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Laminar plume formation by high pressure CO2 FRANCOIS NADAL, CEA CESTA, Le Barp, France, PATRICE MEUNIER, IRPHE, Aix Marseille Univ., CNRS, Marseille, France, BERNARD POULIGNY, ERIC LAURICHESSE, CRPP, CNRS, Univ. Bordeaux, France — Convection flows have often revealed the presence of plumes, especially in the earth's mantle where the Schmidt number is large. There has thus been a large number of studies on plumes created by a point source. However, there are very few results on plumes generated by an extended source. Here, we present experimental, numerical and theoretical results on the flow created by high pressure CO2 dissolved into distilled water. The thin layer of dense fluid created at the surface destabilizes through the Rayleigh-Taylor instability and leads to a laminar and parallel stationary plume. The plume width and amplitude are measured by Particle Image Velocimetry for various aspect ratios, Bond and Rayleigh numbers. They are in good agreement with the numerical result if a no-slip boundary condition is assumed at the free surface. Finally, the theory for a plume generated by a point source is adapted for an extended source, which leads to different scaling exponents (with a logarithmic dependence), in excellent agreement with the experimental and numerical results. This study thus provides a simple and accurate description of axisymmetric plumes generated by an extended source.

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