

## **Associate editor**

- “I have received the comments on the revised version of your manuscript. On this basis, the decision is to accept with minor corrections. Thank you in advance for resolving the reviewer’s comments on this latest manuscript version.”

We thank the associate editor for her/his positive decision regarding the manuscript. We have now introduced the minor revisions requested by the reviewer. We look forward hearing from you.

## Reviewer 1

- “Dear authors, sorry that some of my comments were a bit harsh! Now my feeling is that you did a good job in revising and extending your manuscript and would like to recommend it for publication.”

We sincerely thank the reviewer for his insights and suggestions that definitely lead to a more solid paper.

- “In Sect. 2, you state that the discriminant  $B^2 - 4AC$  must be positive for achieving an equilibrium velocity. Owing to the signs, I find it a bit confusing since I tend to interpret it in the way that  $B^2$  must be greater than  $4AC$ . This is true, but  $A$  is always negative and  $C$  positive (if the slope is steep enough to let movement start). So  $B^2 - 4AC$  is practically always positive as long as  $B$  not equal 0 or  $A$  not equal 0. So the way you wrote it is formally correct, but not perfectly clear what it means. Maybe you can rephrase it.”

We modified the sentence you highlighted to:

“Accordingly, the discriminant  $B^2 - 4AC$  must be positive for a uniform velocity to exist, which is always the case provided that all terms are different than zero and  $C > 0$ , which happens when the slope is steep enough for the motion to occur. Degenerate cases, i.e. when either  $A = 0$  or  $B = 0$ , will be discussed separately.”

- “Following the suggestion of the other reviewer, you introduced a separate subsection about Sobol's analysis. This makes sense, but it looks to me as if the following subsection (3.2) about the O'Brien and Julien rheology still contains aspects of Sobol's analysis that apply to the other rheologies, too. Maybe you could streamline this part a bit.”

We thank the reviewer for spotting this inconsistency. The mentioned subsection has been streamlined and all general aspects related to the Sobol's analysis have been moved to the corresponding section (3.1 Sobol's global sensitivity analysis) as you can see in the tracked changes version of the work.

## **List of relevant changes in the manuscript**

We adjusted the paper according to all the suggestions of the reviewer:

- Lines 67-70 of Section 2 (Governing equations) have been modified according to the reviewer's request.
- Section 3.1 (Sobol's global sensitivity analysis) has been streamlined by including all general aspects related to the Sobol's analysis.