



Modelling Vegetated Dune Field Response to Changes in Environmental Conditions

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Vegetated aeolian dune fields represent complex ecogeomorphic systems that are sensitive to environmental perturbations at various temporal and spatial scales. Our understanding of vegetated dune system response has largely been limited to qualitative observations. A cellular automaton model has been developed that mimics the response of the complex feedbacks exhibited in coastal and semi-arid aeolian environments. Three simple rules control the transport of sand slabs. Slab transport occurs stochastically and is influenced by the vegetation density present on a cell. The model also enforces an angle of repose through avalanching and uses a shadow zone to prevent erosion in the lee of dunes. Vegetation density is evaluated seasonally depending on the local sedimentation balance. Vegetation growth differs according to the physiology of modelled species. This discrete ecogeomorphic aeolian landscape (DECAL) model has been used to investigate the response of dune fields to changes in vegetation coverage and environmental conditions such as a change from a supply-limited to a transport-limited system. The response of a coastal dune system to blowouts has been simulated, resulting in the formation of realistic parabolic dunes comparable to those found in the field. The trajectories of the modelled landscape evolution due to different vegetation growth and environmental conditions elucidate the possible response of the landscape to human or environmental perturbations, including climate change. Our understanding of these responses can aid in the management of complex coastal and semi-arid aeolian dune systems.