



22nd Community Modeling and Analysis System (CMAS) Conference





22ND ANNUAL

CMAS

CONFERENCE

October 16-18, 2023 | Chapel Hill, NC

TABLE OF CONTENTS

1. Welcome Letter.....	4
2. Important Information.....	5
3. Agenda.....	6
Monday, October 16.....	6
Posters.....	8
Tuesday, October 17.....	10
Posters.....	13
Wednesday, October 18.....	16
4. In Memoriam.....	20
5. CMAQ 25 th Anniversary.....	21
6. History of CMAS.....	22
7. About the Area.....	23
8. Map of Friday Conference Center.....	26



1. WELCOME LETTER

Welcome to the 22nd Annual Conference of the Center for Community Modeling and Analysis System (CMAS). Since the first edition in 2001, CMAS conferences have become a popular platform to learn about advances in local-to-regional scale air quality modeling and applications both within and outside the U.S. The U.S. EPA has collaborated with several leading researchers in atmospheric modeling software infrastructure to establish the non-profit CMAS Center to support the air quality modeling user community in the U.S. and abroad. The University of North Carolina at Chapel Hill (UNC) has been the host of the CMAS Center through competitively awarded, successive multi-year EPA contracts since its inception in 2001.

The CMAS Center is a functional entity, providing expertise in support of open-source, public domain air quality model products. UNC has developed an exemplary reputation as the host of the CMAS Center over the past 22 years. The CMAS Community includes nearly 10,000 participants from around the world, and includes regulatory, academia, federal, state, and local governments, industry, consultants, and international users from nearly 100 countries. The CMAS website (<https://www.cmascenter.org>) with its multiple model component links, is a globally renowned information hub for air quality modelers seeking software, data, support, and training. During the past two decades, UNC's CMAS Center has managed over 200 product releases (50+ in the past 5 years alone) of 14 open-source modeling and analyses tools including CMAQ, SMOKE, AMET, MCIP, I/O API, Spatial Allocator, VERDI – all critical tools for a global air quality modeling community.

UNC has established in the CMAS Center a dynamic education and outreach program that includes workshops, training, a visiting scientist program, annual conference(s), and a robust record of > 9,000 peer-reviewed publications. Over the past decade, in collaboration with EPA, UNC has organized more than 11 workshops on specific topics of scientific interest, including bi-annual peer reviews of the CMAQ model. The CMAS training program is highly regarded by the user community and has trained more than 4,000 users from the U.S. and abroad, at no cost to the EPA. A major benefit of the conference has been CMAS Center's coordination with leading environmental journals to publish special issues of selected, peer-reviewed papers from the conference presentations.

With its global outreach activities, the CMAS East Asia conference and training were held earlier this year in Japan this July, and the CMAS South America conference and training are being planned to be held in São Paulo, Brazil in June 2024.

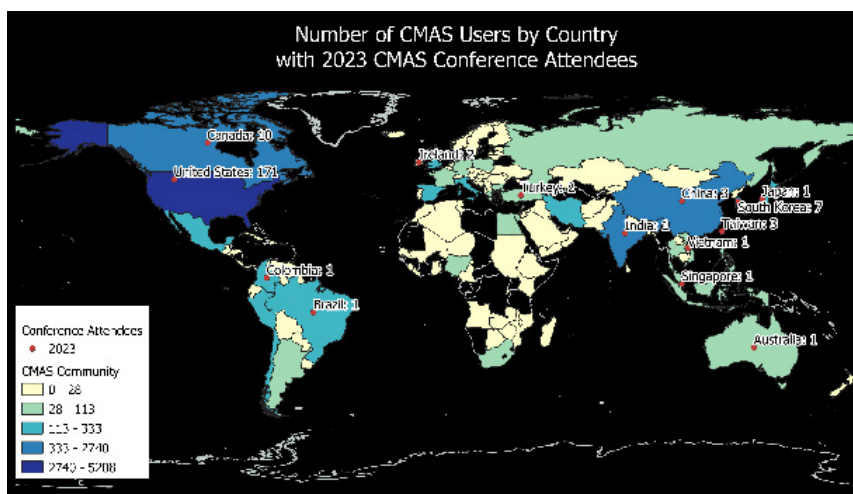
This year's CMAS Conference is also an occasion to celebrate the 25th anniversary of the Community Multiscale Air Quality (CMAQ) model. Plans are on to celebrate this milestone in multiple ways to recognize the scientific advances and also the numerous applications of CMAQ that have been instrumental in developing policies that helped improve air quality both within and outside the U.S. And finally, I also recognize the loss of two giants in this community this year. Adel Hanna, the former Director of CMAS and Jason Ching, formerly with the NOAA and EPA and integral member of the CMAS community have left us. Both Adel and Jason were friends and mentors to many of us, and we will be taking some time during this year's conference to recognize and honor their immense contributions.

On behalf of the CMAS team at UNC, I hope you enjoy your time at this 22nd annual conference and celebrations, and look forward to meeting each of you.

Saravanan Arunachalam, Ph.D.

Director | Center for Community Modeling and Analyses System

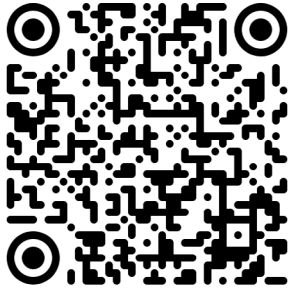
Deputy Director | Institute for the Environment



