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Diurnal Ekman layer cycles at White Sands, New Mexico observed with Doppler lidar ANDREW GUNN, DOUGLAS JEROLMACK, University of Pennsylvania — Atmospheric boundary layer turbulence is produced by shear and buoyancy, which are forced by larger-scale geostrophic and solar controls. Their absolute and relative inputs result in a nonlinear response of boundary-normal flow deflection within the Ekman layer. Classical analytical solutions for the deflection were found by assuming extrema of the shear-buoyancy phase space. At the chosen field site, a low-roughness long-fetch salt flat upwind of White Sands dune field, we employ a ground-based upward-facing Doppler lidar to observe the layers dynamics throughout a continuous 70-day time series of wind vector measurements between 10 and 300 metres aloft. Within this domain we identify transition path bifurcation in the shear-buoyancy phase space, where deflection transience and the associated transformation of the vertical extent of the Ekman layer, are dependent on the daily stability cycle. Our analysis probes the natural system that is often modelled with idealised theory, revealing non-equilibrium dynamics that have implications within atmospheric science and geomorphology.

Andrew Gunn
University of Pennsylvania

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