Simulation of oil spills from underwater accidents II: Model verification

Simulation de deversements de petrole dus a accidents sous-marins II:Verification du modele

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ABSTRACT

A companion paper presented the development of a three-dimensional numerical model to simulate the behaviour of buoyant oil jets that result from underwater accidents. The numerical model was developed based on a Lagrangian integral technique. The model can simulate the behaviour of oil in stratified or unstratified ocean environments. The presence of a multi-directional ambient current is considered. The fluid in the buoyant jet can be a liquid, gas, or liquid/gas mixture, which is typical of many underwater oil-related accidents. The model formulation includes the diffusion and dissolution of oil from the jet to the ambient environment.

In this paper, the numerical model is tested against a variety of conditions. First, the model results are compared with all available asymptotic results. Second, the model is run for cases in which experimental data (both small and large scale) are available, so that the numerical model results can be compared with the observed data. The experimental data includes buoyant jets in stratified and unstratified environments and relatively deep water experiments. They include cases both with and without ambient current. The cases compared include two-dimensional and three-dimensional jet trajectories. All comparisons show that the numerical model results match very well with the experimental data. In addition, the model is used to simulate buoyant oil jets for several cases of practical interest.

Samples of Comparisons between Simulations and Observed Data are on Next Page

Revision received May 29, 1997. Open for discussion till April 30, 1998.

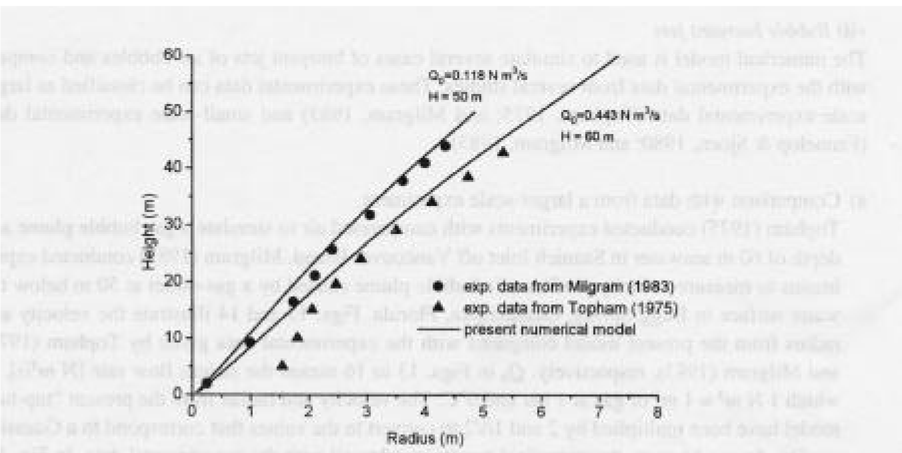

Fig. 14. Comparison between the present numerical model and larger-scale experimental data – radius.

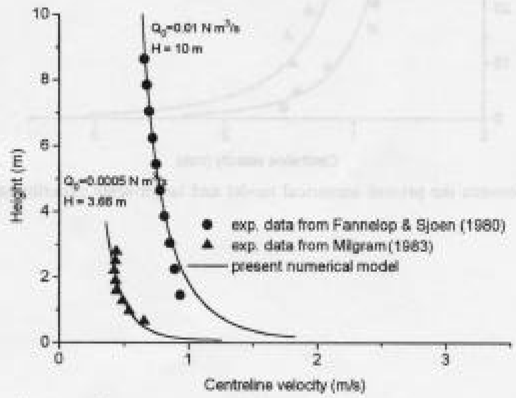

Fig. 15. Comparison between the present numerical model and smaller-scale experimental data – centerline velocity.

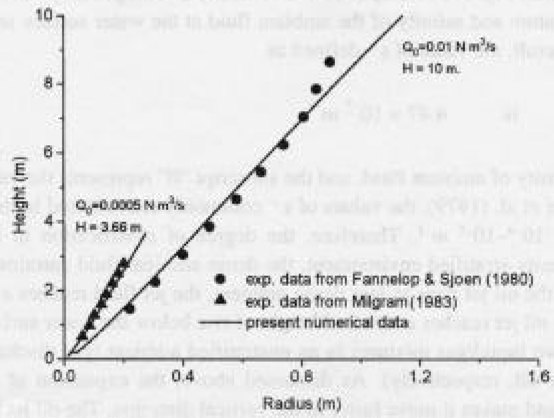

Fig. 16. Comparison between the present numerical model and smaller-scale experimental data – radius.