Note to editor/reviewers. Plain text represents the original comment, and bold text represents the response.

Reviewer 2:

Excellent, comprehensive analysis of debris flow activity after a fire. Findings reveal how well USGS operational models for debris flow rainfall thresholds and debris flow volumes perform for this fire location. Writing is clear, and figures are a nice combination of quantitative data and photos. My comments are mainly minor points of clarification.

1. Equation 1: what are the values of beta, C1, C2, and C3? Are they determined for this fire specifically or are there set values used across multiple fire locations?

Good question. These do not differ based on fire locations, but they do change with rainfall duration. I have now tried to clarify this and have directed readers to the primary publication where Equation 1 was described. Here is the new text.

"Note the coefficients C1-C3 and β do not vary among fires or regions but differ based on rainfall duration. All values are shown in Staley et al. (2017)."

2. Line 158, median I15T with overbar - the overbar on I15T seems to imply a mean value? If the overbar indicates a mean, what values are included in the mean? If it doesn't indicate a mean, what does the overbar represent? The median is the median threshold value computed for all basins?

I have tried to clarify this, here is a new paragraph to clarify that we first generate thresholds for each basin then we summarize them to get a single fire-wide threshold for year 1 and year 2:

"Equation 1 is used to generate spatially explicit rainfall thresholds for individual channel segments or basins (< 8 km^2). However, in practice, managers can only use a single fire-wide rainfall threshold for warnings over a burn area. Therefore, to generate a single Year 1 threshold, we first estimated the 15-minute intensity rainfall threshold for all basins delineated by the hazard assessment (Figure 1) using Error! Reference source not found. **and assuming p = 50% (P50). We then used the median value of all of the basins as the single fire-wide rainfall threshold for warning. A similar method was used to estimate the Year 2 threshold, except we set p = 75% (P75) to estimate a Year 2 rainfall threshold, and then used the median rainfall threshold from all of the basins as the single fire-wide rainfall threshold. These probabilities were used to define a fire-wide 15-minute intensity rainfall threshold ($\overline{I15_T}$); however, the success rate of the P50 and P75 rainfall thresholds have not been rigorously tested. Therefore, in this study we compared the median P50 $\overline{I15_T}$ for all basins in the burn perimeter with the measured peak 15-minute intensity (I15) in 2021 ($\overline{I15_{T21}}$) and the P75 in 2022 ($\overline{I15_{T22}}$) to determine the performance of the P50 and P75 thresholds estimated using** Error! Reference source not found.**."**

3. The first sentence in section 3.2 seems to imply that the rain gauges are mapped in Figure 1 - but they are actually shown in Figure 2.

Changed the text to clarify this: "These gauges (USGS_gc_1, USGS_gc_2, USGS_gc_3; Figure 2) were deployed specifically for the task of verifying the hazard assessment model (Figure 1)."

4. What is the precision of the rain gauge measurements (what depth per tip?)

I've now added this to Table 1.

Rain Gauge Name	**Owner**	**Station ID**	**Data Start**	**Data Stop**	**Data Gap**	**Rain Gauge Model/Tipping Bucket Depth (mm)**
Cinnamon Creek Complex	USGS WSC	GCTC2	19 Jul. 2021	present	7/29/21 to 8/12/21	Vaisala WXT536/0.01
Cinnamon Creek	USGS WSC	GCCC2	19 Jul. 2021	present	No Gap	Vaisala WXT536/0.01
Deadmans Creek	USGS WSC	GCDC2	14 Jul. 2021	present	7/22/21-7/26/21	Vaisala WXT536/0.01
No Name	USGS WSC	GCNC2	15 Jul. 2021	present	7/28/21 to 8/12/21	Vaisala WXT536/0.01
Windy Point	USGS WSC	GCIC2	12 Jul. 2021	present	No Gap	Vaisala WXT536/0.01
East Fork Dead Horse Creek	USGS WSC	GCEC2	13 Jul. 2021	present	No Gap	Vaisala WXT536/0.01
Coffee Pot	USGS WSC	GCFC2	13 Jul. 2021	present	No Gap	Vaisala WXT536/0.01
Bair Ranch	CDOT	N/a	30 Jun. 2021	present	No Gap	Vaisala RG13H/0.02
USGS_gc_1	USGS LHP	N/a	17 Sept. 2020	present	No Gap	HOBO RG3M/0.02
USGS_gc_2	USGS LHP	N/a	17 Sept. 2020	present	No Gap	HOBO RG3M/0.02
USGS_gc_3	USGS LHP	N/a	17 Sept. 2020	present	No Gap	HOBO RG3M/0.02

5. line 277, "If there were multiple storms that were triggered" - do you mean multiple storms that triggered debris flows?

