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Sediment wave formation by turbidity currents: a Navier-Stokes based linear stability analysis BRENDON HALL, LUTZ LESSHAFFT, ECKART MEIBURG, University of California, Santa Barbara, BEN KNELLER, University of Aberdeen — We explore the formation of sediment waves by turbidity currents, based on a linear stability analysis of the bottom boundary layer in a turbidity current. The analysis employs the 2D Navier-Stokes equations for the fluid, and it accounts for the coupled interaction of fluid and suspended particle motion with the erodible bed below. Wavy perturbations of the bottom topography may either be amplified or leveled out under the competing effects of sediment deposition and erosion. The destabilizing effect of the base flow on the stability of the bedform is modulated by the perturbation eigenmodes of sediment deposition and of erosive shear stress. The phase relation between these two perturbation fields determines the total growth rate and phase velocity of the sediment wave. Upstream-traveling waves are dominantly caused by preferred erosion of sediment into the flow along the downstream side of the interface wave, in qualitative agreement with existing experimental and numerical investigations. Results indicate that both short- and long-wavelength modes are amplified. The associated short-wavelength eigenmodes travel at negative phase velocities over parameter regimes that are typical of turbidity currents.

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