Submitted Abstract

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Abstract

Debris flows and the evolution of large alluvial fans intensively shaped the landscape in the Alps. Inner-Alpine lakes are typically bordered by alluvial fans with small and steep catchments. Therefore, sediments that are eroded and transported during heavy precipitation events can accumulate on the lake bottom and be preserved in the sedimentary sequences as clastic layers. Since the knowledge about frequencies and magnitudes of floods and debris flows is limited to recent and historic observations, the analysis of lacustrine sediment cores is key for gaining a long-term perspective. Understanding variations in event occurrence for different climate states can provide an important basis for predicting the probability of debris flow occurrences in our changing climate.

In this study, we present first results of a long lacustrine sediment record from the central basin of Lake Achensee (Austria) in the Northern Calcareous Alps, which was retrieved close to a major alluvial fan and covers the last ~10 kyr. To identify and classify event deposits, we obtained sediment colour data (L*a*b*-values), X-CT data, XRF-scanning data, grain size measurements by laser diffraction and TOC (Total Organic Carbon) for a multi-proxy sedimentological and geochemical analysis. Age control is based on 14C and 137Cs dating.

The investigated event deposits show variability in colour, density, organic and calcium content, suggesting different sediment sources and transport processes. 214 event deposits with a thickness ≥ 0.5 cm are identified over the last ~10 kyr, of which at least six correspond to multiple coeval mass-transport deposits and are inferred to be caused by earthquake shaking. We interpret the other event deposits to be mainly related to hydrologic processes and variations in their sediment proxies may indicate changes in vegetation and geomorphology of the catchment.

Our preliminary results imply an initial occurrence of debris-flow activity between about 8-6.5 cal kyr BP. After an apparent reduced debris-flow activity during the Medieval Climate Anomaly, intense activity emerges during the Little Ice Age, characterised by event layers with an average thickness of ~1.7 cm. A significant shift in the sedimentation pattern in recent times points towards human impact by building the hydropower station in 1924-1927 CE and a possible transition of alluvial fan dynamics from debris accumulation to channel incision. Future research is focusing on event deposit classification, improving age control and incorporating sediment cores from other basins in Lake Achensee.