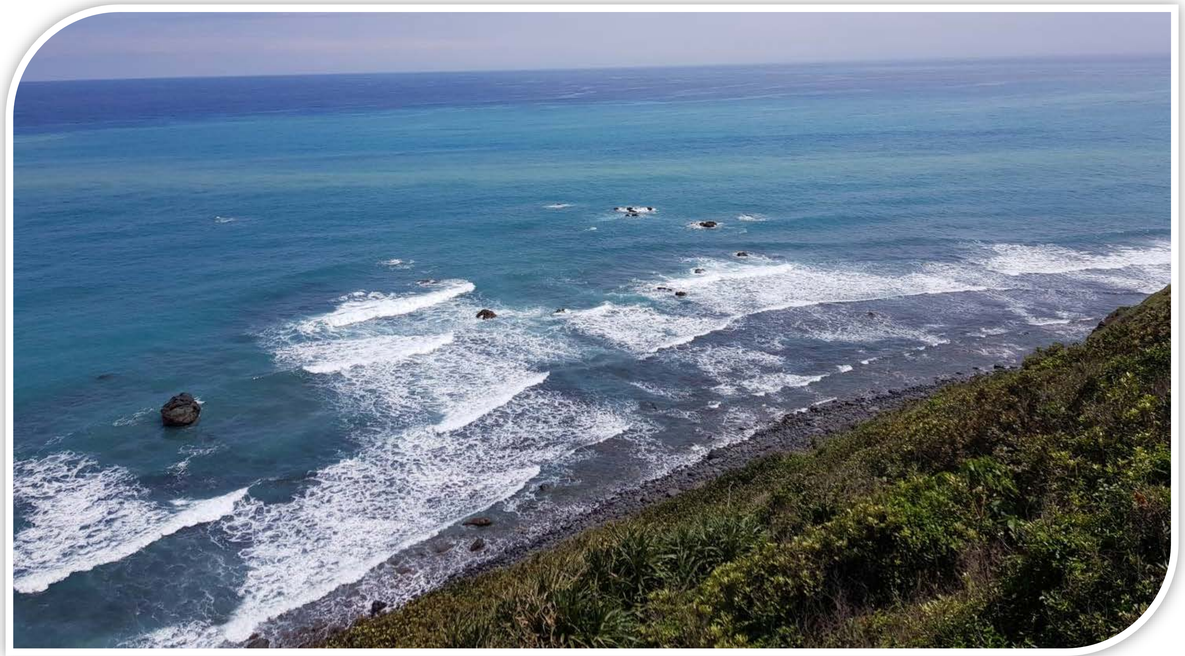
海岸工程實驗室
吳昀達　助理教授

COAST Engineering Laboratory
(Coastal, Offshore structure And Sediment Transport)

