climate model biases in ocean currents, stratification, and transport.

- New York University (Supervised by Laure Zanna): Unification of buoyancy and tracer closures; Assessment and parameterization of vertical energy structure; Parameterization of the grey zone. More information and application at https://apply.interfolio.com/68119.
- University of Colorado, Boulder (Supervised by Ian Grooms): Assessment of 2D eddy energy equation; parameterization of eddy energy transport; parameterizing dissipation in the eddy energy equation. More information and application are at https://iobs.colorado.edu/iobs/JobDetail/?lobId=20799.
- Woods Hole Oceanographic Institution (Supervised by Sylvia Cole): Characterizing scale-dependent EKE from observations; quasi-3D eddy buoyancy and momentum statistics from observations; analysis of vertical eddy structure in observations; synthesis of observations. More information and application are at

https://careers.whoi.edu/opportunities/view-all-openings/science-research/ (position 19-08-09).

nt of research for positions in cation to each

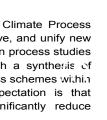
or any of the

Princeton University (Supervised by Alistair Adcroft): Implementation and assessment of extant
parameterizations of mesoscale eddies in process, idealized and global ocean models;
consistent and optimized formulation of closures; development and assessment of improved
and unified closures; evaluation of new closures in climate models. More information and
application at https://www.princeton.edu/acad-position/13701.

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Energy (CPT)

EKERGY CPT



Boulder

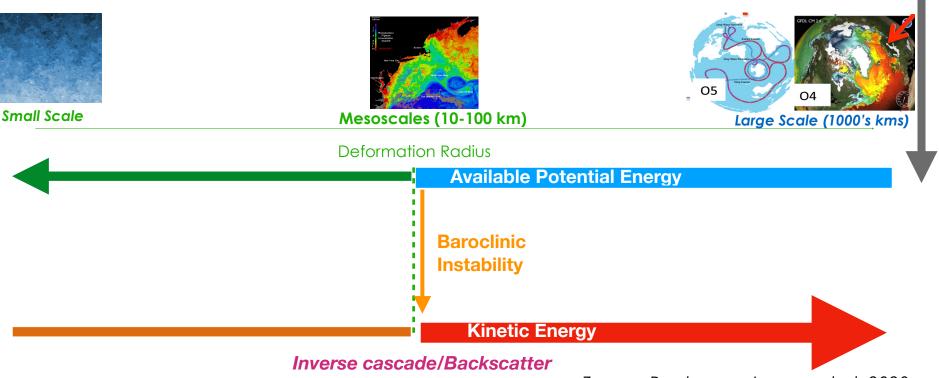
tracer closures;



https://ocean-eddy-cpt.github.io/

Energy Cycle & Mesoscale Eddies

- Sources, sinks and transfer of energy across scales are key to maintain the circulation & transport in the ocean (e.g., Wunsch & Ferrari 2004; Ferrari & Wunsch 2009)
- Mesoscale eddies are a major player in the energy cycle:
 - ➡ extract energy from the mean flow
 - ➡ form the bulk of the kinetic energy in the ocean
 - ➡ transfer of kinetic energy across scales



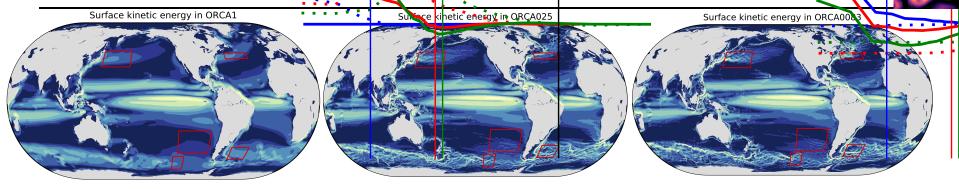
Zanna, Bachman, Jansen et al. 2020 adapted from Salmon, 1998 & Vallis, 2006



Wind + Buoyancy

Work

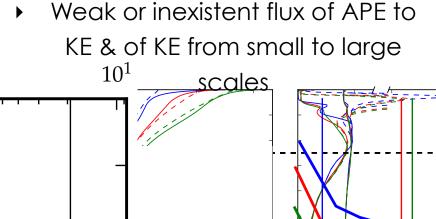
Symptoms of missing mesoscale eddy energy in GGAs

