

Slumping regime in lock-release turbidity currents

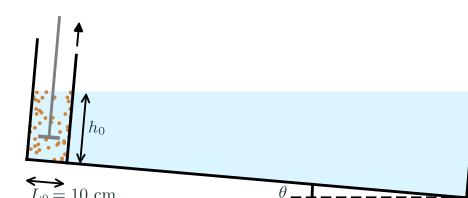
■ - Introduction



- saline currents, horizontal bottom:
 - $u_c \simeq 0.5u_0 = 0.5\sqrt{g/h_0}$
 - $t_{end} \simeq 20t_0 = 20L_0/u_0$
 - constant prefactors

- dynamics of particle-ladden currents on slopes ?

⚙ - Methods



Systematic parameter space exploration:

- 2 different set ups: $\theta \in [0^\circ, 15^\circ]$, $h_0 \in 20, 30$ cm
- 5 different particle diameters + saline water
- particle volume fraction $\phi \in [0.5, 15] \%$

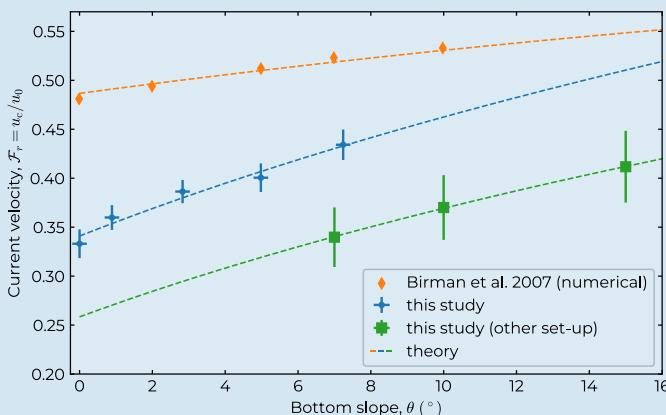


Slumping of a suspension of silica sand ($d \sim 180 \mu\text{m}$).

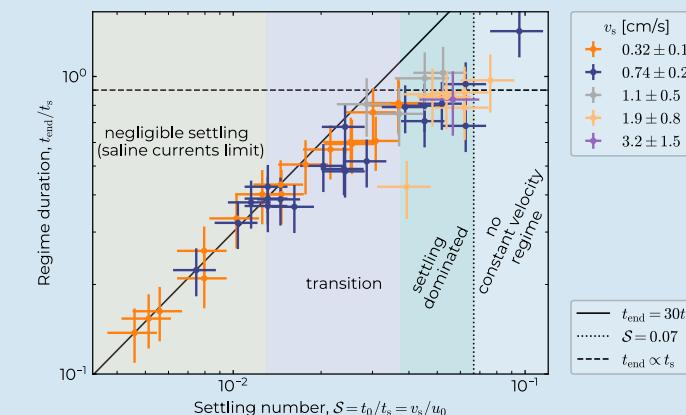
Bottom slope and particle settling matters for turbidity current slumping dynamics !



Bottom slope increases velocity

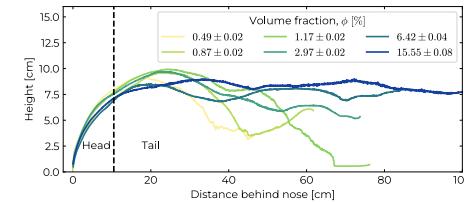


Settling decreases regime duration



💡 - Results

- Existence of a constant-velocity regime on a sloping bottom → slope-induced acceleration occurs later (Birman et al. 2007)
- Bottom slope increases this velocity
- Settling decreases the constant-velocity regime duration
- Current head shape ($\sim L_0$ behind nose) independant of ϕ , v_s and θ



💡 - Discussion/Perspectives

- Origin of the influence of θ on \mathcal{F}_r ? (early times)
- How to include this on depth-averaged models ? (to be tested)
- Influence of lock aspect ratio (h_0/L_0) on velocity ?
- What about steady influx turbidity currents on slopes ?



⚠ - Definitions

- slumping regime: first, constant-velocity, phase of current propagation (see intro)
- $u_0 = \sqrt{(\delta\rho/\rho_f)\phi gh_0}$: characteristic slumping velocity
- $\delta\rho = \rho_p - \rho_f$: excess particle density
- $t_0 = L_0/u_0$: characteristic slumping time
- v_s : particle settling velocity
- $t_s = h_0/v_s$: characteristic settling time