



Sand transport by wind, erosion and deposition and the origin of aeolian bedforms

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Aeolian processes involve the wind action on a sedimentary substrate, namely erosion, sand transport and deposition. They are responsible for the emergence of aeolian dunes and ripples. Here, we discuss the physics of aeolian sediment transport from a physical point of view. Relevant time and length scales associated to turbulent wind fluctuations are summarized using aerodynamic theory. At the microscopic scale, the main forces acting on the grains are detailed. Sand transport is then studied using two phase numerical simulations based on a discrete element method for particles coupled to a continuum Reynolds averaged description of hydrodynamics. We then introduce the concepts – e.g. saturated flux, saturation length – and the relevant framework for the development of a continuum (macroscopic) quantitative description of transport at the core of our current understanding of aeolian dunes formation. At smaller scales, aeolian ripples arise from the interaction of sediment transport and topography. At larger scales, the nonlinear nature of the interaction between dunes leads to the formation of dune fields.