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The Analyses of Turbulence Characteristics in the Atmospheric Surface Layer using Arbitrary-order Hilbert Spectra

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Turbulent characteristics in the atmospheric surface layer are investigated using a data-driven method, Hilbert spectral analysis. The results from empirical mode decomposition display a set of intrinsic mode functions whose characteristic scales suggest a dyadic filter-bank property. It can be concluded from the joint probability density function of the intrinsic mode functions that the turbulent properties are totally different under different stratifications: the amplitudes (or energies) are arranged according to the stability parameter z/L for stable conditions, but tend to cluster randomly for unstable cases. The intermittency analyses reveal that second-order Hilbert marginal spectra display a power-law behaviour in the inertial subrange, and that the scaling exponent functions present deviation, from the theoretical values due to the strong intermittency in the stable boundary layer.