

Abstract Submitted
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Two modes for dune orientation SYLVAIN COURRECH DU PONT, Lab. Matière et Systèmes Complexes - Université Paris Diderot, CLMENT NARTEAU, XIN GAO, Institut Physique du Globe de Paris — Earth sand seas experience winds that blow with different strengths and from different directions in line with the seasons. In response, dune fields show a rich variety of shapes from small crescentic barchans to big star and linear dunes. Linear dunes often exhibit complex and compound patterns with different length scales and orientations, which seem difficult to relate to a single wind cycle. We present results of underwater experiments and numerical simulations where a single wind regime can lead to two different dunes orientation depending on sediment availability. Sediment availability selects the overriding mechanism for the formation of dunes: increasing in height from the destabilization of a sand bed or elongating in a finger on a non-erodible ground from a localized sand source. These mechanisms drive the dunes orientation. Therefore, dunes alignment maximizes dunes orthogonality to sand fluxes in the bed instability mode, while dunes are aligned with the sand transport direction in the fingering mode. Then, we derive a model for dunes orientation, which explains the coexistence of bedforms with different alignments and quantitatively predicts the orientation of dunes in Earth deserts. Finally, we explore the phase diagram and the stability of the fingering mode.

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