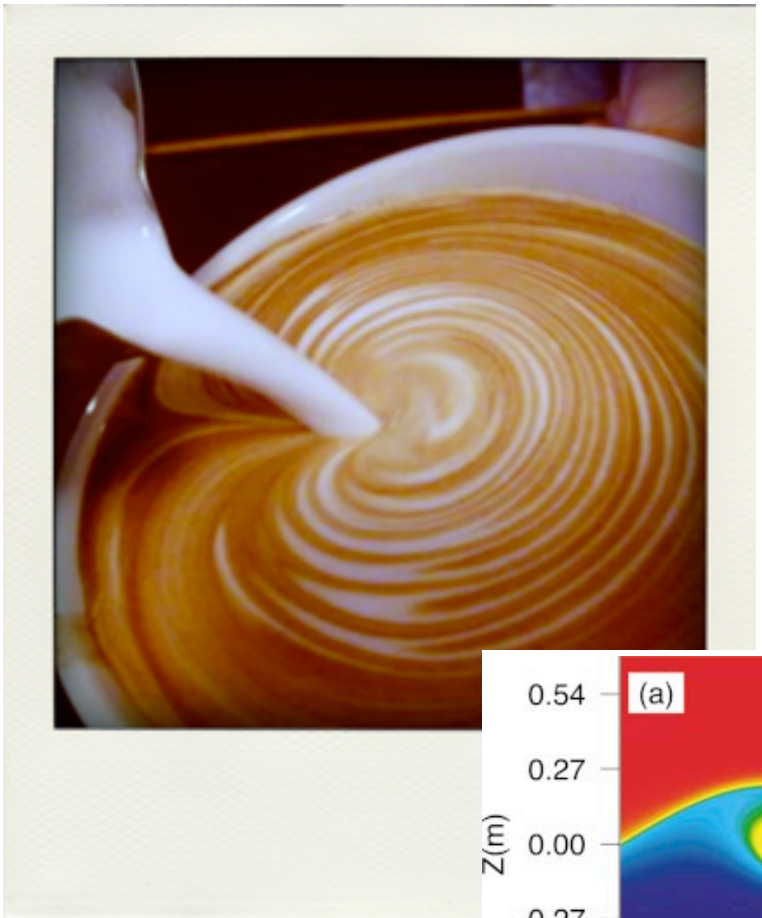
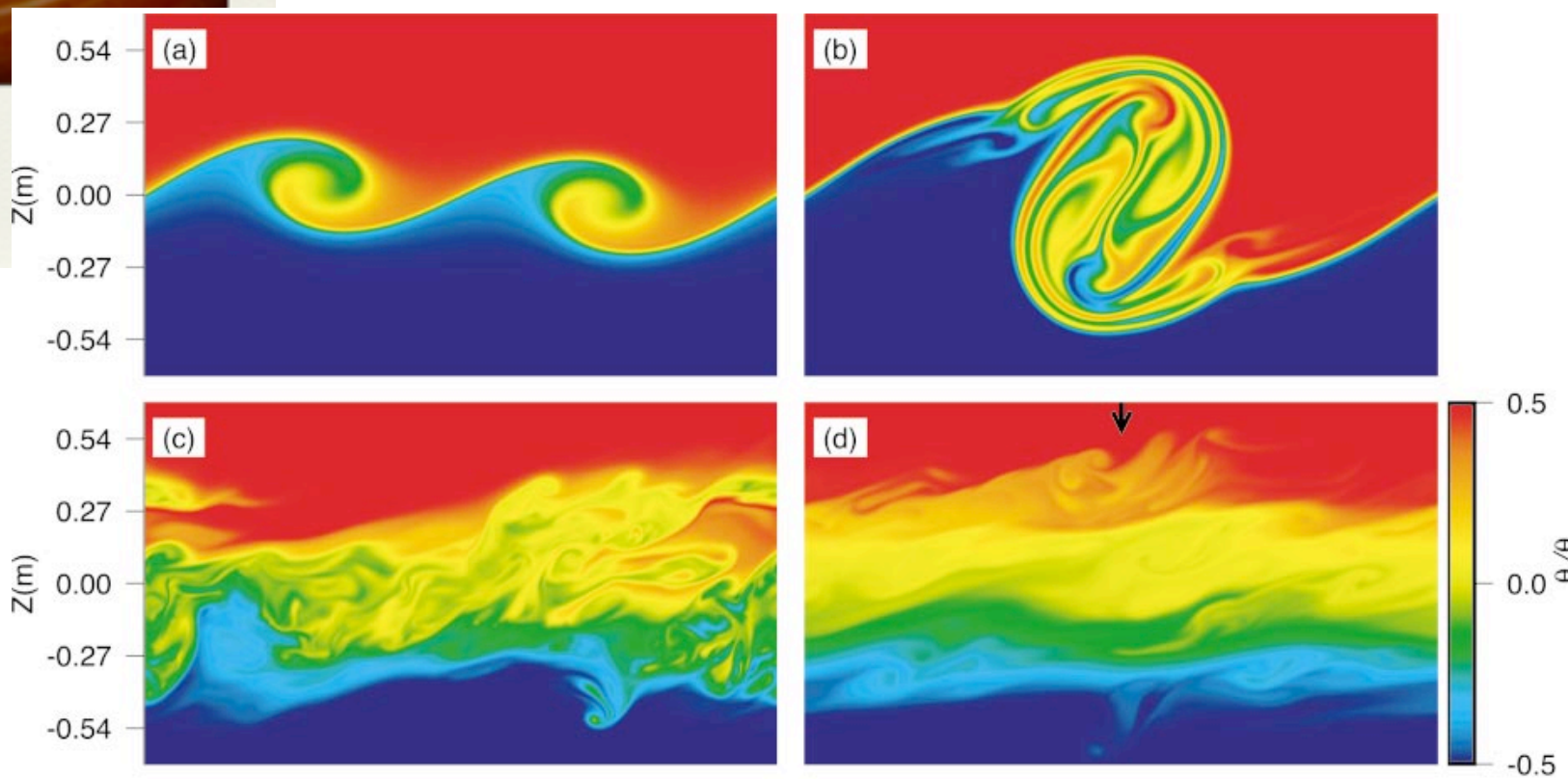



