Abstract

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Numerical simulation of the flow around a subsea pipeline with different protection methods

Hydrodynamic stress induced by marine currents subject subsea pipelines to failure vulnerability. Therefore, several methods have been established to protect such pipelines from hydrodynamic forces. The objective of this work is to investigate the performance of two different protection methods using computational fluid dynamics. A second-order accurate upwind finite volume computational fluid dynamics model was used to simulate isotropic turbulent flow around a subsea pipeline located on flat seabed. A comparison between four turbulence models revealed that both Menter's shear stress transport kFormula and the standard kFormula models yield the best agreement with experimental measurements. Pipeline trenching and double-barrier protection methods were simulated with different geometrical characteristics. A comparison between those two methods was conducted and discussed. It is found that at small aspect ratios, the double-barrier method prevails over trenching in terms of its ability to isolate the pipe from the main current. While at large aspect ratio, trenching provides near-zero pressure coefficient along the pipe wall, which demonstrate its prevalence in protecting the pipeline.