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Interactive comment

Interactive comment on "The 2018 Lake Muir earthquake sequence, southwest Western Australia: rethinking Australian stable continental region earthquakes" *by* Dan J. Clark et al.

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General:

We agree with the reviewers that our contribution has attempted to cover a lot of ground, some not exclusively related to the new data presented on the Lake Muir earthquake sequence. With this in mind we have trimmed the manuscript discussion. However, we retain insight that the Lake Muir sequence has contributed to regarding stable continental region earthquakes. Further, we expand the introduction to appeal more to the international readership of Solid Earth, and better scope our stable continental region focus. One area of concern for both reviewers was the degree to which

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Discussion paper

deductions on earthquake genesis and relationships to faulting may be made from our main shock locations and aftershock relocations. We recognise that the uncertainties relating to earthquake locations were not well-communicated, and have rectified this deficiency. Specifically, we note that the uncertainties on aftershock locations are better than 300 m in all cases. The reviewed manuscript presented the initial Australian National Seismic Network locations for the three largest events in the sequence as these events failed key tests for double-difference relocation. This resulted in the undesirable situation where the main shocks were associated with horizontal location uncertainties of 5-6 km. In the revised manuscript we have relocated the two largest events based upon the relatively well located third largest event in the sequence. This relocation has resulted in collapse of the horizontal location uncertainty ellipses to $\sim$ 1 km, and allows for better comparison between main shocks, aftershocks, and surface and geological data. The revised Figures 3 and 6 are attached as an example of the improvement.

Reply to specific comments made by RC1:

âĂć Section 2.3. "Rapid Deployment aftershock kits… Regarding the seismic station deployment, the closest station has been located at least at 24 km far from the epicentral area of both earthquakes... large uncertainties might afflict the location of small magnitude earthquakes occurred during the swarms". The reviewer misunderstood our communication of the experimental design. The nearest permanent network station is 24 km from the epicentral area. This is explicitly stated in the text. The five rapid deployment aftershock kits range in distance from right on top of the first main shock (LM01), to 42 km distant (LM05). We have added text to Section 2.3, and the caption of Figure 2, to make clear that the black triangles with labels prefixed by 'LM' on Figure 2 are the temporary stations. We understand that the network, comprising permanent and temporary stations, is not as dense as might be achieved in regions where there is a higher perception of earthquake hazard (i.e. non-SCR), but are satisfied that our uncertainties (better than 300 m for aftershocks) is suitable to make our conclusions. âĂć

Section 3.5. “In my opinion this latter argument [new relationships between moment magnitude and surface rupture length] deserves a separate paper. The paper should be more focused to the expected results introduced by the title.” This section has been removed as suggested by both reviewers. âĂć Line 445-448. “They don’t clearly explain if they consider the November earthquake induced by a dynamic triggering of the September event . . .I think the clarification of this point could be an important statement for future and more addressed studies, for instance the fault ruptures interaction or the dynamic triggering between two or more seismic sources.’ Excellent point! The text has been modified to reflect the fact that we do indeed think that the second M5 event was triggered. Further, comparison to the other ‘swarm events’ in Australia which comprise M5 events suggests that mechanical interaction of ‘blocks’ results in subsequent proximal (or co-located) triggered events. We demonstrate in this article that the triggered events can have different failure mechanisms. âĂć “in Figure 6a there is an east-west oriented fringe interruption at latitude/longitude 6190000/4790000? How the Authors interpret it?” The text of Section 3.2 states “Coherence is also partly lost beneath an approximately 2 km wide (N-S) easterly trending band of pine forest (see Figures 3 and 6a for location)”. The north-south extent of this forest is clearly marked with an arrow labelled “pine forest” on both Figures 3 and 6a. We have added the following text to the caption of Figure 6: The north-south extent of an easterly trending band of pine forest associated with degradation of coherence is indicated with a white arrow in part (a). âĂć “For a “not Australian” reader is a bit hard to follow the text with the lack of a clear tectonic map containing the bright place names tags.” Figure 1 is a clear tectonic map as far as stable continental region crust may be divided with respect to seismogenic potential (e.g. Johnston et al 1994; Clark et al. 2012). In the revised manuscript, we have either included all Australian place names mentioned in the text in Figure 1, or written explicit locations into the text itself.