2. IMPORTANT INFORMATION

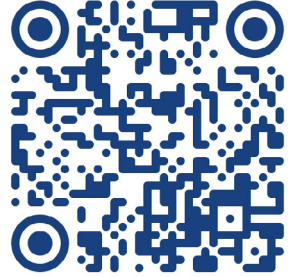
ONLINE 2023 CMAS CONFERENCE AGENDA

<https://www.cmascenter.org/conference/2023/agenda.cfm>



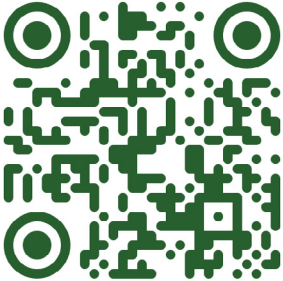
FEEDBACK FORM

<https://forms.gle/chVGspPFNgNcZ4Xs5>



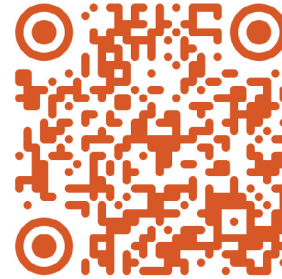
TWITTER

https://twitter.com/CMAS_Center



LINKEDIN

<https://www.linkedin.com/company/cmas-center>



CMAS CENTER

<https://www.cmascenter.org/index.cfm>



Monday, October 16

- 8:00** **Breakfast and Oral Presentation Upload**
- 8:30** **Introductions & Plenary Keynotes (Grumman)**
Opening Remarks - [Michael Piehler](#)
Director, UNC Institute for the Environment; Chief Sustainability Officer and Special Assistant to the Chancellor for Sustainability, UNC-Chapel Hill
- State of the CMAS Center - [Sarav Arunachalam](#)*
Director, CMAS Center, UNC-Chapel Hill
- 9:00** A New Era of Air Quality Monitoring from Space over North America with TEMPO: Commissioning Results
[Xiong Liu](#)
Senior Atmospheric Physicist at Smithsonian Astrophysical Observatory (SAO)
- 9:45** **Coffee Break**
- 10:05** Current challenges and opportunities in modeling wildfire emissions
[Christine Wiedinmyer](#)
CIRES Associate Director for Science; Research Professor, Dept. of Mechanical Engineering, University of Colorado at Boulder
- 10:50** CMAQ: In the Beginning and Making a Mark
[Alice Gilliland](#)
Acting Director, Center for Environmental Measurement & Modeling (CEMM), U.S. EPA's Office of Research and Development (ORD)
- CMAS & CMAQ: Why it Matters... A Regulatory Perspective
[Richard A. "Chet" Wayland](#)
Director, Air Quality Assessment Division, U.S. EPA Office of Air Quality Planning and Standards
- 11:50** *Conference Logistics - [Erin Valentine](#)*
Conference Coordinator, UNC-Chapel Hill
- 11:55** **Lunch Break (Trillium)**

MODEL DEVELOPMENT

Chairs: Ben Murphy (U.S. EPA), Yang Zhang (Northeastern University)

- 1:00** Beyond the Big-Leaf Model for NOAA's Unified Air Quality Forecasting Capabilities
Patrick Campbell
George Mason University/NOAA Air Resources Laboratory Affiliate
- 1:20** Improving the representation of formaldehyde in the Community Regional Atmospheric Chemistry Multiphase Mechanism (CRACMM)
Nash Skipper
ORISE at U.S. EPA
- 1:40** Impact of aerosol nitrate photolysis on air quality over Northern Hemisphere
Golam Sarwar
U.S. EPA
- 2:00** Application of the hyperdual-step method to CMAQ for the assessment of aerosol formation from volatile chemical products
Jiachen Liu
Drexel University
- 2:20** CMAQ 5.3 Parallel Performance for a CY2016 (376 Days)
George Delic
HiPERiSM Consulting, LLC
- 2:40** GPU-Assisted Computation for a Gas-Phase Chemical Solver in CMAQ
Khanh Do
Northeastern University

MULTISCALE MODEL APPLICATIONS & EVALUATIONS

Chairs: Kristen Foley (U.S. EPA), Matthew Alvarado (Verisk AER)

- 1:00** Intercomparison of six global ground-level ozone datasets for health-relevant metrics
Hantao Wang
UNC-Chapel Hill
- 1:20** Modeling studies of the effect of HO₂ uptake by atmospheric aerosol on surface ozone
Yu Morino
National Institute for Environmental Studies, Japan
- 1:40** Quantifying the effects of vegetative in-canopy photolysis and turbulence processes on U.S. air quality
Chi-Tsan Wang
Center for Spatial Information Science and Systems (CSISS), George Mason University
- 2:00** Application of Korean air quality modeling system named GMAF to winter and spring in 2018
HyeonYeong Park
Inha University
- 2:20** Black carbon aging process simulation in a two-way coupled WRF-CMAQ model
Yuzhi Jin (presented by David Wong)
Nanjing University of Information Science and Technology

----- **3:00**

Coffee Break -----

GRUMMAN

MODEL DEVELOPMENT

Chairs: Ben Murphy (U.S. EPA), Yang Zhang (Northeastern University)

3:20 Construction of the Advanced Air Quality Modeling System (AAQMS) and the MPAS-CMAQ coupled model
David Wong
U.S. EPA

3:40 A new paradigm for PBL modeling in meteorological and air quality models
Kiran Alapaty
U.S. EPA

4:00 Modeling Deposition and Resuspension Processes in the Discretized Version of the Street-Network Model MUNICH
Thibaud Sarica
Northeastern University

DOGWOOD

REGULATORY MODELING & SIP APPLICATIONS

Chairs: Xiangyu Jiang (GA Envir. Protection Division), Heather Simon (U.S. EPA)

3:20 Fairbanks attainment demonstration modeling using CMAQ version 5.33 with updated emissions and meteorology
Deanna Huff
Alaska Dept. of Environmental Conservation

3:40 Source Apportionment Modeling to Support Regional Haze Rule Planning in the Western U.S.
Michael Barna
National Park Service

4:00 Source Apportionment of Summertime O₃ in Salt Lake Valley, Utah: Source Contributions and Policy Implications
Nancy Daher
Utah Division of Air Quality

4:20 Biogenic Emissions Modeling and Model Performance Impacts along the Northern Wasatch Front, Utah
Lexie Wilson
Utah Division of Air Quality

----- **4:40** **Poster Introductions (Grumman)** -----

----- **5:30** **Reception and Poster Session (Atrium)** -----

MONDAY POSTER PRESENTATIONS

MULTISCALE MODEL APPLICATIONS & EVALUATIONS

Evaluating CMAQ in Different Spatial Scales: A Case Study in Brazil
Taciana Albuquerque
Federal University of Minas Gerais

Comparison of WRF and AERMET for PBL Estimation in Brazil
Taciana Albuquerque
Federal University of Minas Gerais

Exploring air emissions, transport, and fate of per- and polyfluoroalkyl substances (PFAS) in the Northeastern United States using CMAQ-PFAS

