Review Report for Ertuncay et al., 2025

Review Round 1

Reviewer 1

The submitted manuscript is reporting the integrated seismic analyses of the Mw 6.3 earthquake occurred in the the Sea of Marmara on April 23, 2025. The authors performed the aftershock relocation, the moment tensor inversion for the mainshock, and the ground motion analyses. The presented information is indeed providing principal bases for the fast response of the earthquake and for the following studies to pursue for a further detailed rupture process and the associated ground motion. I only have the minor points listed below, which I hope might be useful for revision.

L21: "more complex faulting behavior"
I am assuming the possible reasons for the large non-DC ratio would be due to a mixture of faults with different orientations (e.g., Frohlich, 1989, GRL; Kube and Lay, 1994, JGR) or artifacts of inversion (e.g., Rösler et al., 2023, Seismica; Rösler et al., 2024, Seismica), but these are not evaluated in the authors' manuscript (and I understand such an issue is out of scope of this fast report). I would think that mentioning the non-DC ratio is informative enough, e.g., "... with a significant non-double-couple component (40%). "

Frohlich, C., Riedesel, M. A., & Apperson, K. D. (1989). Note concerning possible mechanisms for non-double-couple earthquake sources. Geophysical Research Letters, 16(6), 523–526. https://doi.org/https://doi.org/10.1029/GL016i006p00523

Kuge, K., and T. Lay (1994), Systematic non-double-couple components of earthquake mechanisms: The role of fault zone irregularity, J. Geophys. Res., 99(B8), 15457–15467, doi:10.1029/94JB00140.

Rösler, B., Stein, S., & Spencer, B. (2023). When are Non-Double-Couple Components of Seismic Moment Tensors Reliable?. Seismica, 2(1). https://doi.org/10.26443/seismica.v2i1.241

Rösler, B., Stein, S., Ringler, A., & Vackář, J. (2024). Apparent Non-Double-Couple Components as Artifacts of Moment Tensor Inversion. Seismica, 3(1). https://doi.org/10.26443/seismica.v3i1.1157

L22: "within the first 10 km depth" -> within 10 km depth

L24: "in western Istanbul"
Perhaps "east of the mainshock in western Istanbul" would be convenient to follow the spatial relationship between the source and the stations?

L27: "code limits"
Does this mean that the existing GMPE underestimates the observed short-period PGM?

L75–76: "propagated towards the southeast, to the NAF"; "which is closer to the NAF"
If the MMF considered in this study is a fault system (parts of NAF) in the Sea of Marmara, the extent of the MMF is around {from 27.5°E to 29.25°E} and the extent of the NAF is around {from 29.25°E to further east}? If so, the southeastern part of the ruptured area of the 2019 earthquake is closer to the MMF, rather than the NAF?

Sorry if I am missing the extent of MMF here, but I would appreciate it if the authors could clarify (annotate) the spatial extents of both the NAF and MMF on Figure 1.

L105: "correction,detrending" -> correction, detrending (*add space)

L158: "Reported depths range 4 and 13 km"
Is this 4-km depth from the USGS' solution? I could not find the corresponding solution. I would appreciate it if the authors could cite the solution, so that the readers could reach out to the information.

L158: "NEIC 44%, USGS 43%, and GCMT 33%"
Could you please cite each solution? From what I checked, "NEIC 44%" should be from the USGS' W-phase moment tensor solution, but I could not find the corresponding solution of "USGS 43%".

U.S. Geological Survey, Earthquake Hazards Program, 2017, Advanced National Seismic System (ANSS) Comprehensive Catalog of Earthquake Events and Products: Various, https://doi.org/10.5066/F7MS3QZH.

Dziewonski, A. M., T.-A. Chou and J. H. Woodhouse, Determination of earthquake source parameters from waveform data for studies of global and regional seismicity, J. Geophys. Res., 86, 2825-2852, 1981. doi:10.1029/JB086iB04p02825

Ekström, G., M. Nettles, and A. M. Dziewonski, The global CMT project 2004-2010: Centroid-moment tensors for 13,017 earthquakes, Phys. Earth Planet. Inter., 200-201, 1-9, 2012. doi:10.1016/j.pepi.2012.04.002

L186–191:
I am keen to know how this "complex source productivity" can be attributed to. Given the variable causes of an apparent non-DC ratio (please find the related comment above), I would feel that the source complexity may not be solely derived from the non-DC ratio of the 2025 event alone.

