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Reduced-complexity modelling of fluvial system response to environmental change

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Recent developments in numerical modelling in hydrology and geomorphology have recognised the implications of uncertainty in the specification of model boundary conditions and parameter values. Despite this progress, relatively little attention has been given to the role of uncertainty in the physical realism of model process representation (e.g. as determined by choice of model equations). This is of particular significance in the case of reduced-complexity models because, in contrast with models based on reductionist approaches, they typically involve: (1) greater spatial averaging; (2) the neglect of processes that are assumed to be of second-order importance; and/or (3) the implementation of 'rules' based upon physically plausible, but untested, conceptual models. These issues are examined using a new numerical model of alluvial fan formation and entrenchment, which can be applied over time scales of 10^2-10^4 years. This model is implemented within an uncertainty framework to examine temporal sequences of modelled landform evolution for a range of boundary condition scenarios and model structures. Analysis of model output focuses on the potential for elucidating the relationships between environmental change and fluvial system response, and on an assessment of the extent to which model behaviour is sensitive to process representation. The results of this analysis have important implications for the development of river management strategies using reduced-complexity models.