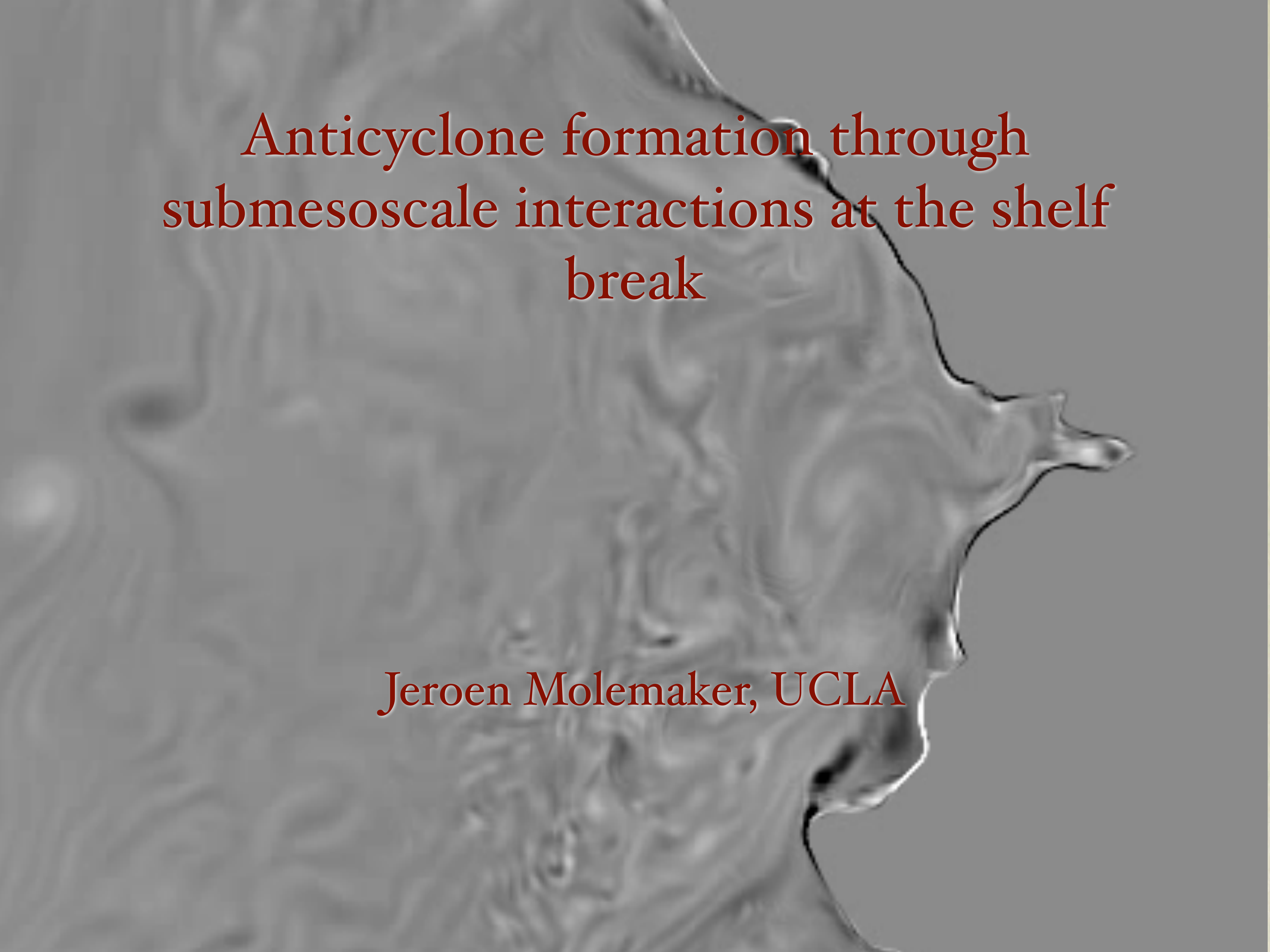
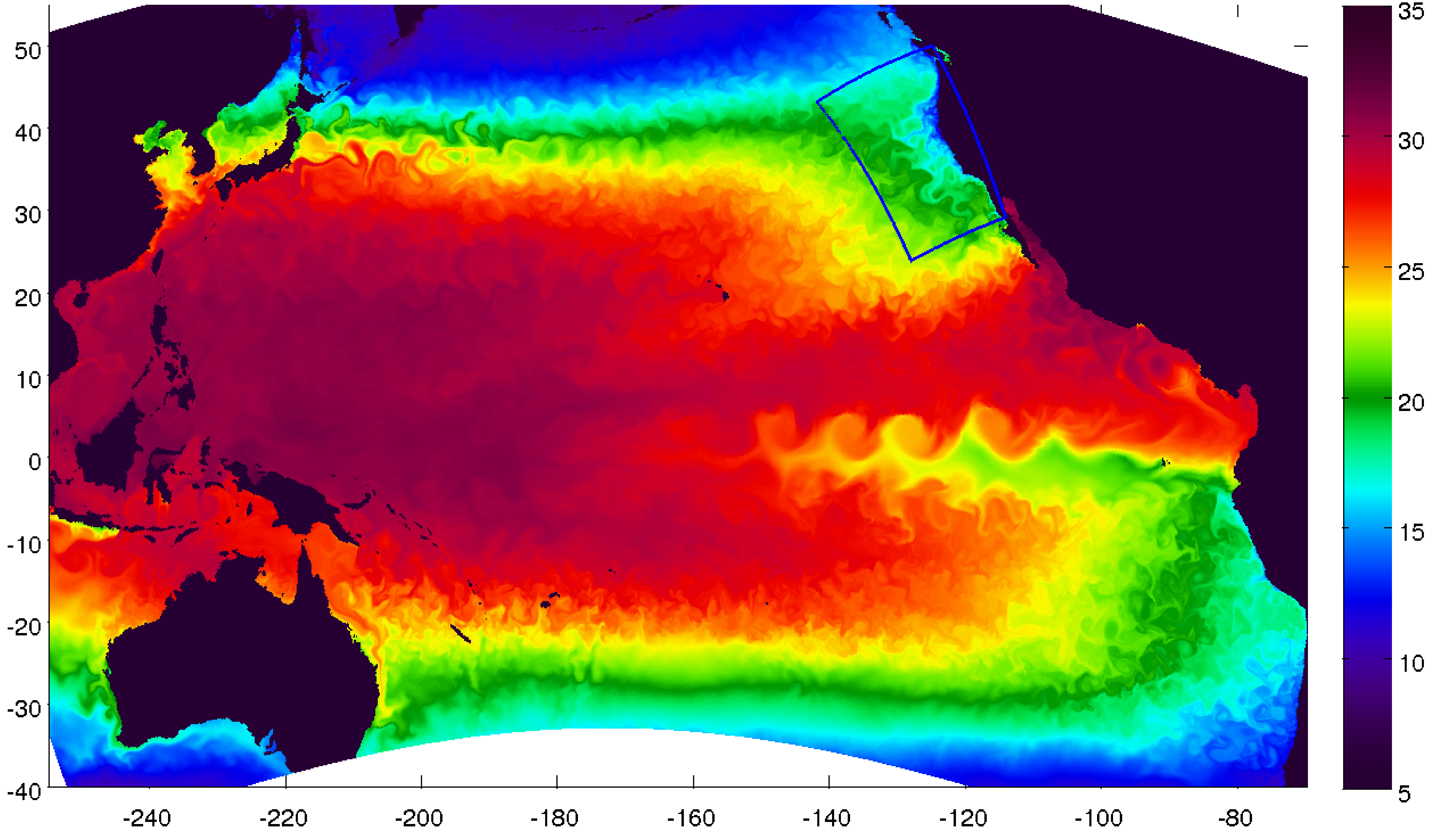


