Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2022-92

Anonymous Referee #2

Referee comment on "An Improved Algorithm for Simulating Surface Flow Dynamics based on the Flow-Path Network Model" by Qianjiao Wu et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-92-RC2, 2022

General comments:

The manuscript authored by Wu et al. presents an improved algorithm to simulate the surface flows. To increase the simulation accuracy and calculation efficiency, a flow-path network model by constructing the drainage-constrained TIN and refining the Manning formula using three terrain parameters. The improved algorithm was conducted and evaluated in the case study area, the Black Brook Watershed in north-western New Brunswick, Canada. Overall, the paper is presented in a clear logic. However, several aspects of issues regarding the algorithm design and accuracy evaluation prevent the recommendation to be accepted in its present form.

(1) In the study, modifying Manning's equation by combining the FPN and three terrain parameters (slope length factor, topographic wetness index (TWI), and flow path curvature) is the key step of the improved algorithm and one of the main contributions of this method. However, why the three terrain parameters were chosen and the roles of the different parameters on improving the simulation were not elucidated explicitly and evidenced powerfully. How about only using one or two parameters or add other terrain parameters???

Actually, the slope used in the classic Manning's equation represents the situation in pixel scale, while the parameters, e.g., the slope length factor and TWI, are calculated in hilly slope (regional) scale. How to handle the merging of parameters in different spatial scales? In addition, the three parameters have strong self-correlation.

(2) A critical step to modify Manning's equation is integration of three added terrain parameters. In this study, the three parameters are weighted by the analytic hierarchy process (AHP) method. However, as presented in Table 1 and Section 2.2.2, the determination of the importance of one factor to another factor and the weights is

subjective. The weighting scheme needs to be validated more.

(3) The good performance of the improved algorithm was validated by comparing with the results derived from the SWAT model. Why was it compared with that derived from the conventional Manning's equation? Besides, the performance of SWAT model simulation largely depends on the parameter calibration upon the sufficient in-situ data. However, the information on the SWAT modeling is not given in detail.

Specific comments:

Line 92: A punctuation is missing after the bracket?

Line 138: The section title is too wordy. The content within the bracket is suggested to be deleted.

Line 143: The same to the advice above.

Line 147: What do the variable symbols mean? Please specify the descriptions for these variables of the formula, albeit the Manning's equation is well known already.

Line 159: Here the abbreviation TWI is not presented first.

Line 160: The punctuation is missing in the paragraph end.

Line 163: The citation is not formatted correctly.

Line 179: What is the new point? Is it reliable?

Line 270: The geographic coordinates should be added in the insert map of Figure 3. The legend for the insert map is suggested. What is the mean of grey line (state boundary)?

What does the red rectangle in the main map refer to?

Line 325: The line thickness and format of Figure 8 may be modified to enhance the clarity, especially for the highlight of the “improved algorithm” line.

Line 375: Similarly, the line thickness and format of Figure 11 should be adjusted.

Line 459: The TWI was calculated by a new algorithm? As presented in Section 2.2.1, the TWI is estimated by the definition reported by Beven and Kirkby (1979).