Earth **Surface**
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Interactive comment on "Comparison between experimental and numerical stratigraphy emplaced by prograding bedforms with a downstream slip face" *by* E. Viparelli et al.

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This manuscript describes development of a numerical model to predict the front progradation and formation of stratigraphy in an experimental Gilbert delta formed out of poorly-sorted sediments. What appears to set this model apart (but is not explicitly mentioned by the authors!) is that it is not phenomenological or tuned with fitting parameters, but it is instead built directly from individual components describing the hydraulics, transport, and grain-size segregation. The authors also devise a clever scheme for gridding the delta domain to deal with the moving boundary in a relatively straightforward manner, and I can see how this could be useful to future studies. The

resulting model accurately reproduces the migration of the delta brinkpoint and sediment sorting in the delta top and front deposits, with deviations potentially arising due to the size-specific bedload transport formula, which is admittedly a very challenging problem. Overall, though, I think the manuscript is scientifically sound, assumptions are clearly stated, and the model presents a potentially useful contribution to better relating sediment transport process and formation of stratigraphy. The quality of writing is good, and the paper is laid out in a clear and organized manner.

I am concerned, though, that the implications of the work are insufficiently stated and explained, and more could be done to expand the relevance of the manuscript:

1. First (as pointed out in Kleinhans' review), the title referring to "bedforms" is a bit misleading. The paper is really about a delta. Is the experimental delta meant to mimic the forward motion of an individual bedform (i.e. ripple or dune) in some way? If so, then this connection could be more explicitly stated (and actually, this would be a very useful connection to make!).

2. The introduction goes directly into describing slip face stratigraphy without any context or broader significance explained. Please provide some. For example, the authors might talk about how our existing understanding is insufficient to be able to interpret fining past sedimentary environments from the upward sequences in the stratigraphy, and how a numerical model could help to improve this understanding.

3. It would useful to consider how this model could be extended to a broader variety of experimental cases (e.g. prograding dunes) or even to the field. This does not need to be a formal analysis, but any discussion on this topic would be helpful to readers seeking significant for their own work. For example, how might the equations constituting the model be modified to accommodate different sedimentary environments?

Also, the issue raised by Kleinhans about performing a sensitivity analysis on the model is a valid one, though the authors also raise a convincing commentary about why such a sensitivity analysis has no place in this paper. However, I do think that a bit more

could be done to demonstrate the effect of using different size-selective transport formulae. At the very least, the authors might choose another size-selective transport formula (e.g. Houssais and Lajeunesse, 2012, JGR), plug this into the model, and compare the model predictions to those generated with the Viparelli et al. (2010) formula. This wouldn't require much lengthening of the paper, as the alternative model results could be shown together with the current model predictions in Figure 7 and 10. This suggestion is not absolutely necessary for the paper, but I do think it would substantially help to explain the point discussed on p. 1169.

Finally, one grammar point. Generally, the convention is to describe the experiments and work performed (i.e. Sec. 2 of this manuscript) using the past rather than present tense. Likewise, the summary at the end of the paper (i.e. section 5 of this manuscript) should be in the past tense.

Below, I have some additional small points that came up while reading. These are mainly just typos or sentences that were difficult to understand:

a) P1152,L7: Remove "a" before "total" and "grain."

b) Fig 3 caption: Notation for xi_b is confusing. Make clear in the caption that this is the elevation of the brinkpoint relative to the datum (as you say in P1160, L15-17).

c) P1157, L18: Should read "Brooks"

d) P1159, L24-26: I'm confused by the expression "diameter of the active layer." Is this referring to total thickness of the active layer or diameter of particles in the active layer?

e) P1164,L22-24: Please better explain what is meant by delta. Is this the thickness of sediment in the slipface deposit or just the thickness of sediment that is actively moving in the slipface? Is the thickness defined in a vertical or slipface-normal coordinate?

f) Fig. 6. I'm confused about the bottom deposit, and the role it plays in the model simulation. This wasn't mentioned before when describing the creation of the model. Is this sloping bottom deposit used as a boundary condition? Based on Figure 1, I

thought that the bottom boundary was flat.

g) Fig. 7. This figure shows reasonable agreement with observations, but then again the changes in the model predictions are relatively minute. The only thing that is really indicated here is the general reduction in the coarse fraction.

h) P1171,L10. Should be "characteristic" not "characteristics"

i) P1171,L16. I think this should refer to Fig. 6.

j) P1171,L20-21. Should read "6.5 m and 7.5 m positions"

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