Emma D'Ambro

U.S. EPA

Modeling PM_{2.5} Sulfate and Hydroxymethanesulfonate in Fairbanks during the ALPACA field campaign

Kathleen Fahey

U.S. EPA

A Study of Clear Air Turbulence (CAT) in Vietnam using output of numerical forecast systems

Quang Hung Le

Vietnam Air Traffic Management Corporation (VATM)

Limitations of WRF land surface model Noah-MP for simulating land-atmosphere variables in California

Huazhen Liu

UNC-Chapel Hill

Source Apportionment of Anthropogenic and Biogenic Organic Aerosol over the Tokyo Metropolitan Area from Forward and Receptor Models

Yu Morino

National Institute for Environmental Studies, Japan

Evaluation of updated urban land-use and geographical data on WRF simulations for the Utah Northern Wasatch Front

Mark Sghiatti

Utah Division of Air Quality

REGULATORY MODELING & SIP APPLICATIONS

Contribution of different source categories can be analyzed during various weather patterns in Taiwan

Hsin-Chih Lai

Chang Jung Christian University

EMISSIONS INVENTORIES, MODELS, & PROCESSES

Developing a method to adjust CO emissions in North Korea using DMZ ground observations, satellite observations and simulations

Eunhye Kim

Ajou University, Emory University

Comparing Vehicular Emissions Inventories in Brazil

Bianca Meotti

Universidade Federal de Santa Catarina

The Impact of Emissions Control Policies on Speciated NMVOC Emissions and Air Quality

Minwoo Park

Konkuk University

Speciation Methods in the U.S. EPA's Modeling Platforms

Karl Seltzer

U.S. EPA

AIR QUALITY, CLIMATE, & ENERGY

Understanding climate change and variability impacts on midcentury CONUS PM_{2.5} by dynamically downscaling global climate and chemistry in WRF and CMAQ

Surendra Kunwar

UNC-Chapel Hill

Air Quality Impact Assessment in Offshore Wind Energy Projects

Krish Vijayaraghavan

Ramboll

Tuesday, October 17

8:00

Breakfast and Oral Presentation Upload

GRUMMAN

EMISSIONS INVENTORIES, MODELS, & PROCESSES

Chairs: Jeff Vukovich (U.S. EPA), BH Baek (George Mason University)

8:40

A Technique to Estimate Nonpoint Industrial and Commercial/ Institutional Fuel Consumption

Rich Mason

U.S. EPA

9:00

Cooking Emissions and Their Chemical Characterization in the United States

Karl Seltzer

U.S. EPA

9:20

Updating Residential Wood Combustion Emissions with the Reactive Organic Carbon Approach

Ben Murphy

U.S. EPA

9:40

Updating Utah dust emission predictions using local soil and land cover conditions

Ty Hosler

Brigham Young University

DOGWOOD

MACHINE LEARNING & REDUCED FORM MODELS

Chairs: Jia Xing (George Mason University), James Kelly (U.S. EPA)

8:40

Efficient Estimation of Sector-Level NO_x Emissions using a Physically-Guided Variational Autoencoder and Multiple Observations

Jia Xing

George Mason University

9:00

Spatiotemporal NH₃ Emissions using a Physically-guided Variational Autoencoder (VAE) with Observations

BH Baek

George Mason University

9:20

Quantifying Aircraft Emissions with Inverse Modeling: A Case Study at the Los Angeles International Airport

Gavendra Pandey

UNC-Chapel Hill

9:40

Development of a Response Surface Model (RSM) using deep machine learning

Joey (Jiaoyan) Huang

U.S. EPA

10:00

Coffee Break

GRUMMAN

EMISSIONS INVENTORIES, MODELS, & PROCESSES

Chairs: Jeff Vukovich (U.S. EPA), BH Baek (George Mason University)

10:30 Transport of soil nutrients to key Utah watersheds via dust events
Ty Hosler
Brigham Young University

10:50 Advancing Sectoral Emission Estimates of NO_x, SO₂, and CO Using Satellite Observations
Zhen Qu
NC State University

11:10 Proposed Updates to Canada's Air-Quality Deterministic Prediction System
Verica Savic-Jovicic
Environment and Climate Change Canada

11:30 Development of a 2020 Emissions Modeling Platform
Alison Eyth
U.S. EPA

11:50 The Future of EPA's Air Quality Time Series
George Pouliot
U.S. EPA

DOGWOOD

MACHINE LEARNING & REDUCED FORM MODELS

Chairs: Jia Xing (George Mason University), James Kelly (U.S. EPA)

10:30 Deep Learning based Digital Twin for Simulating CMAQ Surface NO₂ Levels over the CONUS
Yunsoo Choi
University of Houston

10:50 Machine Learning with Spatial Interpolation Techniques for Constructing 2-Dimensional Ozone Concentrations in Southern California during the COVID-19 Shutdown
Khanh Do
Northeastern University

11:10 Air pollution forecast using Gaussian Processes
Alper Unal
Istanbul Technical University

11:30 Quantification of impacts and uncertainties of nitrogen/sulfur deposition and ozone exposure on growth and survival for U.S. tree species with machine learning
Shih Ying Chang
Sonoma Technology

11:50 The Well-Tempered Deposition Algorithm: Theme and Variation on Physically-based Machine Learning
Colin Lee
Environment and Climate Change Canada

12:10 Lunch Break (Trillium)

Tribute to Adel Hanna

GRUMMAN

COMBINED SESSION: MODELING TO SUPPORT EXPOSURE AND HEALTH STUDIES AND COMMUNITY-SCALE APPLICATIONS & AIR QUALITY STUDIES THAT FOCUS ON ENVIRONMENTAL JUSTICE

Chairs: Cavin Ward-Caviness (U.S. EPA), Neal Fann (U.S. EPA)

- 1:10** On the impacts of grid resolution on the estimates of marginal societal health benefits of PM_{2.5} emissions abatement
Anas Alhusban
Carleton University
- 1:30** Analysis of Global Environmental Health Inequality Using the Adjoint of Hemispheric CMAQ
Amir Hakami
Carleton University
- 1:50** Improvements in U.S. Air Quality have not Addressed Pollution Inequalities - Especially among Minority and Elderly Populations
Shupeng Zhu
University of California, Irvine
- 2:10** Sensitivity analysis of ambient NO₂ concentration to primary emission sources in Alberta, Canada using WRF/CMAQ modeling
Vahid Hosseini
Simon Fraser University
- 2:30** Harnessing Artificial Intelligence for Predicting Public Health Impacts Using EpiMaps
Charles Baschnagel
Booz Allen Hamilton