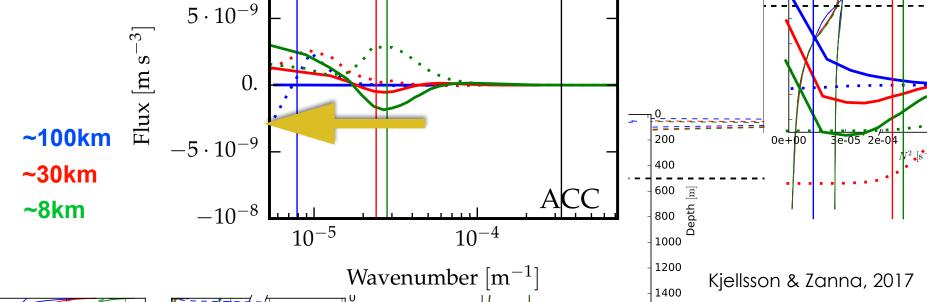


 10^{2}

• Lack of kinetic energy at all scales

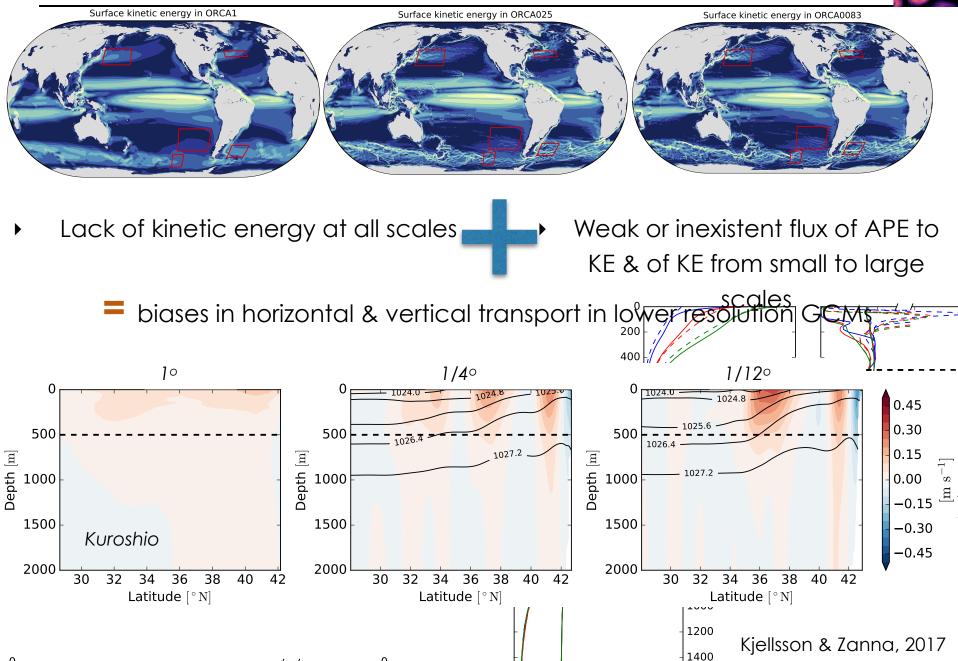
 10^{-8} 10^{3}





Symptoms of missing mesoscale eddy energy in GCMs







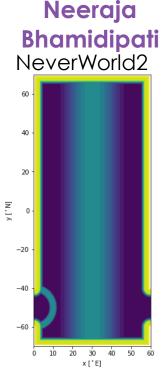


- How:
 - Evaluate existing & future parameterizations of ocean mesoscale

Parameterization of ocean eddies: Potential vorticity mixing, end and Arnold's first stability theorem	erçotion
David P. Marshall ^{a,*} , Alistair J. Adcroft ^b	Energy budget-based backscatter in an eddy permitting primitive equation model
Scale-aware deterministic and stochastic parametrizations of eddy-mean flow interaction	Malte F. Jansen ^{a,b,c,*} , Isaac M. Held ^{b,c} , Alistair Adcroft ^{b,c} , Robert Hallberg ^{b,c}
Laure Zanna ^{a,*} , PierGianLuca Porta Mana ^b , James Anstey ^a , Tomos David ^a , Thomas B	The GM+E closure: A framework for coupling backscatter with the Gent and
	McWilliams parameterization
A scale-aware subgrid model for quasi-geostrophic turbulenc	Scott D. Bachman * National Center for Atmospheric Research, Boulder, CO, USA
Scott D. Bachman ¹ ⁽¹⁾ , Baylor Fox-Kemper ² ⁽¹⁾ , and Brodie Pearson ²	
Effects of vertical variations of thickness diffusivity in an ocean general circulation model	[©] Implementation of a Geometrically Informed and Energetically Constrained Mesoscale Eddy Parameterization in an Ocean Circulation Model J. MAK
Gokhan Danabasoglu ^{a,*} , John Marshall ^b Uni	fied CPT-eddy energy parametrization (202?)

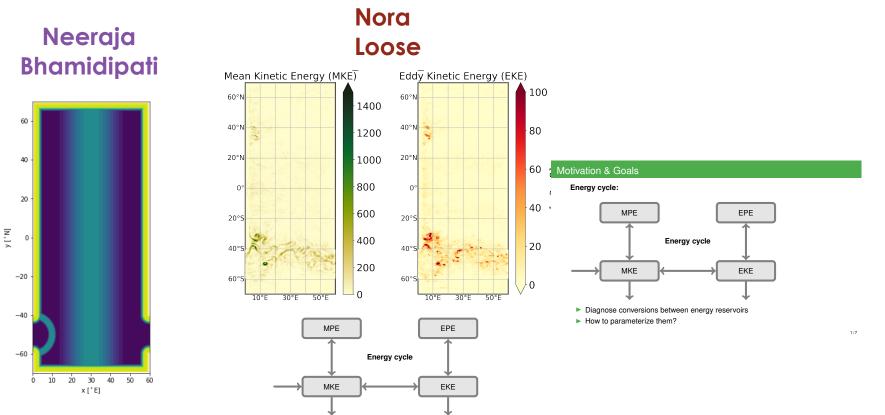


- How:
 - Evaluate existing & future parameterizations of ocean mesoscale in a new idealized configuration — NeverWorld 2 — & global models