Yes, thanks for catching that. The new text says: "If there were multiple storms that triggered debris flows in the same watershed,…"

6. Figure 1: I would have found it helpful to see the locations of debris flows on this figure rather than on a separate figure.

Good Suggestion. I have now added the locations of the debris flow points to Figure 1. I didn't remove them from Figure 2, as I think they are useful reference points in both figures. I also changed what I was showing in Figure 1 to something more relevant. Instead of showing the likelihood for debris flow initiation given a 15-minute rainfall intensity of 24 mm/hr, I am now showing the 15 minute rainfall intensity threshold assuming a 50% likelihood of debris flow initiation. The median value from all of these basins is used to estimate the Year 1 firewide threshold. I have also updated the caption to reflect this:

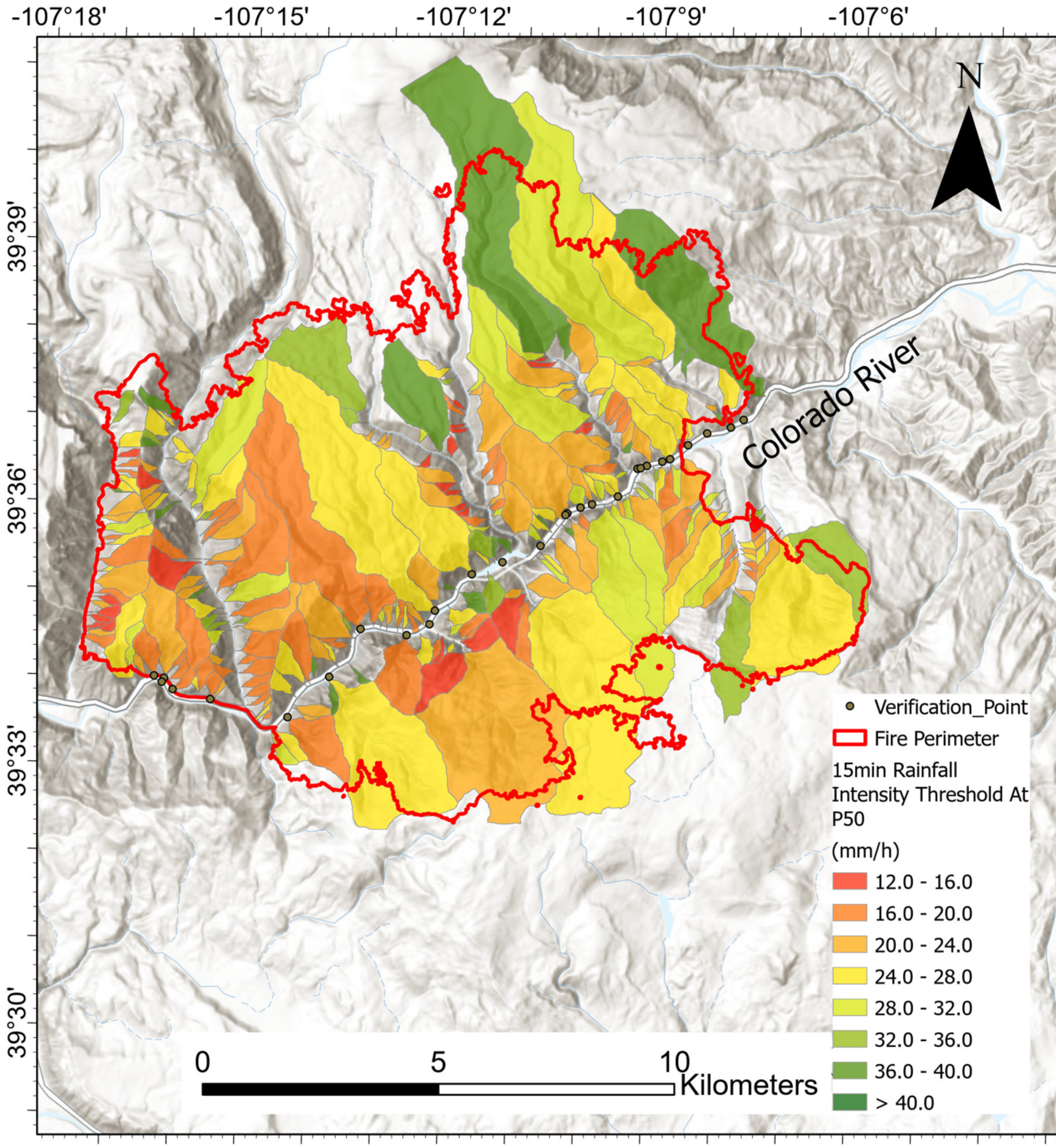


Figure 1. USGS debris-flow hazard assessment produced for the Grizzly Creek Fire perimeter using Error! Reference source not found.**. The 15-minute rainfall intensity threshold is shown for each basin, assuming a likelihood of 50% (P50). The median value from all of these basins is used to estimate the Year 1 15-minute rainfall intensity threshold for the entire burn area.**

7. Figure 2b: I am not seeing deposition at the end of this debris flow track. For both b and c, consider adding an arrow to show flow direction.

I've now added an arrow to show flow direction on Figure2b and 2c. As far as not seeing the deposition, this is a little hard it shows up more clearly in Figure 3. For the reviewer, I have illustrated this below. There is a small blue spot to the right of the red erosion. I've zoomed in and I added a black circle to indicate the deposition location for the reviewer. For the readers of the paper, I think they can see this most clearly in Figure 3a and 3c.

