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DOE/SC-ARM-19-005

Snowflake Settling Speed Experiment Field Campaign Report

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June 2019

ARM

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Work supported by the U.S. Department of Energy,
Office of Science, Office of Biological and Environmental Research

Acronyms and Abbreviations

AMF	ARM Mobile Facility
ARM	Atmospheric Radiation Measurement
ASR	Atmospheric System Research
DOE	U.S. Department of Energy
MASC	multi-angle snowflake camera
OLI	Oliktok Point, Alaska

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1.0 Summary

The goal of the Snowflake Settling Speed Experiment was to study the impacts of ambient turbulence on the average hydrometeor settling speed. The existing U.S. Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) third Mobile Facility (AMF3) deployed at Oliktok Point (OLI) on the North Slope of Alaska includes detailed measurements of air turbulence and ground-based measurements from the multi-angle snowflake camera (MASC) of hydrometeor size, type, orientation, and fallspeed. The existing MASC is surrounded by a double wind fence, which enables measurement of the terminal velocity in still air but limits the ability to study the correlation between ambient turbulence and hydrometeor fallspeed. The scientific objective of this campaign was to assess the impact of turbulence on hydrometeor fallspeed by placing a second MASC next to the DOE MASC and without a wind fence. The goal was to assess if the two instrument measured different fallspeeds as a function of ambient turbulence and winds that could be used to assess the impact of winds on MASC measurements and on hydrometeor settling speeds.

The instrument used was the original University of Utah prototype built in 2011, and it was successfully deployed in November 2017. It appeared to run successfully for two weeks but then failed. Subsequent attempts by DOE Atmospheric System Research (ASR) personnel at OLI and later at Fairbanks did not find the cause of the failure and eventually the instrument was shipped back to Utah in July 2018.

2.0 Results

No results were obtained from the campaign. However, the project scientific goals were accomplished by other means. It was determined through numerical simulations and data analysis that the MASC is susceptible to creating fallspeed artifacts due to interactions of the MASC body with ambient winds, even when it is placed within a double wind fence. It is recommended that MASC fallspeed measurements be considered only in a wind fence when ambient horizontal wind speeds are less than 4.5 m/s.

3.0 Publications and References

None to report at this point.

4.0 Lessons Learned

Personnel at the ARM facilities were remarkably committed to the project success. If there was a failure it was in trying to work within cost limitations to deploy an instrument that was not sufficiently robust due its primitive level of development and aging components.

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