

Earth Surf. Dynam. Discuss., referee comment RC1
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Comment on esurf-2022-14

Anonymous Referee #1

Referee comment on "Theoretical and numerical considerations of rivers in a tectonically inactive foreland" by Stefan Hergarten, Earth Surf. Dynam. Discuss.,
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General comments

The manuscript entitled 'Theoretical and numerical considerations of rivers in a tectonically inactive foreland' is a timely contribution to the discussion of how fluvial sediment transport dynamics influence the transfer of sediment through landscapes and the implications for interpreting sedimentary records. Hergarten usefully identifies two types of rivers contributing to erosion and sediment transport within an alluvial foreland and presents a clear methodology for analysing the net contribution of these respective river types to the overall sediment budget and network morphology. It is the detailed explanation of the modelling approach that is a great asset to this paper and a reason for why I believe this paper is well suited for the Esurf community. While the paper does not integrate any field or lab data to support its modelling, I appreciate the adaption of the model to integrate typical field observations, such as the changing erodibility of sediment surfaces as they increase in age. I think that the insights gained from this modelling approach are a useful baseline for future studies.

While the paper is generally well written and easy to follow, there are a few sentences that would benefit from rewording, of which some are listed below in the technical comments. The grammar and some of the sentence structure could be improved by editing from a native English speaker. The figures are excellent and easy to interpret and the mathematical formulae are correctly defined. The first half of the abstract would be improved by stating more explicitly the context of the paper, as at present it is a little vague and difficult to follow. There are a few recent references that could also be included to give credit to parallel approaches being developed in this field (Malatesta et al., 2017 Basin Research, plus those detailed below).

Specific comments

- In the introduction, it would be useful to explicitly define what you mean by steady state in the context of this work and why this definition is relevant.

- The expectation of high concavity values (>1) for these alluvial rivers was surprising for me, as I am not aware of these values being frequently observed in natural alluvial rivers (c.f. Wickert and Schildgen 2019 ESurf). Why is this model formulation acceptable for this case?

- I think the absence or distribution of accommodation space generation in the model needs to be specified and considered. The low deposition rates along the carrier rivers are perhaps to be expected if there is no accommodation space available for the sediment to be deposited in. I am wondering how the net fluxes and the interactions between the carrier and redistributing channels would shift as an accommodation space is defined. This maybe something to mention in the future work section of the conclusions as it has important implications for understanding the generation of physical and measurable parameters such as downstream grain size fining trends along alluvial rivers (for example, see Harries et al., 2019 ESPL). For the reference case in this paper, I would expect that any size-selective grain size fining that would occur along the length of the carrier rivers would be solely introduced by the integration or recycling of older sediments by redistributing channels or the migration of carrier channels.

- Recent work has demonstrated that sediment transport along alluvial rivers is a non-linear process, even at millennial timescales (Carretier et al., 2019 Sci Rep, Sinclair et al., 2019 Geology). In which case, net sediment transfer is not well characterised by mean values. It might be worth mentioning this work in the introduction and highlighting the usefulness of the reduced complexity approach presented. The observation that the storage time of sediment in the fan surfaces is highly variable and dependant on the distance between channels (section 9) aligns well with the findings of Carretier et al. (2020 EPSL).

Technical comments

Frequently, the phrase 'on the mean' or 'in the mean' is used (e.g. L289, L319 and L426). I think the desired phrase is 'on average.'

L21: 'modelling studies mentioned above' – include more references to modelling studies

L23-24: Reword

L55: by 'tectonically inactive' do you mean without subsidence?

L56 and L419: 'exposed' is perhaps not the right word for this context. You impose boundary conditions.

L214: Remove 'in'

L289: Reword

L339: 'one half to one widths' - reword

L342: Replace 'rate' with 'range'

L429: Reword

L440: Reword