

## Abstract

IAHS 7<sup>th</sup> International Water Resources Management Conference: “The spatial dimensions of water management - Redistribution of benefits and risks”

Invited talk in the Topic „Floods and Spatial Aspects of Flood Risks”

### **Title: „1+1 ≠ 2 in flood risk calculus: on the role of spatial interactions in flood risk assessment and management”**

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Traditionally, flood hazard and risk assessments were based on merging individual small-scale hazard and risk maps into a single large-scale picture providing a basis for national scale risk appraisal. We show that this risk calculus has a number of fundamental problems related to the spatial interactions in the flood risk system. A simple mosaicking of inundation areas and summation of related expected annual damages is challenged by 1) the spatial complexity of the rainfall structure, 2) spatial interactions in the river network and 3) non-linear relationship between flood hazard, exposure and risk. Over large spatial scales, the assumption of a homogenous flood return period is no longer valid. The probability of rainfall with a certain return period decreases with increasing spatial scale. In addition, the processes of dike failures, flood retention, flood wave attenuation and flood peak superposition between tributaries significantly affect inundation patterns. The latter in their turn interact with exposed assets in a non-linear way, finally, downing the fundamental assumption of flood risk additivity. We present a comprehensive approach accounting for the spatial interactions in the flood risk system – the Regional Flood Model (RFM) for Germany. The difference to the traditional approach to flood risk assessment is demonstrated. A series of case studies elucidate the importance of the above-mentioned spatial interactions for flood hazard and risk. Considering spatial interactions should enable more robust nation-wide risk assessments and make it possible to implement the solidarity principle anchored in the EU Flood Directive, which calls for concerted and coordinated measures to reduce flood risks at the river basin scale without adversely affecting other countries and communities.