



Observations of the Energy Cascades in the Oceanic Mesoscale

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A fundamental prediction of the nonlinear dynamics of quasi-two-dimensional flows, such as the ocean and atmosphere, is the counter intuitive inverse cascade of energy from smaller to larger spatial scales, both in the horizontal and vertical. On a beta-plane, this energy cascade is predicted to be inhibited in the meridional direction, for scales larger than the Rhines scales, leading to an anisotropy on the large scales. Many observed phenomena in the ocean are attributed to such fundamental processes. Only in the last few years have multiple satellite altimeter missions provided oceanic observations over a sufficient range of scales to allow the diagnosis of the spectral flux of energy from scales slightly smaller than the deformation radius to much larger scales. We review these measurements, and their robustness to the range of scales resolved, and to measurement noise. We also show evidence of the anisotropic cascade, and relate this to instability processes and to zonal jet formation in the upper ocean.