Geophysical Research Abstracts
Vol. 20, EGU2018-16059, 2018
EGU General Assembly 2018

River morphodynamics in response to natural and anthropogenic driving forces on decadal to centennial timescales

Katrien Wouters (1), Nils Broothaerts (1), Laurens Vervoort (1), Bastiaan Notebaert (1,2), and Gert Verstraeten (1)
(1) KU Leuven, Department of Earth and Environmental Sciences, Leuven, Belgium, (2) Flanders Knowledge Centre Water, Kortrijk, Belgium

River channel dynamics are affected by natural and anthropogenic controlling factors. Changes in climate and land use impact the functioning of river systems indirectly through changes in hydrology and sediment transport. Furthermore, many rivers are nowadays heavily managed for human convenience (e.g. safety, transport, energy), thus directly impacting river channel morphology and functioning. In order to anticipate future changes in channel functioning in relation to future climate and land cover changes, and thus to develop management strategies, numerical channel models can be used. However, these require proper calibration and validation using detailed quantitative data on channel morphodynamics.

We present quantitative data on channel morphodynamics for two rivers (Dijle and Gete) in the Belgian Loess Belt on a decadal to centennial timescale. Both rivers are comparable in catchment size, soil and topographic properties and climatic conditions but are subject to contrasting management practices. The Dijle river is a freely meandering river without bank protection structures whilst the Gete River has been managed intensively (relocation, bank protection, straightening) since the Medieval Period. Detailed cross-sectional topographic data are available for 1969 and 1999 with spacing intervals of ± 50 m. For a selection of cross-sections, data were collected in 2009-2010 (Dijle) and 2017-2018 (Dijle and Gete), allowing to analyse channel morphodynamics with a high temporal resolution. For the regulated river Gete a river reach of 8.5 km has been analysed. Since 1969, a small widening of the channel (± 1 m) is observed but no significant trend of change in channel depth could be discerned. For the active meandering river section of the Dijle river (10 km river length) a clear increase in channel width (2 to 4 m) and depth (0.1 to 0.5 m) can be observed between 1969 and 2009, resulting in a significant increase in cross-sectional area. The total net volume of eroded floodplain sediment due to these channel dimension changes is estimated at ca. 10 m^3 m-1. For both rivers, basic information on channel width and depth are also available for 1881-1883 and 1950 with a spacing of 50 to 200 m, which will allow to calculate channel morphodynamics at centennial timescales.

The major channel morphology changes for the river Dijle in the late 20th century can be related to an increase in average and peak discharge since 1979. These, in turn, can be attributed an increase in urbanized and thus less permeable land cover, whilst a decrease in arable land has resulted in lower erosion rates and sediment fluxes. Thus, a clear-water effect can be held responsible for the morphodynamics of the river Dijle. Over the same time period, no significant increase in major rain events could be observed suggesting that climate played no major role in explaining these morphodynamics. Land cover change is much less pronounced in the Gete catchment hence leading to minor changes in channel morphology. Furthermore, the different morphological response in the two studied catchments can partly be attributed to differences in river management (heavily regulated river vs. active meandering river).