Response Letter to Reviewer #1

Summary

‘Landslide-lake outburst floods accelerate downstream slope slippage’ by Wentao Yang et al. documents the initial and ongoing impact of a couple of landslide-lake outburst floods along the Jinsha River. Using Sentinel-2 image pairs from before and after the outburst floods, the manuscript identifies hillslopes that adjoin the river channel that (i) fail instantaneously after the floods and (ii) where rates of displacement are accelerated in the two years afterwards, over a reach of up 100 km downstream from the initial landslide dam failure location near the village of Baige. The authors identify that the undermining of the hillslopes is driven by lateral erosion of the river channel, induced by the very high discharges during the outburst flood, and suggest that there is an ongoing feedback cycle of landslide-landslide-dam-failure-landslide hazards that is often overlooked in studies of landscape evolution and mountainous hazards. In general, the topic of the manuscript is appropriate for *Earth Surface Dynamics*, however I believe there are several revisions that are required before it is suitable for publication. These are detailed in more below line-by-line, but in general these include the manuscript structure and ordering of the sections, further placing of the work in the broader context through the use of literature and implications for other landscapes beyond this case study, further statement of the methods and uncertainty.

Response: We made changes to the structures of the manuscript as follows: 1) re-wrote the last part of the introduction; 2) deleting the first redundant part of the Materials and Methods part and added more details to elaborate the method and uncertainties; 3) moved the first part of the discussion to the first part of results; re-wrote the discussion part to place the findings of this work in the broader literature context and add implications for landscapes beyond this work; 4) adding appendixes A1, A2 and A3 to make this work clearer.

Line-by-line comments

1. Line 18-27: The opening of the manuscript gives general context for the study area. A similar section is found at the beginning of the Material and Methods section (lines 48-53). I’d recommend combining these sections, it is a little strange why further study area context information is provided in the Materials and Methods section.

Response: We deleted the paragraph in the beginning of the Material and Methods.

2. Line 28: ‘extremely large flux’ – it’s not clear if this refers to sediment flux or water flux. Please clarify

Response: We added the word ‘water’ and the sentence has been changed to “The extremely large water flux of LLFs …” (line 29).

3. Line 28: ‘significant social impacts’ – such as? Can you give specific examples from these references? It will help justify your study

Response: We added three examples in the revised manuscript “For example, in A.D. 2000, a large rock avalanche dammed the Yigong River with an estimated maximum impoundment of >2 km^3. The resulting flood led to record river level rise at gauging stations ~500 km from the landslide and caused major damage to infrastructures (such as roads and bridges) and losses of lives in India (Delaney and Evans, 2015). Recently, the Tangjiashan landslide dammed lake after the 2008 Wenchuan earthquake posed serious threats to the Mianyang city inhabited by millions of people (Fan et al., 2012a). A more astonishing LLF in 1920 BCE is supposed to flood the downstream Yellow River and even changed the ancient Chinese history (Wu et al., 2016).” (lines 30-35).

4. Line 30: ‘from failed dams and along its routes’ is poor English – rephrase to something like ‘many large boulders are often entrained by LLFs, sourced from the landslide dam themselves and along the course of flood route.’

Response: This sentence has been removed, because we re-wrote the last part of the introduction.

5. Line 32: I’m not sure these references are correctly used. The Baynes study explores primarily the impact of extreme flood events (triggered by glacial outbursts, not landslide dams) on bedrock erosion in Iceland, and doesn’t mention a comparison with monsoon flood events. There is assumption here that monsoon-flood events do not have high sediment loads of coarse material, and I’m not sure the references cited support this claim. I’d recommend further engagement and appropriate use of literature throughout the manuscript to help support your claims.

Response: As we re-organized parts of the introduction section, this sentence has been removed. Regardless, we checked throughout the text and paid attention to cite references as properly as we could.

6. Line 40: 'ongoing' may be a better word to use than 'persistent'

Response: We changed the word 'persistent' to the word 'ongoing' (line 44).

7. Line 41: This sentence doesn't quite follow on from the previous one – I'd recommend moving the part about not having the direct and ongoing observations of LLF impacts on hillslope instability to after the statement saying they may also disturb upper hillslopes adjacent to the collapsed banks over longer periods. This part of the introduction is crucial for justifying the work, as you're identifying a knowledge gap that we don't have ongoing observations of hillslope displacement after the initial post-flood assessment. This is what makes your study interesting, but I think you could do a clearer job of justifying this knowledge gap as it's a little unclear at present.

Response: We re-organized this part of the introduction by changing the order of these sentences. Now, the revised paragraph is clearer to introduce the research gap:
"Besides flooding havocs, LLFs have long been recognized as important geomorphic drivers on fluvial systems. Most works on geomorphic impacts of LLFs have been focused on their efficiency in sediment transportation and channel erosion (Cook et al., 2018a; Turzewski et al., 2019). Bank undercutting and parallel retreat are the most-frequently reported consequences of LLF's lateral erosion (Korup and Tweed, 2007). Landslides related to bank undercutting along flood routes are regarded as instantaneous impacts of LLFs, which are often recognized by retrospective field reconnaissance or post-event image interpretations (Cook et al., 2018a; Higaki and Sato, 2012). Intersecting with the LLF routes, these already-occurred landslides are easy to recognize (Cook et al., 2018a). In addition to these instantaneous landslides, LLFs may also disturb upper hillslopes that adjacent to the river channel over longer periods, which are more difficult to recognize and often overlooked. Thus, there is a lack of observations on LLFs' impacts on these ongoing slope slippages." (lines 36-44)

8. Line 45: Give the exact dates of the floods, not just 'late October' and 'late November'.

Response: Exact dates have been added. The sentence has been changed to "… on 12nd October and 12nd November 2018" (line 45)

9. Line 45: add 'ongoing' to 'the impacts of LLF hillslope stability', as this emphasises the novelty of your study

Response: we added the word 'ongoing' as suggested (line 47).

