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A study of Bragg resonance of water waves over sinusoidal bed in the presence of sheared current

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In coastal areas, current often present strong vertical variations, due to the combined effects of wind, tides and bathymetric variations. Such variations can sometimes be approximated by constant vorticity flows, corresponding to currents flowing horizontally, but presenting a linear variation with depth in magnitude.

In this study, we describe the influence of such flows on the Bragg resonance of water waves by sinusoidal bathymetric variations. An experimental setup was designed to control precisely the current profile, and to study the propagation of water waves in opposing current conditions, over a sinusoidal bathymetry.

Besides, results are compared with two models which were derived recently: (1) the Extended Mild slope equation derived in [1], and (2) the extension of the mild-slope equation considering higher order effects of the bottom variations (see e.g. [2]), modified to include both current and vorticity [3].

When experimental results provide illustration of the effect of both the current and the vorticity, a comparison with both numerical methods provide new insights for interpreting the results.

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[3] K. Belibassakis, B. Simon, J. Touboul & V. Rey, "A coupled-mode model for water wave scattering by inhomogeneous vertically sheared current in variable bathymetry", Wave Mot., 74, 73–92, (2017).