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A Novel Method to Unravelling Energy Pathways in the Ocean

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Large-scale currents and eddies pervade the ocean and play a prime role in the general circulation and climate. The coupling between scales ranging from $O(10^4)$ km down to $O(1)$ mm presents a major difficulty in understanding, modeling, and predicting oceanic circulation and mixing, where the energy budget is uncertain within a factor possibly as large as ten. Identifying the energy sources and sinks at various scales can reduce such uncertainty and yield insight into new parameterizations. To this end, we refine a novel coarse-graining framework, which accounts for the spherical geometry of the problem, to directly analyze the coupling between scales. We apply these tools to strongly eddying high-resolution simulations using LANL's Parallel Ocean Program (POP).