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Observing detrital layer formation processes in Lake Mondsee (Austria) during the severe 2013 Central European summer flood.

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Flood chronologies based on lacustrine sediments offer the potential of extending data for flood frequency hydrology far back in time. The varved sediments of Lake Mondsee (Austria) contain a seasonally resolved flood chronology covering the past 7000 years. Calibration of the sediment record against instrumental flood data revealed a partial mismatch between both datasets indicating that the hydrological information in these archives is not fully understood due to the only fragmentary knowledge about driving mechanisms of detrital layer formation.

For this purpose, suspended sediment transport was investigated during the severe Central European summer flood event in June 2013 in the area of Lake Mondsee from the headwaters, through riverine and lake internal transport until final deposition in the deepest lake basin. Highly resolved measurements of meteorological data, suspended sediments, and lake current dynamics were achieved with four river gauges and four monitoring buoys within the lake. Sediment deposition was recorded proximal to the catchment outlet and in the deepest lake basin with two sequential sediment traps.

During the course of the flood event, data show strong precipitation of 187 mm within 96 hours causing a heavy downstream response accompanied by very high suspended sediment loads of up to 62.4 g/l. Within the lake, flood-related sediment signals got strongly diluted and redistributed due to density and current characteristics of the lake water body. Mesopycnal flow as well as hyperpycnal underflow can be identified as main processes for sediment transport in the lake basin. Our results indicate that sediment dynamics in Lake Mondsee are controlled by various interacting processes. This case study reveals that understanding the driving mechanisms of detrital layer formation in terms of recent small-scale processes is crucial to gain a robust flood chronology interpretation.