(a)
(b)
(c)
(d)
0.54
0.27
0.00
-0.27
-0.54
Z(m)
0.5
0.0
-0.5

modeled flow in the southern ocean

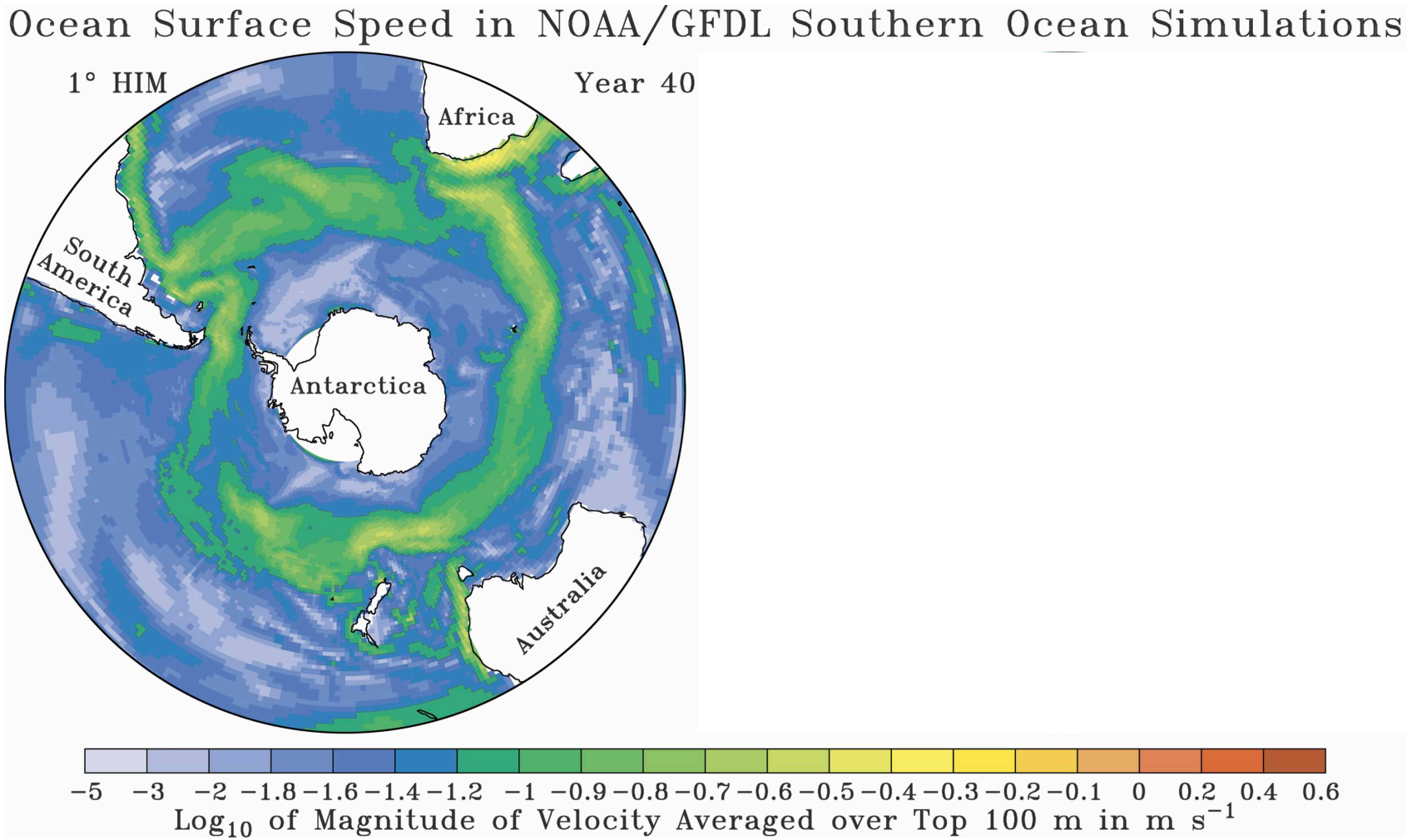


FIG. 6. Instantaneous surface speed in 1° and ⅙° models after 40 yr. Note that the large-scale structure of the 1° model is quite similar to the ⅙° model (the currents have similar locations and have similar horizontal extents). The main difference is in the presence of intense jets and eddies in the ⅙° model.

