

Dustin D. Roten

Ph.D. Candidate | Atmospheric Scientist | STEM Educator

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Education:

Atmospheric Sciences (Ph.D.)
The University of Utah
Salt Lake City, UT
(In progress)

Engineering Physics (M.S.) & Mathematics (M.A.)
Appalachian State University
Boone, NC
(Fall 2016 – Summer 2018)

Physics & Mathematics (B.S.)
Appalachian State University
Boone, NC
(Fall 2010 – Spring 2015)

Professional Experiences:

Graduate Research Assistant (The University of Utah, Salt Lake City, UT) [Fall 2018 - current]

This work integrates space-based measurements of atmospheric CO₂, emissions inventories, and Lagrangian inversion modeling to allocate measured column-averaged CO₂ enhancements to urban/industrial sources. Responsibilities associated with this role include 40+ weekly hours of research work in the areas of land-atmosphere interactions. This work is a part of the Land-Atmosphere Interaction Research (LAIR) group housed in the Department of Atmospheric Sciences at the University of Utah.

Global Change & Sustainability Center Fellow (The University of Utah, Salt Lake City, UT) [Fall 2018 – Summer 2019]

The Global Change & Sustainability Center (GCSC) Fellowship program allows recipients to work with a student cohort focused on interdisciplinary graduate training and research which are centered around themes of environment and sustainability. Fellows participate in a GCSC seminar series as well as the project-based course “Global Changes and Society” in which an environmental issue in the Salt Lake area is identified and a student-lead solution is constructed and executed.

Graduate Research Assistant (Appalachian State University, Boone, NC) [Fall 2016 – Spring 2018]

Funded by the Graduate Research Associate Mentoring (GRAM) Program, the responsibilities associated with this role include 20+ weekly hours of research work and attending professional development opportunities relating to the responsible conduct of research. Conference presentations and publication submissions to peer-reviewed journals are expected.

Adjunct Physics Instructor (Wilkes Community College, Wilkesboro, NC) [Spring 2016]

Responsibilities included restructuring and instructing a hybrid online/face-to-face Physics I course. This position required instruction in both the lecture and on-campus lab section in which all lab equipment was ordered, organized, and maintained.

High School Mathematics Teacher (Ashe County High School, West Jefferson, NC) [Fall 2015 – Spring 2016]

Responsibilities included instructing multiple sections of Math III in addition to a section of Advanced Functions and Modeling. Additional instructional obligations included one-on-one tutoring and attending professional development seminars.

Upward Bound Academic Instructor (Appalachian State University, Boone, NC) [Summers 2016, 2017, 2018]

Funded by the U.S. Department of Education’s TRIO Programs, Upward Bound provides academic support to high school students (who meet certain criteria) to ensure the completion of high school and enrollment in college. Responsibilities included providing targeted preparation in mathematics for students in a classroom setting, structuring curricula, and coordinating STEM based extra-curricular opportunities.

Past Undergraduate Experiences (Appalachian State University, Boone, NC)

Past responsibilities include serving as an undergraduate research assistant with multiple NC Space Grant awards, teaching assistant for multiple Mathematics, Physics, and STEM education courses, supplemental instructor (SI) for multiple Physics courses, and one-on-one tutoring.

Courses Taught:

Secondary: Math III, Advanced Functions and Modeling, familiarity with Math I instruction (North Carolina Common Core)

Post-Secondary: Conceptual Physics I (instructor of record), familiarity with Calculus I and Linear Algebra instruction

Programming Skills:

R/RStudio, MATLAB (Data Acquisition), C, Assembly, familiarity with parallel processing

Description of Research Interests:

Space-based Measurements of Urban CO₂ Emissions – The Orbiting Carbon Observatory (OCO) Project

Launched in 2014, the Orbiting Carbon Observatory-2 (OCO-2) is a NASA affiliated satellite used to characterize CO₂ sources and sinks. Current work involves using these data to understand urban CO₂ emissions by linking OCO-2 observations to urban areas of interest via the column-averaged Stochastic Time-Inverted Lagrangian Transport (X-STILT) model. Prior urban flux estimates are retrieved from the Open-source Data Inventory for Anthropogenic CO₂ (ODIAC). Future work will involve data provided by OCO-3 and GeoCarb, NASA's future geosynchronous satellite to monitor emissions over the United States.

