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Dispersive entrainment in gravity currents in layered porous media CHUNENDRA K. SAHU, JEROME A. NEUFELD, University of Cambridge — We present experimental results to quantify mixing in gravity currents in layered porous media occurring due to dispersion between dense and light fluids. Dye-attenuation based laboratory experiments were performed in homogeneous medium and heterogeneous medium consisting of two or four layers of distinct permeabilities. These experimental results show that the effects of mixing are more prominent closer to the nose and less prevalent towards the source location. In layered media, the volume of entrainment is much higher than that in the homogeneous medium due to flow instabilities like over-riding and Rayleigh-Taylor instabilities, which result in higher mixing rates. These experimental results motivate a general mathematical model in which we exploit the large aspect ratio of these currents to formulate a depth-averaged model of the evolution of the mass and buoyancy. We assume that the entrainment of ambient fluid into the gravity current can be parameterised by the mean horizontal velocity and an entrainment coefficient. Based on our experimental measurements, we quantify the dependence of the dispersive entrainment on the number of layers and their permeabilities.

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