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Comment on esurf-2021-92

Douglas Edmonds (Referee)

Referee comment on "Linking levee-building processes with channel avulsion: geomorphic analysis for assessing avulsion frequency and channel reoccupation" by Jeongyeon Han and Wonsuck Kim, Earth Surf. Dynam. Discuss.,
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I have now read the paper submitted to Earth Surface Dynamics by Han and Kim. The paper presents a 1D advection-settling model of levee formation, and then uses that model to make insights into how the avulsion process is linked to levee building. I found the ideas presented to be thought provoking—it would be remarkable if we could link levee building and river avulsion style. I think that the paper is overall interesting and I applaud the authors on a job well done, and like many ideas they can benefit from revision. I provide some suggestions below and in a marked-up pdf that I hope will be helpful to the authors.

Suggestions:

- I supplied a marked-up pdf with many questions and suggestions for writing clarity.
- I think that the authors have inappropriately assumed that local and regional avulsions correspond to annexational and progradational, respectively. The work we have done (Edmonds et al., 2016; Valenza et al., 2020) show that avulsions overwhelmingly reoccupy existing pathways (regardless of whether they are local or regional). Even progradational avulsions usually have some portion of their new channel that reoccupies a pre-existing channel (making it partially annexational). In my understanding of the Heller and Paola (1996) definition, local and regional do not refer to style (i.e. progradational or annexational).
- The authors could help the reader by refining their conceptual model. They present an interesting idea in section 4.5.3 but it is a bit hard to follow. I think a cartoon schematic might be really helpful here to follow the logic. In particular, I am not sure how channels get 'removed' from the floodplain in the conceptual model. Do you assume they are filling over time from flood sediments? It is also not clear in this conceptual model and the one in 4.5.4 where exactly 'upstream' or 'downstream' are relative to the mountain front. Does upstream mean right at the transition from confined to unconfined as flow leaves the mountain?
- Section 4.5.4 contains some interesting thoughts, but I find it to be quite speculative,

and it might be more impactful to combine that section with the previous one into a clearer conceptual model that can guide the thinking of others. As it stands, I am not sure how useful it is to speculate on these stratigraphic implications when the model presented is quite far detached from stratigraphy and heavily simplified.

- The authors make the unstated assumption that the alluvial ridge (and hence superelevation that drives avulsion) is governed only by suspended sediment deposition during overbank flow. I think that is probably true for rivers that don't meander. But for rivers that meander they are constantly cannibalizing their outer bank levee and leaving behind their inner bank one. Over time and many cutoffs, this could create quite a complex amalgamation of levees, scroll bars, abandoned channels, etc. This 'amalgamation' is the meander belt which probably contributes to the construction of the alluvial ridge. In that way, alluvial ridges could be more than just the levees that are attached to the main channel, and the time history of overbank deposition could be important. I think this work would be stronger if the authors could clarify the limitations of their conceptual model and/or clearly state these kinds of assumptions.

Please also note the supplement to this comment:

<https://esurf.copernicus.org/preprints/esurf-2021-92/esurf-2021-92-RC1-supplement.pdf>