



Morphology of aeolian seif dunes

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Linear seif dunes, which form in the absence of vegetation and display a characteristic meandering shape, are the most typical dunes of our deserts. Only in the last few years it has become clear that while the well-known barchans and transverse dunes appear when there is one prevailing wind direction, seif dunes form under bimodal wind regimes. Indeed, due to the large time scales involved in the dynamics of aeolian landscapes, the conditions for the formation of seif dunes could never be conclusively verified from field measurements. Here we find, by means of calculations using a well-established dune model, which reproduces quantitatively the shape of dunes, that seif dunes develop when the angle defined by the directions of the bimodal wind is larger than 90° . We find that the meandering shape of seif dunes and the common emergence of seif dunes from the horns of barchans are controlled by the time the wind lasts at each one of the two directions. Our calculations show that unusual and so far unexplained bimodal dune forms — including “wedge dunes” observed on Mars — which occur in areas of low sand availability, appear within a wide spectrum of dune morphologies defined by the angle and the characteristic time of bimodal wind regimes.