Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

A study of the role of convective stratification and rates of aeolian activity on arid landscapes.[1] CHINTHAKA JACOB, UT Dallas, JOHN STOUT, US Dept. Agriculture, WILLIAM ANDERSON, UT Dallas — Aeolian activity – wind-driven mobilization of sediment and dust – is driven by aerodynamic surface stress. Existing models for aeolian activity scale mass flux on shear velocity to an exponent that exceeds unity, which demonstrates the role of turbulence in mobilizing sediment and dust. Large-eddy simulation (LES) was used to model neutrally stratified atmospheric boundary layer flows; a computational domain with very long streamwise extent was used to capture large- and very-large-scale motions. A time-series of local surface stress was used to generate a probability density function of stress, which was used to guide the selection of conditional-sampling thresholds. Results show that high stress events are caused by the passage of large scale inclined coherent structures composed of uniform momentum excesses, which are flanked on either side by low-stress regions (the opposite is true when conditioned on low stress events). Since surface heating during the daytime induces buoyancy fluxes that result in additional turbulence production (this is, in addition to production via mechanical shear), we have repeated the aforementioned simulations with convective heating. Parameters of LES cases are set to mimic flat, arid landscape with different heat flux forcing. The variation of structural inclination angle displays good general agreement with previously reported results, varying systematically with the Monin-Obukhov stability parameter under different stability conditions.

[1]National Science Foundation, Grant AGS-1500224

William Anderson
UT Dallas

Date submitted: 20 Jul 2016 Electronic form version 1.4