Engaging physical oceanographers in ECCO

Give three examples:

CLIMODE KESS	—	Subtropical mode water
DIMES	—	mixing in the southern ocean
THEORY	—	GFD applications to understand waves/turbulence in ocean

Using state estimates produced by Gael Forget at MIT.

Gael Forget deployed ECCO adjoint technology to fit a coarse resolution ocean model to Argo data and altimetry etc etc, to produce an 'atlas' that's been given the name OCCA.

OCCA was then used by Matt Mazloff and Patrick Heimbach to initialize an eddying model of the southern ocean and constrain that model with Argo.

OCCA is also being used in the CLIMODE/KESS projects and for a comprehensive studies of the linear baroclinic instability properties of the global ocean

Atlantic mode water

CLIMODE

Marshall et al, 2009, BAMS

Maze et al, 2009. JPO

Forget et al, 2009. JPO

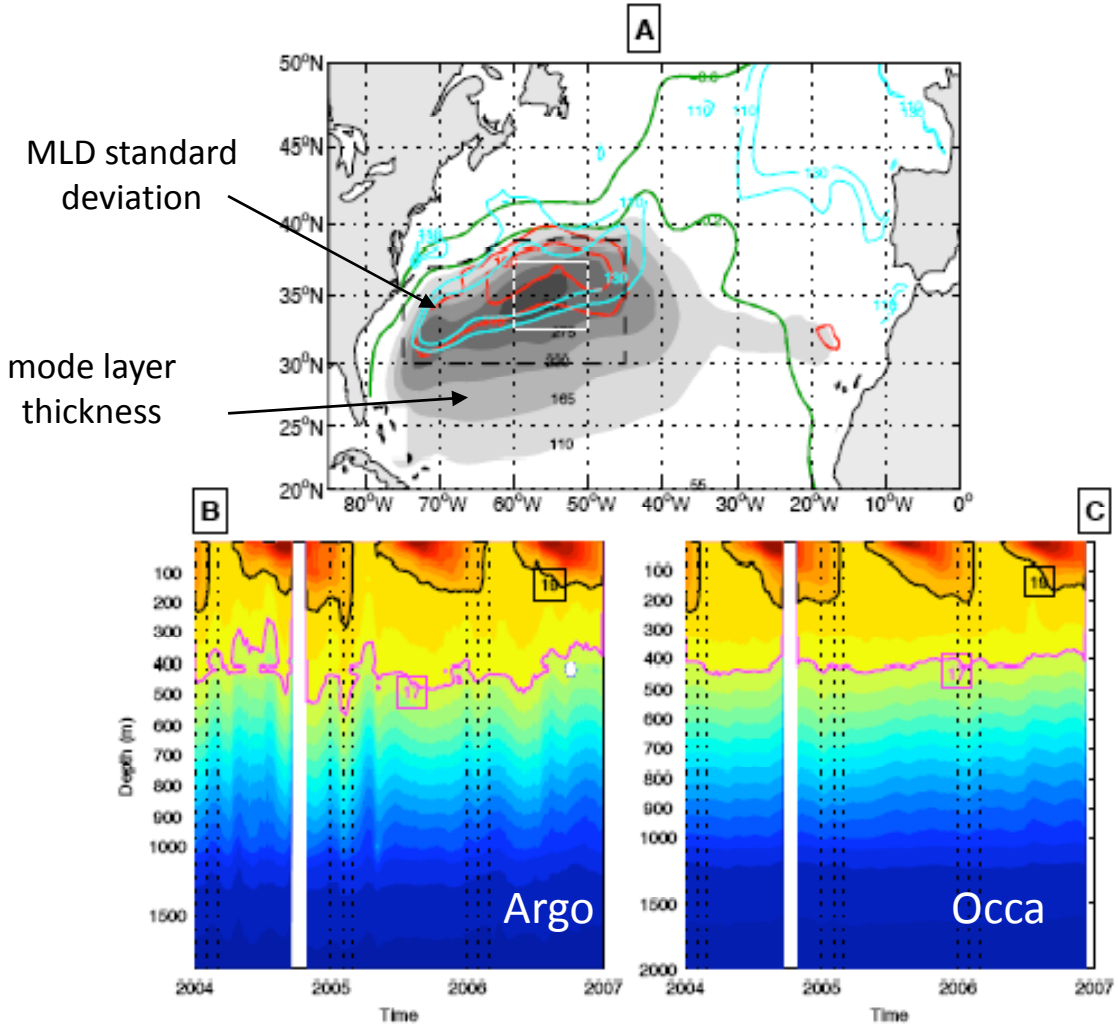
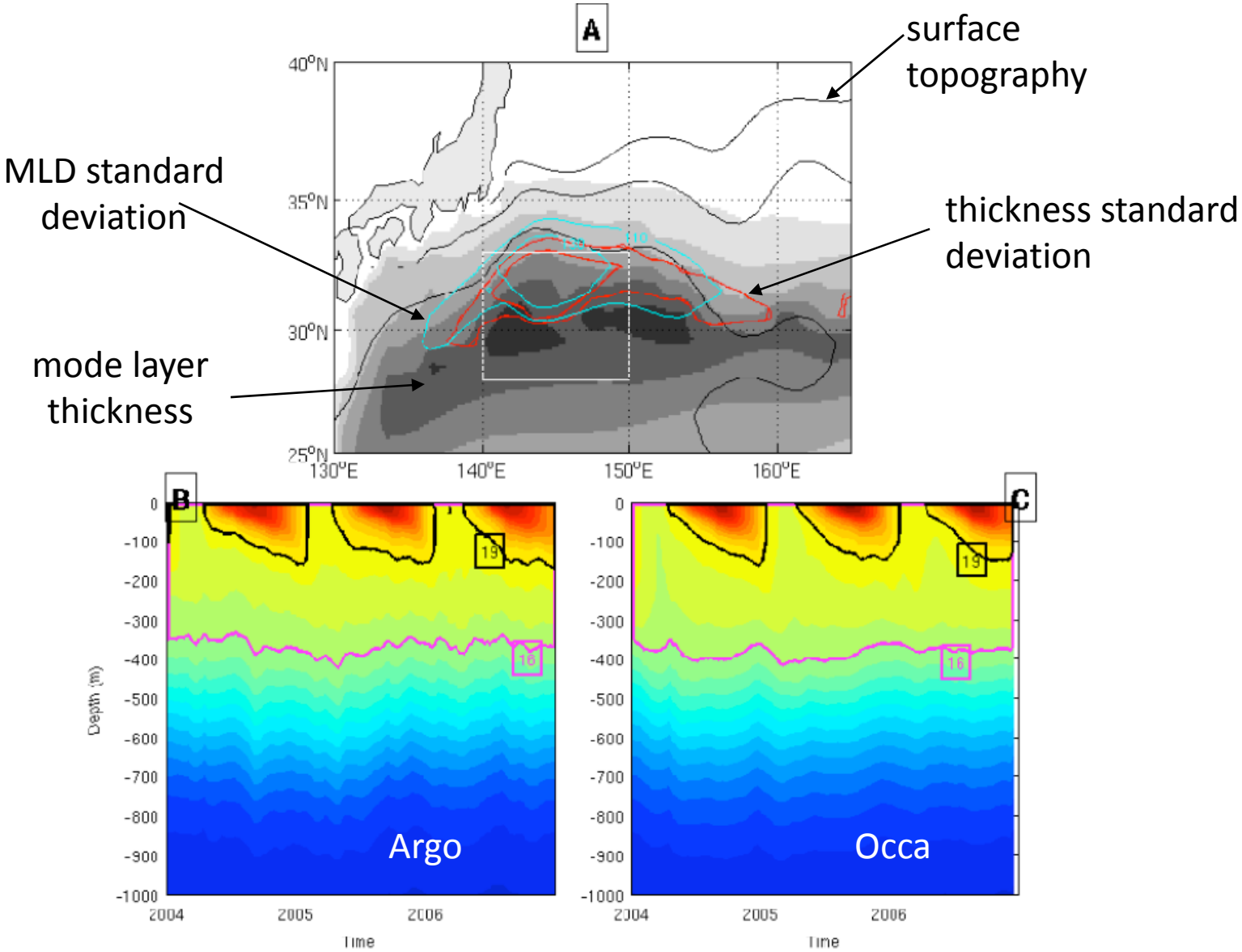
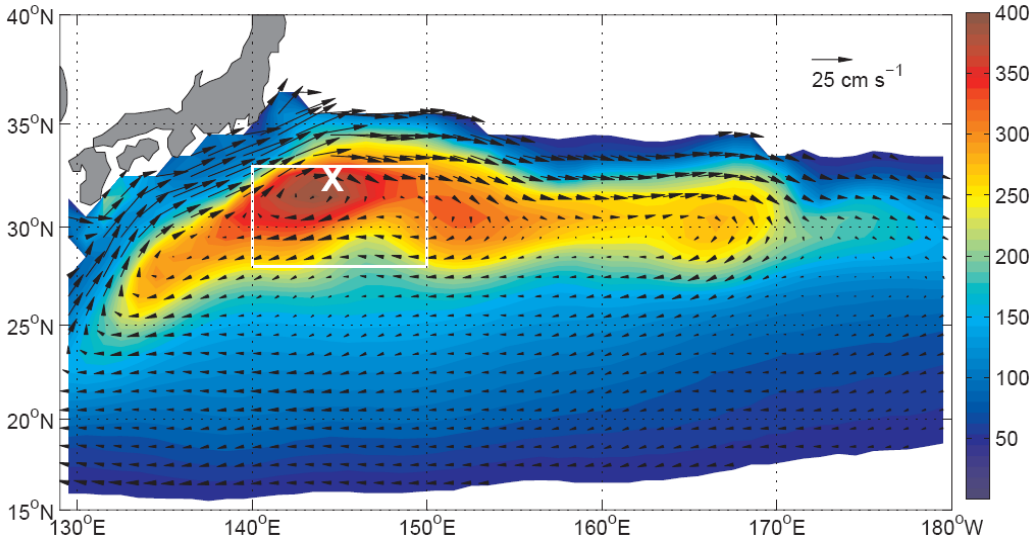