DOGWOOD

AIR QUALITY, CLIMATE, & ENERGY

Chairs: Ozge Kaplan (U.S. EPA), Noah Kittner (UNC-Chapel Hill)

- 1:10** Assessing Impacts of Oil and Gas activities in the Permian Basin to Ozone nonattainment at Carlsbad, New Mexico
Huy Tran
UNC-Chapel Hill
- 1:30** Impacts of clean fleets on regional air quality and implications on environmental justice in South Coast Air Basin of California
Kai Wu
University of California, Irvine
- 1:50** Projecting Future Air quality in Brazil using WRF-Chem considering current policies
Daniel Schuch
Northeastern University
- 2:10** Impacts of Greenhouse Gas and Air Pollution Mitigation Policies in Northeast Asia on the Future Air Quality of Korea
Youjung Jang
Konkuk University
- 2:30** Estimating ZIP Code-Level Air Quality and Health Risks of New York City's Transportation Decarbonization Pathways using EPA's COMET and ZAPPA Tool
Ozge Kaplan
U.S. EPA

----- **2:50**

Coffee Break -----

3:20

CMAQ 25th Anniversary Celebration: Reflecting on the History of the CMAQ System (Grumman)

This year marks the 25th anniversary of the initial release of EPA's Community Multiscale Air Quality (CMAQ) modeling system. In this interactive session, we have convened a panel of scientists who have long histories with the CMAQ system. The panelists will be asked various questions from a moderator, followed by a unique opportunity for audience participation with unscripted questions. Interactions with the panelists can extend into the reception and poster session immediately following this panel discussion.

Moderator: Tanya Spero (U.S. EPA)

Panelists:

Frank Binkowski (Retired, U.S. EPA & UNC-Chapel Hill)

Carlie Coats (UNC-Chapel Hill)

Alison Eyth (U.S. EPA)

Jon Pleim (U.S. EPA)

Norm Possiel (U.S. EPA)

Ken Schere (Retired, U.S. EPA)

----- 5:00

Reception and Poster Session (Atrium)

TUESDAY POSTER PRESENTATIONS

MULTISCALE MODEL APPLICATIONS & EVALUATIONS

Nationwide sensitivities of PM_{2.5} to Power plants emissions using CMAQ-DDMv5.4 and reduced complex models

Lucas Henneman

George Mason University

MACHINE LEARNING & REDUCED FORM MODELS: DEVELOPMENTS & APPLICATIONS

Automated generation of dispersion factor lookup tables for air toxics risk screening using R and AERMOD

Jonathan Dorn

Abt Associates

Predicting Precipitable Water Vapour Using Explainable Machine Learning Techniques

Archit Gupta

Nanyang Technological University

A Model Based Approach of Predicting Air Quality Index Based on Six Elements of Machine Learning: Issues, Challenges & Future Directions

Mohamed Abdul Kader Jailani

Reva University

Development of the CMAQ-CNN PM_{2.5} forecasting models in Taiwan

Yi-Ju Lee

National Central University

Introducing and Evaluating SABAQS, a New Reduced Form Air Quality Model

Heather Simon

U.S. EPA

MODELING TO SUPPORT EXPOSURE AND HEALTH STUDIES AND COMMUNITY-SCALE APPLICATIONS

Using machine learning methods to evaluate the effects of meteorology and policy implementations on ambient pollutant concentrations across China

Shreya Guha

George Mason University

Web-based PM_{2.5} Exposure Modeling Tool for Wildfire Smoke Events

Vlad Isakov

U.S. EPA

Near-Source Safety and Health Risks of Oil and Gas Super Emitters

Chowdhury G. Moniruzzaman

PSE Healthy Energy

Utilizing the reduced complexity model InMAP to analyze emission reductions scenarios in Bogota, Colombia

Ricardo Morales Betancourt

Universidad de los Andes

Evaluating the 1940 Exposures: A Modern Projection and Comparison

Xiaorong Shan

George Mason University

Fusing CMAQ, RLINE and Observations to develop 250m resolution daily pollutant exposure fields as part of a fertility study

Yifeng Wang

Georgia Institute of Technology

AIR QUALITY STUDIES THAT FOCUS ON ENVIRONMENTAL JUSTICE

Can Electric Vehicles Adoption address Environmental Inequalities in Georgia?

Xin He

Georgia Institute of Technology

The Intersection of Total and Wildfire-Attributed PM_{2.5} Exposure Disparities in the United States

R. Byron Rice

U.S. EPA, UNC-Chapel Hill

WORLD URBAN DATABASE AND ACCESS PORTAL TOOL (WUDAPT)

Improving the WRF Model Performance By Using the Local Climate Zones Approach Integrated with MAPBIOMAS Land Surface Data for São Paulo, Brazil

Taciana Albuquerque

Federal University of Minas Gerais

REMOTE SENSING/SENSOR TECHNOLOGY & MEASUREMENTS

A Python Interface to the Remote Sensing Information Gateway (pyrsig): Enabling Satellite Data Analysis

Barron Henderson

U.S. EPA

Pinpointing Ports: Comparing CMAQ Modelling with Satellite and Ground Observations to Understand Current Capabilities for Assessing Port-Related Air Quality Impacts

Aryiana Moore

Georgia Institute of Technology

CLOUD COMPUTING

CMAQ Data Available on the Cloud through Amazon's Open Data Program

Fahim Sidi

U.S. EPA

WILDFIRE EMISSIONS AND AIR QUALITY

Assessing the Impacts of Wildfire Dominance on Air Quality in Turkey's Mediterranean Region: A Comprehensive Analysis Using Ground Observations, Satellite Data, and the WRF/CMAQ Model

Yusuf Aydin

Istanbul Technical University

Deforestation control and its potential air quality co-benefits: South American wildfire emissions reductions

Ricardo Morales Betancourt

Universidad de los Andes

Advancing Smoke Management and Wildfire Mitigation through Probability-Based Smoke Analysis

Azimeh Zare

Desert Research Institute

Modeling polycyclic aromatic hydrocarbons (PAHs) concentrations from wildfires in California

