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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A new form of the Saint–Venant equations for variable topography" *by* Cheng-Wei Yu et al.

Anonymous Referee #1

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This work presents a interesting reformulation of the Saint-Venant equations in order to allow the inclusion of smoother geometrical source terms but maintaining a realistic representation of the arbitrary geometry of natural rivers and creeks. The proposed transformation splits the Piezometric gradient $\partial\eta/\partial x$ into a reference body force in the bottom slope direction S_R and a hydrostatic head gradient $\partial h_a/\partial x$, ensuring that S_R is Lipschitz continuous. The limit case for the proposed formulation is the widespread splitting form of the Saint-Venant equations, in which S_R and h_a agree with the thalweg slope S_0 and the maximum water depth h_0 at each section. The authors propose this simple algebraic transformation in order to avoid oscillatory solutions, or even unstable behavior, which the conventional splitting technique can cause in most of the numerical schemes when S_0 is Lipschitz discontinuous.

This work is original and well written. The tests carried out to demonstrate the applicability of the proposed technique are suitable and the discussion clear and well structured. From my point of view, I can see any important weakness in the mathematical approach and the discussion. Only some minor corrections must be included before this work can be considered for publication. Please, find the detailed comments in the attached pdf.

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2020-75/hess-2020-75-RC1-supplement.pdf

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