Journal Articles

Chang S.Y., Huang J., Chaveste M., Lurmann F., Eisinger D., Mukherjee A., Erdakos G., Alexander M., and Knipping E. (2023) Electric vehicle fleet penetration helps address inequalities in air quality and improves environmental justice. *Communications Earth & Environment*, 4, doi: 10.1038/s43247-023-00799-1, April 22. Available at https://www.nature.com/articles/s43247-023-00799-1.

Pavlovic N.R., Chang S.Y., Huang J., Craig K., Clark C., Horn K., and Driscoll C.T. (2023) Empirical nitrogen and sulfur critical loads of U.S. tree species and their uncertainties with machine learning. Science of The Total Environment, 857, 159252, January. Available at https://www.sciencedirect.com/science/article/pii/S0048969722063513.

Hao H., Eckel S.P., Hosseini A., Van Vliet E.D.S., Dzurbur E., Dunton G., Chang S.Y., Craig K., Rocchio R., Bastain T., Gilliland F., Okelo S., Ross M.K., Sarrafzadeh M., Bui A.A.T., and Habre R. (2022) Daily associations of air pollution and pediatric asthma risk using the Biomedical REAl-Time Health Evaluation (BREATHE) kit. *Int J Environ Res Public Health*, doi: DOI: 10.3390/ijerph19063578, March 17. Available at https://pubmed.ncbi.nlm.nih.gov/35329265/.

Hao H., Eckel S.P., Hosseini A., Van Vliet E.D.S., Dzubur E., Dunton G., Chang S.Y., Craig K., Rocchio R., Bastain T., Gilliland F., Okelo S., Ross M.K., Sarrafzadeh M., Bui A.A.T., and Habre R. (2022) Daily associations of air pollution and pediatric asthma risk using the biomedical real-time health evaluation (BREATHE) kit. *International Journal of Environmental Research and Public Health*, 19(6), 3578. Available at https://www.mdpi.com/1660-4601/19/6/3578.

Craig K.J., Baringer L.M., Chang S.-Y., McCarthy M.C., Bai S., Seagram A.F., Ravi V., Landsberg K., and Eisinger D.S. (2020) Modeled and measured near-road $PM_{2.5}$ concentrations: Indianapolis and Providence cases. *Atmos. Environ.*, 240, 117775 (STI-6696), November. Available at https://www.sciencedirect.com/science/article/abs/pii/S1352231020305070.

Craig K., Erdakos G., Chang S.Y., and Baringer L. (2020) Air quality and source apportionment modeling of Year 2017 ozone episodes in Albuquerque/Bernalillo County, New Mexico. *J. Air Waste Manage.*, 70(11), 1101-1120, (STI 7231), May 15. Available at https://doi.org/10.1080/10962247.2020.1764879.

Breen M., Chang S.Y., Breen M., Xu Y., Isakov V., Arunachalam S., Carraway M.S., and Devlin R. (2020) Fine-scale modeling of individual exposures to ambient $PM_{2.5}$, EC, NO_x, and CO for the Coronary Artery Disease and Environmental Exposure (CADEE) study. *Atmosphere*, 11(65), doi: 10.3390/atmos11010065 (STI-7258).

Chang S.Y., Vizuete W., Serre M., P. V.L., Omary M., Isakov V., Breen M., and Arunachalam S. (2017) Finely resolved on-road $PM_{2.5}$ and estimated premature mortality in central North Carolina. *Risk Analysis,* doi: *10.1111/risa.12775*.

Chang S.Y., Vizuete W., Valencia A., Naess B., Isakov V., Palma T., Breen M., and Arunachalam S. (2015) A modeling framework for characterizing near-road air pollutant concentration at community scales. *Sci. Total Environ.*, 538, 905-921, doi: 10.1016/j.scitotenv.2015.06.139, December 15.

Chang S.Y., Vizuete W., Breen M., Isakov V., and Arunachalam S. (2015) Comparison of highly resolved model-based exposure metrics for traffic-related air pollutants to support environmental health studies. *Int. J. Environ. Res. Public Health*, 12(12), 15605–15625, doi: 0.3390/ijerph121215007, December 8.

