Modelling the evolution of a population of dunes

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We concentrate on the formation and the evolution of a population of crescentic barchan dunes using a discrete model of aeolian sand transport. This model is a $3D$ cellular automaton (CA) in which different sets of next-neighbour interactions allow to distinguish between different types of physical processes (e.g. erosion, deposition, transport). Such an innovation is necessary to implement retroaction mechanisms between a topography and a flow.

For individual barchan dunes, the predictions of the CA satisfy firm morphological and dynamical constraints (e.g. relationships between velocity, volume, width and height). Therefore it can be used to analyse patterns of interaction over a population of dunes as well as the evolution of a single dune under fluctuating wind conditions. In both cases, we focus on the emergence of substructures and evaluate temporal fluctuations of the volume of dunes in order to discuss the stability of a dune field.