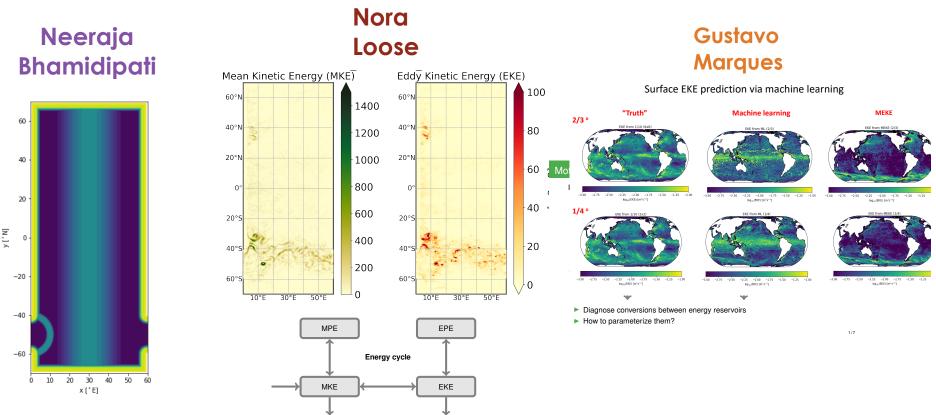


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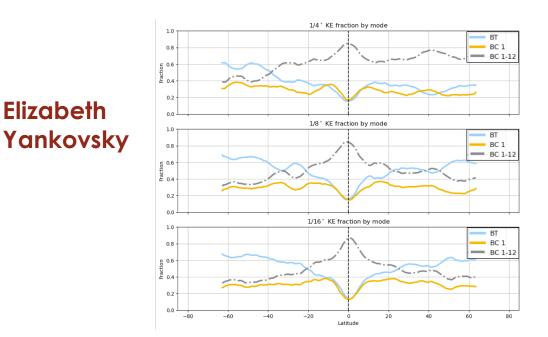


- How:
 - Evaluate existing & future parameterizations of ocean mesoscale in a new idealized configuration — NeverWorld 2 — & global models





- How:
 - Evaluate existing & future parameterizations of ocean mesoscale in a new idealized configuration — NeverWorld 2 — & global models
 - Unify closures of momentum & buoyancy through energy pathways

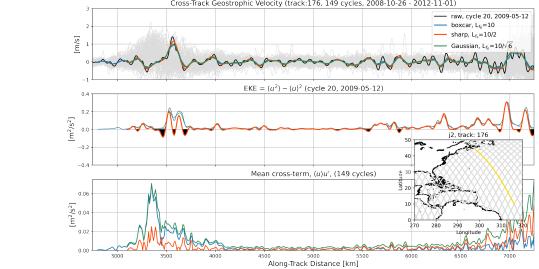




Increase the fidelity of the large-scale transport representation in IPCC-class models by unifying energetics & mesoscale eddy closures of buoyancy & momentum for a robust resolution-, scale- & flow-aware implementation

- How:
 - Evaluate existing & future parameterizations of ocean mesoscale in a new idealized configuration — NeverWorld 2 — & global models
 - Unify closures of momentum & buoyancy through energy pathways
 - Curate observational diagnostics for model evaluations and constraining parameterizations
 Cross-Track Geostrophic Velocity (track:176, 149 cycles, 2008-10-26 - 2012-11-01)

Jake Steinberg



Oc

Increase the fidelit unifying energetics



Multiple postdoctoral research positions are available as part of a multi-institution Climate Process Team (CPT) on Ocean Transport and Eddy Energy. The CPT aims to survey, improve, and unify new advances in energy-, flow-, and scale-aware parameterizations of mesoscale eddies, in process studies and global ocean models; constrain parameters and parameterized fluxes through a synthesis of up-to-date observations of ocean energetics and transport; and implement and assess schemes within IPCC-class climate models at NCAR, NOAA-GFDL, and DOE-LANL. The expectation is that modernized, energetically-consistent mesoscale eddy parameterizations will significantly reduce climate model biases in ocean currents, stratification, and transport.

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- https://careers.whole.ddu/opportunities/view-all-opening/science-research/ (position 19-08-09).
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Climate Process Team on Ocean Transport and Eddy Energy

National Oceanographic and Atmospheric Administration and the National Science Foundation



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Energy (CPT)

EKERGY

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.github.io/

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