modeled flow in the southern ocean

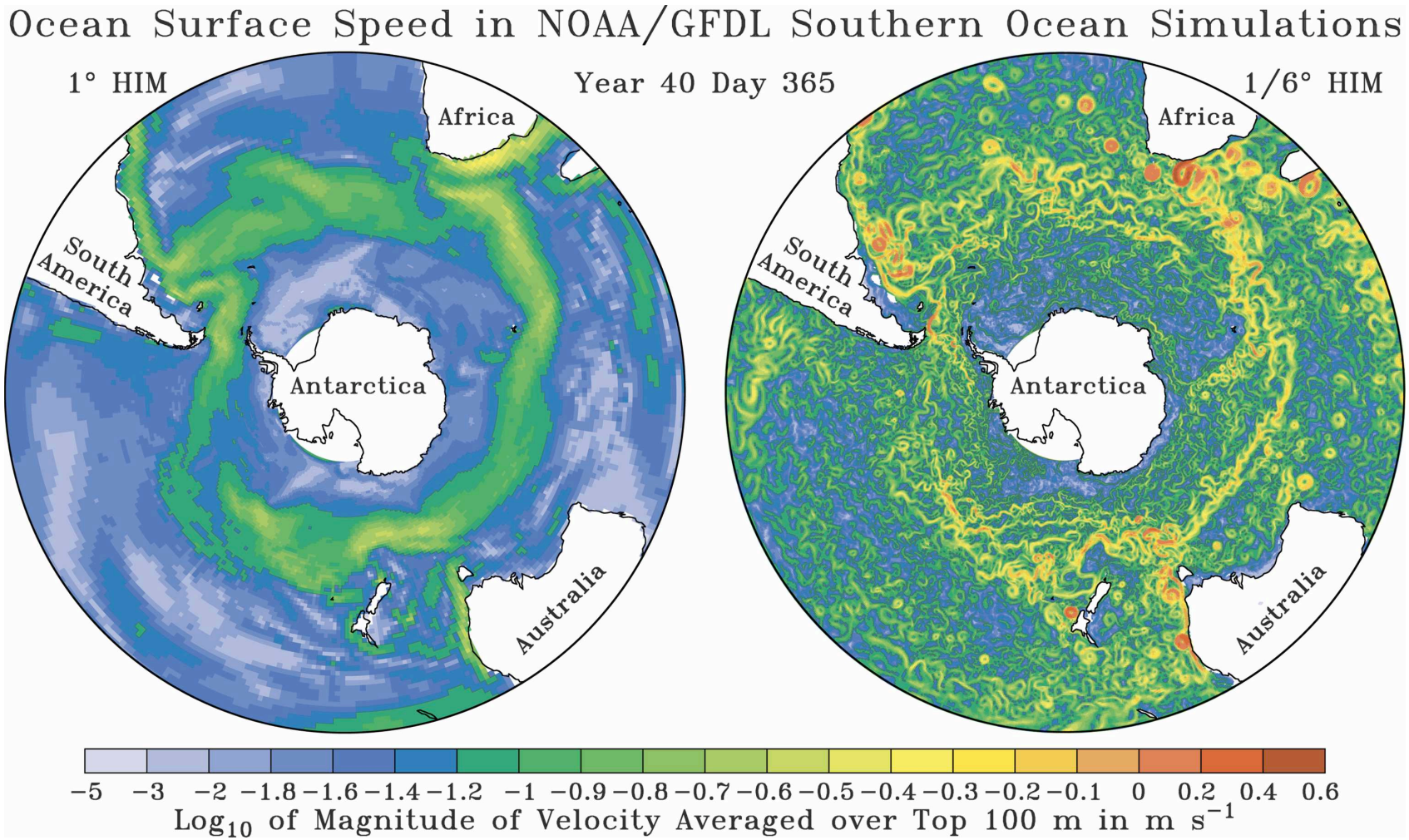
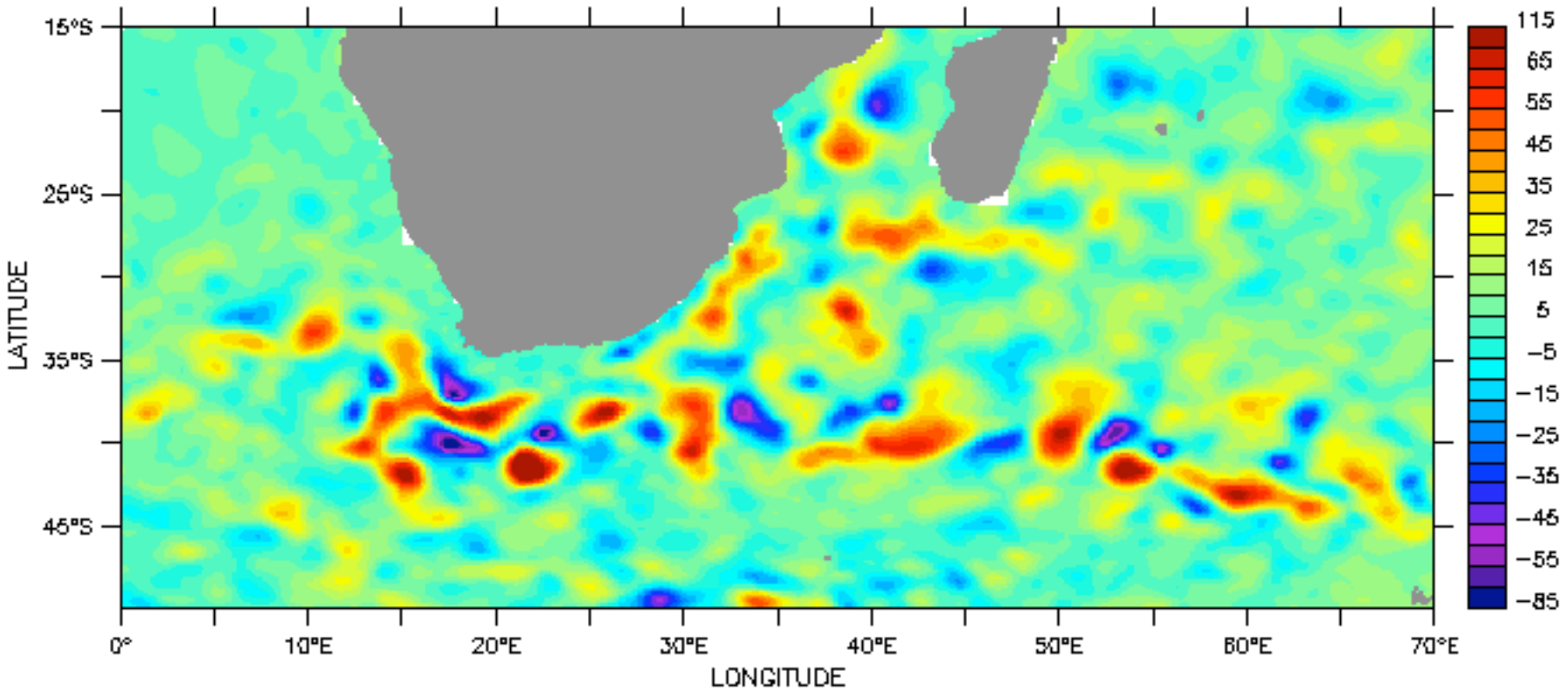


