Geophysical Research Abstracts, Vol. 9, 04334, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04334

Comparison of Two Landscape Evolution Models in the Belgian Loess Belt

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Although several landscape evolution models work on a millennial time scale, these models are often not spatially evaluated against observed data. Moreover, these models often require a lot of data, which makes their application difficult. In this study, the performance of the two landscape evolution models WaTEM LT and LAPSUS is tested in the Belgian loess belt. Both models aim to reconstruct landscape evolution based on a simple model structure with only a few variables. They are both topography-based and spatially explicit, but use different process descriptions. Most importantly, LAPSUS has a more complex description of sediment transport capacity. Model simulations are performed forwards in time in 2D for four different resolutions, while a backward approach is used in 3D. Long-term erosion and deposition data from an augering campaign in the Nethen catchment, complemented by the detailed survey of a trench, are used to evaluate both the spatial patterns of soil redistribution and the sediment export produced by the models. Both models perform good to excellent on all resolutions and scales, resulting in Model Efficiency Factors between 0.60 and 0.99. LAPSUS produces better results in 2D, while WaTEM LT performs slightly better in 3D. Surprisingly, optimal parameter values are similar for different resolutions. The results of this research demonstrate that the more complex process description of LAPSUS improves the results of detailed 2D landscape evolution simulations. However, the simpler process description of WaTEM LT is equally capable of reproducing the overall 3D soil redistribution patterns. This suggests that possible gains associated with a more detailed process description are equated by the need for more, in this case uncertain, data. It can therefore be recommended that models are as complex as necessary, yet as simple as possible, regarding the aim of each investigation.