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Double Diffusive Plumes BRUCE SUTHERLAND, BRACE LEE, University of Alberta — Sour gas flares attempt to dispose of deadly H_2S gas through combustion. What does not burn rises as a buoyant plume. But the gas is heavier than air at room temperature, so as the rising gas cools eventually it becomes negatively buoyant and descends back to the ground. Ultimately, our intent is to predict the concentrations of the gas at ground level in realistic atmospheric conditions. As a first step towards this goal we have performed laboratory experiments examining the structure of a steady state plume of hot and salty water that rises buoyantly near the source and descends as a fountain after it has cooled sufficiently. We call this a double-diffusive plume because its evolution is dictated by the different (turbulent) diffusivities of heat and salt. A temperature and conductivity probe measures both the salinity and temperature along the centreline of the plume. The supposed axisymmetric structure of the salinity concentration as it changes with height is determined by light-attenuation methods. To help interpret the results, a theory has been successfully adapted from the work of Bloomfield and Kerr (2000), who developed coupled equations describing the structure of fountains. Introducing a new empirical parameter for the relative rates of turbulent heat and salt diffusion, the predictions are found to agree favourably with experimental results.

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