Backward-in-time Probabilistic Method Applied to the Golf of Mexico Oil Spill

(Talk)

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(joint work with Igor Mezić and Stefan Ivić)

The concentration of a passive tracer can be found as the solution to the boundary value problem for a linear second-order partial differential equation (PDE) of the parabolic type which includes convection and diffusion terms. An alternative to such formulation in Eulerian frame of reference, is to move to the Lagrangian frame of reference and to use probabilistic particle methods, i.e. to formulate an equivalent set of stochastic differential equations (SDEs). In addition, instead of solving SDEs forward-in-time, a backward-in-time method with spatial averaging developed by Igor Mezić and Sophie Loire can be used. Such an approach leads to important improvement in computational efficiency and eliminates difficulties emerging in other formulations.

We apply this backward-in-time probabilistic method to the problem of computing concentrations for oxygen, 26 hydrocarbons, and 52 species of bacteria in the deep Golf of Mexico during six months after the Deepwater Horizon oil spill. We compare new results to our previous results where the diffusion in parabolic PDEs was neglected therefore leading to a formulation in Lagrangian frame of reference without stochastic terms.

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