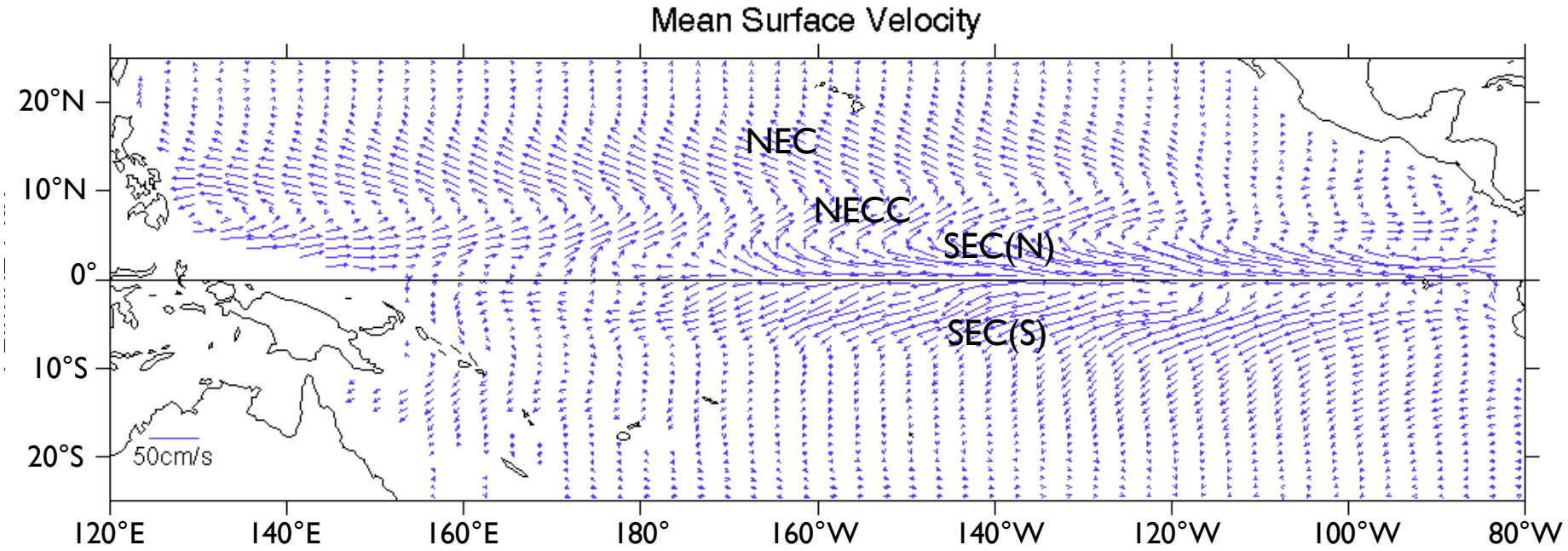
Currents in the tropical Pacific

How they are driven by the wind

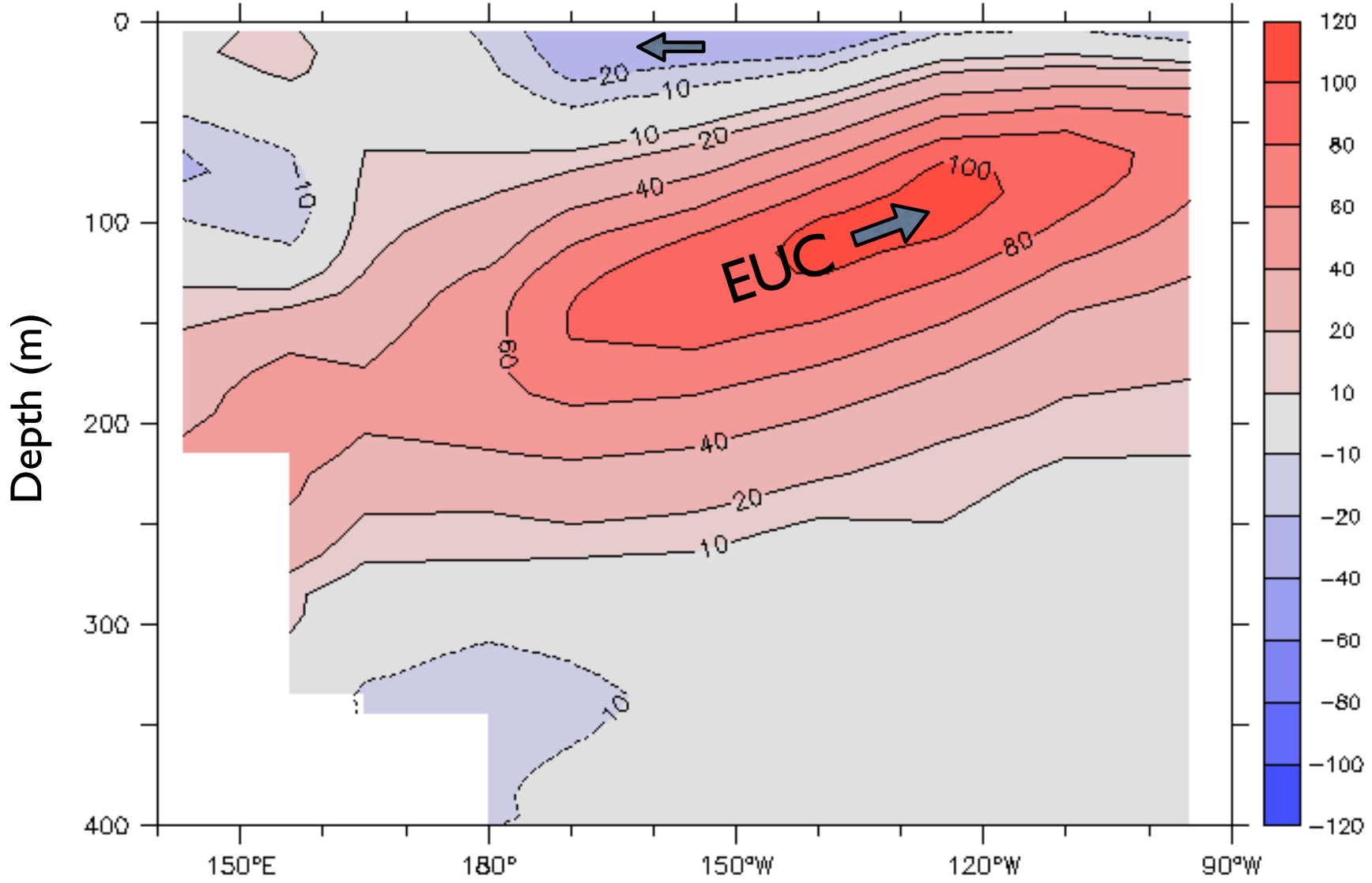
TAO 101
