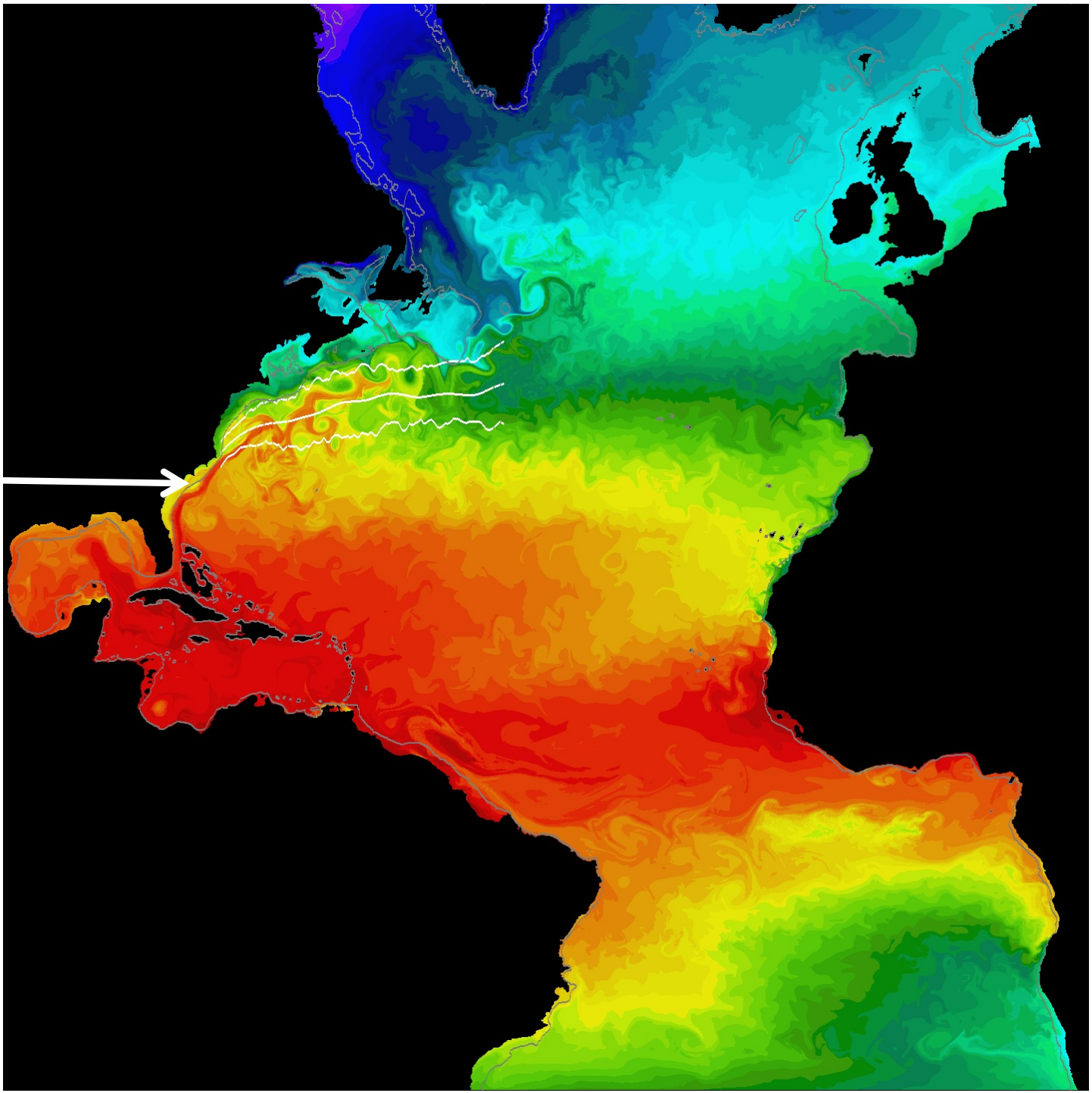
Modeled
Sea Surface
Temperature

Gulfstream



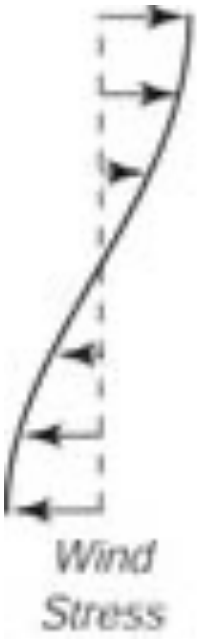
Show full Movie
emphasizing
Western Boundary
Currents & Gyres

