

We express our gratitude to the reviewer for their constructive suggestions, all of which have significantly enhanced the quality of our manuscript. Below, we provide our responses to the main comments. The original reviewer's comments are presented in italics, while our responses are in standard font.

- *1. The abstract is easy to follow overall. What does 'mimicking' mean, experimental evaluation or numerical simulation?*

We rephrased the abstract with the adjective "experimentally" mimicking to avoid confusion. (Line 3).

- *2. The limitations of laboratory experiments are not well described. Therefore, the motivation for using PPP is not clear; please revise it.*

We added the following sentence (Lines 30-37) :

" Most of the laboratory experimental studies, when done with one component mixture for the thawing material soil, are done with sand. In the case of lightweight particles, clay or silt can be considered, but lead to experimental difficulties due to their volatility and compactness after the melting, since going back to their fine powder initial version requires long drying and crushing. We consider here the solution brought by PPP particles, due to their realistic mobility than fine sand particles at the scale of our simulation. We point out as well the potential role of electrostatic forces between plastic particles, mimicking what we observe in the case of clay and silt materials. In addition, these types of particles are granulometric-size color coded and as such help the visualization of cryo-induced morphological features."

- *3. What are the benefits of using PPP compared to conventional sand/soil materials?*

Answered above and this is one of the conclusions of the paper as well.

- *4. Figure 1 is excellent.*

Thank you

- *5. The size distribution of PPP will significantly influence the flow and sedimentary behaviour. Please explain the specific particle size selection criteria.*

This is good remark, thank you. We added a sentence in this direction (Lines 185-187):

"The study of the size influence on the flow and sedimentary behavior is beyond the scope of this study. We focused, here, on mimicking experimentally special geomorphological features using PPP as a first test."

- *6. The authors mentioned potential future perspectives, such as exploring scaling relations and 3D numerical modelling. Please be more specific.*

We added a sentence in conclusion to be more specific (Lines 210-214):

"Further investigations are needed to determine the scaling relations between parameters, which allow the transpose of similarity between model and prototype. This implies the use of dimensionless parameters, such as the densimetric Froude number, the grain size Reynolds number and the Engelund–Hansen formula, similar between the analog and the field model. We plan as well to complement the surface change with time-lapse 3D reconstruction, using photogrammetry or laser scanning."

Kind regards

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