Billy Kessler
12 April 05

Currents from Topex altimetry and surface drifters

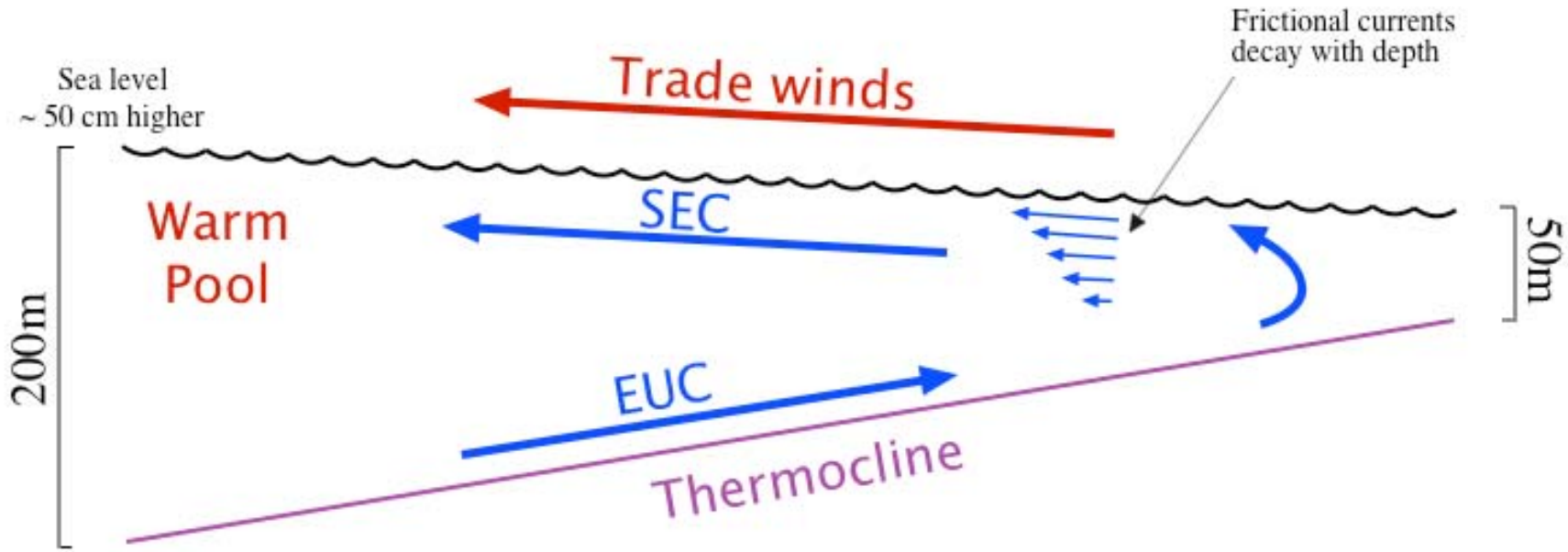


Lagerloef and Bonjean

Zonal currents along the equator



