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River channel dynamics and its implications for sediment budgets; a case study for the River Dijle catchment (1969-2008)

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Processes like lateral river bed migration (meandering) and changes in width and depth of its bed are an essential part of the sediment dynamics of a river system. For a given time period, these processes can either be a net sediment source or sink within the catchments sediment budget. They also have a large influence on the preservation potential of floodplain deposits, and thus also on the value of river valleys as an environmental archive. This study concerns the importance of river channel processes within the Dijle catchment (780 km^2), situated in the Belgian loess belt. Rivers of this catchment have a meandering pattern within very wide (up to 1.9 km) floodplains.

The position of the riverbanks for a 1.4 km long stretch was measured in 2008 using an RTK-GPS, and it was compared with mapped river banks of 1969. For the same stretch, 20 topographic transects across the river channel were measured in 2008, and compared with transects from 1969 at the same locations. Average changes were calculated for three parts of the stretch to avoid influences by the migration of pools and bars on individual transects. The total amount of sediment eroded and deposited during the study period can be derived from the combination of depth and width changes calculated for the transects and the mapping of river bank changes. Specific budgets related with meandering and bed dimension changes can also be calculated.

Results show that during this 40 year period, the river bed has on average incised and widened, while some river meanders are subject to active meandering. Total erosion amounts 0.31 m^3 a^{-1} per m river length whereas total deposition equals 0.13 m^3 a^{-1} per m river length, resulting in net erosion of 0.18 m^3 a^{-1} per m river length. During the study period, point bar deposition could not compensate for the erosion due to meandering, resulting in new and lower floodplain level being formed by those point bar deposits. As a result, river meandering is also a net source of sediment, yielding 0.12 m^3 a^{-1} per m river length (= 70% of total net production), while changes in river channel dimension yield a net erosion of 0.06 m^3 a^{-1} per m river length. Changes in river dimensions can be explained by increasing urbanization of the catchment over the time period considered. If these values would be extrapolated for the entire, 36 km-long, main river, net sediment export out of the catchment due to within-channel processes would amount to 9 10^3Mg a^{-1}, or 15-20% of current-day suspended sediment load. No measurements are available for the bedload transport, which make it difficult to estimate the total importance of river channel processes in the sediment budget of the River Dijle.