On the influence of beach slope on wave shape and wave boundary layer

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Over the past two decades, significant research efforts have been dedicated to the understanding and modeling of sediment transport processes under realistic non-linear waves in the nearshore zone. The erosion mechanisms during extreme events being well described in the literature, the novelty of WEST project is to initiate new research on sediment transport during accretive periods, leading to **beach recovery**. To predict coastal evolution, both erosion and **accretion mechanisms should be accurately defined**. While offshore transport is strongly linked to current, **accretion is linked to wave-generated fluxes occurring in the Wave Boundary Layer (WBL),** mainly via bedload transport. Previous experiments and numerical studies show that **WBL dynamics are induced by various hydrodynamic and morphological factors**. Few studies deal with the influence of morphological factors such as the bed slope.

The present internship will focus on **three parameters describing the Wave Boundary Layer dynamics: the intrawave evolution of the WBL thickness, the phase delay at the bottom and the vertical evolution of the non-linearities**. These parameters will be computed from already simulated results from the numerical model CROCO-Non Hydrostatic version, applied on an idealized beach profile (10 slopes have been simulated from 0.01 to 0.1 for regular waves and for irregular waves). The results will be compared to numerical result from a realistic beach (Porsmilin beach profile, cf Figure). New simulations could also be performed using Dean beach profiles.

The student will process the already simulated data, to study the influence of slope on WBL dynamics. In order to explain the influence of slope, the student will explore the reflection of waves on the beach, its impact on wave non-linearities and possible retroaction on WBL dynamics. This study, as a part of a greater research program, will be the topic of a research paper in an international journal, with the student as coauthor (or even first author if the student is a good writer).

We are looking for a motivated student, **loving waves and beaches** (participation to a field trip is possible during the stay), trained on wave dynamics and fourier transform, with abilities in Matlab or Python, and good in writing.

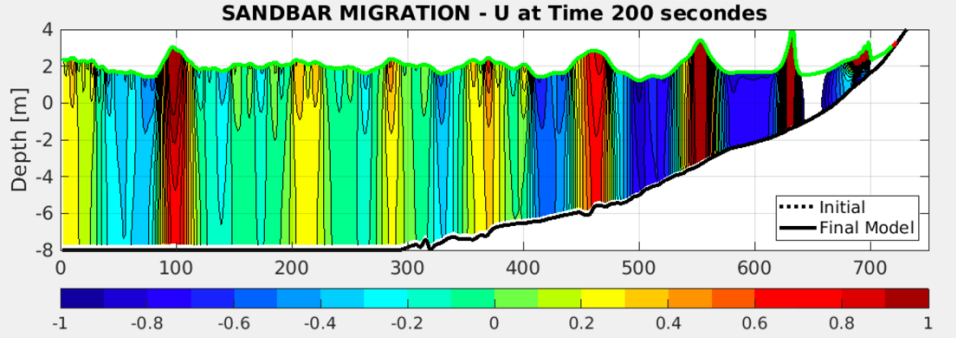

Figure –First simulation of waves and sediment dynamics on Porsmilin beach under realistic waves conditions (Barbier M., 2024)