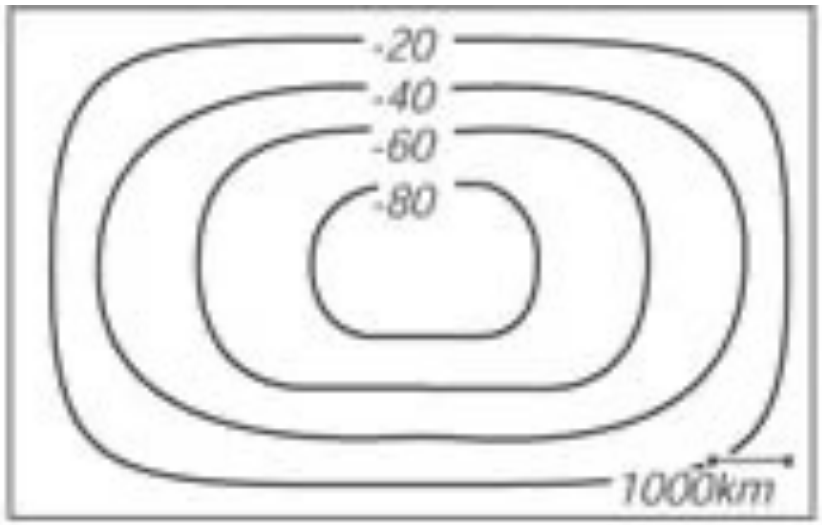
Sverdrup interior

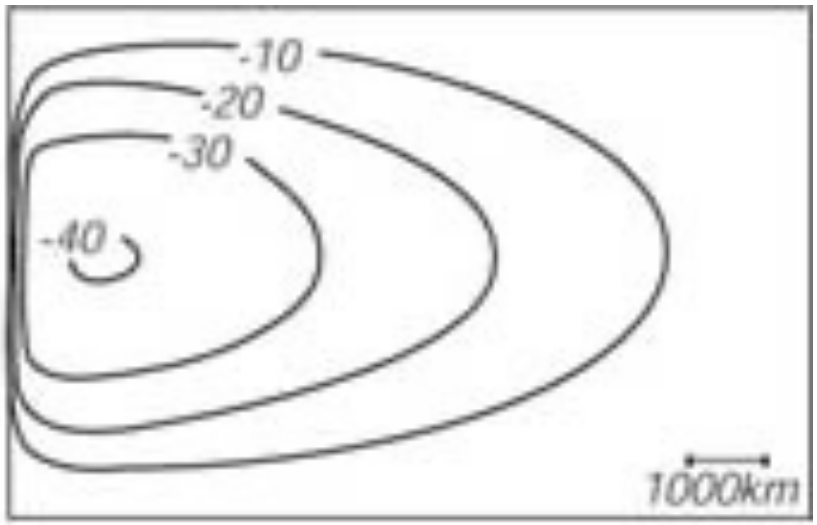
Vorticity: $\nabla^2 p + [(2*H*\beta_0)/(d*f_0)]\ \partial_x p + [2/d]\ \partial_y \tau^{(x)} = 0$

Stommel boundary

p(x,y)







