

Abstract Submitted
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A theoretical model of unbalanced exchange flows through openings¹ NICHOLAS WISE, GARY HUNT, Univ of Cambridge — Buoyancy-driven exchange flows through a single horizontal opening, for example through an opening at high level in a room containing warm air, are balanced, as there must be equal volume flux into and out of the opening. If a second, smaller, opening is introduced at low level in the room, air will enter through this opening. The volume flux out of the primary opening will therefore be larger than the volume flux in. This is an unbalanced exchange flow. A theoretical model to predict the volume flux of unbalanced buoyancy-driven exchange flows is developed. The model builds from a linear stability analysis for perturbations on a density interface, between buoyant and ambient fluid, advected out of the primary opening. Following this approach, we predict the criterion for the onset of bi-directional flow across circular openings as has been previously observed experimentally by others. The method developed is extended to non-circular geometries and comparisons are made between the volume fluxes predicted for circular and square openings.

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