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Study of swash motion in an embayed beach based on observations and phase-resolved wave modeling
Case of the Grande Plage of Biarritz

Context

Due to the ever growing anthropogenic pressure at the coast and the perspective of sea level due to climate change, coastal hazards, such as submersion, are becoming more threatening than ever. Estimation of the total water level (TWL) at the shoreline is an important asset for coastal engineers and those involved in coastal zone management and engineering design. For instance, the TWL describes one of the key components in forecasting tools for the assessment of coastal flood risk or storm impact intensity. In order to estimate as accurately as possible the TWL, numerical tools, phase-resolving models for instance, are used to propagate waves up to the shoreline and compute the wave run-up. However, the use of such models to capture wave run-up is relatively new and require extensive validations. In addition, physical processes occurring in complex environments such as embayed beaches are misunderstood but yet crucial for efficient protection against coastal hazards. In this project, the phase-resolving model based on the Boussinesq equations *BOSZ* is validated against laboratory and field measurements, including wave processes and run-up. In a second time, the hydrodynamics of the Grande Plage of Biarritz and the dynamics of run-up motions are investigated to evaluated the driving mechanisms in such beach configurations.

Results

The figure shows an example of wave modeling at the Grande Plage of Biarritz. Model results were compared with wave and swash data measured during a field experiment in 2018. It showed that the model is able to accurately capture wave transformations at the coast, including wave run-up, making it a suitable tool for the study of run-up motions. In a second time, the model is used to investigate the respective contribution of the geological heritage and the nearshore morphology on the swash hydrodynamics. The analysis of the numerical results carried out for different incident wave scenario and water level shows that while the geology (rocky islands) strongly influences the high frequency wave field, its influence on the low frequencies components is less pronounced. The nearshore bathymetry strongly affects the low frequencies, and ultimately the alongshore distribution of the run-up.