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Space and time in landscape modelling

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The Earth surface may be seen as the result of coupling a system with long spatial tele-connections and mainly short response times (the atmosphere) with a system with mainly short spatial connections and some very long response times (the landscape). One of the challenges of quantifying landscape response to climate change is to understand the processes that drive these spatial and temporal connections, and to represent them in a way that is generic enough to span a sufficient range of physical conditions – climates, soils, gradients and catchment areas.
This review focuses on the relationships between landscape and climate, trying to tease out the dynamics of the processes that have produced the range of observed landscapes in response to consistent differences in climate overlain with Quaternary variability; and focussing on non-glaciated regimes.
It now seems relatively easy to generate landscape evolution models with transport or erosion rates driven by functions of gradient and catchment area, and there are models that begin to express their parameters in terms of climate, but the interaction between climate, inorganic and organic soils, vegetation and hillslope processes remains elusive, with key processes still implicit in poorly understood parameters. Here we examine a few of the key linkages that should be included in more fully integrated models, recognising the practical limits set by the multiply interlocking strands of any complex model. Most existing models can address only a part of this overall complexity, and we must continue make partly subjective judgements about what are the most important processes to include, and what to leave out