Simulation modeling of ocean circulation and oil spills in the Gulf of Mexico

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BOEM's Environmental Studies Program supports fates and effects studies to evaluate the physical-chemical and biological processes that affect the impacts of oil and gas drilling and production discharges, spilled oil, and oil dispersants on Gulf of Mexico (GOM) ecosystems. The Deepwater Horizon (DWH) oil spill has heightened awareness of risks associated with deep water oil and gas exploration and production. The objectives of this project were to develop and apply an oil spill model system capable of evaluating oil transport, fate and exposure for deep water oil spills in the GOM. An existing well-established oil spill model system, comprised of a coupled blowout model (OILMAP-DEEP) and oil transport and fate model (SIMAP), was updated to incorporate current knowledge and integrate with existing environmental data and meteorological/hydrodynamic models. The oil spill models were verified via comprehensive comparisons with field and other data, including the extensive data sets available for the DWH spill. The validated model system was then used to simulate long-term blowout releases from four locations within GOM in water depths from 680 to 2,950 m as part of a comprehensive oil spill risk assessment. The results show that the time required for oil to reach the surface and the spatial extent of oil exposure both in the subsurface and on the surface depend on a number of factors, including the location of the blowout, water depth, use of direct dispersant injection, and crude oil type.