# Anticyclone formation through submesoscale interactions at the shelf break

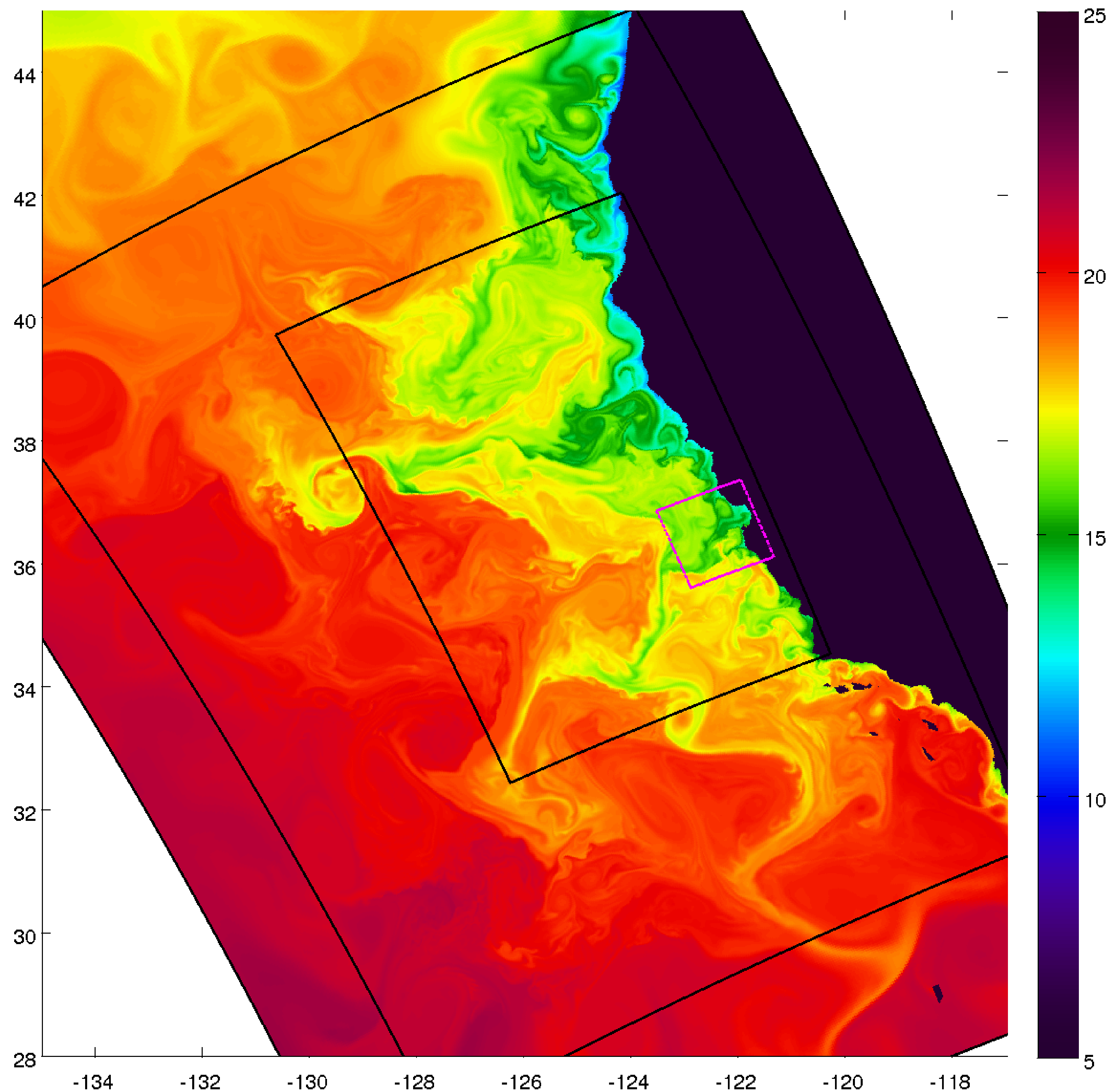
Jeroen Molemaker, UCLA

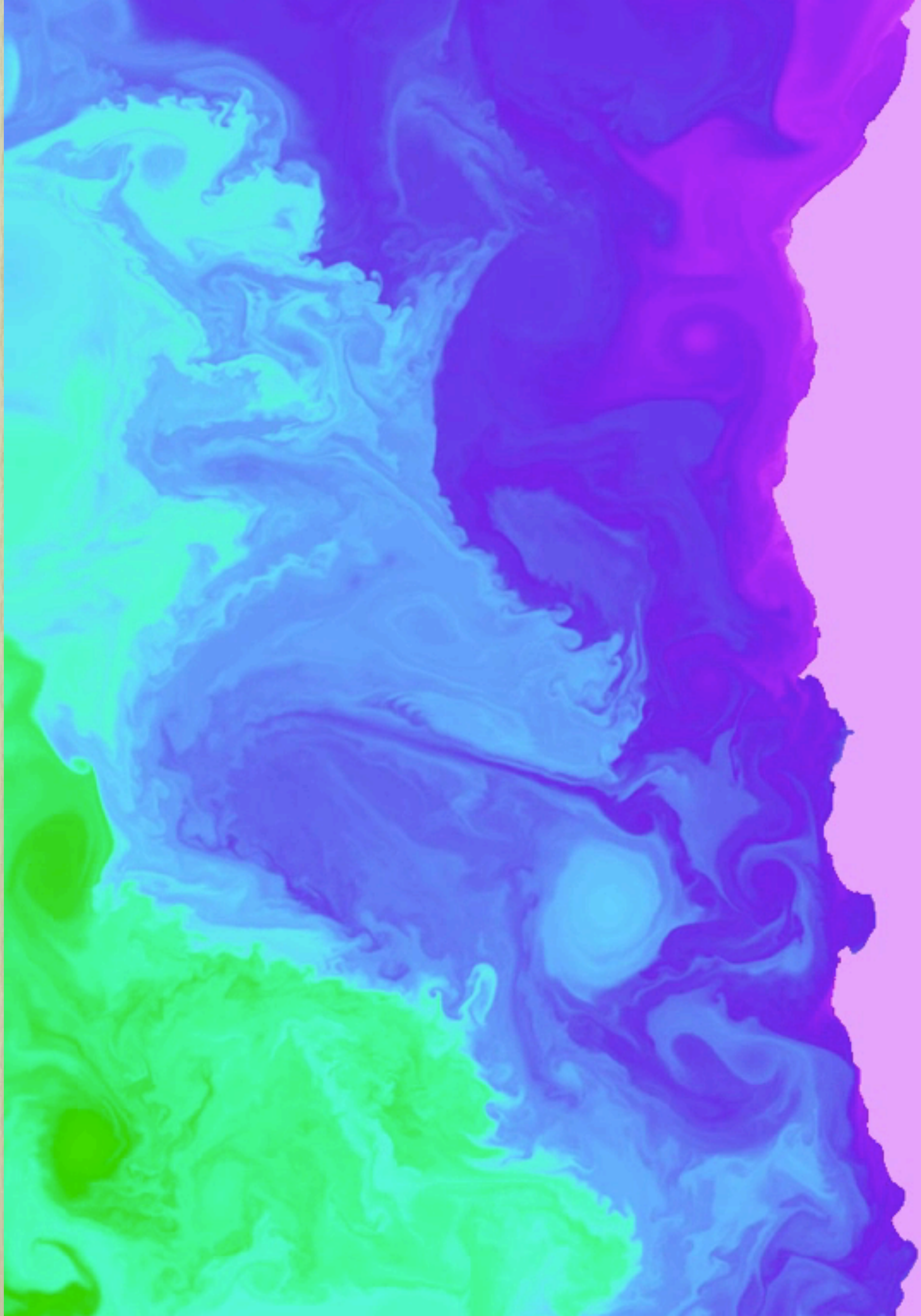
# ROMS



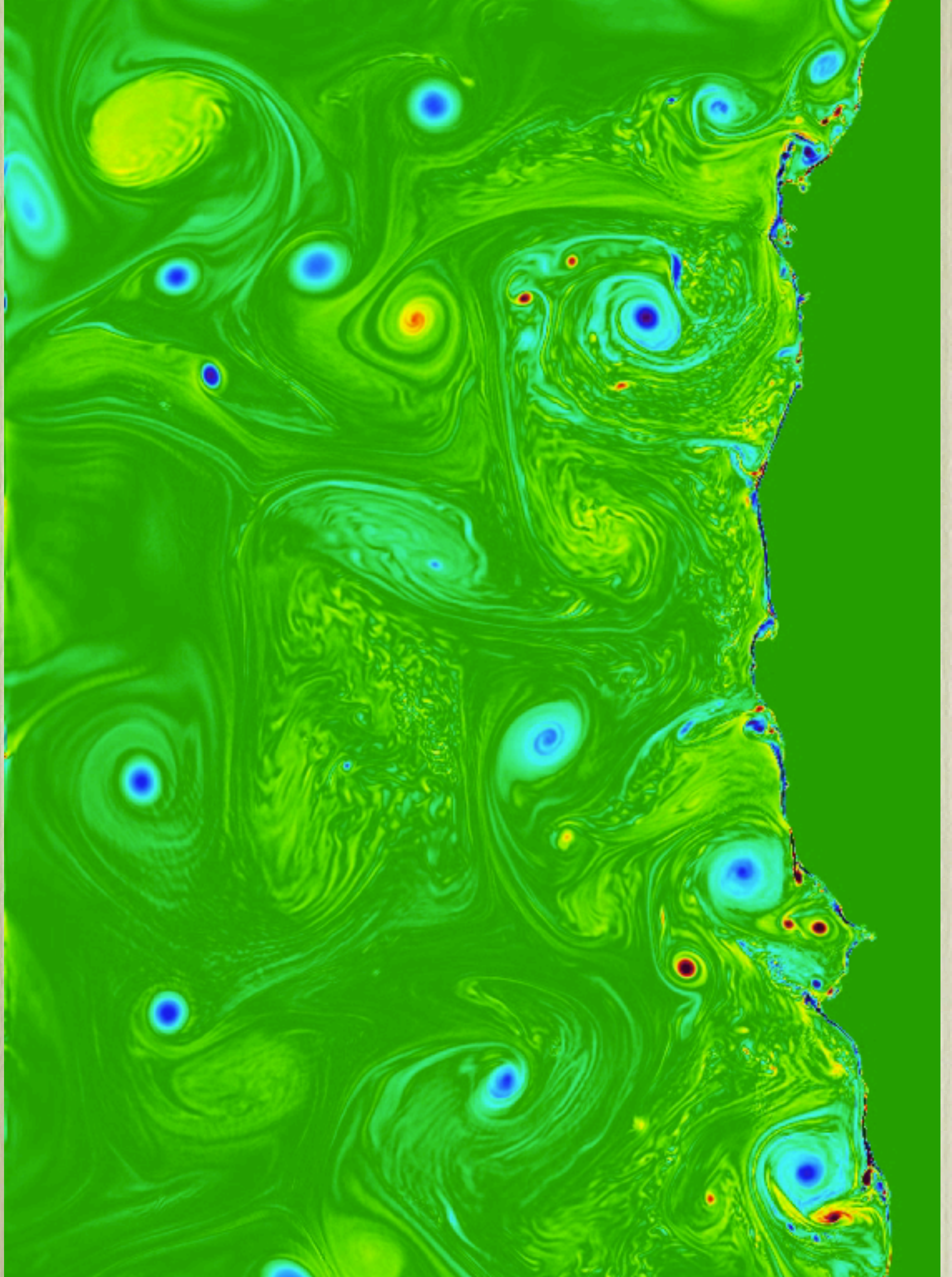
50
40
30
20
10
0
-10
-20
-30
-40
-240
-220
-200
-180
-160
-140
-120
-100
-80
35
30
25
20
15
10
5

