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Holocene geological records of flood regime in French Alps

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In this paper we present a review of a ca. 10-years research effort (1-9) aiming at reconstructing floods dynamics in in French Alps through the Holocene, based on lake sediment records. We will particularly discuss how such geological records can be considered as representative of past climate. This implies a wise interpretation of data in order to really understand "what does the core really says". Namely, we showed that different lake systems record different types of flood events. Low altitude lakes, fed by large-scale catchment areas are more sensitive to regional heavy rainfall events (2–5), whereas high altitude small lakes record local extreme rainfall events (6). Moreover, human societies' development must be taken into account as it is susceptible to modulate the climate-geological record relationship (7). Altogether our data permit the establishment of a Holocene-long perspective upon both regional heavy rainfall and torrential activities in high elevation sites. We hence show that both types of events frequency co-evolve in Northern as well as Southern French Alps where Holocene colder spells generally present higher flood frequencies (6–9). On the other hand, intensities of torrential events present a North-South opposite pattern: during warm spells (e.g. the Medieval Warm Period or nowadays), northern Alps are subject to rare but extremely intense heavy rainfall events, whereas in the southern Alps torrential floods are both rare and weak. During cold spells (e.g. the Little Ice Age), the inverse pattern is observed: torrential floods are more frequent everywhere and above-average intensity in Southern Alps. This point is particularly important for risk management in mountain areas in a context of global warming.

Our results point out how complex can be the response of regional system to global climate changes. We are hence far from completely understanding this complexity which is moreover imperfectly simulated by climate models. As geological records represent the only way to reconstruct long-term trends in flood regimes, more efforts must still be pursued to get a more complete image of this complexity and further improve climate models.

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