

Barchan dune morphodynamics and linear dune formation on Mars

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Observations of sand dunes in satellite images indicate a wide variety of dune forms on Mars. Similar to Earth, Martian sand dunes display differential migration rates. This is evidenced by dune collision and merging. A range of morphological interactions have been observed between smaller barchan and dome dunes that collide with larger barchan and barchanoid dunes. On reaching another dune, they tend to 'side-swipe', merge, coalesce and superimpose.

Several models have been proposed to explain the formation of linear dunes on Earth. These models include the development of helical vortices in unimodal wind regimes, or emphasize the importance of bidirectional wind regimes. Some linear dunes are associated with the modification and extension of an existing dune. On Mars, linear dunes have been reported to form from bi-directional flow patterns (essentially Bagnold's Model) and topographically influenced, complex wind patterns. In addition to these observations, linear dunes extend as lee projections from dunes and topographic obstructions. This paper describes a new mechanism for the formation of linear dunes that complements the above suite. The model proposed here essentially involves the collision and merging of a barchan and dome convoys. This formation mechanism has not been previously reported for dunes on Earth or Mars and represents a new model for the formation of linear dunes.