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Modelling soil erosion with a downscaled landscape evolution model

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The measurement and prediction of soil erosion is an important for understanding both natural and disturbed landscape systems. In particular numerical models of soil erosion are important tools for managing landscapes as well as understanding how they have evolved over time. Over the last 40 years a variety of methods have been used to determine rates of soil loss from a landscape and these can be loosely categorised into empirical and physically based models. Here a physically based Landscape Evolution Model (LEM) (the CAESAR model) is tested for its ability to predict soil erosion on an experimental plot specifically constructed for this purpose on a mine waste rock dump in the Northern Territory, Australia. LEMs can provide information on soil erosion rates at decadal or centennial scales, over large spatial scales and examine how they may respond to environmental and climatic changes. It is reasonable to assume that if LEM formulation is correct they should be capable of operating across a range of both spatial and temporal scales providing.

The results demonstrate that once calibrated for the site hydrology both suspended sediment and bedload yields show a close correspondence in both volume and timing of field measured data. These findings were independently confirmed on an adjacent plot. The CAESAR model also predicts sediment loads within that of field measured data at the decadal scale. The results suggests that integrating surface flow properties, the interactions of multiple grainsizes with runoff together with erosion and deposition: are as important, if not more important than accounting for processes such as rillwash and rainsplash. These findings suggest that soil erosion models may be better focused examining the interactions between flow and sediment in more detail or with better process representation.