10. Line 49-74: Material and Methods section. I note that the first part of your Material and Methods section neither mentions either materials or methods. All of this first section is more context material that should be moved to the introduction section.

Response: This part repeat with the beginning of the Introduction and has been deleted.

11. Line 76-91: More detail is required here about the measurements that you actually made. Can you explain some more of the method behind the COSI-Corr method? Is this a pixel matching method, or some other form of image analysis? Additionally, how was the active channel width measured? Manually? Automatically? Can you give an estimation of the uncertainty associated with these measurements? This is important information that is required to support your conclusions.

Response: Thank you for the suggestions for clarification. We now added the relevant information. For the Cosi-Corr method, we added "The COSI-Corr method is a pixel matching method. To detect surface deformation, the method uses two images at a time, an earlier reference image and a later target image. Both images are transformed from the spatial domain to the frequency domain using the Fourier transformation (Leprince et al., 2007). Sub-pixel changes are detected by using phase changes in the frequency domain. (lines 70-73)"
For … "Uncertainties in this method are often estimated by selecting a stable zone (Yang et al., 2020). Although previous works demonstrated the capability of using similar method to detect surface deformation of up to 1/20 pixel size (Leprince et al., 2007; Stumpf et al., 2016), the smallest reliable displacements is 1/5 of the image pixel size (Yang, 2020)." (lines 100-102)
For measuring channel width and the associated uncertainty, we added "Similar to the method used by Cook et al. (2018), we measured active river channel by manually interpreting active river channels from false colour composite Sentinel-2 images. Fresh bare land near river banks are major features to interpret active river channel. Topographic information from Google Earth are also used as an ancillary data during interpretation. The uncertainty of manually interpret active channel is one pixel size of the used optical imagery (10 m in this work)." (lines 103-106)

12. Line 120: See last point, where do these error bars come from? Over what length reach are the channel width measurements taken? Is 96.33 ± 10 m the average width across the whole 100km study area? Can you break this down to reflect different reaches downstream of the initial landslide location?

Response:

1） where do these error bars come from?

For measuring channel width and the associated uncertainty, we added "Similar to the method used by Cook et al. (2018), we measured active river channel by manually interpreting active river channels from false colour composite Sentinel-2 images. Fresh bare land near river banks are major features to interpret active river channel. Topographic information from Google Earth is also used as an ancillary data during interpretation. The uncertainty of manually interpret active channel is one pixel size of the used optical imagery (10 m in this work)." (lines 103-106)

2） Over what length reach are the channel width measurements taken?

We measured 100 km along the Jinsha River from the Baige landslide to downstream areas (Figure 6).

3) Is 96.33 ± 10 m the average width across the whole 100km study area?

Sorry for the confusion. the uncertainty of +-10m is misleading and should be deleted here. The sentence has been changed from "The successive LLFs increased the mean width of the active channel from 96.33+/- 10 m to 148.56 +/- 10 m." to "The successive LLFs increased the mean width of the active channel from 96.33 m to 148.56 m. (lines 147-148)".

4) Can you break this down to reflect different reaches downstream of the initial landslide location?

The width of different reaches downstream of the initial landslide location before and after the floods are shown in Figure 6 of the revised manuscript. These width are measured at points with 1 km interval.

13. Line 121: you state here that there may be a link between the lateral erosion (channel widening) and the ongoing hillslope displacement. At the locations where hillslopes are actively destabilising, it would be good to see a plot of the width increase for the channel at the corresponding location.

Response: Thank you for the suggestion. We added Appendix A3 and Fig. A3 to show the relation between the lateral erosion (channel widening) and the ongoing hillslope displacement : "We made a plot between the increase (rate) of the channel and the maximum measured displacements, as shown in Fig. A3. It shows no relation between the two variables. This is because slope stability is determined by the integrity of bedrocks in the first order (Gallen et al., 2015)." (lines 264-266)

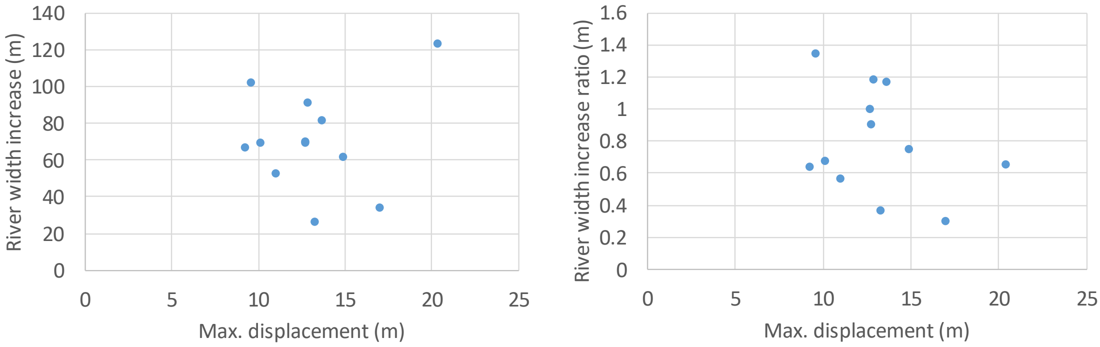

Fig. A3. The relation between measured maximum slope displacements and river width increase (a) and river width increase rate (b).

