Ph.D. Defense Announcement
Rick Schulte
February 25, 2022, at 1:00 p.m.

Rick Schulte
Ph.D. Defense

Friday, February 25, 2022
1:00 p.m.

Defense
Large Classroom (101 ATS) or [Zoom](https://zoom.us/j/97001459850)

Post Defense Meeting
Riehl Room (211 ACRC)

Committee:
Christian Kummerow (Adviser)
Peter Jan van Leeuwen
Michael Bell
Sid-Ahmed Boukabara (NOAA)
Steven Reising (Electrical and Computer Engineering)

UNDERSTANDING AND QUANTIFYING THE UNCERTAINTIES IN SATELLITE WARM RAIN RETRIEVALS

Satellite-based oceanic precipitation estimates, particularly those derived from the Global Precipitation Measurement (GPM) satellite and CloudSat, suffer from significant disagreement over regions of the globe where warm rain processes are dominant. Part of the uncertainty stems from differing assumptions about drop size distributions (DSDs). Satellite radar-based retrieval algorithms rely on DSD assumptions that may be overly simplistic, while radiometers further struggle to distinguish cloud water from rain. The aim of this study is to quantify uncertainties related to DSD assumptions in satellite precipitation retrievals, contextualize these uncertainties by comparing them to the uncertainty caused by other important factors like nonuniform beam filling, surface clutter, and vertical variability, and to see if GPM and CloudSat warm rainfall estimates can be partially reconciled if a consistent DSD model is assumed.

Surface disdrometer data are used to examine the impact of DSD variability on the ability of three satellite architectures to accurately estimate warm rainfall rates. Two architectures are similar to existing instrument combinations on the GPM Core Observatory and CloudSat, while the third is a theoretical triple frequency radar/radiometer architecture. An optimal estimation algorithm is developed to retrieve rain rates from synthetic satellite measurements, and it is found that the assumed DSD shape can have a large impact on retrieved rain rate, with biases on the order of 100% in some cases. To compare these uncertainties against the effects of horizontal and vertical inhomogeneity, satellite measurements are also simulated using output from a high-resolution cloud resolving model. Finally, the optimal estimation algorithm is used to retrieve rain rates from near-coincident observations made by GPM and CloudSat. The algorithm retrieves more rain from the CloudSat observations than from the GPM observations, due in large part to GPM's insensitivity to light rain. However, the results also suggest an important role for DSD assumptions in explaining the discrepancy. When DSD assumptions are made consistent between the two retrievals, the gap in total accumulation between GPM and CloudSat is reduced by about 25%.

Topic: Ph.D. Defense: Rick Schulte
Time: Feb 25, 2022 01:00 PM Mountain Time (US and Canada)

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