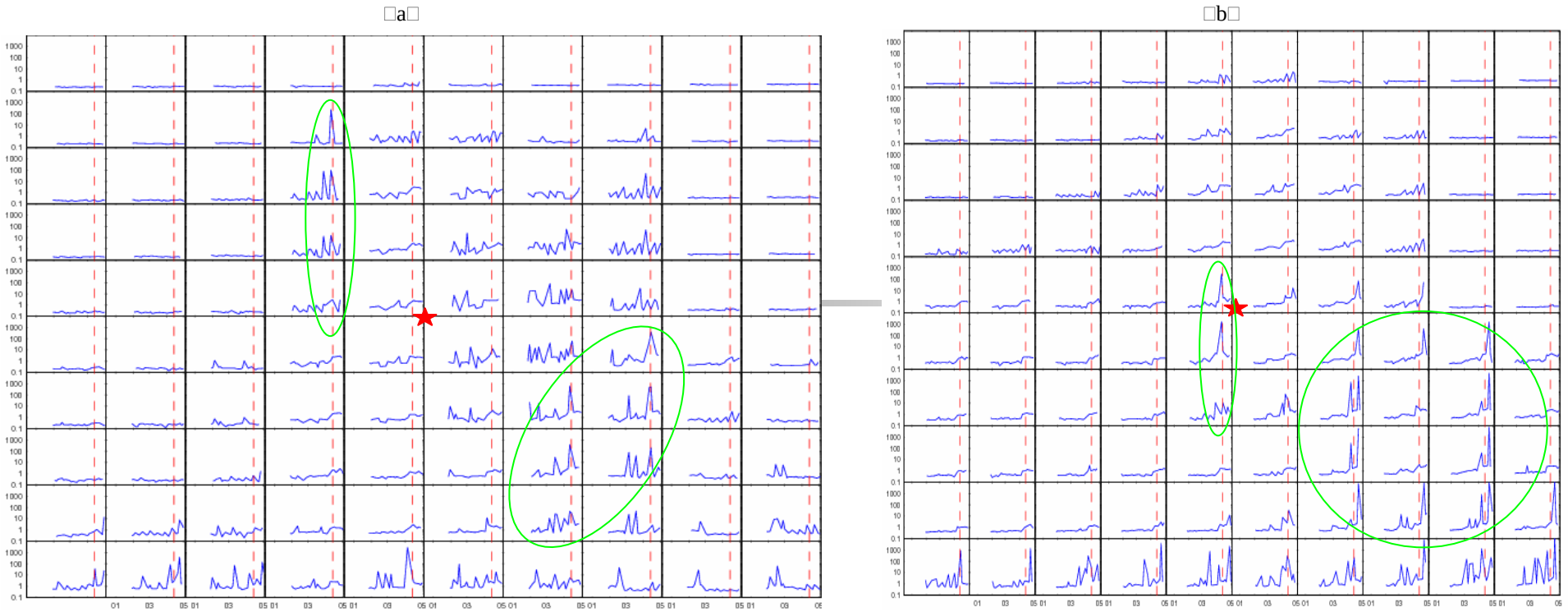
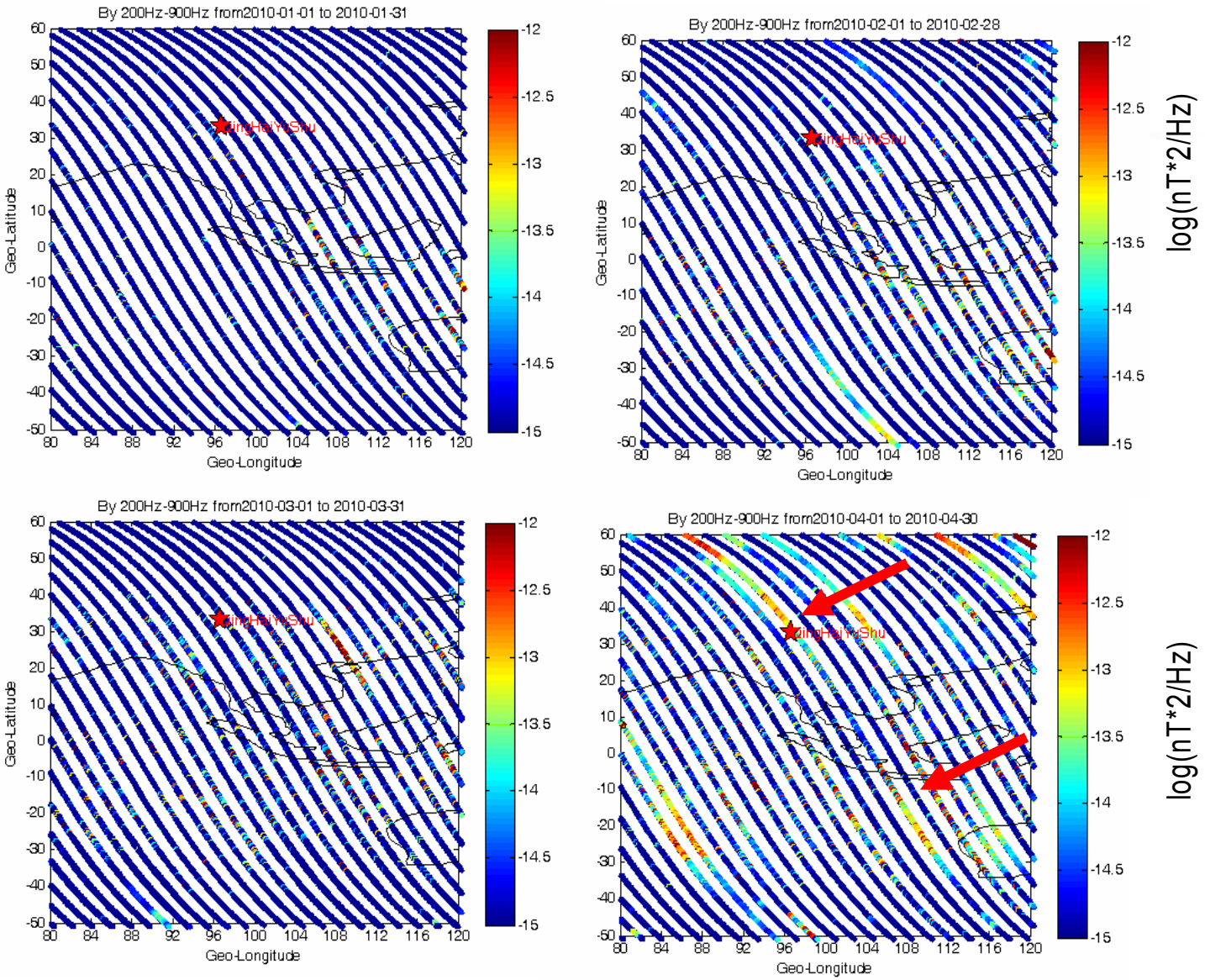


