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Holocene flood stack from three Eifel maar lakes

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Lacustrine sediments are very sensitive to natural and anthropogenically enviromental changes. Thus, lake sediments are excellent climate archives and can be used for reconstructions of past precipitation and flood events. However, we extend our flood record for MIS 2/3 to the entire Holocene up to recent years to get a complete flood stack for the last 60 000 years.
The present study reconstructs paleo floods from event layers in the sediment, of Schalkenmehren Maar (SM3), Ulmen Maar (UM1) and Holzmaar (HM1) combined with recent gauge time-series. All three maar lakes has an inflow by a local stream. Accordingly the sedimentation rate is directly linked to runoff activity and the bioturbation was low so that event layers become visible, but varves are only preserved in lake Holzmaar.
The maar sites are situated in the Eifel near to the town of Daun and were drilled in the ELSA (Eifel Laminated Sediment archive) project. The Eifel area is well suited to approximate Central European weather, because modern water level gauge data from Eifel rivers correlate with respective data from the Rhine (Wernli and Pfahl, 2009).
Combined sedimentological, paleobotanical and geochemical data received from SM3, UM1 and HM1 builds the foundation of the 14C based chronology. The synchronisation of the record is controlled by tephra time markers and pollen. Both are used to align the main cores of the ELSA project and construct an integrated age model for the last 220 000 years [b2k] (Förster and Sirocko, 2014). For the extension of our MIS 2/3 flood stack we used the Laacher See Tephra (10 900 BC) as marker for the correlation with the Holocene cores.
To study the flood events in detail, 10 cm long thin sections were used to distinguish flood layers from distal turbidites. Turbidites have a continuous grain size gradation; the grains size profile of flood events is in contrast characterized by several grain size maxima over the entire layer thickness. A flood event over several days shows numerous peaks of intense discharge, which lead to a discontinuous grain size gradient. The thickness of each flood layer was measured for the classification of the event intensity. As a consequence, 118 flood layers over 7.5 mm thickness were detected in all 3 cores. Flood layers in the interval 10 900 BC up to 4000 BC are not as clearly visible in Holzmaar or Schalkenmehrener Maar as during the later Holocene (when humans cultivated the landscape) but visible flood layers are regularly observed in the record from Ulmen. The Flood layers from 4000 BC up to now are most common in the medieval and Roman sections of the cores; the major events have occurred at 1342 AD, 800 BC and 2100 BC.
Our time-series represents the first highly-resolved chronology for flood events from 60 000 years until present times and indicates variable periodicities of flood activity linked to predominant climatic and anthropogenic development.