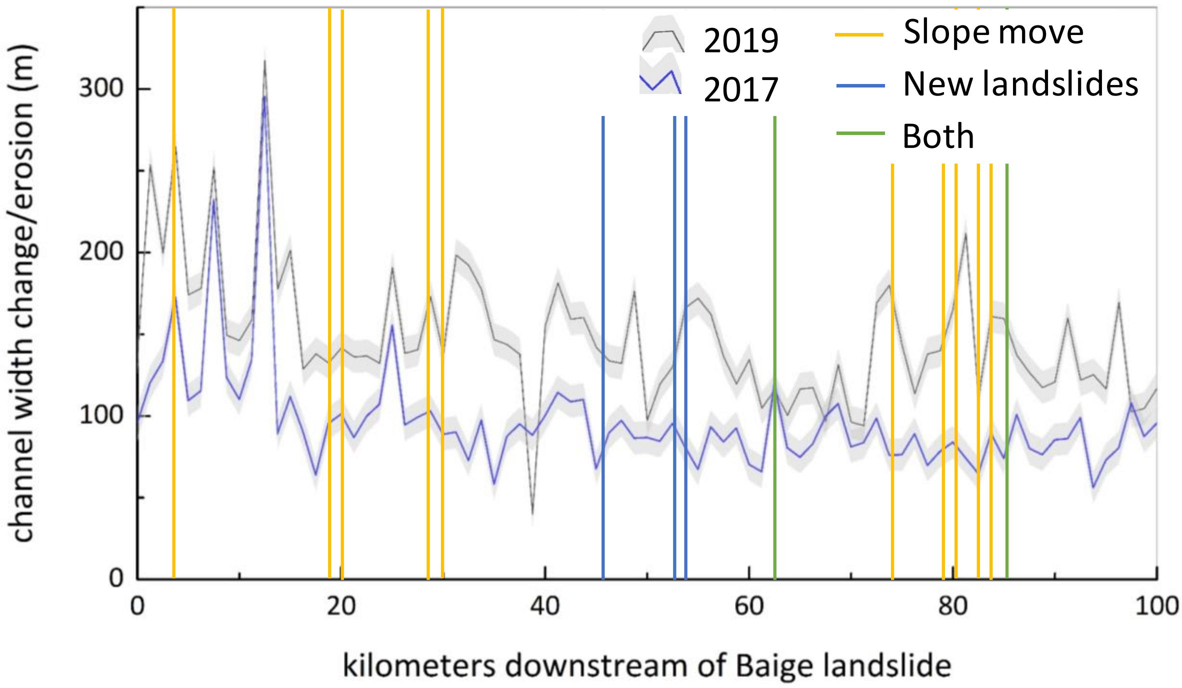

Fig. 6. River widths before and after the Baige floods. The gray shadow indicates an uncertainty of ±1 pixel in the Sentinel-2 imagery.

14. Line 125: So the areas are different, what about their displacement? Did the concurrent landslides move a larger distance than the ongoing landslides have done since the event? They may be inactive now, but how does the mobilisation of sediment compare between these two types of landslide?

Response: In this study, concurrent landslides refer to the landslides that already occurred during the floods. The structure of these concurrent landslides has been completely destroyed and it is not possible to measure displacements for these landslides.

15. Line 127: See previous point on Line 121 – make a figure showing width increase against landslide displacement (either concurrent or ongoing rate)

Response: We added Appendix A3 and Fig. A3. Please also refer to the response to comment 13.

16. Line 133-145: Discussion section. This first section of the discussion section should be in the results section. There is nothing 'discussion' about this, it's more analysis providing new results that we haven't seen yet.

Response: Thank you for the suggestion. We moved this part of the discussion to the results section (lines 108-120).

17. Line 136: Why are these estimates smaller than the flood discharges that we've already been told about on lines 62 and 67?

Response: These estimates are made at the Batang hydrological station for the peak discharge during both Baige floods, whereas the values on lines 55 and 60 are made on the Baige landslide dam. We added a few words to clarify this in the revised manuscript.

18. Line 143-144: This sentence is not required, it's a repeat of information in the previous Sentence

Response: This sentence has been removed and the paragraph has been moved to the Results part.

19. Line 153: 'tens of hundreds of kilometres away' – I think this should be 'tens of kilometres away'

Response: You are right. The term has been changed to 'tens of kilometres away' (lines 168-169).

20. Line 154: General point about the Discussion – I think you could do more to place your work in the wider context, to help show the implications of the work beyond this narrow case study. You make a speculative comment here about the feedback cycle of 'landslide-LLF-landslide' hazard chains, which needs to be supported with further reference to relevant literature (and data). How likely is that the

ongoing hillslope displacements will lead to large landslides that will form dams? You don't present any evidence that this is likely to happen? Later on, you go on to discuss the seismic control on the hillslope stability – how important are the seismic controls for the 'landslide-LLF-landslide' hazard cycle? Can you have the landslide-LLF-landslide hazard cycle without an underlying seismic control? Further development of these implications, with reference to literature, is required to really help this manuscript make some robust and strong conclusions.

