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Solid Earth
Discussions

Interactive comment on "The Ulakhan fault surface rupture and the seismicity of the Okhotsk-North America plate boundary" *by* David Hindle et al.

David Hindle et al.

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We first take the opportunity to thank both reviewers for their helpful and supportive comments and apologise to the second reviewer for not replying directly to them, due to a misunderstanding of the comment and reply procedure.

We now respond to the suggestions for improving the paper which come exclusively from the second reviewer.

In general, I wholeheartedly agree with the reviewers comments and find them close to exactly aligned with my own thoughts on parts of the paper that could be done better.

In response to the general comments:

1) We have assembled the requested additional data on the luminescence dating and will put this into the appendix of the paper (or as a "supplementary data annex"?) - perhaps to be decided together with the editor which format is best.

2) The slip rate could certainly be better dealt with and use of properly defined error bounds makes sense. We will therefore estimate the multi-parametric errors and give a propagated error estimate for the slip rate around a central value.

3) Regarding the figures, I shared the same concerns when preparing the paper, but realised during submission that I have no control over the final size of the figure as it appears in the draft manuscript. This is rigidly fixed by the supplied LaTeX template. In the end, I concluded that although a printed copy at a readable resolution would be nice, the fact of this being an electronic document would mean that zooming-in was possible to the limit of the resolution of the image itself. So I instead concentrated on preparing the highest resolution images I could (mostly in jpeg format, converted from postscript images made with GMT and then integrated into .svg files for additional annotation) whilst keeping file sizes within reasonable bounds. From my side, the images resolve to the degree of detail necessary to show the features made visible by using the TANDEM 0.1 arcsec DEM and the even higher resolution, georeferenced, aerial photo mosaic. The best way to view any of this data is, of course, in an interactive viewer for GeoTiff files such as QGIS. But the source data (TANDEM) is proprietary, and cannot be publicly released in its original form. However, as stated, the images within the pdf file are "zoomable" to the point where all the tectonic features described are visible.

Nevertheless, it would be nice to have the chance to print something on paper to look over in a hard copy form. One suggestion I have made to Copernicus would be to post A3 versions of those figures where copy size and legibility are a real issue, as supplementary data files that could be downloaded and printed separately. This seems to me to be a reasonable compromise.

The issue at the heart of this is the use of extremely high resolution spatial data over very large geographical areas. This has become a significant issue only since the advent of products like TANDEM. A few years ago, data of this extent and resolution was not commonly being reproduced in papers.

In response to the specific comments:

1a) We will give the geographic coordinates of the samples. We may need to do this in an additional table, because it appears the current table format would exceed the margins of the pages set by Copernicus if we added extra columns. But this may be resolvable by Copernicus in discussion with their editors and typesetters. We could also add an appendix figure purely to show the locations of the sample sites.

The issue with sample sites stems from having one site (5) where we only sampled organic material and did not take OSL samples. On reflection, this was a strange decision on my part, but that is the data we have. So to be clear, only 4 pits were used for OSL. The 5th was dug, but we only recovered a small sample of organic material from ca. 60cm depth. This will be explained in the article text.

I can give a few more pictures of pits, but field photos of sampling locations in general are difficult. It is very flat and most of the wider views I have would show the broad location of all the samples together. I can however give a side view from ca. 100m away of the locations of the two sites either side of the interpreted offset channel bank, if that is what the reviewer means? I must be sure I have understood the reviewer's question correctly.

b) we have included the cosmic ray dose rates in our data table.

c) we used SAR and will clarify this in the relevant section

d) We will give radial plots for those samples with >1 or 2 reliable aliquots (5 samples). In many cases, recuperation gave high deviations (>50%) so a large number of aliquots were rejected. Only aliquots with deviation <25% were used. We will explain this in the

appendix.

e) This data was rejected because of the lack of overlap between the quartz and feldspar fractions from within the same sample (10213 - 4b). The quartz fraction gave 8.85 +- 550. The feldspar gave 12300 +- 1100. So at 2 sigma, there is no overlap of the confidence limits and we concluded this is a case of partial bleaching so the only safely usable age is that given by the quartz fraction. We can explain this particular case in the text.

f) a general error of 2% had already been incorporated into the water content and propagated into the given age errors. We will clarify this in the text/table footnotes.

