



Flash flood warning based on fully dynamic hydrology modelling

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Numerical hydrologic modeling has achieved limited success in the past due to, inter alia, lack of adequate input data. Over the last decade, data availability has improved substantially. For modelling purposes, high-resolution data on topography, river routing, and land cover and soil features have meanwhile become available, as well as the observations such as radar precipitation information.

In our study, we have implemented the HYPROM model (Hydrology Prognostic Model) to predict a flash flood event at a smaller-scale basin in Southern Serbia. HYPROM is based on the full set of governing equations for surface hydrological dynamics, in which momentum components, along with the equation of mass continuity, are used as full prognostic equations. HYPROM also includes a river routing module serving as a collector for the extra surface water. Such approach permits appropriate representation of different hydrology scales ranging from flash floods to flows of large and slow river basins. The use of full governing equations, if not appropriately parameterized, may lead to numerical instability systems when the surface water in a model is vanishing. To resolve these modelling problems, an unconditionally stable numerical scheme and a method for height redistribution avoiding shortwave height noise have been developed in HYPROM, which achieve numerical convergence of u , v and h when surface water disappears.

We have applied HYPROM, driven by radar-estimated precipitation, to predict flash flooding occurred over smaller and medium-size river basins. Two torrential rainfall cases have been simulated to check the accuracy of the model: the exceptional flooding of May 2014 in Western Serbia, and the convective flash flood of January 2015 in Southern Serbia. The second episode has been successfully predicted by HYPROM in terms of timing and intensity six hours before the event occurred. Such flash flood warning system is in preparation to be operationally implemented in the Republic Hydrometeorological Service of Serbia.