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Experimental validation of a new closure scheme for scalar diffusion. PARTHA SARATHI, Faculty of Engineering, University of Western Ontario, ROI GURKA, PAUL SULLIVAN, GREGORY KOPP — The study of contaminant diffusion in environmental flows is important to the assessment of the hazards that result from pollutants released into atmosphere. The reduction of scalar concentration is only due to molecular diffusion and this is usually described through a probability density function. Approximations that are made for terms in the differential equations that govern the evolution of the moments of the probability density function of scalar concentration are shown to have solutions that provide qualitative agreement with observed distributions of the first four moments. It is expected that a reasonable approximation of the probability density function is derived through inversion of the first four moments. The new closure scheme for both the convective and diffusive terms has produced some promising qualitative results. Simultaneous measurements of velocity and scalar concentrations, using particle image velocimetry (PIV) and planer laser-induced fluorescence (PLIF) respectively, on a plume in a grid-turbulence water tunnel experiment are used to quantitatively explore this closure scheme. The velocity and concentration fields are measured and analyzed in order to characterize the flow statistics such as turbulent fluxes and distributed moments.

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