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Wind Influence on Rainfall Microphysics through High-resolution Observations

Firat Y. Testik[1,2]
[1]University of Texas at San Antonio, School of Civil and Environmental Engineering, and Construction Management, San Antonio, Texas, United States of America (firat.testik@utsa.edu)
[2]University of Texas at San Antonio, Department of Mechanical Engineering, San Antonio, Texas, United States of America (firat.testik@utsa.edu)

Rainfall microphysics is a critical component for numerous applications including remote sensing and quantitative precipitation estimations, meteorological and hydrological modeling, soil erosion, and telecommunication signal propagation in the atmosphere. This study delves into the effects of wind on rainfall microphysics by utilizing high-resolution commercially available and in-house developed meteorological instruments. Specifically, here we present our findings on the effects of wind on the evolution of raindrop size distribution (DSD) and the governing microphysical processes (i.e. raindrop fall and collisions). This is an observation-based study utilizing high-resolution field measurements. The effect of wind on DSD observations was uncovered using a large dataset available from a multi-institutional field campaign that was conducted in central Oklahoma. The fall and collisions of raindrops were investigated using a large dataset collected at our outdoor rainfall laboratory located on the West campus of the University of Texas at San Antonio, Texas, USA during a 3-year-long field campaign. The dataset includes observations from a unique optical-type disdrometer, called High-speed Optical Disdrometer (HOD), that we developed. HOD's innovative technology enables capturing high-resolution sequential images of the same hydrometeor multiple times as it passes through the measurement volume to provide high-accuracy measurements of hydrometeor characteristics and visual observations of the processes, including first-time field observations of raindrop collisions. We will provide an overview of the DSD evolution through the air column and discuss the underlying physical processes in light of the wind effects. This material is based upon work supported by the National Science Foundation under Grants No. AGS-1741250.