

A. GENERAL COMMENT

I enjoyed reading the manuscript written by Vervoort et al, which presents a co- and post-seismic record at Lago Pollux, and shows that along with previously published studies (Lago Castor; Van Daele; 2016 and Aysén Fjord, Wils et al. 2020), local faults can also produce significant earthquakes. The authors use a 'common' methodology in lake palaeoseismology but brings here ground motion modelling to derive the most likely magnitude and source fault, which is quite innovative and interesting.

The manuscript is well written and organised, although I found it sometimes relies heavily on the findings of Van Daele et al. 2016 and Wils et al. 2020, which can overshadow its original contributions and make it difficult to follow without prior knowledge of these papers. I think making some more clarification or adding supplementary information in the methods and results sections could help reducing this issue.

Another point that concerned me a bit was the lack of important key information about how the age models were made. Although not from their study, the correlation between the Lago Castor and Aysén Fjord sediment cores is an important point in their discussion section. Their argument is based on synchronicity and then on the age models, which can be very different from one method to another. I then suggest please to write explicitly how they were modelled in the respective articles, at least briefly, which modelling settings and inputs.

Regarding the last part of the manuscript, I think that the results and discussion regarding the source fault model are very interesting, but the readability and visual quality of figures 9 and 10 do not allow readers to take full advantage of them. I believe that improving these figures will greatly enhance the impact of your study.

Therefore, I recommend minor/moderate revisions to address these concerns before considering final publication.

B. SPECIFIC COMMENTS

Introduction

Line 30: I think you should also mention that we can also observed co-seismic deformation with sediment cores on each part of faults. e.g.:

- Beck, C., Campos, C., Eriş, K. K., Çağatay, N., Mercier de Lepinay, B., & Jouanne, F. (2015). Estimation of successive coseismic vertical offsets using coeval sedimentary events—application to the southwestern limit of the Sea of Marmara's Central Basin (North Anatolian Fault). *Natural Hazards and Earth System Sciences*, 15(2), 247-259.
- Gastineau, R., De Sigoyer, J., Sabatier, P., Fabbri, S. C., Anselmetti, F. S., Develle, A. L., ... & Gebhardt, A. C. (2021). Active subaquatic fault segments in Lake Iznik along the middle strand of the North Anatolian Fault, NW Turkey. *Tectonics*, 40(1), e2020TC006404.

Study area

Line 57: Sometimes you use "Figure. 1", sometimes "Fig.", please check the style of the journal and change accordingly.

Figure 1: If you know it, please say which type of fault you have (normal, reverse, strike-slip). Fonts are hard to read.

Method

Line 101: Please remove “(very)”: it does not help the reader and is not quantitative.

Line 114: It could be nice to add the CTD profile in the supplementary information.

Line 122: “The present study focusses on sections VIII and IX of the core (9.5-12 m depth)”. This is not a useful information because in the article of Wils et al., 2020; I could not find these sections’ names. Better to refer to the depths maybe? Or to add the scheme of the composite core in supplementary information (SI) to help the reader to check the information you provide.

Line 159: Delta can also collapse spontaneously, maybe you could explicit that.

Line 163: I find this +1/2 unit uncertainty a bit arbitrary but this is true I don’t have better to propose. Why not 1 then? Can you in one sentence argue about that?

Line 179: Please add a reference for all the fault characteristic values you provide.

Results

Line 188: “Figure 2c”, the figures should appear in the chronological order. Same line 242 where we jump from figure 2 to figure 6b.

Line 201: To help the reader, you could add a scale in meters on the right of your figure 2. Besides, you mention an acoustic velocity of 1450 m/s in the water to produce the bathymetric map. What about the sediment? Is the velocity assumed constant? Is it based on the MSCL measurements for the topmost part of the seismic where you have a sediment core? Which value do you use? We missed such important information in the method.

Figure 2:

- It is not super easy to make our own interpretation of the seismic profile due to the quality of the PDF. Can you please add uninterpreted profile in the SI at least, please? For example, the unit 3 I would have been happy to see a zoom of it.
- In Figure 2c, add a scale please.
- You talk in the method of both a centipede sparker and geopulse spinger source system data, but only present two profiles from the spinger source system, why?
- Please provide in the map the location of all the seismic profile that you have, and why did you choose to present these ones? If you don’t present the sparker data please remove from the method section.

Lines 247-255: This section is mainly based on the results of other studies. You should either create a section where you summarise the results of other studies, or reformulate your results so that they are better highlighted here.

Line 257: “Section IX”; again, you refer to a numbered section, but I don’t get this information elsewhere so it doesn’t help to understand your text.

Line 266: I would remove “clearly”

Line 271: Provide the values for the lowest and highest values in brackets.

Figure 5c, there is no colour scale to read the plot.

DISCUSSION

Line 313: "In Lago Castor Unit 2 is much thicker (up to 78 m) compared to Lago Pollux," please give again here the thickness in Lago Pollux.

Line 325: I think it is important to show explicitly those onlaps on the figure.

Figure 7: the caption should say (b) Lago Pollux and (c) Lago Castor and you must then write a caption for (a). Please add scales. If you have all those seismic profiles why not displaying the thickness of those MTDs? The maps in b and c are quite empty: you could also add some info on the slopes to help to better constrain the uncertainties that you have "To accommodate for variability in preconditioning factors, such as slope angle or availability of sediment". Also, maybe add the rivers etc to see where we have more sediment accumulation? I think this figure can be significantly improve, you have a lot of useful information that would help in terms of interpretations and reasoning.

Figure 8: I have a concern regarding the approach and this figure. We do not have in the method section any information regarding the age modelling part. I know both cores are from another study; but as it is the main part of your argumentation you should be clear on how the age model were performed in both papers. If they are not run using the parameter then I would be happy to see how it is with rBacon for example. Please be more explicit about that in your manuscript.

Line 389: "are located along the lake slopes". More or less, at least it is hard to see that on the actual figure.

Line 391: "cfr"?

Line 392: I thought it was $VI_{1/2} + 1/2 = VII$? from your method line 158. Then I am a bit lost.

Figure 9: In general, the fonts of this figure are too small. The maps are hard to read. The isolines are hardly perceptible. etc. This need to be significantly changed please. Same for the GPS coordinates, they are too small. I can unfortunately can't review it properly.

Line 423: Figure 9c I presume? But I can't see what you mean.

Line 437: I see your point, and I am not working in subduction zone, but 30 km is not a lot for such strong earthquakes to my opinion?

Figure 10: I have several questions regarding this model.

- From where do you take the fault map?
- Is there any study on the faults themselves (e.g., trenches)? Data regarding the movement of the faults?
- You will not have the same wave propagation with a strike slip or a normal fault. How sure are you about this tectonic map? Here you mentioned for example "Grey fault traces are not sufficiently long to cause a rupture with the tested magnitude"; Then you should maybe mention it. I feel there are some key information missing regarding tectonics. And I have the same remark as Figure 9, this figure it generally too small and really hard to read.

C. TECHNICAL CORRECTIONS

Line 38: Please remove '~'.

Line 104: Missing dot after "receiver"

Line 106: typo “m in” and not “m)in”

Caption Figure 1: area and not are.

Line 252: add a space after “(2015)”.