M.S. Defense Announcement
Emily Bell
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ATS West Seminar Room (121 ATSW)

Post Defense Meeting
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Committee:
Christian Kummerow (Advisor)
Christopher O'Dell (Co-advisor)
Scott Denning
Daniel Cooley (Statistics)

Evaluation of OCO-2 Small-Scale XCO2 Variability Using Lidar Retrievals from the ACT-America Flight Campaign

With eight 1.25 x 3 kilometer footprints across its swath and nearly 1 million observations of column-mean carbon dioxide concentration (XCO2) per day, the Orbiting Carbon Observatory (OCO-2) presents exciting possibilities for monitoring the global carbon cycle, including the detection of small-scale column CO2 variations. While the global OCO-2 dataset has been shown to be quite robust, and case studies have shown successful observation of CO2 plumes from power plants and cities, the validation of XCO2 gradients on small spatial scales remains challenging: ground-based measurements, while extremely precise, are sparsely scattered and often geographically stationary. In this work, we investigate the use of an integrated path differential absorption (IPDA) lidar as a source for OCO-2 small-scale validation. As part of NASA's ACT-America project, several campaigns over North America have included a number of direct underflights of OCO-2 tracks with the Multi-Functional Fiber Laser Lidar (MFLL), as well as a set of in situ instruments, to provide a precisely collocated, high-resolution validation dataset. We explore the challenges involved in comparing the MFLL and OCO-2 datasets, from instrument principles to retrieval differences, and develop a method of correcting for some of these differences. After nine underflights, a combination of lidar data and a novel in situ-derived CO2 "curtain" have helped us to identify systematic spurious small-scale features in the OCO-2 dataset due to both surface and cloud effects. We show that though real XCO2 features on scales of tens of kilometers remain challenging to observe and validate, the lidar and OCO-2 generally have comparable spatial gradients on synoptic scales.