I notice for the 2019 event that the east-west elongated slip distribution and the aftershock distribution look aligned with the major strike of the fault section in the Kumburgaz Basin (Figure 7 of Karabulut et al., 2021, GJI), though the faulting behaviour would be variable (e.g.,

thrust + strike-slip fault). Such an apparent orientation of the 2019 ruptured area (e.g., strike of 281° of the finite-fault plane), however, is seemingly different from that of the 2025 aftershocks and the CMT solution (e.g., 260°).

Do the authors think that the faults hosting the 2019 event and the 2025 event can be different? Or, do the authors think that there would be some hidden fault branches or steps that are not described in the recognized active faults (red lines in Figure 1), which may characterize the geometrical fault complexity in the corresponding region? Can these signatures be seen in the 2025 relocated aftershock distribution (when we look closer)?

I would appreciate it if the authors could extend a discussion a bit about a possible reason for the source complexity of the 2025 event. The authors' finding is quite interesting.

L190: "as in the case of later events"
Are these the 2025 Mw 6.3 event and the aftershocks? Or perhaps it can be written as; "as in the case of the 2025 Mw 6.3 event"?

L220: "descends by 0.1g up to 0.1g"
Does this mean that A_{0} descends like; 0.4 g, 0.3 g, 0.2 g, and 0.1 g (descends from 0.4 g to 0.1 g every 0.1 g) ?

L215 and 237: I agree with the authors that the rupture extents and dynamics could be linked to the large peak ground motions, but do the authors think that, even under an assumption of a point source, radiation pattern can be associated with the peak ground motion distribution (e.g., Takemura et al., 2019, GJI)?

S. Takemura, T. Furumura, T. Saito, Distortion of the apparent S-wave radiation pattern in the high-frequency wavefield: Tottori-Ken Seibu, Japan, earthquake of 2000, Geophysical Journal International, Volume 178, Issue 2, August 2009, Pages 950–961, https://doi.org/10.1111/j.1365-246X.2009.04210.x

Reviewer 2

This is a very interesting paper that presents a great deal of analysis for a recent event. Thank you for the opportunity to edit and review this work. I overall find the paper is fairly well-written and mostly well-supported by the current figures. I think it will be of interest to our readers and a useful reference for future researchers. There is some work to be done to ensure that Figure 1 provides sufficient context and to ensure that the data and methods sections are detailed enough to allow the reader to fully understand or reproduce the analysis. Generally Fast Reports are also limited to 2-3 figures. I have laid out some suggestions below which I think will help in addressing these and other, smaller issues, all of which I suspect can be completed fairly quickly.

- Line 24: specify which type of intensity, ideally. Ex: “European Macroseismic Scale intensities reaching level 6”.

- Line 29-43: Unable to review the Turkish abstract.

- Line 45-52: There should be a figure to demonstrate this, perhaps as an inset in Fig 1. Be sure to label the NAF, Eurasian Plate, Anatolian Plate, Arabian Plate, Marmara, and the boundary of Turkiye.

- Line 49-50: Awkward wording. Suggest something like “The NAF has experienced multiple large earthquakes (M>7) in the last X years, including notable events in XXXX and XXXX (REF).”

- Line 52-53: Define Ms and Mw. In line 52 I recommend being more specific: has the region experienced ‘large’ earthquakes? ‘Damaging’? Earthquakes alone is not very compelling.

