6. Additional description

6.1. *Movie 1*

Density perturbation field ρ' of the sample simulation presented in §2.2 for the (top) full domain and (bottom) breaking region. Positive values (red) represent fluid displaced upward and negative values (blue) represent fluid displaced downward. The solid gray lines represent isopycnals. The isopycnal $\rho = 1005\,\mathrm{kg/m^3}$ is drawn in black and used to highlight the bolus front boundary. The breaking region (bottom) corresponds to the region surrounded by the thick black box in the full domain (top).

6.2. *Movie 2*

Density perturbation field ρ' of the sample simulation presented in §2.2 for the (top) full domain and (bottom) breaking region with passive tracers distributed outside and inside the breaking zone. The tracers in the constant depth region temporarily oscillate vertically as the wave passes. Tracers in the breaking region are entrained in the resulting vortex demonstrating how the breaking mechanism results in effective transport.

6.3. *Movie 3*

(top) Evolution of the sample simulation tracers with the tracer color determined by cluster membership. Seven clusters have been identified, with the Lagrangian bolus cluster represented in green. (bottom) The time evolution for the bolus cluster from $t_0 = 19.25\,\mathrm{s}$ to $t_f = 65\,\mathrm{s}$. Instantaneous positions of the bolus presented in figure 5(b) are presented here as well. The trajectory of the bolus center of volume is illustrated in gray.

6.4. *Movie 4*

Time evolution of the boluses, from t_0 to t_f indicated by the time values on the left and right, for stratifications with pycnocline thicknesses $\delta = 0.025\,\mathrm{m}$, $0.1\,\mathrm{m}$, $0.2\,\mathrm{m}$, $0.25\,\mathrm{m}$ and $0.3\,\mathrm{m}$. This movie corresponds to a dynamic view of the data presented in figure 8.

6.5. *Tables*

Table I (Simulation Parameters) contains information about the simulations presented in this paper for reproducibility. The simulations are presented by section/study and numbered from 1 to 102. The parameters presented for each simulation are: pycnocline thickness δ, energy factor $E_k/E_{k,0}$, density change $\Delta\rho$, topographic slope s, forcing velocity amplitude a_f giving the desired kinetic energy at the breaking location, starting t_0 and ending t_f times for the tracer trajectories, domain left and right limits, $\widehat{x}_{\mathrm{left}}$ and $\widehat{x}_{\mathrm{right}}$, that together with $\widehat{z}_{\mathrm{bottom}} = 0.002\,\mathrm{m}$ and $\widehat{z}_{\mathrm{top}} = 0.02\,\mathrm{m}$ define the rectangular grids where tracers are positioned in the domain at t_0, total number of tracers and the number of clusters identified by the spectral clustering method.

Table II (Wave Characteristics and Dimensionless Parameters) contains characteristics of the waves generated in the simulations presented in this paper and the resulting dimensionless numbers. The simulations are presented by section/study and numbered from 1 to 102. The quantities presented for each simulation are: pycnocline thickness δ, energy factor $E_k/E_{k,0}$, density change $\Delta\rho$, topographic slope s, wave amplitude a, wavelength λ, wavenumber k, wave speed c_x, wave steepness ka, internal Iribarren number Ir, wave Reynolds number Re_w, wave Richardson number Ri_w and Froude number Fr.