Responses to the comments of RC4 (Maria Ortuño):

First of all, thank you for the detailed review and the suggestions. It was an interesting process to digest the points raised by you, but it helped to address some topics (e.g., ice loading, gelifluction process, colluvial wedge formation) that we have overlooked to explain previously. In addition, your comments helped immensely to erase any inconsistencies from the figures and to improve them for easier understanding.

Description of wedges and their generation rather by gelifluction processes then by tectonic processes:

During logging and interpreting the trench exposures, we have been very aware of the difficulties to distinguish between gelifluction and tectonic processes, especially because both processes may interfere during periglacial climatic conditions in the Vienna Basin. We have considered this for all the colluvial wedges that they were of non-tectonic origin, but all wedges are either bound by faults or cover faults. In trench SDF1, most of the colluvial wedges are covering tension cracks that are filled with similar material, but showing less over all orientation. The combination of both, the chaotically filled tension cracks together with the colluvial on top of them indicated their tectonic origin for us. Nevertheless, you are right, the process of transporting material from the footwall to the hanging wall might have partly been gelifluction.

The implications to seismic hazard:

1: Periodic vs. clustered behavior: We thought that we have discussed the implication that in the case of clustered earthquakes, the intervals between the clusters should be taken instead of the average recurrence intervals between single earthquakes. We also talked about and calculated the time interval between both clusters to between 32 and 41 ka in section 6.1. But you are right, we agree that this an important message and we have stressed this out in greater detail in the conclusions. Due to the comments of the other reviewers, we have rewritten section 6.1. and highlighted the differences between periodic and clustered earthquakes. See also comments to RC1 and RC2.

2: Primary vs secondary ruptures: This is definitively a noteworthy topic for discussion that we did not yet discussed in detail. So, thank you for mentioning the topic. This topic is twofold: First, if there are more fault branches reaching the surface during an earthquake apart from the main fault zone exposed in the trenches. We can exclude that on the observations made in the pipeline trench (WAG) that crosses almost the entire area from E to W and proofs that faulting is only observed within the 1-2 m wide zones, just as in the paleoseismological trenches. The trenches were also about 40 long, but there was no additional faulting observed. Second, the observed surface rupture is secondary faulting to earthquakes along the VBTF, which in turn would be a much larger earthquake than just the rupture along the MF. This was also mentioned by the other reviewers and we answered it further below.

3: Ice loading. We did not discuss this because of the reasons listed below. But, since you mentioned it, it might be a good idea to explain why we can exclude any correlation with glacial retreat. For the Scandinavian ice shield, the effect would be quite low and would only accounting for the youngest (and smallest) earthquake (around 14 ka). The Alpine ice shield was too small to contribute to a significant loading and the Vienna Basin by itself was not glaciated during the Quaternary. However, normally, this effect is mostly seen for reverse faults and not for normal faults (like the MF).

Paleoseismological data:

1: More detailed geomorphic map. This has been also mentioned by the other reviewers. As mentioned before, we thought Figure 3 would be enough to show the surrounding of the trenches. However, we do see your point and have added figure of the geomorphic/geological situation around the trenches.

2: Picture of the landscape. We added such a picture to the figure mentioned above.

3. Subunits in logs, location of deformed units, and references in the text. We changed the trench logs following your suggestions and checked the text to include more references to the figures. We added the uninterpreted photo mosaics to the supplementary.

4. Event horizons. We did not include event horizons in the trench logs because for most of the faulting events, the event horizon can be only seen in the hanging wall. Therefore, we followed rather the suggestions of RC2 to label the colluvial layers that indicate deposition close after the earthquakes. We hope that marking the colluvial layers in the trench logs help to identify the single earthquakes.

5. Structure of trench log description. Rereading this section, we know that the section description for trench SDF1 and SDF3 look differently. We changed the text and included the colluvial layers in the stratigraphic description of SDF3.