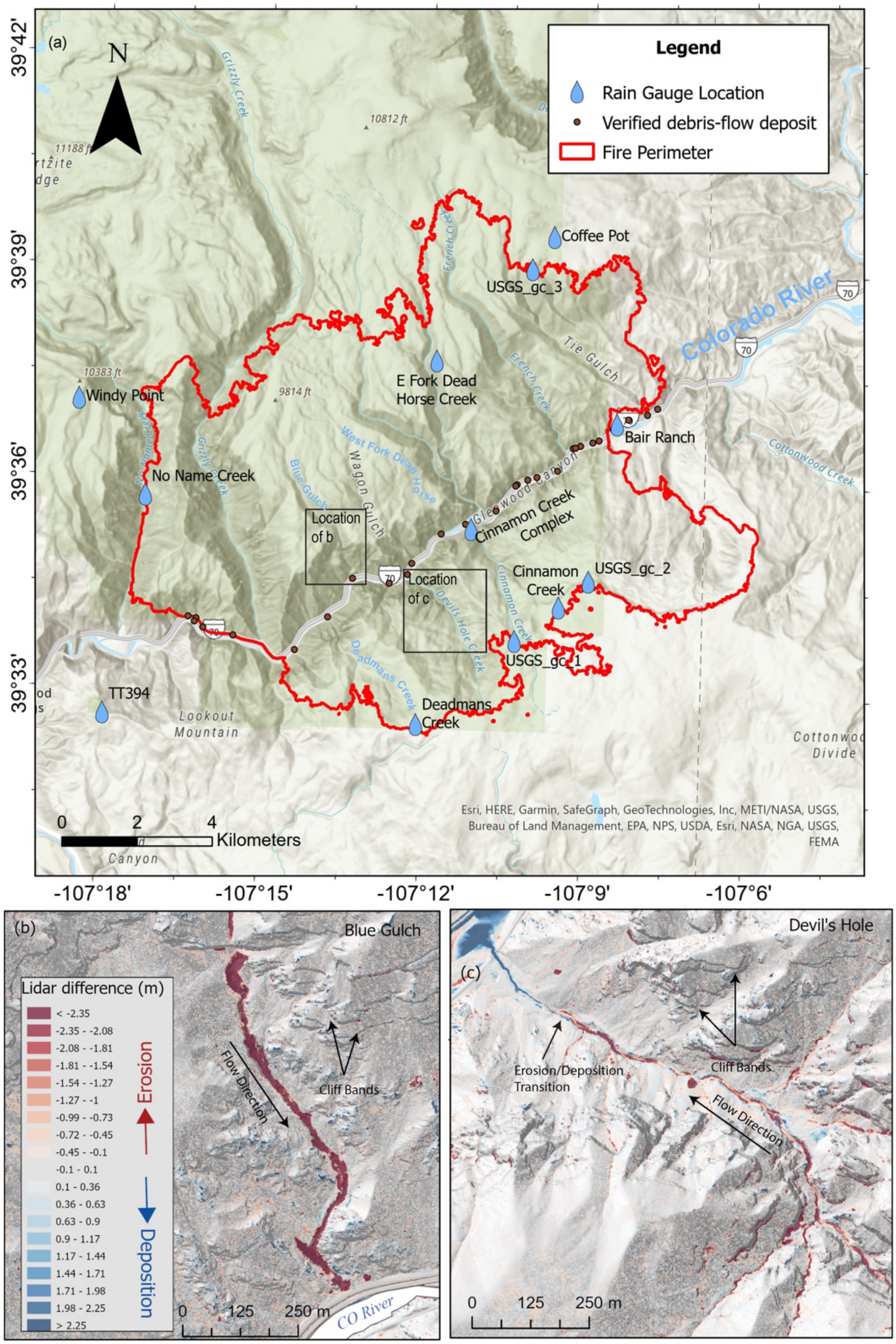