Shupeng Zhu

University of California, Irvine

8:00

Breakfast and Oral Presentation Upload

GRUMMAN

WORLD URBAN DATABASE AND ACCESS PORTAL TOOL (WUDAPT)

*Chair: Gerald Mills (University College,
Dublin)*

9:00 Tribute to Dr. Jason Ching

9:20 WUDAPT Overview and Perspectives
for urban-focused AQ modeling
[Gerald Mills](#)
University College, Dublin

9:40 Implementing WUDAPT Global LCZ
maps into WRF and CESM
[Lei Zhao](#)
University of Illinois

DOGWOOD

REMOTE SENSING/ SENSOR TECHNOLOGY & MEASUREMENTS STUDIES

*Chairs: Barron Henderson (U.S. EPA),
Arastoo Pour Biazar (University of
Alabama, Huntsville)*

9:00 Moving towards routine and
systematic validation of Tropospheric
Emissions: Monitoring of Pollution
(TEMPO) Level 2 Data Products
[Lukas Valin](#)
U.S. EPA

9:20 Preparing PurpleAir and
Geostationary Satellites for AirNow
[Barron Henderson](#)
U.S. EPA

9:40 Remote Sensing Technology and
Statistical Models to Assess the
Impacts of Climate Change on Dust
Transportation from the Sahara
Desert and the Arabian Peninsula to
the Turkey
[Yusuf Aydin](#)
Istanbul Technical University

----- 10:00

Coffee Break -----

GRUMMAN

WUDAPT

Chair: Gerald Mills (University College Dublin)

- 10:30** Enhancing Urban Canopy Features and Air Quality: WUDAPT Implementation Studies in Brazil
Taciana Albuquerque
Federal University of Minas Gerais
- 10:50** Multi-scale modelling of urban carbon emissions: Integrating WRF and MUNICH models in Dublin, Ireland
Ankur Prabhat Sati
University College Dublin
- 11:10** Evaluating Meteorological Effects of GSLA Growth Using Urban Canopy Modeling
Bradley Adams
Brigham Young University
- 11:30** Hyperlocal Air Quality Modeling Using Urban Morphological Data from the World Urban Data Analysis & Portal Tools & Digital Synthetic City
Yang Zhang
Northeastern University

11:50

Promoting WUDAPT to CMAS Collaborations (Grumman)

WUDAPT proposes to stimulate various collaborations with AQ and other communities in performing high profile prototypic AQ and other community based FFP (Fit-for-Purpose) model application TESTBEDs. Recently, several prototype TESTBEDs have been initiated using canopy parameters (UCPS) off of WUDAPT's decade of effort towards generating such information for use in hyper local (street level) to urban scale modeling, and in urban to regional to global scale contexts. This panel will highlight and elucidate pertinent key features from these initial prototype TESTBEDs activities to the CMAS community. Panelists will provide various FFP perspectives regarding Global to Hyper-Local (Street level) scale modeling capabilities from WUDAPT to Boston, Chicago, Baltimore, Paris, and São Paulo TESTBEDs.

Moderator: Gerald Mills (University College, Dublin)

Panelists:

Jon Pleim (U.S. EPA)

Sarav Arunachalam (UNC-Chapel Hill)

Yang Zhang (Northeastern University)

DOGWOOD

REMOTE SENSING

Chairs: Barron Henderson (U.S. EPA), Arastoo Pour Biazar (University of Alabama, Huntsville)

- 10:30** Open Discussion on TEMPO

DOGWOOD

CLOUD COMPUTING

Chairs: Patrick Campbell (George Mason University), Fahim Sidi (U.S. EPA)

- 11:10** Community Multiscale Air Quality (CMAQ) Modeling and Analysis on the Cloud
Elizabeth Adams
UNC-Chapel Hill
- 11:30** Creating an Air Quality Intelligence Ecosystem in the Cloud
Jimmy Minier
Booz Allen Hamilton

12:30

Lunch Break (Trillium)

*Tribute to Jason Ching
Hanna Student Poster Awards
User Forum Award*

GRUMMAN

WILDFIRE EMISSIONS AND AIR QUALITY

Chairs: Fernando Garcia-Menendez (NC State University), Tesh Rao (U.S. EPA)

1:30 Impacts on a Wildland Emissions Inventory when using the Smoke Emissions Reference Application (SERA) emissions factors: Year 2021 Case Study

Jeff Vukovich

U.S. EPA

1:50 Development of a 2021 Canadian Wildland Fire Emissions Inventory Using the National Emissions Inventory Approach

James Beidler

U.S. EPA

2:10 Comparison of Global Fire Emission Inventories and Fire Emission Inventory Processor Updates

Jeremiah Johnson

Ramboll

2:30 Understanding the evolution of reactive organic carbon in wildfire plumes

Havala Pye

U.S. EPA

----- **2:50**

Coffee Break -----

DOGWOOD

CMAQ on the Cloud Hands-on Tutorial

Led by: Elizabeth Adams (UNC-Chapel Hill), Tim Brown (AWS)

1:30 to 2:50

Targeted to CMAS Conference attendees who are also CMAQ modelers.

AWS provides a wide range of High Performance Computer (HPC) services for CMAQ workloads that require scaling and performance, including AWS ParallelCluster, Amazon FSx for Lustre, and Elastic Fabric Adapter (EFA). In this workshop, you will have the opportunity to set up a HPC system and run CMAQ on the Cloud.

The expected duration of this workshop is from 1:30pm to 5:00pm.

Laptop required. In-person only. Workshop is limited to 80 attendees. Register here: <https://forms.gle/J7yEmRTiKkeia448>.