Spatial-temporal electron fluxes serials around the Yushu epicenter

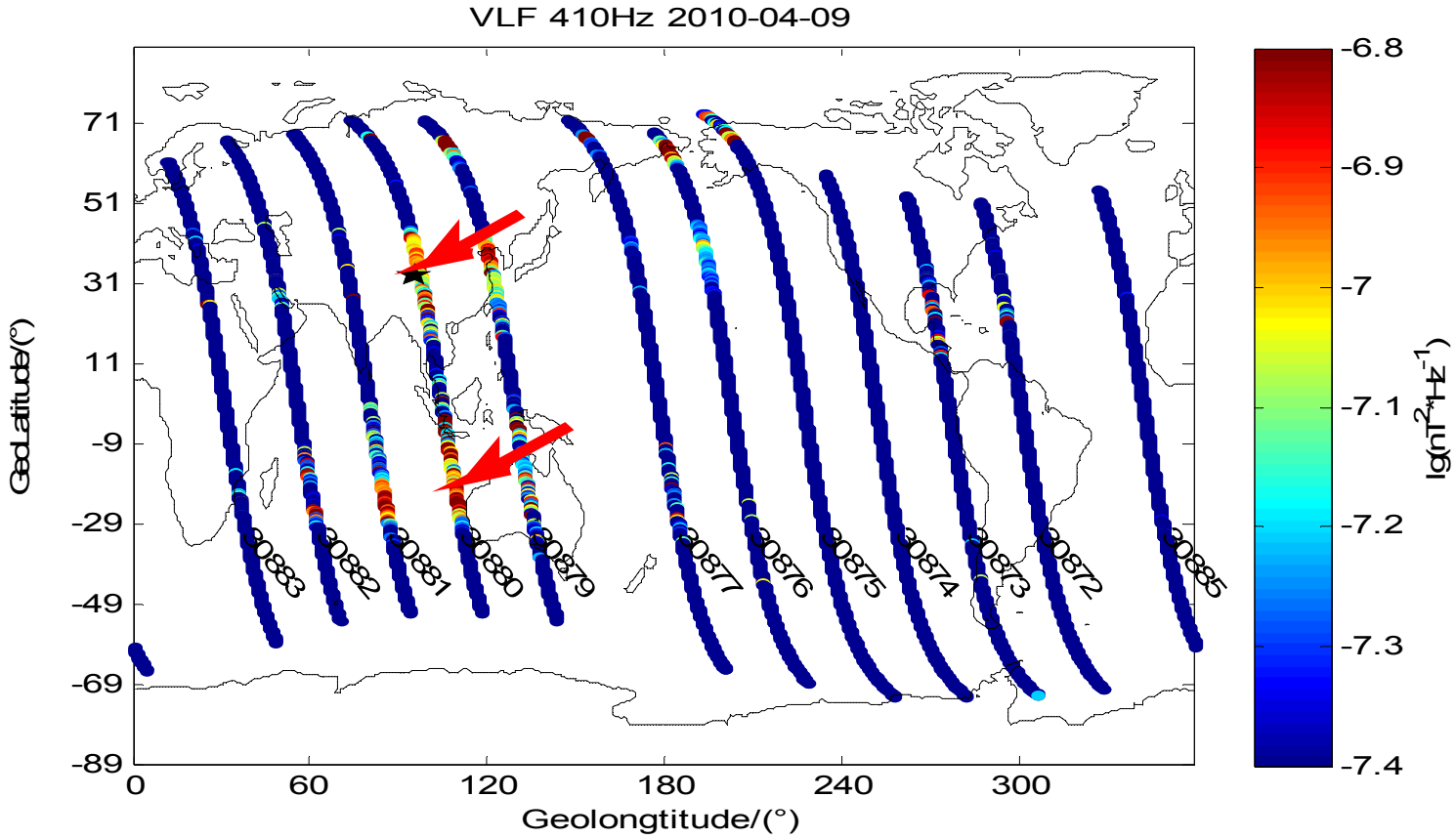
Red star: epicenter
(a)Serails during the night (decending orbits)
(b)Serails during the day (ascending orbits)

