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Hydrology and Earth System Sciences Discussions

Interactive comment on "A mass conservative and water storage consistent variable parameterMuskingum-Cunge approach" *by* E. Todini

E. Todini

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I would like first to thank Referee #1 for his positive evaluation and the useful comments. I have tried to comply to all the requests as it will appear in the sequel.

Referee request

I have little to add to the paper that can improve it, but would like to comment on what appears to me to be a popular misconception in applying the Muskingum-Cunge formulae, which appears to be another sort of paradox. My version of the paradox is that, if one takes Cunge's definition of X = (1-D)/2, where D = Q/[B S0 c Dx], then for all other things fixed, as Dx becomes large then X tends to 0.5, implying pure Kinematic flow with no diffusion. This implies that the longer the reach, the lower the diffusion,

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which is clearly nonsense. The problem stems from the original Muskingum formulations as documented by Linsley et al (1982: 275), where the "river reach" is defined as the distance between the two stations, where hydrographs have been observed and whose properties yield the constant K and X terms. It would be helpful if the paper emphasized that the Dx used in the Muskingum-Cunge formulation should be limited to the computational spatial interval or (sub-)reach (in the paper from 1 km to 8 km long) which is a fraction of the original concept of "reach" in the Linsley et al. (1982) sense. Notwithstanding this comment, what has been done in the paper is to demonstrate the relative insensitivity of the solution with respect to the number of sub-intervals, in cases where their length is of the order of a kilometre or so. The author states (p 1551, 2nd paragraph) "In 1969, Cunge - - - [proposed] a particular estimation of its parameter values which would guarantee that the real diffusion would be equalled by the numerical diffusion." This statement supports the results in table 2 where the peak flow is nearly constant (surprisingly it rises) as Dx is varied, nevertheless, the choice of Dx seems to be arbitrary. In the light of these comments, would the author dare to propose a "rule of thumb" for the choice of Dx in applications?

Authors' reply

I take the point. I have introduced a warning on the size of the computation section to be used, which in general should not exceed few kilometres.

Referee request

Minor points: p 1557 line 1: "Numerical example" section 7. pp 1578 & 9: the tables are almost illegible they are so small.

Authors' reply

I take the point. I will request that, in the final version, the tables be printed one per page in "landscape" mode (this is how they had been originally conceived) in order to be readable. The present version was prepared by the EGU staff to be quickly

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uploaded on the web.

Referee request

The description of the contents of the tables does not appear in the text nor in the table captions, which should be remedied – the inference drawn from them is not directly self-evident.

Authors' reply

Point taken. I have included a comment in the text to better understand the meaning of the different results in the tables.

Referee request

Finally, the name Cappelaere has been mis-spelled throughout.

Authors' reply

I have corrected this mistake as well as another one on Bocquillon's name.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 1549, 2007.

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