



Patrick C. Campbell, Ph.D., CCM

Research Associate Professor

PERSONAL DETAILS

*Cooperative Institute for
Satellite Earth System
Studies (CISESS)*

*Center for Spatial
Information Science and
Systems*

George Mason University

ARL/NOAA Affiliate

College Park, MD

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Portfolio Websites:

www.campbellairquality.com

<https://www.researchgate.net/profile/Patrick-Campbell-13>

AREAS OF EXPERTISE

Air Quality Modeling

*Meteorological/Climate
Modeling*

*Land Surface/Flux
Modeling*

*Chemistry and Aerosol
Formation*

*Emissions Processing and
Modeling*

*Ambient Air
Measurements and
Instrumentation*

PERSONAL SUMMARY

*"I have a driven and
diverse research
background in areas
ranging from in situ
aerosol measurements and
modeling to land surface
and photochemical-
meteorological modeling of
the atmosphere and its
constituents for emission,
air quality, and climate
change studies."*

Patrick C. Campbell

BIOSKETCH

Dr. Patrick Campbell is an Earth systems scientist and research associate professor at the George Mason University Center for Spatial Information Science and Systems and is the associate director of GMU's Satellite and Earth System Studies (SESS) program. Dr. Campbell is also a NOAA Air Resources Laboratory Affiliate under the Cooperative Institute for Satellite Earth System Studies (CISESS). Dr. Campbell is working closely with the NOAA-Air Resources Laboratory Chemical Modeling and Emissions Group on scientific research, development, and application of next-generation atmospheric composition and air quality forecasting models that help protect human and ecosystem health. Since completion of doctorate in 2013, he has authored or co-authored over 35 scientific publications, has received awards for high paper citations and top downloads, and received a NOAA Certificate of Accommodation for leading developments of NOAA's current operational air quality forecasting system. The focus of Dr. Campbell's scientific research over the past 10 years has been on cross-cutting basic and applied research topics spanning multi-platform observations, modeling, and related applications, with a focus on surface-atmosphere exchange, atmosphere-biosphere-chemical interactions, and multimedia surface fluxes. Dr. Campbell has extensive experience in synthesizing multi-platform Earth system measurements using novel data analysis techniques and modeling methods for many pressing environmental and climate issues today. As associate director of GMU's SESS program, he has spearheaded coordination, training, education, and outreach, including taking the lead on the newly formed Air Quality Research and Development Consortium (AIRDC). Dr. Campbell coordinated the inaugural multi-institute AIRDC workshop at GMU, intended to foster increased communication and collaboration on atmospheric science and air quality topics in the greater Washington D.C. area and beyond. Dr. Campbell is also a Certified Consulting Meteorologist with the American Meteorological Society, where he has worked on consulting, outreach, and education, including environmental and human health impact cases involved in expert witness testimony in federal court.

EDUCATION

University of Wyoming **2008 - 2013**

Doctor of Philosophy in Atmospheric Science
Dissertation: "The Climatology, Extent, and Impact of Stratospheric Condensation Nuclei, including their formation in polar regions"

University of Massachusetts at Lowell **2004 - 2006**

Master of Science in Environmental Studies – Atmospheric Science Concentration
Thesis: "A Short Range Ensemble Forecast Experiment on Jet Streaks to Improve Forecasters' Model Diagnoses 2004 – 2006"

University of Massachusetts at Lowell **2000 - 2004**

Bachelor of Science in Meteorology

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CERTIFICATIONS

- Certified Consulting Meteorologist (CCM), # 669, American Meteorological Society

AWARDS & DISTINCTIONS

- NOAA OAR Certificate of Accommodation (2023), For Developing and Implementing the Air Quality Model v6 (*Equivalent to NOAA Federal Silver Medal*)
- NOAA OAR Certificate of Accommodation (2021), For Implementing and Upgrading NOAA's NAQFC (*Equivalent to NOAA Federal Bronze Medal*)
- Top Paper Download for *Campbell et al.* (2018), JAMES, 2018-2019
- NRC Research Fellowship Award, NAS, 2016
- Research Spotlight for *Campbell et al.* (2014), AGU, 2014
- Antarctic Service Medal of the United States of America, NSF, 2012

CURRENT FUNDING AND PROJECTS

Title: CISESS: GMU Air Surface Exchange and Atmospheric Composition Research; PI: Patrick C. Campbell; Sponsor: NOAA; Total Amount: \$242,126; Period of Performance: 8/1/2021 – 7/31/2022; Commitment: 12 calendar months *Salary support only.

