Geophysical Research Abstracts
Vol. 21, EGU2019-6713, 2019
EGU General Assembly 2019
© Author(s) 2019. CC Attribution 4.0 license.

Extreme flood types of the upper Rhône River (French Alps) from one century of observations

Florian Raymond, Bruno Wilhelm, and Sandrine Anquetin

University Grenoble Alpes, Institut des Géosciences de l'Environnement, St Martin d'Hères, France
(florian.raymond@univ-grenoble-alpes.fr)

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 society. However, processes leading to such events are still poorly understood, limiting reliable prediction.

This study aims to explore in what extent high-magnitude flood events can be explained by atmospheric variables. The most extreme flood events (P99,9; i.e. 28 flood events over the period 1923-2010) of the upper Rhône River (French Alps, 10800 km^2) have been studied to establish a typology based on atmospheric variables (from ERA20c reanalysis). Linking occurrence of extreme flood types to such atmospheric variables ultimately aims to propose flood hazard scenario only relying on climate model outputs, thereby skirting the use of hydrological models that may introduce additional uncertainties.

Hierarchical clustering analysis has been performed on the 28 flood events using the three following variables: 8-day and 2-day precipitation amounts as well as an index of flow variation characterizing evolution of discharge during the 7 days before the flood day. Our results suggest that the 8-day and 2-day precipitation amounts are good predictors for most of the flood occurrences. However, in a few cases, the flow index is needed to take into account the potential contribution of snow and/or ice melting.

In detail, the 28 flood events were grouped into three main flood types: (i) floods strongly influenced by high flows from Lake Geneva catchment, probably resulting from high glacial melting, to which a low-to-moderate rainfall episode is added; (ii) floods caused by both long and short rainfall episodes; (iii) floods triggered by short-rainfall episodes only. The first type does not longer exist since the establishment of dam regulation upstream Lake Geneva in the 1960s. Since the two other classes can be well explained by atmospheric variables (i.e. multi-daily precipitation amounts), this methodology opens new perspectives for flood hazard assessments only based on climate model outputs. The replication of flood chronicles based on climate model outputs constitutes the next step of this study.