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Assessment of flood wave impact using hydraulic simulation

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Every year damages or even losses of lives due to severe flooding are reported. Failures of embankment dams or other hydraulic structures often are associated to flooding and might cause additional threat. Where and when and under which conditions people's lives are endangered or structures fail is not known a priori. But there is a need for finding answers to these questions. Officials need information which areas are under risk during extreme flood events. Dam owners need to know which maintenance action is necessary. Industry representative might need to know the risk of being flooded before investing money into a certain region.

The RTD projects CADAM and RESCDAM, improved the knowledge on hydraulic simulation of flooding and inundation significantly. They were followed up by the project IMPACT, which added the topics uncertainty analysis, breach formation, sediment transport and geo-science. The FLOODSITE-project (ongoing) moves away from pure science and tries to extract an integrated, European, methodology for flood risk analysis and management from the advances gained by the former projects.

The University of the Federal Armed Forces of Germany in Munich UniBwM has been involved in the CADAM and IMPACT-project. Besides from this scientific projects flood analysis was carried out for several high water protection plans within Bavaria. From scientific findings and experiences gained applying them in practical applications some aspects on how to assess flood wave impact using hydraulic simulation will be presented.

From 2d-hydraulic simulation the development of water levels and velocities can be determined *directly* at any position in the domain of interest. The model uncertainty is low for hydraulic models. The accuracy mainly depends on the accuracy of the

given topography (DTM) and the chosen bottom roughness. If the model is calibrated then the predictive capabilities will be sufficient. The 2d-hydraulic simulation of flood inundation will be demonstrated using the Malpasset dam-break failure and the 1999-flood event at the Iller-river in Bavaria.

Quantities *derived* from numerical analysis results allow for a wide range of new capabilities in assessing flood wave impact. The benefits of the analysis of shear stresses and momentum flux density for the assessment of damage and hazard will be demonstrated.

2d-hydraulic flood wave simulation is computationally too expensive for direct Monte Carlo analysis. Therefore HR Wallingford (Final report, IMPACT, 2005) proposed to use an upper, mean and lower scenario to assess uncertainty of flood inundation. Nevertheless it is possible to extract from the hydraulic model relevant information at certain points of interest. Using this data reduced models can be constructed, which again can be analysed by Monte Carlo method. The methodology is demonstrated for the breach formation model DEICH_P applied to levee analysis at the Mangfall-river in Bavaria.