NERACOOS

The Northeastern Regional Association of Coastal Ocean Observing Systems

The IOOS RA serving the Northeast

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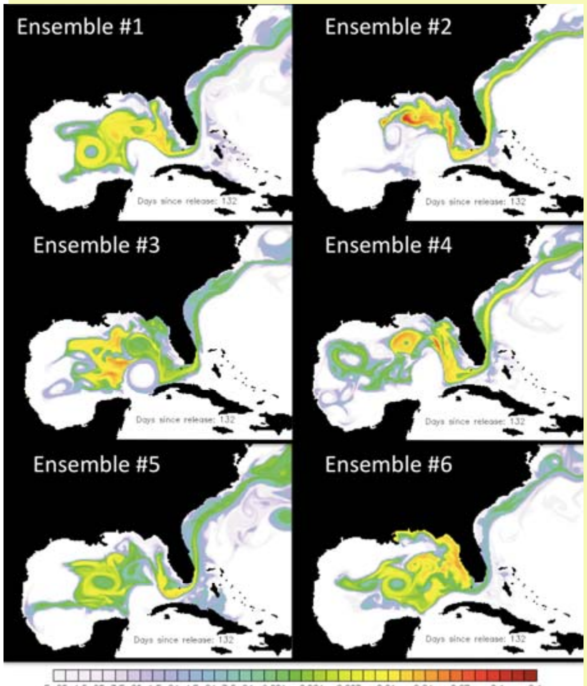
Potential for DeepWater Horizon Spill Oil to Impact New England Coastal Waters

Surface area (0 to 20 m depth) impacted by the oil spill 132 days after the start of the simulation. Dilutions are shown by the color. Note the dilution scale is from 0.0 to 0.2.

There has been speculation since the DeepWater Horizon blowout started on April 20, 2010 that the oil would be transported to the south, captured by the Loop Current in the Gulf of Mexico, and then carried through the Florida Straits to join the Gulf Stream at the southern end of Florida. The oil was then postulated to be transported along the south east coast of the US and finally offshore at Cape Hatteras, where the Gulf Stream separates from the shelf break. For the oil to reach southern New England's coastal waters several additional things are required to happen, either individually or acting in concert. One mechanism is a sustained onshore wind (from the south) that transports the surface oil toward the coast. Another is that the oil becomes incorporated into a meander on the northern side of the Gulf Stream, after it separates from the coast. The meander is then postulated to develop into a warm core ring, which is then advected by the mean southwesterly shelf flows along the shelf break. Surface waters from this warm core ring might then intrude onto the southern New England shelf.

Recently National Center for Atmospheric Research (NCAR) has released simulations of the spill. Simulations were performed for a period of 132 days, assuming a 2 month release (April 20 to June 20, 2010). The simulations assume that the oil is a passive tracer and advected and dispersed by the ocean currents. The predictions are meant to show potential paths of the oil, not forecasts of actual conditions nor of oil. The animations (see http://www2.ucar.edu/news/ocean-currents-likely-to-carry-oil-spill-to-atlantic-coast and snapshot above) are consistent with basic transport paths postulated above. At least six ensemble simulations were performed and results are shown on the web site (see figure below). The animations, to the non critical viewer, raise serious concerns about oil reaching the southeastern coast of the US and even southern New England coastal waters.



Simulation of a passive dye injected at the location of the oil leak in the upper 20m and advected by an ocean model for 132 days for 6 different initial conditions. The dilution factor is colored.

NCAR

A closer examination of the simulations (see figure to the left), using a substantially expanded scale for dilution, shows that the tracer they have used to represent oil is highly diluted (1 to 1,000 or greater) once it reaches the Gulf Stream and even more diluted (1 to 100,000 to 1,000,000) as it is transported to the north along the shelf break and then northeast as the Gulf Stream separates from the coast.

In order to estimate oil concentrations from the above simulations one needs to assume what oil concentrations might be in the water column at the release site. If it is assumed that the oil concentrations in the vicinity of the spill are 100 ppm (100×10^{-6}), as a first approximation, and using the dilutions estimated above, the concentrations of oil in Gulf Stream might be in range of 10^{-9} to 10^{-10}, so exceedingly small.

The major concerns with the simulations are that they for a conservative tracer and not oil. As a result none of the weathering processes (evaporation, biodegradation, dissolution, photo oxidation, formation of tar balls, etc.) that effect oil are included. The volatile and toxic fractions of crude oil are typically lost to evaporation or dissolution within days of the release. The approach does not distinguish between oil that is transported at the sea surface (where it is subject to wind and wave induced drift) or in the water column, where it is dispersed by ocean currents and turbulence. It effectively assumes that all the oil is dispersed in the water column. With transport times of several months (72 days based on the simulation) for the oil to exit the Gulf of Mexico, the oil is likely to be well weathered and in the process of being converted into tar balls. The chances of oil impacting New England coastal waters have not been estimated to our knowledge but appear to be very remote. A formal risk assessment would help fully address this concern.

The above summary was prepared by Dr. Malcolm L. Spaulding, Professor of Ocean Engineering at the University of Rhode Island and President of NERACOOS. Dr. Spaulding is an internationally recognized expert in marine environmental modeling, with a primary focus in the areas of hydrodynamics, pollutant transport and fate, oil spill transport and fate, and the development of integrated modeling and monitoring systems. He has led the development of several widely used oil spill transport and fate and hydrodynamic and water quality models. He has published extensively in the field of marine environmental modeling.

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IOOS Integrated Ocean Observing System