Flood hazard assessments in gauged and ungauged catchments using frequency analysis and stochastic simulation approaches

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Reliable flood hazard assessments are crucial for designing flood protection structures and for developing emergency plans. Design flood estimates inform us about the magnitude and frequency of occurrence of potential flood events. Such estimates are ideally derived from continuous streamflow observations. However, such observations are often not available and we need to think about alternative ways of deriving flood estimates in ungauged catchments. Different approaches have been proposed to derive such estimates, which rely on information on streamflow available in catchments similar to or in proximity of the ungauged catchment of interest. In this seminar, I discuss two flood estimation approaches which are ensemble-based and therefore allow for the representation of process variability in design flood estimation.

A first approach uses similarity in catchment characteristics to attribute a target catchment to a region formed by catchments showing a similar flood behavior. The information on flood hydrographs of catchments in this region is used to derive synthetic design hydrographs, i.e. a flood estimate characterized by peak discharge, volume, and shape, for the ungauged catchment of interest. In contrast to traditional approaches, which do not take account of process variability, flood types are represented by estimating a set of synthetic design hydrographs.

A second approach relies on stochastic simulation and allows for the simulation of spatial event sets including ungauged locations. It uses a flexible copula model to represent the dependence between stations.