# Multiple Nested Grids



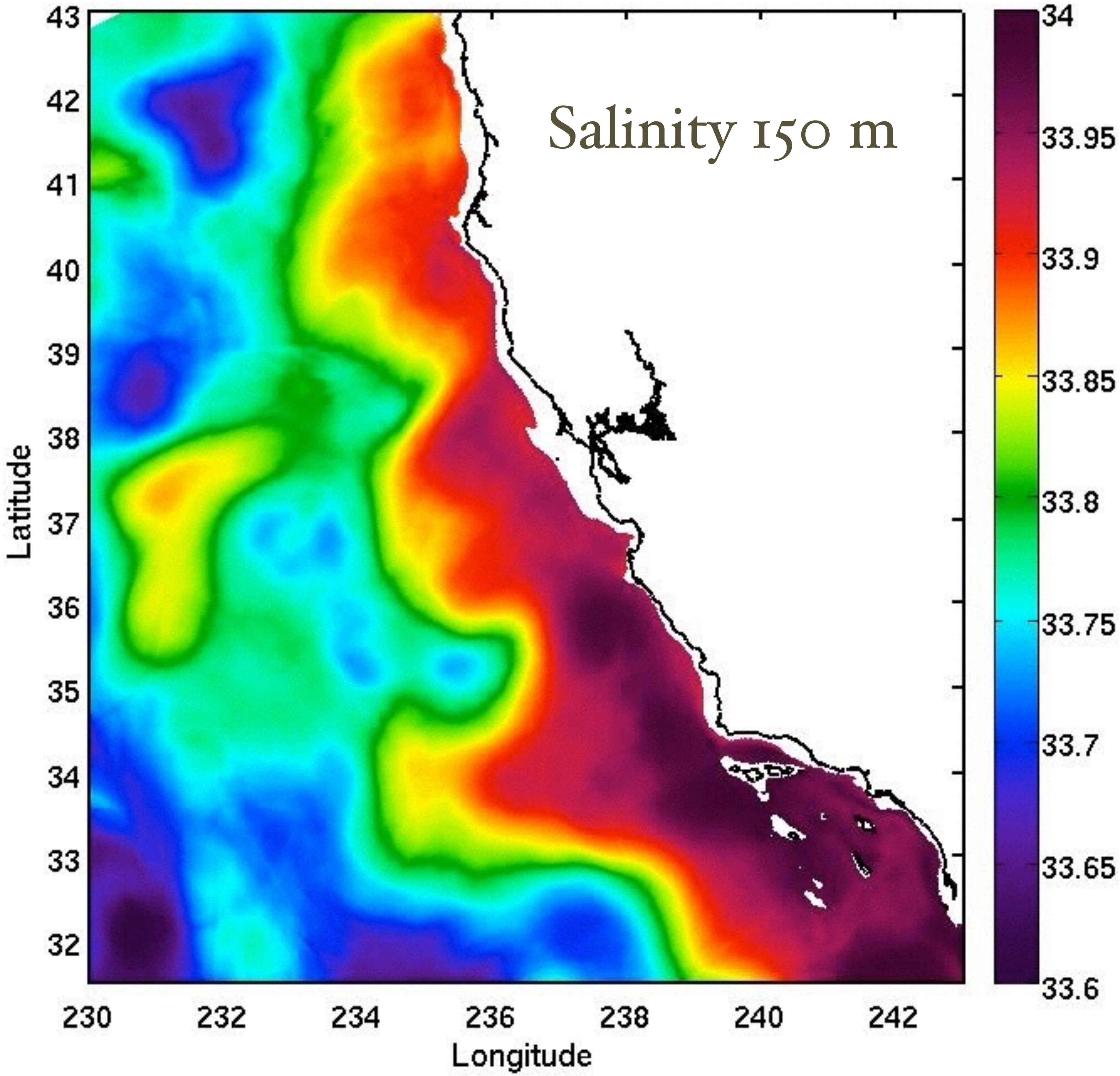


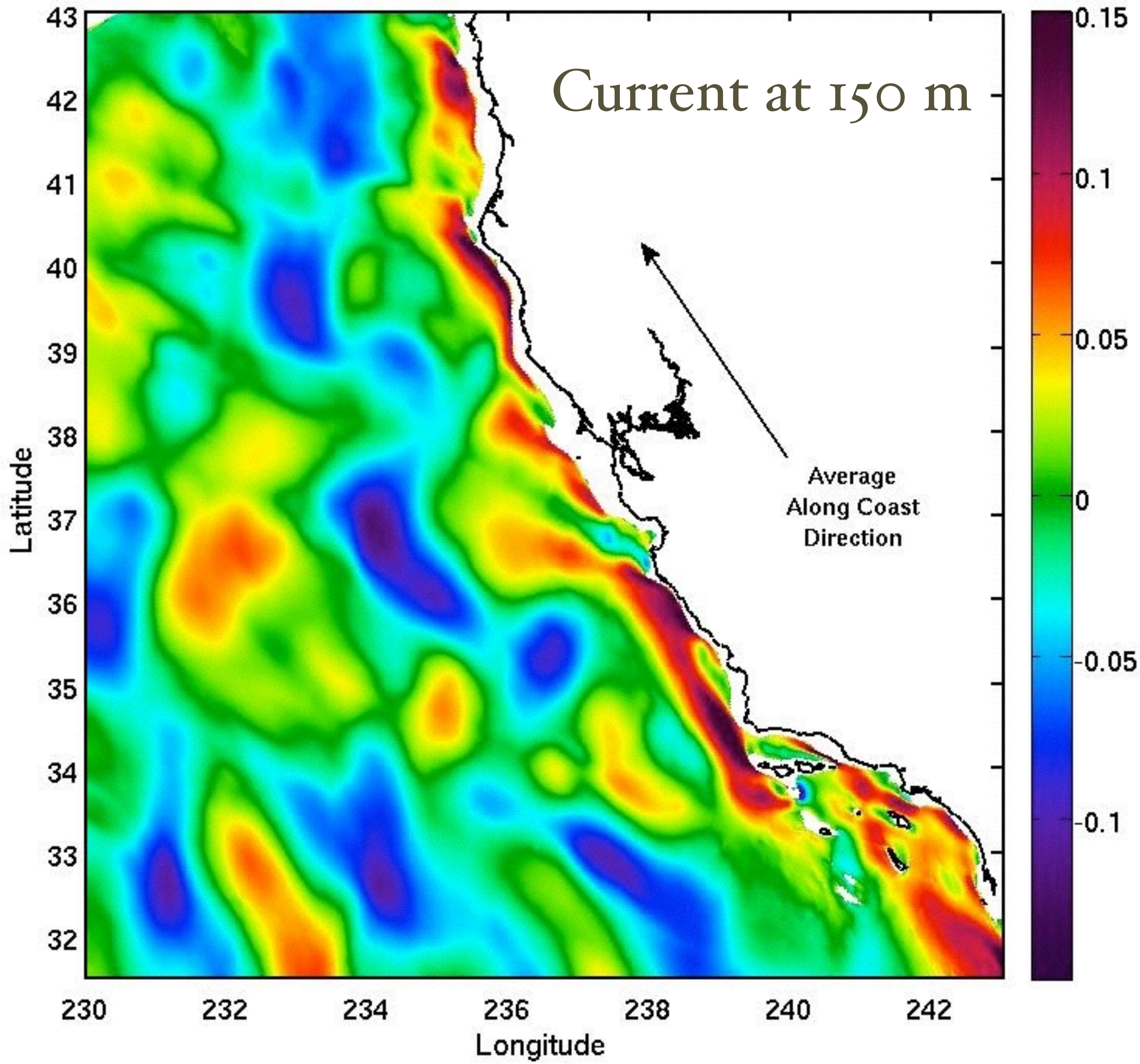
SST off California



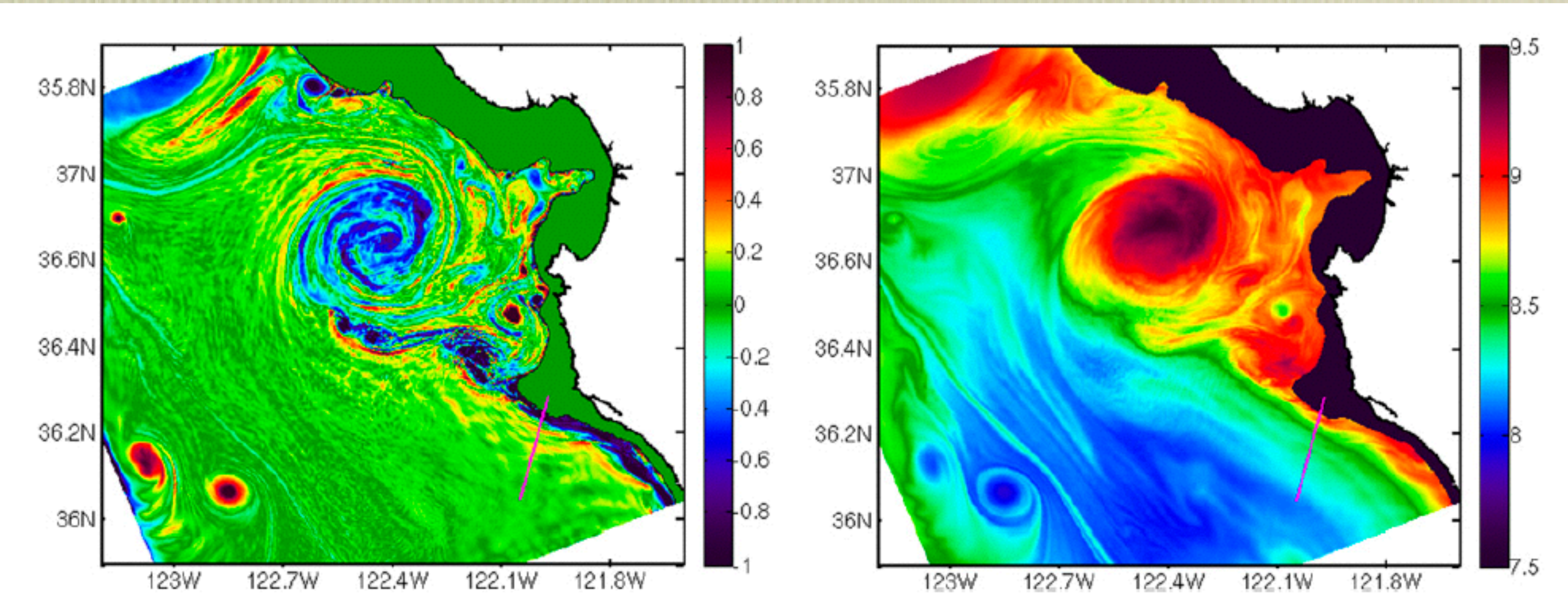
Relative vorticity

z = 150 m

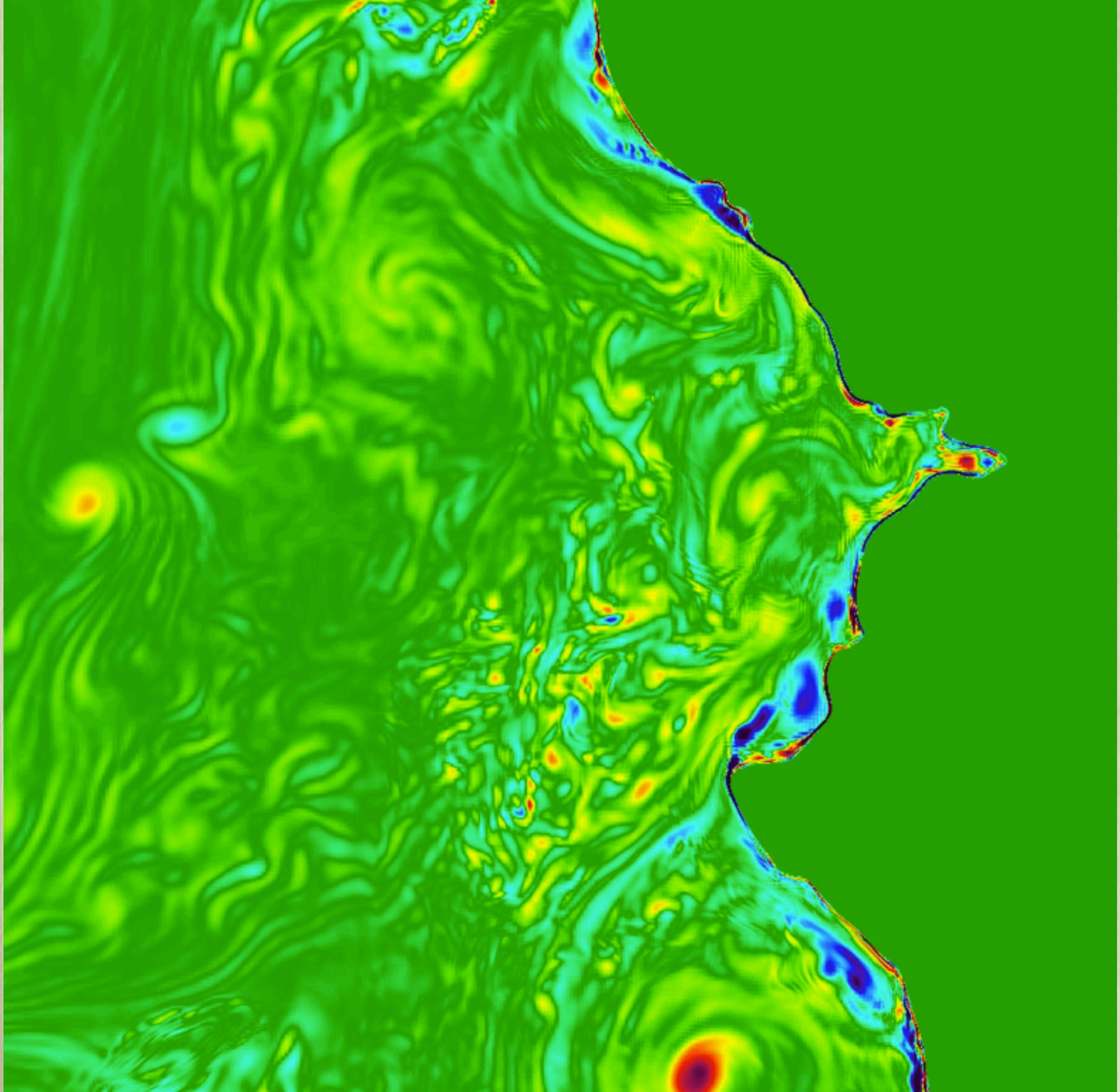

Salinity 150 m
Latitude
Longitude
43
42
41
40
39
38
37
36
35
34
33
32
230
232
234
236
238
240
242
34
33.95
33.9
33.85
33.8
33.75
33.7
33.65
33.6


Current at 150 m
Average
Along Coast
Direction
43
42
41
40
39
38
37
36
35
34
33
32
Latitude
230
232
234
236
238
240
242
Longitude
0.15
0.1
0.05
0
-0.05
-0.1

