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Orographic waves and internal tides: two experimental and numerical studies of topographically induced gravity waves in a pycnocline

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Two situations (one in the atmosphere, one in the ocean) of topographically induced internal gravity waves in a pycnocline have been recently investigated using laboratory experiments and complementary numerical simulations.
The first situation deals with orographic waves generated over an isolated mountain which are trapped at a given level in the atmosphere (for example the top of a marine boundary layer). These experiments (see [1]) have been inspired by a theoretical model, based on Kadomtsev–Petviashvili equations, which predicts wave field and drag exerted by the mountain on the atmosphere from a small set of parameters. Complementary numerical simulations are used in order to investigate the cause of some discrepancies between predictions of the theory and results of the experiments. Boundary layer and internal waves interactions are in particular explored.
The second situation deals with internal solitary waves generated over an oceanic ridge in a configuration close to the one used by Dossmann et al. 2011 ([2]) and in a configuration relevant to straits. These waves are quite frequent in some areas, and can have a strong impact on sea structures (e.g. Offshore platform). They also influence the oceanic dynamics and are difficult to parameterize.
Laboratory experiments have been carried out at the geophysical fluid dynamics laboratory of the French meteorological service research center (CNRM-GAME), which provides facilities for fundamental and applied study of homogeneous, stratified and/or rotating flows.
Numerical simulations are based on an atmospheric (Meso-NH) and an oceanic (Symphonie-NH) non-hydrostatic models adapted to laboratory experiments. Meso-NH [3] is the non-hydrostatic mesoscale atmospheric model of the French research community. It has been jointly developed by the Laboratoire d'Aérologie and by CNRM-GAME. Symphonie-NH [4] is the non-hydrostatic ocean model following the Boussinesq hydrostatic Symphonie-2010 model developed by the Sirocco system team (CNRS & Toulouse University).

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