6. Deformation bands. Deformation bands by themselves are defined as small-scale faults with no visible displacement or with displacement in the range of mm. So, the term is used here correctly, because we want to describe exactly those small lines especially visible in sand layers because of their reduced compaction. Maybe there is a misunderstanding, but the deformation bands are not dipping necessarily parallel to the fault zone, but are mostly antithetic and/or outside the narrow fault zone. We checked the text to avoid any misuse.

7. Description of earthquakes in WAG. We do recognize that this section is too short, especially regarding the event description. We added a more detailed description for the evidence exposed there. However, since this a construction pit with limited access, exposure and description is rather thin compared to the trenches SDF1 and SDF3.

Different material in hanging and footwall. Yes, we do think that the fault acted as physical barrier for deposition of the fine-grained sediments in the hanging wall, that we interprete mostly as sediments that have been deposited by the Danube during flooding events. We briefly addressed that in the trench description, but also added that to the interpretation section of the trenches to make it clearer.

Dating results. As suggested by RC1, we moved the dating description to the newly added methodology section. This should also solve this problem addressed here.

Paleoseismological discussion:

1) Event definition. We do see your point of firstly addressing the bracketing units and changed the relevant sections accordingly. We though that this is clearly seen the trench logs, but of course you are right, it is better to explicitly mention it in the text. Figure 10 has been changed to accommodate the OxCal results as suggested by RC1 and RC2.

2) Mmax. We are a little confused by this comment, so I hope that I address it correctly. In the first section 6.3 (sorry for the typo), we do compare the maximum magnitude from the trenches (derived from inferred surface displacement, 6.8 ± 0.1) to the magnitudes derived from the fault length and from the fault area (6.7 ± 0.3). In order to make it clearer for the reader, we added the resulting magnitude to table 3 and referenced it to this section. However, we do prefer to keep the discussion of each earthquake together. Regarding the use of Wells & Coppersmith (1994): We are aware that the use of this correlations is slightly outdated, but on the other hand, most paleoseismologists in Central Europe have used those equations to estimate the magnitudes. Therefore, we decided to use the same equations for better comparison of the events within Central Europe. Nevertheless, for further recalculations, we added the observed displacements that are used for the calculations.

3: Periodic vs. clustered behavior. See comments below and above.

4: Linkage to the Vienna Basin Transfer Fault. The other reviewers also raised this question. We do think that the MF is connected to the VBTF via the common detachment, and we also mention it shortly that in the discussion about the possible activation of the detachment during an earthquake along the MF. The topic about primary vs. secondary faulting is very interesting one, and a topic to explore in further studies. However, at the moment, the data presented here strongly suggest the inclusion of the MF as primary earthquake source. We cannot, and don't want to, exclude the possibility that the MF is also activated as secondary source for the VBTF. But since we focused in this paper on data for the MF and the impact of this fault to the seismic hazard, we thought that the scenario of a combined rupture of the VBTF and the MF might be beyond the scope of this manuscript. See also comment to RC1 and RC2.

Comments in the supplementary:

Abstract:

1: conservation potential of earthquake surface ruptures smaller than 6.5. Yes, we think that we have shown and discussed that at the beginning of section 6.1, in respect to the exclusion of E1 from the recurrence interval calculation. This might be different in areas with finer sedimentary record, but here in the setting of our trenches, we think this is valid conclusion to draw. We rewrote the section in order to state this more clearly.

2: Magnitude estimates. This is discussed in the second section 6.3 (sorry again for the typo). The largest inferred surface ruptures in both trenches are up to 2 m, suggesting an earthquake around magnitude M=7.0. The magnitude can also derived from the rupture area of an earthquake, not only the length. The fault area of the MF without the detachment area would be a little too small to generate an earthquake of such size. Including the detachment area, the resultant magnitude would fit better to the magnitude observed from the surface displacement. We know that this is not a fact, but we think that it is a possible valid interpretation.