Title: Beyond the “Big-Leaf” Model at NOAA: Use of Novel Satellite Data and In-Canopy Processes to Improve U.S. Air Quality Predictions; PI: Patrick C. Campbell; Sponsor: NOAA; Total Amount: \$685,217; Period of Performance: 8/1/2022 – 7/31/2025; Commitment: 9 calendar months (+24 month TBD Post-Doc).

Title: Transitioning GMU Weather-Aware Emission Modeling Capability (WAEMC) to Support National Air Quality Forecast Capability Operations; PI: Bok Haeng Baek; Sponsor: NOAA; Total Amount: \$619,402; Period of Performance: 9/1/2022 – 8/31/2025; Commitment: 1.2 calendar months.

RESEARCH AND PROFESSIONAL EXPERIENCE

Research Associate Professor. Cooperative Institute for Satellite Earth System Studies (CISESS), Center for Spatial Information Science and Systems, George Mason University, ARL/NOAA Affiliate, College Park, MD, 2023 – Current

Research Assistant Professor. Cooperative Institute for Satellite Earth System Studies (CISESS), Center for Spatial Information Science and Systems, George Mason University, ARL/NOAA Affiliate, College Park, MD, 2019 – 2023

- Atmosphere-biosphere interactions, in-canopy modeling, and implications for wildfire behavior, emissions, and air quality forecasting.
- Research, development, and application of in-canopy vegetative parameterizations and models (e.g., “Canopy-App”; Codes: <https://github.com/noaa-oar-arl/canopy-app>) and implications for next-generation air quality forecasting under the Unified Forecast System (UFS) Rapid Refresh Forecast System (RRFS) - Community Multiscale Air Quality (CMAQ) model (“Online-CMAQ”) (Codes: <https://github.com/noaa-oar-arl/AQM/>).

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- Lead on the development of an Amazon Web Services (AWS) “NACC-Cloud” product that allows users to process and download model-ready NOAA GFSv16 geospatial and meteorological inputs for any user-defined regional CMAQ application worldwide (web-interface: <https://nacc.arl.noaa.gov/nacc/>).
- Lead developer of the Global Forecast System (GFS)-driven NOAA-EPA Atmosphere Chemistry Coupler (NACC) for the Advanced National Air Quality Forecasting Capability (NAQFC) (Codes: <https://github.com/noaa-oar-arl/NACC>; <https://github.com/noaa-oar-arl/NAQFC>)
- Research and development on the NOAA Emission and eXchange Unified System (NEXUS) and connections with next-generation regional and global atmospheric aerosol and composition forecast models (Code: <https://github.com/noaa-oar-arl/NEXUS>)
- Research on emissions processes and modeling, reactive nitrogen atmospheric deposition and composition, air quality, and implications of air-surface exchange processes on air quality forecasting.
- Research on coupled meteorological, photochemical, and chemical transport/air quality modeling.

Post-Doc Research Associate. Department of Atmospheric and Oceanic Science/Cooperative Institute for Climate and Satellites-Maryland, University of Maryland, ARL/NOAA Affiliate, College Park, MD, 2018 - 2019

- Research, development, and evaluation of the Advanced National Air Quality Forecasting Capability (NAQFC).
- Research in coupled meteorological, photochemical, and chemical transport/air quality modeling
- Air quality, deposition, and land-surface flux model development in connection with regional and next-generation global air quality forecast models

NAS/NRC Post-Doc Research Associate. U.S. Environmental Protection Agency, National Exposure Research Laboratory, Durham, NC, 2016 - 2018

- Coupled meteorological, photochemical, and chemical transport/air quality modeling
- Air quality, deposition, and land-surface flux model development in connection with air quality models; including the WRF/Noah-CMAQ land surface model development
- Coupled air quality model evaluation and current-to-future year climate-air quality applications for the U.S.
- Advanced model developments and applications of both offline and coupled versions of WRF/CMAQ and a “next generation” air quality model using MPAS

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Post-Doctoral Research Scholar. North Carolina State University, Air Quality Forecasting Laboratory, Raleigh, NC, 2014 - 2016