Response:

1) How likely is the ongoing hillslope displacements dam river?

There is very few work documenting the 'landslide-LLF-landslide' hazard chains phenomenon, which is a highlight in this work. We clearly demonstrated that the MD-2 is activated by the floods related to the 2018 Baige landslides.

The high-relief topography is similar along the river in the reach from Baige to Mindu, we could estimate qualitatively the possibility of the future landslide dams by comparison. We added the following sentences: "For example, Yang et al. (2020b) found the size of the moving MD-2 slope is larger than the Baige landslide, whereas the river directly below MD-2 is narrower than the later one, indicating high risk of blocking the channel once the landslide occur. If the MD-2 slope failed, the risk of blocking the river would be higher." (lines 170-172)

2) How important are the seismic controls for the 'landslide-LLF-landslide' hazard cycle? Can you have the landslide-LLF-landslide hazard cycle without an underlying seismic control?

We searched all earthquakes with magnitude >4.5 and <500km from the Mindu-1, MD-2 and MD-3 landslides in the last hundred years (Fig. A1 below). There are very few large earthquakes occurred. So, we further explored the literature and found instead of earthquakes, active regional tectonics, weak rock types, large slope gradients and intense precipitations may be major drivers. We discussed this by adding two new paragraphs in lines 178-194.

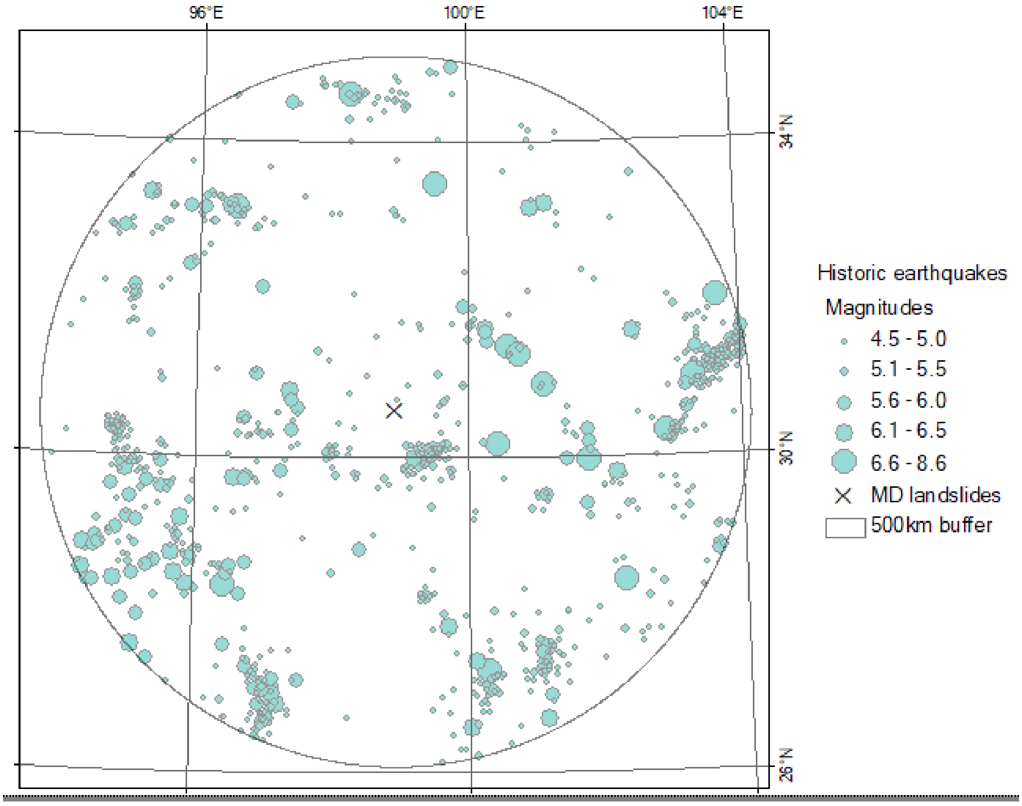

Fig. A1. Historic earthquakes with magnitudes >4.5, within 500km from the MD-1, MD-2 and MD-3 landslides.

21. Line 156: This is the first time that you mention the implications for the infrastructure. You could mention this also in the introduction, to help justify your study – i.e., you need to understand the complete view of hazards associated with LLFs.

Response: As you see in our response to comment 3, we added three examples demonstrating the damages to infrastructures by the LLFs in the introduction section.

"in A.D. 2000, a large rock avalanche dammed the Yigong River with an estimated maximum impoundment of >2 km3. The resulting flood led to record river level rise at gauging stations ~500 km from the landslide and caused major damage to infrastructures (such as roads and bridges) and losses of lives in India (Delaney and Evans, 2015). Recently, the Tangjiashan landslide dammed lake after the 2008 Wenchuan earthquake posed serious threats to the Mianyang city inhabited by millions of people (Fan et al., 2012a). A more astonishing LLF in 1920 BCE is supposed to flood the downstream Yellow River and even changed the ancient Chinese history (Wu et al., 2016)."