- Fig 1: Be sure to add a degree symbol to the x and y axes of (a), to make it clear that these values are latitude and longitude. Can you make it clearer that the aftershocks in (a) are from the result of this study? Line 53 says that this figure shows the 1912 and 1999 earthquake locations, but they are not plotted very clearly. Is the text plotted at the epicenter? What was the approximate extent along-fault for each event? Please refer to these in caption also. For the Maramara Sea, it’s hard to tell where exactly it extends to. What is the dark blue shading and why does it appear to only extend to the near-fault portions of the Marmara Sea? I would prefer to see (b) plotted in discrete bins rather than a continuous function, in order to have some sense for how many events are being plotted in this subfigure. It would also be good to explain in caption how wide the buffer was the determine which events were included alone A-A’. Lastly, for (c), can you explain the relative sizes used for the different elements?

- Line 55-57: This would also be good to include in the broad intro figure I requested for lines 45-52. It should include extents of previous earthquake ruptures in the 20th century and, ideally, the population density of Istanbul. Also please rephrase “called the so-called Main Marmara Fault”, perhaps to “along the so-called Main Marmara Fault”.

- Line 58: If it has long been a topic of debate then please provide a few example references.

- Line 59: Omit the word “long” to avoid repetition from the previous sentence.

- Line 61: On Fig 1, can you outline the approximate extent of these basins, so the reader knows what extent of the MMF is thought to be aseismic?

- Line 63: Omit the word “branching”. Provide reference[s].

- Line 65: Perhaps you can use a different shade of red to indicate the ‘principal fault zone’ in Fig 1?

- Line 65-68: If these features (pull-apart basin, crustal thinning, and thick sedimentary deposits) are the controlling factors of seismogenesis then they should likely be explained in a bit more detail and labelled on Fig 1 somehow. Ensure you provide references to cover all of these features and to support the assertion that they are a controlling factor.

- Line 69: When is the start of the instrumental period here?

- Line 70-71: Reword to "… until the September 2019 magnitude 5.8 earthquake occurred on the MMF, only a few kilometers from the Kumburgaz Basin (REFs). This event had a complex source mechanism (REFs). Karabulut et al., (2021) demonstrated …".

- Line 75-76: Omit "to the NAF". "Karabulut et al.," should be outside of the parentheses, while "(2021)" should remain inside. I'm a little unclear: is the MMF not a segment of the NAF? If so, no part of it is "closer to the NAF". Please make this clearer for readers.

- Line 77-79: In the paragraph from lines 55-61 you already called into question whether this segment of the NAF/MMF is capable of large earthquakes, so this sentence feels a little awkward. Also, please reword to "A seismic gap located in the south…". It should be "the Marmara Sea", not "Marmara Sea". Is Istanbul the "most studied" in Turkiye or in the world?

- Line 80-81: Suggest rewording to: "The current seismic design code of Türkiye estimates its design limits using prescribed short, medium, and long periods that are assessed via empirical ground motions prediction equations…"

- Line 82: What are "these parameters"? Please explicitly name them.

- Line 84: What are the "different design criteria"?

- Line 87: I quickly checked the abstract for the Kalkan and Kunnath reference and saw no mention of "tall" buildings. The word "tall" was also not found in the main body of the text.

- Line 91: It feels odd to "reinterpret initial observations" when this event only happened a couple of months ago, and there are no published studies about it referenced in this sentence. It seems that this is more like an initial interpretation/assessment.

- Line 91-96: Great work on this paragraph — very clear and interesting.

- Line 98: Reword to: "… relocation analysis, a seismic catalog, which contains 562 aftershocks between 23 April and 9 May 2025, is obtained from the Disaster …".

- line 102: It sounds like a number of waveforms were excluded based on "visual quality check". Can you comment on this in terms of the general quality of the recordings? Also what tool/software/code are you using for the pre-processing? Provide references. Are these datasets made available for readers? Because you are using different datasets for different

analyses, you may want to have some sort of supplemental table or multiple tables that make it clear which stations you used for each type of analysis.

- Line 105-106: More details are needed here. What is “station correction”? What amount of tapering was used? Why 0.1-10Hz bandpass? Why a second tapering step? I would also suggest introducing where the data is from before you state what you did to it (currently line 108-110).

