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Atmospheric conditions and catastrophic flood events of the upper Rhône river (north-western Alps, France) during the last 150 years

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High-impact (climate) events such as floods are highly destructive natural hazard causing widespread impacts on socio-ecosystems (e.g. life loss, damage to infrastructure and crops, economic deprivation). In the context of climate change, the frequency and intensity of these events are expected to change, which constitutes an increasingly relevant issue for the public and insurance companies. However, processes leading to such events are still poorly understood, which limits reliable prediction. This remains a priority challenge for the scientific community and stakeholders (IPCC reports, 2013 and Future Earth program).

In this study, we aim to improve the prediction of such events though an in-depth understanding of the triggering atmospheric processes and their use as predictors. The study focus on the catastrophic floods of the upper Rhône River (4000 km^2, north-western Alps, France) over the last 150 years. Large-scale atmospheric conditions leading to flood events are analysed from a various set of climate reanalyses (ERA-20C and 20CR) to identify whether atmospheric processes are similar between events and, thereby, whether key atmospheric features can be identified and used as predictors. The predictor ability of those features is then tested using the ANALOG method on climate reanalyses. This method identifies all days showing atmospheric conditions similar to the ones associated to the flood events. An atmospheric feature is evaluated as a good predictor if only days of floods are retained.