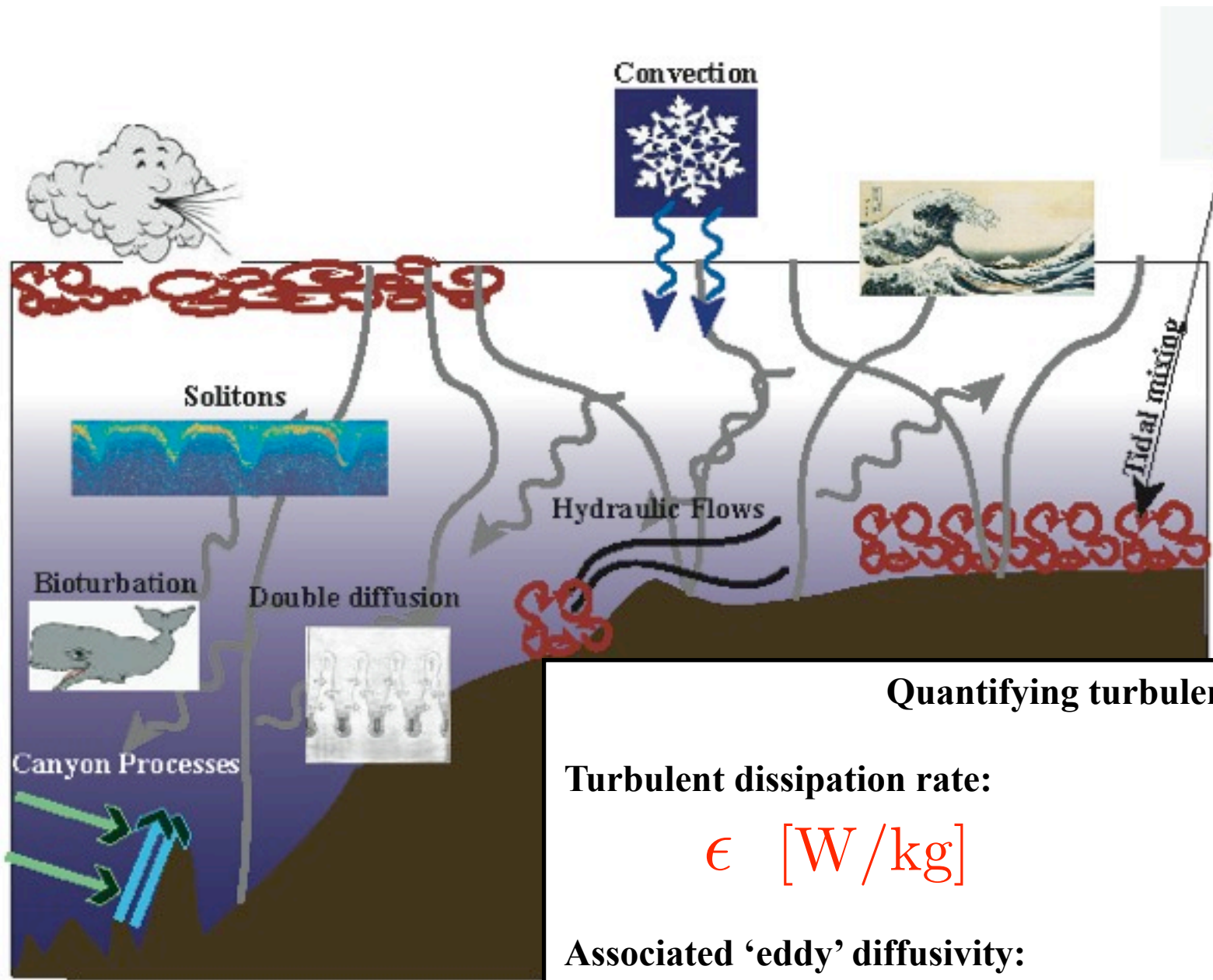
FIG. 6. Instantaneous surface speed in 1° and ⅙° models after 40 yr. Note that the large-scale structure of the 1° model is quite similar to the ⅙° model (the currents have similar locations and have similar horizontal extents). The main difference is in the presence of intense jets and eddies in the ⅙° model.

sea surface height measured from space



AVISO - free on web

Diapycnal Mixing Mechanisms



Quantifying turbulence:

Turbulent dissipation rate:

$$\epsilon \quad [\mathrm{W/kg}]$$

Buoyancy Flux:

$$J_b = 0.2\epsilon$$

Associated 'eddy' diffusivity:

$$K_\rho = 0.2\frac{\epsilon}{N^2} \qquad [\mathrm{m^2/s}]$$

vertical mixing: breaking surface waves

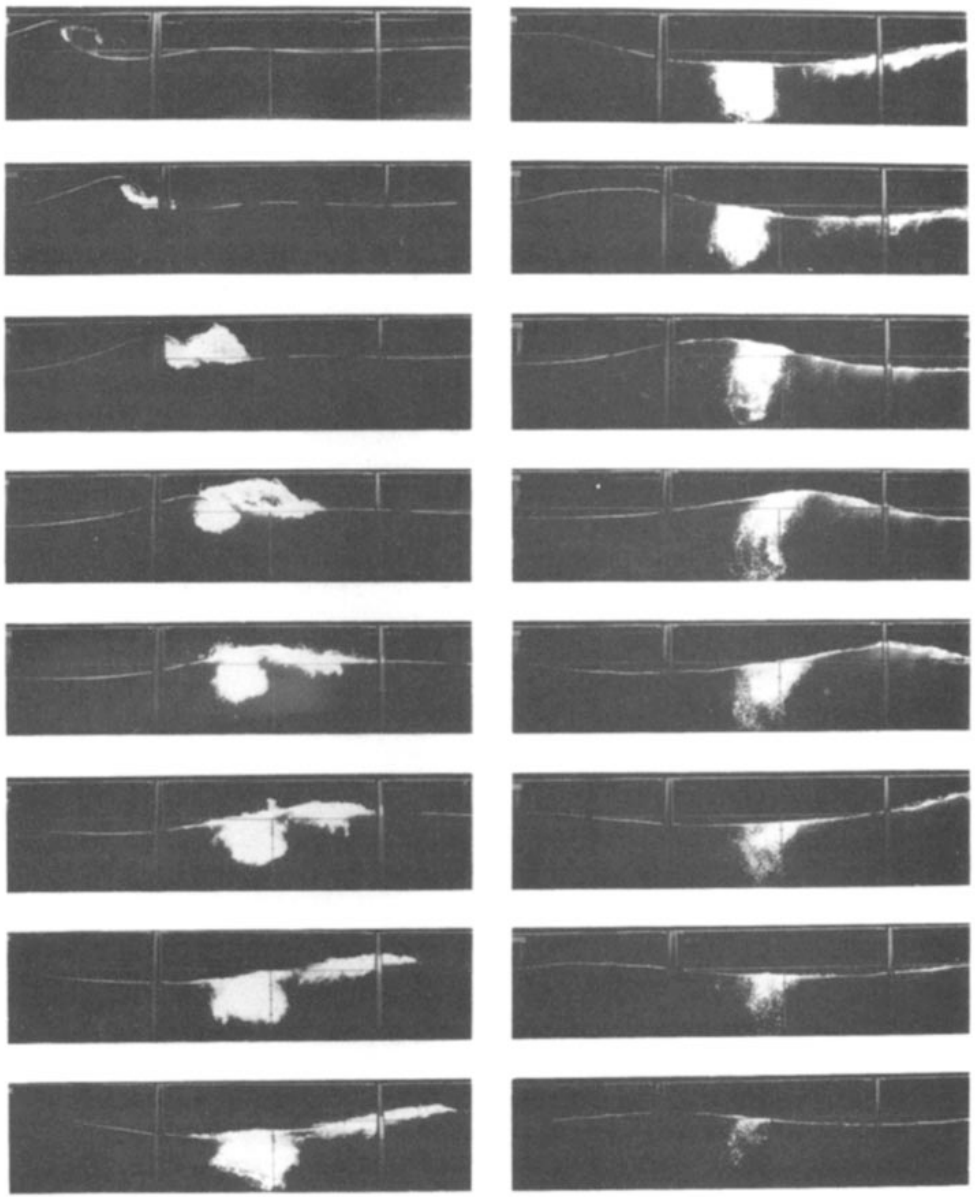
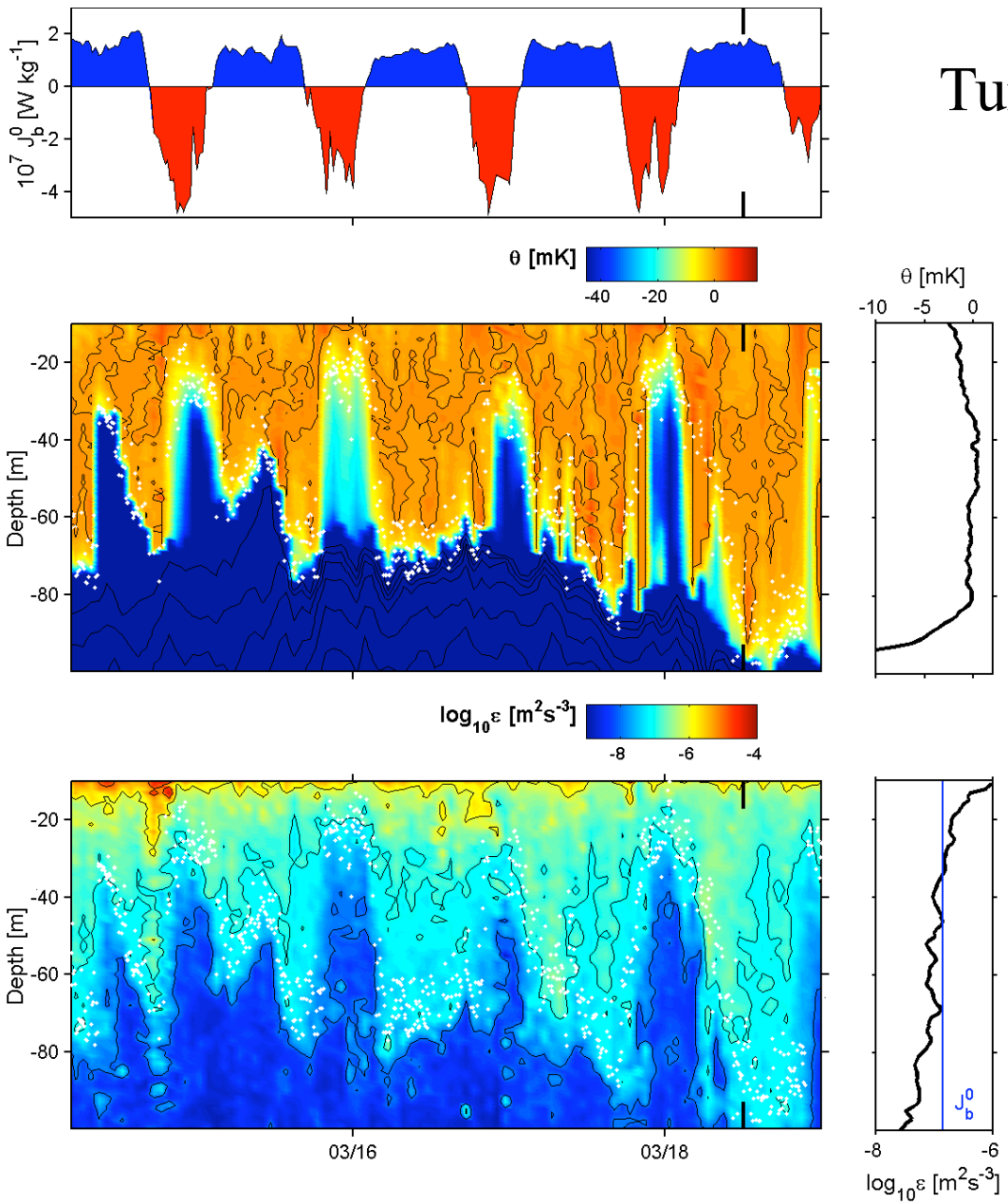


Figure 2 Generation of a plunging breaking wave in the laboratory showing significant air entrainment and degassing as the larger bubbles rise back to the surface. (From Lamarre 1993.)

Turbulence penetration depth proportional to horizontal wavelength of breaking wave

Rapp and Melville 90

vertical mixing: Convection



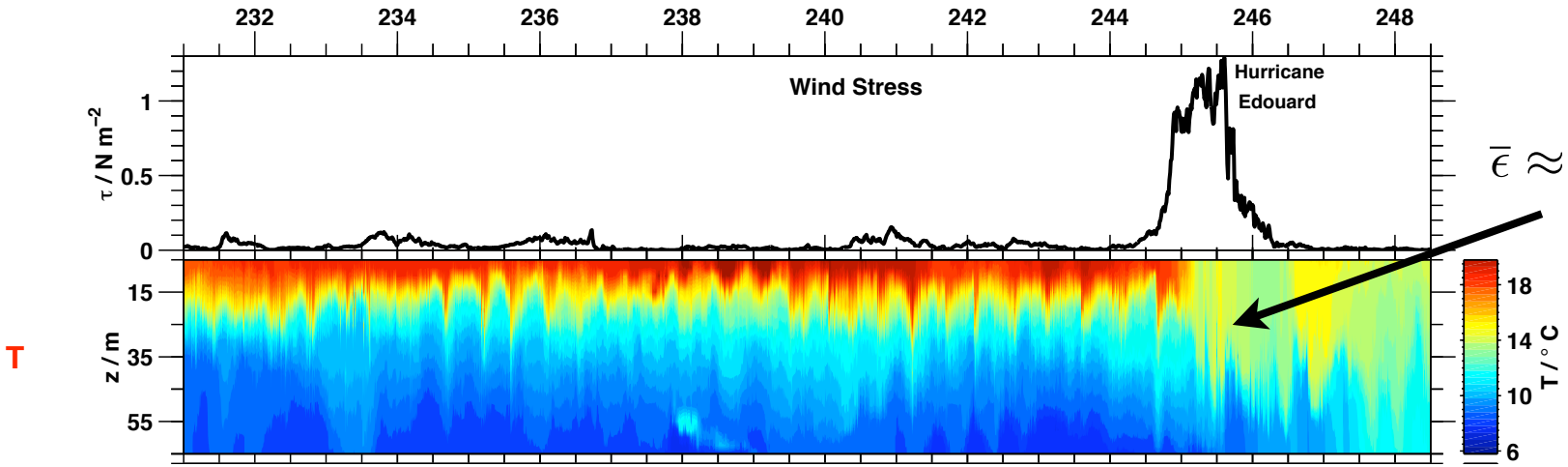
Turbulence produced by destabilizing surface buoyancy fluxes

