Hydrology and Earth System Sciences Discussions

Interactive comment on "An effective depression filling algorithm for DEM-based 2-dimensional surface flow modelling" *by* D. Zhu et al.

Anonymous Referee #2

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This paper describes a study on developing a new scheme to fill in depressions for 2-D surface flow modelling. The topic is relevant to HESS and novel. It is of interest to the journal readers because DEM is widely used in hydrologic/hydraulic modelling. I support its publication. However, there are some minor corrections that should be addressed to improve the paper's quality.

A) Issues in need of further information/clarifications if authors have sufficient time to deal with them this time (i.e., optional corrections)

1) There are many depression filling algorithms available to the community, such as the ones embedded in various GIS software systems (as listed by the authors). It would be useful for the readers to see the differences between the proposed scheme and

the existing scheme such as ArcMap in modelling hydrographs. If the difference is large, this research will be significant to many 2-D flow modellers and all the existing GIS software vendors should adopt this scheme in their systems. If the difference is very small, this paper is still interesting academically, but less significant in practical modelling work. I suggest the authors should carry out this comparison using the case study to make their research more relevant to practical modellers. The result from the comparison could be published in another paper if there is insufficient time for the authors to do the work this time.

2) P4 L4: the authors claim 'Nevertheless, the conventional depression filling algorithms are computationally intensive and very time- consuming, in particular processing high resolution DEMs.' It would be useful to have empirical evidence for this. If it is possible, I would be interested in knowing the computational times for the proposed scheme in dealing with different DEM resolutions. Also, it is useful if the author could quickly run an existing GIS scheme to compare the computational times. Please also comment on how important the DEM processing time is in comparison with the actual hydrodynamic simulation time with MIKE SHE.

3) Many studies have found that different DEM resolutions would change the simulated flows (e.g., https://engineering.purdue.edu/ecohydrology/Pubs/jhyP_Chaubey.pdf). Therefore, it is important to recalibrate the hydrological/hydraulic models if the DEM's resolution is changed. It seems that the MIKE SHE in the study was calibrated only once with one DEM data (100m grid DEM data processed by the proposed scheme?), and then applied to many other different DEMs. Will this practice create an unfair comparison between different DEMs? It would be useful if the authors could recalibrate individual MIKE SHE models for different DEMs so that a more justified comparison could be made. Again, this could be done in another paper if there is insufficient time to do those this time.

B) Errors/missing information on equations

P7 Eq(1), a reference is needed on this equation.

P7 L17, explain what is 'q' in Eq(2)

P7 Eq(3), the '-' sign is missing for the last two items

P8 Eq(4), the '-' sign is missing for the last two items

P8 L19, Eq(6), 'u' in the 2nd formula should be replaced by 'v'

C) Typos/grammatical errors

P2 L4, 'to described by grid based digital elevation models (DEMs).'-> "to be described by grid based digital elevation models (DEMs).'

P6 L24, 'the MIKE SHE model is to demonstrate the issues associated'-> "the MIKE SHE model is used to demonstrate the issues associated'

P6 and P7, Not consistent with 'MIKE SHE' and 'the MIKE SHE'. Ditto with 'Saint Venant equations' and 'The Saint Venant equations'. Add 'the' to those terms.

P7 L4 rephrase the sentence 'the diffusive wave approximation describing the water movement on the surface and the finite difference method are used to solve this equation'

P7 L10, 'the net rainfall' should be 'the net input (net rainfall less infiltration)'

P7 L14, 'where' is not right here because there are no Sfx and Sfy in Eq(1). Replace ''where' with 'and'

P8 L20, 'Where'->'where'

P9 L2, remove 'and'

P9 L4, remove this line since 'I' has been defined already on Page 7.

P9 L5, ZUD is wrong. It should be ZD

P9 L10, 'Where'->'where'

P9 L14, 'the water level in the cells is the same.' should be 'the higher and lower water levels in the cell are the same.'

P10 L13 , 'depression filling algorithm can comprise of' should be 'depression filling algorithm is comprise of'

P11 L4 'The while loop in lines 7–19 accomplish' -> 'The while loop in lines 7–19 accomplishes'

P11 L25, 'located South of London in the UK' -> 'located in the South of London of the UK'

Fig 6. The red dot on the top is at a wrong place.

Fig 8, 9, and 10 are not necessary because there is very little information for readers to see in addition to Table 2. Table 2 is sufficient.

P14 L20, 'Fig. 3' should be 'Fig. 6'

Fig 14, it is difficult to distinguish those lines. It is useful to use the same colour for the same grid resolution, but one with a solid line and the other with a dashed line.

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