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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Estimation of successive co-seismic vertical offsets using coeval sedimentary events – application to the Sea of Marmara's Central Basin (North Anatolian Fault)" *by* C. Beck et al.

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General comments:

This paper uses sediment core records to identify evidence for coseismic displacement events related to segments of the north Anatolian fault system. The study combines possible earthquake evidence from sediment flows preserved in the cores with interpreted evidence of actual single slip events across fault traces inferred from unit thickness differences in cores. The paper also evaluates paleoenvironment in order to

assess likely age of a reference layer.

In general, the most important result of the paper is the potential identification of individual coseismic events at the fault trace using differences in layer thickness on either side of the fault - this type of method has only recently successfully been conducted in a marine environment (e.g., Barnes and Pondard, 2010), so another application of this method is exciting. In addition the Marmara Sea sections of the North Anatolian fault are very poorly known in terms of slip history and hence seismic potential. The abstract, introduction and conclusions do not evenly reflect the content of the paper - much of the paper focuses on describing possible seismic-related layers in the core, paleoenvironment, and methods for deriving marker horizon ages and only a small portion of the text is specifically on identification of slip events when this is the primary conclusion and topic of the abstract. So I think there needs to be more balance to the paper, ideally more focus on the identification of slip events but also the abstract, introduction and conclusions should more clearly reflect the content of the paper with a clear outline of the aims of the paper in the introduction (which may go beyond the primary goal of identifying slip events).

It wasn't clear from the paper if there had been any integration of the core stratigraphy with the seismic data. Is this possible and wouldn't this be very important for analysis of stratigraphic differences across the fault and testing the hypotheses from the cores? This may be published elsewhere but there needs to be some discussion here. I suggest the authors demonstrate with these data the wider stratigraphic picture around the fault even if it's at a slightly bigger scale than the cores (the thickening process described in the downthrown side of the fault should be evident at larger scale).

In summary the paper should be published because of the important potential results of slip scenarios on a segment of the North Anatolian Fault but the paper content and aims need more clarity and I would like to see more explanation and discussion on the fault slip results.

Specific points:

1. In the Structural setting I would much more quickly get to the point of describing the North Anatolian Fault - the regional tectonics can be brief. Information about earthquake sequences on the NAF and the uncertainty of seismic history in the Marmara Sea seem to be missing here. 2. Is there a particular reason why this study focuses on the Central basin structure? Is this of particular importance and if so why? 3. Are the short cores used multicores/megacores which sample and preserve the seafloor? 4. With sedimentation rates, can you clarify that these are including all sediment and therefore sediment flux rather than just hemipelagic sedimentation? 5. For the radiocarbon ages has the conventional reservoir correction of 400 years been applied or no correction (this wasn't 100% clear)? Are there any marine reservoir correction datapoints in this part of the Mediterranean to give an idea of what uncertainty this may generate for the age? 6. The conclusion of the reference layer being the base of the Younger Dryas is not properly explained - some more explanation is needed here. 7. For the correlation of individual horizons between cores (Figure 3 and 5) I think there needs to be some comment on the potential uncertainties of this correlation, ie other possible correlation scenarios. This is only very briefly discussed and errors should be considered. 7. For the correlation between the cores on either side of the fault, I understand that part of the methodology involves identifying hemipelagic layers with the same thickness (line 25, p 4081) - is there any evidence for erosion which might call into question this correlation (ie the equivalent layer may not be the same thickness at both locations? 8. This study focuses on the vertical component of slip and then goes on to calculate potential earthquake magnitudes for the slip measured. But for this probable transtensional fault (including it's steep dip - 70° at this location) I think there needs to be some consideration of the lateral slip component (even though the authors seem to argue for not doing this). Yes the vertical component is more important for tsunami generation but for generation of valid magnitudes the full range of potential displacement scenarios should be considered. 9. Following on from above, the authors note that the net displacement would be very large if there was a considerable strike-slip component

and compare with other sites nearby. The vertical slip component per event from this study is large - is there a possibility that this may represent more than one event? It is also a relatively large slip considering the fault segment length, especially if there is indeed a lateral component ie increasing the fault displacement further. 10. The last part of the paragraph line 5, p 4085 is quite difficult to follow as written. 11. This is primarily a regional hazard paper but the authors should highlight in the discussion and conclusions the global relevance of the study (either in terms of method development or of fault slip behaviour).

The figures are mostly clear.

Grammatical points:

There a number of grammatical corrections that are needed in the manuscript - a native english speaker would be able to assist more fully here, but here are some general suggestions. Suggested word changes: Term (eg in abstract) - component? Which (eg (which northern branch, line 24, p. 4073) = whose here-used = used here associated to = associated with conclude to the = confirm the

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