$$J_b(z=0) = \frac{g\alpha}{\rho_0 c_p} Q_{\text{tot}} + \frac{g}{\rho_0} E\ S$$

Moum and Smyth

Boundary stress mixing the whole water column

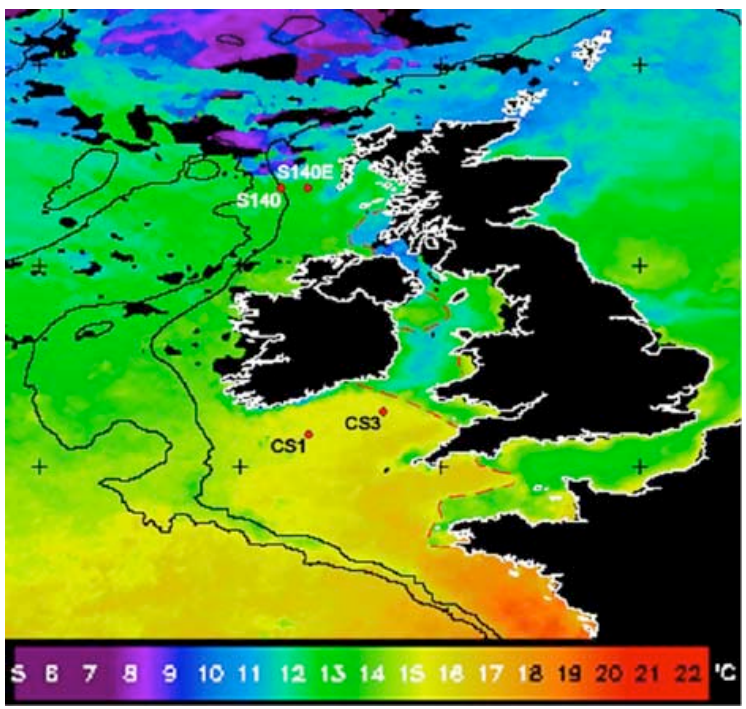
Strong surface friction: hurricanes



$$\bar{\epsilon} \approx 4 \times 10^{-6} [\mathrm{Wkg}^{-1}]$$

(MacKinnon and Gregg 03)

Strong bottom friction: tidal mixing fronts

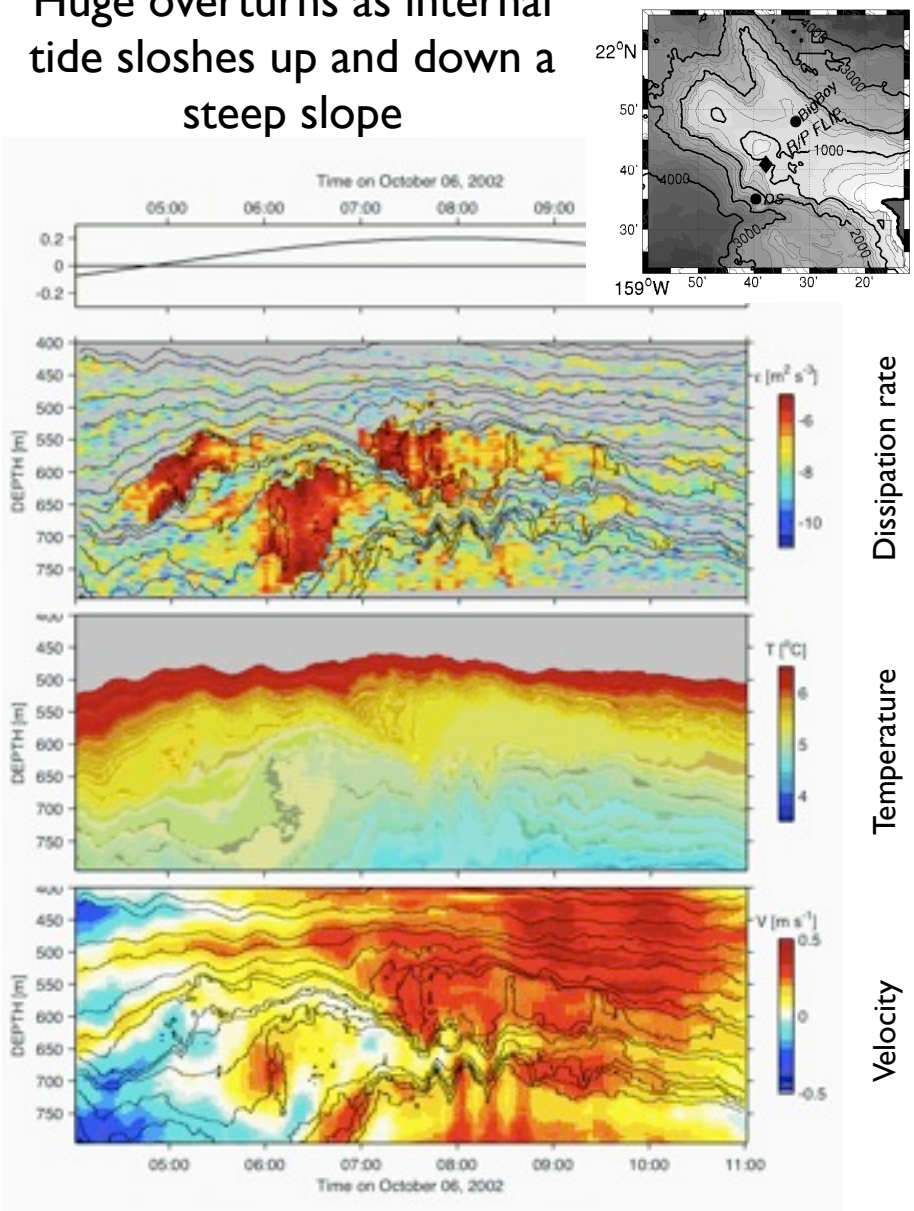


(Rippeth et al 05)