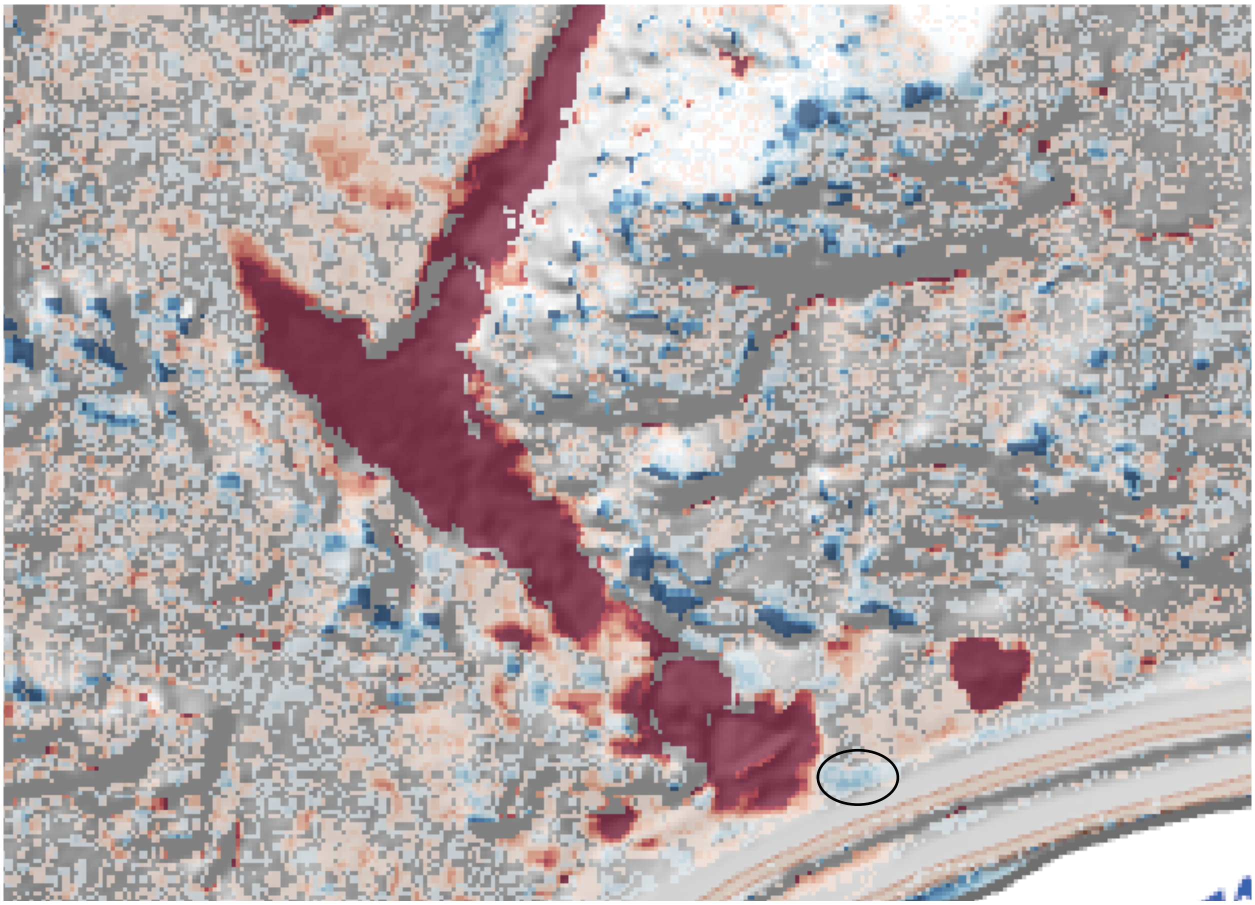