Each cell is 2°X 2°.

PSD of VLF [200-900Hz] for IMSC onboard DEMETER from 1 January to 30 April



global districation of PSD of VLF 410 Hz recorded on 9 April 2010



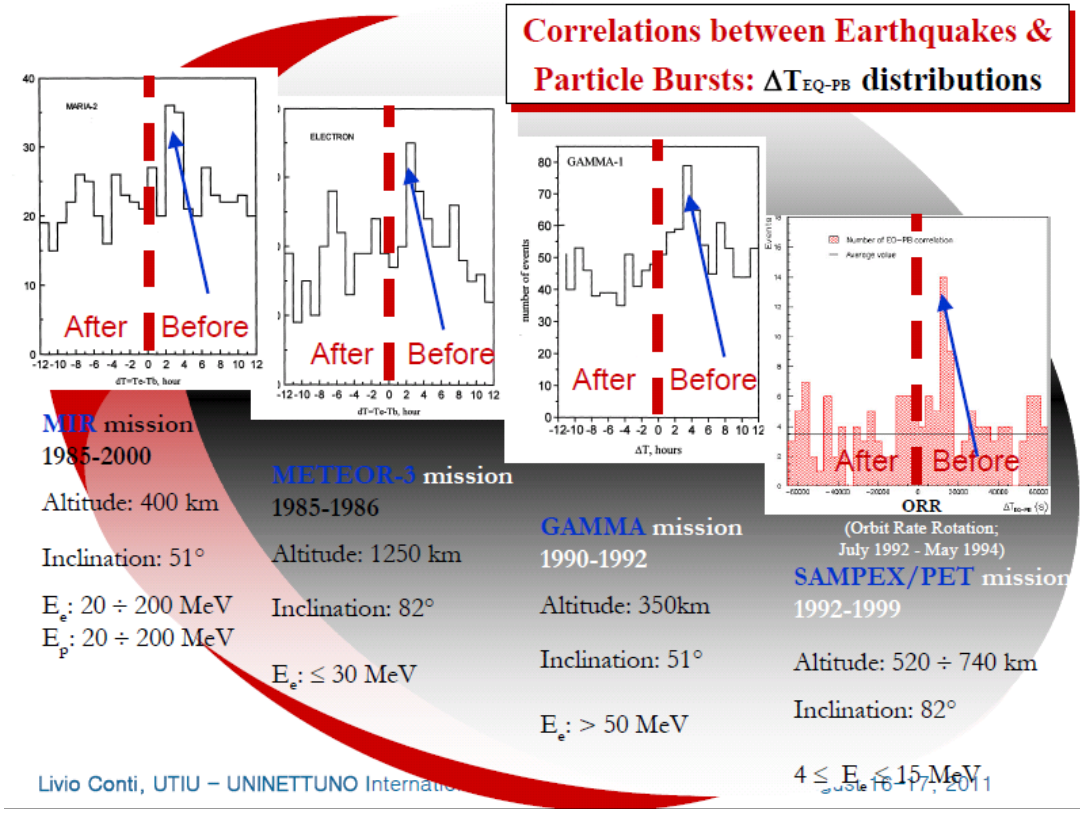
The star represents the epicenter, and the two red arrows indicate the enhanced PSD locations.

