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A new mechanism for generating a bolus within a double layer following Scott Russell

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While seeking to revisit an old experiment of John Scott Russell, we discovered a new mechanism for generating a non-shoaling bolus (an ovoid coherent mass of recirculating mixed fluids immerged in a surrounding medium/a of different density/ies) propagating along a pycnocline. In a study about dead-water (Fourdrinoy et al. 2020), a wave resistance phenomenon induced by internal waves formation at the interface between waters of different densities, we modified the setup used by Scott Russell. The Scottish engineer studied the formation and propagation of dispersive waves when an object is removed from a laterally confined open channel with a shallow layer of water. The "vacuum" created by the mass removal generates a linear dispersive free surface deformation with a front of negative polarity followed by a wave train. If we extend this configuration to a two-layers stratification, we can observe a linear dispersive wave with negative polarity à la Scott Russell, propagating along the interface. In addition, the removal of the object generates under certain conditions a bolus which induces a mixing zone and a gradient transition layer. We will present this new method of boluses creation, as well as an experimental characterization with space-time diagrams thanks to a subpixel detection procedure.

The dual nature of the dead-water phenomenology: Nansen versus Ekman wave-making drags.
Johan Fourdrinoy, Julien Dambrine, Madalina Petcu, Morgan Pierre and Germain Rousseaux.
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