Turbulence in Plant Canopies: Averaging, Advection, Coherent Structures and Stability Features

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ABSTRACT

Plant Canopy roughness elements create a special condition to the boundary layer flows surrounding them. Their generally sparse density (compared to the air volume surrounding them), drag and scalar transfer interactions, and the intermittent nature of turbulence spawns additional challenges to traditional analysis such as MOST.

This presentation considers recently identified features of canopy flow, including flows under complex stability patterns (stable below the canopy mid-point, unstable above; unstable below, stable above). The relative magnitudes of advection, turbulence, and components from averaged turbulence equations are discussed. The ability to simplify flows in some cases, and to model flows in a more complicated numerical fashion such as higher-order closure, Large-Eddy Simulation, and Lagrangian schemes are considered. Turbulent coherent structures are examined and summarized. Two dimensional flows are considered, and three-dimensional flows are briefly discussed. Data from aircraft and arrays are part of the analysis. Implications to scalar exchange measurements are included.