Large Scale Flood Hazard Analysis by Including Defence Failures on the Dutch River System

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Abstract

To make informed flood risk management (FRM) decisions in large protected river systems, flood risk and hazard analyses should include the potential for dike breaching. 'Load interdependency' analyses attempt to include the system-wide effects of dike breaching while accounting for the uncertainty of both river loads and dike fragility. The intensive stochastic computation required for these analyses often precludes the use of complex hydraulic models, but simpler models may miss spatial inundation interactions such as flows that 'cascade' between compartmentalised regions and overland flows that 'shortcut' between river branches. The potential for these interactions in the Netherlands has previously been identified, and so a schematisation of the Dutch floodplain and protection system is here developed for use in a load interdependency analysis. The approach allows for the spatial distribution of hazard to be quantified under various scenarios and return periods. The results demonstrate the importance of including spatial inundation interactions on hazard estimation at three specific locations, and for the system in general. The modelling approach can be used at a local scale to focus flood-risk analysis and management on the relevant causes of inundation, and at a system-wide scale to estimate the overall impact of large-scale measures.

Keywords: flood-risk management, dike breaches, load interdependencies, hazard analysis, hydraulic modelling