Dear reviewer,

Thank you very much for reviewing our paper titled " Spatiteomporial seismicity pattern of the Taiwan orogen". We have read the review carefully and have accordingly made substantive modifications to the manuscript and explained the details in the response letter below. The manuscript was revised to address all changes marked in red.

Sincerely,
Yi-Ying Wen and co-authors

Reviewer #2:
Comment: In the paper by Wen et al., Spatiotemporial seismicity pattern of the Taiwan orogen, the RTL algorithm is applied to the seismicity of Taiwan to investigate the seismicity patterns prior to M>6 events. Based on this analysis, the authors recognize two types of events, the ones that experience seismic quiescence before the mainshock (Q-type) and the ones that show seismic activation prior to the mainshock (A-type). Although the results seem interesting, there are some major issues with the analysis, which are discussed in the following. Therefore, I recommend major revisions before the paper can be reconsidered for publication.
Reply: We deeply thank reviewer for the thoughtful review of this paper. The comments below that allowed us to greatly improve this paper. The manuscript has now been carefully revised based on all comments.

Comment: 1) Revise the Introduction section and discuss the main objectives of the paper and how these will be accomplished.
Reply: Following reviewer's suggestion, we have added the description in L. 63-69.

Comment: 2) The RTL algorithm is based on characteristic parameters, such as the characteristic distance and time. The authors adopt these parameters based on previous studies in Taiwan. However, it should be shown and discussed how sensitive are the results of the RTL algorithm on these parameters.
Reply: Considering both reviews' suggestions, as reply for previous comment, we follow the systematical procedure of correlation analysis over pairs of RTL results proposed by Huang and Ding (2012) to obtain the optimal model parameters, $\widetilde{r_0}$ and $\widetilde{t_0}$, of each event to diminish the ambiguity in determining the characteristic parameters. We calculate 828 parameter sets of r_0 (ranging between 25 and 80 km with a step of 2.5 km) and t_0 (ranging between 0.25 and 2.0 yr with a step of 0.05 yr). After testing many criterion sets, the criterion coefficient C_0 = 0.6 and criterion ratio W_0 =0.5 are acceptable for each event, which means at least 50% of the total combination pairs with correlation coefficient $C \geq C_0$ = 0.6. Here, we obtained the average $\widetilde{r_0}$ = 49.6 km and average $\widetilde{t_0}$ = 1.16 yr. These model parameters are similar to those of previous studies for Taiwan (Chen and Wu, 2006; Wen et al., 2016; Lu, 2017; Wen and Chen, 2017). This supports the feasibility of our characteristic parameters. We have added the description in L. 85-99 and Appendix.

Comment: 3) The authors discuss that a complete catalogue is a significant factor for the RTL analysis and use the events with M≥2.5. Is this the magnitude of completeness since 1991 for Taiwan? Please justify.

Reply: Wu and Chiao (2006) pointed out that the CWBSN greatly enchanced the earthquake monitoring capability in Taiwan and reduced Mc to a value of about M_L=2.0 since the end of 1993, which is consistent with another work (Huang, 2020), as shown in Figure R3. For the RTL analysis, only event No. 1 involves 1-yr data of 1993, and it does not affect the result much.
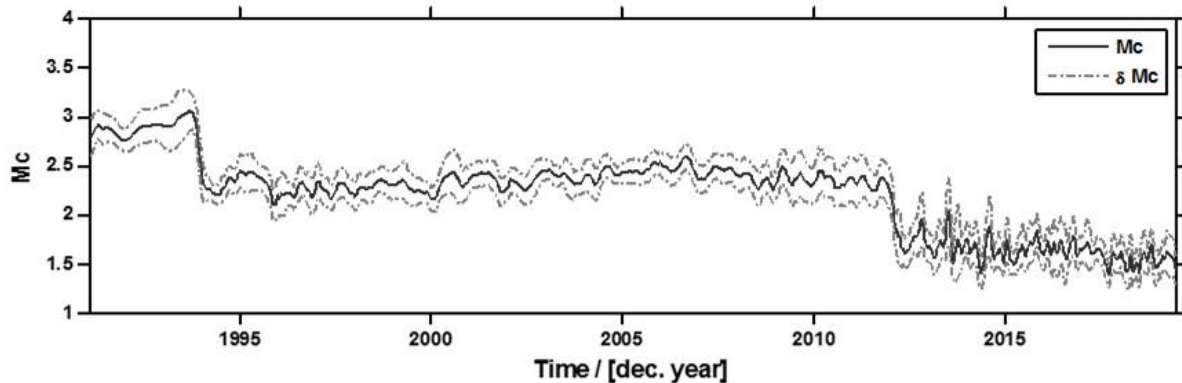