- Global to regional air quality and climate modeling
- Atmospheric chemistry and aerosol modeling
- Regional emissions modeling using the SMOKE model
- Global emissions processing for regional air quality modeling applications
- Global-to-regional coupled air quality model evaluation and applications
- Model proficiencies in CESM, WRF, WRF/CMAQ, WRF/Chem, and WRF/CAM5

Doctoral Research Assistant/Associate. University of Wyoming, Department of Engineering and Applied Sciences, Laramie, WY, 2008 – 2013

- Optical aerosol instrumentation and multi-media in-situ measurements
- Balloon borne particle, gas, and meteorological measurements in remote locations
- New particle formation and composition in the stratosphere
- Global aerosol modeling using CESM/WACCM/CARMA in the stratosphere
- Climatological data analysis of aerosol concentrations and size distributions
- WRF modeling and observational analysis of drylines in southeast Wyoming

Staff Scientist II – Air Quality Meteorologist. AECOM Environment, Chelmsford, MA, 2006 – 2008

- Comprehensive duties in the areas of meteorological and ambient air quality monitoring
- Data processing and analysis, technical report writing, dissemination of results to clients, air quality network operations, instrumentation and calibration, and gravimetric analysis
- Major project/research scientist for a PM_{2.5} downwash study, while providing technical expertise on local vs. regional PM_{2.5} measurements and modeling
- Performed technical writing for reports and presentation at technical conferences

Field Scientist. Massachusetts Department of Environmental Protection – Air Assessment Branch, Lawrence, MA, 2005 – 2006

- Routine and technical duties in support of air monitoring network operations
- Major project included Photochemical Assessment Monitoring Stations (PAMS) and gas chromatograph sample analysis

REFEREED JOURNAL PAPERS

(Total Citations: ~532, h-index: 13)

36. Hung, W.-T., Campbell, P., Moon, Z., Saylor, R., Kochendorfer, J., Lee, T. R., Massman, W., 2023. Evaluation of an In-Canopy Wind and Wind Adjustment Factor Model for Wildfire Spread and Atmospheric Composition Modeling Applications. *Journal of Advances in Modeling Earth Systems*, Under review.
35. Makkaron, P., D. Q. Tong, Y. Li, E. J. Hyer, P. Xian, S. Kondragunta, P. C. Campbell, Y. Tang, B. D. Baker, M. D. Cohen, A. Darmanov, A. Lyapustin, R. D. Saylor, Y. Wang, and I. Stajner (2023). Development and Evaluation of a North America Ensemble Wildfire Forecast: Initial Application to the 2020 Western United States “Gigafire”. *J. Geophys. Res. Atmos.*, 128, 22. <https://doi.org/10.1029/2022JD037298>.
34. Golbazi, M., Alessandrini, S., Kumar, Mearthy, P., Campbell, P. C., Bhardwaj, P., He. C., McQueen, J. (2023). Enhancing fine particulate matter forecasts across the Contiguous United States (CONUS) during wildfires using Analog-based post-processing methods. *Atmospheric Environment*, 316. <https://doi.org/10.1016/j.atmosenv.2023.120165>.
33. Christopoulos, J., Tong, D., Ma, Siqi, Campbell, P. C. (2023). Impacts of the COVID-19 Economic Slowdown on Soybean Crop Yields in the United States. *Sci Rep* 13, 12574 (2023). <https://doi.org/10.1038/s41598-023-39531-6>.
32. Campbell, P.C.; Jiang, W.; Moon, Z.; Zinn, S.; Tang, Y. NOAA’s Global Forecast System Data in the Cloud for Community Air Quality Modeling. *Atmosphere* 2023, 14, 1110. <https://doi.org/10.3390/atmos14071110>.