22. Line 165: Do you know when strong earthquakes (or extreme precipitation) may have occurred in this study area? I think this is important context for your results, and it helps to show whether the landslide-LFF-landslide hazard chain is an phenomenon that could occur in all landscapes, or is it just likely to occur in landscapes that have been weakened by a recent seismic event.

Response: "To form the 'landslide-LLF-landslide' hazard chain, weak riverbank hillslopes may be an important prerequisite. In our study area, we found all slopes with tensile cracks had deformations after the Baige floods (Fig. 8). (lines 178-179)" We found this study area experienced very few strong earthquakes in the last 100 years. So, we tried to explain this from other perspectives: "These tensile cracks may be joint results of interactions among active regional tectonics, weak rock types, large slope gradients and intense precipitations: 1) The Jinshajiang fault zone is the main fault zone in this study area. GPS measurements show that the near-east-west shortening rate of the fault zone is 2~3mm/a (Chen Zhiliang et al., 1998; Chen et al., 2000). However, there is no strong earthquakes occurred in the past 100 years for this section of the fault zone. Despite this, faults with prolonged activity of fault motion produce damage zones and crushing rocks along the Jinsha suture, leading to high landslide susceptibility for this study area (Cao et al., 2016). 2) The strata of the study area mainly include Mesoproterozoic metamorphic rock of gneiss, quartz schist and metagranulite, which can be easily weathered to form layers with weak shear strength during rainfall. 3) The landscape of the study area is deeply incised by with high slope gradients greater than the angle of repose (20-30degree, Larsen and Montgomery, 2012). 4) >60% of the precipitation occurs from July to September. The Monsoon-driven precipitation, characterized by intense storms with large-magnitude and short-duration rainfall is another stimulus for landsliding." (lines 179-189)

23. Line 174: 'our findings are proofs to the theory' is incorrect grammar. Rephrase to something like 'our findings support the theory…'

Response: We changed the sentence as "Our finding … support the claim that landsliding is a key process…" (lines 208)

24. Line186-187: There are several references that you could highlight here to support this statement. See Lamb and Fonstad (2010; Nature Geoscience); Lamb et al. (2014; PNAS); Baynes et al. (2015; PNAS); Cook et al. 2018a (Science) and others. This is an example where further engagement with the literature will help to elevate your manuscript to place your work in the wider context of extreme events in landscape evolution

Response: Thanks for your suggestions and the great example for us to improve the discussion part. We read and compared our findings with these references. For example, we added a new paragraph in the discussion (lines 217-223) to place our work in a wider context:
"Infrequent catastrophic floods could play an important role in landscape evolution (Cook et al., 2018a). Our finding that the mean active channel width increased by 54.2% after the 2018 LLFs indicate that rare catastrophic events could leave a disproportionate footprint on local landscapes. Compared to monsoonal discharges, LLFs can cause extensive bank erosions and efficiently expand active river channels by undercutting hillslope bases and bank retreat. This is consistent with previous findings bedrock canyons on the surfaces of Mars and Earth are probably caused by infrequent catastrophic floods instead of uniform, steady erosion from background runoff (Baynes et al., 2015; Keisling et al., 2020; Lamb et al., 2014; Lamb and Fonstad, 2010; Larsen and Lamb, 2016; Malatesta et al., 2017)."

25. Figure 2: Can you change the colour scheme for the colour bar. A spectrum from red to green is hard for colour-blind readers to interpret, so I'd suggest using an alternative colour scheme. What does the small red circle inside the black square on the bottom of panels d1 and d2 indicate?

Response: We changed the spectrum of red-green to dark red-blue. We added in the figure caption that "Red circles indicate concurrent landslides and black squares are slope slippages" (lines 389-390).

26. Figure 3: See previous point about the colour scheme. What happened to the eastern hillslope in January 06 2019? In this panel only, there is widespread displacement on the hillslope – do you have an explanation for this? Perhaps a rainfall event?

Response: Thank you. We changed the colour scheme. Please find from the revised manuscript. Those detected surface movements in January 06 2019 are background noises. We checked the base and target images and found they are probably caused by changes of mountain shadows as shown in Figure 1R.

