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Computational study of the formation and evolution of a three-dimensional gravity current ANDREW OOI, SHUANG ZHU, The University of Melbourne, NADIM ZGHEIB, BALACHANDAR SIVARAMAKRISHNAN, University of Florida — Gravity currents occur when fluids of different density are brought together. They are relevant in many engineering applications such as the dispersion of hazardous gas cloud or the spillage heavy chemicals from marine vehicles. Thus far, most of the studies have assumed that the gravity current is two-dimensional (or "planar") as it travels down the slope, i.e. the gravity current is homogeneous in the spanwise direction. In this study, we utilise data from direct numerical simulation to investigate the evolution and formation of a fully three-dimensional gravity current propagating down a uniform slope. Previous theoretical studies have predicted that three-dimensional gravity current will evolve towards a "self-similar" circular wedge shape. Flow visualization from experiments showed that, contrary to the theoretical prediction, the gravity current takes on a shape that is more akin to a triangular wedge. Data from our direct numerical simulation agrees with the experimental observation. Furthermore, it has been found that the shape of this triangular wedge is relatively insensitive to the initial shape of the gravity current. The physical mechanisms leading to formation of this triangular shape and the entrainment properties of such a structure will be presented.

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