Figure 2. (a) Map showing the burn perimeter, rain gauges, and locations of debris-flow observations. (b) DEM of difference map showing erosion (red) and deposition (blue) in the lower half of the Blue Gulch drainage. (c) DEM of Difference (DoD) showing erosion (red) and deposition (blue) in the lower half of the Devil's Hole drainage.



8. Figure 5d: this doesn't look like a fan - just in-channel deposition?

Good point. I have changed the figure to say "in-channel deposits" and adjusted the text throughout.

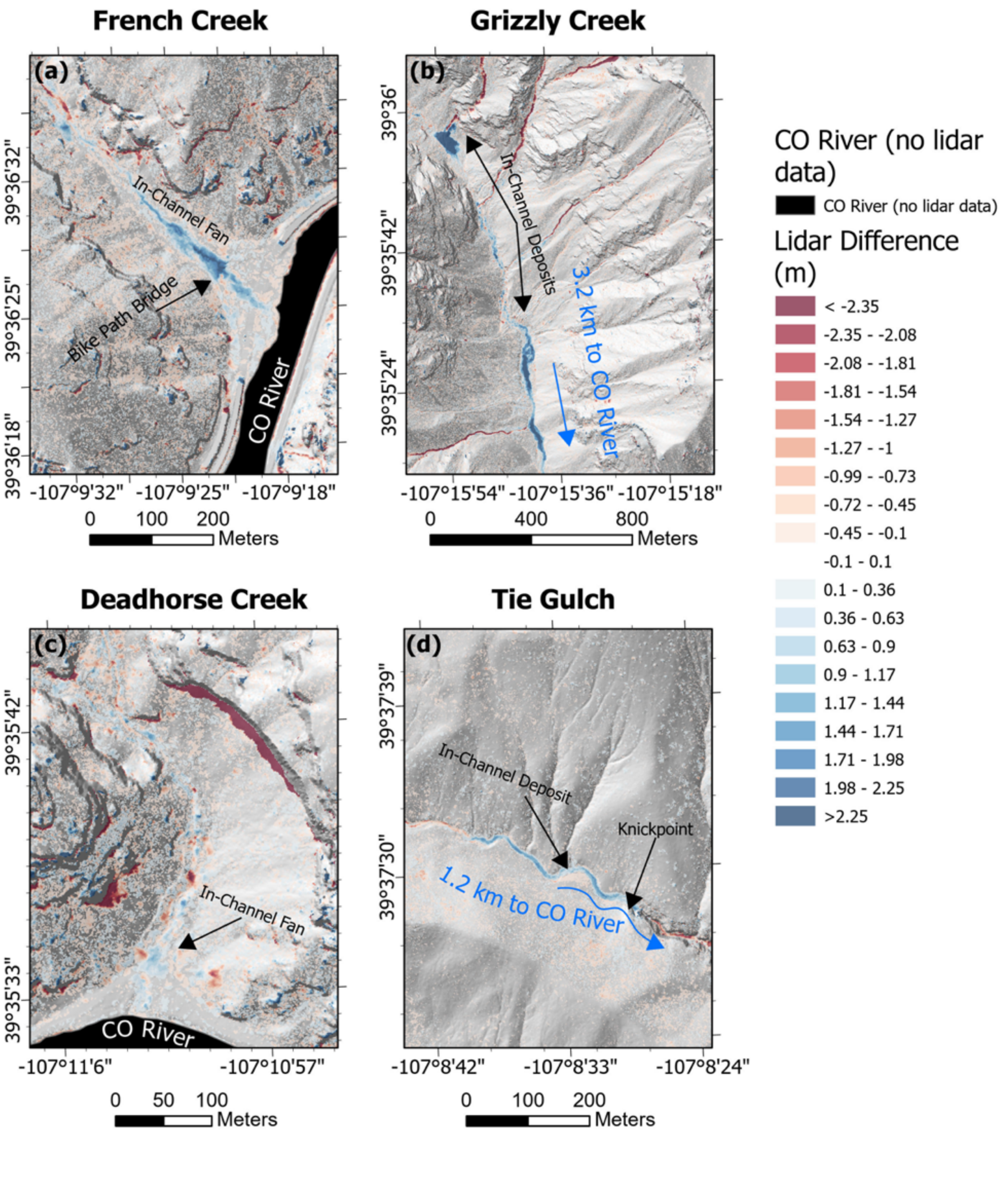


Figure 3. In-channel sediment deposits in large drainage basins. (a) French Creek: a fan forms upstream of the Colorado River, primarily because sediment is blocked by a concrete bike path bridge. (b) Grizzly Creek: Several in-channel deposits formed several kilometers upstream of the Colorado River. No fan formed at the outlet of Grizzly Creek. (c) Deadhorse Creek: relatively minor depositional fan forms upstream of the Colorado River. (d) Tie Gulch: In-channel deposits develops upstream of a knickpoint.

9. Figure 7: this is a nice figure but kind of a lot to take in. I am curious about how the erosion and deposition volumes compare at sites where both of those measurements were collected, but it's hard to evaluate that in this figure - could erosion-deposition comparison be pulled out as a separate figure or subplot? Then just show erosion in this plot? Do each of the debris flow volume points correspond with a rain intensity point in the bottom graph? Could be useful to have a volume vs. intensity plot, as an alternate way to visualize the data.

This is a really useful comment. Based on this comment I have created a new figure that I have added to the supplement to show erosion versus deposition, and I've added in the uncertainty in both erosion and deposition. I will add this in as a new supplemental figure. Here's a note to the reviewer that I will put in the caption. Many channels contributed to an in-channel deposit in Grizzly Creek, but for the purposes of comparing erosion and deposition, all of the erosional channels contributing upstream of the deposit were summed to compare with the deposit volume.