# Vorticity and Temperature at z = 150 m

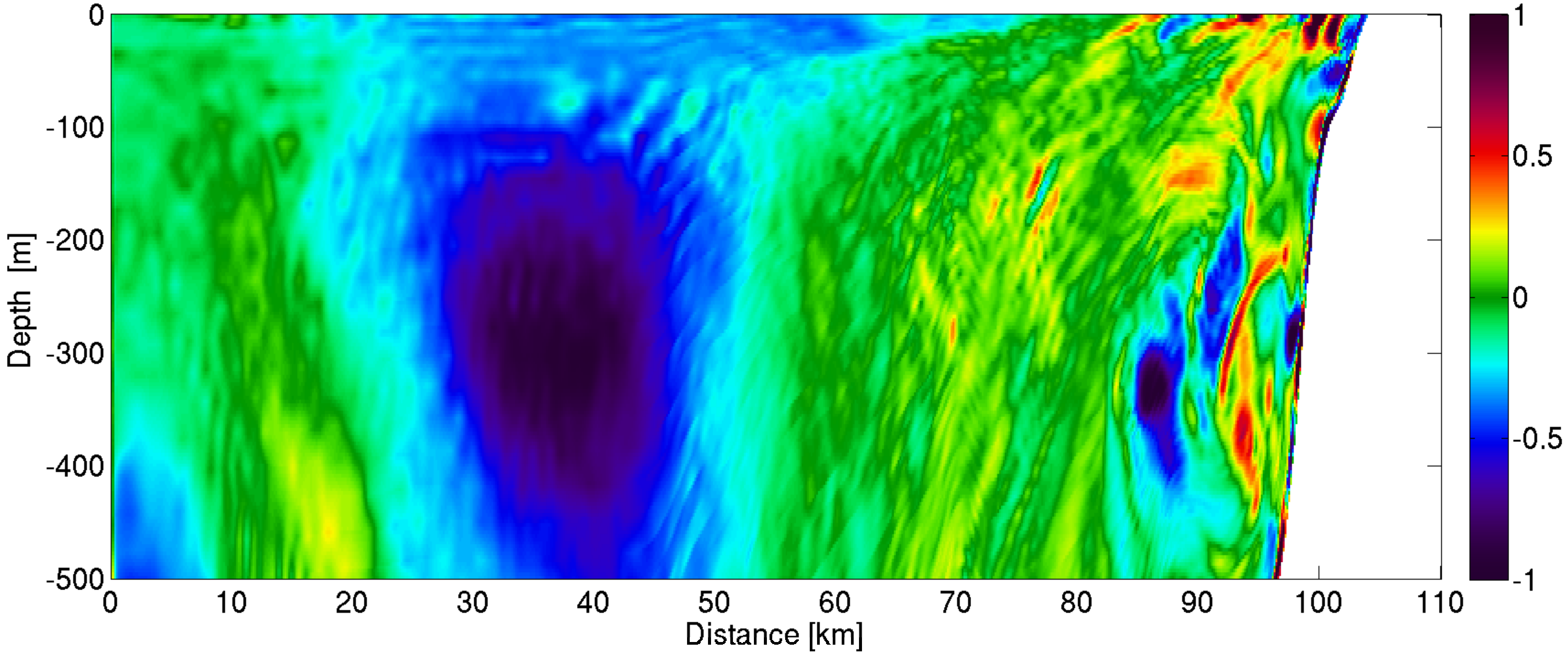



$$\Pi = (\boldsymbol{\zeta} + \mathbf{f}) \cdot \nabla b$$

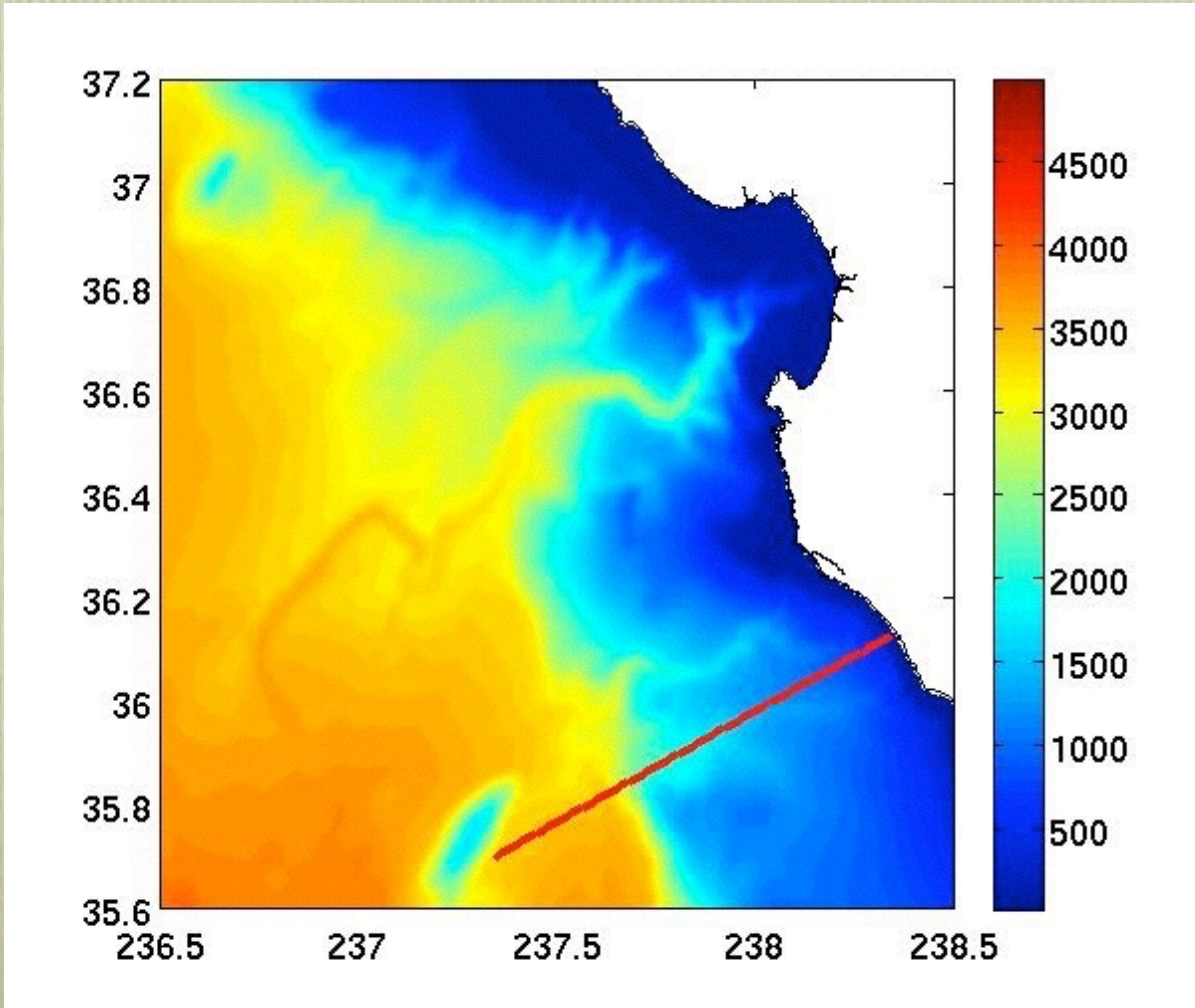


Vorticity
z= 250 m

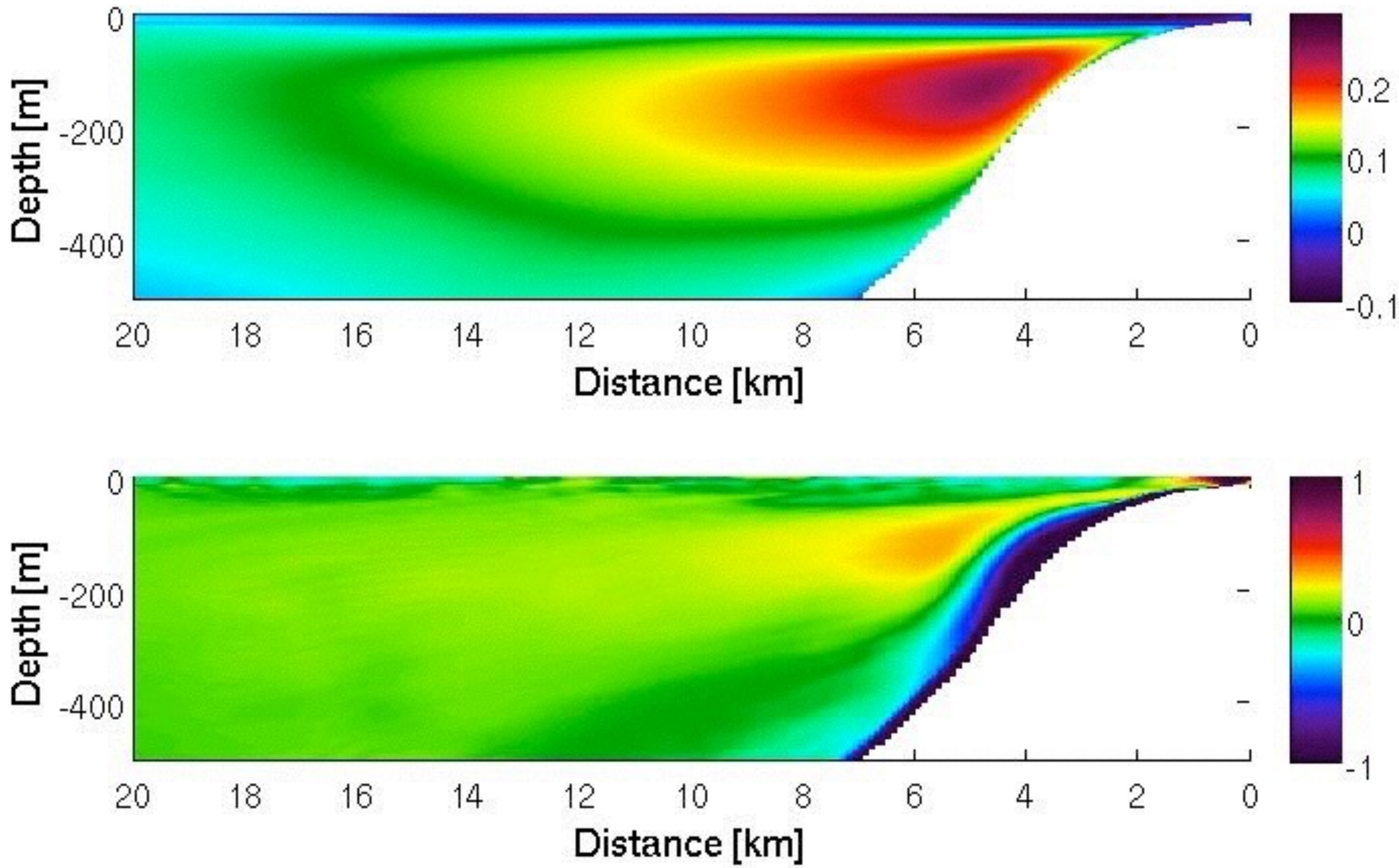
