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comment

# ***Interactive comment on “Spatial and temporal patterns of sediment storage and erosion following a wildfire and extreme flood” by Daniel J. Brogan et al.***

**Anonymous Referee #1**

Received and published: 6 March 2019

General Comments: This paper investigates post-wildfire erosion using multitemporal lidar over time. I think some of the methods used by the authors are quite unique as compared to similar post-wildfire lidar studies (e.g. Pelletier and Orem, 2014 and Orem and Pelletier, 2015). In particular, I like their approach for removing DEM pixels that were determined to be disturbed by the canopy. That technique is novel, and I think it will provide a robust new method that will be embraced by the community. I also applaud the authors for their use of radar estimated rainfall and the approach used to correct it based on local rain gauge data. That allowed the authors to analyze spatially continuous rainfall data, which was useful for their overall analysis. I think that the general thrust of the paper is unique and I think that this manuscript is close to being

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ready for publication. However, there are a few general suggestions that I will make, in addition to many specific suggestions below.

Consider re-writing section 4.2. Section 4.2 is a long chronological narrative, I understand the temptation to write it this way, because that is the way it unfolded in time. But it is really boring to read and fails to convey the salient points well. Consider organizing it in terms of drivers and response. This will help to generalize the paper beyond a case study.

Section 5.2 also needs some attention. The way that you break up the paragraphs is a little strange. I suggest abandoning the enumeration that you use “First, second, third.” For example, on P17 line 19, why does that paragraph start with “third”, and contain the “forth” point, but the next paragraph doesn’t start with “Fifth”? I think the same points can be conveyed without this type of enumeration, and then paragraphs can be grouped by similar ideas.

I was also confused by your use of the term “sediment availability” in the discussion. At present, I don’t see how your data speak to the sediment availability at all, and yet it is invoked as an explanation. I would consider either adding in data that relates to sediment availability, or rephrasing the sentences in which you point to sediment availability.

Lastly, I think it would be really helpful to synthesize these really unique results that moves beyond the case study. This could just be a paragraph in the discussion, but consider helping readers to see how the erosion/deposition sequence could be converted into something that might lead to more insight at different sites in the future.

This paper is really interesting, and despite my detailed comments, I enjoyed the approach, and I think that this manuscript will be a nice addition to the literature.

#### Specific Comments:

P2. L14: Rengers et al. modeled basin scale post-wildfire runoff. doi:

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P3 L7-8: remove “very”

P3 L21: replace “small- to moderate-sized watersheds” to “stream channels” because it seems like all of your analysis is in the channels, not in the larger watershed.

P3 L28: I didn’t see any hypsometric curves

P3 L30: Use a more specific term than “evergreen”

P4 L3: Say how straw and wood mulch were applied

P4 L6: add “channels” after the word combined

P5 L4: Are you going to post the python scripts anywhere?

P5 L18: Can you explain why you used the 50 m sections? You could have just analyzed the lidar on a pixel-by-pixel basis, so why create short reaches to analyze? This would benefit from some more explanation.

P5 L28-29: area-maximum maximum? Is that just a typo or does the second maximum go with the 30-min. rainfall intensity? Maybe rephrase so easier to understand.

P5 L30: Did you generate the burn severity map, if so mention that, if not say where it came from.

P6L5 is that 7am on one day and 7am the next day? Maybe make that more clear

P6L17: for the Moody 2013 ref, you should also ref. Kean et al. 2011 doi:10.1029/2011JF002005 See their figure 8 and reconcile that with your current statement .

P6L26: state goodness of fit for correlation

P6L31 ref a figure after “intervals”

P6 L31: I had (have) a really hard time visualizing exactly what you trying to say here

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in the sentence that begins “Topographic curvature” Can you add a figure that is a schematic of what you are doing? A lot hinges on understanding this process, so I think it will be important that people don’t miss what you are saying here.

P7L32: Why not just extract a line across the DoD at your X-S location?

