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Solid Earth
Discussions

Interactive comment on "Statistics of the Seismic Sequence and Rupture Directivity of the M5.5 Earthquake in Orkney, South Africa" *by* Carsten Dinske et al.

Anonymous Referee #3

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The authors applied several quite novel methods to the aftershock data of the Orkney earthquake. These include the Lower bound approach to determine the b-value of sequences whose largest earthquake is limited by the stimulated volume in case of fluid injection or by the mainshock rupture. This allowed to determine more accurate b and a values of the Gutenberg-Richter distribution. They also analyzed stress drops of aftershocks and appllied the back projection method to track the rupture of the mainshock.

The study has high potential, both thanks to the high quality data and novel methods. However, it did not use it's potential due to very shallow style of the analysis. It applies the methods as a black box without any description of parameers used, justificatioon of

their values, analysis of mutual influencing (trade-off) and similar. The authors even did not describe, at least in brief, the principle of the novel methods taken from the literature and specifics of their implementation. Another weak point is the arbitary choice of the methods applied. No reasoning is given, why b-value analysis of aftershocks and rupture spreading of the mainshock are applied in a common study.

Other comments could be raised, which would only support my clear impression that ths manuscript is not suitable for publication and that even major revision would not help. So I suggest to reject the submission and recommend the authors to consider limiting the analysis to only a single method (b-value statistics?), applied and presented in much more detail.

Comments

Ln 50-60 The end of Introduction is not structured accordingly. Exchanging the order of last two paragraphs starting on lines 49 and 55 would make it more logical. First, tell about the new catalog and next, tell what is your paper about.

Ln 58 How did you classify the three types of seimicity? This is very important to explain as your analysis is based on these data

Ln 71 Is the magnitude level separating the two types of G-R distributiion really M 1.5? I see rather about M 1.0

Ln 74-75 The limitation of aftershocks to the mainshock rupture area is a natural characteristics of any aftershock series, not only to the Orkney M5.5 earthquake

Ln 78 The Lower Bound model must be explained in detail as it is a quite new concept

Ln 79 Using 'We conclude' at this point seems too early; on top of that you should give reasons for this inference

Ln 82 The results given in Table 1 should be commented in detail

Ln 88 Your flow of thoughts is extremely fast - after spending 10 lines for b-value analy-

sis you switch to the stress drop for which you spend only two lines... Stress drop, as a very unconstrained parameter, should be discussed in much more detail; especially the stress drop derived from the Lower Bound model, which is new to most of the readers.

Ln 102 Again, any explanation about the data and method used for stress drop computation is missing.

Ln 128 How did you determine the window for trimming the data?

Ln 133 Please argue for using waveform absolute values and envelope for MRPI stacking. How were the envelopes determined - Hilbert transform? Did you use any frequency filter?

Ln 153 Please be more consistent. For in-mine stations you did not use the term energy stack. However, after comparing with Fig. 12 one finds that the same as for MRPI was used - waveform absolute values and envelope .

Ln 162-164 What you tell here about separating the catalog should have been told in more detail in the beginning

Ln 166 You mention dynamic stress drop, however you showed also static stress drop and Lower Bound stress drop as follows from Table 1

Ln 175-179 Explaining the Bayer's method looks a bit out of scope as you devote more space to it than to MRPI you have used

Ln 180 The reported complex rupture process of the Orkneey earthquake is not based on your results; it is the first occurrence of this term; similar holds for the initial origin and main origin (btw what do these terms mean?)

Ln 215 Author contribution: I do not think it is appropriate and ethical to grant authorship to the PIs of the Dseis project, if they did not contribute in other way. The funding agencies are normally acknowledged in Acknowledgements, and especially in this case it is DFG, which funded the research. So if DSeis contributed by data, ICDP should be

acknowledged instead of giving authorship to the PIs.

Figures

Fig. 2 Indicate by colours/symbols the three types of activity

Fig. 4 is not clear - meaning of symbols is not explained (crosses for the density and dots for the cummulative plot on the left). The cumulative data on the right are different than on the left; this might be the result of the LB model correction, which is however never explained.

Fig.6 is probably an LB model analog to Fig.5 - should be indicated

Fig. 7 is a bit out of scope. How did you obtain dynamic stress drops and for how many events. The reason of log-normal distribution must be discussed in detail. But comparison of normalized distributions looks interesting

Fig. 8 How did you choose the windows for trimming P-waveforms? I am asking because the window end is not increasing monotonously with the increasing S-P time

Fig. 12 The circular shape of the rupture might be an artifact of the method or the network geometry. This should be discussed.

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