Ph.D. Defense Announcement
Robert Nelson
January 14, 2019 at 1:00pm

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Ph.D. Defense

Monday, January 14, 2019
1:00pm

Defense
ATS Large Classroom (101 ATS)

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
Christian Kummerow (advisor)
Christopher O'Dell (co-advisor)
Scott Denning
Jeffrey Pierce
Jennifer Hoeting (Statistics)

Aerosol Parameterizations in Space-Based Near-Infrared Retrievals of Carbon Dioxide

The scattering effects of clouds and aerosols are one of the primary sources of error when making space-based measurements of carbon dioxide. This work describes multiple investigations into optimizing how aerosols are parameterized in retrievals of the column-averaged dry-air mole fraction of carbon dioxide (XCO2) performed on near-infrared measurements of reflected sunlight from the Orbiting Carbon Observatory-2 (OCO-2). The primary goal is to enhance both the precision and accuracy of the XCO2 measurements by improving the way aerosols are handled in the NASA Atmospheric CO2 Observations from Space (ACOS) retrieval algorithm. Two studies were performed: one on ingesting more intelligent aerosol priors into the retrieval and another on reducing the complexity of the aerosol parameterization. It was found that using co-located, instantaneous aerosol information from the Goddard Earth Observing System Model, Version 5 (GEOS-5) resulted in a small improvement against multiple validation sources but that the improvements were restricted by the accuracy and limitations of the model. Implementing simplified aerosol parameterizations that solved for fewer parameters sometimes resulted in small improvements in the retrieved XCO2, but further work is needed to determine the optimal way to handle the scattering effects of clouds and aerosols in near-infrared measurements of XCO2. With several multi-million dollar space-based greenhouse gas measurement missions scheduled and in development, the massive amount of measurements will be an incredible boon to the global scientific community, but only if the precision and accuracy of the data are sufficient.