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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Statistical similarity between high energy charged particle fluxes in near-earth space and earthquakes" *by* P. Wang et al.

Anonymous Referee #2

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Statistical Similarity between High Energy Charged Particle Fluxes in near-Earth Space and Earthquakes'

by Wang et al.

Main comments

This manuscript reports on the relationship between the rapid short-term variations of high energy charged particle fluxes, so-called 'Particle Bursts' (PBs) and the earthquakes occurrences. Particle fluxes were recorded by the electron spectrometer ex-

periment (IDP) onboard the DEMETER micro-satellite. This experiment allowed measurements of trapped electron fluxes in the energy range from 70 keV to about 0.8MeV, and provided information on the electron fluxes between 0.8 and 2.5 MeV. In this paper, the authors attempt to find a correlation between the PBs measurements and the occurrence of seismic events. Statistical properties of high energy charged particle fluxes are considered. Several aspects are developed without clear discussion about the 'PBs seismic precursors'. Hereafter some specific points to be addressed in the frame of this investigation.

Major comments

1. The method applied to analyze the statistical properties of PBs is partially described. In Section 3, it is not clear how the PBs frequency fluctuation is applied in the context of the probability density function (PDF).

2. The authors did explain why they excluded more than 50% of the DEMETER/IDP observations.

Specific points

1 Introduction The works of Anagnostopoulos et al. (2012), Caruso et al. (2007) and Corral (2004) should be detailed in this Section. Page 1- Line 16-27: Authors cited several references in this paragraph. However it is not clear if the seismic activity is related to all electron precipitations. Other effects like the man-made transmitters (e.g. Sauvaud et al., Geophys. Res. Lett., 35, L09101, 2008) should be cited in this paragraph. Page 1- Line 22-24: What are the other types of precursors? Page 1- Line 28: Is the 'spatio-temporal' related to the occurrence time and the location of the earthquakes. More explication should be given Page 1- Line 45: What means 'universal' statistical properties? Page 1- Line 46/475: Why the PBs plays the same role as the energy dissipated in earthquakes?

2 DEMETER data

Page 1- Line 58/64: This paragraph should be moved to the end of the Section. Page 1- Line 58: The word 'analogy' refers to what? I suggest writing: 'We analyze the PBs frequency fluctuations which are defined as...' instead of 'To study this analogy, we analyze the PBs frequency fluctuations. The PBs frequency fluctuation is defined...'. Page 2- Line 69/72: The authors should indicate the magnitude (M > 2) of the investigated earthquakes. In a Table, the authors may list (date, time, geographical latitude and longitude, magnitude) the strongest investigated earthquakes in the time interval 2005-2010. Page 2- Line 77: Why the southern hemisphere (lat: -90° to 0°) and the geographical longitude range (-100° to 45°) are excluded from this analysis? Page 2- Line 82/84: It is not clear from Fig.1a how 'one PB will be regarded as two or more PBs'? Page 2 – Line 84/92: Fig.1a refers to DEMETER observations of Feb. 2005. Is it the case of Fig.1b and Fig.1c? The selected areas and the time intervals are not given for Fig.1. A paragraph should be added to explain: (a) selected areas, (b) time intervals and (c) the gap origins (in Fig.1b and Fig.1c). Page 2 – Line 87: The successive frequency fluctuations are found positive and negative, according to Fig.1c. How the sign of z1 can be interpreted? Is this related to PB precursors when the z1 is negative?

3 Statistical similarity

Page 2 – Line 94/109: In the two paragraphs, the authors estimated the PDF of PBs frequency fluctuations. They did not give clear interpretations of their results (shown in Fig.2). Why the maximum of PDF is around the center (i.e. z(delta n) equal zero)? Are the increase and the decrease of the PDF related to the PBs precursors? What is the physical interpretation of the no symmetric distribution? Is this related to the PB precursor on the Earthquakes' preparation zone? Page 2 – Line 110/116: How the energy distribution of earthquakes is defined? Which seismic event data are used to find the power law of Fig.3a? Why the power law is not fitting the earthquakes data when the fluctuation distribution is smaller than 10 and 'S' bigger than 300 (magnitude around 5.7)? What is the magnitude of the earthquakes considered in Fig3a? Is the maximum (of magnitude) of about 7.0? Page 2 – Line 125: The agreement (in Fig.3b) only

concerns the earthquakes with magnitude smaller than 5.7. What about the strongest earthquakes, above 6 M?

4 Conclusions

Page 2 – Line 138/139: What means the 'spatio' correlation? Page 2 – Line 139: The authors come to the conclusion that the occurrence of earthquakes is 'spatio-temporal' correlated. In the paper, may be, only the 'temporal correlation' was analyzed but not the spatial one. Is it possible to compare their results to the work of Corral (2004)? Page 2 – Line 148: Are DEMETER/IDP measurements associated to the particle counting rates or to the charged particle fluxes? Page 2 – Line 147/150: Is it possible to estimate the time delay (in hours or days) between the PB events and the earthquakes occurrences?

References

It will be useful to consider alphabetic names in the reference list.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 3183, 2014.