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ASSESSING THE RISK OF OIL SPILL IMPACTS USING TRANSPORT AND FATE MODELS

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Abstract

The presentation begins with an overview of oil spill transport and fate models including their linkage to hydrodynamic, meteorological, and impact assessment models. The governing conservation equations are then presented, with a particular focus on the conservation of constituent mass equation; the foundation for spill models. Treatment of advection, dispersion, and weathering processes is summarized, as are the different modes of model operation (nowcast, hindcast, and forecast). Solution methodologies are presented with a focus on Lagrangian or particle based methods, as these are most frequently used for modeling of oil and chemical releases. A hierarchy of Markov models is then described to represent the spill advection and dispersion processes and solved using Monte Carlo techniques. Simulations are presented to show the impact of the choice of Markov model and the number of particles on the dispersion of an instantaneous release. Stochastic model simulations are presented for two case examples to estimate the risk of the spill impacting the environment: (1) a spill of electrical insulating oil from a proposed offshore wind farm transformer, and (2) a spill of fuel oil from a port servicing on an oil fired power plant. Simulation results are presented in the form of probability of surface oiling and minimum travel time contours. For the fuel oil spill results are shown for the both surface and subsurface oil distributions. The presentation concludes with some rules of thumb and lessons learned in the application of the spill models for risk assessment.