Authors' Response to Reviews of

CHONK 1.0: landscape evolution framework: cellular automata meets graph theory

Boris Gailleton, *Luca Malatesta, Guillaume Cordonnier, Jean Braun*
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We thank the reviewers and editorial team for their final comments on our manuscript, which has greatly been improved thanks to their constructive reviews. Please find bellow the last technical modifications in response to reviewer #2's last comments: **RC** stands for Reviewer comment and **AR** for Author's response.

RC: L96 citation format for Howard and Kirby

AR: Sorted

RC: Figure 3: What is "domain from Cell properties"?

AR: It refers to the physical domain of the cells' location and determines which set of process laws affects the fluxes. In our case, a cell is either in a lake or in a river, but other potential examples could be marine, or hillslope-only, … We edited the pseudo code on the figure to clarify.

RC: L411: "Tracking information if activated". I assume that the mix of sources is perfect in the incoming and outgoing feeds? How is the eroded sediment flow partitioned over a cell, in proportion to the respective erodibilities of the initial bedrock sources? Or is erodibility considered to be the same for sediment of any composition?

AR: The partitioning of sediment flux is the same as the water flux, adjusted for local erosion and deposition (between a node and each of its receivers). We edited the relevant paragraph (l. 358 of the manuscript without the diff):
"The tracking capabilities of the method also rely on the labels. While the numerical implementation is tedious, its principle is simple and powerful: any material eroded by any process from any location keeps track of its label when it is incorporated in the mobile sediment flux. The mobile sediment flux is partitioned to the receivers alongside the water flux, adjusted for local erosion and deposition processes. In the stratigraphy, a dynamic sparse matrix of cells is stacking ``containers'' of sediments and keeps track of label proportions to guarantee tracking if re-eroded."

Whether the erodibility value is function of the sediment composition or not depends on the case study: in our section 4.3, the sediment erodibility is constant, and in 4.4 Ksed is a "weighted
average proportional to the content of each lithology in the model" (as stated in the text l.589).

RC: L483 "All the cells below water are 'deprocessed'". Finally, wouldn't this process be simpler if we first calculated the flow of water throughout the grid, taking into account the lakes, and then the flow of sediment once the flow of water and the lakes were known? Would this make it impossible to trace sediment sources, for example? (could you make the word 'impossible' in the discussion-conclusion a bit more specific ?)

AR: It would indeed be simpler (and faster), and this is what some LEM (TISC, pybadlands) do for example. In our contribution, we wanted to stick to our aim to compute all the fluxes and processes at once in each cell. This is important as – while we do not exploit it in this contribution explicitly – it allows the unconditional interoperability between fluxes. For example, one could make the flow partitioning function of the sediment flux. It fits the proof-of-concept nature of our work and we clarified section 3.4.3.

“Note that a simpler alternative would be to process the water fluxes separately to avoid the deprocessing. However, this contribution aims to develop a method able to keep unconditional interoperability between all the fluxes and processes, which would be broken by such sequential separation.”

In the discussion/conclusion, we kept the word “impossible” but added “without significant reworking” as the core of our method is to make the numerically challenging task of dynamic interactions between fluxes and processes straightforward and generic.

RC: - Table 1 dx=200m in all the experiments, so why indicate >30m higher in the text?
AR: We edited the text to dx=200m