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Extreme runoff events of the last 2000 years reconstructed from varved sediments of Lake Mondsee (Upper Austria)

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The natural occurrence of floods under changing climate conditions is wideley discussed since long and reliable records are missing for the pre-historical time period. Lake sediments are ideal archives for investigating environmental variability on a wide range of timescales down to a sub-annual resolution, thus having a great potential to reconstruct detrital sediment fluxes into the lake caused by runoff events.
This study presents a 2000-year record of detrital layers intercalated in a varved sediment succession of pre-alpine Lake Mondsee (47°48'N, 13°23'E). The chronology of the sediment record is based on varve counting, AMS radiocarbon and Cs-137 dating. Overall, 180 detrital layers are detected in the sediments, and two different sediment transport processes have been identified: (i) extreme floods and (ii) debris flows. The deposits of both are well distinguishable by microfacies analysis, μ-XRF element scanning and magnetic susceptibility measurements. Comparing the deposits of the last 30 years to instrumental hydro-climatological data, spring melting caused by „rain-on-snow-events" and heavy summer precipitation are the main triggers of runoff events that induced detrital sediment fluxes to the lake basin.
Within the last 2000 years, the average recurrence time of flood layers is less than 11 years. However, flood layer distribution during this time interval is not homogeneous but indicates variable flood activity. More spring and summer flood layers appeared during the coldest phases of the Little Ice Age (LIA) indicating a major role of climatic boundary conditions as flood triggers. In contrast, during the last 200 years flood layers are evenly distributed without pronounced higher flood frequencies. Debris flows deposits are less common than flood layers having a recurrence interval of 90 years. Despite their low numbers, debris flow layers are correlated with periods of higher flood layer frequency, for example during the LIA and the last 200 years suggesting that both processes are similarly triggered.