Discussion and Conclusion

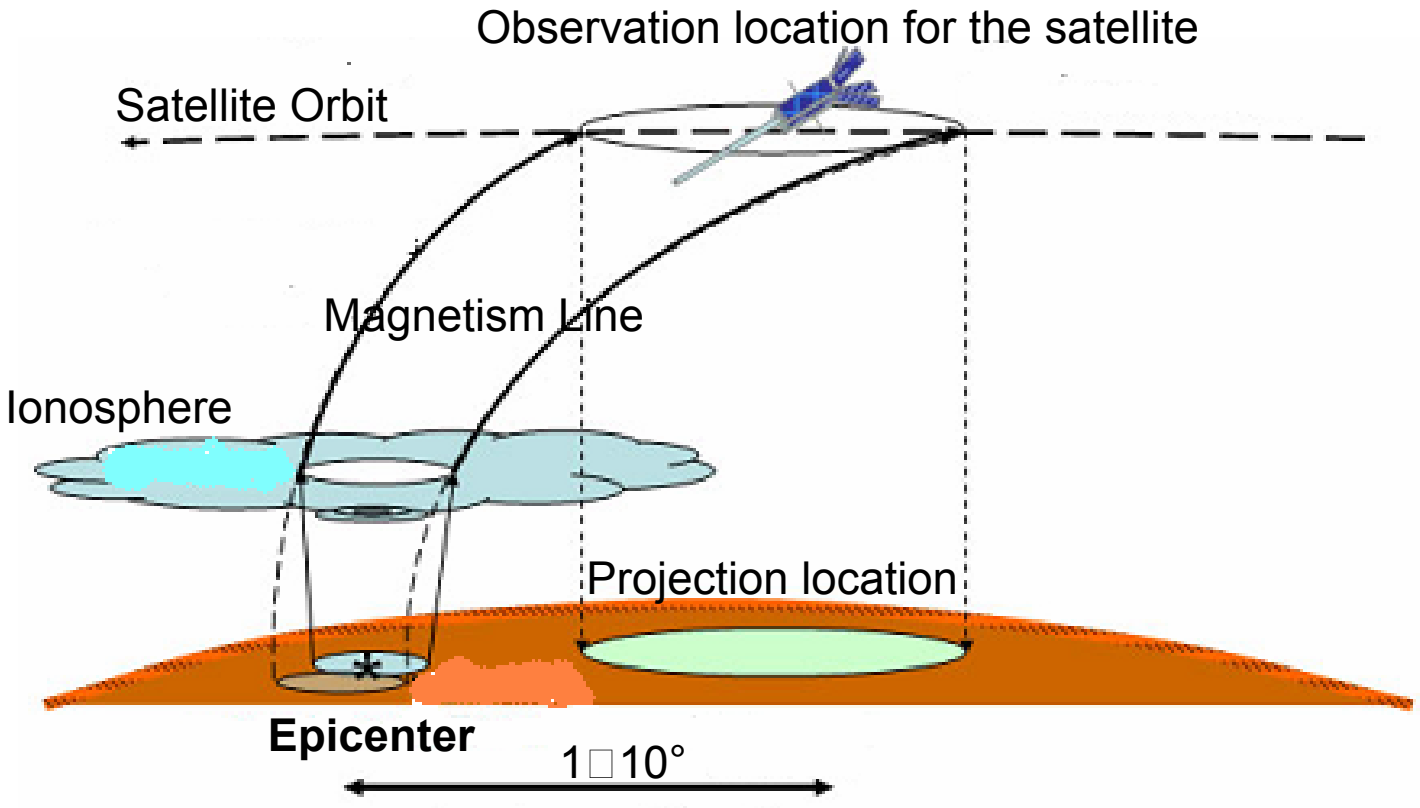
- 1. What's the reason for the variation of the electron flux and magnetism?

  If it is the magnetic storm, why are there local variations, not global ones?

- 2. Variation time of electron flux and magnetism appear several days before the Yushu earthquake, which are much earlier than the several hours in some previous statistic research.



- 3. The location of such variations deviates to the epicenter, which may support the LAI models for the EM transmission from the epicenter to the altitude of the DEMETER.



Thank you for your attention!

Acknowledgements: The *authors thank DEMETER Scientific Mission Center as well as the kind guidance of Prof. Parrot !*