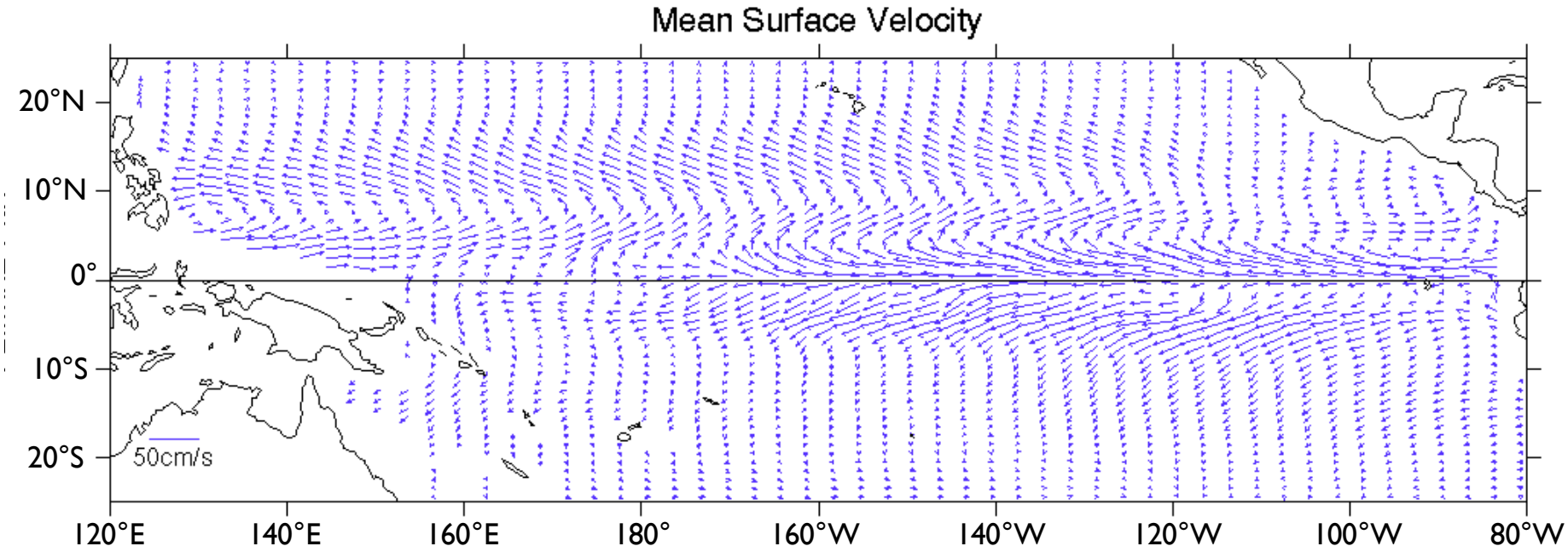
Currents on the Equator



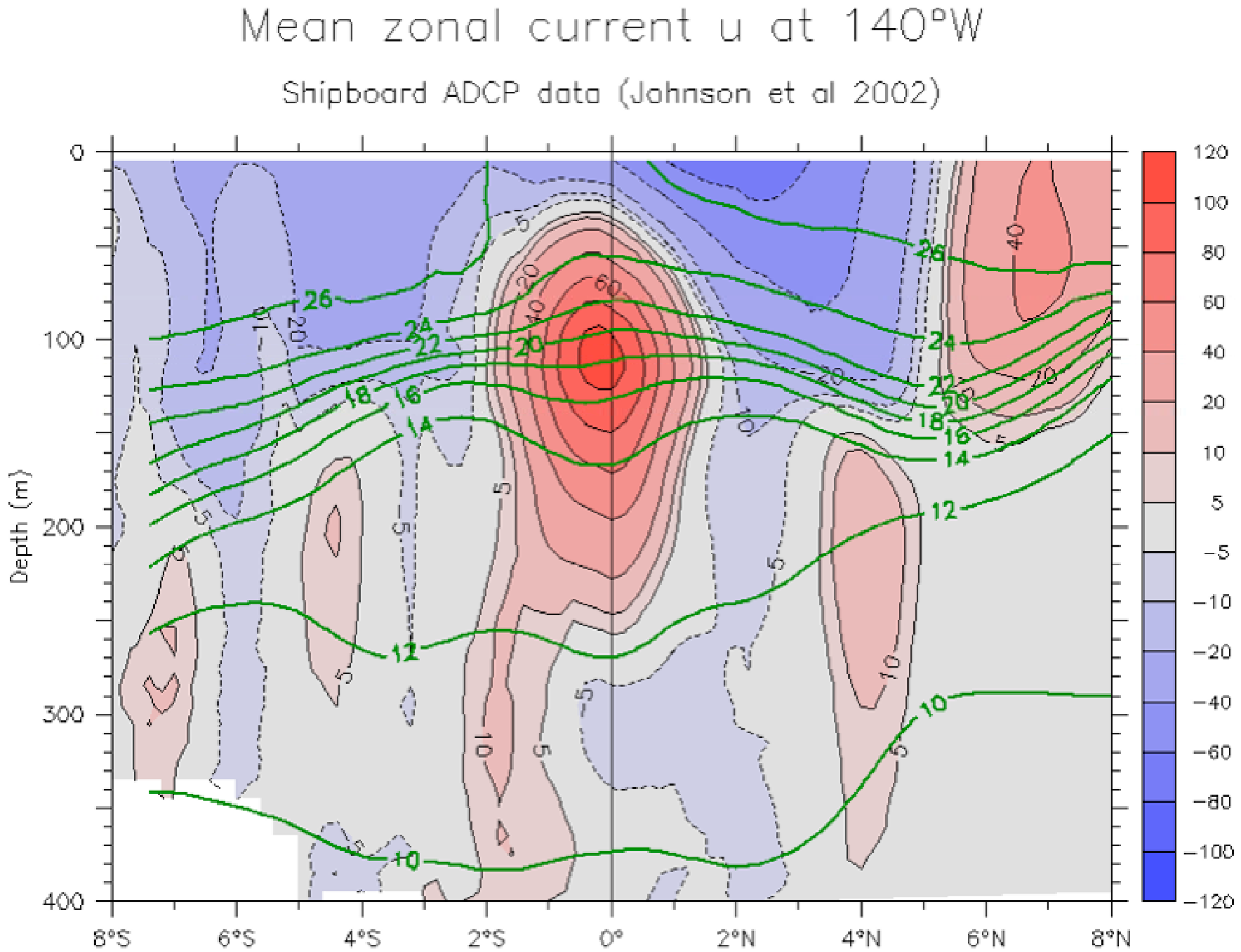
The trade winds 1) Pile up water in the west.
2) Drive the SEC by direct friction.

Below the frictional layer (25m?) pressure due to the high sea level in the west pushes the EUC eastward below the surface.

