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On the use of the diffusive wave for modelling extreme flood events with overbank flow in the floodplain

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Catastrophic flood events are frequently chosen as reference events, for modelling the impact of scenarios of land use management to prevent inundations. However, these rare events are poorly understood due to the poor hydrological knowledge available, and due to the lack of data. A model for routing flood events adapted to the few available data during historical extreme events was developed (Moussa; accepted to Journal of Hydrology). The model subdivides the floodplain into cells linked to the main channel, and the diffusive wave model with overbank flow was used to route floods in the main channel and through the inundation floodplain. The linearized equations are resolved by an implicit numerical scheme to ensure stability and convergence. Extreme flood events on the Hérault river (2500 km^2) and the elementary experimental Roujan catchment (1 km^2) were studied as the application case. As input data the model requires a Digital Elevation Model, geographical map and cross sections in order to subdivide the channel network into cells. The model parameters are the Manning roughness coefficients in the main channel and in the floodplain. The model was applied to simulate the main extreme flood events, and was validated on other flood events under similar hydro-meteorological conditions. Then, the model was applied to quantify the impact of scenarios of land use management. Various scenarios of construction of dams, embankments, or coupling both dams and embankments, were modelled. The model simulates hydrographs in the main channel, the water depth, the area and the volume on both right and left banks of the floodplain cells. Results show that the model developed herein, with relatively little hydraulic modelling, is well adapted to simulate extreme flood events, and is useful for environmental managers to study the impact of land use management on inundations.