

## Building a flood climatology and rethinking flood risk at continental scales

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Floods are one of the costliest natural disasters and the ability to understand their characteristics and their interactions with population, land cover and climate changes is of paramount importance. In order to accurately reproduce flood characteristics such as water inundation and heights both in the river channels and floodplains, hydrodynamic models are required. Most of these models operate at very high resolutions and are computationally very expensive, making their application over large areas very difficult. However, a need exists for such models to be applied at regional to global scales so that the effects of climate change with regards to flood risk can be examined. We use the a modeling framework that includes the VIC hydrologic and the LISFLOOD-FP hydrodynamic model to simulate a 40-year history of flood characteristics at the continental scale, particularly Australia. In order to extend the simulated flood climatology to 50-100 years in a consistent manner, reanalysis datasets have to be used as meteorological forcings to the models. The objective of this study is the evaluation of multiple atmospheric reanalysis datasets (ERA, NCEP, MERRA, JRA) as inputs to the VIC/LISFLOOD-FP model. Comparisons of the simulated flood characteristics are made with both satellite observations of inundation and a benchmark simulation of LISFLOOD-FP being forced by observed flows. The implications of having a climatology of flood characteristics are discussed, and in particular We found the magnitude and timing of floodplain water storage to significantly differ from streamflow in terms of their distribution. Furthermore, floodplain volume gave a much sharper discrimination of high hazard and low hazard periods than discharge, and using the latter can lead to significant overestimation. These results demonstrate that global streamflow statistics or precipitation should not be used to infer flood hazard and risk, but instead a flood inundation climatology is necessary.