Department of
Mechanical Engineering
The University of Hong Kong

DEPARTMENT OF MECHANICAL ENGINEERING THE UNIVERSITY OF HONG KONG

SEMINAR

Effects of seafloor geometries on wave run-up and overtopping waves

Date: 24 April, 2023 (Monday)
Time: 11:30 a.m.
Venue: Room 7-34, Haking Wong Building, HKU

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Abstract:

Tropical cyclones threaten coastal cities every year. Climate change may intensify typhoons and eventually cause severe coastal flooding. Ocean swells generated by strong winds bring significant energy and water influx to the shore, posing potential dangers to coastal structures and properties. Scrutinizing the propagation of long oceanic waves near shore is crucial to achieving accurate and reliable estimations of ocean swell and storm surge for lessening coastal flooding risk. In this study, three-dimensional, volume of fluid (VOF), large eddy simulation (LES) models are developed based on OpenFOAM to investigate the effects of the shapes of the seafloor on the non-linear nearshore wave dynamics, including wave run-ups and overtopping waves. Three theoretical seabeds, namely a straight-line seafloor, a concave seafloor, and a convex seafloor are studied with various angles of inclination. The results show that the wave run-up process, in terms of the amount of water surging toward the shore and the surface elevation, highly depends on the concavity of the ocean bottom. For a gently sloped seabed, the effect of wave breaking is significant. Wave energy is dissipated into turbulent kinetic energy by the process of wave breaking. Convex bathymetry is shown to reduce wave run-up substantially since the rate of reduction in water depth of the convex ocean floor is the fastest among the three topologies, thus speeding up wave-breaking processes and providing extra energy dissipation. In contrast, steep seabed topographies do not allow enough distance and time for wave-breaking. The effects of reflection and deflection from the ocean floor become dominant. Concave seafloor allows greater reflection and deflection of waves, therefore leading to the least flooding risk. Understanding such phenomena will advance flooding forecast systems and coastal defense strategies.

ALL INTERESTED ARE WELCOME

For further information, please contact Prof. K.W. Chow at 3917 2641.