Breaking Internal Waves

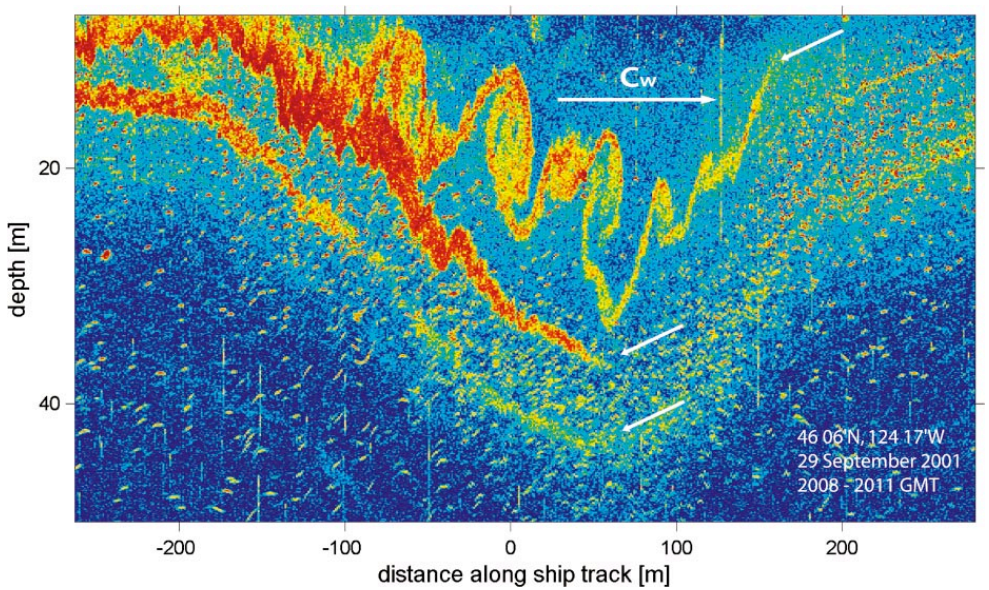
Hawaiian Ocean Mixing Experiment (HOME)

