

Movement of a small slipfaceless dune in Namibia

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In 1977 Ed McKee marked the location of some small dunes on the northern edge of the Namib Sand Sea near Gobabeb in Namibia. We revisited two locations in 1999, 22 years later and found that one dune had changed shape and moved almost 200m while another small slipfaceless dome dune appears to have become detached from the northern end of a sinuous linear dune and moved 90m towards the ENE.

A topographic survey of both dunes was conducted using a Sokkia Set 5 Total Station. Using the field measurements it is possible to calculate the migration direction, distance and the volume of the dome dune. The dome dune has a diameter of 45m is 1m high in the middle and has a volume of 551m³, it appears to have moved 90m towards the ENE. A linear migration rate of around 4 m/yr. This compares favourably with migration rates for small dunes measured in previous work by Besler (1975) indicates around 15m movement towards the NE over 4 years between 1969 and 1973, a rate of 3.75 m/yr, further monitoring between 1973 and 1978 in Besler (1980) showed that movement slowed to 2 m yr. The migration direction is also close to the calculated resultant for potential sand transport, roughly 10° west of south, calculated by Livingstone (1989) and 213° (Lancaster 1985) calculated from adjacent interdune areas.

Taking a bulk density for dry sand of 2200kg/m³ then the dune will have a mass of 1,212,200kg, approximately 1,200 tonnes. Assuming that the dune volume has been conservative, ie. It has not increased or decreased greatly in volume over nineteen years we can attempt to estimate sand transport in kgm⁻¹s⁻¹. Where the mass of the dune is 1,212,200kg, the width of the dune is 45m, and the time in seconds is 693,992,000, this gives 0.000039 kgm⁻¹s⁻¹, or 1.2 tonnes/m/yr. This compares favourably with the measurements of dune encroachment by Ward and von Brunn (1985) who give values between 0.08 to 0.69 m³/m/yr (Ward and von Brunn 1985) which is equivalent to 0.000006 to 0.000048 kg/m/s.

This represents the net migration, in reality the gross sand transport is probably much greater. The vector sum (resultant) potential sand transport estimates for the northern Namib calculated by Lancaster (1985) are 63 tonnes/m/yr, equivalent to 0.002 kg/m/s. These values are two or three orders of magnitude greater than the values based on measurements of dune migration indicating that dune migration is only a small part of total potential sand transport.

References

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