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Proto-dune formation under a bimodal wind regime

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Early-stage aeolian bedforms develop into sand dunes through complex interactions between flow, sediment transport and surface topography. Depending on the specific environmental and wind conditions the mechanisms of dune formation, and ultimately the shape of the nascent dunes, may differ. Here, we investigate the formation of a proto-dune-field, located in the Great Sand Dunes National Park (Colorado, USA), using a three dimensional linear stability analysis.

We use in-situ measurements of wind and sediment transport, collected during a one-month field campaign, as part of a linear stability analysis to predict the orientation and wavelength of the proto-dunes.

We find that the output of the linear stability analysis compares well to high-resolution Digital Elevation Models measured using terrestrial laser scanning. Our findings suggest that the bed instability mechanism is a good predictor of proto-dune development on sandy surfaces with a bimodal wind regime.