Geophysical Research Abstracts
Vol. 14, EGU2012-12466, 2012
EGU General Assembly 2012

Suspended sediment dynamics in the Kromme Rijn river: indication for intense fine sediment exchange between water column and streambed

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The limited transparency of the river water of the Kromme Rijn, a dammed distributary of the Rhine River in the Netherlands, restricts the ecological function of the stream and the achievement of the EU-Water Framework Directive targets. To increase water transparency in this river, the 'Hoogheemraadschap De Stichtse Rijnlanden' (HDSR) water authority considers to design one or more large-scale sediment traps. For an optimal design of these possible sediment traps, further knowledge about the local sediment characteristics and sedimentation and resuspension rates is a prerequisite. At the request of the HDSR water authority, we studied the fine sediment characteristics and dynamics in the Kromme Rijn river and its tributaries.

Between summer 2010 and summer 2011, eleven monthly water samples were collected from six monitoring locations in the 25 km long reach of the Kromme Rijn river between the inlet from the Nederrijn river and Utrecht. Additional samples were collected from seven monitoring locations in streams and canals discharging into the Kromme Rijn river. The water samples were analysed for suspended sediment concentration and the suspended sediment was analysed for loss on ignition and particle size distribution by laser diffraction. In addition, at these monitoring locations, small sediment traps with an 8 cm circular opening were installed at 0.7 m below the water surface to measure the gross long-term sedimentation rate. These sediment traps were emptied every two months.

During the monitoring period, the average sediment load in the Kromme Rijn near the inlet was 112 g/s and decreased to about 90 g/s near Utrecht. The vast majority of the sediment load (91%) in the main branch of the Kromme Rijn originates from the inlet from the Nederrijn river. The 2-16 μm and 16-63 μm particle size classes comprise about 80% of the suspended sediment. The average organic fraction of the suspended sediment was 36%. The sediment collected from the sediment traps were slightly finer and contained less organic matter (20%). The long-term (>2 months) average gross sedimentation flux in the Kromme Rijn river was measured to be 330 g m^{-2} d^{-1}. As the sediment load only decreases by 20% in the 25 km long studied reach of the Kromme Rijn river and the sediment supply from the tributary streams and canals is limited, this gross sedimentation flux should be compensated by an average gross resuspension flux of approximately 240 g m^{-2} d^{-1}. This would imply that the river reach length over which the effect of a possible sediment trap is noticeable is limited to about 5-10 km.