Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Oklahoma City Contaminant Dispersion: 3D Velocity and Concentration Data Analysis for a Scaled Puff Release Experiment[1] TY HOMAN, MICHAEL BENSON, US Military Academy, ANDREW BANKO, CHRIS ELKINS, Stanford University — Magnetic resonance (MR) techniques were leveraged to experimentally obtain velocity and concentration measurements for a novel puff release contaminant dispersion study, with the motivation of providing a high fidelity, three-dimensional data set for comparison with JU2003-related studies. The study involved a 1:2206 scaled model of downtown Oklahoma City as it was in 2003, placed inside a water channel for boundary layer simulation. Flow through the channel was fully turbulent with a Reynolds number of 36,000 based on hydraulic diameter. An MRI system was used to take scans at 12 time-specific measurement phases throughout the puff release cycle, allowing for incremental visualization of the contaminant plume during its transport downstream. The resulting data set is analyzed using isosurfaces, streamtraces, and contour planes, while tracer flux analysis is leveraged to characterize flow into and out of an intersection and several street canyons. Comparison with wind tunnel data from an experiment involving similar geometry is also discussed in detail. The MR data set provides a means of comparison for other related studies and computational models, and can be used to identify dispersion characteristics relevant to emergency response efforts and city planning.

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Date submitted: 27 Jul 2020 Electronic form version 1.4