Effects of variability in probable maximum precipitation patterns on flood losses

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The assessment of the impacts of extreme floods is important for dealing with residual risk, particularly for critical infrastructure management and for insurance purposes. Thus, modelling of the probable maximum flood (PMF) from probable maximum precipitation (PMP) by coupling hydrologic and hydraulic models has gained interest in recent years. Herein, we examine whether variability in precipitation patterns exceeds or is below other uncertainties in flood loss estimation and if the flood losses within a river basin are related to the probable maximum discharge at the basin outlet. We developed a model experiment with an ensemble of probable maximum precipitation scenarios created by Monte-Carlo simulation. For each rainfall pattern, we computed the flood losses at single house level in the Aare river basin in Switzerland (3000 km2) with a model chain and benchmarked the effects of variability in rainfall distribution with other model uncertainties. The results show that flood losses vary considerably within the river basin and depend on the timing and superimposition of the flood peaks from the basin's sub-catchments. This leads to the conclusion that the estimation of the probable maximum expectable flood losses in a river basin should not be based exclusively on the PMF. Consequently, the basin-specific sensitivities to different precipitation patterns need to be considered when analysing the impacts of extreme floods.