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31. Jena, C.; Zhang, Y.; Wang, K.; Campbell, P.C. Decadal Application of WRF/Chem under Future Climate and Emission Scenarios: Impacts of Technology-Driven Climate and Emission Changes on Regional Meteorology and Air Quality. *Atmosphere* 2023, 14, 225. <https://doi.org/10.3390/atmos14020225>.
30. Jeong, G.-R.; Baker, B.; Campbell, P.C.; Saylor, R.; Pan, L.; Bhattacharjee, P.S.; Smith, S.J.; Tong, D.; Tang, Y. Updating and Evaluating Anthropogenic Emissions for NOAA's Global Ensemble Forecast Systems for Aerosols (GEFS-Aerosols): Application of an SO₂ Bias-Scaling Method. *Atmosphere* 2023, 14, 234. <https://doi.org/10.3390/atmos14020234>
29. Li, Y., Tong, D., Ma, S., Freitas, S. R., Ahmadov, R., Sofiev, M., Zhang, X., Kondragunta, S., Kahn, R., Tang, Y., Baker, B., Campbell, P., Saylor, R., Grell, G., and Li, F.: Impacts of estimated plume rise on PM_{2.5} exceedance prediction during extreme wildfire events: A comparison of three schemes (Briggs, Freitas, and Sofiev), *EGUsphere* [preprint], <https://doi.org/10.5194/egusphere-2022-713>, 2022.
28. Tang, Y., Campbell, P., Lee, P., Saylor, R., Yang, F., Baker, B., Tong, D., Stein, A., Huang, J., Huang, H.-C., Pan, L., McQueen, J., Stajner, I., Tirado-Delgado, J., Jung, Y., Yang, M., Bourgeois, I., Peischl, J., Ryerson, T., Blake, D., Schwarz, J., Jimenez, J.-L., Crawford, J., Diskin, G., Moore, R., Hair, J., Huey, G., Rollins, A., Dibb, J., and Zhang, X.: Evaluation of the NAQFC Driven by the NOAA Global Forecast System Version 16: Comparison with the WRF-CMAQ Downscaling Method During the Summer 2019 FIREX-AQ Campaign, *EGUsphere* [preprint], <https://doi.org/10.5194/egusphere-2022-356>, 2022.
27. Campbell, P. C., D. Tong, R. Saylor, Y. Li, S. Ma, X. Zhang, S. Kondragunta, and F. Li (2022). Pronounced increases in nitrogen emissions and deposition due to the historic 2020 wildfires in the western U.S. *STOTEN*, 839, 156130. <https://doi.org/10.1016/j.scitotenv.2022.156130>.
26. Campbell, P. C., Y. Tang, P. Lee, B. Baker, D. Tong, R. Saylor, A. Stein, F. Yang, J. Huang, H.-C. Huang, J. McQueen, I. Stajner, J. Sims, J. Tirado-Delgado, Y. Jung, F. Yang, T. Spero, and R. Gilliam (2022). Development and evaluation of an advanced National Air Quality Forecast Capability using the NOAA Global Forecast System version 16. *Geosci. Model Dev.*, 15, 3281–3313. <https://doi.org/10.5194/gmd-15-3281-2022>.
25. Ma, S., D. Tong, L. Lamsal, J. Wang, Y. Tang, R. Saylor, T. Chai, P. Lee, P. C. Campbell, B. Baker, S. Kondragunta, L. Judd, and I. Stajner (2021). Improving predictability of high ozone episodes through dynamic boundary conditions, emission refresh and chemical data assimilation during the Long Island Sound Tropospheric Ozone Study (LISTOS) field campaign. *Atmospheric Chemistry and Physics*, 21, 16531–16553. <https://doi.org/10.5194/acp-21-16531-2021>.
24. Lin, H., D. J. Jacob, E. W. Lundgren, M. P. Sulprizio, C. A. Keller, T. M. Fritz, S. D. Eastham, L. K. Emmons, P. C. Campbell, B. Baker, R. D. Saylor, R. Montuoro (2021). Harmonized Emissions Component (HEMCO) 3.0 as a versatile emissions component for atmospheric models: application in the GEOS-Chem, NASA GEOS, WRF-GC, CESM2, NOAA GEFS Aerosol, and NOAA UFS models, *Geoscientific Model Development*, <https://doi.org/10.5194/gmd-14-5487-2021>.
23. Gonzalez, A., Millet, D., Yu, X., Wells, K., Griffis, T., Baier, B., Campbell, P. C., Choi, Y., DiGangi, J., Gvakharia, A., Halliday, H., Kort, E., McKain, K., Nowak, J., Plant, G. (2021). Fossil vs. non-fossil CO sources in the US: New airborne constraints from ACT-America and GEM. *Geophysical Research Letters*, <https://doi.org/10.1029/2021GL093361>.
22. Campbell, P. C., D. Tong, Y. Tang, B. Baker, P. Lee, R. Saylor, A. Stein, S. Ma, and L. Lamsal (2021). Impacts of the COVID-19 Economic Slowdown on Ozone Pollution in the U.S. *Atmospheric Environment*, <https://doi.org/10.1016/j.atmosenv.2021.118713>.
21. Qu, Z., D. J. Jacob, R. F. Silvern, V. Shah, P. C. Campbell, L. C. Valin, and L. T. Murray (2021). US COVID-19 shutdown shows importance of background NO₂ in inferring nitrogen oxide (NO_x) emissions from satellite NO₂ observations. *Geophysical Research Letters*, <https://doi.org/10.1029/2021GL092783>.
20. Gilliam, R.C., J.A. Herwehe, O.R. Bullock Jr., J.E. Pleim, L. Ran, P. C. Campbell, and H. Foroutan (2021). Establishing the Suitability of the Model for Prediction Across Scales for Global Retrospective Air Quality Modeling. *Journal of Geophysical Research: Atmospheres*. <https://doi.org/10.1029/2020JD033588>.