P8L11: Cool approach!

P9L23: do you mean “The lowest TOTAL amount . . .”

P9L29: Does mesoscale refer to the 2013 flood? Make sure that is clear

P9L32: Add this rainfall to table 2

P10L4: Do you have a way to estimate the size of the footprint of each laser point on the ground?

P10L9: I don’t think it is accurate to say that “the ALS data . . . generally fall along a 1:1 line”. There seems to be a lot of deviation.

P10L15: reference tables after the word “ratios”

P10L18: Did you observe step pools?

P10L20: add “reaches” after channels

P10L31: add “within our LoD” after “deposition”

P11L10 :is the net deposition number (19000) from the ALS or your cross-sections? There is so much missing data that it is hard to believe this is a complete number. I am more interested in the longitudinal patterns than the specific volume estimates because of the missing data.

P12L26: There is so much missing data that it is hard to feel confident in the total volumes of erosion/deposition values in SG or HG. Consider focusing more on the patterns.

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P13L5: “this plus other data . . .” what other data are you referring to?

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P13L6: you mention hillslope scale, but I didn’t think you had data on the hillslopes

P13L9: not quite a mass balance here, but I understand why

P13L16: “highly correlated” with what?

P13L33: “erosion occurred in the lower gradient” hmm that doesn’t seem intuitive if slope is a major component of the driving shear stress. Can you help to explain why this makes sense somewhere?

P14L6: Is BS\_m already defined? On page 5 BS is burn severity

P14L8: reference a figure after the word “scatterplots”

P16L1: What field data shows grain size?

P16L7: Add a ref like Passalqua 2015 doi:10.1016/j.earscirev.2015.05.012 I also am not sure I agree with the word “recent” We’re going on >20 years of lidar differencing

P16L11: “the predominant post-fire effect is deposition in the channels and valley bottoms” This is a more general statement than I think you are intending. For example, I don’t think you would argue that this is necessarily true for the Poudre River. That is a channel/valley bottom, but it sounds like there was not extensive deposition there. So I suggest just refining the language to focus on the spatial scale at which you think it is representative.

P16L15 what fraction of the channel network does your ALS capture?

P16L28: Seems like you should mention the coarse substrate and depth to water table before this

P16L28: What exactly do you mean by stripping and coarsening of the channels?

P17L2: string “large” and add “documented” after “debris flows”

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P17L15: I don't think you actually mean "allow researchers to be repeated" consider clarifying

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P17L25: you qualitatively describe lidar here, why not just suggest a point density (pt/m^2) that you think would be good to shoot for.

P18L15: What proportion of the area was reduced from this approach?

P18L18: Your 7th point seems pretty obvious, but I guess the people at NEON didn't think about that. I thought it was typically standard practice.

P18L24: ref a figure at end of this sentence

P18L25: ref a figure at end of this sentence

P19L2: As far as I can tell, sediment availability is not something you measured (is it measureable?). Your results may allow you to make some inferences about sediment availability, but I don't think that the way things are presented right now allow you to say that the geomorphic changes were largely controlled by sediment availability.

P19L12-14: Maybe they aren't correlated because you calculated them across 50 m averages.

P19L16: What data do you have on sediment supply?

P19L21: Am I missing something? How do you know that sediment availability increased? What data are you pointing to for this statement?

P19L29-30: Spatially explicit models are being used: McGuire et al 2016 doi: 10.1002/2016JF003867; McGuire et al. 2017 doi: 10.1002/2017GL074243

P20L27: What makes sediment "available"? Figure 1: Mark the location of Laramie with a dot. What determines the thickness of the blue lines?

Figure 2: How did you calculate the maximum intensity?

Figure 10: Make sure to say these are "Pearson" correlation coefficients. They are

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averaged for each time period, right?

Figure 11: Consider using equal axes in A and D.

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Interactive comment on Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2018-98>, 2019.

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