



Flood-frequency change in the Mekong river: scenarios for the 21st century

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Flood-frequency in the Mekong, a major river in Southeast Asia under the influence of the Asian monsoon, is well studied and documented. However, most of the approaches in the literature is based on assumptions such as stationarity and independence. We start by detecting a nonstationary flood-frequency distribution in the Mekong river. Using a set of statistical tools like the nonstationary generalized extreme value distribution or the discrete and the continuous wavelet transform, we quantify and successfully test its significance. This change seem to have been forced by the western North Pacific monsoon, as we prove with significant correlations and qualitative arguments. The area of the basin that is most affected by this monsoon component is consistent with the areas that most contribute in terms of hydrograph volume.

The change in the frequency distribution is proved to be due to a step change in the variance of the time series. Increased variance significantly increases the probability of extremes and therefore the flood hazard. After looking at regime changes in proxy representations of the past monsoon intensity, we conclude that the detected step change is exceptional and investigate possible developments of the flood regime in the future. For that, we estimate a monsoon index, taken from the literature, from an ensemble of GCM data. A persistent state of enhanced variance under SRES A1B scenario is identified during the 21st century.

The monsoon index reveals that the new variance state originated by the step change observed in the 20th century is a permanent feature that remains active during the 21st century under a climate change scenario. Most importantly, the approach allows for the quantification of a new source of uncertainty, generally not accounted for, which is based on nonstationarity in the frequency domain. Finally, a framework for flood frequency estimation in the Mekong for the whole of 21st century is suggested.