



Strategies for the set-up of a multi-process landscape evolution model.

Arnaud Temme, Jeroen Schoorl, and Lieven Claessens

Wageningen University, Land Dynamics, Wageningen, Netherlands (arnaud.temme@wur.nl)

Landscape evolution models have become geomorphology's virtual laboratories, in which wide ranges of assumptions and conditions can be simulated over large spatial and temporal scales. The larger the spatial and temporal scale, the larger the probability that landscape evolution is a result of multiple, interacting processes. Building a landscape evolution model that combines these multiple geomorphic process requires special attention for the formulation and interaction between these processes. This contribution focuses on this formulation and presents strategies and model tests that can be used to inform model setup decisions.

A first decision in the setup of multi-process landscape evolution models concerns the number of processes to be included. We argue that the relevance of individual processes is not merely a function of the volume of material involved in that process, but also a function of the effect the process has on the activity of other processes. For instance, the volume of material involved in landsliding may be very small relative to the volume of material involved in water erosion and deposition, but if that small volume blocks river valleys, it would still be important in landscape evolution. A strategy to inform this decision with model tests is presented.

Following up on the blocking of river-valleys through landslides, prospective landscape evolution modellers must decide whether interaction between geomorphic processes occurs through the presence of sinks. In our example, it clearly does – meaning that the landscape evolution model must be equipped to deal with sinks instead of proclaiming them errors that must be removed as soon as they occur. Similar reasoning could be applicable to many areas in the world, including post-glacial hummocky plains, karst landscapes and tectonically active mountain ranges.

Thirdly, a decision must be made about the temporal resolution at which every process operates. We present a model test to inform this decision that uses observations of landscape evolution – such as river terrace sequences, or a buried palaeo-surface. Temporal resolution of individual processes is varied, while keeping resolution of other processes constant. Effects on model performance are monitored, and the lowest temporal resolution that leads to acceptable model performance is selected.

In these strategies, the explicit consideration of uncertainty effects on the resulting setup decisions is advocated. As we will show, Monte-Carlo technology provides a simple toolbox that allows this consideration.