Ocean Turbulence: parametrizations, uncertainty and stochasticity

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Abstract

Ocean mesoscale eddies are turbulent processes which strongly affect the strength and variability of large-scale ocean jets. Their horizontal scales, roughly 10 to 100 km, are too small to be adequately resolved in current ocean models. Representing eddy-mean flow processes in climate simulations remains a key challenge, especially quantifying the dependence of eddy effects on the underlying dynamics of the resolved flow and external forcing.

I will present new ways to diagnose, analyse and parametrize turbulent eddy effects. The work is based on the analysis of idealized and state of the art ocean models, fluid mechanics and stochastic dynamics. I will discuss novel approaches to (1) improve current numerical mixing schemes using stochastic physics and (2) develop of a new turbulence closure based on non-Newtonian flow and wind-induced turbulence. The new schemes will be shown to improve drastically the mean and variability of the ocean in coarse resolution and eddy-permitting simulations. In addition, the stochastic components represent a measure of uncertainty.

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