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The impact of DEM resolution on Landscape Evolution Model performance and parameter sensitivity

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Landscape Evolution Models utilise a reduced complexity approach for the numerical modelling of geomorphology. Although they can be exceptionally simple in their implementation, over decades of development and increased model and computational efficiency, many Landscape Evolution Models have increased in complexity without losing their speed advantages. This makes the models attractive to operators seeking an effective and rapid way to forecast landscape changes over short- to medium-term timeframes.

Previous sensitivity analysis on the CAESAR-Lisflood model, have highlighted the model's sensitivities to the spatial and temporal resolution of the driving rainfall inputs, and also to different values for user defined parameters. The latter showed that the arbitrary choice of sediment transport formulae used was a significant uncertainty influencing model outputs over the key medium-term timeframe. More recent work has focussed on the resolution of the DEM used to drive the model and unexpectedly we found a model's sensitivity to different parameters varied with the grid resolution. However, some key model outputs, such as total sediment yield, were reliable using a range of DEM resolutions. Coarser resolution DEMs also resulted in dramatically reduced computation times and using this sensitivity test, it was possible to identify a model 'sweet spot' balancing performance and efficiency.