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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Critical behavior in earthquake energy dissipation" *by* J. Wanliss et al.

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We thank the reviewer for helpful comments, criticisms, and suggestions. In what follows we will address these. The reviewers comments are first listed, and then our point by point replies.

"1) the chosen earthquake catalog is processed without any preliminary completeness analysis. The minimum magnitude is said to be 1.6, but there is no proof that it is complete down to that magnitude. Such an effect can be easily seen on their Figure 1, where we clearly see a change of the minimum of the signal after January 2003, betraying the change of completeness and/or detection ability with time."

We include a preliminary completeness analysis of our dataset. Following Rydelek and Sacks [1989] we define the completeness magnitude Mc as the lowest magnitude at which all of the earthquakes in a space-time volume are detected. The magni-

tude where the lower end of the distribution of frequency versus magnitude leaves the Gutenberg-Richter law is taken as an estimate of Mc. We use the method of Zuniga and Wyss [1995] in which Mc is estimated by fitting a Gutenberg-Richter model to the observed frequency-magnitude distribution. The expected relationship can be written like this:

ãĂŰlogãĂŮ_10 N=a-b(m-M_c)

In this equation N is the number of events with a magnitude larger than or equal to m, a is called the earthquake productivity, and b is related to the relative distribution of large and small earthquakes [Gutenberg and Richter, 1944]. The fit is computed using a maximum curvature as explained by Wiemer and Wyss [2000] and in Figure 1 we show the results of this preliminary analysis. Our best fit yields Mc=3.4, b=1.13$\pm$0.01, and a=7.75. Thus our catalogue satisfies the Gutenberg-Richter law only for M>Mc.

"2. the 3D spatial window reaches a depth of 700km. This means that they mix events occurring within media with very different physical properties and boundary conditions (superficial events and deep-focus events)." Although the spatial window is deep our data are almost entirely from much shallower regions, with the mean depth of recorded seismic activity mapping to a depth of 50.7$\pm$44.1 km. We will include this information as it implies that the mixing of events is not nearly as critical as the reviewer may have thought. However, we don't think that the problem of mixing events is at any event critical to our analysis. We have performed fractal, mutifractal and complex network analysis of the same dataset, and have found universal behaviors, common to this and other datasets. This in turn already suggests that some statistical features of seismicity are universal, regardless of the type of soil, fault and plates. We have no a priori reason to believe that the physical differences between event locations are important, though it would be interesting to contrast our results with results from other seismic regions in order to confirm this.

Points 3-8 will be addressed next.

Interactive comment on Nonlin. Processes Geophys. Discuss., 2, 619, 2015.

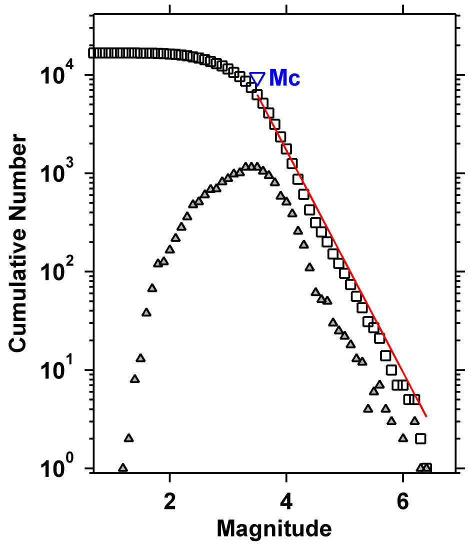

Fig. 1.