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A New Model of Event-Driven Aeolian Sand Transport by Boundary Layer Turbulence

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The erratic and intermittent nature of wind-driven sand transport challenges traditional transport models, which lack physical mechanisms for explaining and taking into account this spatio-temporal variability.

This paper presents a novel semi-empirical model for quantifying aeolian sand transport by boundary layer turbulence in the framework of an event-driven dynamical system. The model is informed by previous investigations into the nature of spatio-temporal variability in sand transport generally, and the formation and behaviour of aeolian streamers by top-down turbulence specifically, as well as detailed time-series analysis of synchronous transport and wind speed data using a variety if methods, ranging from cross-correlation and wavelet spectra, to ARMA modelling.

The model is proposed here as a fundamentally new approach to the problem of predicting transport rates in response to wind forcing, moving beyond the traditional simplistic parameterisation based on shear velocity alone and incorporating additional environmental variables such as boundary layer depth, fetch, and saltation decay.