



## **A process flood typology along an Alpine transect: classification based on cluster analysis**

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Flood classification according with their causative processes helps to understand how flood regimes change across climates. The aim of this work is to create a flood classification scheme along a longitudinal Alpine transect spanning 200 km in a North-South direction. The investigation is focused on the analysis of floods that have similar properties and can be defined as a type. After the definition of flood types we analyzed their properties, their spatial organization and the relation with the topography of the transect. Precipitation and temperature follow a sharp gradient across the transect, with both precipitation and temperature low around the main alpine ridge. Along this gradient the causative processes of floods are changing, modifying the flood regimes of catchments. The three main floods each year on 33 alpine basins (from 50 to 500 km<sup>2</sup>) are isolated from about 20 years of hourly discharge. An hydrological model simulates the catchment conditions at the begin of each event. For each flood we created a set of indexes to describe hydrograph properties, meteorological inputs and catchment conditions. A

cluster analysis on these indexes defined how many flood types can be found in our data and what are their unique properties. Successively a classification tree analysis defined the best criteria to identify those clusters. Results indicate that transect floods are best divided in three clusters, that can be related with Snowmelt, Rain and Flash Floods. The successive classification tree analysis showed that a good classification can also be achieved using few criteria, but that the application of an hydrological model is useful to identify snowmelt events. The distribution of these flood types in space and time across the Alps is reported, and it is in agreement with the processes involved. This approach proved, across different climates, to be able to identify groups of floods that could be related with the driving processes, and to define and evaluate simple criteria for their identification.