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Data-adaptive harmonic analysis of high-dimensional oceanic turbulent flows

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Oceanic turbulent flows consist of complex motions (fronts, eddies and waves) that co-exist on many different spatio-temporal scales and nonlinearly interacting with each other. In this study data-adaptive harmonic decomposition (DAHD) has been applied to high-dimensional datasets of complex turbulent flows simulated by ocean models of different complexity. DAHD allows a low-rank description of multiscale and chaotic dynamics by a small subset of data-adaptive patterns oscillating harmonically at given temporal frequency. The shape and scaling laws of temporal energy spectrum of the extracted patterns reveal global fingerprint of underlying dynamics, providing new opportunities to characterize and compare oceanic datasets and models.

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