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19. Chen, X., Y. Zhang, K. Wang, D. Q. Tong, P. Lee, Y. Tang, J. Huang, P. C. Campbell, J. T. McQueen, H. O. T. Pye, B. N. Murphy, D. Kang. 2021. Evaluation of the offline-coupled GFSv15-FV3-CMAQv5.0.2 in support of the next-generation National Air Quality Forecast Capability over the contiguous United States. *Geoscientific Model Development*, Preprint. <https://gmd.copernicus.org/articles/14/3969/2021/>.
18. Tang, Y., H. Bian, Z. Tao, L. D. Oman, D. Q. Tong, P. Lee, P. C. Campbell, B. Baker, S. Lu, L. Pan, J. Wang, J. T. McQueen, I. Stajner. 2021. Comparison of Chemical Lateral Boundary Conditions for Air Quality Predictions over the Contiguous United States during Intrusion Events. *Atmospheric Chemistry and Physics Discussions*. <https://doi.org/10.5194/acp-21-2527-2021>.
17. Tang, Y., D. Q. Tong, K. Yang, P. Lee, B. Baker, A. Crawford, W. Luke, A. Stein, P. C. Campbell, A. Ring, J. Flynn, Y. Wang, J. T. McQueen, L. Pan, J. Huang, and I. Stajner. 2020. Air quality impacts of the 2018 Mt. Kilauea Volcano eruption in Hawaii: A regional chemical transport model study with satellite-constrained emissions. *Atmospheric Environment*, 237, <https://doi.org/10.1016/j.atmosenv.2020.117648>.
16. Campbell, P. C., Bash, J. O., Herwehe, J. A., Gilliam, R. C., & Li, D. 2020. Impacts of Tiled Land Cover Characterization on Global Meteorological Predictions Using the MPAS-A. *Journal of Geophysical Research: Atmospheres*, 125, e2019JD032093. <https://doi.org/10.1029/2019JD032093>
15. Uttamang, P., P. C. Campbell, V. P. Aneja, A. F. Hanna, 2019, A multi-scale model analysis of ozone formation in the Bangkok Metropolitan Region, Thailand, *Atmospheric Environment*, 229, 117433. <https://doi.org/10.1016/j.atmosenv.2020.117433>
14. Campbell, P., J. Bash, C. Nolte, T. Spero, E. J. Cooter, K. Hinson, L. Linker, 2019, Projections of Atmospheric Nitrogen Deposition to the Chesapeake Bay Watershed, *J. Geophys. Res. Biogeosci.*, 124. <https://doi.org/10.1029/2019JG005203>
13. Campbell, P. C., Bash, J. O., & Spero, T. L., 2018, Updates to the Noah land surface model in WRF-CMAQ to improve simulated meteorology, air quality, and deposition. *Journal of Advances in Modeling Earth Systems*, 11. <https://doi.org/10.1002/2018MS001422>
12. Campbell, P., F. Yan, Z. Lu, Y. Zhang, and D. Streets, 2018, Impacts of Transportation Sector Emissions on Future U.S. Air Quality in a Changing Climate. Part I: Projected Emissions, Simulation Design, and Model Evaluation, *Environmental Pollution*, 238, 903-917, doi: 10.1016/j.envpol.2018.04.020.
11. Campbell, P., F. Yan, Z. Lu, Y. Zhang, and D. Streets, 2018, Impacts of Transportation Sector Emissions on Future U.S. Air Quality in a Changing Climate. Part II: Air Quality Projections and the Interplay between Emissions and Climate Change, *Environmental Pollution*, 238, 918-930, doi: 10.1016/j.envpol.2018.03.016.
10. Campbell, P., Y. Zhang, R. Leung, J. Fan, Q. Zhang, and Y. Zhang, 2017, Evaluation of a Multi-scale WRF-CAM5 Simulation during the 2010 East Asian Summer Monsoon, *Atmospheric Environment*, 169, 204-217, doi: 10.1016/j.atmosenv.2017.09.008.
9. Yahya, K., K. Wang, P. Campbell, Y. Chen, T. Glotfelty, J. He, M. Pirhalla, and Y. Zhang, 2017, Decadal Application of WRF/Chem for Regional Air Quality and Climate Modeling over the U.S. under the Representative Concentration Pathways Scenarios. Part 1: Model Evaluation and Impact of Downscaling, *Atmospheric Environment*, 152, 562 – 583, doi: 10.1016/j.atmosenv.2016.12.029.
8. Yahya, K., P. Campbell, and Y. Zhang, 2017, Decadal Application of WRF/Chem for Regional Air Quality and Climate Modeling over the U.S. under the Representative Concentration Pathways Scenarios. Part 2: Current vs. Future Simulations, *Atmospheric Environment*, 152, 584 – 604, doi: 10.1016/j.atmosenv.2016.12.028.
7. Yahya, K., K. Wang, P. Campbell, T. Glotfelty, J. He, and Y. Zhang, 2015, Decadal evaluation of regional climate, air quality, and their interactions using WRF/Chem Version 3.6.1, *Geosci. Model Dev., Discuss.*, 8, 6707-6756, doi: 10.5194/gmdd-8-6707-2015.

