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# What type of floods are rainfall-runoff models able to simulate based on a long-term atmospheric reanalysis?

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Over the past decades, different strategies have been developed to reconstruct natural catchment flows, and study flood temporal variability and physical mechanisms. For example, the use of paleoflood evidences, such as lake sediments, allows the reconstruction of long flow series covering centuries to millennia, but often with a low resolution (seasonal to decadal dating uncertainties). Alternatively, other methods, based on observed hydro-climatic series, produce flow series at higher time scale (daily), but over much shorter time periods (several decades). The recent production of long-term atmospheric reanalysis offers interesting opportunities for simulating longer continuous flow series at daily to sub-daily temporal scales, which enable a better understanding of the hydro-meteorological mechanisms of past flood events.

In this study, daily continuous flow series have been simulated over the past 150 years on several French catchments, in order to analyze historical flood occurrence and characteristics. The applied methodology, already tested on several French and Canadian catchments (Kuentz et al., 2015, Brigode et al., 2016), has three main steps. First, analogous atmospheric situations of the historical days are identified within the observation period using the Twentieth Century Reanalysis (20CR, Compo et al., 2011) from the National Oceanic and Atmospheric Administration (NOAA), available between 1851 and 2012. Then, a daily climatic ensemble is generated on each studied catchment, by sampling the climatic observations over the historical period according to the atmospheric similarities previously identified. Finally, a rainfall-runoff model is used to transform the climatic ensembles into continuous daily streamflow series. The studied catchments have been selected because of the availability of long observed streamflow series and their different hydro-climatological regimes. The performances of the simulated flow series have been quantified by catchment types (snow- or rainfall-dominated), flood characteristics (season, length, etc.) and atmospheric genesis (using a weather pattern classification).

References:

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