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Comment

Interactive comment on “Network response to internal and external perturbations in large sand-bed braided rivers” by F. Schuurman et al.

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General Comments:

In this contribution the authors present a numerical model of sediment transport built on Delft3d. They then design and run a set of experiments where the upper boundary condition of water flow is varied, the channel boundaries are altered, partial barriers are inserted to the flow, channel bars are removed, or barriers are imposed upon the channel bars.

This contribution is basically a list of, to me, a set of numerical experiments that the authors try to baggage together as an exploration of system response to perturbations. The individual experiments are interesting in their own right, but this manuscript as

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presented is quite a tough read, and is a long description of various model scenarios. I would recommend that the authors reconsider what they consider to be a 'perturbation' and try to find some generic message or insight on river networks and how they evolve. The manuscript would also be enhanced if a more thorough exploration of the model space was made, rather than a set of individual experiments where various initial conditions or boundary conditions are changed.

My biggest problem with this paper is that the model scenarios presented are not all perturbations. A perturbation is a change to the system state, yet here we are presented to different initial conditions, different boundary conditions and only one or two true perturbations. Furthermore, the model conditions explored are rarely justified: why would a dam be built across only one channel? Would it not be futile to try and protect a bar in a large braided river? Is this a realistic scenario? If it is, then explain why.

I think that there is very good science within this manuscript, but the structure of the text is poor, with simple mistakes like the model descriptions not following the numbering in Table 2. In its present form it is an unyielding list of model scenarios and so the simple scientific messages that are contained within are lost. In summary, this paper poses relevant scientific questions within the scope of Esurf, using a sound numerical model based on valid assumptions. The aspects in which this manuscripts falls down are: (1) the contents do not reflect the title and (2) the structure is a mess.

Comments on the text as the arise:

Abstract:

"physics-based" Drop this phrase. The bank erosion is arbitrary and follows a heuristic law. What is wrong with it simply being a numerical model? I notice the authors like this phrase and have used it in past publications but lets be honest, the model is not based on first order physics.

"The results showed that the perturbations initiate an instability that propagates in

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downstream direction by means of a bifurcation instability" What is a bifurcation instability - please define this jargon. The way I read the manuscript was that the perturbations, those that were truly perturbations, modified the existing bifurcations. Bifurcation is the division of something into two branches, I guess it would follow that a bifurcation instability is an instability that leads to the splitting of a system - the formation of a bar. However, once the bars are made they are modified not sub-divided, no?

"...with a feedback to the upstream bifurcation" From all the model runs I only saw downstream changes due to perturbations. If there was some upstream propagation it was in the model run 9 where an unexplained initial condition was imposed. Is this therefore not the therefore the model evolving to steady state?

Page 203:

line 14: Delete "natural". line 16: Delete "how fast, and how far", I get the idea with a simple "how". line 26-27: Change "...and bifurcation become unstable" to "...and the bifurcation becomes unstable".

Page 204:

line 7: Change 'dataset' to parameter space or something better. These are simulations and no data is being created.

Page 206:

line 23: Delete "so called" and "Thus".

Page 207 to 208:

I would argue that only the runs in group D represent perturbations, as the model has been run to a state and then perturbed. The rest are a series of model with different boundary conditions and/or initial conditions. This is in my opinion the central problem with this manuscript: 5 out of the 14 models are exploring a perturbation, and the remaining 9 models have nothing to do with a perturbation to the system and are very

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Interactive Discussion

Discussion Paper



distracting from the central message of the paper.

page 213:

The sections describing the discharge attenuation and channel confinement are interesting but have nothing to do with the abstract of the paper or the title. Where is this going? These model runs explore different boundary conditions. Is this a paper on how braided rivers form under different forcing?

line 6: Non-erodible walls had a relatively small effect on the bar pattern statistics relative to what?

page 214:

The section on inflow asymmetry bears no relation to a perturbation of the steady system developed in section 3.1, 3.2 or 3.3. Why is this initial condition been used? A perturbation would, for example, be a change in the flow direction during a model run. This experiment explores how an initial condition is altered, not how the system responds to the change in flow direction at the upper boundary. I don't understand how this model relates to parts 3.1 to 3.3.

Forgive me, but is it not also obvious that a different boundary condition will lead to a different bar morphology?

Why is run 2 followed by run 9? What happened to runs 5, 6, 7 and 8?

page 215:

Why would anyone dam only one bar of a braided river?

Again, now run 12 is being described before any mention of runs 5, 6, 7, 8, 10 and 11.

page 217:

Could you give an example of where engineers have tried to protect a channel bar in a braided river? Is this a likely prospect?

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Discussion Paper



page 219:

Why is it surprising ("remarkable") that the structure does not have a large effect upstream of the structure? The structures modelled in section 3.6 likewise had only a minor effect.

page 220:

The sand mining section is nonsense and should be deleted. This is an arbitrary initial condition and how the model evolves has nothing to do with exploring how a braided river responds to a perturbation, for example the removal of a bar from a actual model run. Taking run 12 as a good example of a perturbation, I recommend the authors wind up a model to steady state and then remove a bar. This would be a perturbation.

page 221:

line 25: "The novelty in this study is the propagation of perturbations by means of bifurcation asymmetry, which is a consequence of bifurcation instability, and bar reshape." I don't understand this sentence at all.

page 222:

line 2: "This way, even small perturbations, for example a relatively small dam on top of a bar, may cause major impact on bar and branch planimetry and dynamics..." I don't see a major difference between Figures 5 and 12 for example. Could the major impacts be better explained?

line 19: "According to theory..." What theory? Big bang theory?

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