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AREAS of EXPERTISE/RESEARCH AREAS

- High performance computing
- Air quality model development and applications
- Model coupling
- Parallel I/O
- Aerosol radiative effects
- Big data/analytical algorithms
- Application of machine learning

EDUCATION

North Carolina State University
Ph.D. Computer Science, May 1996
Research Areas: scientific computing, parallel numerical algorithms, optimization
Advisors: Edward W. Davis and Robert E. Funderlic

Oklahoma State University
M.S. Applied Mathematics, May 1991
Research Areas: matrix numerical algorithms, numerical analysis

Oklahoma State University
B.S. Mathematics and Computer Science (double major), May 1988

PROFESSIONAL EXPERIENCE

Computer Research Scientist
National Exposure Research Laboratory
U.S. Environmental Protection Agency (August 2008 – present)
National Oceanic and Atmospheric Administration (August 2006 – July 2008)
Research Triangle Park, NC

- Served as a chief architect in designing the Advanced Air Quality Modeling System (AAQMS) to facilitate the construction of the offline CMAQ model, WRF-CMAQ coupled model, and MPAS-CMAQ coupled model seamlessly.
- Developed two key components, MIO and unified coupler for the AAQMS platform. MIO provides capability handling input and output (I/O) with three distinctive netCDF flavours which are used in the CMAQ, WRF, and MPAS models. In addition, this MIO renders

- pseudo and true parallel I/O operations. The unified coupler bridges CMAQ and a meteorological model, either WRF or MPAS with the same interface.
- Constructed MPAS-CMAQ coupled model with aerosol radiative direct effect.
 - Conducted research the impact of reducing data precision in emission input on CMAQ annual simulation as well as emission data compression efficiency.
 - Conducting research the impact of reducing data precision in WRF model input on WRF annual simulation as well as input data compression efficiency.
 - Guided a student in using Convolutional Neural Network (CNN) to identify and classify vehicle model make, model type, and year, aiding emission calculation.
 - Served as a chief architect in designing and implementing the WRF-CMAQ two-way coupled model with direct aerosol short-wave radiative effects.
 - Expanded the WRF-CMAQ two-way coupled model to account for indirect aerosol effects.
 - Conducted a \$1 million DOE-funded study to examine the capability of the WRF-CMAQ two-way coupled model to accurately represent the effects of aerosol loading on radiative forcing over a 21-year (1990-2010) study period, during which there were substantial reductions in aerosol precursor emissions (e.g. SO₂, NO_x) in North America and Europe.
 - Mentored postdoctoral fellows on the DOE project.
 - Updated the U.S. National Air Quality Forecasting System (<http://airquality.weather.gov/>) and enhanced its computational performance to meet daily tight production schedule.
 - Maintained, updated, evaluated, and applied the CMAQ-WRF two-way coupled model in various studies.
 - Conducted research to examine how data mining can be applied to model validation.
 - Conducted theoretical research in reducing the bottleneck caused by multiple processors communicating to the I/O processor at the same time as well as methodology to enhance parallel I/O technology using pnetCDF library

Sr. Consultant - Science Applications (June 1998 – August 2006)

Lockheed Martin Information Technology,
Research Triangle Park, NC (contractor to the US EPA)

- U.S. National Air Quality Forecasting System (AQF)
Served as the chief architect to design the forecasting system using multiple instruction and multiple data (MIMD) paradigm. This algorithm enhances the capability of overlapping communication, and I/O with computation to reduce the overall execution time. This design has been used as the core model in the NOAA Air Quality Real Time Forecast System (CCTM-AQF), which has been producing daily 48-hour U.S. air quality forecast. Developed a tight-coupled in-line PREMAQ-AQF model, where PREMAQ is the meteorological data processing module, to reduce the turnaround time to meeting the daily tight production schedule
- Remote Sensing Information Gateway (RSIG)
Developed tools to integrate data from various sources such as AQS, CMAQ/AQF and satellite data for visualization and analysis purposes. These tools provide simple mechanism for user to validate model with observation or satellite data and to link air quality model result with other model such as exposure study.
- Data Mining
Conducted theoretical research in data mining techniques, to examine how the vast amounts (>100 Tb) of numerical air quality model output data could be use in enhance epidemiological analysis, such as with EPA's Children's Health Study.