- line 106-107: This sentence sounds like Ertuncay et al., (2025) is a published article with description of the data, rather than the link to the dataset used in this article. I suggest rewording to “Data used in this study are available from Ertuncay et al., (2025), including waveforms and ground motion parameters.”. You could also move that reference to the Data Availability section and refer readers there. I wasn’t clear about which of the files in the Zenodo repository related to data quality. This maybe speaks to a bigger problem that the files in this repository don’t have any accompanying text, such as a readme file to explain header names or data structure. You could also include this in the Data Availability section.

- line 112: Change to “… in total, 2 short period, 67 broadband, and 164 strong motion recordings were identified for the ground motion assessment.”.

- line 113-114: It’s unclear if the broadband station issues mean that they are removed before or after your tally of 67 broadband instruments. See comment above for line 102 that you should have some clear information about which stations/data were used for which parts of your analysis. It needs to be sufficient that someone else could reproduce your entire study using public data plus your repository.

- line 125: Why are only 400 events relocated out of the 545?

- line 133-134: Can you provide rationale / references for the choice of parameters / bandpass / number of iterations?

- line 137-138: I suspect this is actually the “… peak psuedo-spectral acceleration, PSA, at 0.3s and 1.0s periods.”? Also, neither here nor in the “Data” section do you describe how you calculate the PGA and PSA. Using what software? On horizontal and/or vertical components only?

- line 140: Why the GMPE of Kale et al., 2015? Is it pertinent to this region? Is it used in the national seismic hazard model / building code? Also can you explain how you use these equations for “ground motion interpolation”? These equations relate earthquake source parameters to shaking and intensity at sites of interest, but it’s unclear from your sentence how you would use them to interpolate between known shaking/intensity measured at seismic stations.

- line 142: Can you reproduce the equation from Loth and Baker, or at least reference the equation number in that reference? Please give the reader some general concept of what this spatial cross-correlation is based on.

- line 145: Is the point source approximation appropriate here? Approximate dimensions of a M6 are 10x10km, and apparently your nearest station is 25km away. Maybe more importantly: is there a reason not to use the rupture length? Perhaps the GMPE you've chosen only considers Rhypo instead of Rjb or Rrup?

- line 149-150: No need to repeat that the events are within the Kumburgaz Basin, as it is already said on line 147. I don't think that it's clear from Fig 1 that these aftershocks "propagated towards Istanbul". If that were the case, I'd expect to see lighter shades of green (early events) in the west, near the epicenter, and darker shades of green (later events) to the east, towards Istanbul. Did Karabulut find that stress was focussed only on the "eastern edge"? If so, that is more interesting/similar to the 2025 event.

- line 153: Mw should already be defined at first usage, not here.

- line 158: What are the "reported depths" you reference on this line, or who are they from?

- line 160: The term "an online report" is a bit unclear. Is it a supplement to this article?

- line 163: Again, please specify which intensity. I think because you're using Worden et al., 2012, that it's probably Modified Mercalli Intensity, and therefore probably roughly equivalent to the EMS-98 at the intensities in question, but good to be explicit. I see that you specify on line 169, but it would be better at the first mention of intensity in each section of the article.

- line 167-168: The finding that ground motions mimic vs30 isn't terribly surprising, but it is probably important to show the vs30 map so the reader can see this for themselves. This could be a good supplementary figure.

- line 170: Ground motion decaying with distance from the epicenter is the expectation everywhere; it isn't really "consistent with regional attenuation characteristics" unless you explicitly calculate the expected drop off using a regional attenuation model. If so, please explain/cite and present those results.

- line 172-173: This comment on the point source analysis should have been in the methods section, I think. Also the dense station coverage would, to me, argue for using a non-point source because you have sufficient station coverage to observe the detailed radiation pattern from a 2D/3D geometry.

- line 174-175: As I suspected in my comment on line 140, the GMPE/GMICE are not used for interpolation. They are used to compare the expected shaking from GMPE/GMICE with either observed ground motion recordings or the shakemap results. I don't think comparison with shakemap makes sense as those are interpolated values. Comparison with observed data at

seismic stations is interesing, but needs to have been explained more clearly in the methods. I also am not convinced by the assertion that the Kale GMPE underestimated for PGA/PSA0.3 but matched for PSA1.0. Can you provide the standard deviation or some other measure of goodness of fit, to better convince the reader than what is seen in Fig 3b,d,f? Otherwise, I would probably advise that you omit this finding.