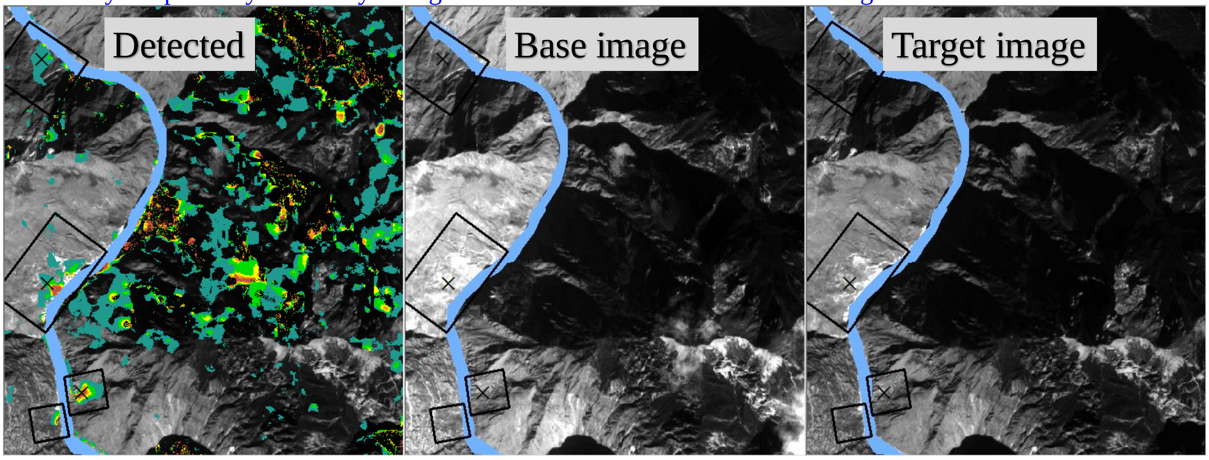

Figure 1R. Background noises in the detected surface movements (a) and the base and target images used to derive the result. These background noises may be caused by changes of mountain shadows.

27. Figure 4: Why is the orange line not plotted between ~March 2019 and Jan 2020, when the blue line is plotted across this period?

Response: This is because of missing data between March 2019 and Jan. 2020, due to low image quality. We added a sentence to the figure caption to explain this: "No displacement data for MD-2 during March 2019 and January 2020, due to low image quality" (lines 399-400).

28. Figure 5: I think it would be good to see an additional figure showing the width increase against the hillslope displacement. If the hillslopes that have higher displacement correspond to section of the channel that widened more extensively, this would help support your conclusions about the long term impact of LFFs on landscapes.

Response: We added Appendix A3 and Fig. A3. Please also refer to the response to comment 13.

29. Also Figure 5: What does the y-axis represent? Would plotting actual channel width be easier to interpret?

Response: We changed the y-axis title to "active channel width". The blue and black curves are measured actual channel width before and after the floods.

30. Figure 7: In the caption, it would be good to explain why there are so many data gaps in the flow records. Were the gauging stations not operational? How likely is it that during these periods of missing data, there may have been floods of higher magnitude that have been missed?

Response: The data for these years are not available. We do not know reasons for these unavailable data, but we are certain that peak annual discharge of water would be less than their maximum value in 1954. The Jinsha River, the upper reaches of the Yangtze River, is the most important and populated rivers in China. Any discharges than the 1954 havoc would be well documented. We added a few words to the figure caption: "Note multi-year gaps in the data available, partly due to the remoteness of the station. Despite the gaps, any event with discharge larger than those in 1954 would be recorded. (lines 381-383)"

Response Letter to Reviewer #2
Summary
This manuscript looks at the effect of a large landslide lake outburst flood in the Jinsha River on the adjacent hillslopes. The authors demonstrate that the flood caused channel widening and destabilized the hillslopes in a number of locations along the flood course. This is certainly an interesting and relevant topic, and I think that the authors nicely demonstrate that the LLFs have destabilized hillslopes and caused long-lasting slope deformation in susceptible hillslopes. However, there are several things that need improvement before the manuscript can be publishable, particularly the methods presentation. Also, although what is shown in the manuscript is nice, I found myself disappointed by the lack of depth in the analysis. The paper demonstrates that hillslope deformation following major floods happens, but doesn't explore any further. What influences the locations of the landslides? Did all slopes with tensile cracks end up moving, or are there some that didn't? What might influence the timing and rates of the post-flood deformation? It is nice to document that this effect happens, but I don't feel that I've gained much new insight into it.

Response: We re-wrote much part of the discussion and added some sentences to the discussion part to settle these major concerns.

What influences the locations of the landslides? Did all slopes with tensile cracks end up moving, or are there some that didn't?

We added two new paragraphs in the discussion part (lines 178-194) to answer these two questions:

"To form the "landslide-LLF-landslide" hazard chain, weak riverbank hillslopes may be an important prerequisite. In our study area, we found all slopes with tensile cracks had deformations after the Baige floods (Fig. 8). These tensile cracks may be joint results of interactions among active regional tectonics, weak rock types, large slope gradients and intense precipitations: 1) The Jinshajiang fault zone is the main fault zone in this study area. GPS measurements show that the near-east-west shortening rate of the fault zone is 2~3mm/a (Chen Zhiliang et al., 1998; Chen et al., 2000). However, there is no strong earthquakes occurred in the past 100 years for this section of the fault zone. Despite this, faults with prolonged activity of fault motion produce damage zones and crushing rocks along the Jinsha suture, leading to high landslide susceptibility for this study area (Cao et al., 2016). 2) The strata of the study area mainly include Mesoproterozoic metamorphic rock of gneiss, quartz schist and metagranulite, which can be easily weathered to form layers with weak shear strength during rainfall. 3) The landscape of the study area is deeply incised by with high slope gradients greater than the angle of repose (20-30degree, Larsen and Montgomery, 2012). 4) >60% of the precipitation occurs from July to September. The Monsoon-driven precipitation, characterized by intense storms with large-magnitude and short-duration rainfall is another stimulus for landsliding.

Besides deformations on slopes with tensile cracks, we also found some deformations on slopes that have no visible tensile cracks. However, both types of slopes had bank collapses adjoining the active river channel, though the former slope type has much larger area of deformations. The removal of buttressing by the 2018 LLFs' erosion may attribute to the hillslope slippage in downstream reaches, which is substantiated by our observation that detected deformations are larger near the riverbank and decrease in concentric ellipses upslope."

