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Investigating Holocene flood frequency through Bayesian age modelling of radiocarbon dated palaeoflood deposits

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Understanding regional flood response to climate change is one of the major challenges of climate change science (IPCC, 2007). Evidence of past flooding from palaeoflood studies over the last three decades indicates that over long-term timescales (centuries to millennia) flood magnitude and frequency varies in response to climatic variability. The precision of palaeoflood chronologies typically enables centennial scale variations to be determined, whilst documentary flood records from the last 500 years indicate that flood frequency may increase over decadal timescales. The increasing resolution of climate change from annually laminated archives, such as ice cores, means that it is inherently difficult to compare palaeoflood records with climate proxies at the desired resolution necessary to investigate whether shifts in flood magnitude and frequency are driven by temperature changes. In this paper the bayesian age modelling of radiocarbon dated palaeoflood deposits is used to interrogate published palaeoflood chronologies. Such age modelling is usually carried out on sediments in which a continuous sedimentation is assumed e.g. lake deposits. By contrast, palaeoflood sequences are formed by individual large, rare events, clustered in certain time periods, which may result in high variability in the rate of deposition. The first aim of this paper, therefore, is to test different Bayesian models to identify the most appropriate for the modelling of palaeoflood deposits. The various modelling approaches used are illustrated using selected palaeoflood sites. The implications of the results for the dating of palaeoflood sequences are discussed. Finally, where refined chronologies are considered an improvement, some preliminary interpretations are made with regards the response of flood magnitude and frequency to climatic variability.