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Internal Gravity Waves: Generation and Breaking Mechanisms by Laboratory Experiments

Giovanni la Forgia (1,2), Claudia Adduce (1), and Federico Falcini (2)

(1) Roma Tre University, Department of Engineering, Rome, Italy , (2) Institute of Atmospheric Sciences and Climate, National Research Council, Rome, Italy

Internal gravity waves (IGWs), occurring within estuaries and the coastal oceans, are manifest as large amplitude undulations of the pycnocline. IGWs propagating horizontally in a two layer stratified fluid are studied. The breaking of an IGW of depression shoaling upon a uniformly sloping boundary is investigated experimentally. Breaking dynamics beneath the shoaling waves causes both mixing and wave-induced near-bottom vortices suspending and redistributing the bed material.
Laboratory experiments are conducted in a Perspex tank through the standard lock-release method, following the technique described in Sutherland et al. (2013). Each experiment is analysed and the instantaneous pycnocline position is measured, in order to obtain both geometric and kinematic features of the IGW: amplitude, wavelength and celerity.
IGWs main features depend on the geometrical parameters that define the initial experimental setting: the density difference between the layers, the total depth, the layers depth ratio, the aspect ratio, and the displacement between the pycnoclines. Relations between IGWs geometric and kinematic features and the initial setting parameters are analysed.
The approach of the IGWs toward a uniform slope is investigated in the present experiments. Depending on wave and slope characteristics, different breaking and mixing processes are observed. Sediments are sprinkled on the slope to visualize boundary layer separation in order to analyze the suspension e redistribution mechanisms due to the wave breaking.