GRUMMAN

WILDFIRE EMISSIONS AND AIR QUALITY

Chairs: Fernando Garcia-Menendez (NC State University), Tesh Rao (U.S. EPA)

- 3:20** Real-time fire detection from image sequences with low latency and memory efficient machine learning
Sambit Bhattacharya
Fayetteville State University
- 3:40** Direct and indirect exposures to fires in the wildland-urban interface of California: active fire threats, air pollution, and associated health impacts and population vulnerability
Joseph L. Wilkins
Howard University
- 4:00** Evaluating the Ability of Statistical and Photochemical Models to Capture the Impacts of Biomass Burning Smoke on Urban Air Quality in Texas
Matthew J. Alvarado
Verisk Atmospheric and Environmental Research
- 4:20** Impact of Prescribed Fire on Air Quality in Southeastern US in 2020
Kamal Jyoti Maji
Georgia Institute of Technology
- 4:40** Integrating Fire Behavior Models and Chemical Transport Models: A case study of Coupling WRF-SFIRE with CMAQ
Zongrun Li
Georgia Tech

DOGWOOD

CMAQ on the Cloud Hands-on Tutorial

Led by: Elizabeth Adams (UNC-Chapel Hill), Tim Brown (AWS)

- 3:20 to 5:00**
- Tutorial continued.

----- 5:00

Adjourn -----

***Thank you for joining us for the 2023 CMAS Conference!
Please be sure to complete our feedback survey (link on pg. 5).***

4. IN MEMORIAM

ADEL FAHIM HANNA

Adel Fahim Hanna, 77, founding director of the UNC Institute for the Environment's Center for Environmental Modeling for Policy Development (CEMPD) and Community Modeling and Analysis System (CMAS) died April 23, 2023. Hanna, a beloved professor, colleague and mentor served the UNC community for more than two decades before his retirement in March 2021. Hanna was named director of the CMAS Center when it was inaugurated by the U.S. EPA in 2001. The Center moved to its home at the Institute for the Environment in 2003. As director, Hanna was instrumental in growing the user community to thousands of users worldwide. He oversaw the implementation of a comprehensive training program. He spearheaded special issues in scientific journals, bolstering the reputation of the CMAS Center. He also convened an external advisory committee comprised of a diverse user community of domestic and international users from the public and private sectors and academia to guide the leadership of the CMAS Center. Under his leadership, the CMAS Conference evolved into a highly successful annual conference at UNC-Chapel Hill. Outside of work, Hanna was a devout family man to his wife of 46 years Souzan Yanni, their sons Hani and Peter and grandchildren Emma and Kevin Swanson-Hanna. He was a founding member of St. Mary's Coptic Cathedral in Raleigh, NC, where he was awarded for his service in 1994. Hanna was born in Cairo, Egypt, Oct. 11, 1945. He earned his undergraduate and PhD degrees in atmospheric science from Colorado State University in Fort Collins, Colorado. "Adel was a very lovely friend and colleague," said Sarav Arunachalam, deputy director of UNC-IE and director of CEMPD. "He laid the foundation for a very successful and thriving program at UNC for the global air quality modeling community and made UNC synonymous with CMAS for this community. I am fortunate and privileged to have been mentored by Adel from when I first joined MCNC and then at UNC, and he will be sorely missed by all who knew him."



JASON CHING

Jason Ching, 82, died suddenly on September 4, 2023 while on a trip to Australia's Great Barrier reef. He had travelled there following the International Conference on Urban Climates (ICUC11) in Sydney, at which he received the Luke Howard Award for lifetime contributions to urban climate science. It was a fitting tribute to his research work of over 50 years on the planetary boundary layer, turbulence, landscape heterogeneity at small scales and, air quality & meso-scale modeling. Jason began his meteorological education at the University of Hawaii (BS in 1962) before continuing to Penn State University (MSc in 1964) and then to the University of Washington (PhD in 1974). He joined NOAA as a research meteorologist upon graduation and later joined the U.S. EPA. During his 40-year career at NOAA and the EPA he worked on some of the most significant atmospheric projects of the 20th century, as legislation on air quality directed scientific enquiry from observation and

discovery to understanding and modelling. Jason's career path from the 1970s until now has coincided with the creation of the scientific infrastructure that underpins modern climate science. After his "retirement" in 2011, Jason joined UNC-IE and initiated and engaged in innovative collaborations with members of the International Association for Urban Climate (and others) toward the goal of extending the National Urban Database and Access Portal Tools (NUDAPT) concept to worldwide coverage. One of the projects he was closely associated with was the World Urban Database and Access Portal Tools (WUDAPT) project, which was formally started following the 8th International Conference on Urban Climates in 2012. WUDAPT took on the challenge of creating a global database on cities suited to climate studies, including the generation of urban parameters to support modeling. Jason was an indefatigable atmospheric scientist with a unique ability to identify pathways to progress and to convince (and cajole) colleagues to collaborate unselfishly to the wider community and society.

He was the quintessential citizen scientist. He had a natural inquisitiveness, a fundamental belief in scientific method and progress, and a commitment to building scientific communities where knowledge is shared.

5. CMAQ 25TH ANNIVERSARY

CMAQ: Celebrating 25 Years of Air Quality Modeling Excellence



EPA develops software models and tools to address a range of environmental issues. These developments have exploded with the advent of technology since the turn of the century. The Community Multiscale Air Quality (CMAQ) modeling system is one of EPA's models that has withstood the test of time. This month, EPA proudly celebrates the 25th anniversary of CMAQ's initial release, which occurred June 30, 1998. Read about what has made the CMAQ model so successful over the years and why it is still relevant today.

What is CMAQ?

CMAQ is EPA's premier modeling system for studying air pollution from global to local scales and is a powerful computational tool for translating fundamental atmospheric science principles to policy scenarios. CMAQ combines current knowledge in atmospheric science and air quality modeling, multi-processor computing techniques, and an open-source framework to deliver fast, technically sound estimates of ozone, particulates, toxics and acid deposition. EPA and states nationwide have used CMAQ to support air quality

management. Over the years, CMAQ has been continually updated to incorporate new state-of-the-science knowledge and use high-performance computing power to characterize air quality more accurately and efficiently to protect human health and the environment. CMAQ boasts a community of thousands of users across six continents who use the modeling system for air quality management, forecasting, and research.

CMAQ's development was initiated in the early 1990s to advance air quality science used in regulatory models by leveraging computational advancements. Regulatory models previously had been developed to address pollutants individually. However, CMAQ was designed as a "third-generation" modeling system that incorporates meteorological, emissions, and atmospheric chemistry models to simultaneously predict the concentrations of multiple linked harmful air pollutants. CMAQ was thoughtfully built for endurance and to meet the needs of both regulatory analysts and scientists using these principles: modular, extensible, one-atmosphere.

