Numerically Modelling Stochastic Lie Transport in Quasi-Geostrophic Dynamics

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In this talk we present a stochastic parameterisation (derived from the stochastic variational approach for geophysical fluid dynamics introduced by Holm (Proc Roy Soc A, 2015)) for unresolved eddy motions in a two-layer quasi-geostrophic (QG) model in a horizontally periodic channel with forcing and dissipation. The parameterisation is based upon the idea of "transport noise", which models the modifications to the velocity field due to unresolved flow dynamics. This model assumes that the transport of large scale components is accurate, but that the velocity field used to transport these components is missing contributions from unresolved scales. We present a time-integration scheme for the stochastic QG model and describe a procedure for estimating stochastic forcing to approximate unresolved components using data from high resolution simulations. Finally, we compare the high resolution model output with the stochastic model at lower resolution and demonstrate the results of uncertainty quantification experiments.