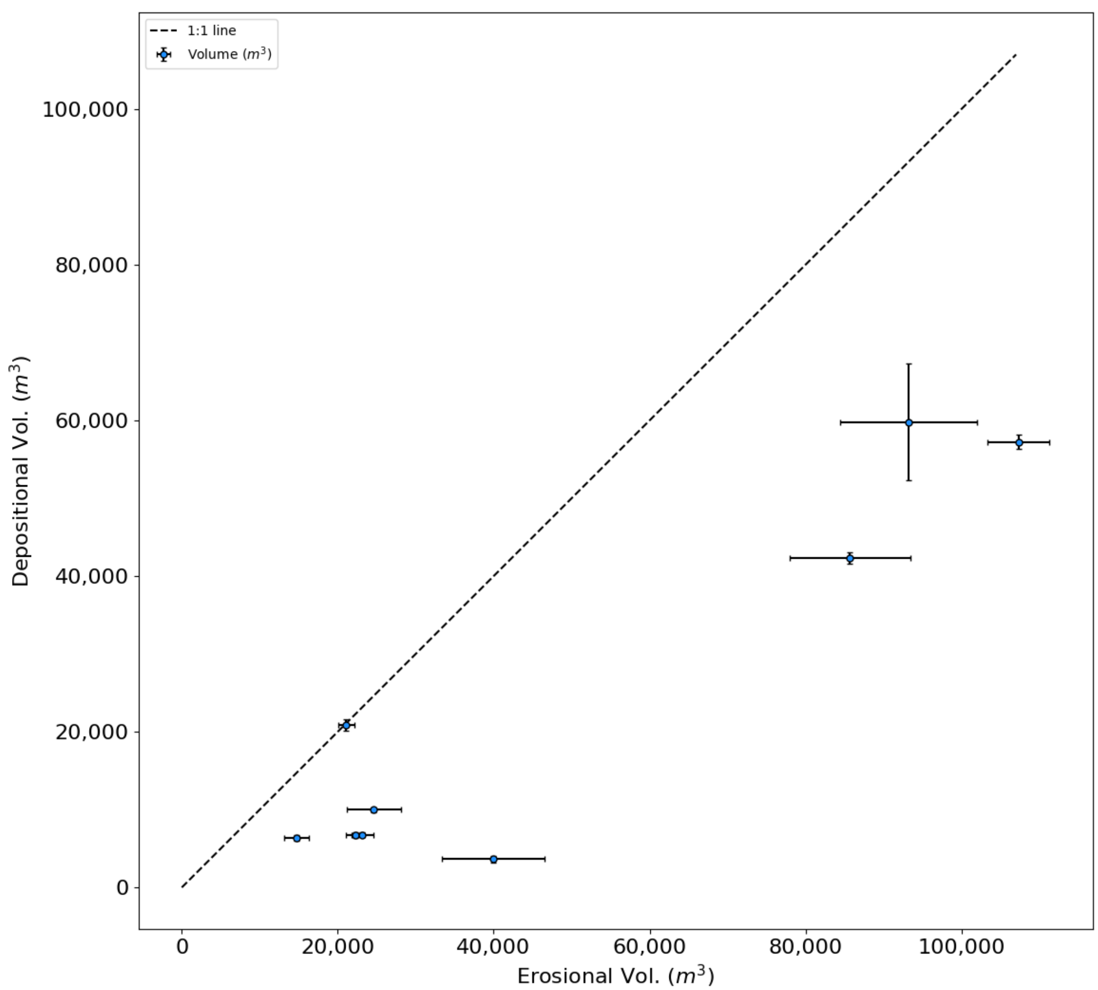


Figure S6. Comparison of all the erosional volumes in locations where we have known depositional volumes. Error bars represent the uncertainty. Note that many channels contributed to an in-channel deposit in Grizzly Creek, but for the purposes of comparing erosion and deposition, all of the erosional channels contributing upstream of the deposit were summed to compare with the deposit volume.

As for updating figure 7. I don't think it hurts to leave in the deposition. I like the suggestion about plotting erosion versus rainfall intensity, but I think it is misleading so I am not including this figure. Here's the problem. There were multiple rainstorms between the two lidar datasets. We know the timing of the debris flows, as we have highlighted in several figures, and for comparison with the Gartner Volume equation we use the peak 15-minute intensity or sum of peak 15-minute intensities in the case of multiple debris flows because that is consistent with their methodology. However, because there were multiple storms and in some cases multiple debris flows, a plot of erosion versus maximum rainfall intensity may not account for the multiple pulses of the erosion that took place due to the cumulative rainfall and therefore it may be misleading.

