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Paleoflood activity and climate change over the last 2000 years recorded by high altitude alpine lake sediments in Western French Alps.

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Extreme precipitation events can trigger floods that may have serious human and economic consequences. The flood represents extreme rainfall event, which in high altitude mountain regions are mostly triggered alternatively by local convective summer storms or, less frequently, by regional widespread rainfall event. The former's precipitation pattern comes from Mediterranean Sea fluxes, dominant in the south; instead of the latter coming from the Atlantic Ocean, dominant in the north of the French Alps. The aim of the study is then to explore which regime dominates in Western French Alps. Paleoflood chronicle is a way to understand past continental climate through the variability of both frequency and intensity. In this study we explore the paleoflood activity as recorded by sediments of the small alpine lake Muzelle (2200 m.a.s.l.) located in the western French Alps. Lake Muzelle catchment area is 5 km^2 -around 4 % being glacier covered- and is drained by one main stream. Lake Muzelle is 18.8 meters deep and is ice-covered during 7-8 months each year. Moreover, the watershed is being used for pastoral activity for several centuries.

In this study, we use sedimentological analysis as well high resolution XRF core scanner geochemistry to identify turbidites interpreted as flood deposits. 256 turbidites were documented in the sediment sequence. Sr/Ti geochemical ratio is used to identify the coarsest grain size fraction of the flood deposit and the thickness of each deposit was measured. Dating was carried out using short-lived-radio-elements (210Pb, 137Cs, 241Am), historical events as well as nine 14C dates and paleomagnetic declination to constrain the age model over the last 2000 years. The study includes also palynological and sediment DNA analysis to understand past human activity on the watershed.

As a result, the 31 years frequency shows a stable period from 0 to 1100 AD. Between 1100 and1200 AD the flood frequency presents a brutal increase with a relatively low intensity. From 1300-1600 AD corresponding to the early stage of the Little Ice Age (LIA), the frequency of flood events doubles and more intense events are recorded. A second period of high frequency around 1600-1800 AD, show fewer events but more intense. The maximum of flood frequency is reached between 1750-1900 AD, with a decrease in intensity. 1900-2000 AD shows a decrease of flood frequency but still higher than the beginning of the LIA.

Glacial variability and anthropogenic activity, such as pastoralism, has an impact on vegetation cover which can both influence flood variability though the modification of erosion processes and try to be removed from the climatic signal. This record provides evidence of higher flood frequency during the LIA cold period, with lesser intensity during the warmer periods such as Medieval Climate Anomaly and current Global Warming. This situation is similar to precipitation patterns previously defined for the southern Alps, such as the Lake Allos record (Southern French Alps), and thus lake Muzelle is dominated by Mediterranean regime.