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NUMERICAL SIMULATION OF HIGH WATER WAVES AND THEIR INTERACTION WITH AN OFFSHORE WIND TURBINE PILE

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Abstract. In this work the action produced by water waves on the structure of a monopile offshore wind turbine is computed using computational fluid dynamics simulations. On the one hand, the geometry of the wind turbine is that of a 5MW reference one, whose pile is submerged in intermediate water depth and is considered rigid for the fluid flow simulation. On the other hand, the waves have a significant height with respect to the water depth. To carry out the 3D turbulent fluid flow simulations the OpenFOAM interFoam solver is employed. Due to the relative water depth and wave height, a high order stream function theory is chosen as the most appropriate wave model. This wave model is already implemented in OpenFOAM so as to generate the waves without using moving boundaries. A dynamic wave absorption technique is used at the outlet boundaries to avoid wave reflections back into the computational domain. In order to validate the results, numerical simulations with the scientific computer code Reef3D are carried out. The free surface position, wave run-up and wave loads are analyzed and compared both in time and frequency domains. Additionally, the maximum value of the wave force in the main flow direction is estimated with the Morison equation.

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