Response to "What might influence the timing and rates of the post-flood deformation?"

We used precipitation data from the Global Precipitation Measurement (GPM) mission to analyse the influence of precipitation on the timing and rates of the post-flood deformation.

"Figure 3 indicate the velocity of three slope deformations. All these slopes showed increased moving speed immediately after the floods, indicating that the Baige floods probably accelerated slope slippage. For MD-1, the speed decreased quickly after the floods, which may indicate the deteriorations of the floods' effect with time. For MD-2, we can also see similar deformation-time pattern before May 2019. The deformation continued with a lower speed from May 2019 to January 2020. The deformation of slopes may be related to precipitation or river discharge. As we do not have daily or monthly hydrological data, we analysed the GPM monthly precipitation from Nov. 2018 to Feb. 2020 (Supplement S2). Rainy season in 2019 begins from March to October. The beginning of the rainy season in March may explain the acceleration of MD-1 and 2 in March. The deformation continued during rainy season (March to October). However, the acceleration of MD-2 after 18 Jan. 2020 does not agree with precipitation change and should be explained by other triggers." (lines 195-203)

More specific points:

1. Please provide some more information about the methodology. I only realized that COSIcorr is a software from reading the acknowledgments. There needs to be much more explanation of how the method works, exactly what you did, and any parameters or settings used in the COSI-corr software. In addition, there needs to be some information about uncertainty and potential errors in the numbers you obtain. Where does the 2 m cutoff from? And how is this related to the 10 m resolution of the Sentinel imagery?

Response: Thank you for the questions, which were also raised by Reviewer 1. Cosi-Corr is an open-source software widely used in tracking movement and deformation of landforms related to geomorphic and tectonic processes. Following reviewers' suggestions, we added one paragraph (copied below) to introduce the technique in the "Methods" section.

The following sentences have been added to improve the methodology part:
"The principle of the method is to compare the difference in the reference image and the target image. There are two correlator engines to perform the procedure: The frequency and the statistical. The frequency correlator transforms the images into the Fourier domain and detect sub-pixel surface changes in the phase images, whereas the statistical correlator compares changes in the spatial domain (Leprince et al., 2007). The frequency correlator is more accurate to detect surface changes than the later correlator and is used in this work. To perform the frequency correlator in the COSI-Corr, the initial and final window sizes are two major parameters to be defined. The final window is set no larger than the initial window size by default. For both windows, smaller sizes are sensitive to background noises, whereas larger window sizes often result in smooth results (Lacroix et al., 2018; Yang et al., 2020). In this work, we used moderate window size combinations of 64 and 32 for the initial and final window sizes." (lines 74-82)
"Uncertainties in the derived surface deformation have several sources, such as DEM errors during orthorectification, solar angle differences between the reference and the target image, et al and can be estimated as the mean and standard deviation of displacements in a manually elected stable area (Bontemps et al., 2018; Lacroix et al., 2018; Yang et al., 2020). In this work, we used the stable area as Yang et al. (2020) near the MD-2 landslide." (lines 96-99)

2. Is the Nov. 12, 2018 image from before, after, or during the flood on Nov. 12? If before, then how do you differentiate concurrent slope deformation from post-flood slope deformation over the larger area? Does the lack of change from 2015 to Nov. 12 2018 mean that the first flood had no effect?

Response: The Nov. 12, 2018 image was acquired during the second flood on Nov. 12. In this work, the concurrent landslides and post-flood slope deformations are very different from each other. The concurrent landslides are landslides that already occurred and can be manually interpreted by comparing feature changes in images before and after the floods, whereas post-flood slope deformations are landslides that have not yet failed and are calculated (accelerated) by the floods.
We added the following sentences:" Despite the Nov. 12, 2018 image was acquired during the second flood on Nov. 12, undetected displacements from 2015 to Nov. 12 2018 suggests that the first flood has little post-effect on slow deformations and cannot be detected in a short time. (lines 138-140)"

3. The temporal pattern of displacement for the MD slopes is interesting, especially the correspondence between MD-1 and MD-2. Do you have any explanation for the changes in rate? Is it related to precipitation or river discharge? What happened in March 2019 when MD-1 and 2 both accelerated?

Response: We added an Appendix A2 to explain this issue:
"As we examined from very high spatial images on Google Earth, all these three slopes have tensile cracks. Compared with the MD-3 slope, MD-1 and MD-2 are all stable slopes before the floods. Their consistent behaviours before and after the floods indicate that both LLFs indeed accelerated slope slippage. The deformation of slopes may be related to high precipitation storm events, but we do not have local daily or monthly hydrological data. The Global Precipitation Measurement (GPM) monthly precipitation data from Nov. 2018 to Feb. 2020 (Response Figure 5)show that rain season in 2019 began from March to October. This may explain the acceleration of MD-1 and 2 in March. The deformation continued during rainy season (March to October). However, the acceleration of MD-2 after 18 Jan. 2020 needs triggers other than precipitation. (lines 255-262)"