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6. Campbell, P., Y. Zhang, K. Yahya, K. Wang, C. Hogrefe, G. Pouliot, C. Knote, A. Hodzic, R. San Jose, J. Perez, P. J. Guerrero, R. Baro, and P. Makar, 2015, A Multi-Model Assessment for the 2006 and 2010 Simulations under the Air Quality Model Evaluation International Initiative (AQMEII) Phase 2 over North America: Part I. Indicators of the Sensitivity of O₃ and PM_{2.5} Formation Regimes, *Atmospheric Environment*, 115, 569 – 586, doi: 10.1016/j.atmosenv.2014.12.026.
5. Bergmaier, P. T., B. Geerts, Z. Wang, B. Liu, and P. Campbell, 2014, A Dryline in Southeast Wyoming. Part II: Airborne Raman Lidar Observation, *Mon. Wea. Rev.*, 142, 2961-2977, doi: 10.1175/MWR-D-13-00314.1.
4. Campbell, P., M. Mills, and T. Deshler, 2014, The global extent of the midstratospheric CN layer: A three dimensional modeling study, *J. Geophys. Res. Atmos.*, 119, 1015 – 1030, doi: 10.1002/2013JD020503.
3. Campbell, P., and T. Deshler, 2014, Condensation nuclei measurements in the midlatitude (1982–2012) and Antarctic (1986–2010) stratosphere between 20 and 35 km, *J. Geophys. Res. Atmos.*, 119, doi:10.1002/2013JD019710.
2. Campbell, P., B. Geerts, P. T. Bergmaier, 2014, A Dryline in Southeast Wyoming. Part I: Multiscale Analysis Using Observations and Modeling on 22 June 2010. *Mon. Wea. Rev.*, 142, 268–289. doi: <http://dx.doi.org/10.1175/MWR-D-13-00049.1>
1. Gazeaux, J., Clerbaux, C., George, M., Hadji-Lazaro, J., Kuttippurath, J., Coheur, P.-F., Hurtmans, D., Deshler, T., Kovilakam, M., Campbell, P., Guidard, V., Rabier, F., and Thépaut, J.-N., 2013, Intercomparison of polar ozone profiles by IASI/MetOp sounder with 2010 Concordiasi ozonesonde observations, *Atmos. Meas. Tech.*, 6, 613-620, doi:10.5194/amt-6-613-2013.

CONFERENCE PROCEEDINGS

2. Campbell, P., Y. Zhang, F. Yan, Z. Lu, and D. Streets, 2015, Impacts of Emissions Changes from the Transportation Sector on Future U.S. Air Quality, Air and Waste Management Association's 108th Annual Conference and Exhibition, June 2015, Raleigh, NC.
1. Campbell, P., and T. Deshler, 2013, Stratospheric condensation nuclei: A climatology in the mid-latitude and Antarctic regions, American Institute of Physics Conference Proceedings, 19th International Conference on Nucleation and Atmospheric Aerosols, June 2013, Fort Collins, CO.

