Physics-based, Data-driven Modeling of Air Quality Impact from Stationary and Mobile Sources at 1-Meter Resolution

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**Abstract:** Public health studies have indicated strong correlations between air pollution and adverse respiratory and cardiovascular effects, premature death, and mortality. The hydrocarbon fueled distributed generation (DG) facilities and the highway vehicles are the two major emission sources close to communities, raising local air quality concerns. At the local community domain scale (~1 km), high resolution (~1 m) air quality information is important to health studies. And built environment and/or moving vehicle induced turbulence have significant effects on air pollutant dispersion process. However, widely used regulatory dispersion models have well-documented limitations. This talk presents the Computational Fluid Dynamics (CFD)-aided, data-driven modeling of the turbulence, dispersion, and transformation of the air pollutants from DG facilities and highway vehicles. For the DG facility emission, a new building downwash parameterization method, the mixture model, was proposed by introducing the “sidewash” concept. This model significantly improved the performance of the current regulatory dispersion model. For the high vehicle emission, curbside measurement data, on-road chasing measurement data, and CFD simulations showed the on-road NO2 formation process is important but missing in the current dispersion model. An on-road NO2 formation parameterization method was proposed to improve the current model. CFD-aided, data-driven modeling would improve dispersion models and thereby public health research.

**Bio:** Bo Yang is a postdoctoral researcher advised by Prof. K. Max Zhang in the Energy and the Environment Research Lab in the MAE department, where he also obtained his PhD. His current research focuses on the improvement of the USEPA regulatory air pollutant dispersion model, AERMOD.