- **Dispersion Model**
Analyzed and implemented EPA's primary air quality dispersion model, AERMOD, on SMP (Symmetric Processor System) and Multicore system. A work load distribution algorithm was developed based on the ratio of computation intensity of various sources such as point and area to minimize load unbalance issue among allocated processors, thus it can reduce execution time by as much as 15%.
- **Computational Fluid Dynamics, CFD**
Used Fluent and Gambit Computational Fluid Dynamic software to study effectiveness of a new flushing system design in urban storm water drainage system.
- **I/O Research**
Developed a distributed/parallel file I/O system to provide scalable I/O performance as well as to cope with large memory requirements needed for higher resolution or larger domain grids in air quality simulations. Conducted an I/O study on the CCTM-AQF model to optimize the performance of different I/O processor placement strategies.
- **Algorithmic Research**
Developed two parallel algorithms that use a novel approach to decompose a spatial domain into a tree structure, to perform polygon-on-polygon and line-in-polygon intersection. The algorithms also include flexibility in determining an "optimal" decomposition to achieve better performance in the overlaying phase of the intersection process.

Postdoctoral Researcher/Co-Investigator (May 1996 – June 1998)

Department of Computer Science, North Carolina State University

- Investigated and developed generic algorithm to cope with load imbalance occurring in large scale scientific application.
- Investigated a practical solution to implement an Aerosol Model on a high performance platform using High Performance Fortran (HPF).
- Developed an algorithm in PVM3.4 to enable synchronized communication across processes for tightly coupled cross-media modeling applications.

Research Assistant (November 1992 – May 1996)

Department of Computer Science, North Carolina State University

- Implemented a testbed Regional Oxidant Model (ROM), an EPA air quality model, on a Kendall Square Research KSR1 and a Cray Research T3D; evaluated performance for various methods of exploiting parallelism; and, investigated techniques and methodologies for improving performance of applications executed on parallel systems.
- Developed a fast scheme to exchange data among allocated processors; a fast scheme to perform sum reduction on a T3D; a mathematical cache offsetting scheme to avoid cache collision and to provide extensibility to the code, and an optimal data partitioning scheme which minimizes inter-processor communication and balances work load, on a distributed-shared memory system.
- Applied data dependence analysis at the procedural level to determine the potential of parallelizing the testbed code using a single geographical cell approach on a KSR1 and a T3D.
- Implemented, a scalable version of the Regional Oxidant Model (ROM) gas-phase chemistry solver, which uses a Quasi Steady State Approximation (QSSA) algorithm, on a T3D.
- Developed various human intervention techniques to improve performance on MPP systems.

Visiting Research Scientist (June 1993 – August 1993)

Cray Research, Inc., Eagan Minnesota

- Examined various optimization techniques with a gas-phase chemistry solver using a Quasi Steady State Algorithm (QSSA) and a shallow water model on Cray vector machines and Cray's first Massive Parallel Processor (MPP) system, T3D

LEADERSHIP SERVICE at EPA

- Contributing member to EPA's cross-agency Developing and Deploying Environmental Software (DDES) workgroup, Infrastructure workgroup, MPAS workgroup.
- Invited advisory member to EPA's OEI High Performance Computing alternate solution assessment team.
- Provide technical guidance for the EPA Office of Science and Information Management (OSIM) in selecting EPA HPC system
- Advisor and evaluator for the AMAD next generation HPC system
- Key architect of the Advanced Air Quality Modeling System (AAQMS)
- Key architect of the new I/O system, Model I/O (mio)
- Key architect of the WRF-CMAQ and MPAS-CMAQ coupled models, and the unified coupler