Wu C.-F., Wu T., Hashmonay R.A., Chang S.Y., Wu Y.S., Chao C.-P., Hsu C.-P., Chase M.J., and Kagann R.H. (2014) Measurement of fugitive volatile organic compound emissions from a petrochemical tank farm using open-path Fourier transform infrared spectrometry. *Atmos. Environ.*, 82, 335–342, doi: 10.1016/j.atmosenv.2013.10.036, January.

Chang S.Y. and Wu C.-F. (2012) Evaluating the performance of the horizontal radial plume mapping technique for locating multiple plumes. *J. Air Waste Manage.*, 62, 1249-1256, doi: 10.1080/10962247.2012.710552, August 3.

Wu C.-F. and Chang S.Y. (2011) Comparisons of radial plume mapping algorithms for locating gaseous emission sources. *Atmos. Environ.*, 45(7), 1476-1482, doi: 10.1016/j.atmosenv.2010.12.016, March.

Wu C., Chen C.-H., Chang S.Y., Chang P.-E., Shie R.-H., Sung L.-Y., Yang J.-C., and Su J.-W. (2008) Developing and evaluating techniques for localizing pollutant emission sources with open-path Fourier transform infrared measurements and wind data. *J. Air Waste Manage.*, 58(10), 1360-1369, doi: 10.3155/1047-3289.58.10.1360, October.

Meeting Presentations, Webinars, and Conference Proceedings

Coughlin J., Chang S.Y., Pavlovic N.R., Huang J., Craig K.J., Scarborough C., and Driscoll C.T. (2023) Spatially varying nitrogen critical loads and the influences of mediating factors. Presentation given at the *NADP Spring Meeting, Madison, WI, May 1-5,* by Sonoma Technology, Petaluma, CA. STI-7898.

Chang S.Y., Pavlovic N.R., Coughlin J., Huang J., Craig K.J., Scarborough C., Horn K., Driscoll C.T., and Herrick J. (2022) Empirical critical levels of ozone for U.S. tree species and their uncertainties with machine learning. Presentation given at the *National Atmospheric Deposition Program 2022 Science Symposium, Knoxville, TN, November 17,* by Sonoma Technology, Petaluma, CA, the Freedom Consulting Group, Columbia, MD, and the Syracuse University Department of Civil and Environmental Engineering, Syracuse, NY. STI-7769.

Pavlovic N.R., Coughlin J.G., Chang S., Huang J., Craig K.J., Scarborough C., Horn K., and Driscoll C.T. (2022) Mapping variability of nitrogen critical loads using machine learning. Poster presented at the *2022 National Atmospheric Deposition Program Conference, Knoxville, TN, November 14-18,* by Sonoma Technology, Petaluma, CA, the Freedom Consulting Group, Columbia, MD, and the Syracuse University Department of Civil and Environmental Engineering, Syracuse, NY. STI-7770.

Huang J., Sussman E., Houk J., and Chang S.-Y. (2022) Public health effects from the adoption of California's Advanced Clean Cars II regulation in Oregon and Connecticut in 2030 and 2040. Presentation given at the *21st Annual CMAS Conference, October 17-19,* by Sonoma Technology, Petaluma, CA. STI-7749.

Huang J., Chang S.Y., Huang S., and Lurmann F. (2022) Understanding the contributions of different types of biomass combustion to ambient $PM_{2.5}$ in the U.S. using CMAQv5.3.3. Poster presented at the

American Association for Aerosol Research (AAAR) conference in Raleigh, North Carolina, October 3-7, by Sonoma Technology, Petaluma, CA. STI-7792.

Chang S.Y. (2022) Accelerating Electric Vehicle (EV) use: drivers, outcomes, and environmental justice (EJ) implications. Presentation given at the *AASHTO Committee on Environment and Sustainability Annual Meeting, Austin, TX, July 13,* by Sonoma Technology, Petaluma, CA. STI-7746.

