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Discussions

Interactive comment on "Conservative finite-volume forms of the Saint-Venant equations for hydrology and urban drainage" *by* Ben R. Hodges

Anonymous Referee #2

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The paper deals with the derivation of new forms of the momentum equation for one-dimensional open-channel flow, suitable for the implementation in hydrologic and urban drainage finite volume models. I enjoyed reading the paper

I have read the paper first (with pleasure), then the comments by referee #1, finally the response of the Author. I was satisfied with the response of the Authors but, unfortunately, I was unable to see the supplement with the updated version of the paper. My review thus relies on the original version of the manuscript.

As my general impression was in fair agreement with that of referee #1, and given the positive response by the Authors, I am reporting here only some additional comments

regarding some unclear aspects (that maybe have already been addressed in the updated version of the manuscript). Hence, I am looking for seeing the revised version of the manuscript.

Major comments

-p.8, eq. 17: I have some doubts on this equation. For what I understand, the LHS term of Eq. 17, in which appears the vector u_î, is in vector form. The RHS terms seem to be scalars (i.e., projections). Unfortunately, the versor î is allowed to change between the upstream and downstream sections of the finite volume (only his slope is allowed to change, of course, as his horizontal direction is assumed constant here). In the RHS, the first term is projected along î_u, the second term is projected along î_d, the third term I do not know. Please clarify.

-p.9, l.21-ff: This reasoning seems to be tailored for rectangular cross-sections with the breadth B=constant. It is not so intuitive (to me) to extend it to cross-sections of general shape. If the breadth changes along the control volume, the side pressure has a component along the channel axis too. How it this considered? At p.11, l.1 I see "bottom pressure term", but the wet boundary of the channel is not only its bottom.

-p.12, l.10-ff: This reasoning should apply also to the cross-sectional area, not only to the bottom elevation (if the cross section is not prismatic, see the comment above).

-p13, l. 4: the implications of the second approximation deserve some additional comments. Does this approximation mean that the derived equations are only suitable for (smooth) subcritical flows? The power of FV scheme is the ability to handle rapidly varying flows, discontinuities and shock waves.

-p.19, l.28: When the cross-sections are broadly spaced... This is not a trivial issue. In fact, in hydrology and urban drainage applications is generally difficult to include a great number of (close to each other) cross sections. However, the use of broadly spaced cross sections conflicts with the 2nd geometric restriction (bottom elevation varying monotonically within the control volume). Moreover, how to find a tradeoff between broadly spaced cross-sections and an effective representation of convective accelerations? (this last point is maybe less important when considering smooth flows).

Minor comments

-p.2, l.1: form of momentum equation

-p.2, l.27: opposite to?

-p.4, l.26: parenthetical citation "(Burger et al., 2014)".

-p.7, l.6: simpler than those

-p.8, l.9: vertical and normal to the horizontal projection of the mean flow

-p14, l.11: an, not and.

-p.18, l6-ff: already said at the beginning of p.13. (In general, the discussion seems more a summary than a discussion).

-p.19, l.25: delete the repeated "as".

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