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# Internal tide modeling from laboratory to ocean scales : Hydraulic & Topographic controls

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## Abstract

Internal tides are involved in the Meridional Overturning Circulation energy balance. The issue about the relative importance of the mechanical and thermodynamical energy sources induces a need for a quantitative evaluation of the energy transfers and for a clear understanding of the physical processes involved in these energy transfers.

In supercritical regions (internal tide generation area with supercritical topographies and hydraulic control) such as the strait of Gibraltar, large topographic variations and strong currents lead to more complex generation mechanisms of internal waves and environmental interactions. This area can be subject to local spectacular breaking and driving turbulence orders of magnitude higher than open-ocean levels. A numerical approach is adopted to explore internal tide regimes in these regions. Simulations are performed using a non-hydrostatic non-Boussinesq free-surface ocean model.

Taking an idealized modeling approach at laboratory scale, a regime analysis has been proposed using and identifying key non-dimensional parameters for internal wave dynamics. This analysis has permitted to characterize a topographic control on vertical modes above supercritical topographies and on high mode solitary wave formation. Then our analysis is applied to two well-known realistic cases: the Strait of Gibraltar and Georges Bank through large eddy simulations. These two oceanographic "supercritical" regions are particularly interesting for their specific topographies and stratification conditions.

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