Earth Surf. Dynam. Discuss., 1, C503–C506, 2014
www.earth-surf-dynam-discuss.net/1/C503/2014/

Earth Surface Dynamics Discussions Open Access

Interactive comment on "Morphodynamic regime change induced by riparian vegetation in a restored lowland stream" *by* J. P. C. Eekhout and A. J. F. Hoitink

Anonymous Referee #1

Received and published: 6 January 2014

The paper reports on the morphological evolution of a restored reach of a lowland stream in the Netherlands. The study is valuable, as not many river restoration projects have been monitored after realization with this detail (but see Gurnell et al., 2006). The paper is presented in a clear way. However, in my opinion, there are a few points that need addressing, before publication of the manuscript. I do agree with the interactive comment by S. Dixon that the main issue is about the interpretation of the morphological changes in relation to vegetation establishment. I am not sure that vegetation is the main factor in controlling the observed changes in morphological evolution. My impression is that the main interpretations and conclusions, as presented by the authors (including the title of the paper), is not supported by the observed data. The first period

after the restoration is probably affected by the decreased sediment transport capacity of the new channel. Moreover, it looks like the chosen meander wavelength was not in equilibrium with the morphological conditions of the reach. Meander wavelength is usually 15-20 times channel width, which in this case means about 100-120 m (e.g. Seminara, 2006). The initial wavelength is shorter and the cutoff increased it to about 20 widths (if I am correct measuring on the maps). These two are probably the main reasons for the initial greater morphological changes. In addition, the study considers a period of 1.5 years, with only one growing season for the vegetation and is therefore rather short in order to infer about equilibrium and the effect of vegetation. The vegetation shown in Figure 9 is mainly herbaceous, annual vegetation. Do you expect woody vegetation (riparian trees) is going to develop in the next years? In the paper, time is measured in days after project conclusion and there is no discussion about seasonality of vegetation growth (e.g. Mahoney and Rood, 1998). The last larger flood (after about 440 days) occurred in a moment where vegetation was strong. What would like to be the effect of a flood in winter or early spring (day 600?), when the vegetation dies off?

Other specific comments:

- About NDVI computation: please report on the spatial accuracy of the aerial image in the text (at present it is mentioned only in figure caption). NDVI has been widely used to quantify vegetation occurrence, but commonly the threshold value is larger than 0 (about 0.1-0.2). Did you assess this threshold, comparing the NDVI classification with field measurements and/or visual interpretation of the aerial image? Wet sand is likely to have associated values of the NDVI of about 0.1-0.15.

- About computation of the bed shear stress: a spatial and temporal average of the bed shear stress has been computed, considering one cross section (at the water level gauge) and the entire period between consecutive bed surveys. This estimate is quite rough, as it does not consider the transversal variability of the bed shear stress and the fact that sediment transport is not a linear function of the shear stress. Is the cross section at the water level gauge similar to the bed topography in the study reach?

Would it be possible to compute the shear stress in the different areas (channel, banks, floodplain, and chute cutoff)? It would be much better to relate the RMSD to this local estimate of the shear stress. Bed shear stress in the floodplain (particularly for periods with lower discharge) is definitely lower than that in the channel, and this could modify the relationships reported in Figure 11. Furthermore, a dimensionless version of the bed shear stress would be better, as it would allow the comparison of these results with other case studies.

- Moreover, a local estimate of the bed shear stress would allow the investigation of the relationship between inundation frequency and bed shear stress. Vegetation growth is affected by flow level, but sediment transport has probably a stronger effect on vegetation removal.

- Is there any information about the return period of the floods that occurred during the 1.5 years of this study? This is relevant in order to discuss about morphological changes in the floodplain, and to frame the observed morphological changes in a broader context, particularly when discussing about equilibrium.

- p. 726, lines 5-10. I am not sure this sentence is correct. I would say the opposite, i.e. initial changes are driven by disequilibrium of the configuration, whereas in the second part there are typical meander processes, with most of the changes occurring in the channel and in the bank area.

- p. 726, lines 13-17. I do not agree that this case shows a shift from a high energy system to a low energy one. First, energy is the same; if vegetation has an effect on energy, it is probably an increase in the main channel (narrower) and a decrease in the floodplain (due to increased roughness). Second, the chute at the beginning is due to lack of equilibrium in the sediment supply and, possibly, a wrong wavelength.

- p. 726, lines 23-26. Authors do not consider timing of flooding, that is crucial in determining channel evolution, as well as growing season of vegetation. A major flood in spring or early summer could remove most of the vegetation, delaying vegetation

establishment by one year.

References:

- Gurnell AM, Morrissey IP, Boitsidis AJ, Bark A., Clifford NJ, Petts GE, Thompson K. (2006) Initial Adjustments within a New River Channel: Interactions between Fluvial Processes, Colonising Vegetation and Bank Profile Development. Environmental Management 38, 580-596.

- Mahoney JM, Rood SB. (1998). Streamflow requirements for cottonwood seedling recruitment – an integrative model. Wetlands 18, 634-645.

- Seminara G. (2006) Meanders. Journal of Fluid Mechanics 554, 271-297.

Interactive comment on Earth Surf. Dynam. Discuss., 1, 711, 2013.