LEADERSHIP SERVICE OUTSIDE EPA

- NUG (National Energy Research Scientific Computing User Group) Executive Committee Member
- Project proposal reviewer for the Natural Environment Research Council (NERC <https://nerc.ukri.org/>) in the UK, Constructing a Digital Environment Demonstrator Call. Project Title: Adding Capability Through Integrated Observational Networks (ACTION) in 2020
- Session Chair for the 2018 Joint International Conference on ABaCAS and CMAS-Asia-Pacific, May 21-23, Beijing
- Advisor of the City of Shanghai Air Quality Forecasting System for Expo 2010
- Served as a guest lecturer at the Environment and Natural Resources Department, Ho Chi Minh City University of Technology, Fall 2022.
- Served on Ms. Jia Jung's Ph.D. Committee, University of Houston and guided her on aerosol radiative direct effect in various application.
- Serving on Ms. Sara Farrell's Ph.D. Committee, University of North Carolina, Chapel-Hill and guiding her on aerosol radiative direct effect with long wave.
- Judge for the North Carolina School of Science and Mathematics science fair (2012 - 2022) on various categories: environmental science, mathematics and computer science, and engineering and technology
- Judge for State of North Carolina Science Fair in senior environmental science category (2013 - 2022)

MENTORSHIP and TEACHING

Sara Farrell, Ph.D. student, University of North Carolina, Chapel-Hill (Fall 2022 – present)

Jia Jung, Ph.D. student, University of Houston (Fall 2017 – Fall 2021)

Mackenzie Knox, ORAU student (February 2023 - present)

Bridget Hyland, ORAU student (October - December 2022)

Michael S. Walters, ORAU student (December 2020 - May 2022)
Jiangdong Wang, visiting student researcher from Tsinghai University (May 2015 – December 2015)
Rachael Atlas, ORISE student researcher (2014 – 2015)

Lecturer, North Carolina State University, Department of Computer Science (Summer 1994)
Lecturer, Oklahoma State University, Department of Mathematics (Fall 1988 – Fall 1991)

PEER REVIEWER

Advances in Meteorology, Applied Sciences, Atmosphere, Atmospheric Environment, Atmospheric Pollution Research, Energies, Environmental Modelling and Software, Environmental Pollution, Environmental Science and Technology, Geoscientific Model Development, Journal of the Air & Waste Management Association, Pure and Applied Geophysics, Science of the Total Environment, EPA technical and scientific products, National Energy Research Scientific Computing Center Science board, Natural Environment Research Council, NOAA.

SELECTED AWARDS AND HONORS

- (2023) U.S. EPA Scientific and Technological Achievement Award (STAA) – for the journal articles titled “Extending the Community Multiscale Air Quality (CMAQ) modeling system to hemispheric scales” and “Impacts of different characterizations of large-scale background on simulated regional-scale ozone.”
- (2016) U.S. EPA National Exposure Research Laboratory, Computational Exposure Division, Best Publication Award – for the journal article titled “Unexpected benefits of reducing aerosol cooling effects”
- (2015) U.S. EPA Scientific and Technological Achievement Award (STAA) – for the journal article titled “WRF-CMAQ Two-way Coupled System with Aerosol Feedback: Software Development and Preliminary Results.”
- (2014) U.S. EPA Bronze Medal for Commendable Service Award – for collaborative effort in developing and applying mathematically rigorous techniques to inform air quality policy management.
- (2012) AMAD Blue Ribbon Paper Award – on the topic of developing WRF-CMAQ two-way coupled model
- (2012) U.S. EPA Silver Medal for Superior Service – for scientific leadership in developing and delivering integrated atmospheric modeling systems to inform policies that simultaneously address air quality, climate change, and energy issues
- (2012) Computerworld Honors Program Laureate (Environment Category) – for establishing an air quality forecasting system in Shanghai to inform citizen about air quality daily
- (2011) U.S. EPA ORD Award – for developing, testing, and delivering a more robust and scientifically-defensible multi pollutant regional air quality modeling system to EPA's program and regional offices
- (2009) U.S. EPA Gold Medal for Exceptional Service – for scientific leadership in the successful transition of air quality modeling research to operations, to produce reliable air quality forecasts over the continental United States
- (2009) U.S. EPA National Exposure Research Laboratory (NERL) Goal 5 Award – for exceptional/outstanding ORD technical assistance to the regions or program offices
- (2005) Lockheed Martin Corporation Spot Award
- (2002) Lockheed Martin Technology Services, Lightning Award
- (1999) Lockheed Martin Technology Services, Lightning Award