Figure R3: The annual variation of Mc in Taiwan. (Huang, 2020)

Comment: 4) The results of the RTL analysis, presented in Fig.2, further show negative RTL values and seismic quiescence stages prior to the quiescence stage identified and marked by the authors. How can these stages affect future large events and the main conclusions of the paper?

Reply: As reply in previous comment, this temporal phenomenon is similar to the situation of spatial pattern that most studies show the target event occurred on the edge of the seismic quiescence area. The seismicity rate change corresponds to the stress change, and the occurrence of mainshock can be interpreted as a perturbation of background seismicity by the stress state change (Dieterich, 1994; Dieterich et al., 2000). Wen et al. (2016) found that the 2010 Jiashian mainshock was occurred on a region with stress state changing from decrease to increase. It indicates that the large earthquake could occur on the region with anomalous seismicity and stress state change. Again, we emphasize that we intend to figure out the possible relationship between the seismicity change pattern and the regional tectonics, therefore, we focus on the characteristic of the seismic variation stage prior to the target event. As discussion in the manuscript, although some RTL values are small, they can still represent the meaningful seismic stage. For example, the seismicity increase following the 2003 Chengkung mainshock (event No. 1) can be identified by the temporal RTL functions of some close events with seismic activation stage between 2004-2006, including event Nos. 2, 5, 6, 7 and 3.

Comment: 5) The resolution of Fig.2 should be improved.

Reply: We indeed generate high-quality figures, however, the converted PDF file shows lower resolution.

Comment: 6) Discuss how the spatial variations of the b-value, shown in Fig.3, were calculated.

Reply: We have added the details in L. 257-265.

Comment: 7) In Fig.3, spatiotemporal clustering of seismicity is still visible following large events, although the catalogue is declustered. Are the aftershocks effectively being removed?

