



## **Direct measurements of hydraulic jumps in an active submarine density current**

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For almost half a century, it has been suspected that hydraulic jumps, which consist of a sudden decrease in downstream velocity and increase in flow thickness, are an important feature of submarine density currents such as turbidity currents and debris flows. Hydraulic jumps are implicated in major seafloor processes, including changes from channel erosion to fan deposition, flow transformations from debris flow to turbidity current, and large-scale seafloor scouring. We provide the first direct evidence of hydraulic jumps in a submarine density current and show that the observed hydraulic jumps are in phase with seafloor scours. Our measurements reveal strong vertical velocities across the jumps and smaller than predicted decreases in downstream velocity. Thus, we demonstrate that hydraulic jumps need not cause instantaneous and catastrophic deposition from the flow as previously suspected. Furthermore, this paper will also discuss how our unique data set highlights problems in using depth-averaged velocities to calculate densimetric Froude numbers for gravity currents.