PROFESSIONAL ASSOCIATIONS

Member, American Geophysical Union (2014 – 2015)
Member, Institute of Electrical and Electronics Engineers (IEEE) Computer Society (1994 - present)
Member, Society for Industrial and Applied Mathematics (SIAM) (1990 – 2003)
Member, American Mathematical Society (1990 - 2000)

PEER-REVIEWED PUBLICATIONS

- (42) Yin Yi, Golam Sarwar, Jinting Bian, Ling Huang, Qinyi Li, Sen Jiang, Hanqing Liu, Yangjun Wang, Hui Chen, Tao Wang, Jianmin Chen, Alfonso Saiz-Lopez, David Wong, Li Li, “Significant impact of reactive chlorine on complex air pollution over the Yangtze River Delta region, China”, *Journal of Geophysical Research – Atmospheres*, under review
- (41) Xin Yi; Sijia Yin; Golam Sarwar; Qinyi Li; David C. Wong; Maggie Chel Gee Ooi; Ling Huang; Tao Wang; Likun Xue; Yangjun Wang; Hui Chen; Jianmin Chen; Alfonso Saiz-Lopez, “Potential environmental impact of the chlorine-containing disinfectants usage during the COVID-19”, *Atmospheric Environment*, under review
- (40) Michael S. Walters, and David C. Wong, “The Impact of Altering Emission Data Precision on Compression Efficiency and Accuracy of Simulations of the Community Multiscale Air Quality Model”, *Geosci. Model Dev.*, 16, 1179-1190, 2023
- (39) Yeqi Huang, Xingcheng Lu, Jimmy C.H. Fung, David C. Wong, Zhenning Li, Yiang Chen, Wanying Chen, “Investigating Southeast Asian biomass burning by the WRF-CMAQ two-way coupled model: Emission and direct aerosol radiative effects”, *Atmospheric Environment*, Volume 294, 1 February 2023
- (38) Jiandong Wang, Jia Xing, Shuxiao Wang, Rohit Mathur, Jiaping Wang, Yuqiang Zhang, Chao Liu, Jonathan Pleim, Dian Ding, Xing Chang, Jingkun Jiang, Peng Zhao, Shovan Kumar Sahu, Yuzhi Jin, David C. Wong, and Jiming Hao, “The pathway of impacts of aerosol direct effects on secondary inorganic aerosol formation”, *Atmospheric Chemistry and Physics*, 22, 5147–5156, 2022
- (37) Amir H. Souri, Kelly Chance, Juseon Bak, Caroline R. Nowlan, Gonzalo González Abad, Yeonjin Jung, David C. Wong, Jingqiu Mao, and Xiong Liu, “Unraveling Pathways of Elevated Ozone Induced by the Lockdown 2020 in Europe by an Observationally Constrained Regional Model: Non-Linear Joint Inversion of NO_x and VOC Emissions using TROPOMI”, *Atmospheric Chemistry and Physics*, 21, 18227–18245, 2021
- (36) Kai Wang, Yang Zhang, Shaocai Yu, David C. Wong, Jonathan Pleim, Rohit Mathur, James T. Kelly, and Michelle Bell, “A Comparative Study of Two-way and Offline Coupled WRF v3.4 and CMAQ v5.0.2 over the Contiguous U.S.: Performance Evaluation and Impacts of Chemistry-Meteorology Feedbacks on Air Quality”, *Geosci. Model Dev.*, 14, 7189-7221, 2021
- (35) Jia Jung, Yunsoo Choi, David C. Wong, Delaney Nelson, and Sojin Lee, “Role of sea fog over the Yellow Sea on air quality with the direct effect of aerosols”, *Journal of Geophysical Research – Atmospheres*, 2021 Mar 16, 126(5)