Reply: As shown in Figure R4, the cumulative number of earthquakes from declustered catalog suggests the aftershocks being removed effectively.
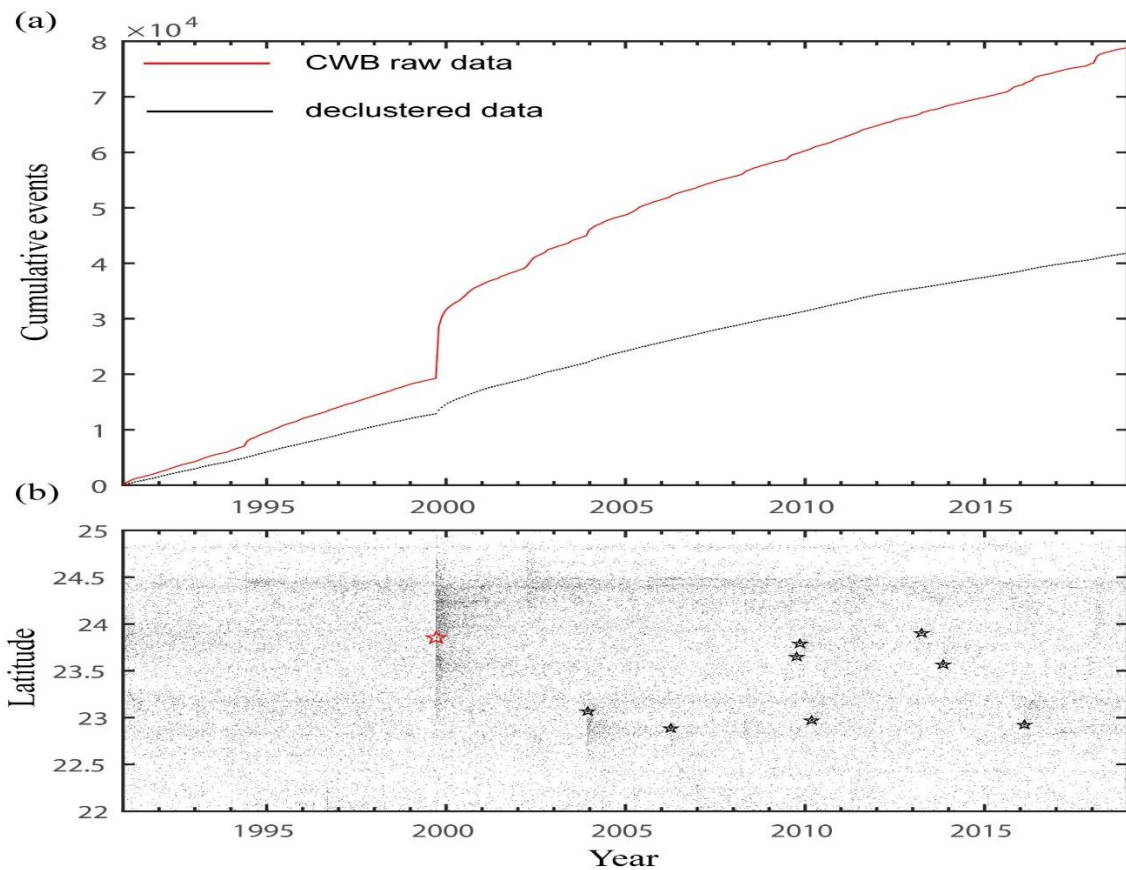

Figure R4: (a) The cumulative number of earthquakes from the original CWB catalog (red line) and the declustered catalog (black line). (b) The declustered seismicity distribution as a function of time and latitude.

Comment: 8) Line 133. How the four years time span prior to the investigated events was selected?

Reply: Various seismic activation or quiescence processes of about 2-4 years were found prior to some events occurred in Taiwan (Chen and Wu, 2006; Wen et al., 2016; Wu et al., 2008) and worldwide (Huang et al., 2002; Huang and Ding, 2012). Thus we only consider the last abnormal stage within four years prior to the investigated events.

Comment: 9) Lines 139-143. How the criteria i) and ii) were selected? Are the results sensitive to these criteria?

Reply: Since the influence weight of the RTL function is contributed from the location, occurrence time and magnitude of the prior events, Wen and Chen (2017) suggests that the sufficient number of background seismicity should be considered as a criterion. They set up the criteria through many testing, and we apply the same criteria here.

Comment: 10) In Fig. 4, explain what the colorbars represent. Similarly for Fig.6.
Reply: Thank reviewer's reminder, we have added more explaination in L. 168-169, L. 238 and the figure captions.

Comment: 11) Overall, a better justification of the presented results is required.
Reply: In this study, we use two different methods to investigate the characteristics of seismicity behavior for eight earthquakes. We do not intend to group them spatially in the beginning, but the results do. This gives another point of view for the seismicity pattern in different tectonics. Our results, which show many consistencies with several previously studies, are reliable and meaningful.

Comment: Some minor comments to the text concern:
1) A few issues with English language throughout the text should be improved.
Reply: We have sent our manuscript to a professional English Language Editing company before submitting this revision. Please find the Editing Certificate in the attachment.

Comment: 2) Spatiotemporal rather than Spatiotemporial.
Reply: We have corrected it.

Comment: 3) In Page 2, Lines 32-34, refer to the full names of these methods before using the abbreviations. Also add a brief discussion to introduce them properly.
Reply: We have added the full names of these methods in L. 34-37 and introduce three of them in various parts of the manuscript.

Comment: 4) Add Rundle et al. (2000) to the list of references.
Reply: We have added it.

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Spatiotemporal seismicity pattern of the Taiwan orogen

prepared by the authors

Yi-Ying Wen, Chien-Chih Chen, Strong Wen, and Wei-Tsen Lu

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