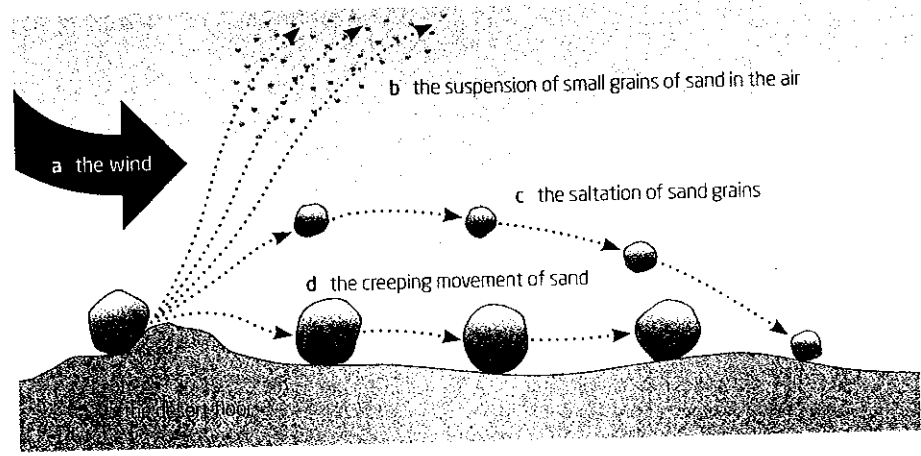


How sand moves

CHAZAL and Mc CARTER. OXFORD EAP. DUP. OXFORD 2018

- 1 When the wind blows over the desert floor, its flow is influenced by the nature of that surface, its roughness on all scales. Such surface roughness interferes with the smooth flow of air, causing disturbances in the air and currents. These in turn interact with the sand grains on the surface, which may be moved along or temporarily kicked up by the wind, which modifies its movement - a constant interaction between the wind and the grains. The act of moving sand grains removes energy from the wind and transfers it to the grains, which, crashing into their colleagues, transfer that energy in turn to them. The result is that close to the ground surface, where most of the action is going on, the wind speed is reduced. There is a speed gradient whereby the wind speed increases with the height. Speed gradients cause pressure gradients, and pressure gradients mean planes - and grains - can fly. What happens on a very small scale very close to the surface of the ground in the desert is critical to the grand-scale results.
- 2 A wind moving at a very high speed - perhaps 300 kilometres per hour (190 mph) - can pick up and transport pebbles, but typical winds deal with sand and smaller grains. Clearly the wind speed needed to start sand grains moving depends on the size of the grains, but the minimum wind speed necessary to move the fine sands of the desert is around 16 kilometres per hour (10 mph). Look closely at the sand dunes next time you are at the beach: it's remarkable how even a light wind can nudge sand grains along the surface. This nudging is referred to as *surface creep*, but if the wind picks up a bit, it will lift grains very briefly off the surface. They fall back quickly, but when they do, they bang into other grains and kick them into the air. Very quickly, the whole process gathers energy, and in moderate wind there will be a cloud close to the surface, comprised of sand grains travelling by jumping and kicking off other grains as they land.
- 3 This is the process that we saw taking place in rivers in a less dramatic way, the impacts between grains being cushioned by water. In air, there is virtually nothing to lessen the impacts, and *saltation* - movement by jumping - is a violent business. It has been observed that a single high-speed saltating grain can move a surface grain more than six times its own diameter and two hundred times its own weight - saltation of sand can maintain movement of grains too large to be moved by the wind alone. This is fundamental. In a moving cloud of sand grains, the majority, perhaps 75 per cent, are moving by saltation.



SOURCE: Welland, M. (2009), pp.149-50. *Sand: A journey through science and the imagination*. Oxford: Oxford University Press.

3 Using the information in paragraph 1, complete the stages in the process of sand movement in the diagram below. For each blank space you need to identify the verb in the text and convert it to the appropriate noun.

Example: *the wind blows* → *the blowing of the wind*

