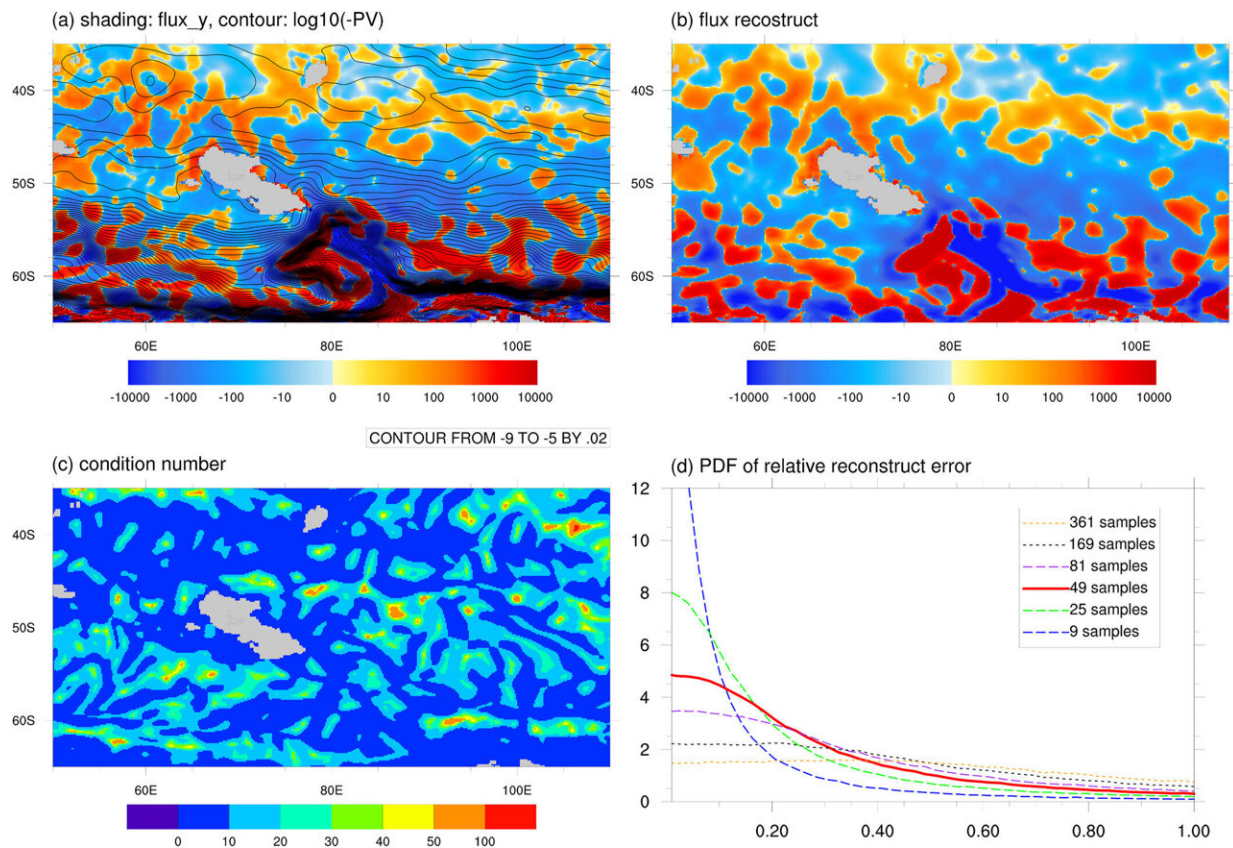


New diagnostic framework offers insights into ocean eddy transport in Southern Ocean

July 24 2023, by Li Yuan



(a) The meridional sub-filter potential vorticity (PV) flux and PV contour, (b) the reconstructed flux (unit: 10^{-13} kg/(m⁴ s)), (c) the condition number of PV gradient matrix, (d) the probability density function of relative reconstruct error using different number of sample. (d) is for the whole Southern Ocean State Estimate domain and other panels are for the selected region. (b, c) use 49 samples. Credit: *Journal of Advances in Modeling Earth Systems* (2023). DOI: 10.1029/2023MS003728

Scientists from the Institute of Atmospheric Physics (IAP) of the Chinese Academy of Sciences have developed a new diagnostic framework to better understand and analyze the intricate isoneutral oceanic mesoscale eddy transport in the vast Southern Ocean. The study was published in *Journal of Advances in Modeling Earth Systems* on July 8.

Mesoscale eddies, which contain most of the [ocean](#) kinetic energy, impact ocean material [transport](#), momentum budget, and interactions with large-scale and submesoscale ocean circulation.

The study offers a more nuanced perspective on [eddy](#) potential vorticity (PV) transport dynamics. "In this new framework, we introduce Leonard's decomposition in large eddy simulations and the stationary-transient decomposition to create a more holistic picture of the transport by ocean eddies," said Xie Jingwei, a Ph.D. candidate at IAP and first author of the study.

Originally proposed for atmospheric flows in the 1960s, large eddy simulation (LES) has become a highly promising and successful method for simulating turbulent flows, especially when integrated with large-scale ocean modeling. This research also introduces several LES concepts, hoping to enlighten any potential ocean modeling and parameterization.

The researchers applied their [diagnostic method](#) to realistic model data of the Southern Ocean and investigated the eddy transport regarding scale dependence, potential enstrophy, and anisotropy. "By systematically investigating the multiscale dynamic properties in the generalized eddy PV flux and its corresponding PV transport tensor, our study could provide theoretical support for any potential parameterization," said Xie.

While the diagnostic framework may seem highly technical, its appropriate application may help to fill knowledge gaps between ocean dynamics and ocean modeling.

More information: Jingwei Xie et al, A Multifaceted Isonutral Eddy Transport Diagnostic Framework and Its Application in the Southern Ocean, *Journal of Advances in Modeling Earth Systems* (2023). [DOI: 10.1029/2023MS003728](https://doi.org/10.1029/2023MS003728)

Provided by Chinese Academy of Sciences

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