# Vertical Structure



# Monterey Bay

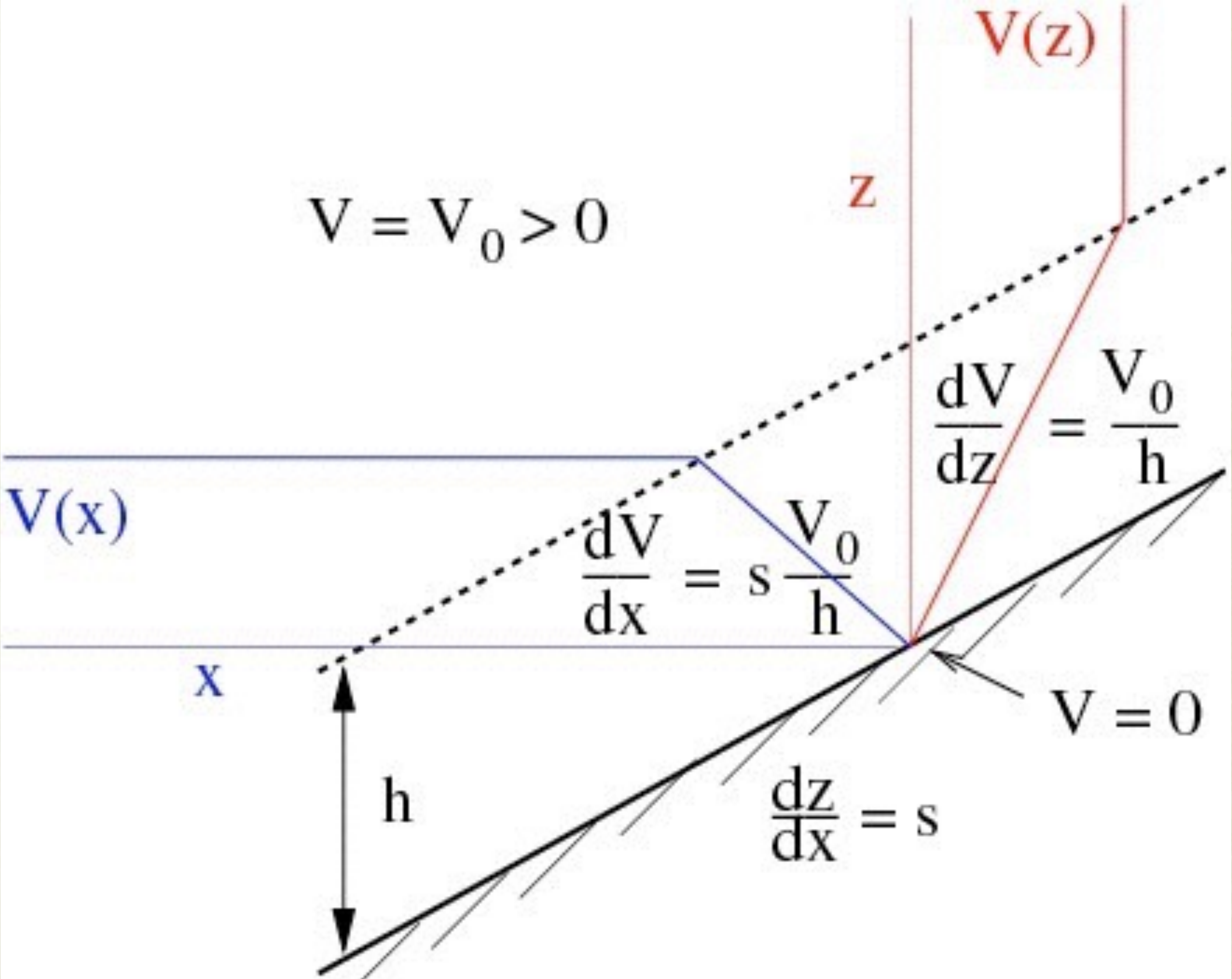


# Cross-shore section

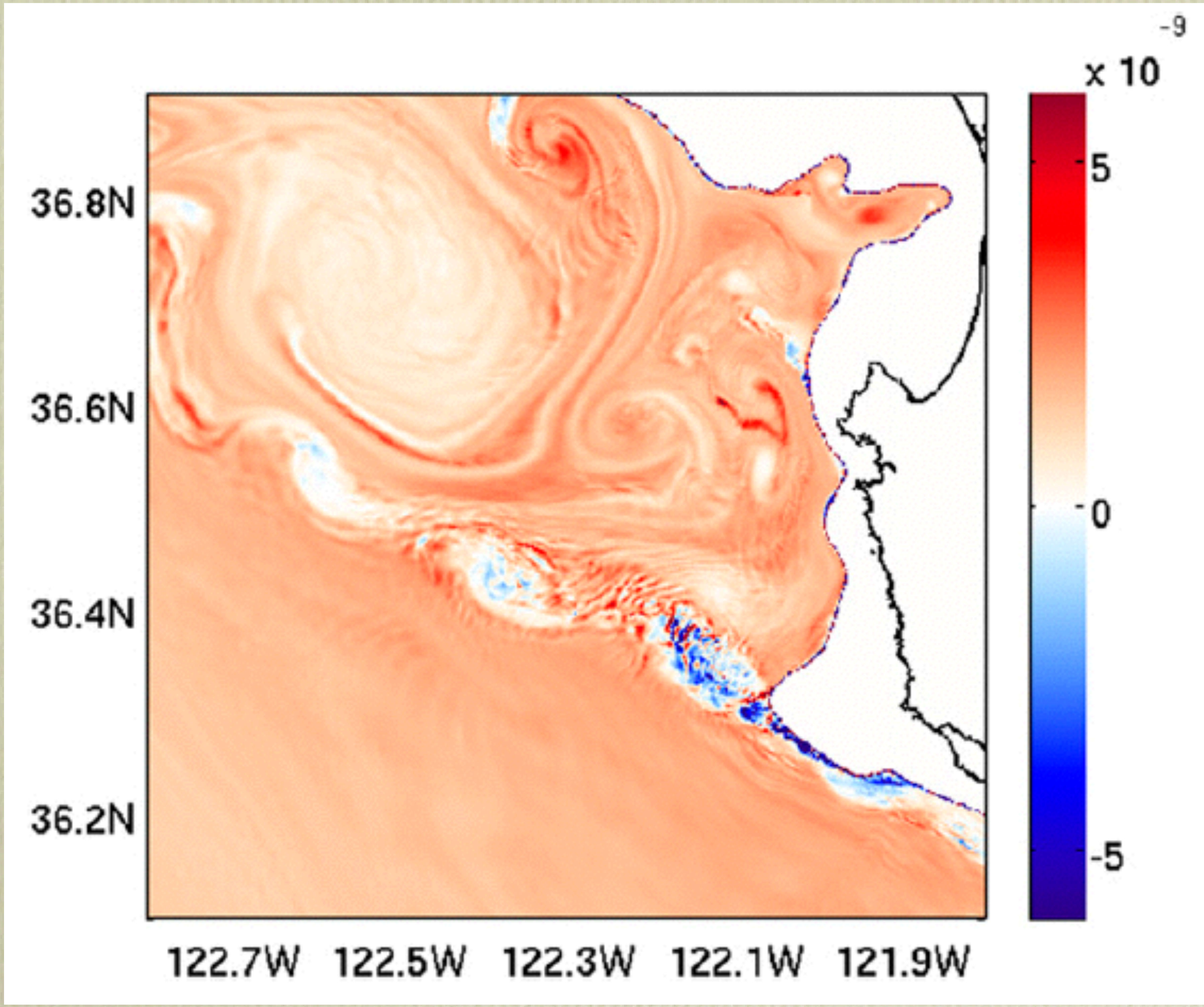



V

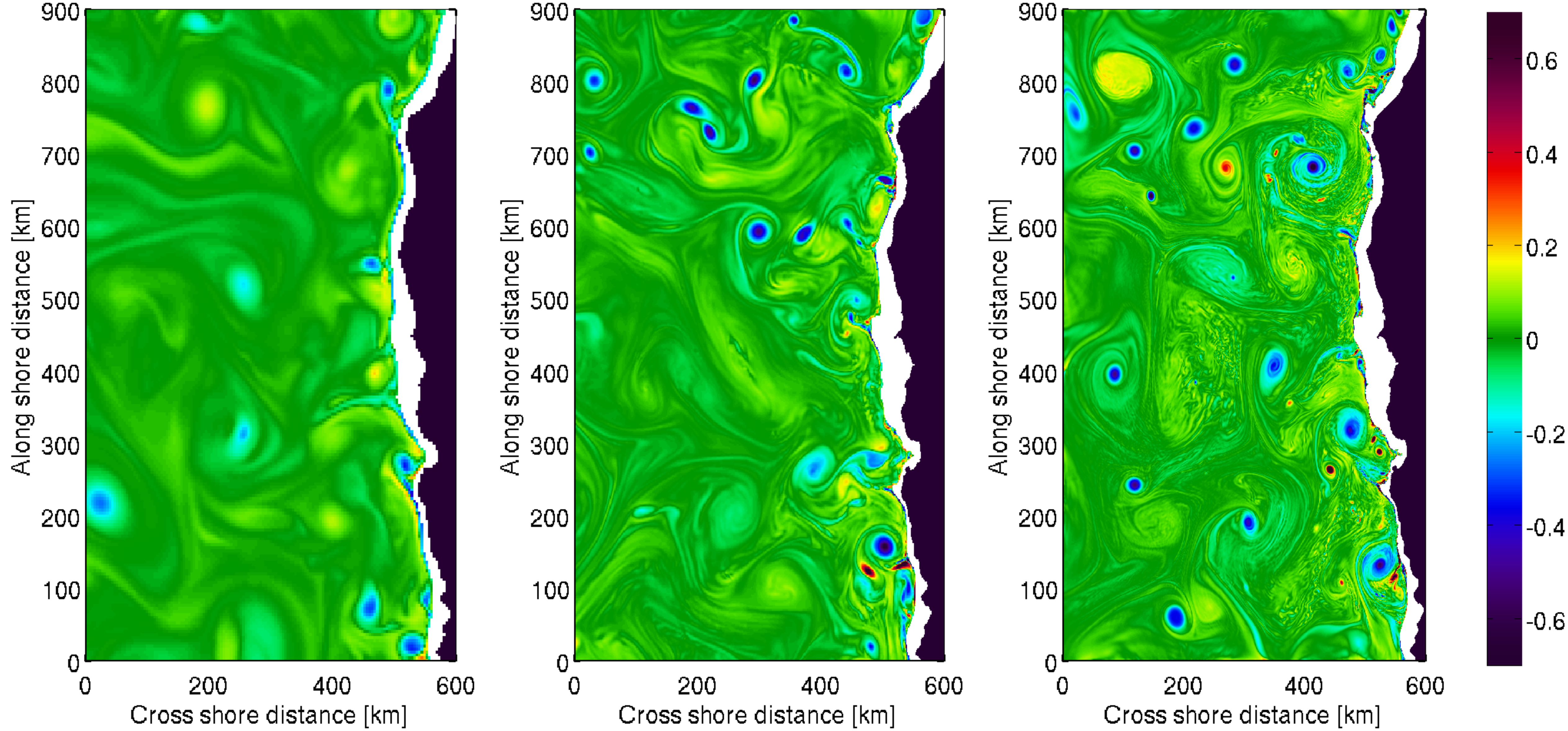
# 'Viscous' Boundary layer



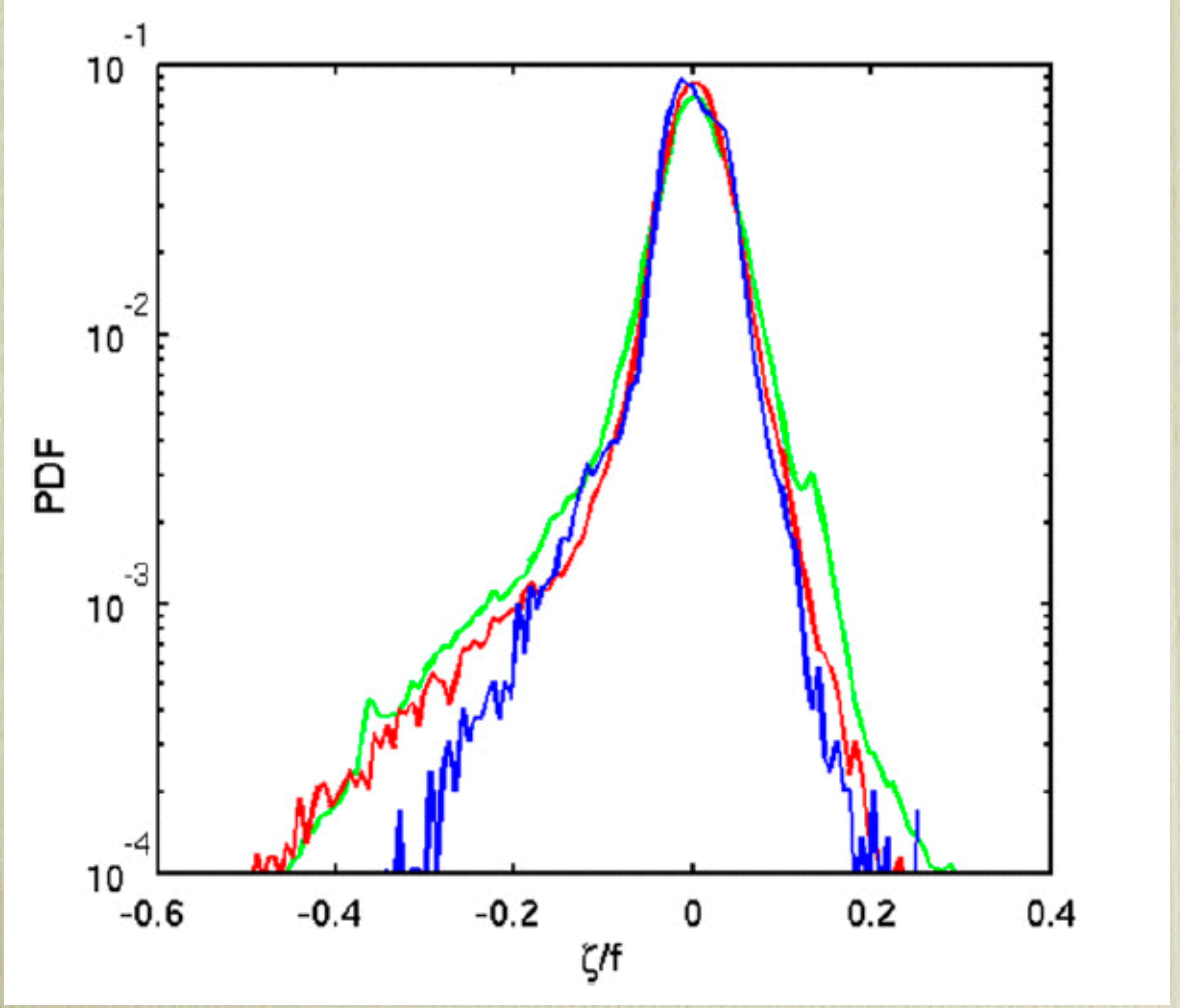
# Pushing the envelope of centrifugal instability



