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Multi-Point Monin–Obukhov Similarity of Turbulence Cospectra in the Convective Atmospheric Boundary Layer[1] CHENNING TONG, MENGJIE DING, Clemson University — The shear-stress and temperature-flux cospectra in the convective atmospheric surfce layer are predicted using the multi-point Monin-Obukhov similarity theory (MMO). The surface layer contains the convective layer ($z \gg -L$) and the convective-dynamic layer ($z \ll -L$). The former consists of the convective range ($k \ll 1/z$) while the latter consists of the convective range ($k \ll -1/L$) and the dynamic range ($-1/L \ll k \ll 1/z$), where z, k, and L are the height from the ground, the horizontal wavenumber, and the Obukhov length, respectively. We predict the cospectra for both ranges. They have the same scaling in the convective range for both $z \ll -L$ and $z \gg -L$. The shear-stress cospectrum and the vertical temperature-flux cospectrum have k^0 scaling in both the convective and dynamic ranges. The horizontal temperature-flux cospectrum has $k^{-1/3}$ and k^{-1} scaling in the convective and dynamic ranges respectively. The predicted scaling exponents are in general agreement with high-resolution large eddy simulation results. However, the horizontal temperature-flux cospectrum is found to change sign from the dynamics range (negative) to the convective range (positive), which is shown to be caused by the the temperature–pressure-gradient interaction.

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