A CUMULATIVE PROBABILITY DENSITY FUNCTION OF DATED LOWER MEUSE RIVER DEPOSITS

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Over the last decades the Lower Meuse River (the Netherlands) has been the focus of a growing number of earth-scientific and (geo)archaeological studies. Of particular interest for fluvial geomorphologists are the changes that occurred in the Late Glacial landscape, with shifts between braided and meandering river planforms, the formation of fluvial terraces by phases of channel entrenchment, and the mobilisation and redeposition of local fluvial sediments by aeolian transport. Targeted case studies have laid the groundwork for a broad understanding of fluvial responses during glacial-interglacial cycles and climatic anomalies such as the Younger Dryas [1, 2].

The Lower Meuse has also been a hotspot for geoarchaeological studies, as the catchment was home to the early agriculturalists, and it was an intensively cultivated area afterwards, particularly during the Iron Age and Roman Periods [3].

Studies from both fields of research have caused a steady growth in the data set of dating information derived from the fluvial environment, often from well-studied local settings that are supported with detailed sedimentary and palynological information.

In the current study we performed a Cumulative Probability Density Function (CPDF) on the currently available data set of c. 250 radiocarbon and OSL (Optically Stimulated Luminescence) dates that were collected within a fluvial context. A first analysis of the CPDF suggests that the clustering of dated units since the Weichselian Late Glacial coincides with; (i) changes in channel planform, (ii) phasing of the Lower Meuse flooding regime and the occurrence of extreme flood events during the Holocene, and (iii) human influence. A hitherto not deployed application of CPDF analysis in fluvial environments was to study major changes in channel planform; first occurring during the Bølling-Allerød interstadial with a shift to meandering, a return to a (semi-)braided style during the cold Younger Dryas, and a final transformation into meandering during the early Holocene. Peaks in the CPDF based on radiocarbon dates alone related to the formation and preservation of organic deposits in permanently wet residual channel zones of meandering rivers, whereas OSL dates clustered over cold periods when the sandy deposits of braided rivers formed. Moreover, a two-stage Younger Dryas climate event was inferred from the CPDF results, with increasingly dry conditions during the later part, marked by the clustering of OSL-dated aeolian deposits at that time and a sharp reduction in the formation/preservation of organic deposits. Whereas this division was previously suggested based on local observations in the Lower Meuse Valley [4], the current CPDF demonstrates its existence over a larger region, and thus further supports the significance of such climate-induced changes on fluvial behaviour.

Following the more standard application of CPDF-analysis, we used the clustering of change (activity) dates that marked lithological transitions versus those of stability dates to reconstruct phased changes in the Lower Meuse flooding regime. Intervals of increased and reduced dating information were compared with similar results from NW-European river catchments [5] and other hydroclimatic proxy records in order to infer a regional coherence in flood regime changes and to identify the dominant climatic forcings for these to have occurred.

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