# Subsurface Anti-cyclones at the end of



# PDF of relative vorticity at 150m

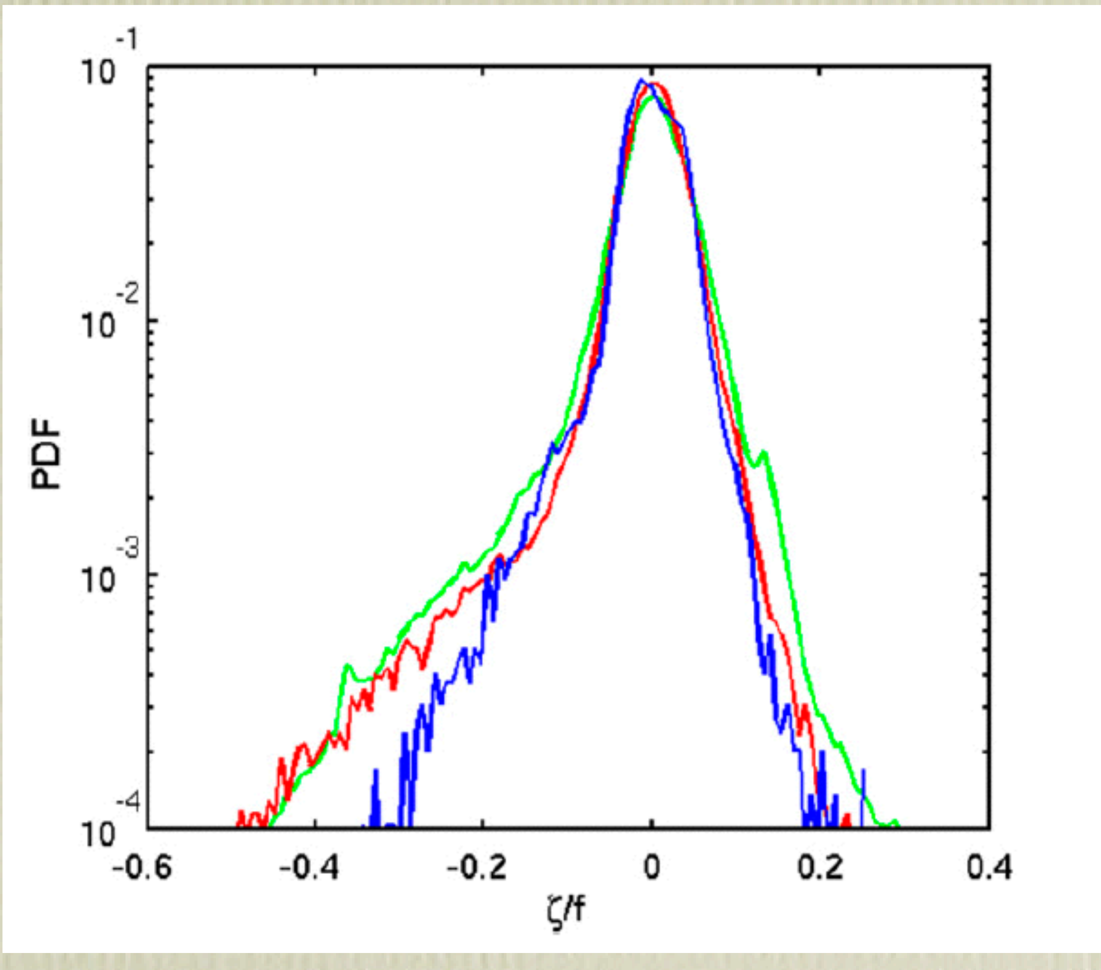


# Post critical mixing?

* AAI (Yavneh et al., 2001, McWilliams et al. 2004, Molemaker et al. 2005)

* Vertical Shear

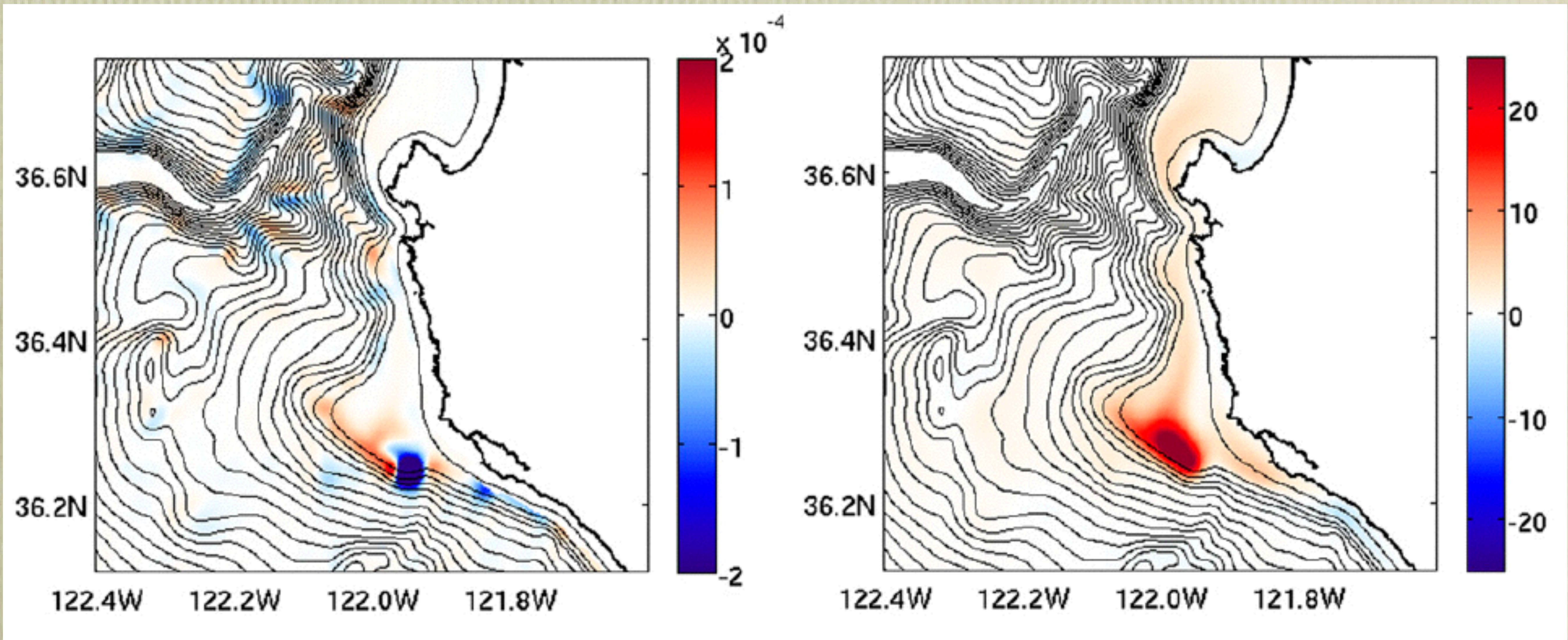
$$\Pi = (\boldsymbol{\zeta} + \mathbf{f}) \cdot \nabla b$$



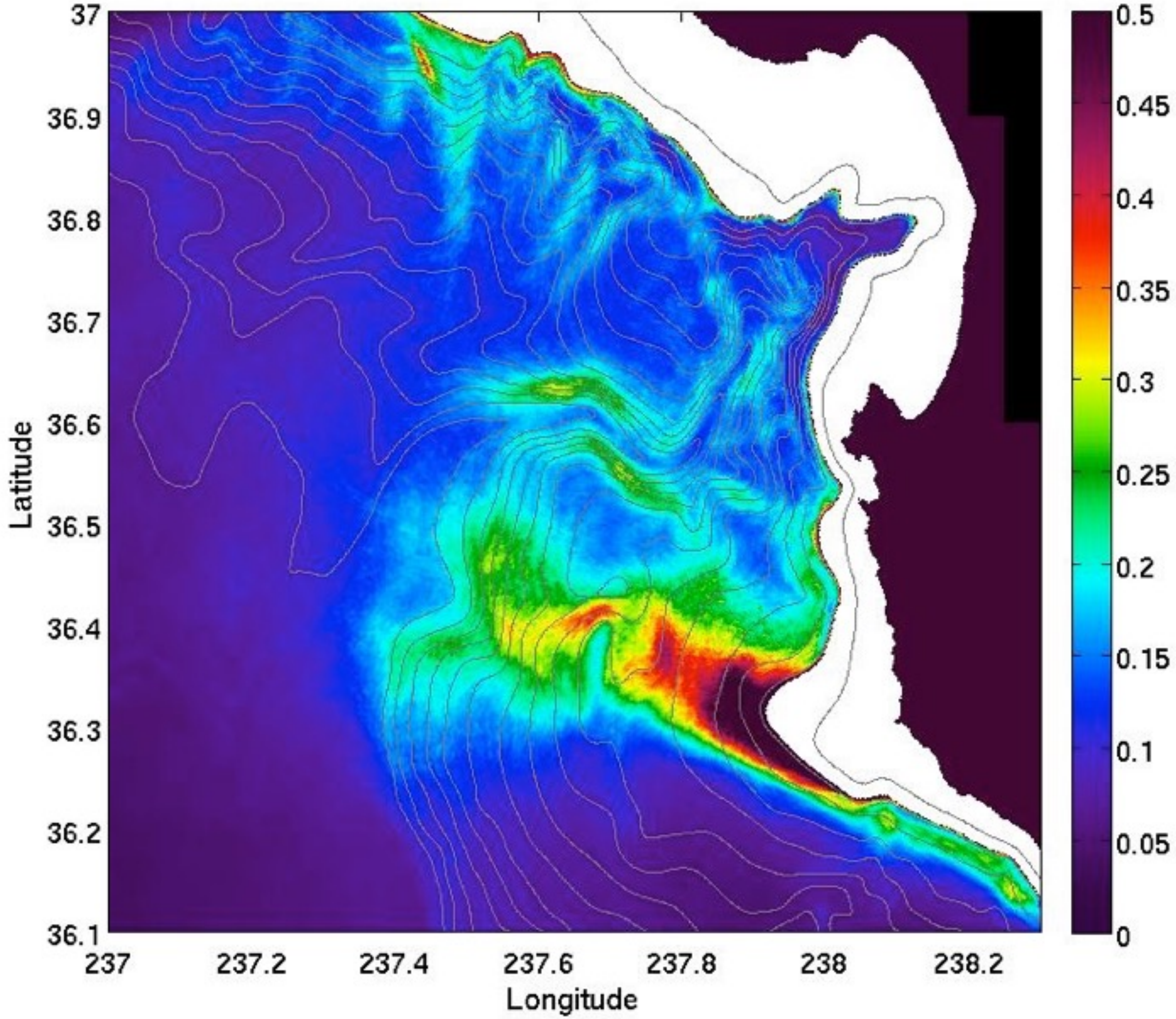
# Bottom Pressure torque and Form Stress

$$\mathcal{T} = J(p_b,\ H)$$

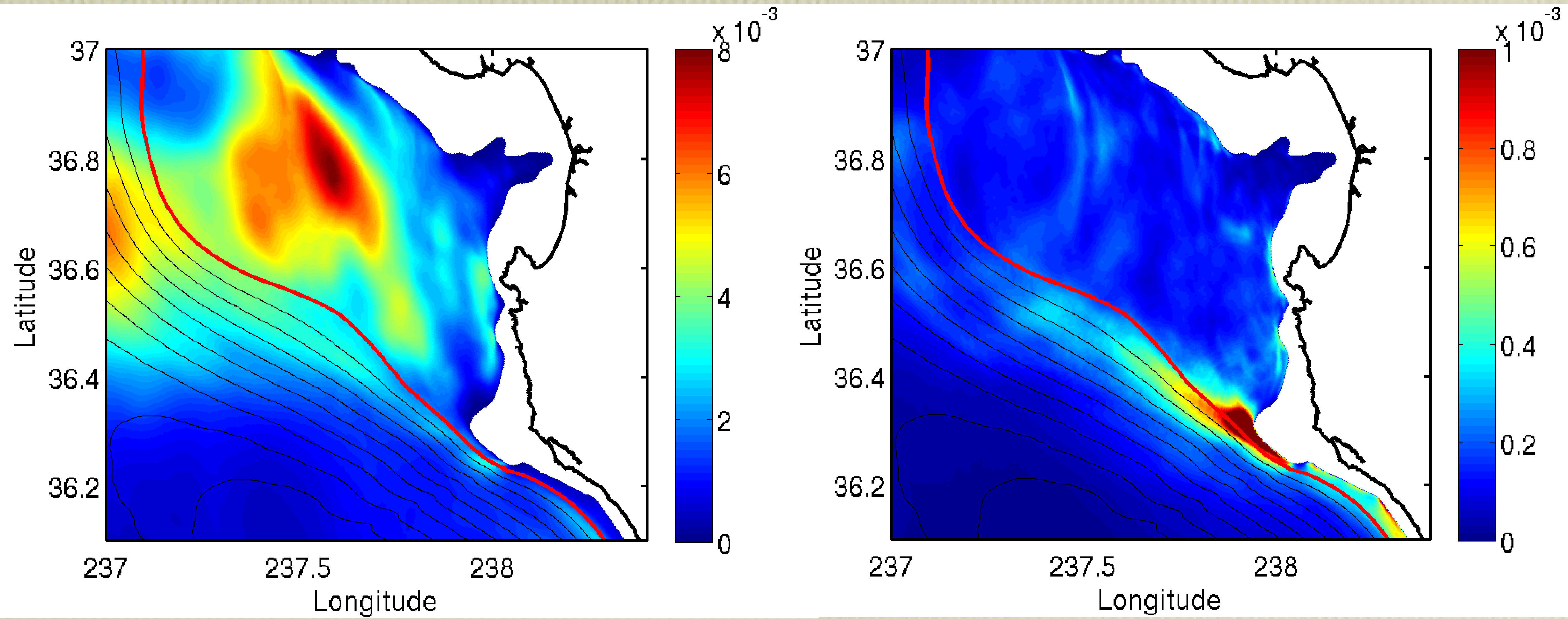
$$p_{bH_0} = -\int \frac{\mathcal{T}}{\partial H/\partial n}\, ds\,.$$



