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A carbon storage perspective on alluvial sediment storage in the Rhine catchment

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Despite the large amount of detailed geomorphological studies of fluvial systems, which include measurements on the total organic carbon, little is known on the coupling of long term carbon and sediment flux. Therefore, we present results from a synoptic study of organic carbon storage on floodplains that are important sinks in terms of the sediment and carbon flux in fluvial systems.

The influence of the sedimentary facies in fluvial systems was investigated based on a statistical analysis of 1948 organic carbon measurements in different parts of the Rhine catchment. The analysis allows the development of a conceptual carbon budget model of fluvial systems. The carbon budget was coupled with a Holocene alluvial sediment budget model, to estimate the Holocene sequestration rates of carbon storage in floodplains.

Averaged over the Rhine catchment, the sedimentary carbon sequestration rate ranges between 3.4 to 25.4 g $m^{-2}year^{-1}$ with more reasonable values between 5.3 to 17.7 g $m^{-2}year^{-1}$. Compared to the recent particulate carbon export, these rates are in the same order of magnitude but somewhat smaller indicating that approximately the same amount of the exported carbon may be stored in floodplains. However, compared to sedimentary carbon sequestration rates obtained elsewhere, the presented values are at the lower limit, corresponding to the lower mean Holocene soil erosion and floodplain accumulation rates.