



**Universität Stuttgart**

**Auslandsorientierter Studiengang  
Wasserwirtschaft  
Master of Science Program  
Water Resources Engineering and  
Management - WAREM**

Master's Thesis:

# **Identifying the behavior of joint floods in neighboring catchments based on PCA**

submitted by :

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Date : **July 15, 2019**

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# Abstract

Floods have always been a significant threat to human life and the economy. Flood management is a combination of techniques and knowledge to predict and minimize flood damage. Flood early warning systems are developed for quick prediction and reaction to flood occurrence in large and small catchments. However, a greater focus has been on the individual characteristics of single catchments. The simultaneous occurrence of floods in different sub-catchments of a catchment could be more disastrous and harder to predict and manage. Gaining knowledge about both individual behaviors as well as the joint behavior of all sub-catchments can aid early warning systems with more detailed information. This study targets to assess the similarity in behavior and interaction between different sub-catchments in case of simultaneous and lagged occurrence of floods. In this study, the extreme floods of the sub-catchments of the Upper Neckar are selected from the available data. Correlations between pairs of sub-catchments are calculated based on the joint and time-lagged occurrence of the events. Also, clustering of sub-catchments into groups of similar behavior is done. On the meteorological level, the entire process is performed before and after the subtraction of the trends through the application of PCA. The results of this study show that the analysis of the residual data after removing the trend can be interpreted better with the topography and the river networks of the catchment. This allows a more in-depth focus on the interaction between the sub-catchment rather than general conditions like seasonal fluctuations. The peak identification method presented in this study can be modified and improved. Additionally, the application of PCA and peak identification method can be tested on different catchments and aid the early warning systems in the region.