Model development on the dynamic of wave-current interaction and the implementation on the offshore wind power

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In this study, we performed the three-dimensional numerical simulation and analysis for solving the dynamic loads from waves and currents on the offshore wind turbines. Scenarios focused on the extreme weather conditions. During the typhoon event, the wind-driven storm waves and currents have to be considered while solving the dynamic load on the structures. The Splash3D model was adopted to perform the simulation of the interaction between breaking waves and structures. The core of the Splash3D model is the Truchas model which was developed by Los Alamos National Laboratory (LANL) and featured as high accuracy. Splash3D is capable of solving the dynamic process for the interaction between the structure and fluids with complex breaking free-surface. This model is also able to simulate the local scour under the violent flow condition. In order to adequately simulate the waves under monsoon or typhoon, we developed a new wave generation module based on the dispersion relationship. This wave-maker module was used to generate regular waves, irregular waves, and breaking waves under the extreme weather condition. The module was used to simulate the synthetic effect under the effects of waves and currents for obtaining the force distribution on the foundation of the offshore wind turbine.

Keyword: Splash3D, wind power, VOF, wave-current interaction, dynamic loads, wind turbines.