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Quasi two dimensional flood modelling approach with dynamic discretisation (elements added and removed during simulation) of the floodplain

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In flood modelling, many one-dimensional (1D) hydrodynamic models are too restricted in capturing the spatial differentiation of processes within the floodplain and two-dimensional (2D) models are too demanding in data requirements and computational resources. The latter is an important consideration when uncertainty analyses using the Monte Carlo techniques are to complement the modelling exercises. Hence, a quasi-2D modelling approach has been developed which still calculates the dynamic wave in 1D but the discretisation of the computational units is in 2D. Partial differential equations written in finite difference form are used to solve the St. Venant equations for momentum and continuity. The discretisation of the floodplain is dynamic, meaning that the discretisation elements are i) inserted during the simulation when the flood water first overbanks into the floodplain and ii) removed during a receding hydrograph when the water in the floodplain is emptying into the main river channel. For the insertion and removal of the floodplain elements an explicit solution in time was implemented. A flood event on the River Saale, Germany, was used as a test case. The results show a better spatial representation of the flow processes in the floodplain without a large additional expenditure for simulations and data pre-processing.