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Analyzing Spectral Fluxes in Wind-Driven Gyres using Wavelets

The dynamics of wind-driven gyres are complex. Energy is input at the planetary scales, it cascades downwards to smaller length scales and eventually dissipates at molecular scales. Many models have been used to study this physical problem. Recently, we have performed a series of numerical simulations of a Rotating Shallow Water model (RSW) that resolves a wider range of scales than have been previously performed (the planetary scales, the mesoscales and some aspects of the sub-mesoscale.)

For periodic domains, computing the energy spectra and spectral fluxes is relatively straight forward using Fourier methods. This is more complicated for flows in a basin that are inherently inhomogeneous in nature. Here, we present a Wavelet based method that is advantageous over Fourier methods in that it allows for both better resolution of the large scales and furthermore provides spatially localized spectral information. These techniques show great promise and could readily be applied to better understand the dynamics of inhomogeneous flows in the world's oceans.