- (34) Jordan L. Schnell, Daniel R. Peters, David Wong, Xi Lu, Hongliang Zhang, Hao Guo, and Daniel E. Horton, "Potential for electric vehicle adoption to mitigate extreme air quality events in China", *Earth's Future*, 4, Dec, 2020
- (33) S. Guan, D. C. Wong, Y. Gao, T. Zhang, and G. Pouliot, "Impact of wildfire on particulate matter in the southeastern United States in November 2016", *Science of the Total Environment*, Volume 724, 1 July 2020, 138354
- (32) D. Kang, R. Mathur, G. Pouliot, R. Gilliam, and D. C. Wong, "Significant Ground-level Ozone Attributed to Lightning-induced Nitrogen Oxides during Summertime over the Mountain West States", *Climate and Atmospheric Science*, Volume 3, Article number: 6 (2020)
- (31) M.Y. Wang, Steve H.L. Yim, D.C. Wong, K.F.HO, "Mapping ozone source-receptor relationship and apportioning the health impact in the Pearl River Delta region using adjoint sensitivity analysis", *Atmospheric Environment*, September 2019, DOI: 10.1016/j.atmosenv.2019.117026.
- (30) Daiwen Kang, Kenneth E. Pickering, Dale J. Allen, Kristen M. Foley, David C. Wong, Rohit Mathur, and Shawn J. Roselle, "Simulating lightning NO production in CMAQv5.2: evolution of scientific updates", *Geosci. Model Dev.*, 12, 1–13, 2019.
- (29) Jia Jung, Amir H. Souri, David C. Wong, Sojin Lee, Wonbae Jeon, Jhoon Kim, Yunsoo Choi, "The impact of aerosol-meteorology interactions on meteorology and air quality using aerosol optical depth assimilation during the KORUS-AQ Campaign", *Journal of Geophysical Research Atmospheres*, Vol 124, Issue 14, July 27, 2019. DOI: 10.1029/2019JD030641.
- (28) Y. Zhang, J. J. West, R. Mathur, J. Xing, C. Hogrefe, S. J. Roselle, J. O. Bash, J. E. Pleim, C. Gan, and D. C. Wong, "Long-term trends in the PM_{2.5}- and O₃-related mortality burdens in the United States under emission reductions from 1990 to 2010", *Atmospheric Chemistry and Physics (ACP)*, *Atmos. Chem. Phys.*, 18, 15003-15016, 2018
- (27) Luxi Zhou, Donna B. Schwede, K.Wyat Appel, Michael J. Mangiante, David C. Wong, Sergey L. Napelenok, Pai-Yei Whung, and Banglin Zhang, "The impact of air pollutant deposition on solar energy system efficiency: An approach to estimate PV soiling effects with the Community Multiscale Air Quality (CMAQ) model", *Science of the Total Environment*, Volume 651, 2019, Pages 456-465
- (26) Yu, S., P. Li, L. Wang, Y. Wu, S. Wang, K. Liu, T. Zhu, Y. Zhang, M. Hu, L. Zeng, X. Zhang, J. Cao, K. Alapaty, D. C. Wong, J. Pleim, R. Mathur, D. Rosenfeld, J. Seinfeld, "Mitigation of severe urban haze pollution by a precision air pollution control approach", *Scientific Reports*, 2018 8:8151, DOI:10.1038/s41598-018-26344-1
- (25) Luxi Zhou, Kirk R. Baker, Sergey L. Napelenok, George Pouliot, Robert Elleman, Susan M. O'Neill, Shawn P. Urbanski, and David C. Wong, "Modeling crop residue burning

experiments to evaluate smoke emissions and plume transport”, *Science of the Total Environment*, Volume 627, 15 June 2018, Pages 523-533

