

Relating excess and redistributed heat in the global subtropics

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$$\frac{\partial T'}{\partial t} = F' - \bar{\mathbf{v}} \cdot \nabla T' - \mathbf{v}' \cdot \nabla \bar{T} + \mathbf{v}' \cdot \nabla T' + D'_{mix}$$

$$\mathbf{v}' \propto \nabla T'$$

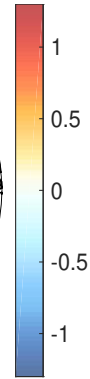
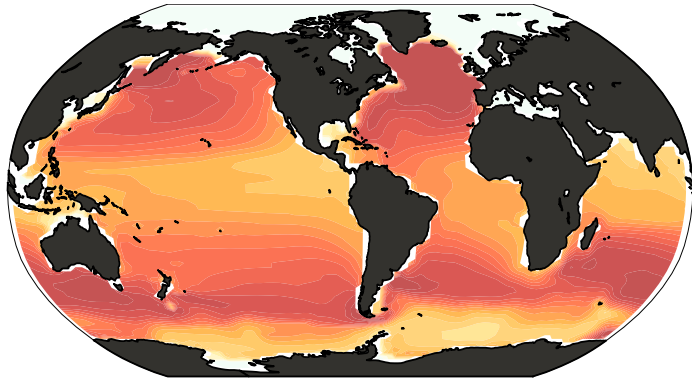
Hypothesis: changes in velocity are geotropically-balanced with changes in $\nabla T'$

1) Do advection changes ($\mathbf{v}' \nabla T$) dominate heat redistribution between the tropics and subtropics? Yes!

2) Can we recover $\mathbf{v}'$ from anomalies in temperature (are they geotropically balanced with $\nabla T'$)? Yes!

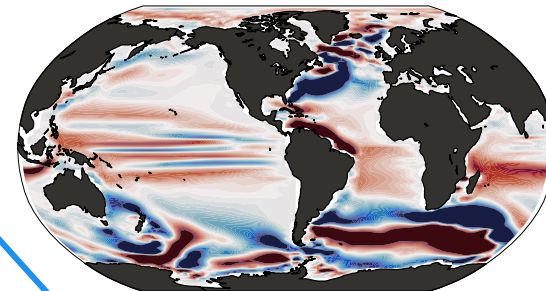
Excess heat in UVic (2100)

$(Jm^2)_{0^{10}}$

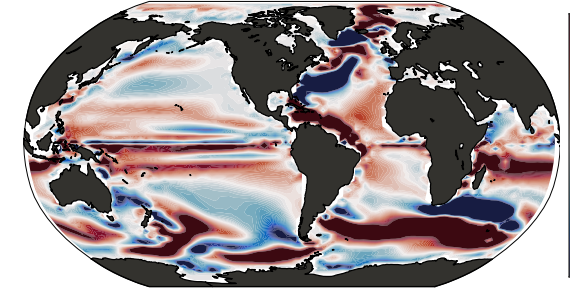


Correlation ≈ -0.85

Zonal transport anomaly (avg. 2050-2100 in Sv)



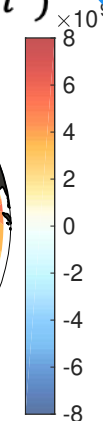
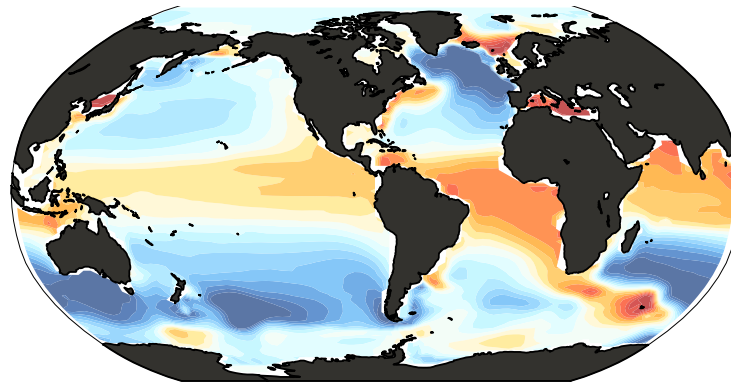
Thermal-wind estimate (Sv)



Motivation: what sets patterns of ocean warming heat storage?

How/why are excess heat (passively added, resulting from SST anomalies) and redistributed heat patterns related?

Redistributed heat in UVic (2100) $(Jm^2)_{\times 10^9}$



Summary:

- Excess and Redistributed heat patterns are not independent!
- Their patterns co-evolve due to geostrophic link between temperature and velocity.
- Heat redistribution acts to smooth gradients in excess heat throughout the pycnocline.

Thank you!!