Geophysical Research Abstracts
Vol. 14, EGU2012-5299, 2012
EGU General Assembly 2012

Filtering signals: complexity experiments with LAPSUS

A.J.A.M. Temme (1) and M.J. van de Wiel (2)

(1) Wageningen University, Land Dynamics, Wageningen, Netherlands (arnaud.temme@wur.nl), (2) University of Western Ontario, London, Canada

Landscapes respond to external drivers such as climate, tectonics and sea level changes. However, this response is in many cases indirect and complex. In fact, recent research has suggested that it is by no means certain that input signals are directly reflected in output signals, such as sediment output. This means that landscapes have a certain filtering or shredding function. Understanding this function and its limits is crucial because it poses limits to our predictive capabilities. We need to know what we can and what we cannot predict. Moreover, the landscape's filtering function may imply that some of the relations that have formerly been sketched between stratigraphy (a result of sediment output) and climate (a landscape input) may be invalid.

The filtering function in geomorphic systems has been recognized in a limited set of laboratory and computer model settings. Based on theoretical considerations, it is also expected in natural systems. Our objective is to explore the filtering function with landscape evolution model LAPSUS.

Therefore, we explore patterns and causes of complexity in simulations of landscape evolution. Focussing on 50.000 year timeseries of simulated total annual sediment output, we check whether self-organized criticality occurs and over which timescales input (e.g. climate) signals are discernible in the output timeseries.

In a first experiment, causes for simulated variation in annual sediment output under stable input are explored. These causes suggest that the larger simulated sediment outputs are not due to model imperfections and may reflect true system functioning. In this sense, they reinforce earlier tests with models at smaller timescales that reached similar results.

In a second experiment, the differences in complexity of the output are explored spatially. In a second experiment, the differences in complexity of the output are explored in relation to spatially variability. Results indicate that he timescales over which input signals are discernible in simulated sediment output vary between catchments and can be related to the spatial characteristics of the catchment.