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An ensemble-based eddy and spectral analysis, with application to the Gulf Stream

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The 'eddy' ocean, recognized for several decades, has been the focus of much observational and theoretical research. We here describe a generalization for the analysis of eddy energy, based in the use of ensembles, that addresses two key related issues: the definition of an 'eddy' and the general computation of energy spectra. An ensemble identifies eddies as the unpredictable component of the flow, and permits the scale decomposition of their energy in inhomogeneous and non-stationary settings. It also avoids the 'tapering' or 'windowing' of the data required by traditional approaches. We apply the analysis to a mesoscale resolving (1/12 degree) ensemble of the separated North Atlantic Gulf Stream. Our results show that the eddies are consistent with the theoretical predictions of quasi-geostrophy both at the surface and ocean interior.