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Combining geomorphic and documentary flood evidence to reconstruct extreme events in Mediterranean basins

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Palaeoflood hydrology is the reconstruction of flood magnitude and frequency using geomorphological flood evidence and is particularly valuable for extending the record of extreme floods prior to the availability of instrumental data series. This paper will provide a review of recent developments in palaeoflood hydrology and will be presented in three parts: 1) an overview of the key methodological approaches used in palaeoflood hydrology and the use of historical documentary evidence for reconstructing extreme events; 2) a summary of the Llobregat River palaeoflood case study (Catalonia, NE Spain); and 3) analysis of the AD 1617 flood and its impacts across Catalonia (including the rivers Llobregat, Ter and Segre). The key findings of the Llobregat case study were that at least eight floods occurred with discharges significantly larger than events recorded in the instrumental record, for example at the Pont de Vilomara study reach the palaeodischarges of these events were 3700-4300 m^3/s compared to the 1971 flood, the largest on record, of 2300 m^3/s. Five of these floods were dated to the last 3000 years and the three events directly dated by radiocarbon all occurred during cold phases of global climate. Comparison of the palaeoflood record with documentary evidence indicated that one flood, radiocarbon dated to cal. AD 1540-1670, was likely to be the AD 1617 event, the largest flood of the last 700 years. Historical records indicate that this event was caused by rainfall occurring from the 2nd to 6th November and the resultant flooding caused widespread socio-economic impacts including the destruction of at least 389 houses, 22 bridges and 17 water mills. Discharges estimated from palaeoflood records and historical flood marks indicate that the Llobregat (4680 m^3/s) and Ter (2700–4500 m^3/s) rivers witnessed extreme discharges in comparison to observed floods in the instrumental record (2300 and 2350 m^3/s, respectively); whilst further east in the Segre River there was no geomorphic evidence of any flooding of greater magnitude than 2000 m^3/s, or the 1982 event.