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Elizabeth Adams, M.S.P.H., M.S.

Education

- Continuing Studies
  - Painting with Python, Spring 2014, University of North Carolina, Chapel Hill
  - Ocean Circulation Modeling, Spring 1997, University of North Carolina, Chapel Hill
  - Applied Numerical Modeling, Fall 1996, University of North Carolina, Chapel Hill
- M.S.P.H., (1990-1993) in Public Health from University of North Carolina, Chapel Hill, NC, USA
  - Environmental Science and Engineering
- M.S., (1987-1989) in Chemistry from University of North Carolina, Chapel Hill, NC, USA
  - Physical Chemistry
- B.S., (1983-1987) in Chemistry from Stony Brook University, Stony Brook, NY, USA

Registrations, Certifications, and Memberships

- American Geophysical Union
- American Meteorological Society
- Data Analysis Tools for High Resolution Air Quality Satellite Datasets, NASA's Applied Remote Sensing Training Program (ARSET), Jan 17 –Jan 22, 2018

Work Experience

- Research Associate (2008 to Present) at UNC Institute for the Environment, Center for Environmental Modeling and Policy Development (CEMPD)

  ### Cloud Computing

  - Created the CMAQ on AWS HPC Workshop using AWS Workshop Studio. Workshop provides hands-on instructions to run CMAQ for a two-day 12US1 CONUS domain using the AWS ParallelCluster Web-based User Interface. (2023)
  - Created and maintain the AWS Parallel Cluster Tutorial and Azure Cycle Cloud Tutorial in Markdown using Read the Docs methodology. Tutorials provide instructions to create High Performance Computing Clusters and run CMAQ using a reproducible, open source workflow. Results include performance and scalability of CMAQ for a two-day CMAQ 12km CONUS domain benchmarks with post-processing scripts for Quality Assurance and Timing Analysis of the results. (2021-present)
  - Created native and containerized versions of the Community Multiscale Air Quality (CMAQ) model and benchmarked the 12SE1 and 12km CONUS domains using native-built and/or containers on multiple computing environments; EPA (Atmos), UNC (Dogwood), RENCI Kubernetes Cluster HeLx and on commercial cloud computing

platforms including Amazon (Amazon Web Services or AWS) and Microsoft (Azure). (2020-2021)

Open Data Warehouses

- o Created and maintain the CMAS Data Warehouse within the Registry of Open Data on Amazon AWS and uploaded the 2018_12US1 CMAQ Annual Platform and the CMAQv5.4 2018_12NE3 Benchmark Data into the S3 buckets. (2018-present)
- o Upload and maintain EPA's EQUATES modeling input and output data for years 2002 through 2019 to CMAS Center Google Drive and maintains the metadata archive on UNC Dataverse (EQUATESv1.0: Emissions, WRF/MCIP, CMAQv5.3.2 Data -- 2002-2017 US_12km and NHEMI_108km) (2022-present)
- o Upload and maintain datasets (NEI Platform Data, MCIP, and CMAQ annual and benchmark datasets) from EPA to the Google Drive and maintains the metadata on the CMAS Data Warehouse on Dataverse. (2018-present)

User Community Support and Training

- o Manage the CMAS Center User Discourse Forum and provides support by answering user issues and providing best practice tips for reporting, diagnosing and solving bugs or user errors. (2018-present)
- o Maintain and administer the biannual (Spring and Fall) CMAS Center Online Training Courses for Community Multiscale Air Quality (CMAQ) and the Sparse Matrix Operator Kernel Emissions (SMOKE) on the Amazon Web Services (AWS) Elastic Compute Cloud (EC2) and UNC's Sakai Learning Management System and provides user support. (2015-present)

Testing and Documentation

- o Perform testing of CMAQ model releases including CMAQ-ISAM and CMAQ-DDM**3D** on UNC's compute servers. Also performs AMET testing, and maintains documentation and release information on GitHub and the CMAS Center Website for CMAQ and AMET. (2017-present)
- o Perform testing of WRF-CMAQ coupled model to compare the model output for different compilers (gnu versus intel). Uses VERDI and R scripts to generate base and sensitivity plots. (2020-present)
- o Perform testing and maintain tutorial instructions for installing and running CMAQ including netcdf-C, netcdf-Fortran, I/O API, CMAQ, CMAQ-DDM3D, and CMAQ-ISAM in markdown on the USEPA CMAQ GitHub site. (2017-present)
- o Perform testing and maintain documentation and distribution of VERDI, a Java program for visualizing air quality, meteorology, and emissions data, including maintaining the User Guide, FAQs, and bug fixes for each software release on GitHub and the CMAS Center Website. (2008-present)

Modeling and Development
- o Performed CMAQ-Direct Decoupled Method 3D (DDM3D) runs, post-processed using combine, and created plots using VERDI for Nationwide runs for two time periods. For

