We would like to thank the anonymous referee for the thoughtful review of our manuscript and for giving these constructive comments and suggestions, which substantially helped us improve the quality of the paper. All the points that were raised have been adopted in the revised manuscript. We believe the new version of the manuscript has been significantly improved. Below is a point-by-point answer to the comments and suggestions raised by the reviewer.

Major comments:

1. Aftershock selection and illustration.

Number and locations of early aftershocks are critical in this algorithm. I am not sure how the early (within 2 h) aftershocks could accurately reveal the rupture pattern of earthquakes. I do recommend the authors make plots of the early aftershocks for the events shown in this manuscript. By doing this, readers can easily judge how the early aftershocks reflected the source dimension. Statistical analysis might be required to demonstrate this question.

Reply: In the new version of the manuscript, we have added temporal and spatial distribution plots of the early aftershock sequences of the Wenchuan Mw7.9 and Kaikōura Mw7.8 earthquakes in Section 2.2.2, as well as interpreted the insets. The added content is as follows: “The early aftershocks of these two earthquakes were mainly distributed along the direction of the surface rupture zone and within a certain range on both sides of the surface rupture zone, based on the spatial and temporal distribution of the aftershock sequences (Fig. 3). The Wenchuan earthquake's early aftershocks mostly occurred within 300 kilometers of the epicenter and were concentrated along the main rupture direction. And the early aftershocks of the Kaikōura earthquake were distributed within 200 kilometers of the epicenter and were relatively dispersed along the main rupture strike, which was primarily caused by the earthquake's complex fault system (Wallace et al., 2018). Early aftershocks in both cases exhibit a pattern of rupture in a single direction. Based on this, we believe that the fitting results in figure 2 can roughly depict the length and direction information of the earthquake rupture.”

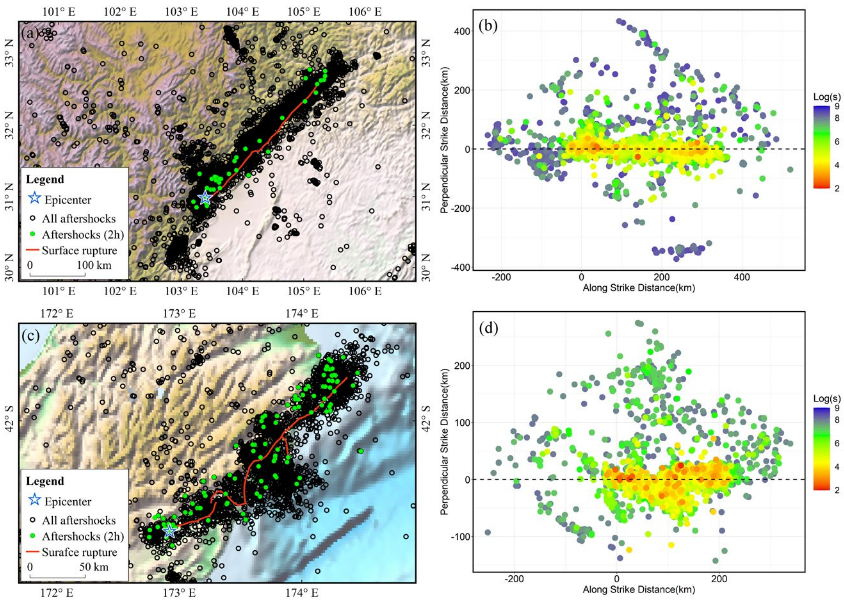

Figure 3: Spatial and temporal distribution of early aftershock sequences after the mainshock. (a) and (c) depict the spatial distribution of aftershocks of the 2008 Wenchuan Mw 7.9 earthquake and the 2016 Kaikōura Mw 7.8 earthquake, respectively. (b) and (d) depict the temporal distribution of aftershocks of the Wenchuan and Kaikōura earthquakes, respectively. The s in Log(s) denotes the time in seconds between the aftershock and the mainshock.

2. The authors have proven that the accuracy of the estimated intensity map by this method by comparing it with other results. That is good. We can estimate the damage levels in space. But the time efficiency is less discussed or demonstrated. How fast you could deliver this result? And comparing it with other approaches would greatly enhance the importance of this work.

Reply: Some discussion of time efficiency and comparisons with other methods are added to Section 4.2, and the corresponding references were added. The added contents are as follows:
"The primary goal of developing this method is to provide information services to response workers during the black box period of an earthquake emergency. Lessons learned from the calculations of all the cases in this study and from actual earthquakes emergency work (Zhao et al., 2022b; Zhao et al., 2023). If seismic stations in the seismogenic region are as sparse and uneven as those in western China, once the earthquake is determined to be suitable for use with AL-SM99, a reliable seismic intensity assessment map can be produced within 1-1.5 h of the mainshock. The majority of the time required to produce the results is spent acquiring aftershock data, while processing the aftershock data takes only a few seconds and the calculation and output of the maps takes about five minutes."
"Chen et al (2022a) proposed a rapid assessment method that can generate intensity assessment maps within 30 minutes. The spatial location of the rupture trajectories obtained from the inversion of rupture processes for earthquakes of small magnitudes may be less satisfactory (Honda et al., 2011; Yao et al., 2019). In small-magnitude earthquakes, however, seismic intensities assessed using aftershock data may be more accurate (Kang et al, 2023). The AL-SM99-fitted curves of the spatial distribution of aftershocks can be used as a cross-reference for the correction of the above inversion results, speeding up the operation using both methods. For global earthquakes, when the magnitude reaches the trigger threshold of the ShakeMap system, it will generate the first version of the assessment results through the original solution built into the system within minutes after the earthquake, and will be continuously updated as data is aggregated and accumulated (Worden et al, 2020). It inspires us to combine AL-SM99 with aftershock monitoring to dynamically present intensity assessment results, since for earthquakes with small rupture scales, relying on the epicenter coordinate or a small number of aftershocks can provide very useful shaking distribution estimates."
Reference:
"Honda, R., Yukutake, Y., Ito, H., Harada, M., Aketagawa, T., Yoshida, A., Sakai, S. I., Nakagawa, S., Hirata, N., and Obara, K.: A complex rupture image of the 2011 off the pacific coast of Tohoku earthquake revealed by the meso-net, Earth Planet Sp., 63(7), 583–588, https://doi.org/10.5047/eps.2011.05.034, 2011."
"Yao, Q., Wang, D., Fang, L. H., and Mori, J.: Rapid estimation of magnitudes of large damaging earthquakes in and around Japan using dense seismic stations in China, Bull. Seismol. Soc. Am. 109, 2545–2555. https://doi.org/10.1785/0120190107, 2019."

