Computing rare transitions between zonal mid-latitude jets

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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 wavenumber 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 when direct numerical simulations are not possible. We use an adaptive version of multilevel splitting algorithms on a barotropic quasi geostrophic model of mid-latitude atmosphere. We are able to obtain a detailed statistical description of the high-dimensional phase space as well as the typical transitions. A large-deviation result is also obtained.