SELECT CONFERENCE PRESENTATIONS (< 3 years)

14. Campbell, P.C. et al. (2023). Beyond the Big-Leaf Model for NOAA's Unified Air Quality Forecasting Capabilities. 22st Annual CMAS Conference, Chapel Hill, NC. October, 2023.
13. Moon, Z., Campbell, P.C. et al. (2023). A Model for Forest Canopy Effects on Weather and Atmospheric Composition in the NOAA Unified Forecast System. 35th Conference on Agricultural and Forest Meteorology/14th Fire and Forest Meteorology Symposium/Sixth Conference on Biogeosciences, Minneapolis, MN. May 2023.
12. Hung, W.-T., Baker, B., Campbell, P.C. et al. (2023). Development and evaluation of a machine learning based wildfire spread prediction model for regional air quality forecasting. 35th Conference on Agricultural and Forest Meteorology/14th Fire and Forest Meteorology Symposium/Sixth Conference on Biogeosciences, Minneapolis, MN. May 2023.
11. Campbell, P.C. et al. (2023). Beyond the Big-Leaf Model for NOAA's Unified Air Quality Forecasting Capabilities. 35th Conference on Agricultural and Forest Meteorology/14th Fire and Forest Meteorology Symposium/Sixth Conference on Biogeosciences, Minneapolis, MN. May 2023.
10. Campbell, P.C. et al. (2022). Pronounced increases in nitrogen emissions and deposition due to the historic 2020 wildfires in the western U.S. National Atmospheric Deposition Program 2022 Fall Meeting, Knoxville, TN. (Virtual). November, 2022.
9. Campbell, P.C. et al. (2022). Use of NOAA's Global Forecast System Data in the Cloud for Community Air Quality Modeling. 21st Annual CMAS Conference, Chapel Hill, NC. October, 2022.

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8. Campbell, P.C. et al. (2022). Impacts of Wildfire Emissions on Nitrogen Deposition in the U.S. International Association of Wildland Fire, Fire & Climate Conference, Pasadena, CA. (Virtual). May 2022.
7. Campbell, P.C. et al. (2021). The National Air Quality Forecast Capability Using the NOAA Global Forecast System: Model Developments and Community Applications. 20th Annual CMAS Conference, Chapel Hill, NC, (Virtual). November, 2021.
6. Campbell, P.C. et al. (2021). Advancement of the National Air Quality Forecast Capability Using the NOAA Global Forecast System: Model Development and Community Applications. 10th International Workshop on Air Quality Forecasting Research (IWAQFR), World Meteorological Organization (Virtual). October, 2021.
5. Tang, Y., P.C. Campbell, et al. (2021). An Improved National Air Quality Forecasting Capability Using the NOAA Global Forecast System. Part II: Comparisons with WRF/CMAQ. 2021 Meteorology and Climate - Modeling for Air Quality Conference (Virtual). September, 2021
4. Campbell, P.C. et al. (2021). An Improved National Air Quality Forecast Capability Using the NOAA Global Forecast System. Part I: Model Development and Community Application. 2021 Meteorology and Climate - Modeling for Air Quality Conference (Virtual). September, 2021.
3. Campbell, P.C. et al. (2021). An Improved National Air Quality Forecasting Capability Using the NOAA Global Forecast System. 2nd Annual NOAA General Modeling Meeting and Fair (Virtual). April, 2021.
2. Campbell, P.C. et al. (2021). Impacts of the COVID-19 Economic Slowdown on Ozone Pollution in the U.S. NOAA OAR Senior Management Meeting (Virtual). January 11, 2021.
1. Christopoulos, J., D. Tong, S. Ma, and P. C. Campbell (2021). Assessment of COVID-19 Related Emission Changes on Crop Yields Across the Continental United States. 101st Annual AMS Conference (Virtual), Houston, TX. Jan 2021.

