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Direct numerical simulations of gravity currents on a slope with sedimentation and resuspension H.J. ANJUM, J.N. MCELWAINE, DAMTP, University of Cambridge, C.P. CAULFIELD, BP Institute & DAMTP, University of Cambridge — We report on direct numerical simulations of gravity currents on a slope with sedimentation and resuspension in two-dimensions. We use a hindered sedimentation model where the sedimentation flux is $u_s\phi(1-\alpha\phi)$, where u_s is the dilute limit sedimentation velocity, and ϕ is a (nondimensional) particle concentration. We consider in detail the two limiting cases of $\alpha = 0$ and $\alpha = 1$. On the boundaries we apply a zero flux boundary condition, which models resuspension. This means physically that any particles that are deposited are immediately re-entrained. On the upper surface entrainment of the ambient fluid can be balanced by sedimentation and since no buoyancy is lost through the bottom surface nearly steady currents are possible, although buoyancy is gradually lost through the tail. We compare our simulations with an analytic model based on equations for the total buoyancy, $B = \int \phi_V \, dV$ and the down-slope centre of mass $X = 1/B \int x\phi_V \, dV$. These require a closure relation based on the Froude number which we define using the vertical centre of mass $H = 1/B \int y\phi_V \, dV$ similarly to Anjum et al. (2012). We show that with this definition the Froude number is constant for most of the flow's evolution.

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