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# Flood-initiating catchment conditions: A spatio-temporal analysis of soil moisture patterns in the Elbe river basin

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Large-scale floods are the result of a complex interaction between meteorological event characteristics and initial catchment conditions. As soil moisture is a key variable of hydrological initial conditions, we propose to classify daily soil moisture patterns and link them to extreme flood flows to get a probabilistic insight into flood initiating soil moisture conditions. The study is implemented in the Elbe catchment using daily hydrological and meteorological data over the period 1951-2003. First, soil moisture is simulated using a semi-distributed conceptual rainfall-runoff model. A principal component analysis is then applied to identify specific patterns of the soil moisture index (soil moisture content standardized by field capacity) that explain most of the variability of the soil moisture dynamics within the catchment. Days of similar soil moisture patterns are identified by clustering of the leading principal components. The entire analysis involves the parameter uncertainty of the applied rainfall-runoff model. It is shown, that the five leading principal components explain 89 % of the soil moisture spatio-temporal variability. Flood-prone soil moisture patterns with their corresponding return period can be identified. Furthermore, correlation analysis provides a physical interpretation of the principal components and thus on flood-prone soil moisture patterns.