0

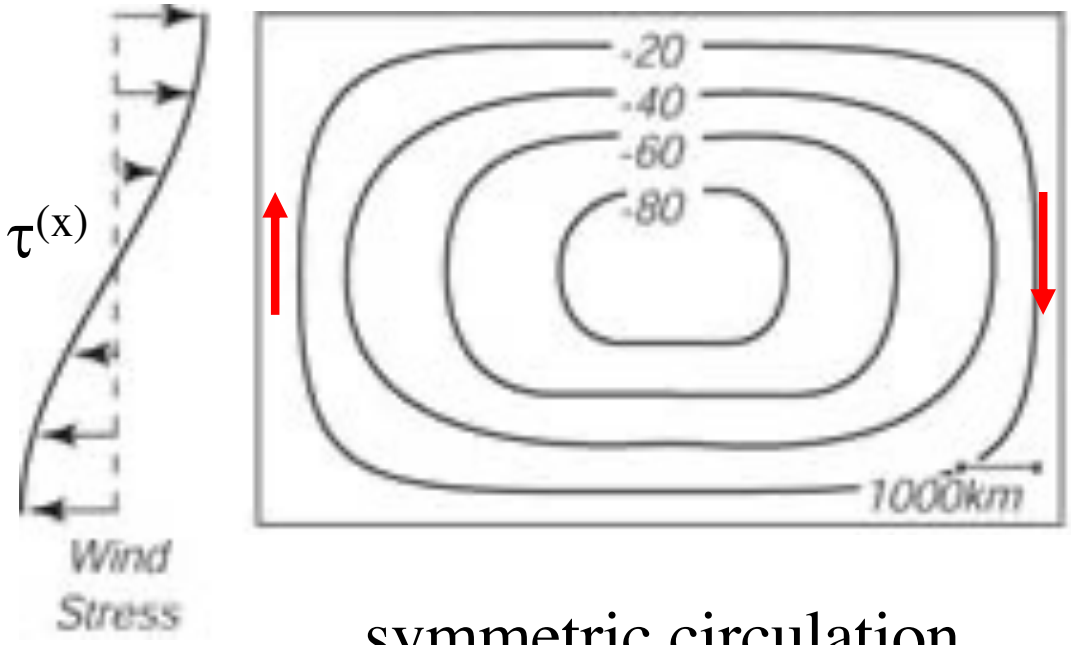
L_1

$\tau^{(x)}$

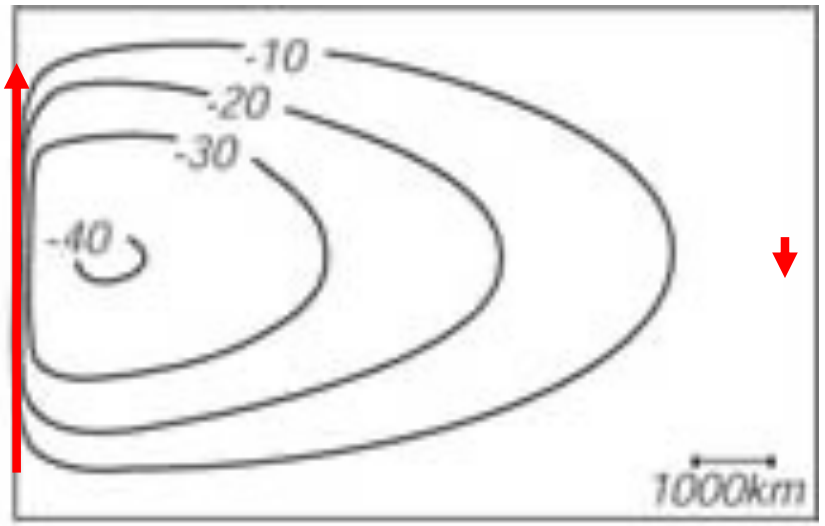
$\beta_0=0$

$\beta_0>0$

Vorticity Tendencies		wind-stress curl (surface Ekman)	+ friction (bottom Ekman)	+ planetary (beta effect)	= 0
		$\partial_y \tau^{(x)}$	$\nabla^2 p$	$\partial_x p$	
symmetric ocean circulation	West	-1	+0.1	-1	= -1.9
	East	-1	+0.1	+1	= +0.1
asymmetric ocean circulation	West	-1	+1.0	-9.0	= 0.0
	East	-1	+0.1	+0.9	= 0.0



symmetric circulation



asymmetric circulation

adapted from Stommel(1947)

Potential Vorticity Conservation

following a fluid parcel

$$D/Dt \left[(f + \xi)/H \right] = 0$$

$f = f_0 + \beta_0 * y$	planetary (background) vorticity
ξ	relative (local) vorticity of the geostrophic flow
H	vortex tube stretching (by surface Ekman pumping)

$$f + \xi = \text{constant}$$

and the "constant" here contains the
surface Ekman pumping due to the steady wind-stress curl