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The effect of spatial and temporal correlations in the evaluation of flood risk in Europe

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Flood risk models as developed for the insurance sector tend to have two distinct features that set them apart from many other model applications. Firstly, the insurance sector has an interest in large-scale models (viz., country scale and larger), so that flood risk across their entire portfolio, which is often geographically dispersed over a large area, can be consistently assessed. Secondly, it's also relevant to the insurance sector to model spatio-temporal correlations of the drivers of flood loss correctly across the entire domain, in order to not over- or underestimate the financial consequences of flood events. As flood risk can conceptually be regarded as the result of the combined effects of intense local precipitation (triggering local "pluvial" flood events), and high river discharge (driving large-scale "fluvial" floods), there is a need to model both these variables in such a way that the statistics at any one location as well as the correlations in space and time are aptly described.

In this work, additionally to giving an overview of the European Flood Model that is currently being developed at RMS, we describe the development and the analysis of a coherent, continent-wide set of stochastic model forcings and their effect on large-scale flood modelling. Our results show that by applying the model we are able to simulate input forcings such that the statistics compare favourably with those of observations. Moreover, by providing these forcings to our hydrological model, we are able to adequately reflect the corresponding hydrological response in terms of discharge. Furthermore we discuss the application of this model for flood risk evaluation across Europe, specifically by interpretation of some key model results, such as spatial and temporal correlations of precipitation and discharge for various aggregation periods and evaluation windows (e.g., precipitation and discharge maxima over a month, and their correlations in both space and time), as well as effects of seasonality on precipitation and discharge regimes.