Huang J., Chang S.Y., Huang S., and Lurmann F. (2022) Understanding the contributions of different types of biomass combustion to ambient $PM_{2.5}$ in the U.S. using CMAQv5.3.3. Poster presented at the *21th Community Modeling and Analysis System Conference, Chapel Hill, North Carolina,* by Sonoma Technology, Petaluma, CA. STI-7792.

Pavlovic N.R., Chang S., Huang J., Craig K.J., Clark C., Horn K., and Driscoll C.T. (2021) Empirical nitrogen and sulfur critical loads of U.S. tree species and their uncertainties with machine learning. Poster presented at the *AGU Fall Meeting, New Orleans, LA, December 13-17,* by Sonoma Technology, Inc., Petaluma, CA. STI-7576.

Huang J., Houk J., Chang S.-Y., and Minjares R. (2021) Benefits from low-NO_x omnibus and Advanced Clean Trucks (ACT) adoption in 13 States and D.C. from 2020 to 2050. Presented at the *CMAS Conference, virtual, November 4,* by Sonoma Technology, Petaluma, CA, and the International Council on Clean Transportation, San Francisco, CA. STI-7615.

Chang S.Y., Huang J., Alexander M., Eisinger D., Pavlovic N., and Knipping E. (2021) Air quality benefit from accelerated EV penetration in Southern California: a case study in the Interstate 710 corridor. Presented at the *CMAS Conference, virtual, November 4,* by Sonoma Technology, Petaluma, CA, and Electric Power Research Institute, Palo Alto, CA. 600600-7613.

Huang J., Houk J., Chang S.-Y., and Minjares R. (2021) Benefits from low-NO_x omnibus and Advanced Clean Trucks (ACT) adoption in 13 states and D.C. from 2020 to 2050. Presented at the *CMAS Conference, virtual, November*, by Sonoma Technology, Inc., Petaluma, CA, and the International Council on Clean Transportation, San Francisco, CA. STI-7615.

Pavlovic N.R., Driscoll C.T., Craig K., Huang J., Chang S.Y., Clark C.M., and Horn K. (2021) An application of machine learning to determine critical loads of nitrogen and sulfur in forest ecosystems in the U.S. Presentation given at the *NADP 2021 Fall Meeting and Symposium, virtual event, October 27,* by Sonoma Technology, Petaluma, CA. STI-7667.

Chang S.Y., Huang J., and Eisinger D. (2021) Environmental justice benefits of accelerated fleet penetration of electric vehicles. Presented at the *September EPRI internal meeting* by Sonoma Technology, Inc., Petaluma, CA. STI-921027-7605.

Chang S.Y., Craig K., and Lurmann F. (2021) An environmental data web service based on near road dispersion modeling to support the Los Angeles Pediatric Research Integrating Sensor Monitoring Systems (PRISMS) Informatics Center. Presentation *International Society of Exposure Science, virtual conference*. STI-7589.

Driscoll C.T., Scarborough C., Huang J., Craig K., Pavlovic N.R., and Chang S.Y. (2021) Constraining uncertainties of critical loads for atmospheric nitrogen and sulfur deposition with machine learning. Presented to *Syracuse University*, May 3, by Sonoma Technology, Inc., Petaluma, CA.

Chang S.Y., Pavlovic N., Craig K., Kirk-Davidoff D., and Wang Q. (2021) Predicting fog and stratus dissipation for solar energy applications in California using meteorological measurements and machine learning. Presentation given at the *101st Annual AMS Conference, virtual event, January,* by Sonoma Technology, Petaluma, CA. STI-7426.

Pavlovic N.R., Driscoll C.T., Craig K., Huang J., Chang S.Y., and Clark C.M. (2020) An application of machine learning to determine critical loads of nitrogen and sulfur in forest ecosystems in the U.S. Presentation given at the *NADP 2020 Fall Meeting and Symposium, virtual event, October 29,* by Sonoma Technology, Petaluma, CA. STI-7420.

Chang S.Y., Pavlovic N., Beachley G., Puchalski M., and Rogers C. (2020) TDep measurement model fusion (MMF) method to fuse modeled and measured air quality data to estimate total deposition with Python geoprocessing. Presentation given at the *NADP Fall Meeting and Symposium, virtual event, October 26-27,* by Sonoma Technology, Petaluma, CA. STI-7419.