- Fig 2: The use of dashed lines through the Sea of Marmara makes it seem that you have measured/observed contours on land and inferred contours underwater. Realistically, they are all inferred by the shakemap interpolation. I would therefore suggest using a consistent line style. Slightly odd to plot Fig 2 in [%g] but Figs 3 and 4 in [cm/s^2]. I personally prefer [%g] for all, but either is fine as long as it is consistent.

- Fig 3: Define EC8 classes in the caption and/or in text. I suspect that the residuals are from the mean value? The residuals are also hopefully calculated by taking into account the actual/modelled vs30 of each site. Please ensure this is the case and make it clearer in the caption, methods, and results sections.

- line 178-183: This feels more like a description of the method than the result. Also how were site conditions considered? The result, as I can see it, is that the recorded ground motions are lower than the design values for all editions of the code.

- Fig 4: Please label each station on the subfigures. I suggest using the word “damping” rather than using a symbol. You could consider only plotting results out to 1 or 2 s period, to be able to better see the acceleration at 0-0.5s period, where the results are most interesting.

- line 186: Fig 1 doesn’t make it look like they are 7km apart, based on the scale bar. Also if they are 7km apart on an east-west strike-slip fault then are they even on the same fault plane? Is it the MMF/NAF or a subsidiary? No need to repeat that it ruptured in the Kumburgaz Basin.

- line 187: Can you describe what a “significant” CLVD component means? This could probably go near line 156, to help reader interpret the result you showed there.

- line 188-189: I think the Karabulut paper should be described in greater detail to support this assertion. What method did they use? Which area did they show as having increased stress for future earthquakes? I’m still unclear about what “closer to the NAF” would mean, or “toward the Kumburgaz Basin” given that we are already in that basin.

- line 190: Are the “later events” just the current 2025 event or are there others? If so, please state which ones and provide references.

- line 191-193: The description of the seismic gap feels like it should be a separate paragraph, as the current paragraph (185-191) was more about complexity of the earthquake source. However, I also think that this sentence could go into the description of the seismic gap on line 57-61.

- line 197: Why are eastward aftershocks consistent with regional tectonics and a RL SS mechanism?

- line 199-200: I think it is too speculative to suggest that because the çınarcık Basin didn't rupture yet that it is probably aseismic, and I'm also a bit unclear on why that suggests a creeping segment "to the west". To the west of what? You might say that additional work may be needed to better understand which segments of the MMF/NAF are aseismic, given this new earthquake — but it would be better supported by having one coherent figure showing the past ruptures and the extent that was believed to be aseismic prior to 2025.

- line 202-204: Silivri and/or the seismic station names aren't labelled on Fig 1 yet. the same goes for the stations mentioned on line 204 and 208-209. Also if Silivri is the name of the 2019 earthquake then that should be done consistently throughout the paper. On line 203, remove the "at" between "hand," and "PGA".

- line 205: Remove the "are" between "which" and "also suffered".

- line 202-211: If you want to make a connection between site condition and shaking then it should be done by plotting these values. As it stands, Fig 3 doesn't seem to really support any assertion that shaking is controlled by site class, which makes this paragraph feel misleading.

- line 212-215: Be sure to refer readers back to the appropriate figures when discussing a topic. In this case, Fig 2. In this case, however, I wonder if this effect is because the rupture/aftershock plane is skewed east of the epicentre but you modelled it as a point source? The USGS shakemap shows it as having stronger intensity to the west near Corlu (https://earthquake.usgs.gov/earthquakes/eventpage/us7000pufs/shakemap/intensity). A supplementary figure with site conditions would be useful again. On line 215 I suggest saying "near Istanbul" or "towards Istanbul", as the high measurements don't appear to be right in Istanbul.

