LARGE-SCALE REALISTIC LABORATORY MODELING OF INTERNAL TIDE GENERATION AT THE LUZON STRAIT

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The Luzon Strait, located between Taiwan and the Philippines, is a fine example of internal tide generation by complex bathymetry. Strong internal tides propagate away from this double-ridge system resulting in some of the largest internal solitary waves observed worldwide with vertical displacements up to 200 m and velocity of the order of 1 m/s. In recent years, this setting has been the focus of extensive field studies, remote observations and numerical simulations.

To complement the aforementioned studies, we performed an internal tide laboratory experiment on an unprecedented scale. The experiment was conducted at the Coriolis facility at LEGI (Grenoble, France), site of the world largest rotating table (13 m in diameter). We modeled the generation of internal tides using realistic three-dimensional topography, density stratification and barotropic tidal forcing; the latter was achieved through the use of prismatic tide generators. Particular care was taken to achieve dynamical similarity with the ocean problem, with the values of dimensionless groups such as criticality, Froude number and tidal excursion being closely matched to established values for the Luzon Strait.

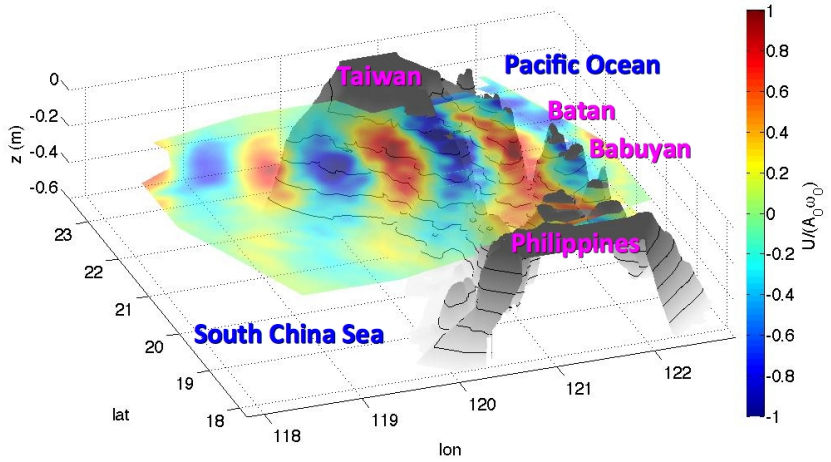

Figure 1. Experimental observations of the radiated internal tide for a semidiurnal case. The bathymetry is in gray, the colormap indicates the horizontal (east-west) velocity U in a plane near the pycnocline, normalized by the amplitude of the barotropic flow $A_0\omega_0$.

The experimental results [1] advocate that a broad and coherent weakly nonlinear, three-dimensional, semidiurnal internal tide that is shaped by the overall geometry of the double-ridge system is radiated into the South China Sea (cf. Fig. 1) and subsequently steepens, as opposed to being generated by a particular feature or localized region within the ridge system. On the contrary, the radiated diurnal internal tide is less sensitive to the Luzon bathymetry and is unlikely to evolve in a nonlinear manner.

References

[1] M. J. Mercier, L. Gostiaux, S. Ghaemsaidi, J. Sommeria, H. Didelle, S. Viboud, K. R. Helfrich, T. Dauxois, T. Peacock. *Large-scale, realistic laboratory modeling of M_2 internal tide generation at the Luzon Strait*, Geophys. Res. Lett., **40**, 5704–5709 (2013).

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