



NSF-Duke-NCSU-UNC

Joint MUMS Program Transition - SPUQ Workshop

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SPEAKER/ABSTRACT

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“Estimating Ocean Circulation Structure: Deterministic and Stochastic Simulators”

Abstract:

The state of the world oceans is a crucial factor in the understanding of our climate. However, ocean circulation cannot be measured directly, it has to be inferred from indirect observations of various tracers (oxygen, salinity, temperature, etc.) or Lagrangian data. In this talk we consider the inverse problem of inferring ocean circulation structure (water velocities, diffusion coefficients) based on tracer concentration measurements. We propose a Bayesian solution based on a quasi-horizontal flow model connecting water velocities and diffusion coefficients to tracer concentrations. The forward problem of solving the advection-diffusion equations does not have a closed form solution. In order to evaluate the likelihood function, we consider two strategies. The first one is based on a deterministic multi-grid PDE solver. The second approach is based on a stochastic solver derived using the Feynman-Kac probabilistic representation of a PDE solution. In each case an adequate Markov chain Monte Carlo sampler is used to explore the posterior distribution for the quantities of interest.