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Identifying flood deposits in lake sediments : Changing frequencies and potential links to long-term climate change

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In an effort to improve the understanding of long-term variability in flood frequency and how they relate to climate change, we have developed a method that objectively identifies the sedimentary imprint of individual river floods in downstream lake basins. Here we have applied the method to two lake sediment records collected from two different mountainous areas in Southern Norway, resulting in detailed records of Holocene river-flood activity covering the last c. 10,000 years. Identification of historically known floods during instrumental and historical times (AD 1958, 1938, 1860 and 1789) suggest that the approach is reliable not just for recent times, but also for the entire Holocene.

The results indicate that both frequency and distribution of floods over southern Norway has changed significantly during the Holocene. Flood frequency was, for example, highest over the last 2300 years when recorded flood frequency was about 2-3 times higher than the Holocene mean. During the early and middle Holocene flood frequency was on the contrary generally low; around half of the Holocene mean.

The two examined flood records, retrieved from lakes lying c. 70 km apart, reveal subtle differences, but nonetheless produce a pattern that alternates on centennial timescales. Our results indicate that these differences cannot be explained by local conditions associated with the respective catchments. Moreover, we rule out possible external factors such as altitudinal changes due to isostatic movement, changes in vegetation cover etc. The present regional discharge regime is dominated by spring–summer snow-melt and we conclude that the observed changes in flood frequency most likely is attributed to changes in snow cover, which primarily is a function of winter precipitation and the accumulation (integrated over decades) of perennial snowfields in the mountains.