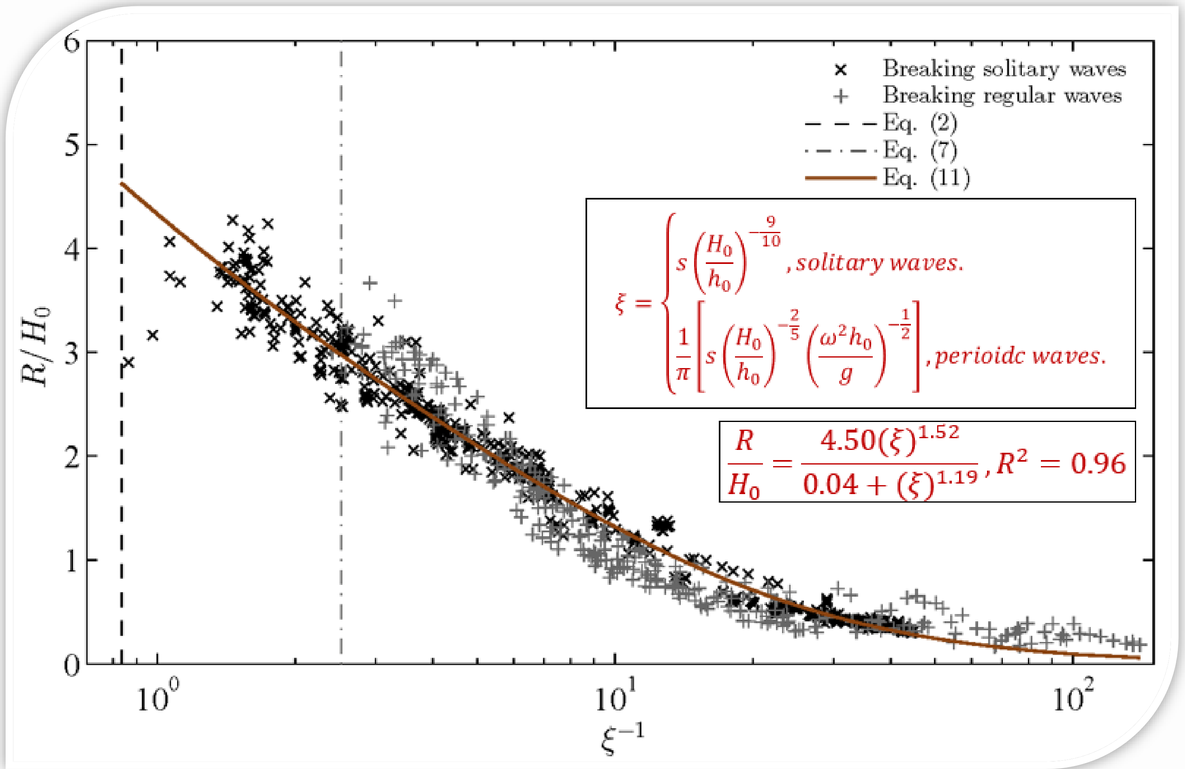
Research Interest

Dr. Wu' s research is in the area of fluid mechanics with applications to coastal and ocean engineering, including but not limited to wave-structure interactions, wave breaking, surf-/swash-zone hydrodynamics and sediment transport. The aim is to gain more understandings of the physics based on what we observed from the nature and for the need of engineering practices. Research methodologies are mostly relied on well-controlled laboratory experiments with the use of image- or optic-based non-intrusive measuring technique and high-resolution numerical modeling based on the Navier-Stokes equations.