(24) Rohit Mathur, Jia Xing, Robert Gilliam, Golam Sarwar, Christian Hogrefe, Jonathan Pleim, George Pouliot, Shawn Roselle, Tanya L. Spero, David C. Wong, and Jeffrey Young, “Extending the Community Multiscale Air Quality (CMAQ) Modeling System to Hemispheric Scales: Overview of Process Considerations and Initial Applications”, Special Issue: Global and regional assessment of intercontinental transport of air pollution: results from HTAP, AQMEII and MICS, *Atmospheric Chemistry and Physics*, May 2017, DOI: 10.5194/acp-2017-329

(23) Appel, K. W., Napelenok, S. L., Foley, K. M., Pye, H. O. T., Hogrefe, C., Luecken, D. J., Bash, J. O., Roselle, S. J., Pleim, J. E., Foroutan, H., Hutzell, W. T., Pouliot, G. A., Sarwar, G., Fahey, K. M., Gantt, B., Gilliam, R. C., Kang, D., Mathur, R., Schwede, D. B., Spero, T. L., Wong, D. C., and Young, J. O., “Description and evaluation of the Community Multiscale Air Quality (CMAQ) modeling system version 5.1”, *Geosci. Model Dev.*, 10, 1703-1732, 2017.

(22) Jia Xing, Jiandong Wang, Rohit Mathur, Shuxiao Wang, Golam Sarwar, Jonathan Pleim, Christian Hogrefe, Yuqiang Zhang, Jingkun Jiang, David C. Wong, Jimin Hao, “Impacts of aerosol direct effects on tropospheric ozone through changes in atmospheric dynamics and photolysis rates”, *Atmos. Chem. Phys.*, 17, 9869-9883, 2017.

(21) Pengfei Li, Liqiang Wang, Ping Guo, Shaocai Yu, Khalid Mehmood, Si Wang, Weiping Liu, John H. Seinfeld, Yang Zhang, David Wong, Kiran Alapaty, Jon Pleim, Rohit Mathur, “High reduction of ozone and air particulate matter during the 2016 G-20 summit in Hangzhou by forced emission controls of industry and traffic”, *Environ Chem Lett*, December 2017, Volume 15, Issue 4, pp 709-715. DOI 10.1007/s10311-017-0642.

(20) Wang, J., Xing, J., Mathur, R., Pleim, J., Wang, S. Hogrefe, C., Gan, C-M, Wong. D. C., and Hao, J., “Historical trends in PM_{2.5} related premature mortality during 1990-2010 across the northern hemisphere”, *Environmental Health Perspectives*, Vol 125, Number 3, p400-408, March 2017.

(19) Xing, J., Mathur, R., Pleim, J., Hogrefe, C., Wang, J., Gan, C.-M., Sarwar, G., Wong, D. C., and McKeen, S., “Representing the effects of stratosphere-troposphere exchange on 3D O₃ distributions in chemistry transport models using a potential vorticity based parameterization”, *Atmos. Chem. Phys.*, 16, 10865-10877, 2016.

(18) Hang, J., Lin, M., Wong, D. C., Wang, X., Wang, B., and Buccolieri, R., “On the influence of viaduct and ground heating on pollutant dispersion in 2D street canyons and toward single-side ventilated buildings”, *Atmospheric Pollution Research*, Volume 7, Issue 5, p817-832, September 2016.

(17) Xing, J., Wang, J. Mathur, R., Pleim, J., Wang, S. Hogrefe, C., Gan, C-M, Wong. D. C., and Hao, J., "Unexpected benefits of reducing aerosol cooling effects", *Environmental Science and Technology*, 2016 Jul 19, 50(14):7527-34.