- line 216-222: I'm not sure what you mean about design codes being "in agreement" with the calculated accelerations, and I'm definitely a bit lost on the discussion of A0. Why is this relevant? If you want to keep it in then it needs more context and description of how it is a "major issue" even though nothing looks like a major issue in Fig 4. I also think you should avoid commenting on the appropriateness of the building code without considering the way those design values are determined. For example, is it based on a certain return period level of shaking, such as the 1-in-475 / 10% probability of exceedance in 50 years? And is that appropriate to compare with this event? What is the return period of earthquakes of this size on the NAF? What's the return period of this level of shaking, per the building code hazard model? And how does this factor into the actual performance of the buildings near these stations? Building code design levels aren't necessarily "good" because an earthquake doesn't exceed them, if there is still damage to buildings constructed using that code. And earthquake shaking exceeding the code isn't necessarily a failure of the code if the event was exceedingly rare/strong compared to how the design values are determined.

- line 223: I don't think Fig 4 shows that the observed accelerations "almost reach" the design values, and I would also caution that they are "design values" and not "maximum design amplitude". The latter is important because they actually specify the minimum level of shaking that buildings must be designed to, not the maximum.

- line 225: The Eryılmaz reference, a news article, is not in english so I wasn't able to verify. However, an AP news story cited 378 reports of "structural damage" and only 1 collapsed building, which was a "derelict, long-abandoned structure in the city's historic Fatih district" (https://apnews.com/article/turkey-earthquake-istanbul-sea-marmara-magnitude-emergency-46f20a2c0b6fa3cad7634d28d1f7e5d7). Perhaps you can find some academic references to support the assertion that damage was caused by "low construction quality in old buildings, lack of building inspections, and the ageing effect", since that is beyond what can be appropriately and technically decided by a news article.

- line 227: What are "underestimated design amplitudes"? You mean earthquake shaking stronger than the design value for that location and soil type? Again, this needs to be discussed and considered in the full context of the code. I think this section of the discussion needs to be treated a little more thoughtfully, with additional references and a stronger quantitative case made in Fig 4 if you wish to retain these paragraphs.

- line 230: I would refer to these as the "outstanding" scientific questions. On that note, (1) isn't something that is discussed at all. Under (5), ensure these locations are labelled on a map. (6) is also not discussed at all in the paper.

-general: I probably would've expected to see a short summary at the end of the paper. You will also need to cut down your figure count to 3, per the Fast Reports guidelines. I would probably suggest thinking about what you want to focus on in the revised version of the paper. Figure 3 is quite large for how much it gets talked about, and the residuals could probably be easily moved to a supplement. You could then combine a few traces from Fig 4 in with the remaining traces of Fig 3.

Response to Review Round 1

Dear Editor,

We have finally finalised the revision process by following the suggestions given by the reviewers. First of all, we are sincerely glad for the reviews that we got. They really helped us to improve the quality of the paper.

We improved the data quality, thanks to the questions raised by Reviewer D, by contacting the national data providers directly, and we managed to improve the total number of signals as they updated their databases.

Moreover, now, Figure 1 provides way more information, starting from regional tectonic settings to the local situation in the Sea of Marmara and its surroundings. We included population density information and used different colouring for the ruptured faults in the vicinity of Istanbul, which highlighted the current situation of the area. Moreover, we added an inset figure to visualise the area close to epicenter in which 2019

earthquake and its aftershocks and the April 2025 event and its aftershocks can be seen better. Moreover, we clarified the moment tensor solutions on the Figure.

Apart from that, we followed the suggestions given by the reviewers, and we believe that in the revised version, the local tectonic settings are more clearly stated.

In the strong motion analysis, we followed the suggestions to clarify the data processing steps on both GMP calculation and MMI estimation. We merged the GMP and MMI figures with the GMPE figure to comply with journal regulations, and we believe providing that information side- by-side will help the reader to understand the ground motion observations more clearly. We also quantify the misfit between the observation and prediction of GMPE by adding the residuals to the Supplementary Material document that we established for the revised version.

Supplementary Material also includes the V_{s30} map of the study area, as requested by Reviewers. To clarify the issues regarding to the A_0 parameter for the old seismic design codes, we added the previous Turkish seismic hazard map along with the new one.