Chang S.Y., Pavlovic N., Beachley G., Puchalski M., and Rogers C. (2020) TDep Measurement Model Fusion (MMF) method to fuse modeled and measured air quality data to estimate total deposition with Python geoprocessing. Presentation given at the *19th Annual CMAS Conference, Chapel Hill, NC, October*, by Sonoma Technology, Petaluma, CA. STI-7419.

Craig K., Baringer L., Chang S.Y., Eisinger D., and Landsberg K. (2020) The Near-Road Air Quality Transportation Pooled Fund – lessons learned from a 5-year research program: measurements compared to modeled concentrations. Presented at the *U.S. Transportation Research Board, 99th Annual Meeting, Workshop 1772 "Near-Road Air Quality: Current Conditions and Analysis Insights," Washington, D.C., January 16,* by Sonoma Technology, Inc., and the Washington State Department of Transportation. STI-7227.

Craig K., Erdakos G., Chang S.-Y., and Baringer L. (2019) Source apportionment modeling to investigate local and non-local contributions to ground-level ozone in Albuquerque, New Mexico. Presentation given at the *2019 CMAS Conference, Chapel Hill, NC, October 23,* by Sonoma Technology, Inc., Petaluma, CA. STI-7145.

Craig K., Chang S.Y., Erdakos G., and Baringer L. (2019) Projecting future ground-level ozone concentrations in Albuquerque, New Mexico. Poster presented at the *2019 CMAS Conference, Chapel Hill, NC, October 21-23,* by Sonoma Technology, Inc., Petaluma, CA. STI-7175.

Brown S., Craig K., Eisinger D., Landsberg K., Mukherjee A., Baringer L., Chang S.Y., DeWinter J., McCarthy M., and Huang S. (2019) National assessment of near-road (NR) air quality: requirements, trends, and analysis insights. Presented for the U.S. Transportation Research Board webinar series, September 30, by Sonoma Technology, Inc., and the Washington State Department of Transportation.

Brown S., Craig K., Eisinger D., Landsberg K., Mukherjee A., Baringer L., Chang S.Y., DeWinter J., McCarthy M., and Huang S. (2019) National assessment of near-road (NR) air quality: requirements, trends, and analysis insights. Presented to the AASHTO Committee on Environment and Sustainability, 2019 Annual Meeting, Minneapolis, MN, August 7, by Sonoma Technology, Inc., Petaluma, CA, and the Washington State Department of Transportation, Olympia, WA. STI-7154.

Craig K.J., Huang S., Pavlovic N., Chang S.Y., Cavallaro A., and Drury S. (2019) Improving spatial resolution of wildland fire location and fuel biomass data inputs to NOAA's NAQFC. Presentation given at the *International Fire Behavior and Fuels Conference, Albuquerque, NM, April 30,* by Sonoma Technology Inc., Petaluma, CA. STI-7017.

Craig K., Baringer L., Chang C., Bai S., Landsberg K., and Eisinger D. (2019) Near-road PM$_{2.5}$, modeled vs. monitored data comparison: Indianapolis case study. Presented at the Transportation Research Board 2019 Annual Meeting, Analysis Subcommittee, Transportation and Air Quality Committee, January 14, by Sonoma Technology, Inc., Petaluma, CA, and the Washington State Department of Transportation, Olympia, WA. STI-7020.

Chang S.Y., Craig K., Seagram A., Lurmann F., Hosseini A., Sarrafzadeh M., Rocchio R., Habre R., and Bui A. (2018) An environmental data web service based on near-road dispersion modeling to support the Los Angeles Pediatric Research Integrating Sensor Monitoring Systems (PRISMS) Informatics Center. Poster presented at the *2018 CMAS Conference, October 22-24, Chapel Hill, NC,* by Sonoma Technology, Inc., Petaluma, CA. STI-6994.

