



Raked Linear Dunes as An Example of The Coexistence of Two Modes of Crest Orientation

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Raked linear dunes exhibit a marked asymmetry with a perpendicular pattern of secondary ridges on one side and a smooth sinuous slope on the other. Although these dunes occur in multidirectional wind regimes, they resemble barchans connecting to each other with the same arm. Here we show that this specific dune morphology results from the coexistence of two dune growth mechanisms. The main linear ridges result from the extension of a finger dune in the mean sand flux direction. Secondary ridges are superimposed bedforms associated to the development of a transverse bed instability. These two modes for dune orientation are not perfectly perpendicular and the bed instability grows preferentially on the leeward side of the linear dune according to the prevailing wind direction. This explains the asymmetry as well as the relationship between the crest-to-crest wavelength of the secondary ridges and dune height. All these characteristics are observed and measured in modern sand seas but also in a numerical model to analyze the influence of sand availability, the period of wind directionality and wind strength.