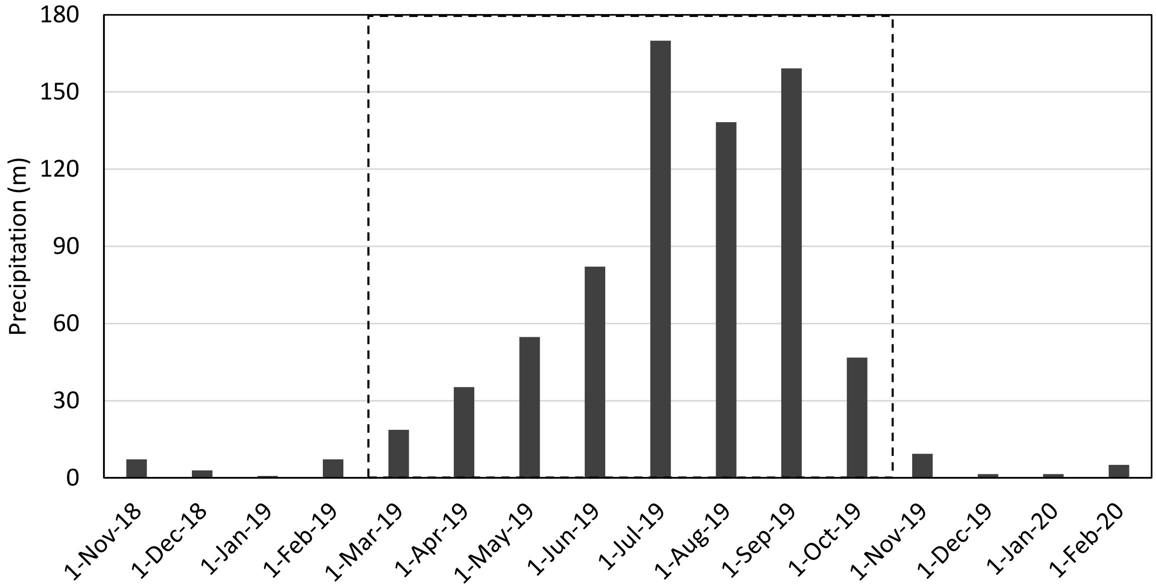

Fig. A2. Monthly GPM precipitation near the MD-1, MD-2 and MD-3 slopes.

4. Line 22: reaches

Response: The suggestion has been accepted.

5. Line 28: flux of what?

Response: Changed to "water flux" (line 29)"

6. Section 2: I don't think materials and methods is the best descriptor of what's in this section. Maybe study area, materials and methods

Response: This part is redundant with part of the introduction and has been removed.

7. Line 50: "created by the collision"

Response: The suggestion has been accepted.

8. Line 51: replace grand plain with plateau

Response: The suggestion has been accepted.

9. Line 55: "precipitation combined with active tectonics"

Response: The suggestion has been accepted.

10. Section 2: this contains more than just materials and methods, so either rename or put the study area in a different section

Response: This part is redundant with part of the introduction and has been removed.

11. Line 65: After Nov. 8, 2018, several excavators were deployed

Response: The suggestion has been accepted.

12. Section 4.3: I found this discussion confusing. What do you mean by downstream erosion? This whole section seems to be about slope stability, and not about things moving downstream. As well, the discussion of possible controls on slope stability seems very speculative. A strong earthquake could have weakened the slopes, but is there any reason to think that this has happened? Surely there must be some studies about landslide susceptibility in this region.

Response: We changed the title of the section to "Possible mechanism for hillslope slippage". In addition, we added the following paragraph to address the concern raised in this comment:

"To form the "landslide-LLF-landslide" hazard chain, weak riverbank hillslopes may be an important prerequisite. In our study area, we found all slopes with tensile cracks had deformations after the Baige floods (Fig. 8). These tensile cracks may be joint results of interactions among active regional tectonics, weak rock types, large slope gradients and intense precipitations: 1) The Jinshajiang fault zone is the main fault zone in this study area. GPS measurements show that the near-east-west shortening rate of the fault zone is 2~3mm/a (Chen Zhiliang et al., 1998; Chen et al., 2000). However, there is no strong earthquakes occurred in the past 100 years for this section of the fault zone. Despite this, faults with prolonged activity of fault motion produce damage zones and crushing rocks along the Jinsha suture, leading to high landslide susceptibility for this study area (Cao et al., 2016). 2) The strata of the study area mainly include Mesoproterozoic metamorphic rock of gneiss, quartz schist and metagranulite, which can be easily weathered to form layers with weak shear strength during rainfall. 3) The landscape of the study area is deeply incised by with high slope gradients greater than the angle of repose (20-30degree, Larsen and Montgomery, 2012). 4) >60% of the precipitation occurs from July to September. The Monsoon-driven precipitation, characterized by intense storms with large-magnitude and short-duration rainfall is another stimulus for landsliding. (lines 177-189)"

13. Lines 165-168 seem pretty repetitive of the point you have been making throughout the paper.

Response: These sentences has been removed.

14. Line 184-185: I don't understand what you mean with this sentence

Response: The sentence has been changed to "Compared to monsoonal discharges, LLFs can cause extensive bank erosions and efficiently expand active river channels by undercutting hillslope bases and bank retreat." (lines 219-220)

15. Figure 5: y axis looks like channel width, and not change in channel width. What determines the placement of the points on the y-axis? Does this have meaning, or are they just stuck on the width line? If there is no y-axis value for the points then they should not be plotted like this.

Response: We changed the y axis to "channel width" and made a new figure as shown below.