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Flushing of a dense fluid from an urban canyon part 1: Steady state measurements NIGEL KAYE, ZAHRA BARATIAN, Clemson University — We consider the role of buoyancy on the vertical transport of a dense gas due to a horizontal wind flow above a street canyon. The density of the pollutant suppresses vertical mixing as the turbulent shear flow at the top of the canyon must do work to raise the dense gas up above the canyon top. We present results of a series of experiments to measure the rate of removal of a dense miscible fluid from a two dimensional square canyon open at the top. The cavity is formed by square blocks up- and down-stream. Dense fluid is introduced at a constant rate at the base of the cavity and is removed by mixing with the flow passing over the top of the cavity. Two different steady flows are observed. For higher Richardson numbers, a two layer stratification develops in which there is a relatively sharp interface. In this case the mixing is parameterized in terms of an entrainment velocity across the interface that is a function of the Richardson number and the fractional depth of the interface below the cavity top. For lower Richardson numbers no interface is observed and the buoyancy increases linearly with height above the cavity base. We also found a range of Richardson numbers for which both steady stratifications are possible and for which the steady flow depends on the initial conditions.

Nigel Kaye
Clemson University

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