Wind-Induced Error of Raindrop Size Distribution Measurement Using a Two-Dimensional Video Disdrometer

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ABSTRACT

The authors investigate a disdrometer that provides information on raindrop size distribution, terminal velocity, and shape using video imaging technology. Two video cameras are enclosed in a large box and provide images of the passing drops. The box modifies the air flow, and this in turn affects the drop trajectories, causing some of the drops to miss the sensing area in the instrument's opening. The authors investigate the distortion of the trajectories using numerical simulation methods of computational fluid dynamics. This approach enables the authors to quantify the effects of wind velocity and direction on the instrument's measurement of drop size distribution. The results of the study lead to the conclusion that the shape of the enclosure of the instrument causes errors in the detection of the small drops. Small drops can get caught in a vortex that develops over the inlet. Some of them end up being counted more than once as they cross the sensing area while others are carried away and not counted at all. Also, the spatial distribution of the drops passing across the sensing area is distorted by the wind. The computational results are supported by observational evidence.