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Internal bores: An improved model via a detailed analysis of the energy budget ZACHARY BORDEN, TILMAN KOBLITZ, ECKART MEIBURG, UC Santa Barbara — Internal bores, or hydraulic jumps, arise in many atmospheric and oceanographic phenomena. The classic single-layer hydraulic jump model accurately predicts a bore's behavior when the density difference between the expanding and contracting layer is large (i.e. water and air), but fails in the Boussinesq limit. A two-layer model, where mass is conserved separately in each layer and momentum is conserved globally, does a much better job but requires for closure an assumption about the loss of energy across a bore. Through the use of 2D direct numerical simulations, we show that there is a transfer of energy from the contracting to the expanding layer due to viscous stresses at the interface. Based on the simulation results, we propose a two-layer model that provides an accurate bore velocity as function of all geometrical parameters, as well as the Reynolds and Schmidt numbers. We also extend our analysis to non-Boussinesq internal bores to bridge the gap between the single and two-layer models.

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