Figure 1: Panel A: Observed three years (2004-2006) mean characteristics of the $18 \pm 1^{o}C$ layer in the OCCA dataset. Mean thickness (shaded gray), monthly thickness standard deviation (red contours) and mixed layer depth standard deviation (blue contours). The two thick green contours are mean SSH (-0.2m;-0.6m), chosen to mark the arc of the subtropical and subpolar gyre. The box marked by the black dashed line encloses the main formation area of NASTMW (see section d). In Panel B: Every Argo profile within the $10^{o} \times 5^{o}$ white box centered on 35N/55W shown in panel A, is plotted as a function of time, beginning in January 2004 and ending in December 2006. The white bar indicates a period of time when there were no profiles. The $19^{o}C$ and $17^{o}C$ isotherms, enhanced in black and magenta, are plotted. The first day of January, February and March in each of the years is indicated by the vertical dotted lines. Panel C: As in Panel B but sampling the OCCA data set to mimic Argo profiles.

Pacific mode water

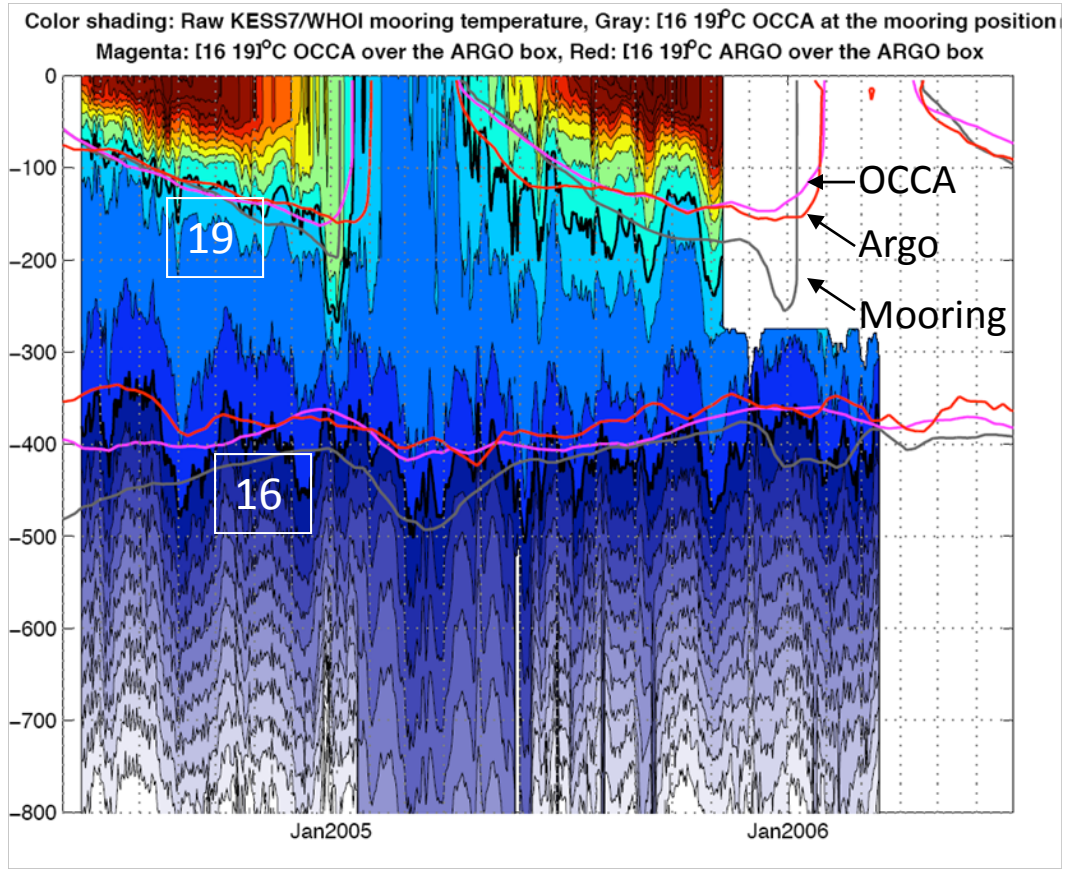
KESS





thickness of mode water layer

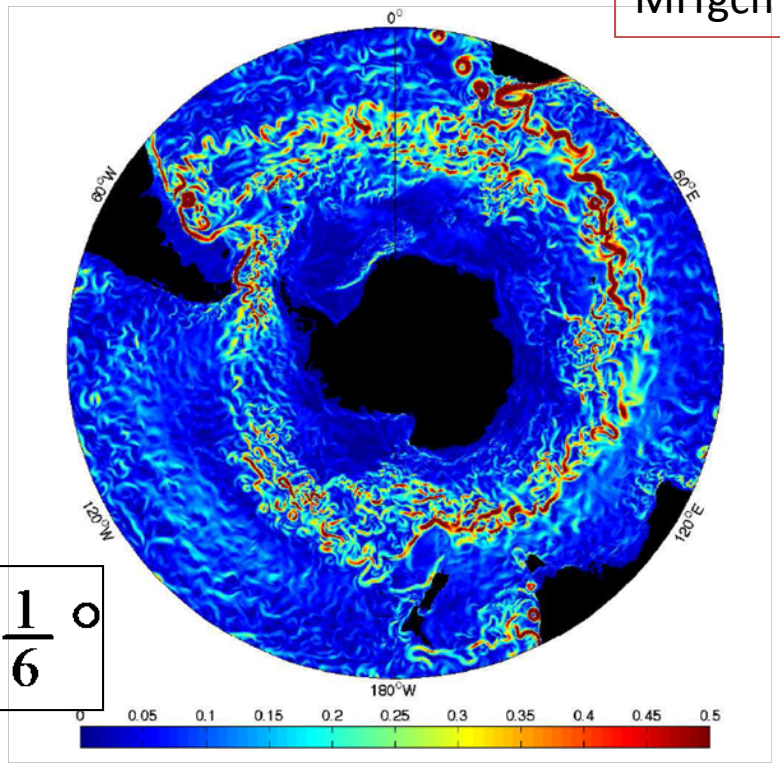
Kess mooring



Maze et al, in preparation

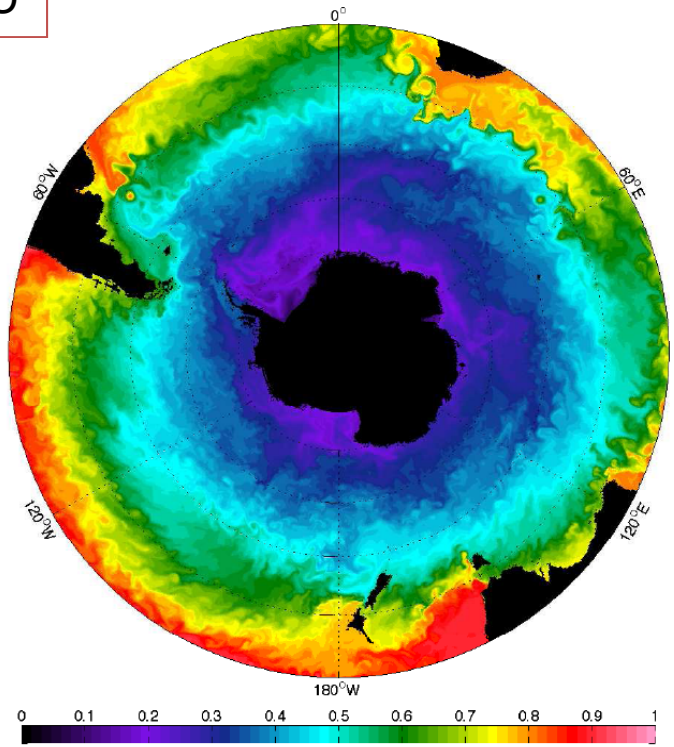
Effective diffusivities estimated from an eddy resolving model constrained by observations

