Natural Hazards and Earth System Sciences
Discussions

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC1
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Comment on nhess-2021-393

Anonymous Referee #1

Referee comment on "Classifying marine faults for hazard assessment offshore Israel: a new approach based on fault size and vertical displacement" by May Laor and Zohar Gvirtzman, Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2021-393-RC1, 2022

Review to nhess-2021-393:

"Classifying offshore faults for hazard assessment: A new approach based on fault size and vertical displacement", by Laor and Gvirtzman.

Laor and Gvirtzman propose innovative and elegant approach to cope with fault hazards in marine environments, a challenging territory to explore this geohazard. The suggested methodology is formulated and exercised in a case study along the continental slope offshore Israel, but can be applied elsewhere around the world in similar marine environments. This paper is well worth publishing in NHESS.

Hereby I propose several comments and suggestions that in my opinion will improve the manuscript, widen the scope of the discussion, and extend its role among the previously published faults, landslides and seismicity maps of the study area.

General Comments

- **Fault hazard**: The problematics of fault hazards should be explained already in the introduction so as to allow the reader a better background and understanding along the text and before arriving to section 5.4 and Figure 13. Please resolve this general term into its specific aspects: surface rupture, coseismic deformation and ground acceleration. Hidden/blind faults may produce coseismic deformation without surface break.

- **Fault maps**: Several fault maps have already been published in the past and besides citing them it is important to discuss, at least qualitatively, how the newly presented map relates to them. Furthermore, past researchers proposed hypotheses about specific faults, such as the one along the Israeli coastline, the Pelusium line (Neev et al,. 1973), transversal faults bordering the Palmahim disturbance (Garfunkel and Almagor, 1979), fault offshore the Carmel Coastal Plain (Kafri and Folkman, 1981), etc. I think it is important to place the present work and discuss its role among and along the history of research, at least in a quantitative manner.

- **Seismicity**: Studying active faults, there is a need to refer to the ongoing seismicity in the region (e.g. Katz and Hamiel, 2018) by discussing the finding of the present work in relation with the location, depth, magnitudes and mechanism of the continental slope seismicity, at least qualitatively.

- **Seismogenic zone**: The PGA map of the Israeli Building Code 413 is based on seismogenic zones defined by Shamir et al. (2001). How does the presented hazard map (e.g. Figure 13) relates to these zones? Should the continental slope be added as a new seismogenic zone to the database of the Israeli PGA map?

- **Landslides**: Same idea as above.

Specific comments

Highlights

I suggest rephrasing the highlights to better speak in favor of the importance, finding and potential application of this work. For example, the first highlight (Mapping "active faults"…) is a general notion not specific to this study; the forth highlight (Large faults scarps…) seems to have already been attributed to Elfassi et al. (2019a) in lines 142-144?

Abstract

You propose a new innovative approach and exemplify it on the specific case study of the Israeli continental slope. Why not wrapping up the abstract by proposing its implication and application to elsewhere similar marine environments, marine building codes, hazard assessment for submarine infrastructure facilities, etc?

Line 21: Please explain in short, what do you mean by 'active faults': are they capable of surface rupture, coseismic surface deformation, ground acceleration, and within a given time frame? See also the relevant comment above.

Line 28-29 (and 64-65): You write about three hazard levels but mention only two? What would be the role of the middle category?

Introduction

Lines 45-46: Some of the works mentioned in the introduction did dealt with active faults (e.g. Armijo et al., 2005); also, there is very interesting work of Elias et al. (2007) regarding active historical seismogenic fault offshore Lebanon, I think it should be mentioned as well.

The Dor and Palmahim disturbances play major role in this study. There is a need to give some background about them.

Section 1.2 deals with the goal and the methodology of this work. Consider rephrasing the headline to 'Goal and methodology'?

Chapter 2. Scientific background

Lines 144-147: I think this hypothesis needs to be verified by magnitude estimation. For example, as a thumb rule, M~6 crustal earthquakes are considered the minimum for generating surface rupture. What would be the estimated magnitude of the high (red) hazard class of faults for generating surface rupture - you have length, depth, area, and can assume vertical offset, say 1 meter?

Lines 157-161: "… it has been suggested that faulting was initiated by basinwards salt flow" - is this explanation relevant also to group II (Figure 9) that is located outside the salt area? Or also to group I of strike slip nature?

Lines 171-174: There is a need to present in short the nature of the 350ky horizon, it is the key for evaluating the recent activity of the study faults. Similarly, describe in short the lithology of units 3 and 4. Is it the contrast between the two that yields the 350 ky horizon? Unit 4 is the lithological environment that hosts the faults system studied in this work.

Section 3.2 Bathymetry data and Table 1

What are the uncertainties associated with these grids, mainly in the vertical dimension,

which is the key parameter to define the total offset and rate of slip.

Section 4.4. Fault geometry and location

Lines 328-332: Looks to me also like a set of blocks rotated around horizontal axis?

Discussion

Line 380 – The very high sedimentation rate could also be attributed to down slope transport of materials?

5.4. Assessing the hazard of surface rupture

466-470: Please note that modern approach for surface rupture hazard mitigation is being developed towards Probabilistic Fault Displacement Hazard Analysis (PFDHA), much like PSHA for ground shaking.

There are a few transversal (striking E-W) faults in the mapped region. They seem to be unique and deserve some attention.

Technical comments

Hidden faults: Do you mean blind faults?

Lines 243-249: Can you explain the reason for the increase of sedimentation rate from the deep basin towards the off shelf zone? If this area is also subject to slope failure, one would expect increase of sediment accumulation towards the basin?

Line 308-9: Please rephrase.

Line 310: Should be: "dashed red line in…"?

Figures

General: Please increase font size of coordinates, legend or any text where needed, e.g. Figures 3c, 4, 6, 9, etc.

Figure 1: I suggest increasing the area covered by the bottom left inset so as to allow orientation to readers who are not familiar with the research area, and please, add coastline.

Figure 3c: Please explain in the caption the areal extend of section 3c. Also, denote the location of Palmahim disturbance.

Figures 7, 8, 9: Please mark the location and extent of these maps on one of the previous figures.

Figure 10b: Please mark unit 1 on panel b.

References and sources of Information

Can you provide references or links to the sources of data mentioned in Table 1? Else, I believe you need to acknowledge these sources?

Reference to the Kingdom HIS platform?

References not mentioned in the text

Kafri, U. and Folkman, Y., 1981. Multiphase reverse vertical tectonic displacement across major faults in northern Israel. **Earth and Planetary Science Letters**. Volume 53, Issue 3, Pages 343-348

Katz, O. and Hamiel, Y., 2018. The nature of small to medium earthquakes along the Eastern Mediterranean passive continental margins, and their possible relationships to landslides and submarine salt-tectonic-related shallow faults. Geological Society, London, Special Publications, 477, 15-22, https://doi.org/10.1144/SP477.5

Shamir, G., Bartov, Y., Sneh, A., Fleischer, L., Arad, V. and Rosensaft, M., 2001, Preliminary seismic zonation in Israel. GSI Report No. GSI/12/2001, GII Report No. 550/95/01(1).