Aiming of water waves in a time-varying metabathymetry

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We investigate both analytically and numerically the two-dimensional propagation of shallow water waves over a time-varying medium, which switches from isotropic to anisotropic at a given time. Motivated by the study of Pacheco-Peña et al. [1], where temporal waveguides were designed for electromagnetic waves, we propose here a water-wave analog. The anisotropy is established with the abrupt appearance of a plate array at the fluid bottom, which changes the effective water depth in each direction in the long-wavelength limit [2]. Depending on the wavenumber angle incident on the plate array, the angle of the energy flow will change, allowing us to deflect the wave. A schematic representation of such a deviation is depicted in Figure 1. Note that isotropic time variation of the water wave speed has been explored in [3] and [4]. Finally, an experimental setup has also been designed, which allows the plate array to be suddenly lifted at the fluid bottom.

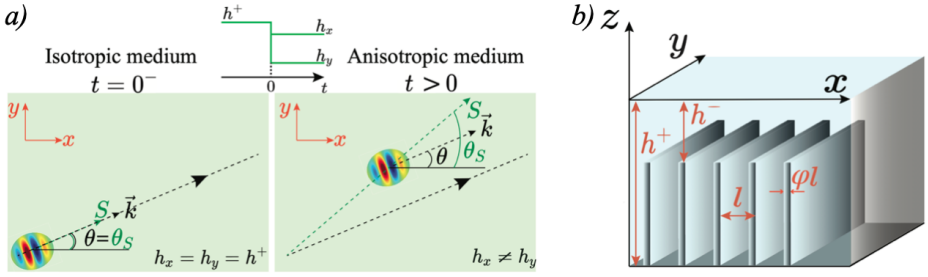

Figure 1. a) Wave packet deviation from its initial trajectory due to the anisotropy introduced at t=0. b) Representation of the plate array at the fluid depth.

Références

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