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Nonlinear dynamics of density currents in an f-plane, two-layer model with a rigid lid

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We study the nonlinear dynamics of a density current generated by a diabatic source in a rotating and in a non-rotating system, in the presence and in the absence of frictional losses, using a steady state hydrostatic shallow water model. We produce explicit solutions, analyzing the dynamics as a function of the Coriolis parameter, the Rayleigh friction coefficient, and of the relative depth of the two layers. Results show that the runout length of a frictionless density current in a rotating system equals its propagation speed in a non-rotating system multiplied by the inertia period, and that, in the presence of friction, this length is largest when the inertia frequency is comparable to the Rayleigh friction coefficient, and smallest when the two layers have a comparable depth.