



EGUsphere, referee comment RC2
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Comment on egusphere-2022-267

Anastasia Piliouras (Referee)

Referee comment on "Episodic sediment supply to alluvial fans: implications for fan incision and morphometry" by Anya S. Leenman and Brett C. Eaton, EGU sphere, <https://doi.org/10.5194/egusphere-2022-267-RC2>, 2022

This paper presents results from experiments of alluvial fans to determine how abrupt changes in sediment supply affect fan morphodynamics and how the duration of sediment supply oscillations affects fan response. The authors present a concise and well-written story that examines several features and behaviors from a set of four experiments, showing that time-varying sediment supply causes changes in large-scale fan morphology and channel dynamics, and that increasing the period of the oscillations creates more elongate fans with lower slopes. This paper is an important contribution to the experimental and alluvial fan communities, and provides a sound argument for changing how we model these systems. I suggest the paper be published after some minor revisions.

Comments:

The introduction would benefit from a brief discussion of what we know about adjustment timescales relative to event timescales in alluvial fans. I know this is touched on in the discussion, but this is a classic concept in geomorphology and is worth highlighting. You are looking to determine if changes in sediment supply over time will have any impact on the system, so this will clearly be related to the timescale of the change relative to the timescale of system adjustment or an avulsion timescale. This would set you up to discuss your results in the context of timescales later on, which I also suggest placing more emphasis on in the discussion, as it would be helpful to explain a lot of your results.

Why were there 3 (or 4?) experiments done for Run 1 but only 2 for Runs 7-9? Further, why did you do repeats but then only present results from one experiment? It would be

beneficial to show the results averaged from all of the experiments, not just one.

You have selected particular distances at which to measure things in your data analysis (e.g., 0.25 m down-fan for fan head entrenchment). Please provide a justification for selecting these distances.

Figure 5, and all figures of a similar nature, would benefit from including text on the figures that lists the mean or median value for each experiment. On Figure 5, for example, we can see the difference in how slope changes over time, but what is the time-averaged slope for Run 1 compared to Runs 7-9? Please include this information on each figure. If you're also going to talk about variance, as you do later, put that number on the figure along with the mean/median.

Figure 8: What is the physical reasoning for the spike in F_n after sediment supply is turned off? Is it related to excavation of the feeder channel? Some discussion of this would be appreciated, as it is not necessarily expected or intuitive.

Looking at Figure 5 and Table 1, I suspected that if the channels become more entrenched with the longer periods, those entrenched channels would have less or slower lateral migration. There may also be a larger difference between the channel gradient and fan gradient for fans with longer periods of oscillation (Run 9) compared to those with shorter periods (Run 7). Combining this with Figure 8, by eye, it looks like there is overall faster migration in Run 7 compared to Run 9, possibly due to this entrenchment. What does this tell us? There could be drastically different adjustment times, avulsion times, and overall system dynamics if the channel gradients are very different from fan gradients.

Figure 9: Can these be separated out into separate plots? it's really quite difficult to see anything. Or at least have a row of erosion, a row of deposition, and then a row where they're combined like this

It would be helpful to show fraction area abandoned alongside fraction area newly inundated to observe the change in channel network structure as it reorganizes.

Regarding fan head trenching (discussion lines ~319-326), how do you reconcile the fact that previous studies did get a trench with constant Q_s ? You have replicates, so is it true across all replicates that you did not get trenching in Runs 1 and 7, only 8 and 9? Later, your explanation for why there is a trench in 8-9 but not 7 doesn't quite get there. You suggest a decrease in the number of channels during 0-S that concentrates flow and erosion in a few channels, leading to downcutting. But you have periods of low sed supply in all runs, so it must be related to some response or adjustment timescale, which in Run 7 is likely longer than the period of oscillation, no?

Technical comments:

Table 1 should include the standard deviation and error.

L151: 7 mm is not sand. Rephrase to just say "approximately the size of the largest grains."

You note that video speed differs because photos were collected at different intervals. This can be corrected when the videos are made by adjusting the frame rate. Please consider adjusting this so readers can see the difference in relative rates of channel mobility.

L163: "for their self-organised adjustment **the** input conditions or changes thereof"
change 'the' to 'to'

It would be helpful to remind the reader in the figure captions and/or text if these various metrics you're plotting are at a transect or fan-averaged.

L314: The experiments don't say anything about amplitude, only period. You have the one prelim experiment in supplemental, but I'd focus the discussion here on duration for what you can actually show.