January (P1 period) sensitivity runs were performed for three sectors (GT, OT, and PT) and for July (P3 period) sensitivity runs were performed for five sectors (PT, OT, PD, CE, GT). Also performed five groups of Statewide runs (G1-G5) for the January (P1) period for the five emission sectors PT, OT, PD, CE, and GT. The sector definitions include Production Tanks (PT), Other (OT), Production (PD), Combustion Engines - Compressors (CE), Gathering (GT). CMAQ-DDM3D and Brute-force runs are used to determine the first order sensitivity or the response of pollutant concentrations (Ozone, PM2.5) to changes in emissions (VOC and NOx). (2021)
   - Performed base minus zero out runs for an annual 12km CONUS domain and three short-term 4km domains covering four power plants located in the southeastern United States to determine impacts on secondary pollutants (MDA8 ozone, daily and annual average PM2.5 sulfate and nitrate) and daily and annual average primary PM2.5. (2020)
   - Performed annual CMAQ modeling for two resolutions (36km and 12km) for historical case using boundary conditions from the GISS model, using AMET to postprocess and analyze the outputs. (2015)
   - Developed c-shell batch scripts to run the CALPUFF/POSTUTIL/CALPOST/POSTCALPOST suite of models for two different visibility methods, and 2 different background concentrations, for 2001, 2002, 2003, and the combined 2001-2003 years for BART and Regional Progress Analysis modeling for Arizona Regional Haze Federal Implementation Plans. (2011)
   - Assisted with the analysis of the Multi-pollutant Electric Generating Unit Response Surface Model using CMAQ (EGU-RSM) on UNC's HPC server. (2011)
- Environmental Applications Analyst at SGI and Cray Research Inc, On-site at MCNC Environmental Modeling Center (1995-2001)
   - Provide technical support, installation, and testing of environmental modeling applications on high performance computers.
- Environmental Chemist, Chemistry Division, Surface Science Branch, Naval Research Lab., Washington, DC (1993-1995)
   - Optimized the catalytic process of a patented method to detoxify polyhalogenated organic waste as an alternative to incineration. Developed a suitable protocol for characterizing the reaction properties using GC-MS and CE.

Research Experience

Papers

- Kristen M. Foley, George A. Pouliot, Alison Eyth, Michael F. Aldridge, Christine Allen, K. Wyat Appel, Jesse O. Bash, Megan Beardsley, James Beidler, David Choi, Caroline Farkas, Robert C. Gilliam, Janice Godfrey, Barron H. Henderson, Christian Hogrefe, Shannon N. Koplitz, Rich Mason, Rohit Mathur, Chris Misenis, Norm Possiel, Havala O.T. Pye, Lara Reynolds, Matthew Roark, Sarah Roberts, Donna B. Schwede, Karl M. Seltzer, Darrell Sonntag, Kevin Talgo, Claudia Toro, Jeff Vukovich, Jia Xing, **Elizabeth Adams**, "2002–2017 anthropogenic emissions data for air quality modeling over the United States", Data in Brief, 2023, 109022, ISSN 2352-3409, https://doi.org/10.1016/j.dib.2023.109022.

- Elizabeth Adams, Christos Efstathiou, Zac Aldeman, Kristen Foley, Fahim Sidi, Winston Hao, Saravanan Arunachalam, Air Quality Modeling on the Cloud: Pairing Data Availability and High-Performance Clusters, EM Magazine 2024-01-03, *Part of* ISSN: ISSN <EM Magazine (Online) ISSN 2470-4741 » EM Magazine (Print) ISSN 1088-9981>

USEPA Reports

- **Elizabeth Adams**, Carlie Coats, Christos Efstathiou, Saravanan Arunachalam, Implementation and Testing of the Community Multiscale Air Quality (CMAQ) model on the "Cloud", U.S. EPA Contract No. EP-W-16-014, WA 4-01 "Operation of the Center for Community Air Quality Modeling and Analysis (CMAS)"