Regarding to the design codes, we decided to keep all 4 station records and their relative design codes. The station in the right panel of the Figure (Figure 3), shows the spectral amplitudes of the stations that are closer to the epicentre, and one is located on the northeast. The other is located northwest of the epicentre. The ones on the right panel show how the spectral amplitudes are amplified in certain areas, even though they are relatively further away from the epicentre.

Finally we believe that the title of the report should be renamed to “23 April 2025 Marmara Sea (M_w 6.3), Tu¨rkiye earthquake: mainshock, aftershock, and ground observations” as the wording “Initial” does not provide any meaningful information regarding the report.

We believe that thanks to the comments from the Reviewers, our paper is now in much better shape, and we hope it is good enough for publication.

Best Regards,
On behalf of the authors,
Deniz Ertuncay,
National Institute of Oceanography and Applied Geophysics - OGS

Review Round 2

Reviewer 1

I have evaluated the revised manuscript and the authors’ responses. I can confirm that the authors have thoroughly addressed the reviewer’s comments, and the manuscript has been extensively revised accordingly.

Reviewer 2

Dear Authors,

I want to start by offering my most heartfelt apology for the delay in publication and failure to respond promptly to your messages. I fell quite ill with covid in September and ended up falling very far behind on all obligations. I regret that this had lead to your article not being published sooner, and I hope this experience won't negatively impact your perception of the Seismica team due to my issues.

Next, I thank you for your great work in updating this manuscript. It is truly a pleasure to read, and provides an excellent overview of the seismic situation in the Sea of Marmara region, up to and including the 2025 earthquake. I have only a small number of very minor final revisions to address a couple of issues with figures/captions and small wording choices. While it won't be necessary at this stage, for future manuscripts please ensure you attach a detailed "response to reviewers" explaining how each matter was addressed. I consider the article "accepted" at this point, but will hold off on sending files to copy-editing until you can update the figures and any final wording changes you wish to implement. In the meantime, I will contact the Media and Branding Team, so they can start working with you on publicizing this article.

Again, thank you for your patience and my apologies that this process has been much slower on my end than usual. I look forward to seeing this article in print very soon.

Kind regards,
Tiegan

Required:

- Figure 1a says it has a bottom left inset showing tectonic configuration but it is not present. Ensure that the named fault segments (line 64) are labelled somewhere in Fig 1. Also it's a little unclear which part is the MMF. Could you move the label further out of the way but include one or more arrows connecting the feature[s] to the label?

- Please add a subfigure label and lat/lon marks to the map at the bottom right of Figure 2. The caption has an incorrect reference to subfigure e and needs additional information. I suggest rewriting this as:
"Ground shaking maps for different ground motion parameters and corresponding values at the stations are shown in panels a), c), e), and g). The star represents the epicentre of the point source used during the interpolation. PGA, PSA and MMI are colored according to colorbars shown at the bottom right. Panels b), d), and f) show the corresponding observed ground motions at each station compared with the GMPE by Kale et al. (2015), whose median is drawn as a solid blue line and the ± one standard deviation (σ) as a dashed blue line. Points are colored based on the EC8 site condition category shown in panel h). Station labels in panel b) are shown in map h)."

- lines 182-188: The last four sentences of this paragraph ("On the other hand,..." onward) are a little confusing to me, and seem to repeat things you have already said. I suggest omitting

these sentences, except "The instrumental macroseismic intensity
185 exceeds level 6 along the coast and decays gradually with increasing distance from the epicentre.". You can move the reference to the supplemental map of vs30 to a reference at the end of the sentence from line 180-182: "The elevated values recorded at the stations in these areas can be justified by either the closer proximity to the epicentre or the effect of site amplification, as suggested by low V s30 values at stations TK-3415, TK-3416, and TK-3428 (Figure 2h and S1).". To be honest, I think it would probably be easier to plot panels b, d, and f using the vs30 from S1 rather than EC8 class which seemingly encompasses larger areas with many different vs30 values.
- line 199: Some of the listed stations are not the closest, so I would say "... they are either the stations closest to the epicentre and/or those that recorded the largest PGAs (Figure 2).". The reference to Fig 2 helps the reader see the location of these stations and the PGA values, whereas Fig 3 should be referenced on line 201, as: "As shown in Figure 3, observed spectral amplitudes are...".

