EGU22-6134
https://doi.org/10.5194/egusphere-egu22-6134
EGU General Assembly 2022

A High Resolution Topography (HRT) based stochastic model for multi-year river adjustment post restoration

Georgios Maniatis[1], Richard Williams[2], and Trevor Hoey[3]
[1]University of Brighton, School of Applied Sciences, Brighton, UK (g.maniatis@brighton.ac.uk)
[2]University of Glasgow, School of Geographical and Earth Sciences, Glasgow (Richard.Williams@glasgow.ac.uk)
[3]Brunel University London, Department of Civil and Environmental Engineering, London, UK (Trevor.Hoey@brunel.ac.uk)

Recent developments in generating High Resolution Topography (HRT), such as UAV photogrammetry, LiDAR and dGPS, have been extensively used in fluvial settings. Most data generation methods are based on commercial sensing and pre-processing tools that are tested by geoscientists in a trial-and-error manner for clarifying: a) their accuracy; and b) their applicability in field settings that are generally outside the range of their factory calibration. For many applications, this involves the concurrent deployment and the cross comparison of more than one sensing techniques. Despite the above, HRT techniques reduce surveying time and costs significantly. The frequency of surveying has increased to a point where it is now common to monitor the development and survival of in-stream bed forms with high resolution Digital Elevation Models (DEMs) on a monthly to annual basis.

In parallel, river scientists have developed dedicated GIS workflows for: a) parameterising the errors during DEM differentiation, thus producing better constrained DEMs of Difference (DoDs); and b) delineating automatically (or semi-automatically) DEMs for the coherent identification of Geomorphic Units (GUs), a term used to distinguish in-stream bed forms and morphological features within the 3 Tier Classification of Wheaton et al., (2015, https://doi.org/10.1016/j.geomorph.2015.07.010).

Here, we use the outputs from the GUT (Geomorphic Unit Tool, Riverscapes consortium) GU delineation as a proxy to predict the change of in-stream geomorphic variability. More specifically, we present a Markov-Chain (MC) model with a state incorporating all the observed GUs and transition matrices built using observed GU changes. The models are then left to converge to a set of probabilities that demonstrates what would happen to the stream if subjected to the observed hydrological forcing for a period that exceeds the surveying plan. To validate the model, we apply it for three successive post-restoration surveys (between 2012-2017) of a 700 m long reach of the Allt Lorgy restoration scheme (Scotland). The first two surveys are used to parametrise the MC transition matrix and the initial states and the third to test the predictions. The results show that the observed GU probabilities are within the predicted uncertainty ranges when the MC chain is modified and a proxy for sediment input is introduced as an additive term.

The MC model is intended to describe post-restoration morphological evolution, and subsequently to provide a tool for predicting morphological change and the end state, assuming constant hydrological forcing.

How to cite: Maniatis, G., Williams, R., and Hoey, T.: A High Resolution Topography (HRT) based stochastic model for multi-year river adjustment post restoration, EGU General Assembly 2022, Vienna, Austria, 23–27 May 2022, EGU22-6134, https://doi.org/10.5194/egusphere-egu22-6134, 2022.

Displays

Display link