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Comment on esurf-2021-92

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Community 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., https://doi.org/10.5194/esurf-2021-92-CC1, 2021

In the submitted preprint 'Linking levee-building processes with channel avulsion: Geomorphic analysis for assessing avulsion frequency and style' Han and Kim describe the relation between avulsion frequency and style and levee geometry. For this a numerical model is used, and the results are tested using two field cases. They explore the interesting hypothesis that levee slope on one had is a function of avulsion frequency, and on the other hand can also be an important agent in avulsion style. For the latter mechanism they find an interesting relation with morphology of abandoned channels. We think this paper is relevant to better understand fluvial sections and modern delta landscapes and will be worth publishing. We also see opportunities to clarify statements made and to make a wider comparison with existing studies. This includes adding more cases for validation, but also discussing other important factors in levee and avulsion that known to be important from literature.

- The cause and effect of levee geometry and avulsion frequency is not always clear: do avulsions force levee topography or the other way round, or both?
- Some confusion raises regarding the term levee slope and how this is controlled. E.g. in L 384 isn't levee height meant here instead of slope? Boechat Albernaz et al. (2020) (https://doi.org/10.1002/esp.5003) find fast initial heightening and then widening of levees (decreasing the slope over time), could slope simply be a function of time?
- The authors state that topographical leveling/smoothing after channel abandonment is important for avulsion potential, this mechanism could be explained more: is floodplain deposition meant here, and where in the system exactly? We can indeed imagine that this makes topography more gentle, and less avulsions help in that sense, because large areas of inactive delta plain only experience modest floodplain deposition, smoothing out topography.
- Important in this hypothesis is the proposed mechanism of abandonment of the river, which is currently not fully explained. There are more phases of infilling of abandoned channel, that even occur before the end of avulsion. The statement in L 382 is not correct; topographic lows, in particular residual channels have finer infillings than the channel belts they are in. The paper by Toonen et al. 2012 (https://doi.org/10.1002/esp.3189), a review on sedimentology of residual channels, may be of interest.
- We think the smoothing hypothesis is interesting to explore, but now a discussion

misses on how important this is compared to other factors that have been discussed in avulsion and levee literature before. For example, vegetation and even tides (in some cases present up to a delta apex) are also relevant to mention, even though these were not a central topic in the study. A link between vegetation density and levee width (hence slope) was found. For more on this, we recommend Kleinhans et al. 2018 https://onlinelibrary.wiley.com/doi/10.1002/esp.4437 and Boechat Albernaz et al. (2020) who use numerical models to build levees.

- Important are the timescales at which mechanisms take place: how fast do levees grow compared to avulsion duration? Filgueira-Rivera et al. (2007) and Boechat Albernaz et al. (2020) for example, find that levee crest height is reached relatively fast and that it is a function of flood level height, while avulsions generally take much longer to complete (e.g. Stouthamer & Berendsen 2001: https://doi.org/10.1306/112100710589). L 388: if this is correct, how can this be seen in the geological record? A hiatus with small time, this is very hard to see, and therefore the relevance for geology may be relatively small.
- The authors use two geological cases to validate the outcomes of the study. To fully understand them and relate them to the model outcomes, more introduction of these cases as well as some figures would be helpful. The authors may also consider adding more cases datasets from literature, e.g. in Boechat Albernaz et al. 2020 (fig 10, data in their supplements) and in the work of Stouthamer (2005) on reoccupation (involving also timescales) https://archives.datapages.com/data/sepm_sp/SP83/Reoccupation_of_Channel_Belts_and_Its_Influence.htm)

We thank the authors for their contribution on this topic, and hope they will find these suggestions insightful.

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