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Invariant high-order parameterization schemes

Numerical weather prediction relies on the process of averaging systems of nonlinear differential equations which leads to a closure problem: unresolved subgrid-scale terms have to be replaced by functions of the explicitly resolved variables. This process is called parameterization. In this talk we tackle the problem of finding invariant parameterization schemes for geostrophic eddies in a barotropic ocean model. As a model we consider the system of incompressible inviscid two-dimensional Euler equations on the beta plane. The parameterization used for the eddy vorticity flux and eddy energy flux are of one-and-a-half order type, as we also consider the equation for turbulent kinetic energy in the closure schemes. By preserving the infinite dimensional maximal Lie invariance group of our model we construct invariant higher-order closure schemes. We carry out numerical experiments to assess the performance of the invariant scheme versus that of the non-invariant scheme.