- (16) Gan, C-M., Hogrefe, C., Pleim, J., Mathur, R., Xing, J., Wong, D. C., Gilliam, R., Pouliot, G., and Wei, C., “Assessment of the Effects of Horizontal Grid Resolution on Long-Term Air Quality Trends using Coupled WRF-CMAQ Simulations”, *Atmospheric Environment*, Volume 132, May 2016, Pages 207–216.
- (15) Xing, J., Mathur, R., Pleim, J., Hogrefe, C., Gan, C.-M., Wong, D. C., Wei C., and Wang J., “Air pollution and climate response to aerosol direct radiative effects: a modeling study of decadal trends across the northern hemisphere”, *Journal of Geophysical Research: Atmospheres*, Vol. 120, Issue 23, Pages 12221 – 12236, Dec 2015.
- (14) Xing, J., Mathur, R., Pleim, J., Hogrefe, C., Gan, C.-M., Wong, D. C., and Wei C., “Can a coupled meteorology-chemistry model reproduce the historical trend in aerosol direct radiative effects over the Northern Hemisphere?”, *Atmos. Chem. Phys.*, 15, 9997-10018, 2015.
- (13) Gan, C-M., Pleim, J., Mathur, R., Hogrefe, C., Long, C., Xing, J., Wong, D. C., Gilliam, R., and Wei, C., “Assessment of long-term WRF-CMAQ simulations for understanding direct aerosol effects on radiation "brightening" in the United States ”, *Atmos. Chem. Phys.*, 15, 12193-12209, 2015
- (12) Gan, C-M., Binkowski, F., Pleim, J., Xing, J., Wong, D. C., Mathur, R., and Gilliam, R., “Assessment of the aerosol optics component of the coupled WRF–CMAQ model using CARES field campaign data and a single column model”, *Atmospheric Environment*, Volume 115, Pages 670–682, August 2015.
- (11) Hogrefe, C., Pouliot, G., Wong, D. C., Torian, A., Roselle, S., Pleim, J., and Mathur, R., "Annual application and evaluation of the online coupled WRF–CMAQ system over North America under AQMEII phase 2", *Atmospheric Environment*, Volume 115, Pages 1-756, August 2015.
- (10) Wong, D. C., Yang, C. E., Fu, J. S., Wong, K., and Gao, Y., “An approach to enhance pnetCDF performance in environmental modeling applications”, *Geosci. Model Dev.*, 8, 1033-1046, 2015.
- (9) Xing, J., Mathur, R., Pleim, J., Hogrefe, C., Gan, C.-M., Wong, D. C., Wei, C., Gilliam, R., and Pouliot, G., “Observations and modeling of air quality trends over 1990–2010 across the Northern Hemisphere: China, the United States and Europe”, *Atmos. Chem. Phys.*, 15, 2723-2747, 2015.
- (8) Wang, J., Wang, S., Jiang, J., Ding, A., Zheng, M., Zhao, B., Wong, D. C., Zhou, W., Zheng, G., Wang, L., Pleim, J. E., and Hao, J., “Impact of aerosol–meteorology interactions on fine particle pollution during China's severe haze episode in January 2013”, *Environ. Res. Lett.* 9, September 2014.
- (7) Yu, S., Mathur, R., Pleim, J., Wong, D., Gilliam, R., Alapaty, K., Zhao, C., and Liu, X., “Aerosol indirect effect on the grid-scale clouds in the two-way coupled WRF-CMAQ: model

description, development, evaluation and regional analysis”, *Atmos. Chem. Phys.* 14, 11247–11285, 2014.

(6) Yu, S., Mathur, R., Pleim, J., Pouliot, G., Wong, D., Eder, B., Schere, K., Gilliam, R., and Rao, S. T., “Comparative evaluation of the impact of WRF-NMM and WRF-ARW meteorology on CMAQ simulations for O₃ and related species during the 2006 TexAQS/GoMACCS study”, *Atmospheric Pollution Research*, Vol 3, Issue 2, p149-162, 2012.