MITgcm + ECCO



$\frac{1}{6}° \times \frac{1}{6}°$

Surface current speed

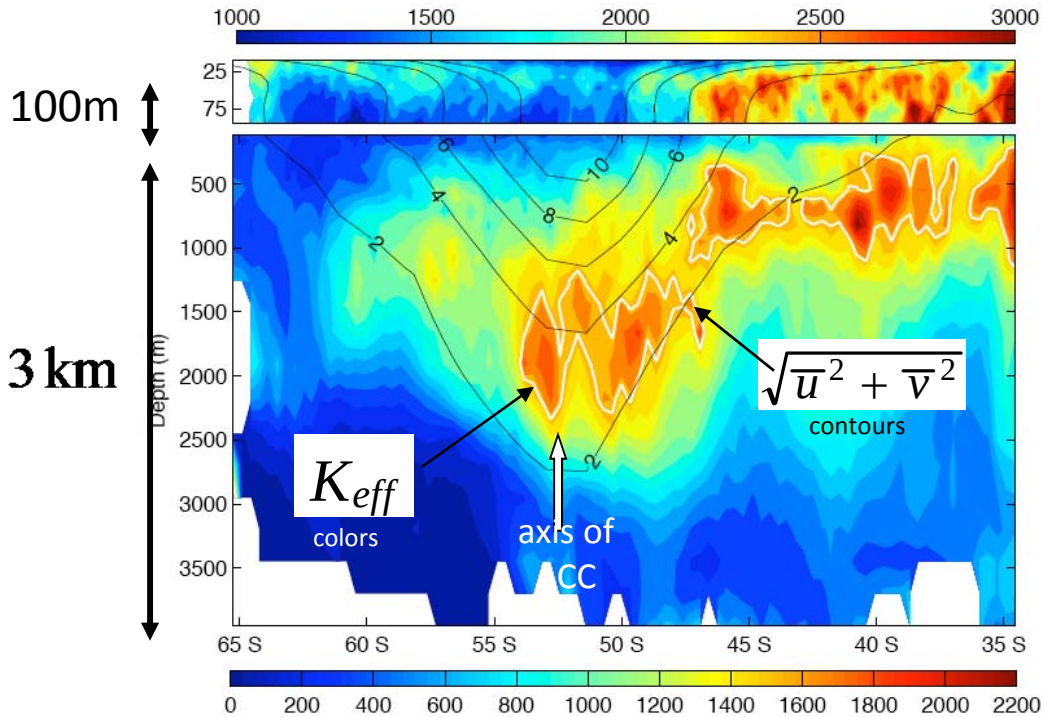


Surface tracer distribution

$$\frac{\partial q}{\partial t} + \mathbf{v} \cdot \nabla q = k \nabla^2 q$$

carry out calculation in 3-dimensions

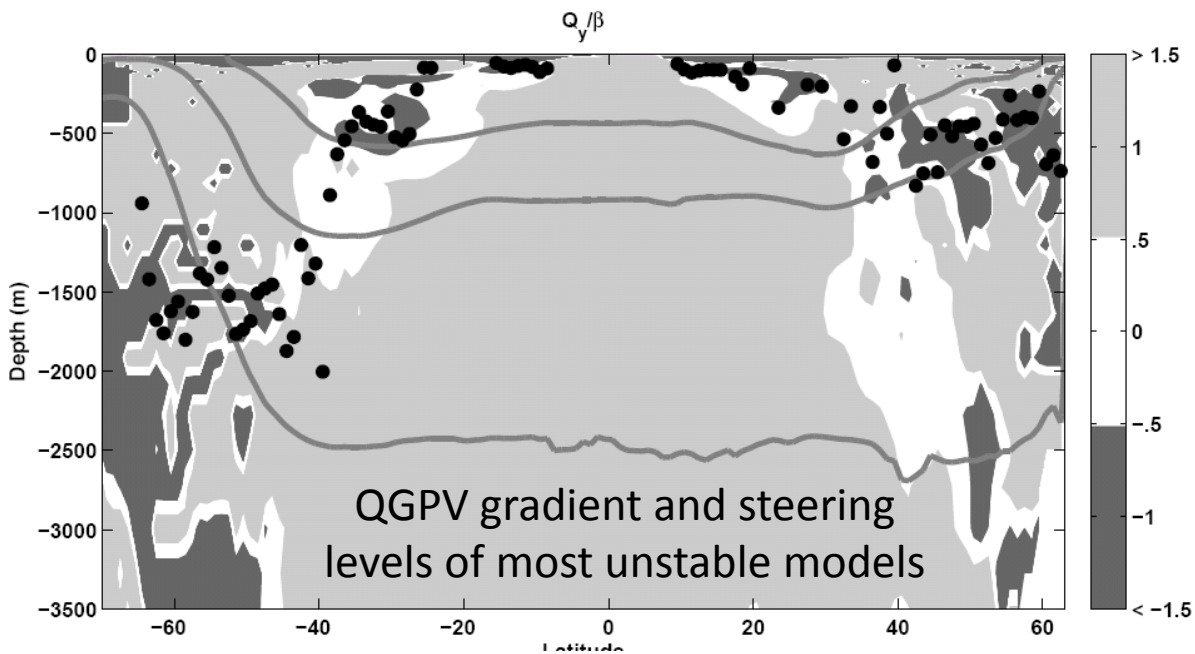
Ryan Abernathey, John Marshall
Matt Mazloff, Emily Shuckburgh
Patrick Heimbach