Conference Presentations

- **Elizabeth Adams**, "Community Multiscale Air Quality (CMAQ) Modeling and Analysis on the Cloud", 22nd Annual CMAS Conference, 2023, Chapel Hill, NC
- **Elizabeth Adams,** Manish Soni, Tim Brown, "CMAQ on AWS HPC Workshop", 22nd Annual CMAS Conference, 2023, Chapel Hill, NC
- **Elizabeth Adams**, Christos Efstathiou, Carlie Coats, Robert Zelt, Mark Reed, John McGee, Saravanan Arunachalam, "Community Multiscale Air Quality (CMAQ) Modeling and Analysis on the Cloud", 21st Annual CMAS Conference, 2022, Chapel Hill, NC
- **Elizabeth Adams**, Christos Efstathiou, Carlie Coats, Robert Zelt, Mark Reed, John McGee, Saravanan Arunachalam, "Tutorials: CMAQ on AWS and Azure", 21st Annual CMAS Conference, 2022, Chapel Hill, NC
- Daiwen Kang, Donna Schwede, Jerry Herwehe, Tony Howard, Yadong Xu, **Liz Adams**, Cody Simmons, Heidi Paulsen, and Steve Beaulieu, "Updates on VERDIs New Functionality and Development", 2022, Chapel Hill, NC
- **Elizabeth Adams**, Carlie Coats, Christos Efstathiou, Saravanan Arunachalam, Mark Reed, Robert Zelt, "Implementation and Testing of the Community Multiscale Air Quality (CMAQ) model on the Cloud", 20th Annual CMAS Conference, 2021, Chapel Hill, NC
- Jo Ellen Brandmeyer, **Elizabeth Adams,** Tony Howard**, "**VERDI Visualization of Geospatial Datasets", 15th Annual CMAS Conference, 2016, Chapel Hill, NC
- Saravanan Arunachalam, Jared Bowden, **Elizabeth Adams**, Mohammad Omary, Alejandro Valencia, Prakash Karamchandani, Brian Kim, William Chan, "Enhanced Approach to Model Air Quality Impacts of Aircraft Operations in and around an Airport for Surface Movement Optimization Research", 12th Annual CMAS Conference, 2013, Chapel Hill NC
- Darin Del Vecchio, Donna Schwede, William Benjey, Todd Plessel, **Liz Adams**, "Recent Updates to Visualization Environment for Rich Data Interpretation (VERDI)", 12th Annual CMAS Conference, 2013, Chapel Hill, NC
- Qun He, Donna Schwede, Kirk Baker, Todd Plessel, Tommy Cathey, **Liz Adams**, Mary Ann Bitz, Nicholson Collier, "Recent Updates to the Visualization Environment for Rich Data Interpretation (VERDI)", 9th Annual CMAS Conference, 2010, Chapel Hill, NC
- Zuber Farooqui, William Vizuete, J. Jason West, Uma Shankar, Zachariah Adelman, Saravanan Arunachalam, Chris Davidson, **Liz Adams**, Aijun Xiu, and Neil Davis, "Development of a Dust

Emission Model and Assessment of PM10 in the UAE Using the CMAQ-WRF Modeling System", 9th Annual CMAS Conference, 2010, Chapel Hill, NC

- U. Shankar, B. Henderson, S. Arunachalam, Z. Adelman, , L. Ran, **E. Adams**, M. Barna, and M. Rodriguez, "Evaluation of CMAQ Performance During the Rocky Mountain Atmospheric Nitrogen and Sulfur (RoMANS) Study", 8th Annual CMAS Conference, 2009, Chapel Hill, NC
- Saravanan Arunachalam, Uma Shankar, Zachariah Adelman, Aijun Xiu, Neil Davis, **Liz Adams**, Binyu Wang, Moeko Yoshitomi, Adel Hanna, "Multipollutant Modeling for the Middle East - An Initial Assessment of Outdoor Air Quality in the U.A.E.", 8th Annual CMAS Conference, 2009, Chapel Hill, NC
- Youn-Seo Koo, Sung-Tae Kim, Jong Hyuk Choi, Saravanan Arunachalam, Zac Adelman, B.H. Baek, **Liz Adams**, "An Operational Evaluation of Air Quality Forecasting System in Korea", 7th Annual CMAS Conference, 2008, Chapel Hill, NC
- McHenry, J. N., N. Seaman, C. Coats, D. Stauffer, A. Lario-Gibbs, J. Vukovich, **E. Hayes**, and N. Wheeler. "The NCSC-PSU numerical air quality prediction project: Initial evaluation, status, and prospects." Preprints, *Symp. on Atmospheric Chemistry Issues in the 21st Century,* Amer. Meteor. Soc., 2000, Long Beach, CA
- **Hayes, E.A.**, SGI "MM5 on IA32 Clusters", The Tenth PSU/NCAR Mesoscale Model Users' Workshop, 2000, Boulder, CO
- McHenry, J.N., N.L. Seaman, C. Coats, A. Lario-Gibbs, J. Vukovich, N. Wheeler, and **E. Hayes**, 1999, "Real-time nested mesoscale forecasts of lower tropospheric ozone using a highly optimized coupled model numerical prediction system", 1999, Amer. Meteor. Soc., Dallas
- **E.A. Hayes**, "Parallel Implementation of the Regional Acid Deposition Model (RADM)", Computing in Environmental Resource Management Proceedings of the Air and Waste Management Association, 1996, Research Triangle Park, NC