Geological setting:

Historical earthquakes. In principal, you are right. The uncertainties are too large to exclude the activation of the splay faults via small historical earthquakes, especially since earthquakes seem to cluster close to the areas where the splay faults connect with the VBTF. So, it would be possible that there have been small earthquakes at the southern tips of the splay faults. However, north of the Danube, close to and in Vienna, where the splay faults have their largest throw (shown in industrial seismic data), there is a significant lack of earthquakes, and no historical earthquakes. The few earthquakes there are all instrumental recordings and not larger than ML=3.0. We changed the sentence to avoid further confusion.

MF as creeping fault vs. small earthquakes. Thank you for the comment. We did not realize this paradox and changed the manuscript accordingly.

Paleoseismologically characterized faults: There are none so far, except the Aderklaa-Bockfliess fault, addressed in Weissl et al. (2017). The trenching there did not exposed the fault. The offset of the Quaternary was inferred from geoelectrical data. We stated this more clearly in the introduction.

Trenching results:

SDF1. We took your suggestions (also see below) and have rewritten the trench description by using a simpler structure and referencing to the figures, where applicable. See also general comments on paleoseismological data above.

Gelifluction vs. colluvial wedge. Thank you for raising this question here, because the differentiation between gelifluction and tectonic processes is a task that we have been challenged with several times. Interestingly, we did not find evidence for gelifluction in trench SDF1. However, in trench SDF3 and in another trench in a similar setting (which is not ready to be published yet), we have seen colluvial wegdes that have been affected by gelifluction. These look very different from the wedges in SDF1. We did also not find overturned faults as are typical for fault zones affected by gelifluction. As far as we are aware of, colluvial wegdes can be also formed by (episodic) erosion from the foot wall towards the hanging wall. And this what we think happened here. This would also lead to a layered wedge, but bound at least partly by the fault, which is exactly what we have seen in these trenches here. The initial, more chaotic layering is observed in the underlying tension cracks. We have rewritten the trench description and added also a small sketch to clarify this issue. We hope that with the improved version of the manuscript, the evidence for tectonic origin of the colluvial wedges is better presented.

Tension cracks / filled fissures. We homogenized the terms. Since the infill consists of the same material as the overlying wedge, but with less oriented. This is one of the reasons why we favor the interpretation of colluvial wedges instead of gelifluction.

Section 3.1.1. According to your earlier comments, we changed this section to provide more information about the bracketing units. However, there are 4 colluvial wedges associated with chaotically filled tension cracks (A2-A5) plus the displacement caused by the youngest earthquake (A1). That are 5 earthquakes. I think there is a misunderstanding, because we state the 4 colluvial wedges are evidence for 4 earthquakes, and then the displacement of the youngest colluvial wedge caused by another earthquake. We changed the wording to avoid further misunderstandings.

Section 3.2.1. Yes, that is the observation that we wanted to describe. We changed the wording to avoid any confusion. We included the fault numbers into the log figure.

WAG trench. As mentioned above, we do recognize that this section is too short, especially regarding the event description. This outcrop being a construction pit with limited access, exposure and description is rather thin compared to the trenches SDF1 and SDF3. However, we added a more detailed description for the evidence exposed there. We better stress out the most important observation which is that the fault displaces the loess, reaches the surface, and cuts off the terrace (Fig. 9A). At the beginning, we were confused what you mean with folding, but then we understand how you came to the conclusion. We hope that with the new description and the improved figures, the situation is better to understand for outsiders.

Luminescence data. As already mentioned above, we followed the suggestions of RC1 and added a section about methodology and moved the description of the dating technique and protocol. We added the uncertainties to table 2 and discussed the meaning of the uncertainties.

Figures:

We took all your suggestions and improved the figures accordingly. Thank you for pointing out the parts that needed improvement. As mentioned above, we included uninterpreted photo mosaiques in the supplementary.