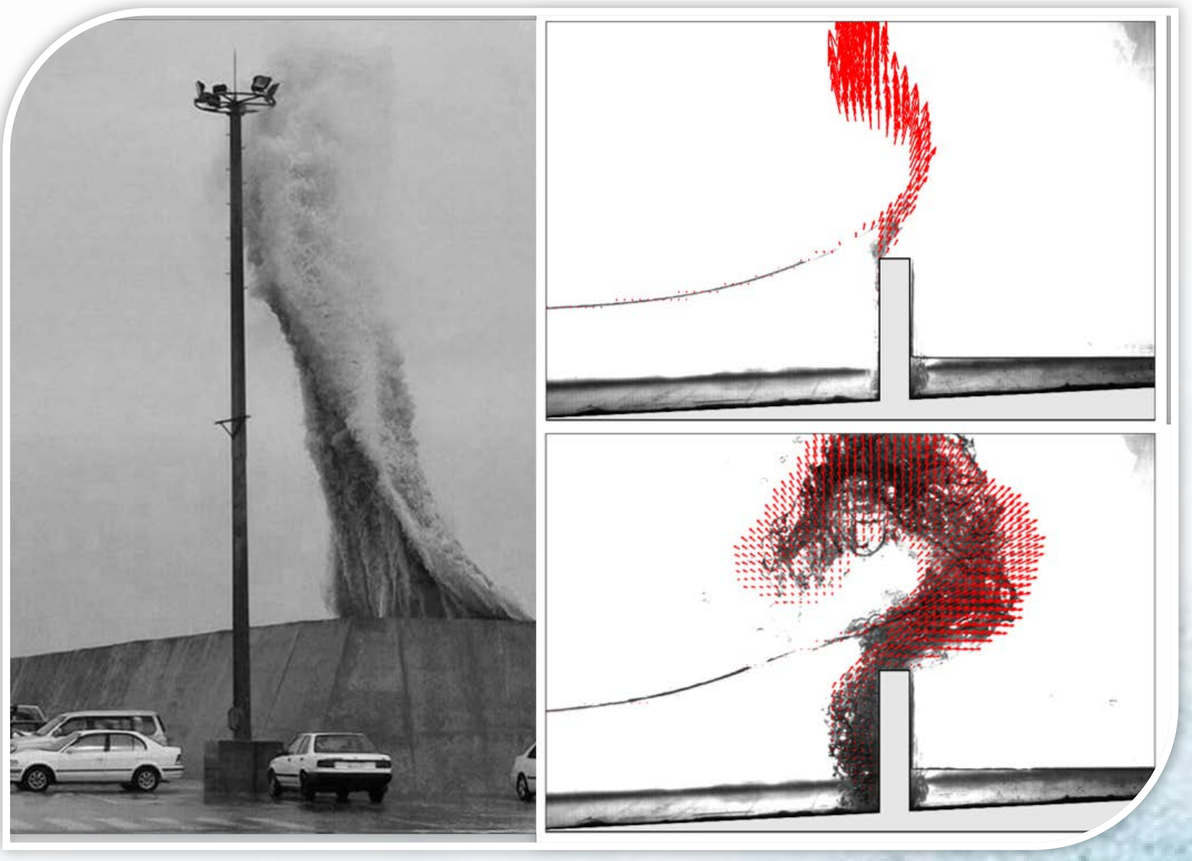
Unified Runup Formula

The normalized runup heights, R/H_0 (R = runup height; H_0 = incident wave height), for breaking solitary and periodic waves can be characterized by a single dimensionless parameter, called the surf parameter ξ, which is defined by a theoretical wave-breaking criterion. Existing laboratory data for both breaking solitary and periodic waves were collected, including surging, plunging, and spilling breakers. A set of new laboratory experiments was carried out in a large-scale wave flume with a 1/100 slope. When the laboratory data were plotted against the surf parameter, they collapsed into a trend, which can be described by a best-fit curve. This empirical formula can be used to provide a quick estimation of maximum runup height for both breaking solitary and periodic waves in the laboratory scale.



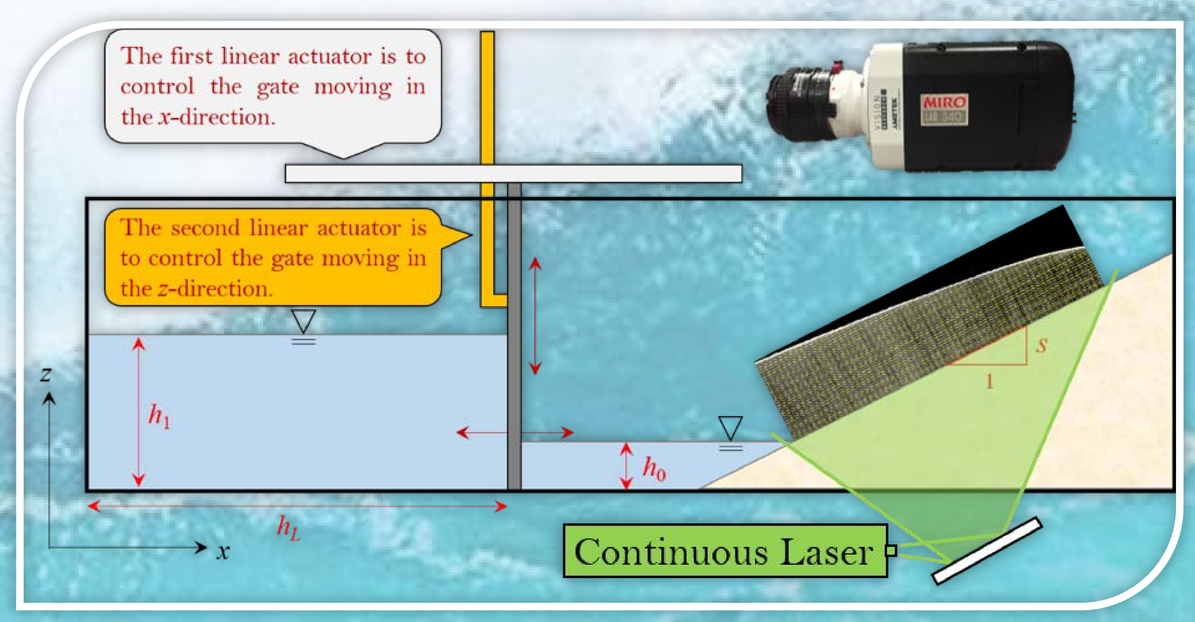
Wave-Structure Interaction

Wave overtopping on coastal structures typically occurs during typhoons due to the combination of large wave caused by strong wind and sea level rise attributed to storm surge. Failure of coastal breakwaters mostly results from strong waves induced hydrodynamics, leading to the impingement on the seaward of levee, wave overtopping the crown of levee and overtopping flow pounding the landward of levee. In this study, a non-intrusive image-based measuring technique, bubble image velocimetry, is employed to measure the violent free surface flow due to breaking wave impinging and overtopping on a vertical seawall. Effects of high- and low-aerated cases in terms of mean velocities and turbulence characteristics are reported in order to clarify how the field-scale breaking waves impact, overtop and destroy the seawalls in the nearshore regions.



Ongoing Project

A three-year research project from 2019/01/01 to 2021/12/31 has been funded by the Ministry of Science and Technology, entitled "Experimental study of dam-break-generated bore over smooth, rough and mobile beaches". The objective is to understand the hydrodynamics of bore over different types of beaches in terms of runup process, swash flows and fluid density variations due to wave breaking and sediment transport. A state-of-the-art bore generator is designed and the multi-phase image- and fiber-optic-based measuring systems will be developed to help understand the complicated flow characteristics.



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