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Quantification and classification of hydro-meteorological flood controls in northeast Switzerland as a basis for robust impact modelling

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Flood events are generated and shaped by different hydro-meteorological processes. Taking these drivers into account is essential for understanding flood generation and for developing robust hydrological models. We call a hydrological model robust if it is able to reproduce different flood types with different drivers at the same quality. Such models are a prerequisite for assessing climate change impact as they minimize bias associated with a potential change in frequency of projected flood types. For the same reason, identification of the key hydro-meteorological processes is crucial to enable a suitable downscaling of meteorological parameters.

To gain understanding of the main hydro-meteorological processes associated with floods in a mesoscale alpine catchment (Thur River, 1700 km2), we analyse all events exceeding a 2-year flood over the past 50 years. Resulting 47 events are temporally delineated based on an adapted constant-k approach (Blume et al., 2007) using hourly runoff data. Each flood event is then characterized based on a variety of hydro-meteorological parameters and indices descriptive of catchment distributed (pre-) event conditions based on daily meteorological data.

This comprehensive data set is used to classify the events based on hydro-meteorological parameters only and to derive typical flood-generating “storylines”. Changes in these storylines over the past 50 years are discussed. Furthermore, the importance of each hydro-meteorological parameter is quantified which in turn might help to assess uncertainties associated with climate change impact studies.

References

Blume, T., Zehe, E., and Bronstert, A.: Rainfall—runoff response, event-based runoff coefficients and hydrograph separation, Hydrological Sciences Journal, 52, 843–862, doi:10.1623/hysj.52.5.843, 2007.