Geophysical Research Abstracts
Vol. 18, EGU2016-13266, 2016
EGU General Assembly 2016

A new conceptual framework for water and sediment connectivity

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For many years scientists have tried to understand, describe and quantify sediment transport on multiple scales; from the geomorphological work triggered by a single thunderstorm to the geological time scale land scape evolution, and from particles and soil aggregates up to the continental scale. In the last two decades, a new concept called connectivity (Baartman et al., 2013; Bracken et al., 2013, 2015; Parsons et al., 2015) has been used by the scientific community to describe the connection between the different scales at which the sediment redistribution research along the watershed are being studied: pedon, slope tram, slope, watersheds, and basins. This concept is seen as a means to describe and quantify the results of processes influencing the transport of sediment on all these scales. Therefore the concept of connectivity and the way scales are used in the design of a measurement and monitoring scheme are interconnected (Cerdà et al., 2012), which shows that connectivity is not only a tool for process understanding, but also a tool to measure processes on multiple scales.

This research aims to describe catchment system dynamics from a connectivity point of view. This conceptual framework can be helpful to look at catchment systems and synthesize which data are necessary to take into account when measuring or modelling water and sediment transfer in catchment systems, Identifying common patterns and generalities will help discover physical reasons for differences in responses and interaction between these processes.

We describe a conceptual framework which is meant to bring a better understanding of the system dynamics of a catchment in terms of water and sediment transfer by breaking apart the system dynamics in stocks (the system state at a given moment) and flows (the system fluxes). Breaking apart the internal system dynamics that determine the behaviour of the catchment system is in our opinion a way to bring a better insight into the concepts of hydrological and sediment connectivity as described in previous research by Bracken et al (2013, 2015). By looking at the individual parts of the system, it becomes more manageable and less conceptual, which is important because we have to indicate where the research on connectivity should focus on. With this approach, processes and feedbacks in the catchment system can be pulled apart to study separately, making the system understandable and measureable, which will enable parameterization of models with actual measured data. The approach we took in describing water and sediment transfer is to first assess how they work in a system in dynamic equilibrium. After describing this, an assessment is made of how such dynamic equilibriums can be taken out of balance by an external push.

Baartman, J.E.M., Masselink, R.H., Keesstra, S.D., Temme, A.J.A.M., 2013. Linking landscape morphological complexity and sediment connectivity. Earth Surface Processes and Landforms 38: 1457-1471.

Bracken, L.J., Wainwright, J., Ali, G.A., Tetzlaff, D., Smith, M.W., Reaney, S.M., and Roy, A.G. 2013. Concepts of hydrological connectivity: research approaches, pathways and future agendas. Earth Science Reviews, 119, 17-34.

Bracken, L.J., Turnbull, L, Wainwright, J. and Boogart, P. Submitted. Sediment Connectivity: A Framework for Understanding Sediment Transfer at Multiple Scales. Earth Surface Processes and Landforms.

Cerdà, A., Brazier, R., Nearing, M., and de Vente, J. 2012. scales and erosion. Catena, 102, 1-2. doi:10.1016/j.catena.2011.09.006

Parsons A.J., Bracken L., Peoppl , R., Wainwright J., Keesstra, S.D., 2015. Editorial: Introduction to special issue on connectivity in water and sediment dynamics. In press in Earth Surface Processes and Landforms. DOI: 10.1002/esp.3714