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A 2D flood inundation model based on cellular automata approach

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In the past years, the cellular automata approach has been successfully applied in two-dimensional modelling of flood events. When used in experimental applications, models based on such approach have provided good results, comparable to those obtained with more complex 2D models; moreover, CA models have proven significantly faster and easier to apply than most of existing models, and these features make them a valuable tool for flood analysis especially when dealing with large areas.
However, to date the real degree of accuracy of such models has not been demonstrated, since they have been mainly used in experimental applications, while very few comparisons with theoretical solutions have been made. Also, the use of an explicit scheme of solution, which is inherent in cellular automata models, forces them to work only with small time steps, thus reducing model computation speed.
The present work describes a cellular automata model based on the continuity and diffusive wave equations. Several model versions based on different solution schemes have been realized and tested in a number of numerical cases, both 1D and 2D, comparing the results with theoretical and numerical solutions. In all cases, the model performed well compared to the reference solutions, and proved to be both stable and accurate.
Finally, the version providing the best results in terms of stability was tested in a real flood event and compared with different hydraulic models. Again, the cellular automata model provided very good results, both in term of computational speed and reproduction of the simulated event.