Dear reviewer,

Thank you very much for your letter and for the considerable comments. Those comments are all valuable and helpful for revising and improving our paper, as well as important guiding significance to our research.

I want to discuss the first comments that the respected reviewers proposed. The Mike series models are the most mature and widely used models, and the HEC-RAS was a new modified model in 2023 Therefore, I want to compare these two models with the DBCM proposed by our team.

(1) The Mike series models are the most mature and widely used models, which is the indirect coupling of hydrologic and 2D hydrodynamic models. For instance, Mike SHE and Mike11 are coupled to form Mike Urban, and Mike11 and Mike21 are dynamically coupled to form Mike Flood. The indirect coupling between the hydrologic and the 2D hydrodynamic models can be developed by coupling Mike Urban and Mike Flood. The 1D hydrodynamic model is a connection channel between the hydrologic and the 2D hydrodynamic models.

Compared with the coupling of hydrologic and 1D hydrodynamic models, this coupling type has satisfactory and acceptable accuracy and is widely used. As the 2D hydrodynamic model is only calculated in local inundation regions, its computational efficiency is greatly improved in comparison with the full 2D hydrodynamic model. However, in this coupling type, it is assumed that the water first discharges into the 1D rivers, and then flows through 1D rivers to the 2D regions. The hydrologic model is not directly coupled with the 2D hydrodynamic model, which is inconsistent with the actual flood processes. In reality, water may be discharged into both 1D channel and 2D waterbodies simultaneously, and the hydrologic, 1D and 2D hydrodynamic models should be linked directly. Direct coupling of hydrologic and 2D hydrodynamic models can reflect the flood processes more truly, which deserves more attention.

(2) HEC-RAS (version 6.4) was revised and improved in 2023. Figure 1, from the HEC-RAS 2D User's Manual, Version 6.4, Exported - July 2023, shows the multiple 2D inundation regions for floodplains that are connected with the 1D river channels. In HEC-RAS, the flooding process in 1D rivers is simulated by a 1D hydrodynamic model, whereas the flooding process in 2D regions is simulated using 2D diffusion wave equations (DWEs) or 2D shallow water equations (SWEs). The 1D hydrodynamic model is coupled with the 2D DWEs or SWEs. If the 2D regions are discretized into finer grids and the flooding process is simulated using 2D SWEs, the 1D hydrodynamic model is coupled with the 2D SWEs. In this way, the HEC-RAS is similar to Mike Flood. It has high numerical accuracy but is computationally prohibitive for large-scale applications. Conversely, if the 2D regions are discretized into coarse grids and the flooding process is simulated using 2D SWEs, the 1D hydrodynamic model is coupled with the 2D DWEs. In this way, the HEC-RAS is similar to the coupled Mike SHE and Mike 11, which can expand the application scale at the cost of reducing the accuracy.

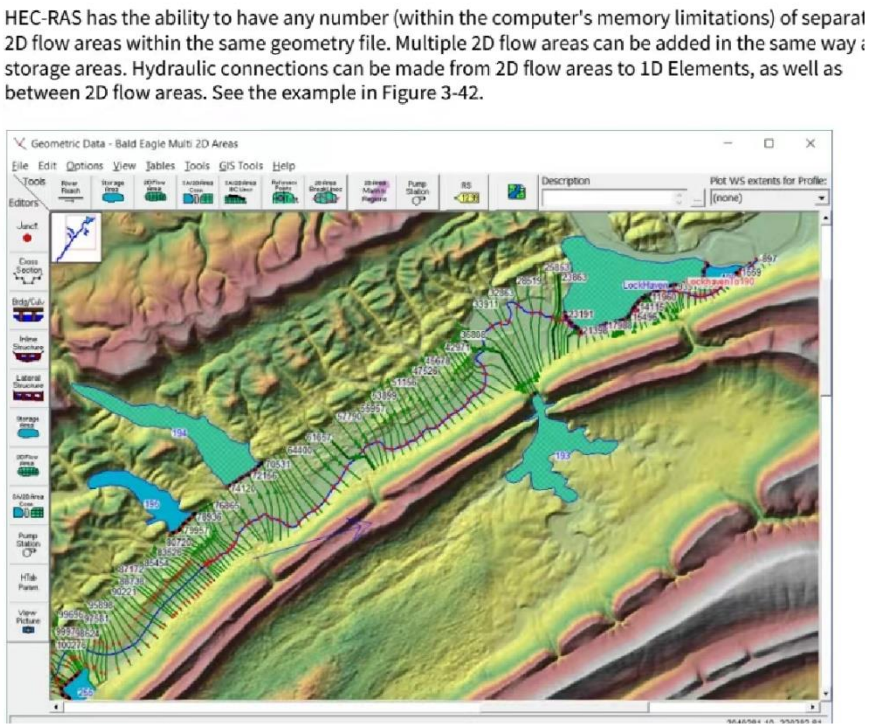

Figure 1 The computational domain of the HEC-RAS obtained from HEC-RAS 2D User's Manual Version 6.4 Exported - July 2023

(3) In the DBCM or M-DBCM proposed by our team, the computational domain is divided into non-inundation and inundation regions, and the area of non-inundation regions is much larger than that of inundation regions. The hydrologic model is applied to non-inundation areas, whereas the 2D hydrodynamic model is applied to the local inundation areas. When the rain intensity increased, the inundation regions expanded because of the gradual accumulation of surface water volume. The inflow discharge positions, flow path, and discharge values subsequently changed. Therefore, a coupling moving interface (CMI) is formed between the inundation and non-inundation regions. The hydrologic and 2D hydrodynamic models are coupled via this CMI. In DBCM, the results of the hydrologic model affect the 2D hydrodynamic computation, and the results of the hydrodynamic model also affect the hydrologic computation, which can take into account effects due to overflowing in the floodplain, backwater effects at the confluences.

To further improve computational efficiency, multi-grids were used to divide the computational domain. The areas prone to flood disasters were divided into finer grids, while the others were divided into coarse grids. The hydrologic model was applied to coarse grids, while the hydrodynamic model was applied to fine grids. Different time steps were accepted in fine and coarse grids.

Compared with the Mike series model, the coupling mechanism of DBCM is more consistent with the natural flood disaster. Compared with HEC-RAS, it can save computation time and has better numerical stability.

The DBCM has potential development if further improvement is made. This model can be further improved by adding a 1D hydrodynamic model to it. The flow in a narrow river can be simulated using a 1D model. And the direct coupling of hydrologic, 1D and 2D hydrodynamic models will be proposed in future works.

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