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Instability of plumes driven by localized heating FRANCISCO MARQUES, Univ. Politecnica de Catalunya - UPC, JUAN M. LOPEZ, School of Mathematical and Statistical Sciences, Arizona State Univ, YOUNGHAE DO, Department of Mathematics, Kyungpook National Univ. — Plumes due to localized buoyancy sources are of wide interest due to their prevalence in many situations, including fires, chimneys, volcanoes, deep sea hydrothermal vents and a wide variety of other atmospheric and oceanic situations. In this study, we are interested in the transition from laminar to turbulent plumes. In experiments, this transition is found to be sensitive to external perturbations. Therefore a well-controlled set-up has been chosen: a localized heat source at the bottom of an enclosed cylindrical container, at a uniform temperature except for the heat source. At moderate Rayleigh numbers Ra, the flow consists of a plume, which is steady, axisymmetric and purely poloidal. By increasing Ra, the flow undergoes a supercritical Hopf bifurcation at Ra 3.8E7, to an axisymmetric "puffing" plume, that becomes unstable to three-dimensional disturbances at about Ra 5.4E7. At larger Ra $>$ 1.E8, the plume becomes chaotic via a torus-breakup bifurcation.

Francisco Marques
Univ. Politecnica de Catalunya - UPC

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