2) a) We will increase the "zoom" of these figures (i.e. make the geographical areal extent smaller but keep the same size for the graphic). I also would like to emphasize the fact that this is an "interpretation", as the reviewer rightly notes, a little more in the text by adding a sentence in this regard. The error estimate will be redone as the reviewer has requested.

b) We will change the way we refer to slip rates and give the associated uncertainty as suggested. I may look again at what the "central" value for the offset is. And perhaps give the uncertainty as 5m. Although the uncertainty from error propagation may well remain the same as the reviewer calculated, to 1 decimal place.

3) We will add scale bars to the requested figures. We will also find a solution for the size of the figures, but will have to do so in cooperation with the Copernicus typesetting department, as discussed above.

fig 1 – we will add shear sense arrows and the region covered by figure 2.

fig 2 – we will make the requested changes. We don't know much about the Neogene other than that they are continental, clastics.

fig 3 – we will make the requested changes

fig 4 – we will make the requested changes

fig 5 – "East" is actually indicated on the sketches of both photos, but may not be legible. We will increase the size of the text.

fig 6, 8 – we will make the requested changes

fig 7 – a) and b) samples are a vernacular applied by us in the field. They simply differentiate two different samples from different positions in the same pit. I will look at how to explain this better and add the ID's.

Minor comments: we will make the requested changes but make the following remarks:

p3 l4 regarding TANDEM resolution, we are far enough north that the longitudinal resolution is ∼10m. The original gridded data we received is also formatted in degrees. Hence, I had thought it better to use 0.1 arcsecs as this is accurate. But I can add the information of how many metres this corresponds to.

p3 l8 regarding the Jurassic rocks. Most of the basin today is covered by Quaternary, infill. However, there are a couple of spots where Jurassic rock sticks out of the Quaternary, and suggests that there was once a more widespread Jurassic landscape that has been eroded away and buried, but a couple of outliers which somehow avoided erosion/incision, remain.

p3 l27-29 regarding figure 4, everything is visible if you zoom in on the electronic version of the figure. We will see what solution we can reach with Copernicus regarding final figure size etc.

p5 l26 "dry zones" are interpreted from the 5,6,7 frequency band combination satellite image. In fact, they are better defined as regions that are unsaturated, but surrounded by saturated ground, since the most clearly visible thing in this part of the image is the region with a water table at or close to the surface (turquoise colours).

p7 l5 regarding channel abandonment, it is certainly true that sedimentation could have

continued for a while, or alternatively, that abandonment was a little bit younger than the age we determined. However, there are complex issues raised here, relating both to the periodicity of flow in alluvial fan distributary channels and the deposition and preservation of sedimentary deposits within them. In general, preservation of sediments ∼10000 yrs old, at a depth of 60-80cm, quite some portion of which is a soil profile, probably reflects abandonment relatively synchronous with deposition of the dated sediments. We can add more information on the sampling sites and extend our interpretation and explanation appropriately, so that it is clear what assumptions we are making, and what potential uncertainties arise as a result.

p7 l17 we will remove the word peneplain

p8 title we will replace seismic with seismological.

p9 l17 We will make the position of Ust Srednekan clearer (it is actually indicated on the figure already).

p9 l31-32 We will correct the duplication of the sentences.

we will also remove mention of "initial" age.

section 4.3 title we will remove mention of scarp slope

p10 l32 we will add a reference

p11 l11 we will modify the sentence

With that, we thank the reviewer once again for very thorough and helpful comments, and look forward to completing the revisions.

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