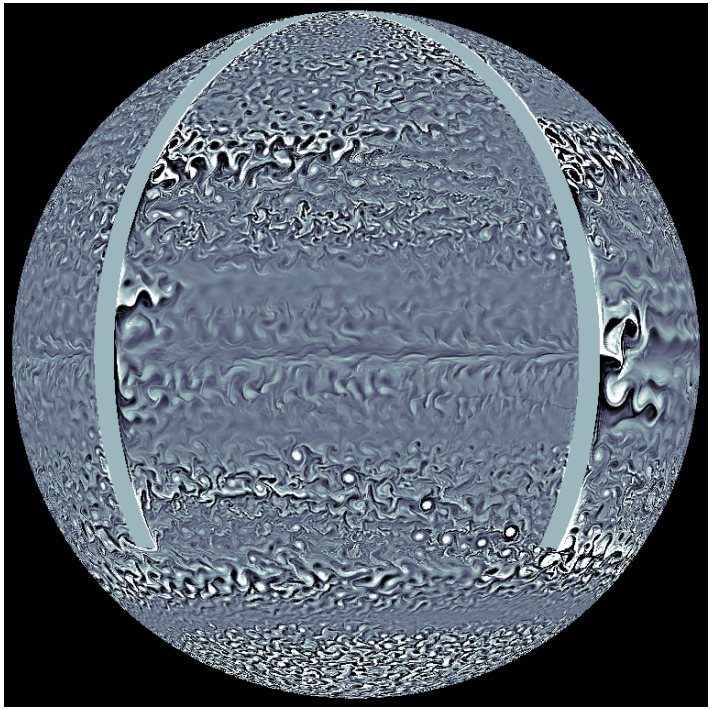
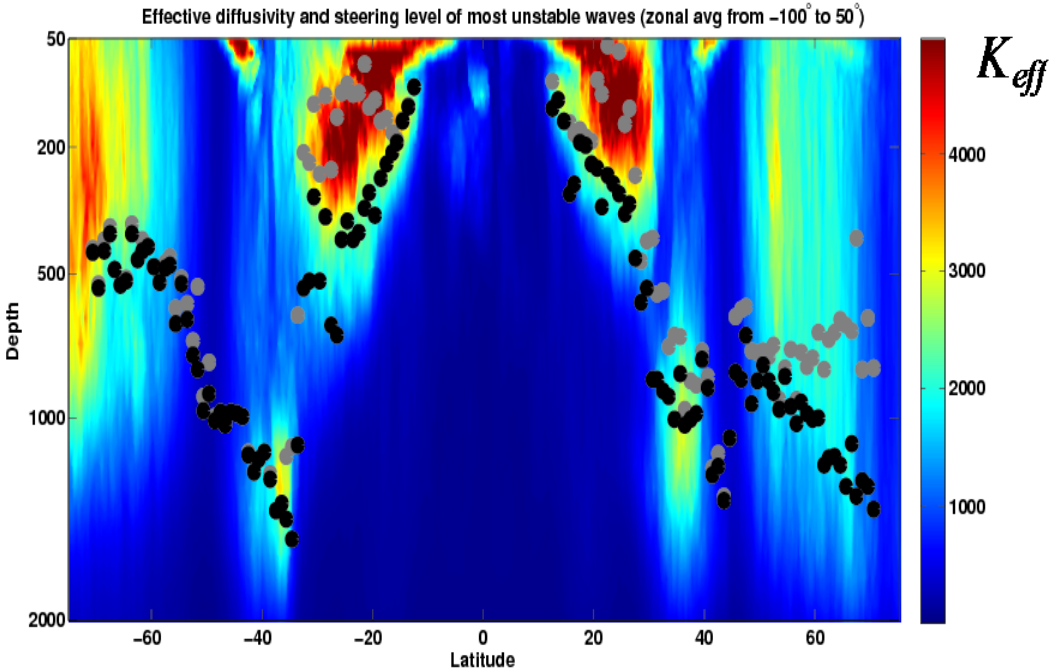


Abernathey et al, 2009, JPO

Scales, growth rates and spectral fluxes of baroclinic instability in the ocean
Tullock et al, 2009: submitted to JPO

Uses Forget's atlas



QGPV/beta

C520 ECCO grid run in pure gfd mode