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Operational hydraulic flood impact forecasting with RIM2D for improved disaster management

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The disastrous flood of July 2021 in Germany has shown that forecasts of river discharge or water levels at selected gauges do not provide sufficient information for timely and location specific warning of the population and targeted disaster management actions. The gauge forecasts as well as the available flood hazard maps were insufficient to assess the flood severity in downstream areas. In order to provide more actionable flood forecasts, the hydraulic model RIM2D was developed and setup for the Ahr river. It solves the inertial formulation of the shallow water equations on a regular grid, and is highly parallelized on Graphical Processor Units (GPUs). Moreover, the modelling concept is parsimonious and allows for fast model setup. We show that hydraulic simulations driven by the available hydrological gauge forecasts would have been feasible with short simulation duration. It would be possible to provide spatially explicit forecasts of inundation depths and flow velocities with sufficient lead time. Moreover, we also show that impact forecasts indicating human instability in water and building failure hazard can be additionally provided in operational mode. We argue that using these hydraulic and impact forecasts would have had a substantial impact on the flood alertness of the population and responsible authorities, enabling a better early warning and disaster management. This could eventually save lives during future extreme flash floods.