"Generalized formulation of CMAQ's governing equations and modular code structure are key attributes that have enabled its continuous scientific evolution over the past two decades to address emerging and increasingly complex air pollution problems," affirmed Rohit Mathur, senior EPA research physical scientist and current scientific lead for CMAQ development.

After several years of development, CMAQ made its public debut in 1998, and shortly thereafter it was accompanied by ample EPA documentation of the science in CMAQ and how to use it. Although most of the science in those technical notes has been updated, the fundamental equations remain intact in today's CMAQ.

CMAQ was used by EPA to inform air quality management rules, such as the Clean Air Interstate Rule and the Clean Air Mercury Rule. CMAQ is also among the viable modeling tools endorsed by EPA for use in State Implementation Plans (SIPs) used by states to meet NAAQS regulations, and for demonstrating attainment of NAAQS by states, specifically for ozone, PM, and regional haze.

Follow @EPAresearch on Twitter throughout 2023 as the EPA and the CMAS Center highlight some of the accomplishments, milestones, and notable elements from CMAQ's 25-year history, and search for #CMAQ25th.

This was written by Tanya Spero, a research physical scientist in the U.S. EPA's Office of Research and Development.

6. HISTORY OF CMAS

Center for Community Modeling and Analysis System (CMAS)

The U.S. EPA contracted the Center for Environmental Modeling for Policy Development (CEMPD) through the University of North Carolina at Chapel Hill (UNC) Institute for the Environment (IE) to establish a Center for Community Modeling and Analysis System (CMAS) for supporting community-based air quality modeling. CMAS is an approach to the development, application, and analysis of environmental models that leverages the complementary talents and resources of the modeling community in order to set new standards for quality in science and in the reliability of the application of the technology. CEMPD developed a resource in the CMAS Center to distribute the features of CMAS to the global modeling community. From research to application to outreach, the goal of the CMAS Center is to advance the community modeling paradigm through the establishment of a centralized resource to serve the members of the environmental modeling community.

What does CMAS do?

Currently, the following activities are available through the CMAS Center:

- Online help desk - get help with the supported CMAS products
- Software clearinghouse - download the supported CMAS products
- Training courses - attend a training course on emissions and air quality modeling
- Conferences - attend the annual CMAS conference to interact with the community
- Development assistance - add new science to the supported CMAS products
- Software documentation - access on-line documentation for the CMAS products
- Software-related research - learn about the latest developments in modeling research
- Data clearinghouse - access air quality modeling data from around the community

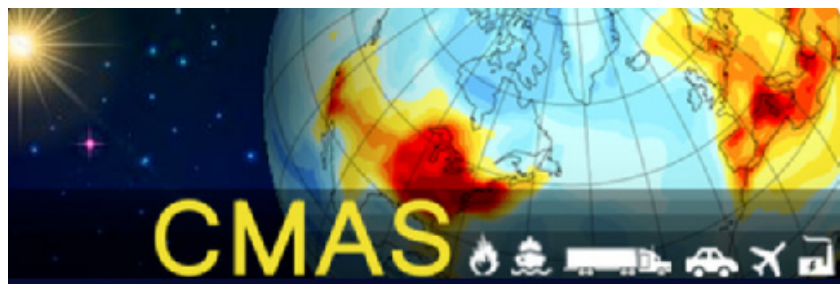
Who is included in the community?

A primary focus of CMAS is to instill a sense of community among the users of environmental models. From the individual to the organizational level, the beneficiaries of CMAS include, but are not limited to,

- Government
- Industry
- Academia
- Research
- Consultants
- Stakeholder groups

By promoting cooperation within and between the different groups in the environmental modeling community, CMAS provides the foundation to enable the community

to participate in the examination of issues and the subsequent development of strategies that meet societal challenges in environmental protection.



Why do we need CMAS?

Historically, advancements in air quality model technology could not be easily shared between modelers because of technical incompatibilities. By standardizing with open-source, advanced modeling systems, CMAS enables collaborative development and linking of models for meteorology, emissions, air quality, hydrology, and environmental and health effects. CMAS will build on the pioneering work by U.S. EPA and other research organizations by developing advanced tools to assist users to build models, develop datasets, analyze results, and understand model behavior. Because the CMAS-supported models use a “modular” approach with well-defined communications between modules, developers can upgrade existing processes or add new ones, thus ensuring the rapid evolution of the technology to meet the changing needs of the environmental modeling community.

Models-3 represents the U.S. EPA's first tangible product to evolve out of the community modeling paradigm. With a framework for a community model in Models-3, there is a need for centralized coordination of development and application efforts for mutual benefit to scientists, model developers, practitioners of modeling, and regulatory users of modeling results. CMAS and its accompanying center at the CEMPD will facilitate the effort to draw the interests of the modeling community towards advancement through cooperation.

7. ABOUT THE AREA

CONFERENCE LOCATION

The CMAS Conference will be held in Chapel Hill, North Carolina, U.S.A. The Research Triangle Park (RTP) area is one of the most prominent high-tech research and development parks in the world and is named for the three hub cities of Raleigh, Durham and Chapel Hill, which also house three major research universities (North Carolina State University, Duke University, and the University of North Carolina at Chapel Hill, respectively). The area is conveniently located (a few hours drive) between the Blue Ridge Mountains to the West and Atlantic coast to the east. Several museums, nature trails, and themed gardens along with vibrant downtown areas in each of the hub cities offer numerous choices of restaurants, shopping, and entertainment.



VENUE LOCATION

The meeting will be held at the Friday Conference Center at the University of North Carolina (UNC) Chapel Hill. UNC was the first public university in the USA. Chapel Hill is well connected by the local Chapel Hill Transit (bus) service, a fare-free system running on fixed routes. The area is accessible via the Raleigh-Durham International Airport (RDU) with connections to most major U.S. airports and select European cities.

Address: 100 Friday Center Dr, Chapel Hill, NC 27517



AIRPORT

The closest airport to Chapel Hill and the Friday Center is Raleigh/Durham International airport (RDU). The airport is located about 15 minutes away from Chapel Hill, so you will need to arrange for transportation from the airport to the conference center or to your hotel. Please contact your hotel directly to inquire about transportation to/from Raleigh Durham airport (RDU).

