Computing rare events in beta-plane turbulence by adaptive multilevel splitting

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Abstract

Zonal jets are known to naturally emerge from beta-plane turbulence due to the arrest of inverse energy cascade by Rossby waves. Transitions between jets of different wavenumbers are indeed observed in particular regimes showing a striking example of bimodality in the context of 2-D turbulence. As the Rayleigh dissipation and stochastic forcing are decreased these transitions become more and more rare.

The aim of this talk is to show that it is possible to compute large ensembles of reactive trajectories connecting the different metastable states even at very low probability regimes where long DNS simulations are clueless. This is achieved using an adaptive version of multilevel splitting algorithms in the full dimensional phase space of the model. Doing so enable us to distinguish Cn symmetry-breaking bifurcations as well as large deviation behavior when Rayleigh dissipation is decreased.

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