



Evolution of oblique dunes in a landscape-scale experiment

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Abstract

The minimum dune size has always been a limit for experimental modeling of aeolian bed forms. In arid environments where dunes develop naturally, their morphology and dynamics may be strongly influenced by unknown initial conditions and a variety of uncontrolled factors such as sediment availability, vegetation, topography or cohesion. For these reasons, it is still unclear to what degree crest orientation is constrained by wind directionality. Here we report results from a landscape-scale experiment in which we can analyze dune formation under a bimodal wind regime. Starting from a flat sand bed, regular topographic measurements over a four year period reveal the development of linear dune pattern with a constant wavelength and an increasing amplitude. On a seasonal time scale, we show that dunes propagate in different directions according to the dominant wind. Finally, we find that crests are oriented in a direction that takes into account contributions of seasonal wind regimes. Thus, early dunes in the Tengger desert (Shapotou, China) may be classified as oblique dunes with an angle of 50° between their crests and the resultant sand flux.