Craig K.J., Huang S., Pavlovic N., Chang S.Y., and Cavallaro A. (2018) Improving spatial resolution of wildland fire location and fuel biomass data inputs to NOAA's NAQFC. Presentation given at the *17th Annual CMAS Conference, Chapel Hill, NC, October 23,* by Sonoma Technology, Inc., Petaluma, CA. STI-6993. Available at https://www.cmascenter.org/conference//2018/slides/craig_improving_spatial_2018.pdf.

Craig K., Erdakos G., Baringer L., and Chang S.Y. (2017) Source apportionment modeling to investigate background, regional, and local contributions to ozone concentrations in Denver, Phoenix, Detroit, and Atlanta. Presentation given at the *16th Annual CMAS Conference, Chapel Hill, NC, October 23,* by Sonoma Technology, Inc., Petaluma, CA. STI-6759.

Craig K., Erdakos G., Baringer L., and Chang S.Y. (2017) Source apportionment modeling analysis findings. Webinar presented to the Electric Power Research Institute, August 30, by Sonoma Technology, Inc., Petaluma, CA. STI-916029-6786.

Reid S., Hafner H., Du Y., Chang S.Y., and French T. (2017) Ozone precursor trends and emissions inventory evaluation in California's South Coast Air Basin. Presented at the *27th CRC Real World Emissions Workshop, Long Beach, CA, March 27*. STI-6691.

Chang S. Y., Viuete W., Serre M., Isakov V., Arunachalam S. (2016) Fine-scale characterization of premature deaths associated with exposure to PM$_{2.5}$ from on-road sources in Central North Carolina. Poster presented at the 2016 NC BREATHER Conference, Charlotte, NC, April 8. Best poster award.

Chang S.Y., Vizuete W., Isakov V., Breen M., Arunachalam S. (2015) The evaluation of alternative exposure metrics for traffic-related air pollutant exposure in North Carolina. Presented at the *25th International Society of Exposure Science Annual Conference, Las Vegas, NV, October 18-22*.

Chang S. Y., Arunachalam S., Serre M., Isakov V., Vizuete W. (2015) Fine-scale characterizing of the premature death associated with exposure to PM$_{2.5}$ from onroad sources. Presented at the *14th Annual CMAS Conference, Chapel Hill, NC, October 5-7.*

Chang S. Y., Arunachalam S., Isakov V., Breen M. (2015) Evaluation of model-based exposure metrics for multiple pollutants at fine resolution. Poster presented at the *108th Air & Waste Management Association Annual Conference and Exhibition, Raleigh, NC, June 22-25*.

Chang S. Y., Arunachalam S., Naess B., Talgo L., Valencia A., Iskov V., Palma T., Jackson L., Breen M. (2014) Connecting fine-scale air quality modeling of traffic-related pollutants with EPA's EnviroAtlas. Presented at the *13th Annual CMAS Conference, Chapel Hill, NC, October 27-29*.

Chang S. Y., Arunachalam S., Naess B., Talgo L., Valencia A., Iskov V., Palma T., Breen M. (2014) A modeling framework for improved characterization of near-road exposure at census block scale. Poster presented at the *24th International Society of Exposure Science Annual Conference, Cincinnati, OH, October 12-16*.

Chang S. Y., Arunachalam S., Naess B., Talgo L., Valencia A., Iskov V., Schultz B., Palma T. (2013) A modeling framework for improved characterization of near-road air quality at fine scales for nationwide exposure assessment. Presented at the *12th Annual CMAS conference, Chapel Hill, NC, October 28-30*.

Wu T.G., Chang S.Y., Hashmonay R.A., Chao C.P., Hsu C.P., Wu C.F. (2012) Using the vertical radial plume mapping technique for estimating the emission rate of benzene in a tank farm. Presented at the *105th Air & Waste Management Association Annual Conference and Exhibition, San Antonio, TX, June*.

Weng C.Y., Chang S.Y., Wu C.F. (2011) Inversing air dispersion models to locate emission sources with optical remote sensing data. Presented at the *104th Air &Waste Management Association Annual Conference and Exhibition, Orlando, FL, June*.

Yeah C.K., Chang S.Y., Wu C.F. (2010) Integrating open-path Fourier transform infrared and air dispersion models for emission source localizations. Presented at the *103rd Air & Waste Management Association Annual Conference and Exhibition, Calgary, AB, Canada, June*.