Huge overturns as internal tide sloshes up and down a steep slope



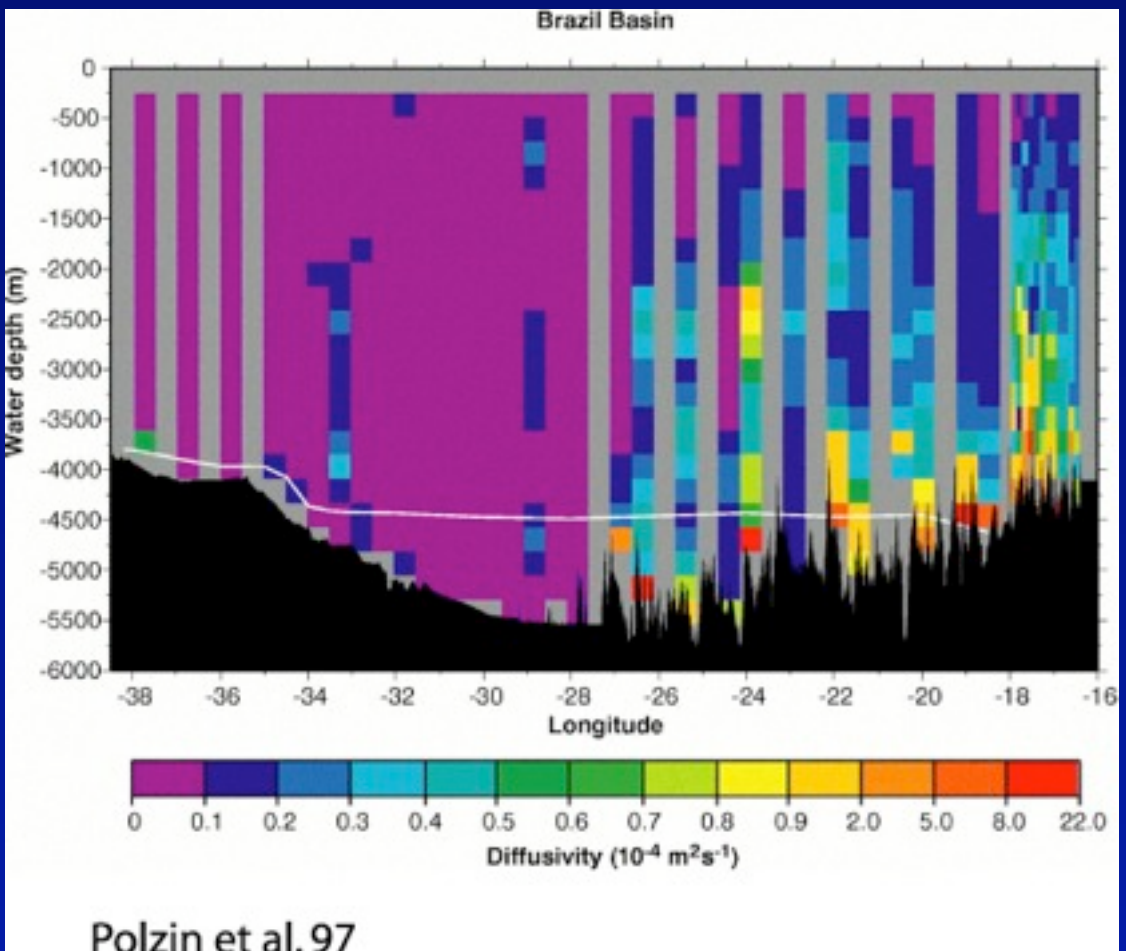
Klymak et al 07

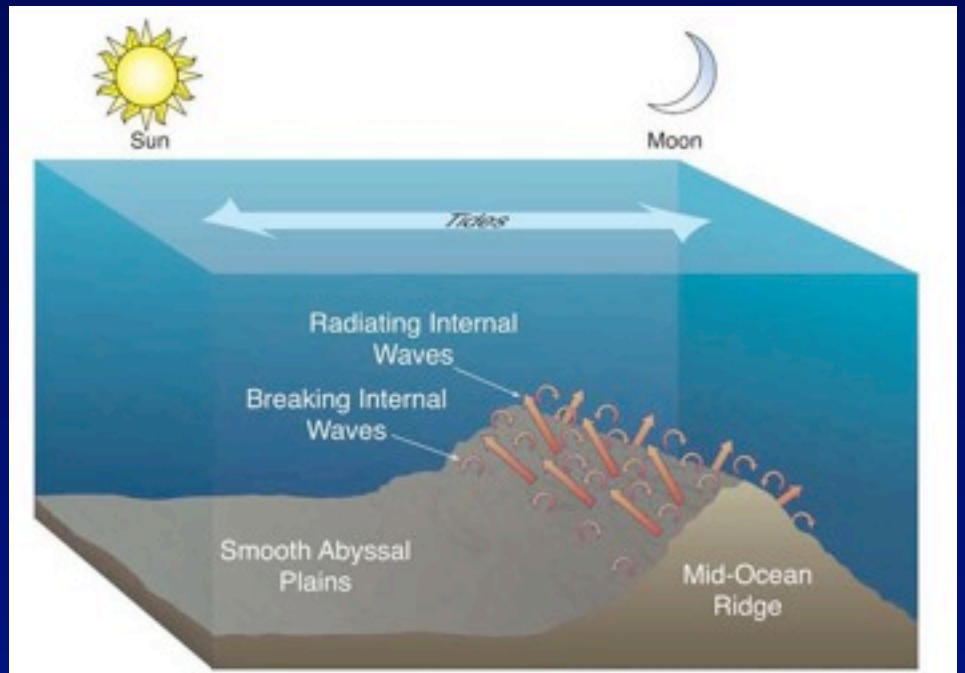
Breaking solitons on the Oregon Shelf



Moum et al 03

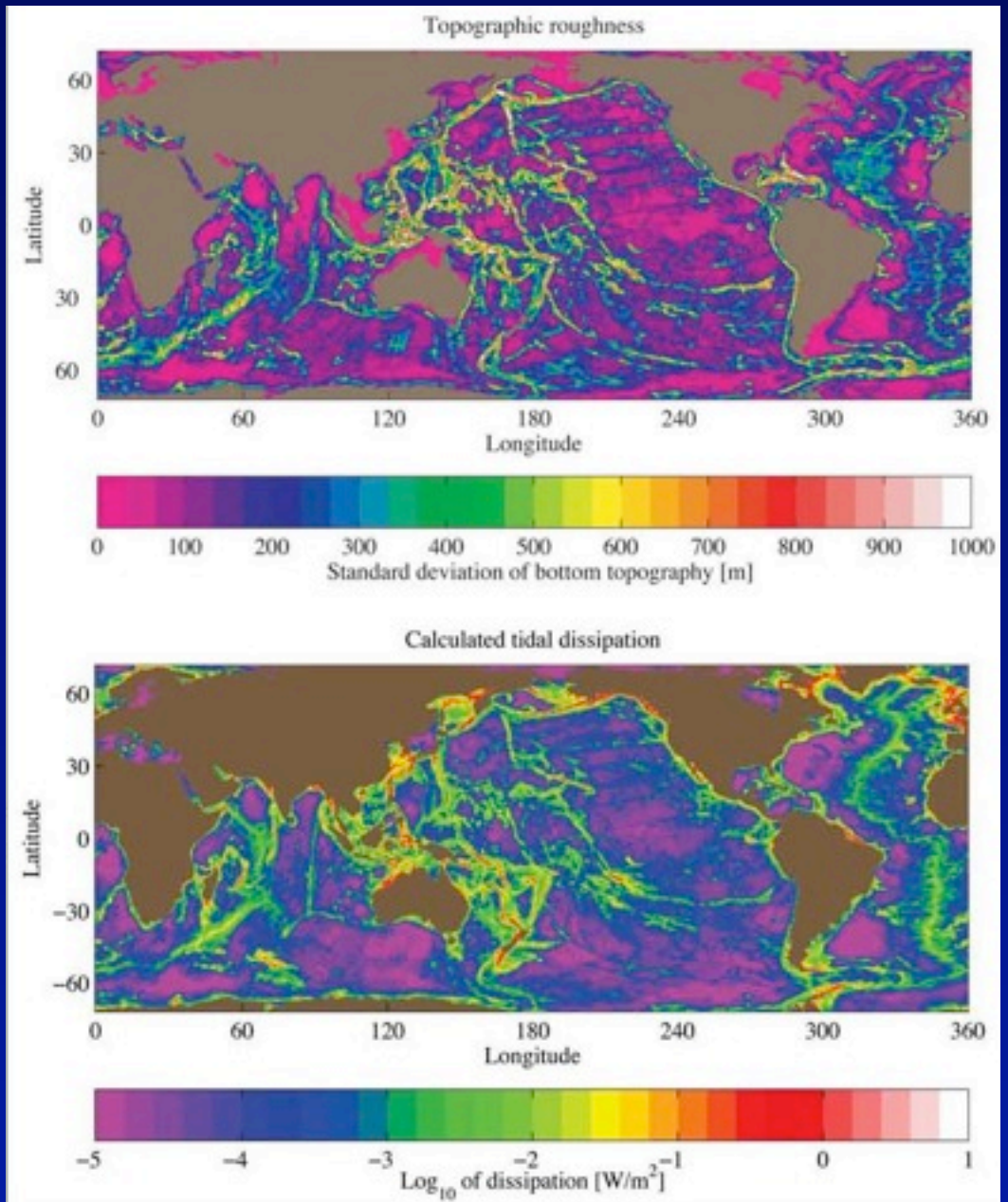
Enhanced mixing where internal tides are created, and break, over bumpy topography





From Jayne et al (Oceanography, 2004)

Relation of tides to diapycnal diffusivity



From Jayne et al (Oceanography, 2004)