Geophysical Research Abstracts
Vol. 14, EGU2012-2161, 2012
EGU General Assembly 2012

Stochastic Plume Simulations for the Fukushima Accident and the Deep Water Horizon Oil Spill

E. Coelho (1), G. Peggion (2), C. Rowley (3), and P. Hogan (3)

(1) University Southern Mississippi (resident at Naval Research Laboratory), Stennis Space Center, USA, (2) University of New Orleans (resident at Naval Research Laboratory), Stennis Space Center, USA, (3) Naval Research Laboratory, Stennis Space Center, USA

The Fukushima Dai-ichi power plant suffered damage leading to radioactive contamination of coastal waters. Major issues in characterizing the extent of the affected waters were a poor knowledge of the radiation released to the coastal waters and the rather complex coastal dynamics of the region, not deterministically captured by the available prediction systems. Equivalently, during the Gulf of Mexico Deep Water Horizon oil platform accident in April 2010, significant amounts of oil and gas were released from the ocean floor. For this case, issues in mapping and predicting the extent of the affected waters in real-time were a poor knowledge of the actual amounts of oil reaching the surface and the fact that coastal dynamics over the region were not deterministically captured by the available prediction systems.

To assess the ocean regions and times that were most likely affected by these accidents while capturing the above sources of uncertainty, ensembles of the Navy Coastal Ocean Model (NCOM) were configured over the two regions (NE Japan and Northern Gulf of Mexico). For the Fukushima case tracers were released on each ensemble member; their locations at each instant provided reference positions of water volumes where the signature of water released from the plant could be found. For the Deep Water Horizon oil spill case each ensemble member was coupled with a diffusion-advection solution to estimate possible scenarios of oil concentrations using perturbed estimates of the released amounts as the source terms at the surface.

Stochastic plumes were then defined using a Risk Assessment Code (RAC) analysis that associates a number from 1 to 5 to each grid point, determined by the likelihood of having tracer particle within short ranges (for the Fukushima case), hence defining the high risk areas and those recommended for monitoring. For the Oil Spill case the RAC codes were determined by the likelihood of reaching oil concentrations as defined in the Bonn Agreement Oil Appearance Code. The likelihoods were taken in both cases from probability distribution functions derived from the ensemble runs.

Results were compared with a control-deterministic solution and checked against available reports to assess their skill in capturing the actual observed plumes and other in-situ data, as well as their relevance for planning surveys and reconnaissance flights for both cases.