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The Development of an Axisymmetric Gravity Current

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Three-dimensional releases of fixed volumes of saline fluids into fresh water and their radial spread have been examined experimentally. At high Reynolds numbers three distinct regimes have been identified. A short initial phase, a secondary phase where the frontal speed is constant and a final stage where the front speed is reduced. In the secondary stage the gravity current's head is dominated by the presence of a ring vortex above the front. This stage of the flow propagation comes to an abrupt end with the breakdown of the ring vortex at a clearly defined point. The experimental results have been compared to 2D and 3D numerical simulations. The simulations compare well with the experimental data for the early stages of the flow. The results show the development of a complex flow field and highlight the unsuitability of shallow water modelling for axisymmetric lock releases.

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