(5) Yu, S., Mathur, R., Pleim, J., Pouliot, G., Wong, D., Eder, B., Schere, K., Gilliam, R., and Rao, S. T., “Comparative evaluation of the impact of WRF/NMM and WRF/ARW meteorology on CMAQ simulations for PM_{2.5} and its related precursors during the 2006 TexAQS/GoMACCS study”, *Atmos. Chem. Phys.*, 12, 4091-4106, 2012.

(4) Wong, D. C., Pleim, J., Mathur, R., Binkowski, F., Otte, T., Gilliam, R., Pouliot, G., Xiu, A., and Kang, D., “WRF-CMAQ two-way coupled system with aerosol feedback: software development and preliminary results”, *Geosci. Model Dev.*, 5, 299-312, 2012.

(3) Fu, J. S., Dong, X., Gao, Y., Wong, D. C., and Lam, Y. F., “Sensitivity and linearity analysis of ozone in East Asia: the effects of domestic emission and intercontinental transport”, *Journal of the Air & Waste Management Association*, 62(9), 1102-1114, Sep 2012.

(2) Otte, T. L., Pouliot, G., Pleim, J. E., Young, J. O., Schere, K. L., Wong, D. C., Lee, P. C. S., Tsidulko, M., McQueen, J. T., Davidson, P., Mathur, R., Chuang, H.-Y., DiMego, G., and Seaman, N. L., “Linking the Eta Model with the Community Multiscale Air Quality (CMAQ) Modeling System to Build a Real-Time National Air Quality Forecasting System”, *Weather and Forecasting*, Volume 20, Issue 3, pp. 367-384, June 2005.

(1) D. C. Wong, E. W. Davis, and J. O. Young, “A software approach to avoiding spatial cache collisions in parallel processor systems”, *IEEE Transactions on Parallel and Distributed Systems* Volume: 9, Issue: 6, June 1998.

PAPERS UNDER REVIEW

(2) Yin Yi, Golam Sarwar, Jinting Bian, Ling Huang, Qinyi Li, Sen Jiang, Hanqing Liu, Yangjun Wang, Hui Chen, Tao Wang, Jianmin Chen, Alfonso Saiz-Lopez, David Wong, Li Li, “Significant impact of reactive chlorine on complex air pollution over the Yangtze River Delta region, China”, *Atmospheres*. In review.

(1) Xin Yi; Sijia Yin; Golam Sarwar; Qinyi Li; David C. Wong; Maggie Chel Gee Ooi; Ling Huang; Tao Wang; Likun Xue; Yangjun Wang; Hui Chen; Jianmin Chen; Alfonso Saiz-Lopez, “Potential environmental impact of the chlorine-containing disinfectants usage during the COVID-19”, *Atmospheric Environment*. In review.

PAPER IN PREPARATION

(2) Mackenzie Knox, and David C. Wong, “The Impact of Altering Emission Data Precision on Compression Efficiency and Accuracy of Simulations of the Community Multiscale Air Quality Model”, *Geosci. Model Dev.*, In preparation.

(1) David C. Wong, Jeff Willison¹, Jonathan E. Pleim, Golam Sarwar, James Beidler, Russ Bullock, Jerold A. Herwehe, Rob Gilliam, Daiwen Kang, Christian Hogrefe, George Pouliot, and Hosein Foroutan, “Development of the MPAS-CMAQ Coupled System for Multiscale Global Air Quality Modeling”, *Geosci. Model Dev.*, Submitted.

TECHNICAL REPORTS, BOOK CHAPTERS, AND OTHER PUBLICATIONS

(12) David C. Wong, Hosein Foroutan, Jonathan E. Pleim, O. Russell Bullock, “A proof-of-concept for linking the global meteorological model, MPAS-A with the air quality model, CMAQ”, ITM Book chapter

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