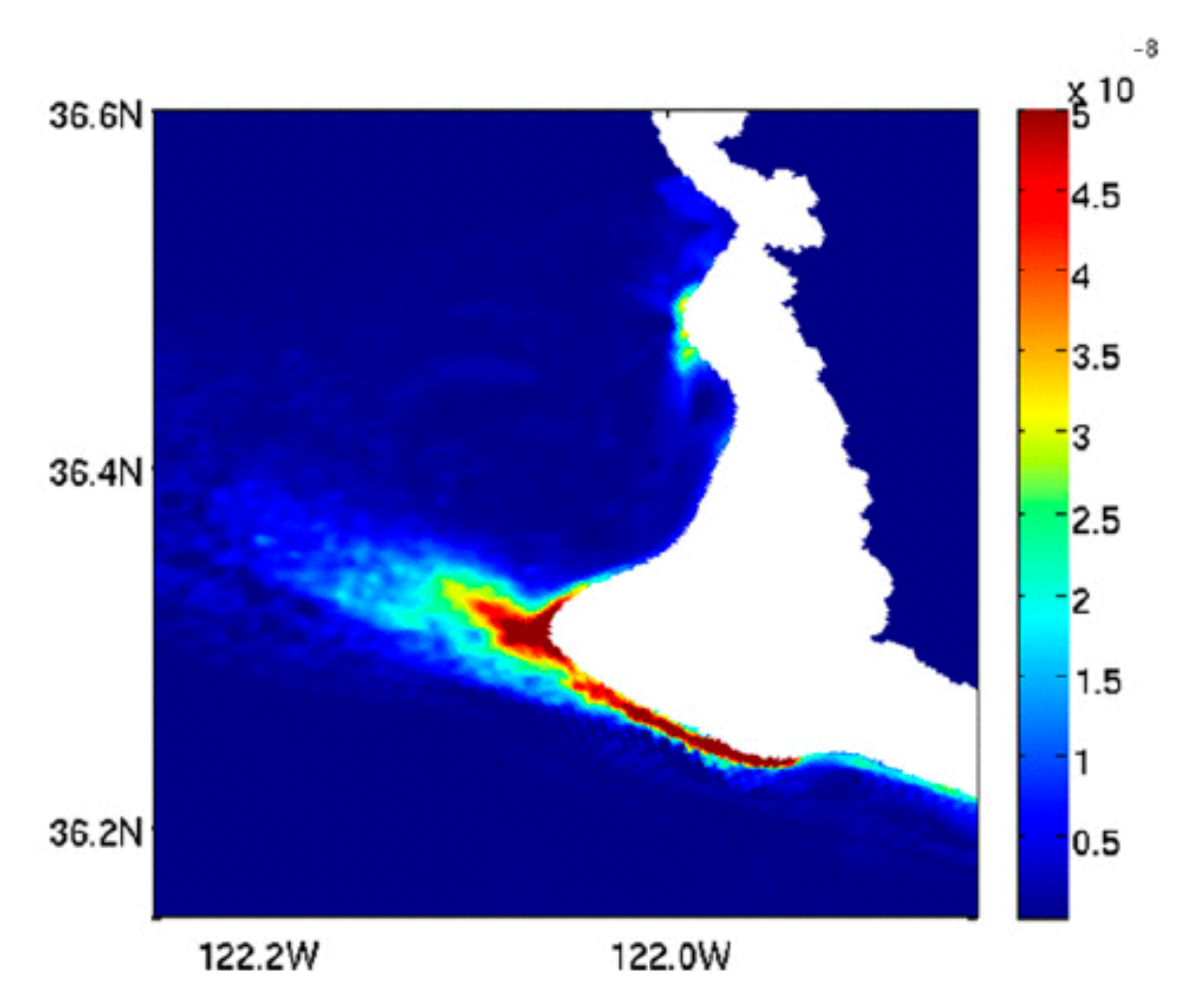
# Divergence variance



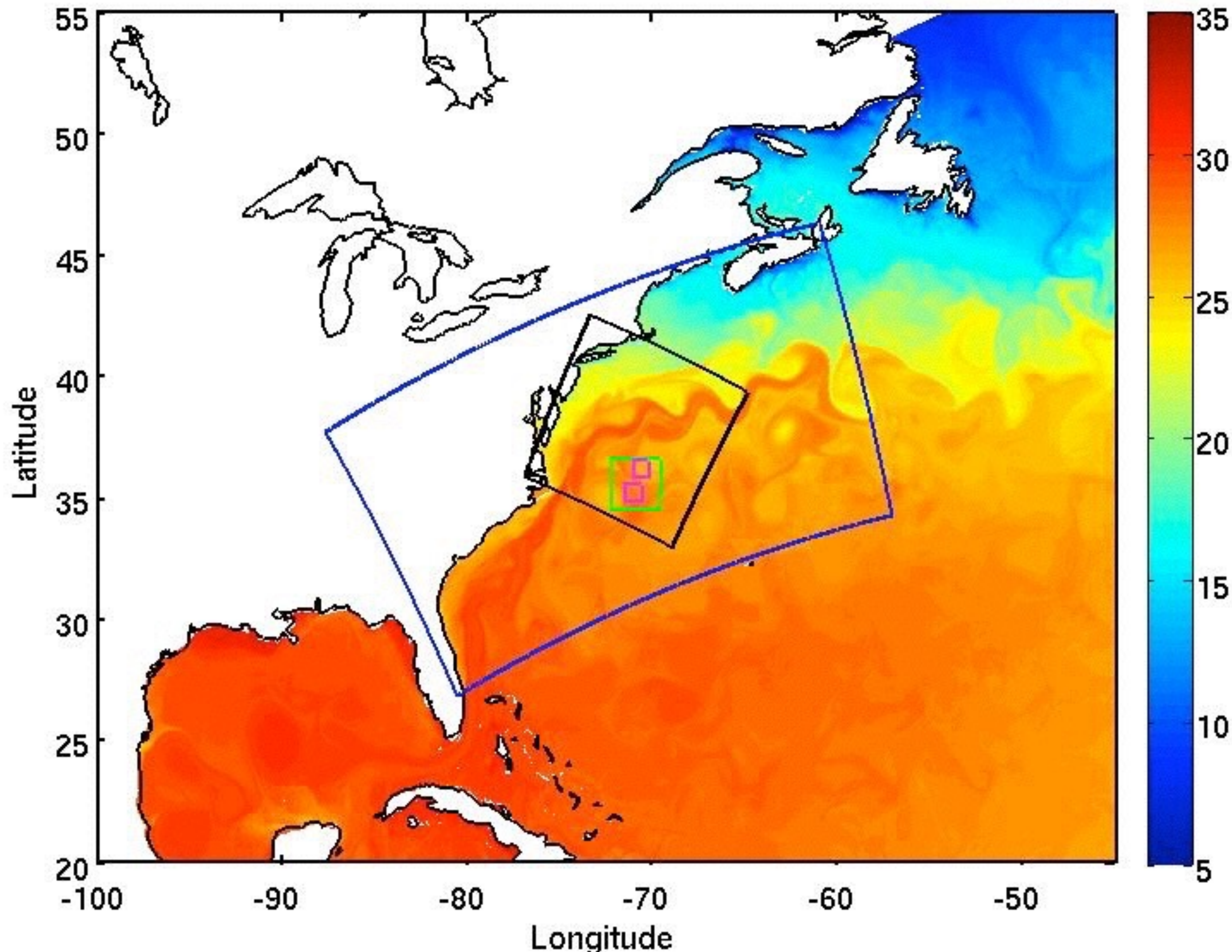
# Mesoscale and SubMesoscale Kinetic energy