 Lin S.C., Chang S.Y., Wu C.F. (2010) Source localization with one-dimensional radial plume mapping technique using two monitoring lines. Presented at the *103rd Air & Waste Management Association Annual Conference and Exhibition, Calgary, AB, Canada, June*.

Wu C.F., Chang S.Y. (2009) Comparisons of reconstruction algorithms for the horizontal radial plume mapping methodology. Presented at the *102nd Air & Waste Management Association Annual Conference and Exhibition, Detroit, MI, June*.

Chang S. Y. , Chen C. H., Wu C. F., Shie R. H., Chang P. E, (2008) Applying a skewed distribution as the basis function in the radial plume mapping technique for source localization with the OP-FTIR. Presented at the *101st Air & Waste Management Association Annual Conference and Exhibition, Portland, OR, June*.

Wu C. F., Chen C. H., Chang S. Y., Sung L. Y., Yang J. J., Shie R. H., Su J., and Chang P. E. (2007) Applying OP-FTIR measurements and wind data to localize fugitive emission sources. Presented at the *100th Air & Waste Management Association Annual Conference and Exhibition, Pittsburgh, PA, June*.

Formal Reports

Houk J., Huang J., Chang S.Y., and Eisinger D. (2021) Benefits of state-level adoption of California medium- and heavy-duty vehicle regulations. Final report prepared for The International Council on Clean

Transportation, San Francisco, CA by Sonoma Technology, Inc., Petaluma, CA, October. Available at https://theicct.org/sites/default/files/publications/state-level-hdv-emissions-reg-oct21.pdf.

Erdakos, G., Chang, S., Huang, J., Sussman, E., and Craig, K. (2021) Project-level $PM_{2.5}$ emissions analysis of future zero emission vehicle fleet changes. Technical memorandum prepared for the California Department of Transportation, Sacramento, CA, by Sonoma Technology, Petaluma, CA, June.

Houk J., Craig K., and Chang S.Y. (2020) MOVES modeling analysis for Johnson and Wyandotte counties, Kansas. Final report prepared for the Kansas Department of Health & Environment, Topeka, KS by Sonoma Technology, Petaluma, CA, STI-919054-7262, June 19.

Craig K. and Chang S.Y. (2020) Machine learning for very short-term predictions: Chapter 4 in Development, implementation, and integration of a holistic solar forecasting system for California. Report prepared for the California Energy Commission, EPC 17-006, April.

Erdakos G., Chang S.Y., Eisinger D., Heller A., and Unger H. (2019) Zero emission vehicles: forecasting fleet scenarios and their emissions implications. Final report prepared for NCHRP 25-25, Task 115 by Sonoma Technology, Inc., Petaluma, CA, and Louis Berger, Denver, CO, STI-918083-7043, November. Available at http://www.trb.org/Main/Blurbs/180232.aspx.

Craig K., Baringer L., Chang S.-Y., McCarthy M., Bai S., Ravi V., Eisinger D., and Landsberg K. (2019) Analysis of modeled and measured near-road $PM_{2.5}$ concentrations in Indianapolis and Providence during 2015 and 2016. Final report prepared for the Washington State Department of Transportation, Olympia, WA, by Sonoma Technology, Inc., Petaluma, CA, and the Washington State Department of Transportation, Olympia, WA, STI-914202-7127, October.

Craig K.J., Erdakos G.B., Chang S.Y., Baringer L., Brown S., and Lavezzo T. (2019) Air quality modeling of 2017 ozone episodes in the City of Albuquerque. Final report prepared for the Environmental Health Department, City of Albuquerque, NM, by Sonoma Technology, Inc., Petaluma, CA, STI-918015-7010, June.

Bai S., Du Y., Baringer L., Chang C., Seagram A., and Eisinger D. (2017) Greenhouse gas analysis for transportation projects. Report prepared for the California Department of Transportation, Sacramento, CA, by Sonoma Technology, Inc. Petaluma, CA, CTAQ-RT-17-317.13.1, STI-914113-6761-FR, June.