Shih Ying (Changsy) Chang, PhD

Air Quality Scientist, Project Manager

Sonoma Technology

Dr. Chang joined Sonoma Technology in 2016; he applies his air quality modeling knowledge and scientific programming skills to conduct air quality modeling simulations, calculate emissions, and analyze air quality data for various applied research projects.

Emission Modeling. Dr. Chang has applied the Sparse Matrix Operator Kernel Emissions (SMOKE) model to support source apportionment modeling with the Comprehensive Air Quality Model with extensions (CAMx) for the Electric Power Research Institute (EPRI) and City of Albuquerque. Dr. Chang also managed the SMOKE modeling for a wildfire health study funded by National Institute of Health (NIH). Besides SMOKE, he used the MOtor Vehicle Emission Simulator (MOVES) and Emissions Factor (EMFAC) models to support litigation projects and develop emission modeling tools, such as the Caltrans-EMission FACtor Model (CT-EMFAC) and the Caltrans-Construction Emission Tool (CAL-CET). He is also the lead MOVES and emissions modeler for a near-road model-monitor comparison study funded by the Transportation Pooled Fund (TPF) program.

Chemical Transport Modeling. Dr. Chang has applied CAMx with Plume in Grid (PiG) and source apportionment to evaluate single-source $PM_{2.5}$ and ozone impacts to air quality, visibility, and deposition. These analysis results were used in support of litigation projects and regional air quality assessment projects. He also serves as the manager and technical advisor of CMAQ modeling for a wildfire health study funded by NIH.

Education

- PhD, Environmental Sciences and Engineering, University of North Carolina at Chapel Hill
- MS, Environmental Health, National Taiwan University
- BS, Public Health, National Taiwan University

For a list of publications, see sonomatech.com/ResPub/SYCpub.pdf.

Dispersion Modeling to Support Health Studies. Dr. Chang built a web service that provides real-time air quality data in southern California for the Pediatric Research using Integrated Sensors Monitoring Systems (PRISMS) program. The PRISMS program, which is funded by the National Institutes of Health (NIH), will use the air quality data to predict asthma attacks in children. To provide estimates of near-road air quality concentrations, Dr. Chang developed an on-demand modeling system based on the U.S. Environmental Protection Agency's (EPA) Research Line-source dispersion model (R-LINE).

Machine Learning for Environmental Applications. Dr. Chang used machine learning techniques to support environmental studies regarding prediction and causal relationship. He used extreme gradient boosting (XGBoost) and random forest (RF) to predict short-term cloudiness and solar irradiance to support power generation planning for the California Energy Commission (CEC). He also used SHapley Additive exPlanations (SHAP) to identify the important predictors and their contribution to the prediction. He also used XGBoost to establish the relationship between sulfur/nitrogen deposition and tree survival/growth to develop methods to estimate critical loads (CLs) for multiple tree species.

Dr. Chang earned his PhD in Environmental Sciences and Engineering with a focus on near-road air quality applications. His PhD dissertation developed a hybrid modeling framework to map traffic-related air pollutants in high resolution to estimate premature mortality due to exposure to traffic-related air pollutants. In addition to modeling work, Dr. Chang enjoys computer programming. He is fluent in multiple programming languages, including Python, MATLAB, R, Linux scripting, and Fortran, and has years of experience working with Linux cluster environments.

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