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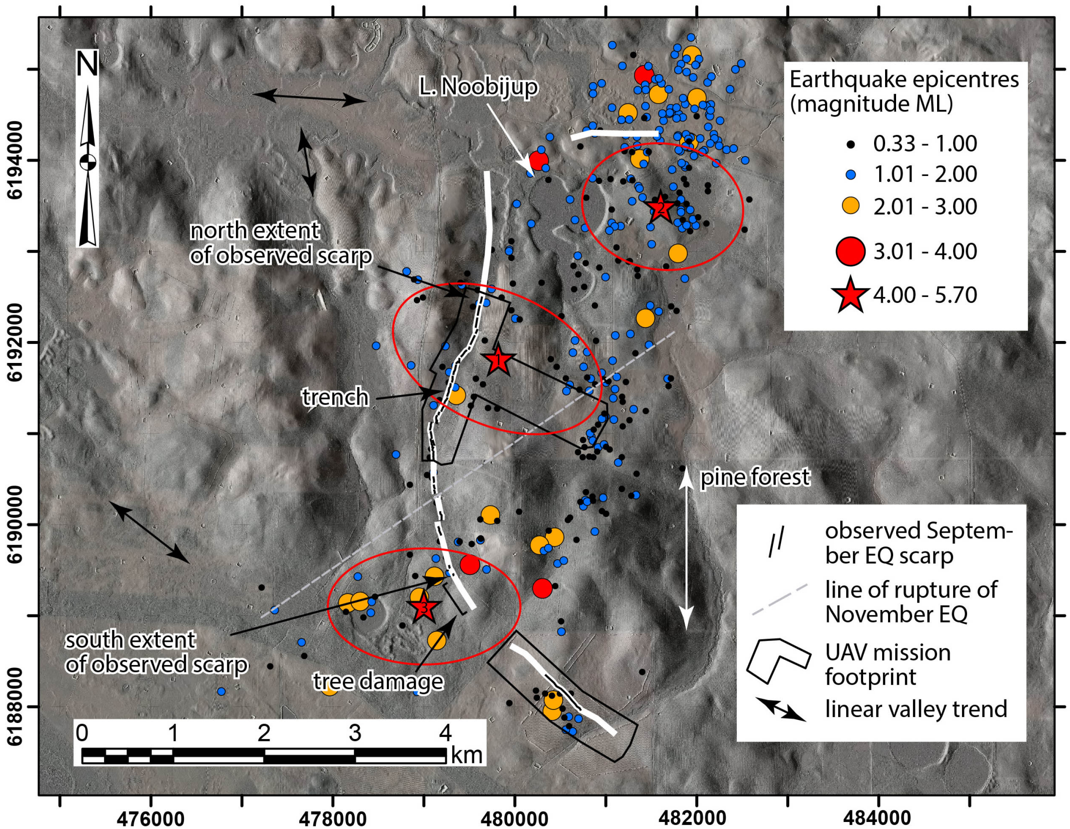

Fig. 1. Revised Figure 3: Map of the Lake Muir surface ruptures and associated seismicity.

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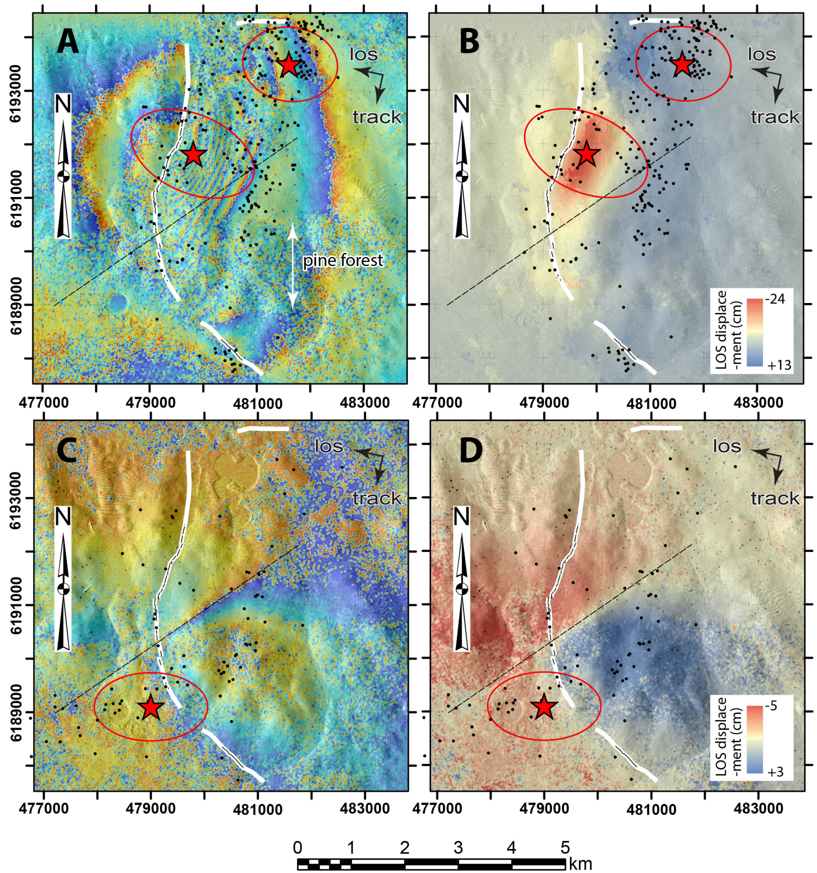

Fig. 2. Revised Figure 6: Phase images and images of the unwrapped InSAR line of sight (LOS) displacement field for the (a) & (b) September MW5.3 and (c) & (d) November MW5.2 events.

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