M.S. Defense Announcement
Kevin Yang
Tuesday, October 12, 2021, at 3:00 p.m.

Kevin Yang
M.S. Defense

October 12, 2021
3:00 p.m.

Defense
ATS Large Classroom (101 ATS) or via Zoom

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
Christine Chiu (Adviser)
Christian Kummerow
Steven Miller
Imme Ebert-Uphoff (Electrical and Computer Engineering)

Breaking the Deadlock in Aerosol Remote Sensing and Three-Dimensional Radiative Transfer Using Machine Learning

In the recent IPCC report, aerosols remain one of the primary sources of uncertainty in understanding the Earth's radiation budget in changing climate. To reduce the uncertainty, knowledge of aerosol properties and their interactions with clouds needs to be advanced. Our current understanding of aerosols has largely relied on passive satellite observations. Unfortunately, because satellite reflectance measurements are influenced by three-dimensional (3D) cloud radiative effects, there remains a lack of aerosol observations near clouds. Such a lack can have a significant impact on existing estimates of aerosol radiative forcing, since the optical and microphysical properties of aerosols near clouds are distinctly different from those far from clouds.

To tackle this outstanding issue in aerosol remote sensing, this thesis provides two approaches, both capitalizing on machine learning techniques. The first approach is to incorporate cloud radiative effects through fast and accurate 3D shortwave radiative transfer emulators, which can be used by existing aerosol retrieval methods and other applications. The second approach is to use a newly developed retrieval method. This method does not require cloud screening and works for all-sky conditions. Our retrieval uncertainty for all-sky aerosol optical depth (AOD) is 0.02 ± 4%AOD, comparable to the uncertainty provided by NASA Aerosol Robotic Network. More importantly, our method shows skills for in-cloud aerosols, which is surprising. This unexpected result is examined by explainable Artificial Intelligence techniques, and its implications will be discussed.

Topic: M.S. Defense: Kevin Yang
Time: Oct 12, 2021 03:00 PM Mountain Time (US and Canada)

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