MODELING EXPERIENCE

- NOAA-EPA Atmosphere Chemistry Coupler (NACC)
- National Air Quality Forecasting Capability (NAQFC)
- Harmonized Emissions Modeling Component (HEMCO)
- NOAA Emission and Exchange Unified System (NEXUS)
- Unified Forecast System Air Quality Model (UFS-AQM), “Online-CMAQ”
- Offline Community Multi-scale Air Quality (CMAQ) Model
- Global Forecast System (GFS)
- Global Ensemble Forecast Systems for Aerosols (GEFS-Aerosols)
- Unified Forecast System for Aerosols (UFS-Aerosols)
- Advanced Research Weather Research and Forecast (WRF-ARW) Model
- Coupled WRF/CMAQ Model
- Online Coupled WRF/Chem Model
- Noah Land Surface Model
- Online Coupled WRF/CAM5 Model
- Sparse Matrix Operator Kernel Emissions (SMOKE) Model
- NCAR Community Earth System (CESM) Model
- Whole Atmosphere Community Climate Model (WACCM)
- Community Aerosol and Radiation Model for Atmospheres (CARMA)
- Environmental Policy Integrated Climate (EPIC)
- Model for Predictions Across Scales (MPAS)

Patrick C. Campbell, Ph.D., CCM

IN SITU MEASUREMENT EXPERIENCE

- Detailed Aircraft Field Campaign Trace Gas and Aerosol Measurements (e.g., 2019 FIREX-AQ)
- Ground-Based Trace Gas and PM_{2.5} Networks (e.g., U.S. EPA/AQS and AirNow)
- Optical Particle Counters
- Condensation Nuclei Counters
- Laser Particle Counters
- Electrochemical Cell Ozonesondes
- Differential Mobility Analyzers
- Scanning Mobility Particle Sizers
- Condensation Particle Counters

SATELLITE DATA ANALYSIS EXPERIENCE

- Global Ecosystem Dynamics Investigation (GEDI) LIDAR
- Moderate Resolution Imaging Spectroradiometer (MODIS)
- Visible Infrared Imaging Radiometer Suite (VIIRS)
- Ozone Monitoring Instrument (OMI)
- SCanning Imaging Absorption spectroMeter for Atmospheric CHartographY (SCIAMCHY)

SCIENTIFIC COMPUTER PROGRAMMING EXPERIENCE

- FORTRAN
- Python
- Interactive Display Language
- R

DATA ANALYSIS AND VISUALIZATION PROFICIENCIES

- NCAR Command Language (NCL)
- UNIX C Shell Scripting
- Integrated Data Viewer (IDV)
- Visualization Environment for Rich Date Interpretation (VERDI)
- Microsoft Office

CLOUD DATABASE AND HPC EXPERIENCE

- Amazon Web Services (S3 and HPC platforms)

LARGE DATABASE MANAGEMENT EXPERIENCE

- MYSQL

COMPUTATIONAL PROPOSAL EXPERIENCE

3. Extreme Science and Engineering Discovery Environment (XSEDE) – Texas Advanced Computing Center's (TACC) Stampede Dell Linux Cluster, Completed performance testing for selected model systems, October 2015.

2. National Energy Research Scientific Computing Center's (NERSC) Edison Cray XC30 Cluster, Completed performance testing for selected model systems, September 2015.

1. National Center for Atmospheric Research (NCAR), Computational & Information Systems Laboratory's Yellowstone High-Performance IBM iDataPlex Cluster, Completed performance testing for selected model systems, March 2015 and September 2015.

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PROFESSIONAL MEMBERSHIPS, REVIEWERSHIPS, AND EDITORIAL BOARDS

- Member, CCM, *American Meteorological Society*
- Member, *American Geophysical Union*
- Reviewer, *Bulletin of the American Meteorological Society*
- Reviewer, *Scientific Reports*
- Reviewer, *Nature Geosciences*
- Reviewer, *Weather and Forecasting*
- Reviewer, *Geophysical Research Letters*
- Reviewer, *Geoscientific Model Development*
- Reviewer, *Journal of Advances in Modeling Earth Systems*
- Reviewer, *Atmospheric Chemistry and Physics*
- Reviewer, *Environmental Pollution*
- Reviewer, *Atmospheric Environment*
- Reviewer, *Journal of Geophysical Research: Atmospheres*
- Reviewer, *Journal of Environmental Sciences*
- Reviewer, *Atmosphere*
- Reviewer, *Aerosol and Air Quality Research*
- Review Editor, "Review Editor on the Editorial Board of Air Pollution Management", *Frontiers in Environmental Engineering*
- Editor, "Improving Air Quality Predictions and Assessment Across Scales", *Atmosphere*
- Editor, "PM2.5 Predictions in the USA", *Atmosphere*