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Deviations from Equilibrium in Daytime Atmospheric Boundary Layer Turbulence arising from Nonstationary Mesoscale Forcing[1] BALAJI JAYARAMAN, Oklahoma St. U. , JAMES BRASSEUR, U. Colorado, SUE HAUPT, JARED LEE, NCAR — LES of the "canonical" daytime atmospheric boundary layer (ABL) over flat topography is developed as an equilibrium ABL with steady surface heat flux, Q_0 and steady unidirectional "geostrophic" wind vector V_g above a capping inversion. A strong inversion layer in daytime ABL acts as a "lid" that sharply separates 3D "microscale" ABL turbulence at the O(10) m scale from the quasi-2D "mesoscale" turbulent weather eddies (O(100) km scale). While "canonical" ABL is equilibrium, quasi-stationary and characterized statistically by the ratio of boundary layer depth (z_i) to Obukhov length scale ($-L$), the real mesoscale influences (U_g and Q_0) that force a true daytime ABL are nonstationary at both diurnal and sub-diurnal time scales. We study the consequences of this non-stationarity on ABL dynamics by forcing ABL LES with realistic WRF simulations over flat Kansas terrain. Considering horizontal homogeneity, we relate the mesoscale and geostrophic winds, U_g and V_g, and systematically study the ABL turbulence response to non-steady variations in Q_0 and U_g. We observe significant deviations from equilibrium, that manifest in many ways, such as the formation of "roll" eddies purely from changes in mesoscale wind direction that are normally associated with increased surface heat flux.

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