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Reconstructing Holocene fluvial activity in Ireland using alluvial radiocarbon dates

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Advances in fluvial geochronologies and multi-proxy environmental correlatives are providing increasingly robust models of river response to Holocene environmental change. At the forefront of recent scientific progress is the development and analysis of databases of fluvial radiocarbon dates, where particular emphasis is given to terminus post quem ('change after') radiocarbon dates that mark the onset of alluviation linked to episodes of enhanced flooding. Here we report on the first attempt to apply these meta-analysis techniques to dated fluvial deposits in Ireland, which offer tremendous potential for recording climate changes associated with shifts in meridional atmospheric circulation, largely free from the effects of continentality in the east. The resulting Irish fluvial radiocarbon database is considerably smaller than examples from other European countries, such as Germany, Poland, Spain and the UK, and a patchy geographical distribution of dated sites across Ireland highlights the relative dearth of Irish fluvial research up to now. Despite a comparatively small number of significant 'change after' radiocarbon dates, however, the application of generic meta-analysis techniques reveals a pattern of Holocene flooding that is consistent with widely cited palaeoclimate proxies for regional temperature and precipitation. The Irish flood record also closely matches that derived from an established and much larger UK radiocarbon database, thereby corroborating the growing body of evidence that supports an underlying climate forcing of fluvial activity during much of the Holocene. Fluvial systems in Ireland are shown to be sensitive to climate, but the majority of major radiocarbon-dated flooding episodes appear to lag the UK by ca. 100 years. Although this may be the result of database precision, we suggest that the hydrological buffering and sponge effects of widespread peatland cover across Ireland may have impeded hydrological connectivity during Holocene flooding episodes. In addition, this investigation reveals systematically lower sedimentation rates across Ireland compared to the UK, which may have reduced the geomorphic effectiveness of fluvial sediment archives to record major flood events. These considerations, together with an increasing focus on regional variations in fluvial activity across the Holocene, can only be properly addressed with a more concerted and expanded programme of Holocene fluvial research in Ireland.