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Magnetic and geochemical signatures of flood layers in lake sediments

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Floods carry sediments that quickly become deposited whenever rivers meet lakes. In catchments that are subjected to repeated flooding, downstream lakes can therefore contain record of past events across multiple timescales. High-resolution core scanning analyses such as X-ray fluorescence (XRF) scanning and magnetic susceptibility (MS) return data that are frequently used to detect flood layers in soft sediment archives such as lakes, fjords and ocean basins. In order to delineate the copious information that can be extracted from soft sediment records we have explored ways in which high-resolution data can be utilized and subsequently vetted by high-precision measurements. By combining magnetic hysteresis measurements and first-order reversal curves (FORCs) with inductively coupled plasma optical emission spectrometer (ICP-OES) measurements of chemical elements on 36 samples, important information not only about flood dynamics and variability are acquired, but also sources of noise in high-resolution scanning techniques are identified. Specifically, we show that a lake flood record from Southern Norway containing $\sim$ 100 floods distributed over 10 000 years can be sub-divided into at least two groups, suggested to contain floods generated by spring snow melting and intense summer rainstorms. The temporal evolution of this pattern shows a marked shift towards spring floods around 2000 years ago compared to the earlier part of the record. The approach presented here is of universal character and should be applicable to all kinds of soft sediment archives.