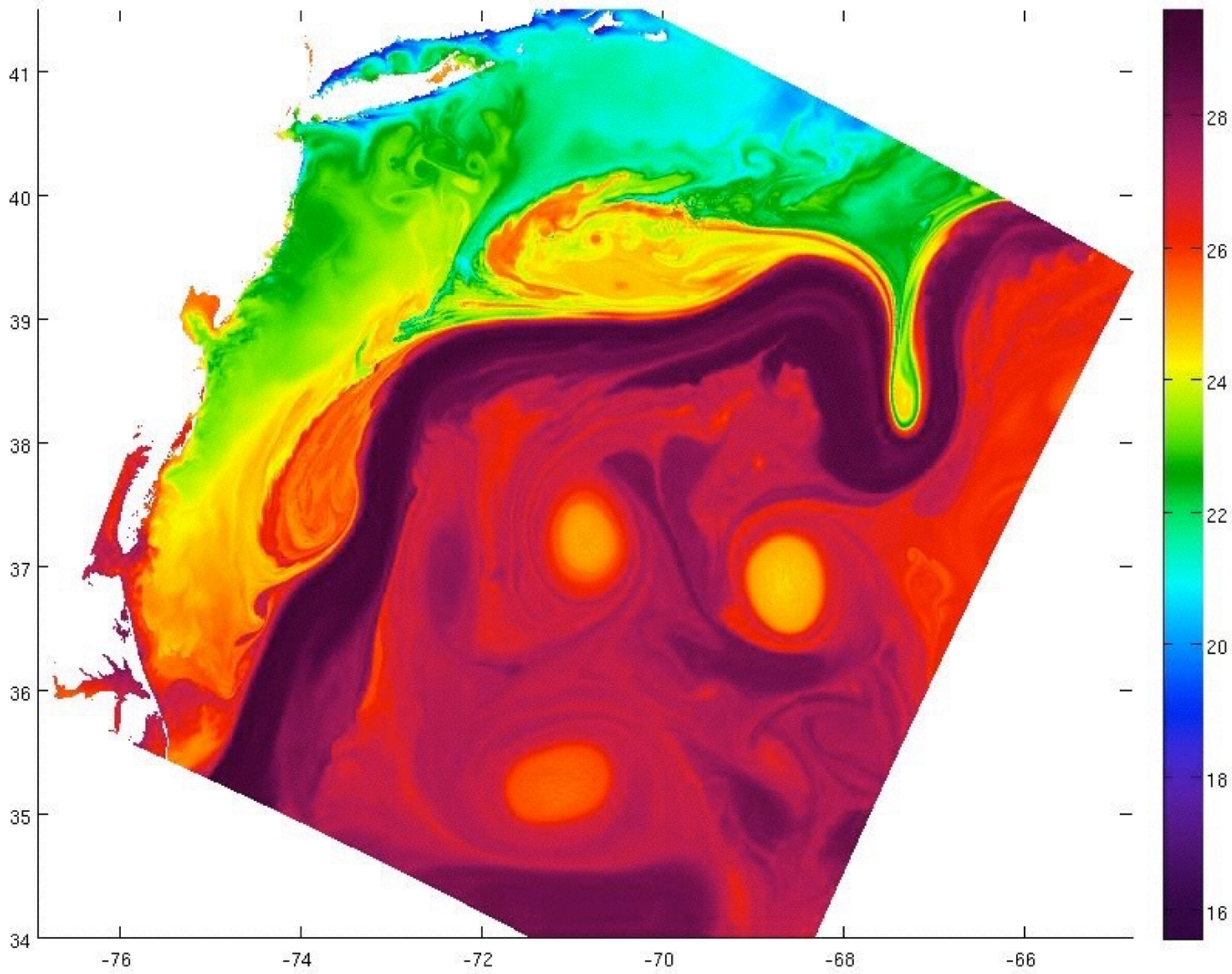
# Enhanced energy dissipation



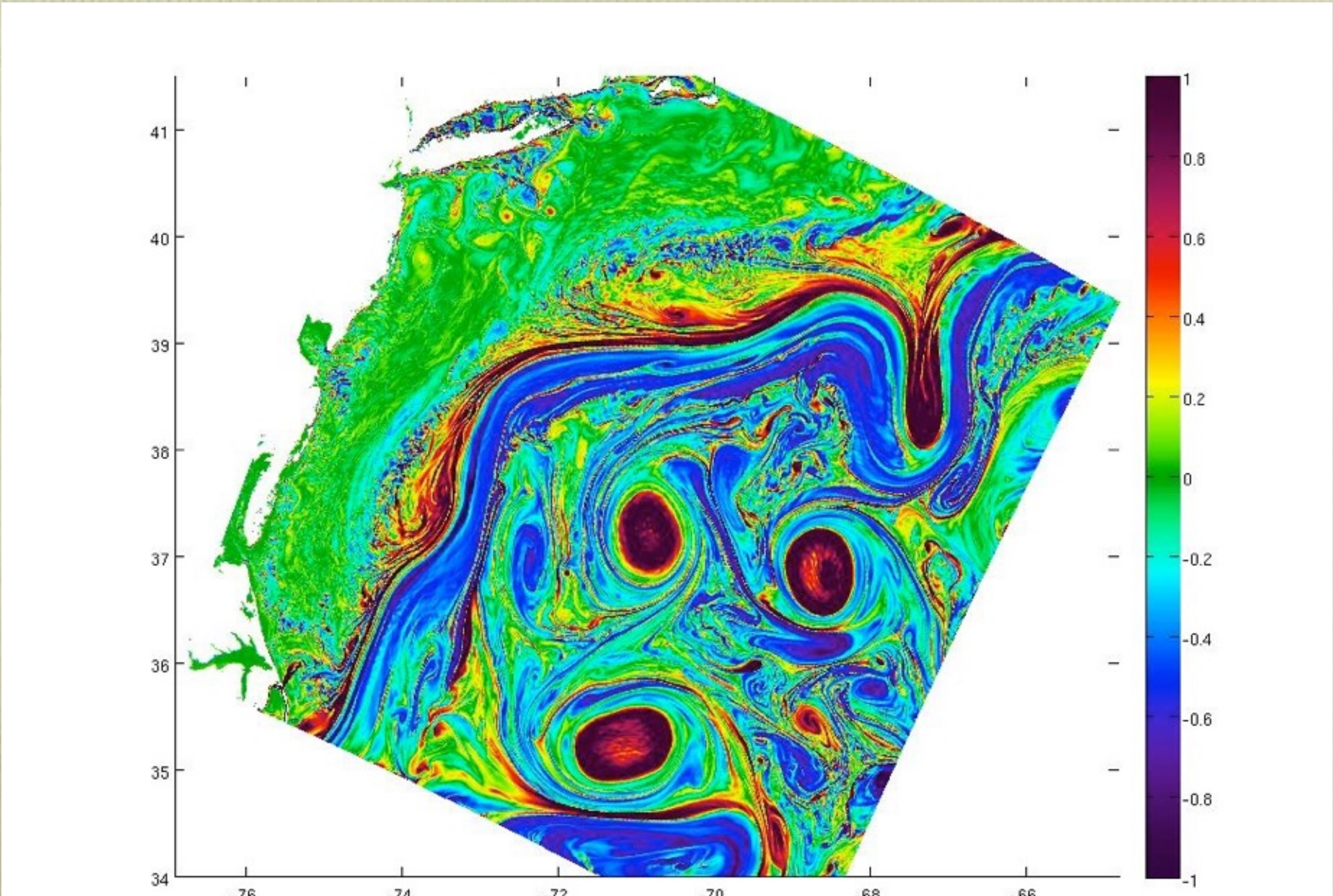
# Subsurface Anti-Cyclones in an Western Boundary Current

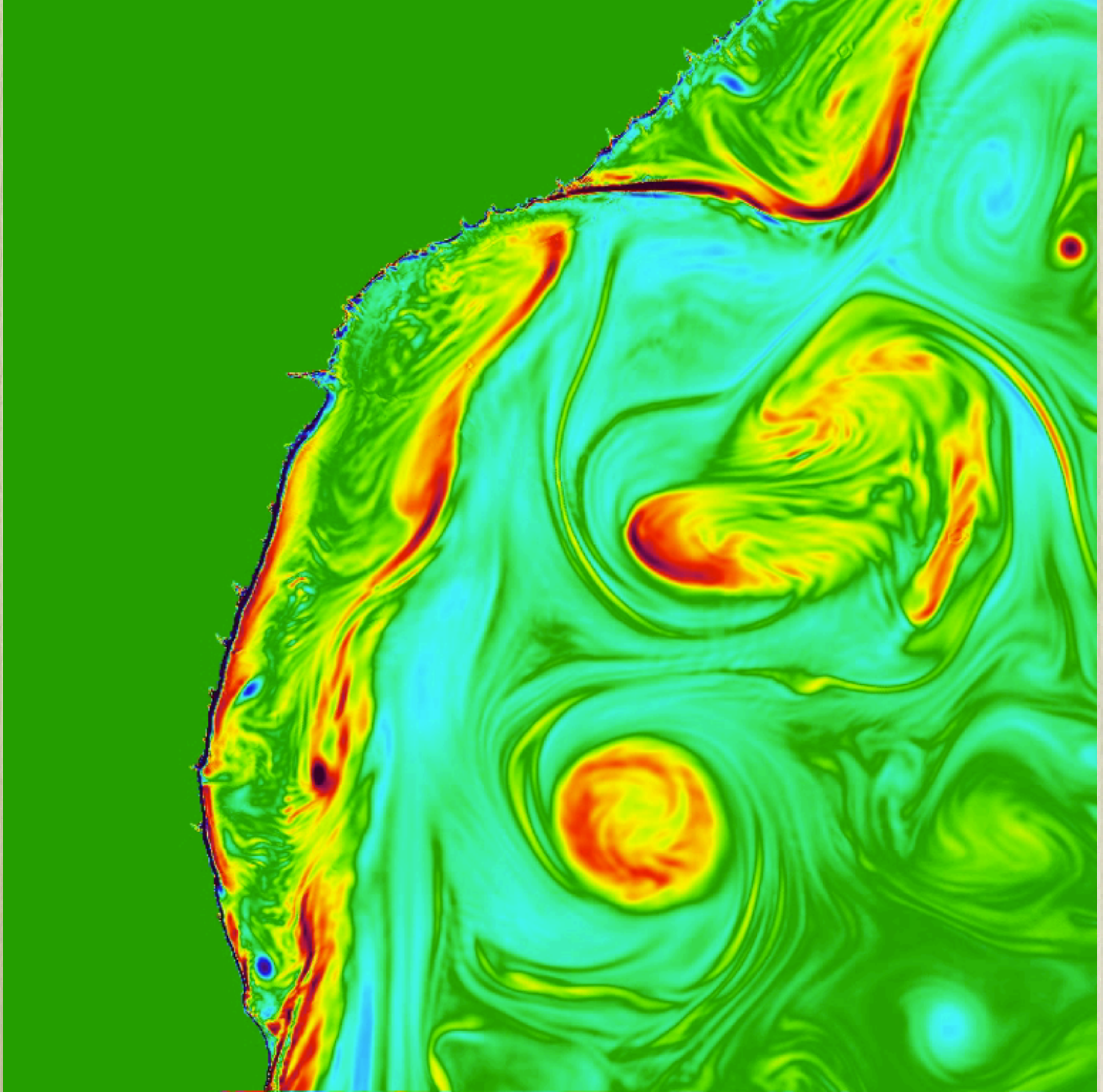


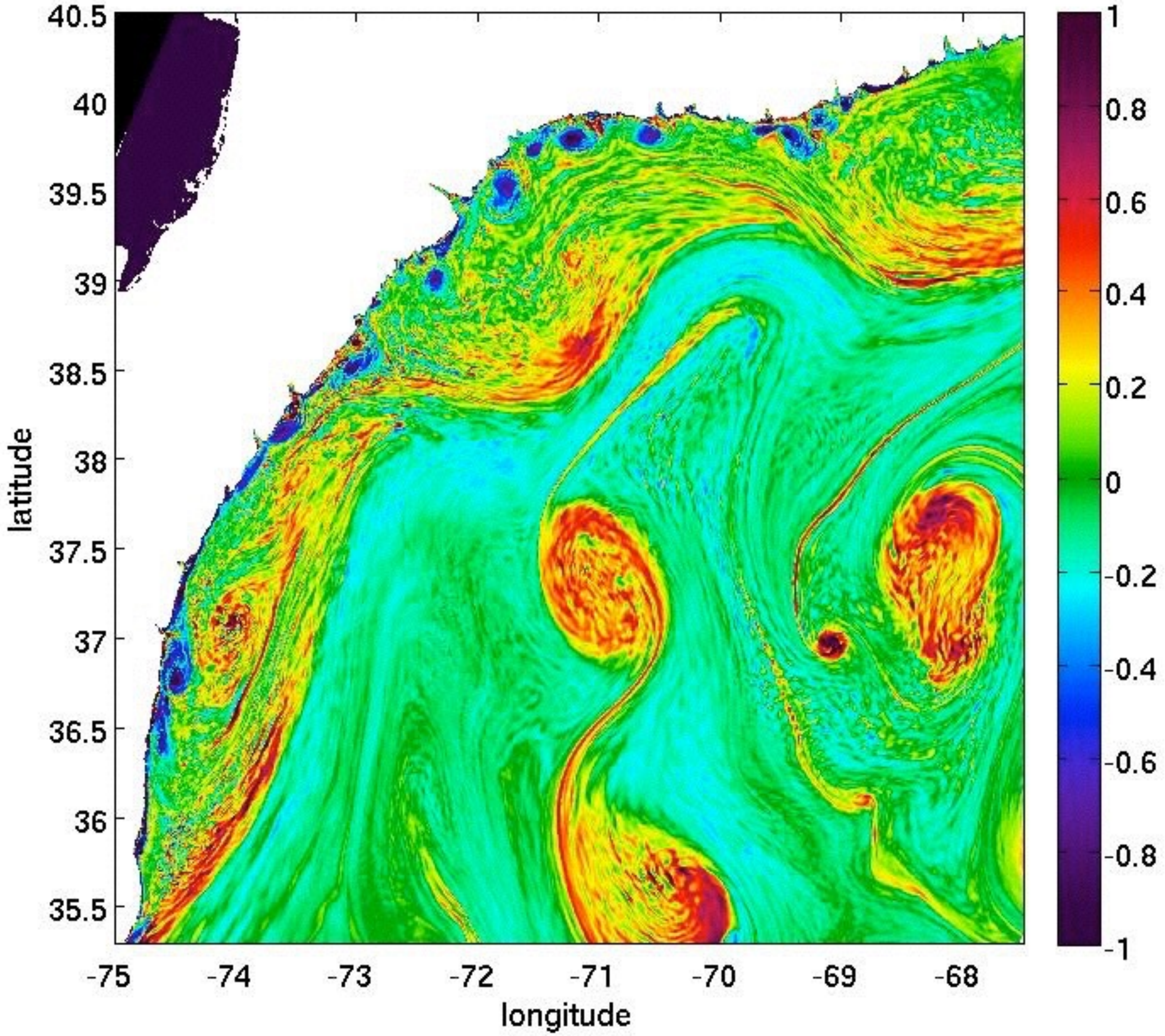
# SST near Cape Hatteras



# Surface Relative Vorticity







40.5
40
39.5
39
38.5
38
37.5
37
36.5
36
35.5
latitude
-75
-74
-73
-72
-71
-70
-69
-68
longitude
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1

# Summary

- A bottom turbulent boundary layer on a slope leads to horizontal shear
- Coastally trapped current can separate
- Instability occurs; sign of shear is critical
- Centrifugal instability leads to vertical exchange and local energy dissipation
- Shear production and separation of slope current is ubiquitous


0001
#3703581 : patel:sm.patel:FxNestingSims.FB_Cam02SimA-0001 - 13:22 Jan 07