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Comparison of recent sedimentation patterns in Mondsee and Hallstätter See (Upper Austria) and implications for palaeoflood reconstructions in the Eastern European Alps

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Rainfall-triggered flood events represent one of the most serious societal and economic threats in Central Europe. Nevertheless, the thorough assessment of this hazard is still limited by the restricted knowledge about the long-term spatio-temporal recurrence patterns and complex climatic trigger mechanisms of extreme flood events. As instrumental and documentary flood time series rarely exceed a few hundred years, long and precisely dated palaeoflood records from natural archives, e.g. lake sediments, offer an excellent opportunity to gain important information about long-term flood dynamics. This can improve the understanding of flood occurrence under different climatic boundary conditions as well as flood-generating processes and thus allow a more reliable assessment of future flood scenarios. However, the spatial coverage of lake sediment palaeoflood records across Europe is still limited and individual lakes are very heterogeneous in their sedimentological response and sensitivity to flooding. It therefore remains questionable whether single lake sediment palaeoflood records are representative on a larger spatial scale. Investigating adjacent lakes in terms of their individual flood response can therefore (1) help to improve the understanding of key hydro-climatological variables and lake internal processes, both controlling flood layer deposition, and (2) allow to assess the completeness and representativeness of single palaeoflood records, particularly with regard to different flood seasonality. Here we present first data from a project aiming at establishing a new palaeoflood record for the Eastern Alps by investigating the sediments of Hallstätter See in the Calcareous Alps of Upper Austria. These are compared with results from adjacent Mondsee (ca. 35 km to the northwest), located at the northern fringe of the Calcareous Alps. The recent sediments from these two lakes have been investigated with respect to their reflection of large flood events by using detailed sediment microfacies analysis on large-scale thin sections and high-resolution μ-XRF scanning. The depositional environment in Hallstätter See is mainly controlled by seasonally variable and largely runoff-triggered input of allochthonous clastic-detrital material by the Traun River, a major tributary of the Danube. In consequence, the sediments reveal a complex cm- to sub-mm-scale lamination, reflecting detrital input by frequent individual runoff events that are not necessarily extreme floods. This largely contrasts the depositional environment in Mondsee, where detrital material delivered through the relatively small tributaries is intercalated within the regular endogenic calcite varves only during major flood events. This comparison highlights that both lake systems are very different in their response to flooding, depending on catchment geology and morphology, tributary characteristics as well as flood seasonality. Hence, even for lakes in the same climatic domain, the comparison of resulting palaeoflood records is not necessarily straightforward since every lake sediment record only reflects certain aspects of regional flood history, strongly influenced by the individual characteristics of the lake system.