Dynamics under location uncertainty

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Fluid dynamics systems generally involve a wide range of spatio-temporal scales. Numerical representation can only simulate some of the scales. The others, at the unresolved scales of motion, must be parameterized for each type of phenomenon (wave, eddy, current), in terms of expected effects on the resolved scales. We propose a randomized fluid dynamics models referred to as models under location uncertainty (LU), where the fluid transport velocity has a time-uncorrelated noisy component. These approximations generally simplify theoretical descriptions, numerical simulations, data comparisons or more recently model error quantifications for data assimilation. We applied this framework to geophysical fluid dynamics, reduced order models for wind turbine controls, fluid mixing and wave-turbulence interaction.