Flushing of a dense pollutant from a square 2D street canyon
NIGEL KAYE, ZAHRA BARATIAN, Clemson University — Experimental results are presented the rate of flushing of a dense pollutant from a square street canyon. Both finite and continuous release source conditions are considered. For Richardson numbers $R_i$ greater than 1 a clear two-layer stratification is observed, whereas for small $R_i$ the canyon remains well mixed. For the finite release experiments, the initial rate of removal of pollutant is well described with an exponential decay function with the non-dimensional decay rate $k$ being a function of $R_i$. Steady-state measurements from continuous release experiments for $R_i > 1$ showed that the rate of entrainment across the density interface (directly analogous to the exponential decay rate) is almost exactly the same function of $R_i$, provided the Richardson number is based on the buoyancy of the lower layer and the canyon height. An energy argument can be used to relate $k(R_i)$ to the mixing efficiency of the turbulent shear flow. Our results indicate that there is a peak in the mixing efficiency at $R_i = 1$ above which the mixing efficiency decreases with increasing $R_i$ and a two-layer stratification is observed.