3. To better validate the accuracy of the source dimension estimated from the early aftershocks, the authors could compare your results with source ruptures, at least for large earthquakes. I believe there are many cases that can be utilized for such comparison.

Reply: Nine earthquakes with Mw⩾7.0 were used as an example in Section 3.2.Our results were compared to surface rupture lengths calculated using an empirical formula for wells and those documented in the literature, and the average linear direction of surface rupture was calculated using ArcGIS software (Table 2). Subject to the conditions of use, the results of our method's fitting can provide reasonably accurate information on the length and direction of surface rupture. In addition, we include a comparison with the back-projection results of Chen et al (2022a) in this section, which supports our conclusions. However, since Lowess is essentially a nonparametric regression method that ignores the complex physical relationships contained in the aftershock sequence, we believe its results cannot fully replace those obtained through physical means (e.g., back-projection techniques). But the different methods can be cross-referenced to make further corrections to the results. The added content is as follows:
“We gathered the source rupture data from Chen et al (2022a) using the back-projection technique. And using the same technique, a set of results reflecting the surface rupture of the 2016 Kaikura Mw7.8 earthquake was calculated, using waveform data from high sensitivity seismograph network in Japan. Both the Lowess and back-projection results show rupture directions similar to those indicated by the long axis of the isoseismic line in the area with intensity VIII of the Wenchuan earthquake, but the former estimates a longer rupture length (Fig.11(a)). Furthermore, the back-projection results reveal more details about the rupture. For example, the back-projection results point to a possible fracture near the IX-degree intensity anomaly in the long-axis direction. This method has also demonstrated benefits in determining the intensity anomaly area in the application of the 2022 Maduo Mw7.3 earthquake (Chen et al, 2022b). As a nonparametric method, the points fitted by Lowess are clearly distributed along a curve. However, when the fault system in the seismogenic region is complex, the dominant orientation of the rupture traced using the back-projection method may be problematic(fig.11(b)). A clear guide to array data selection may be required when using the back-projection method, and we recognize that the results of array data calculations will be more accurate if the appropriate region is chosen. We believe that the two methods can be cross-referenced in their application to obtain more accurate intensity assessment results.

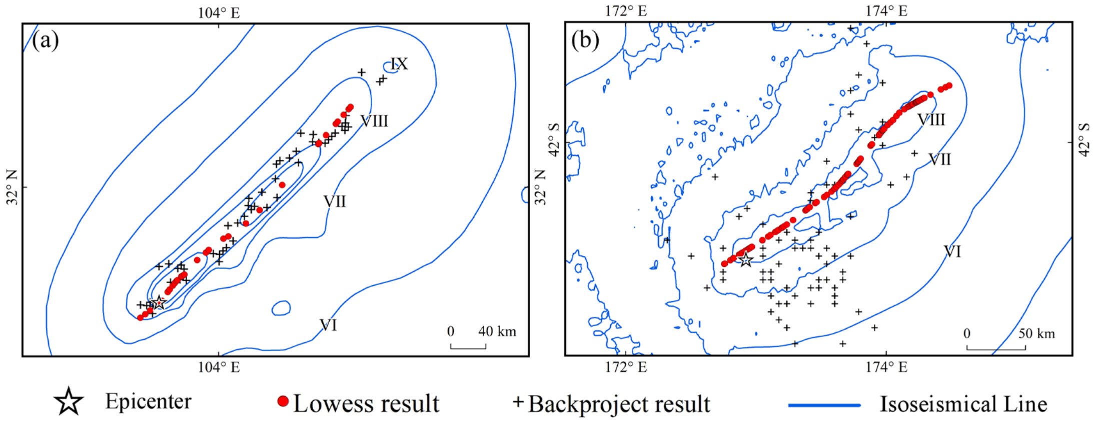

Figure 11: Comparison of surface rupture results obtained using the lowess and inverse projection methods for the

(a) 2008 Wenchuan Mw 7.9 and (b) 2016 Kaikōura Mw 7.8 earthquake."

4. Comparison of your results with Chen et al. (2022a, b) that you already cited in this work is also beneficial.

Reply: We have added a comparison with Chen et al's (2022a,b) work to both the examination of the source rupture results and the discussion of time efficiency, which adds to the richness of our manuscript.The additions are mentioned above in the responses to major comment 2 and 3.

Minor comments:

1. The English needs improvements.
Line 10, mainshocks
Line 13, of 59 M XXX~XXX earthaukes that occurred from 2000-2022
Line 21, Our study suggest that with early accessible aftershocks, we are able to rapidly determine the rupture fault plane (s), thus have better estimae of the seismic intensities.
Line 44, of an earthquake is limited,
Line 47, after earthquakes
Line 94, We selected Mw ≥ 6.6 shallow earthquakes that occurred during 2000-2022 in this study.
...

Reply: We have checked the language errors in the manuscript and polished it.