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Novel Identification of Gravity Waves in an Experimental Gravity Current CAROLINE MARSHALL, University of Leeds, ROBERT DORRELL, Hull University, GARETH KEEVIL, JEFFREY PEAKALL, STEVEN TOBIAS, University of Leeds — The body of gravity currents has typically been assumed to be two-dimensional, however the instantaneous three-dimensional flow structure has never been observed experimentally. This key aspect of an extensively studied flow remains poorly understood. Fully three-dimensional particle tracking velocimetry measurements (Shake-the-Box) of constant-influx solute-based gravity current flows are presented for the first time. These measurements call into question some standard assumptions made about the body of gravity current flows. Cross-stream velocity is typically neglected, yet in this work cross-stream and vertical velocities are shown to be equivalent in magnitude. Dynamic mode decomposition is used to identify the presence of three-dimensional internal waves within the body centered at the height of the velocity maximum. Estimation of the Doppler-shifted Brunt-Vaisala buoyancy frequency demonstrates that these are internal gravity waves, and that they may form a critical layer within the flow. As the body often forms by far the largest part of the gravity current, these observations suggest that a new model of the gravity current body is needed to understand these often seen and critical flows.

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