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Random forest algorithm as a regionalization model of flood-mechanisms

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Hydrologists are challenged to estimate extreme discharges from catchments with data of poor temporal and spatial resolution. Floods are complex processes derived from catchment responses to various meteorological inputs, commonly summarized under one distribution function, representing the cumulative effect of all triggering events (Merz & Blöschl, 2003). A better understanding of driving precipitation inputs, catchment properties and a-priori conditions are required to characterize flood mechanisms and to determine shape, volume and peak of the extreme discharges. This research focuses on the estimation of floods. The study area is the northwestern Switzerland with small to medium catchments (0.5 to 200 km2), with low concentration times and a highly variable response to the meteorological input in terms of associated peak discharges and volumes.

We use a random forest algorithm to evaluate similar catchment reactions at the occurrence of a flood. We consider catchment descriptors and event specific characteristics for the training of the model. The flood hydrograph serves as the training target variable in order to describe the catchment response. Our regionalization method suggest that the meteorological input of a catchment, specifically the temporal entropy of precipitation, is the most significant parameter for clustering catchment reactions and should, therefore, be consider for such a task. This model has the potential of identifying donor catchments for estimating extreme discharge at the ungauged catchments, using the floods similarities derived by the random forest.

References:

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