10. Figure 8. As I understand the model, the threshold intensity to produce a debris flow will vary by basin. Yet here the symbols for "above threshold intensity" seem to be based on the median threshold across basins? Why not show the symbols based on the threshold intensity computed for each basin individually? I am also confused by the caption text "from the 11 rain gauges" - are there intensity values given for each gauge individually or are the values averaged across all gauges?

Hopefully this is now clarified by the text that I changed in response to comment 2 above.

11. Figure 9. The value of (b) is not clear to me, other than as a means to add the south canyon data. Visually the power law lines do not seem to fit the data well.

Good question regarding the value of (b). The main thing to observe is that the volume increases monotonically with drainage area. Therefore, we could apply a simple correction factor to lower the estimated volumes and that should work across drainage basins. I point this out in this text:

"Nevertheless, because of the linear nature of the offset in the volume estimate (Figure 9), it may be possible to apply a linear correction to the estimated volumes (e.g., multiply the estimated volume by 0.21) to obtain a regionally corrected volume estimate."

As far as the power-law fit, we now show an R^2 value and 2*standard error (which should capture 95% of the points around the trendline) so readers can interpret goodness-of-fit metrics. Also note that most debris-flow volume data are fairly noisy. Take a look at Figure 2 in Gartner et al., 2014 for reference.