



## **Barchan asymmetry as a proxy for wind conditions on Earth and Mars**

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The absence of weather stations in many remote arid regions on Earth and Mars introduces a difficulty in testing atmospheric circulation models. While several proxies have been recommended for the reconstruction of wind regimes, they remain to be tested in a wide range of terrains. We examine the relationship between instrumented wind data and barchan asymmetric shape in order to ascertain if this dune attribute can be used to reliably infer aspects of a wind regime.

The two study areas are located in La Joya, Peru and the Namib Desert, Namibia. Dune observations were made using high resolution satellite images available on Google Earth. The wind data was sourced from Wunderground and the National Peruvian Meteorological Service.

Asymmetric barchans are reported to form in bimodal wind regimes (Tsoar, 1984). The barchan dune is oriented parallel to the strong wind regime and is modified by oblique gentler winds. Our analysis of wind data and dune form supports the Tsoar model for barchan asymmetry.

Numerical simulations have shown that the duration of winds in bi-directional regimes also influences asymmetry (Parteli, 2014). Our analysis finds good agreement between the model simulations of Parteli et al (2014) and the instrument data for Namibia and Peru.

We use our findings on Earth to infer formative wind direction and duration at five sites on Mars. These are the first maps of wind direction and relative duration for Mars. Our findings do not concur with previous estimates of wind direction derived either from the NASA Ames General Circulation Model or dune slipface orientation.

We propose that the Parteli et al (2014) approach can be usefully applied to remote areas on Earth and Mars to extract data on relative wind duration and direction.

Parteli, E.J.R., Duran, O., Bourke, M.C., Tsoar, H., Poschel, T., Herrmann, H.J., (in press). Origins of barchan dune asymmetry: Insights from numerical simulations. *Aeolian Research*.

Tsoar, H., (1984). The formation of seif dunes from barchans - a discussion. *Zeitschrift fur Geomorphologie*, 28, 99-103.