Earth Surf. Dynam. Discuss.,
doi:10.5194/esurf-2016-55-RC2, 2016

Earth Surface Dynamics Discussions

Interactive comment on "Assessment of structural sediment connectivity within catchments: insights from graph theory" *by* Étienne Cossart and Mathieu Fressard

Anonymous Referee #2

Received and published: 7 December 2016

Review of "Assessment of structural sediment connectivity within catchments: insights from graph theory" by Cossart and Fressard for Earth Surface Dynamics.

This manuscript describes a number of connectivity metrics for assessing sediment connectivity and applies them to a catchment.

My main concern is that is it not clear what specifically is the original contribution of this manuscript. It seems that many of these connectivity metrics have been developed elsewhere and some even have been applied before to address sediment connectivity specifically (e.g., IC). I suggest the authors clearly lay out the connectivity metrics presented and which ones are original to this work, which ones come from network theory, and which ones have been applied previously to the specific question of sediment

connectivity. This will allow the reader to better judge the novelty of this work.

I like figure 6 and what I believe it is trying to show. But there was not enough information presented that describes how you went from the information in Figure 5 (geomorphic description of the system) to the results in Figure 6. I think there are useful insights there, but the application overall (methods, results, discussion) was lean. I finished reading this section without having a firm grasp on what was done or how the different connectivity metrics synergistically provide insight to this geomorphic system. Perhaps my reading was a little clouded by the English grammar.

Additionally, the manuscript would be better off if it were edited for English grammar. There were issues throughout the paper that made for clunky reading, but overall it was understandable. I think there is a contribution here that builds off of the sediment connectivity literature. However, I believe the authors need to (1) better articulate the novelty of this work and (2) provide a more complete description of the application. For these reasons I recommend major revision, and believe after these points are addressed, that it could be a fine contribution to Earth Surface Dynamics.

Detailed manuscript comments (P, page; L, line):

P 1, L 6: "To understand the sedimentary signal. . .authors refer to the concept of connectivity." Author's do not refer to connectivity to understand the sedimentary signal. Instead they may refer to connectivity to *describe* the sedimentary signal. Or they may *apply* the concept of connectivity to understand the sedimentary signal.

P 1, L 7: I am not sure what "filiations" refers to.

P 1, L 20: In what way are these indices robust? I do not recall reading this in the main text? "and may lead to simulations" in what way lead to simulations? Akin to work by Czuba and Foufoula-Georgiou (2014) and Schmitt et al. (2016) or something else? Please more fully discuss.

P 1, L 24-25: Are you saying here that connectivity was first defined by ecologists or

by Bennet (2004) specifically? Be certain and careful if saying the latter.

P 3, L 4: I suggest using subscripts for “h” and “o” in “Vh” and “Vo”. And elsewhere, see P 3, L 25 also.

P 5, L 8: “whithin” should be “within”.

P 8, L 25: The work of Czuba and Foufoula (2014) and Schmitt et al. (2016) (and their subsequent work) are relevant here as they both explicitly take steps, under several assumptions including that the sediment remains in the channel, to assess sediment connectivity with time as the important quantity for transfer though a link.

P 11, L 28: What specifically is original about this work? It seems to me that much of the graph theory work for describing sediment connectivity that is presented here has its origins elsewhere.

References: Czuba, J. A., and E. Foufoula-Georgiou (2014), A network-based framework for identifying potential synchronizations and amplifications of sediment delivery in river basins, Water Resour. Res., 50, 3826–3851, doi:10.1002/2013WR014227.

Schmitt, R. J. P., S. Bizzi, and A. Castelletti (2016), Tracking multiple sediment cascades at the river network scale identifies controls and emerging patterns of sediment connectivity, Water Resour. Res., 52, 3941–3965, doi:10.1002/2015WR018097.

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