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Kieran Dunne,
ESurf Handling Associate Editor,
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Dear Kieran Dunne and ESurf Editoral Team,

Upon reflection on the reviewers' recommendations to split the manuscript, we have divided the original manuscript into three standalone papers, each addressing a unique aspect of our research on stratigraphic, fluvial grain size fining. This has greatly enhanced the readability of the material we present. In doing so, we have also worked hard to ensure that each manuscript contains ample scientific results. The first paper introduces the new model, GravelScape, detailing its coupling method and validation against previous models, specifically focusing on the impact of altering two parameters (F and G) that reflect subsidence and topography within the basin. This methods paper also identifies limitations in prior approaches, emphasizing the need to compute topography and deposition rates separately from subsidence. The second paper delves into the different factors that impact topography, internal variation, and subsequent grain size fining by varying further parameters (G, K, F, and β that control fan extent, basin erodilbility, and more). We also define a set of autogenic parameters and present how they correlate with grain size fining. Paper 2 also proposes a novel framework for distinguishing whether grain size fining is driven primarily by subsidence (mean deposition) or autogenic processes, using natural examples to facilitate the framework's application. The third paper extends the model by incorporating flexure, exploring the evolution of foreland basins and stratigraphic profiles over time, with a case study comparison to the Alberta foreland basin. This paper builds on the previous two by considering the system as a dynamic, evolving entity rather than a series of static snapshots. While splitting the work into three standalone papers, we have put much effort to minimize the amount of overlap between them, especially in the method and model description sections.

In addition to splitting the original work, we have addressed specific comments from Reviewer 2 by refining the overall structure, clarifying parameters more consistently, detailing the impact of each input, reducing paragraph lengths and providing more concrete examples. We also enhanced the discussion surrounding autogenic parameters within the model. Specifically, we have clearly demonstrated that the autogenic processes evidenced in the model experiments are not numerical artifacts, as they vary in a consistent and physically-meaningful manner with model parameter values. We prioritized adding content only where it improved flow or clarity, and we removed unnecessary parameters. We have provided a detailed line-by-line breakdown of how we addressed the reviewer comments in a separate document titled "Reviewer Comments and Author Responses". Due to the nature of the work's division with substantial restructuring, the LaTeX file of changes was not meaningful to include. Thus, we summarize below the key changes in each paper from the original pre-print text to assist in the editorial and review process:

- Paper 1: The revisions for the first paper relative to the original manuscript content were moderate. We reorganized and expanded the discussion following the initial validation of the model against previous approaches, focusing on improving clarity and conciseness. We moved and re-plotted the spatial and temporal validation (previously split between supplementary materials and appendix) into the main text (Part 1-Figure 6) to better justify the physical versus numerical nature of the model. We focused on only two key parameters (F and G) within the main validation part of the paper (Paper 1-Figure 4).
- Paper 2: The second paper underwent the most significant changes relative to the original manuscript, especially regarding the figures. We also added Marine Prieur as co-author for paper two based on her contributions to the discussion and introduction, especially related to autogenic dynamics within the stratigraphic record. In response to Reviewer 2's comments, we clarified the treatment of autogenic dynamics and their impact on grain size. We removed some autogenic parameters (e.g., depositional waves, channel mobility, and local minima) and concentrated on explaining trends based on depositional divergence and rugosity, which showed the strongest correlations with grain size dynamics. We replaced Figures 13 and 14 with a condensed Paper 2-Figure 7, focusing on the strongest correlated parameters. Additionally, we explicitly described and display the grain size results (Paper 2-Figures 2,3, and 4) for each parameter used to generate correlation plots (Paper 2-Figure 7). We also removed the autogenic recovery

time parameter and, instead, only emphasize the most impactful correlations relevant to the grain size. In the discussion section, we summarized the impacts of each parameter in plain language and highlighted the dominant mean trend of all these parameters through a framework (Paper 2-Figure 8) referencing natural examples of autogenically versus subsidence-dominated basins. Finally, we expanded the discussion to address the implications for the stratigraphic record, making the framework more tangible.

- Paper 3: The changes to the third paper were relatively minor and the figures did not change substantially. We expanded the introduction on foreland basin evolution, improved the paragraph structure (introducing more sections), and and moved material from the appendix into the main text. We added a summary of the framework from paper 2 into the introduction of paper 3 -Figure 1. We reduced lengthy paragraphs and some very general comparisons to modern basins within the stratigraphy section (Imposed Subsidence Stratigraphic End Members). We then added the autogenic dynamics of flexural foreland basin evolution (that was previously in the appendix of the original manuscript) into the main text as part of the figure on foreland basin evolution (paper 3-Figure 3). We also added the high β foreland basin (previously in the appendix) into the main text as paper 3- Figure 4.

The core findings of the original manuscript remain unchanged after these revisions. However, the changes described aim to significantly enhance clarity through substantial restructuring and improved presentation, especially in regards to the correlations between grain size and autogenic dynamics observed in the model. We appreciate the reviewers' constructive comments and hope these revisions meet their expectations.

Sincerely,

Amanda Wild, Jean Braun, Alex Whittaker, and Sebastien Castelltort