Uncertainty in Gridded Emissions Inventories

This work, conducted at Appalachian State University, explored uncertainties introduced in gridded emissions inventories (EIs) due to proxy data selected for construction. The current focus of this work is to quantify the emissions and the associated uncertainty of large point sources (power plants, paper mills, cement factories, etc.) with as fine a resolution as possible. Current methods include the implementation and automation of the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model and the application of spatiotemporal metrics to understand the uncertainties introduced from unknown, yet crucial power plant parameters in the context of emissions inventory based atmospheric CO₂ models. Specifically, the role that stack height and exhaust velocity played in dispersion characteristics was investigated. Implications include quantifying uncertainties for coupled EIs and Lagrangian inverse models.

Ion Trapping | Plasma Diagnostics | Ion Chemistry

The reactive and radiative properties of intermediately charged neon ions are of interest to a variety of applications including terrestrial and astronomical plasma diagnostics. In order to study their reactivity, a time-of-flight mass spectrometer (TOFMS) was used in tandem with a radio-frequency ion trap to bombard gases of interest at nanoTorr pressures with electrons. These ions were then ejected from the trap into the TOFMS for measurements.

Publications:

D. Roten, P. Spell, E. Marland, G. Marland. *Characterizing the Sensitivities of Emission Inventory Based Atmospheric FFCO₂ Models to Point Source Parameters*. (submitted: Dec. 2018)

S. Hogue, **D. Roten**, E. Marland, G. Marland. *Gridded Estimates of CO₂ Emissions: Uncertainty as a Function of Scale*. Mitigation and Adaptation Strategies for Global Change. (doi: 10.1007/s11027-017-9770-z)

Presentations:

D. Roten, P. Spell, S. Hogue, E. Marland, G. Marland, C. Thaxton. (Poster), *Spatiotemporal Metrics for the Characterization of Point Source FFCO₂ Emissions and Dispersion*, American Geophysical Union (AGU) 2017 Fall Meeting, New Orleans, LA. (Dec. 13, 2017)

D. Roten, P. Spell, S. Hogue, E. Marland, G. Marland, C. Thaxton. (Poster), *Spatiotemporal Metrics for the Characterization of Point Source FFCO₂ Emissions and Dispersion*, Celebration of Student Research and Creative Endeavors at Appalachian State University Boone, NC. (April 2017)

D. Roten, *Modeling with 9-12 Mathematics*, North Carolina Council of Teachers of Mathematics (NCCTM) 2016 State Conference, Greensboro, NC. (Oct. 28, 2016)

D. Roten, T. Dula, C. Patteson, B. Johnson, A. G. Calamai. (Poster), *Production & Storage of Ne³⁺ for Radiative Lifetime Measurements*, Celebration of Student Research and Creative Endeavors at Appalachian State University, Boone, NC. (April 2015)

D. Roten, T. Dula, C. Patteson, B. Johnson, A. G. Calamai. (Poster), *Production & Storage of Ne³⁺ for Radiative Lifetime Measurements*, State of North Carolina Undergraduate Research and Creativity Symposium (SNCURCS) at North Carolina State University. Raleigh, NC. (Nov. 22, 2014)

D. Roten, J. Meyer, B. Johnson, A. G. Calamai. (Poster), *A Search for Multiply-Charged Ion Production in a Low Energy Ion Trap*, Celebration of Student Research and Creative Endeavors at Appalachian State University Boone, NC. (April 2014)

D. Roten, J. Meyer, B. Johnson, A. G. Calamai. (Poster), *A Search for Multiply-Charged Ion Production in a Low Energy Ion Trap*, State of North Carolina Undergraduate Research and Creativity Symposium (SNCURCS) at the University of North Carolina- Charlotte. Charlotte, NC. (Nov. 16, 2013)

Professional Roles (Past & Present):

Member: American Geophysical Union, Sigma Pi Sigma

Technology & Engineering Education Collegiate Association (TEECA) National President/President-Elect (2010-2013)

- Special Recognition Award of Outstanding Service as President (Columbus, Ohio; 2013)
- Special Recognition Award of Outstanding Service as President-Elect (Long Beach, California; 2012)

Physics and Astronomy Club President (2013-2014)

Physics and Astronomy Club Vice-President (2012-2013)