

Reviewers comments:

Reviewer #1 Evaluations:

Science Category: Science Category 1

Presentation Category (Required): Presentation Category A

Key Points (Required): Yes

Reviewer #1 (Comments to Author (shown to authors):

Dear Dr. Newman,

Thank you for the opportunity to review manuscript #2016GL070426, "On the reported conclusion that the 1255 AD earthquake ruptured 800 km of the Himalayan Frontal Thrust east of Kathmandu" by Ian Pierce and Steve Wesnousky.

This paper represents a strongly worded analysis of a recent study (Mishra et al., 2016) about trenching across the Main Frontal Thrust, and in particular reassesses their trench logs and radiocarbon statistics.

This is a contentious area of study. There are deep seated disagreements between paleoseismologists on the history of earthquakes along the Himalaya, especially between the years 1000 and 1300. Rupture of an earthquake in 1255 has been inferred in the Sir Khola in central Nepal, but the eastern extent of the rupture is not known. The paper by Mishra et al. (2016) purports to have discovered rupture associated with this earthquake 800 km east of Sir Khola, which would require that the 1255 event was a giant event of $M \sim 9$.

Pierce and Wesnousky here argue that there are fundamental flaws in the analysis presented by Mishra et al. (2016), and that these flaws disqualify the conclusion. Here are my comments on each of the flaws identified by Pierce and Wesnousky.

Flaw #1: Panijhora. Figure 3 of Mishra et al shows that sample P10 does not have a clear relationship to the fault, as the shear zone is simply been extended through a massive unit. Sample P10 is the only sample from this trench with an age close enough to the purported age of rupture to be relevant.

My comments: Yes, I agree. The dashed extension of the shear zone shows that the authors do not know exactly where the fault is, and P10 could have been deposited before or after slip. The other ages are much older. Also, as Pierce and Wesnousky point out, even if P10 were relevant it would not demonstrate that rupture happened in 1255, but only that it happened after AD 989.

Flaw #2: Harmutti. Mishra et al. reinterpret previously published ages as indicating that samples were emplaced following fault displacement. The original interpretation from Kumar et al. (2010) indicates that the samples predate displacement.

My comments: Looking at Figure 11 of Kumar et al. (2010), yes, I agree. These samples are from faulted rocks and should predate, not postdate, slip.

Flaw #3: Nameri. Mishra et al. reinterpret previously published ages to extract a capping age. Pierce and Wesnousky point out that the radiocarbon ages are inverted, indicating that the samples are contaminated with reworked detrital charcoal, so these results are invalid.

My comments: Looking at Figure 9 of Kumar et al., yes, I agree. These ages show samples from 600 AD stratigraphically above samples from 1200 AD.

Flaw #4: Chalsa. Again, Mishra et al. again attempt to refine ages from a previous study, but the units are massive so it is not possible to identify the actual fault. Mishra et al. conclude that these observations "confirm" that rupture occurred in 1255 AD; previously Kumar et al. stated that the broad range of ages allowed the last earthquake to have occurred ~1100 AD.

My comments: Yes, the authors seem to be overinterpreting radiocarbon ages in a trench with poorly exposed structure.

Flaw #5: Sir Khola. Mishra et al. (and previous studies) are biased in interpreting the trench here. They a priori assume that if there was a Medieval rupture, it happened in 1255, thereby disqualifying an 1100 rupture. Rupture could equally well have occurred in 1100 AD, as has been suggested in the Marha Khola to the west.

My comments: This is possible based on the trench results. The interpretation of 1255 rupture in the Sir Khola is in large part based on the historical reports of a large earthquake occurring at that time.

Overall: This paper is strongly worded, and likely will not be received well by some scientists, especially those involved in the Mishra et al. (2016) study. Nevertheless, I think that papers like this are important and useful. Open discussion - and yes, criticism - of science that is improperly supported is necessary to a healthy, scientific community.

The authors here are not arguing that a Medieval earthquake occurred in 1100 AD, but rather than the data allow that such an event might have occurred, and that the data do not compellingly show that there was a giant earthquake in 1255 that extended nearly to the border of Bhutan. This is a reasonable and fair analysis.

In terms of scientific importance, I find that this issue is both relevant and important. The question of how large, how often, and where earthquakes occur in the Himalaya is central to much of the research done in the area, and extremely relevant to the populations there. Giant earthquakes have been proposed in western Nepal, but in general earthquakes in the east are thought to be somewhat smaller (based in large part on a single datapoint: 1934, which was ~M8.2-8.4).

I believe that this paper should be published as is.

(Only one edit - there is a typo in the reference list for Mishra et al. (2016) - "Paleoseismic" is misspelled as "Paleseismic.")

Sincerely,
XXXXXXX

Reviewer #2 Evaluations:
Science Category: Science Category 1
Presentation Category (Required): Presentation Category A
Key Points (Required): Yes

Reviewer #2 (Comments to Author (shown to authors):

Excellent contribution. Thank you for writing this commentary of misleading and misrepresented data along the Himalayan front. You have given voice to my own concerns following the 2013 Sir Khola paper (Sapkota et al) and the Mishra et al., 2016 articles. Thank you.

My only specific edits are as follows.

1) the title could use stronger wording. Why not replace "On the reported ... " with "Flawed ... " or something similar? 2) I am puzzled by referencing of 'Jayangandoperumal research group' instead of 'Mishra et al., 2016' throughout this commentary piece. And 3) One trench site is referred to as "Harmutti" sitethroughout, but the caption to Figure S2 uses "Harmutty" on line 15 and "Harmutti" appears on Line 16 of the supplemental file.

You could even go further with this rebuttal, but I suspect the limits on length of article preclude this. If not, you might consider adding a paragraph on the apparent paradox that large, blind MFT events (like April 2015) and likely very large, emergent HFT ruptures (e.g., ~1100 AD) do not appear to impact Kathmandu as severely as expected (no historic record strong shaking in ~1100 AD). Yet 1255 AD was devastating in KTM... In the absence of direct evidence for surface rupture of the HFT in 1255 AD, it seems equally likely that the 1255 AD quake may have been generated by a relatively small, but yet to be identified source close to KTM rather than a more distant HFT event.