Address: John Brantley Blvd, Morrisville, NC 27560

PUBLIC TRANSPORT

Chapel Hill has a free public transit system of buses. Please see Chapel Hill Transit's Routes and Schedules for routes, schedules, and more information about public transportation.

CHAPEL HILL



- Suttons Drug Store has been around for decades, nearly a century since 1923. It's a Chapel Hill tradition. Everyone has been there, just check out all the photos on the wall. While the pharmacy is no longer in operation, you can still find all of the old fashioned staples and hot off the grill eats.

- You'll find the markings Est. 1922 on the front of the Carolina Coffee Shop. It's even older than Sutton's and holds the title of the oldest continually running restaurant in North Carolina. It's easy to find, just look for the Parade of Humanity mural at Port Hole Alley on East Franklin Street. Don't let the year distort your idea of the menu – it is modern southern cuisine and cocktails and weekend brunch.

- Maple View Ice Cream & Country Store, with its wrap around porch, rocking chairs, and farm acreage views has inside the most delicious, creamy, award winning ice cream. The flavors change with the season and are as wholesome as the Holstein milking cows across the street at Maple View Farm. No worries if you're a true chocolate, vanilla and strawberry kind of person, they serve those flavors plus favorites like butter pecan, and cookies and cream all year 'round.

- Top of the Hill Restaurant and Brewery, aka the Social Crossroads of Chapel Hill, is the place to be during basketball season; particularly a UNC vs Duke game. And if you're into craft brews, you'll be interested to know they are the eighth oldest surviving brewery in the state and developer of over eighty different varieties since 1996.

- Most likely the most photographed spot in all of Orange County, the Old Well on UNC Campus, is a neoclassical rotunda located at the southern end of McCorkle Place. Its current decorative form completed in 1897, was modeled after the Temple of Love in the Gardens of Versailles and has a drinking fountain reported to give good luck to those who drink from it. The original well served as the sole water supply to the university for many years.

- The Chapel Hill Mural named 1941 Curt Teich Postcard is probably the other most photographed spot in Orange County. Artist Scott Nurkin, who studied under Michael Brown (painter of many of the murals downtown), completed the mural in October of 2013 which commemorates various landmarks on the campus of UNC. The mural is located on the backside of the outdoor bar He's Not Here, a legendary collegial haunt and home to the famous Blue Cup which you may also see in many a photograph.

- For bacon lovers, the single, double, and massive triple BLT at Merritt's Grill are addictive and have been described in reviews as "...but oh my that freaking BLT!" And how does adding Pimento Cheese sound? Well they earned the title of best BLT with Pimento Cheese in the state of North Carolina by Peoples Magazine and Infatuation! By the way they have an awesome outdoor seating area perfect for all that good messiness that's going to come from whatever you get on the menu.



- Do you have the desire to relax in an open space while savoring a carefully prepared cup of coffee from beans roasted in small batches and sourced directly from small farms across the world? Then you'll want to check out Open Eye Café. The Open Eye Café is dubbed Carrboro's Living Room and a favorite among locals since 2004. For a quaint getaway experience, Open Eye's little sister Caffè Driade is a good bet. Think beautiful Northern -Italian style shop nestled in the woods. It actually is near the Chapel hill greenway and accessible by a greenway trail on the east side of town.

- For bacon lovers, the single, double, and massive triple BLT at Merritt's Grill are addictive and have been described in reviews as "...but oh my that freaking BLT!" And how does adding Pimento Cheese sound? Well they earned the title of best BLT with Pimento Cheese in the state of North Carolina by Peoples Magazine and Infatuation! By the way they have an awesome outdoor seating area perfect for all that good messiness that's going to come from whatever you get on the menu.

- The Chapel Hill Mural named 1941 Curt Teich Postcard is probably the other most photographed spot in Orange County. Artist Scott Nurkin, who studied under Michael Brown (painter of many of the murals downtown), completed the mural in October of 2013 which commemorates various landmarks on the campus of UNC. The mural is located on the backside of the outdoor bar He's Not Here, a legendary collegial haunt and home to the famous Blue Cup which you may also see in many a photograph.



Some other great places to check out in Chapel Hill:

- Carolina Brewing
- Craftboro Brewing Depot
- Dingo Dog Brewing Company
- Steel String Craft Brewery
- Top of the Hill Restaurant & Brewery
- Vecino Brewing Co.
- Botanist and Barrel
- Gizmo Brew Works
- The Casual Pint
- Hillsborough Gallery of Arts
- Thomas Stevens Gallery
- ArtsCenter
- North Carolina Crafts Gallery
- Womancraft Gifts
- FRANK Gallery

HILLSBOROUGH

Hillsborough, at over 250 years old, is the birthplace of the North Carolina Regulators, home of Mary Todd Lincoln's confidante, Elizabeth Keckley, and eternal home of William Hooper, signer of the Declaration of Independence who was laid to rest in the Presbyterian Church Cemetery here in 1790. Hillsborough is also on the National Register of Historic Places.

WEST HILLSBOROUGH AND NASH STREET

- West Nash Street, just west of downtown Hillsborough, is one of the hippest streets in Hillsborough. A great place to "hang" and relax, enjoy home brews, award-winning barbecue, music, custard and people watching. The newest entry to Nash Street is the corner Nash Street Tavern, featuring a diverse selection of craft beers and personally selected wines - they also showcase local and regional bands. Just a few doors down is Hillsborough BBQ Company offering pit-cooked whole hog BBQ as its specialty and Whit's Frozen Custard makes their custard fresh everyday.

RIVERWALK

- Riverwalk is an 1.8-mile commuter and recreational trail near downtown Hillsborough. It follows the Eno River and is handicap accessible, with paved paths, boardwalks and two 100-foot bridges. The trail is open from Gold Park to River Park through Hillsborough's historic downtown. The final phase will run south to Occoneechee Mountain State Natural Area and east to the Historic Occoneechee Speedway trails and the Poet's Walk at Ayr Mount. Riverwalk is part of the state's Mountains-to-Sea Trail. Free parking is available at Gold Park or at the Eno River Parking Deck beside Weaver Street Market.

Don't want to take your plastic badge holder home? We will happily reuse/recycle them! Please drop them off at the registration table in the badge return box. If you have any questions, please see our admin team at the registration table, ask one of our team members with the yellow name badges, or send us an e-mail at CMASconference@unc.edu.

