Dear Prof. Dr. Wenbin Xu,

Thank you for considering our paper for Seismica and the reviews. Please find our answers to the comments of the reviewers (black) below beneath each comment (grey).

Yours faithfully,

Malte Metz on behalf of all authors

Answers to comments from Reviewer A:

Reviewer A:

Dear authors and editor,
I enjoyed reviewing the manuscript “The July-December 2022 earthquake sequence in the southeastern Fars arc of Zagros mountains, Iran” and I suggest it for publication pending minor revision.

This paper provides a detailed analysis of a series of earthquakes in the SE Fars arc, Iran, in July and November 2022. Three main earthquake sequences, mainshocks ranging from Mw 5.6 to 6, were analyzed using different techniques. The authors solved these earthquakes' source mechanisms and rupture planes by combining geodesy and seismic data with joint inversions and relocating the aftershock sequences. The region is known for blind thrust faults regarding sedimentary cover vs. basement involvement. Thus, this kind of detailed analysis is necessary and quite helpful.

The manuscript is in a rather good shape; the research is well explained, and detailed information about each technique, results, and discussion sections are well covered. I want to thank the authors for including their results in the supplementary section and taking the time to prepare publication-ready figures. My comments, written below, are very minor:

- Mainshocks (Table 2) could also be relocated to determine the hypocenter depths. Probably the authors would need to use a relocation code that doesn’t require waveform access. It looks like ISC has phase arrival data for these events starting at ~0.9 degrees. With these data, you could probably estimate hypocenter depths with ~ 3-5 km depth error. Previous studies (e.g., Wei et al., 2015) show that mainshocks could also initiate deeper than the resolvable slip patch, like the aftershock. It would be a valuable point to add to the sedimentary cover vs. basement depth discussion in section 4.1.

Wei, S., S. Barbot, R. Graves, J. J. Lienkaemper, T.Wang, K. Hudnut, Y. Fu, and D. Helmberger (2015), The 2014 Mw6.1 South Napa earthquake: A unilateral rupture with shallow asperity and rapid afterslip, Seismol. Res. Lett., 86(2A), 344–354.

We have reassessed the hypocenter depths using the abedeto tool (https://github.com/HerrMuellerluedenscheid/abedeto). It utilises the time difference of teleseismic direct P and surface reflected pP wave arrivals to obtain the hypocenter depths for small to moderate earthquakes. Results are added to the main manuscript and the supplementary material. We also added the results into the discussion to provide a more complete picture of the analysed earthquakes.

- The listric fault activation possibility (Figure 9) can be further tested following Eyidogan and Jackson (1985) and Braunmiller and Nabelek (1996). To see whether the A2 event involved listric faulting, it could be represented as separate point sources with different dips and depths and solved accordingly. If this gives a better fit, then listric involvement would be likely.

We acknowledge the proposed test for listric faulting but have our concerns with respect to application to the event A2. A profound analysis of listric faulting as shown by Braunmiller and Nabelek (1996) requires good knowledge of the earth's structure at the location of the earthquake to model . According to the authors, it also requires a fault of a certain minimum dimension to assess the moment contributions at the centroid, and at the top and bottom rupture plane edges (15–20 km). Finally, clear waveform signals for P and S waves are needed.
A2 is rather small (Mw 5.7–5.8) compared to the earthquake cases Braunmiller and Nabelek (1996) applied their method on, which were assumed to rupture the whole brittle crust. Furthermore, we don't have a very detailed knowledge of the subsurface structure in the area. That reduces the resolution on small effects in the waveforms caused by a possible change in dip along the rupture plane. We also don't have very good waveform records, especially of the S-waves due to the interference of the P-waves of A3, which were emitted ~1 min after A2.
As we have also not seen other clear indications for listric faulting (e.g., location lineaments of the aftershocks along listric trajectories), we have decided to not test this rather unlikely option. We have added a sentence into the discussion with respect to Braunmiller and Nabelek (1996) to summarise this comment within the manuscript.

Braunmiller, J., and J. Nabelek (1996), Geometry of continental normal faults: Seismological constraints, J. Geophys. Res., 101, 3045–3052, doi:10.1029/95JB02882.
Eyidogan, H., and J. Jackson (1985), A seismological study of normal faulting in the Demirci, Alasehir and Gediz earthquakes of 1969–70 in western Turkey: Implications for the nature and geometry of deformation in the continental crust, J. Geophys. Res., 81, 569–607, doi:10.1111/j.1365-246X.1985.tb06423.x.

Minor comments:

- The abstract and non-technical summary earthquake dates (years), written as 2023, need to be corrected.

Done. The dates have been corrected to 2022.

- It would be helpful to have BELA annotated in Figures 3 and 7 (e.g., lines 305-306)

Done. Annotations have been added to Figures 3 and 7 along with an explanation in the figure captions.

- Can you add information about the gray profile lines to Figure 4 b, and d? (and to similar figures)

The profile lines show the elevation along (dark grey) and around (light grey) the used profile line A–A'. We have updated all figure captions where necessary (Figs. 4, 5, 8).

- Fig 9 can benefit from a north arrow.

Done. We have indicated North in each profile. We also indicated the profile line A–A' (as used in Figs. 4, 5, and 8) for better comparability to the mentioned figures.

Answers to comments from Reviewer B:

Reviewer B:

The authors examined an earthquake sequence in southern Iran with seismologic and space-geodetic methods, and found diverging source depth for some or all the main shocks and their corresponding aftershock sequences. They note that this observation would be controversially discussed, but I could not follow the controversy, as the authors claim that this behavior is frequently observed in the area and might go back to a weakness layer in the middle crust.

We acknowledge your comment and have rephrased the abstract, parts of introduction, the discussion, and the conclusion for a more consistent wording with respect to the vertical separation of main- and aftershock, e.g. we have removed “controversially” from the abstract.

The manuscript can not be followed easily, in part due to the sometimes flawed grammar, in part due to the many methods applied, which made it difficult for me to navigate the manuscript. It might be worth to thoroughly edit the manuscript for grammar in a new submission. It may also help to structure the methods applied more clearly.

We have included a new introductory paragraph within both the method and the results section to clarify the structure of these parts and simplify the navigation for the reader within the manuscript. Furthermore, the whole manuscript was reviewed and edited again by all authors to minimise grammar errors. We also applied the grammarly tool to our text.

Here are a few minor comments:
l. 14: Fars Arc (uppercase)
Done. Spelling is now “Fars Arc” through the whole manuscript for consistency.

l. 15 , characterized ... diapirism,
Done. Commas have been added.

l. 21: in -> at
Done.

l. 51: world's most
Done.

l. 53: doublets: A brief definition would be helpful to allow the reader to follow more easily
We changed the sentence to clarify the definition of earthquake doublets and multiple earthquakes.

l. 71: Fars Arc (FA) should be abbreviated earlier on
Done. Abbreviation is now done at the first occurrence in the main text.