- lines 255-261: This section is a little confusing to me. If A0 is an acceleration coefficient, it is presumably based on the site condition and would determine the level of hazard at a site. The way this section is phrased makes it sound like the A0 is determined based on hazard. I think you can avoid all of this by instead simply stating something like "A major issue with previous design codes was that it used a coarse zonation map to assign amplification factors, which set the design level thresholds at relatively low amplitudes for most of the western side of Istanbul (Figure S3/REFERENCE). The latest design code incorporates...".

-Figure S1: Add lat/lon.

- Fig S3: All the labels are too small to read. Perhaps you can make this into two figures so they are each a full page. If so I suggest adding a label for where Istanbul and the Sea of Marmara are. But more importantly, do you have permission or is the licensing such that you can reprint these figures under the Seismica license? You may want to simply reference these materials instead of including them as a supplement.

- The two paragraphs from lines 254-279 seem to have a lot of overlap. I would reorganize it so that the first paragraph describes the observed ground motions (lines 268-272) and compares them to design motions (lines 272-273, lines 254-255), and the second paragraph discusses how design values have evolved (lines 255-263) and what factors affect building damage beyond current building codes (lines 273-279).

- line 291: I think this is the start of the "Conclusions" section.

- line 300: This final sentence is a bit misleading, as this was only observed at one station, but might be interpreted by someone as meaning that the codes are close to being insufficient. I might say something like "Although the observed ground motions were close to building code design values at one station, more work is needed in understanding patterns of amplification northeast of the Maramara Fault.".

Suggestions:

- line 64: "Kumburgaz, Çınarcık, and Princes' Island (Figure 1).." should be "Kumburgaz, Çınarcık, and Princes' Island segments (Figure 1)..".

- line 74: "The magnitude 5.8 earthquake..." should be "The magnitude 5.8 Silivri earthquake...", or perhaps "The Mw 5.8 Silivri earthquake...", so the reader connects this to the name on line 80.

- line 84: "Seismic gap located in the south of Istanbul..." should be "A supposed seismic gap located in the south of Istanbul..." or "A seismic gap located in the south of Istanbul...".

- line 117: "Many broadband stations suffered from the saturation effects..." should be "Many broadband stations suffered from saturation effects...".

- line 120: I believe "5% taper ratio, filtering with 4th-order Butterworth bandpass filtering between 0.01 - 50 Hz, have been applied..." should be "5% taper ratio, and filtering with 4th-order Butterworth bandpass filtering between 0.01 - 50 Hz have been applied...". You may also want to move this sentence to the relevant methods section (3.3).

- line 141: If you have a reference to point that further explains the "with the frequency band chosen based on the event magnitude and station distance" statement, I suggest adding it here.

- lines 146-148: Somewhat confusing to have parentheses within parentheses. I suggest changing this one long sentence in to 3 smaller ones: "Ground-shaking maps and the corresponding macroseismic intensity (in terms of Modified Mercalli Intensity, MMI) distribution were generated using ShakeMap (version 4; Wald and Worden, 2016; Worden et al., 2018). Inputs are the peak ground motion parameters: peak ground acceleration (PGA) and peak pseudo-spectral acceleration (under the assumption of single degree of freedom system with 5% damping ratio, PSA), at 0.3s and 1.0s, recorded at 224 seismic stations. For each station, the maximum of the horizontal component is used as input."

- line 162: I'd add reference to Fig 1a top left inset in "... which also showed a similar pattern (Figure 1a, top left inset).".

- line 209: move definition of "non-DC" here, instead of line 213.

- line 233: "... the important question of whether stress barriers and/or the likelihood of another creeping segment in the west." should be "... the important question of whether stress barriers and/or another creeping segment may exist in the west."

- line 244: This sentence should probably be moved to the end of line 241, so you don't jump from talking about 3428/3415 to 3433/3431/3434 and back to 3428/3415. Also I'm not sure this

sentence is very compelling, as it seems to say that "site amplification may cause site amplification"? You may want to omit this sentence or add some additional clarification.