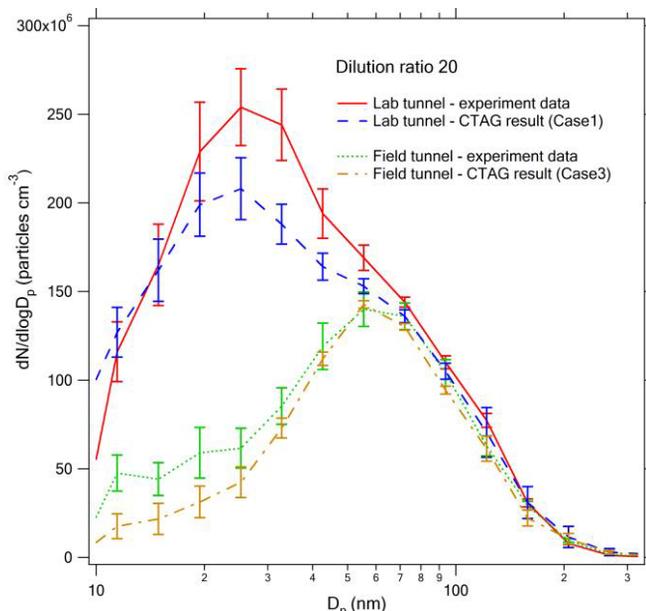


COMPREHENSIVE TURBULENT AEROSOL DYNAMICS AND GAS CHEMISTRY

By ANSYS Advantage Staff

Approximately 35 percent to 40 percent of the urban population living near major roads is exposed to elevated levels of pollutants. Cornell researchers have developed a micro-scale environmental simulation framework called Comprehensive Turbulent Aerosol Dynamics and Gas Chemistry (CTAG) by writing user-defined functions in ANSYS Fluent to describe the mixing, chemical reactions and particle dynamics in the on-road domain (tailpipe to road) and near-road domain (road to ambient). They expect the effort to provide a better understanding of pollutant concentrations and emissions control devices.

Cornell researchers recently used the CTAG framework to gain insight into the performance of fabricated dilution systems that are used to dilute raw exhaust from combustion sources for measuring pollutants at the tailpipe. The goal was to compare the performance of two different types of dilution tunnels to determine their impact on particle concentration measurement accuracy. The team conducted experiments to compare the two dilution tunnels, focusing on the effect of the dilution process on particle number concentration. “The close agreement between the measured and simulated particle size distribution (PSD) shows that CTAG is able to capture the dynamics inside the dilution tunnels,” says Dr. Max Zhang, associate professor in the Department of Aerospace and Mechanical Engineering. “Both experimental data and simulation revealed that particle size measurements are sensitive to dilution conditions, such as type of mixing and relative humidity of the dilution air.” ▲



CTAG simulation vs. experimental data for particle size distribution

Experimental data and simulation revealed that particle size measurements are sensitive to dilution conditions.

Learning Experience

ANSYS and Cornell University have developed a unique collaboration that has flourished for well over a decade, helping to extend Cornell's reputation as one of the world's leading research institutions. ANSYS software is used by students and teachers in the classroom as well as project teams and researchers to solve challenging mechanical and fluid-flow problems.

References

Wang, Y.J.; Yang, B.; Lipsky, E.M.; Robinson, A.L.; Zhang, K.M. Analyses of Turbulent Flow Fields and Aerosol Dynamics of Diesel Engine Exhaust Inside Two Dilution Sampling Tunnels Using the CTAG Model. *Environmental Science & Technology*, 2013, Vol. 47, Issue 2, pp. 889–898.