Currents from Topex altimetry and surface drifters

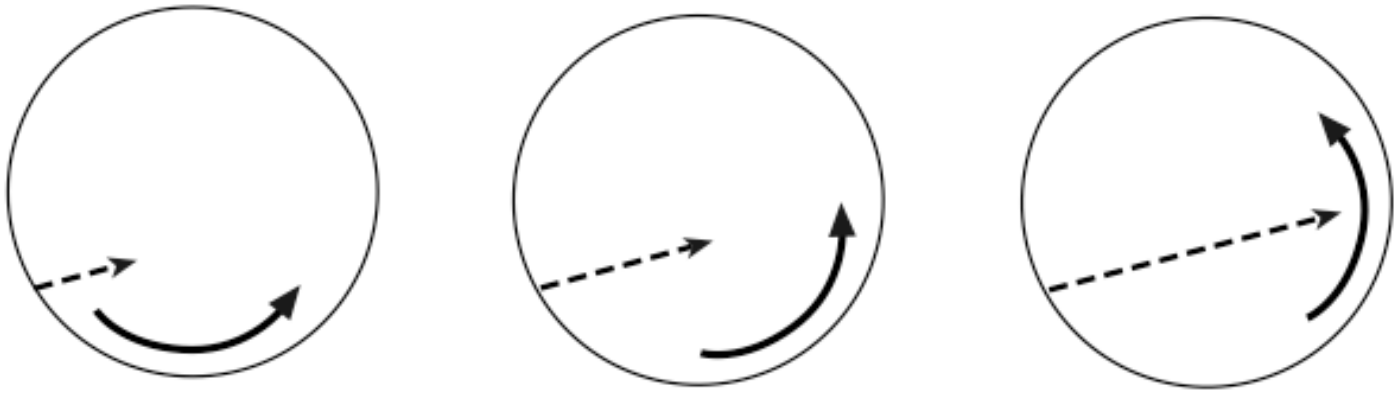


Lagerloef and Bonjean

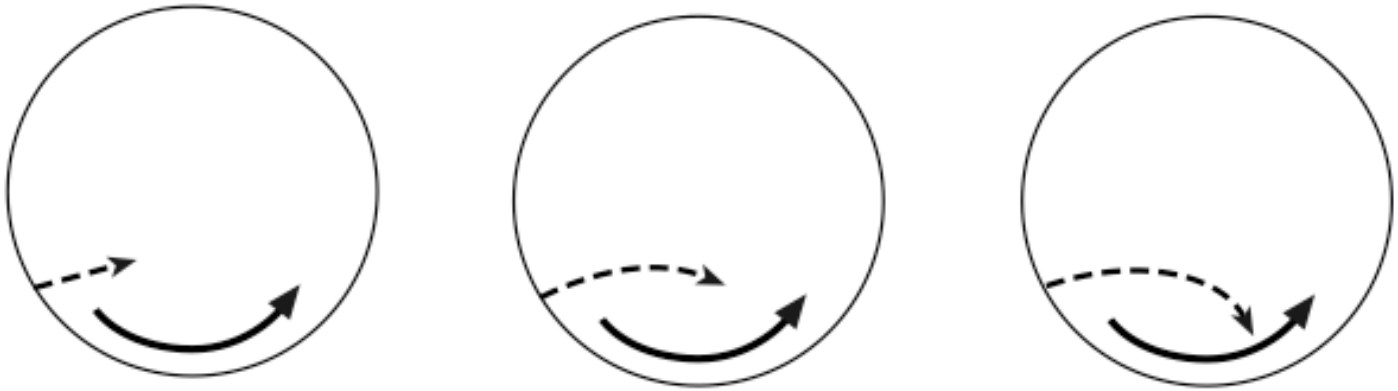

Mean zonal current u at 140°W
Shipboard ADCP data (Johnson et al 2002)
Depth (m)
0
100
200
300
400
8°S
6°S
4°S
2°S
0°
2°N
4°N
6°N
8°N
120
100
80
60
40
20
10
5
−5
−10
−20
−40
−60
−80
−100
−120

Coriolis “Force”

Looking down on the North Pole from space:



Moving with the rotating earth:

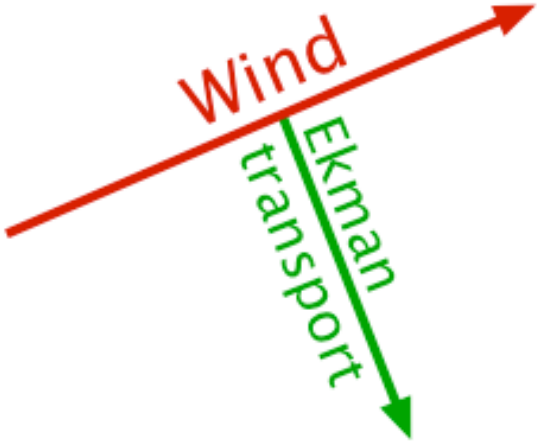


➡Turning due to the Coriolis “force” is just straight motion seen within a rotating reference frame.

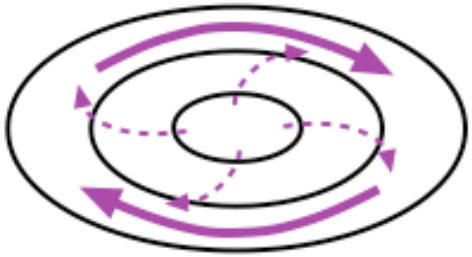
Consequences of the Coriolis Effect

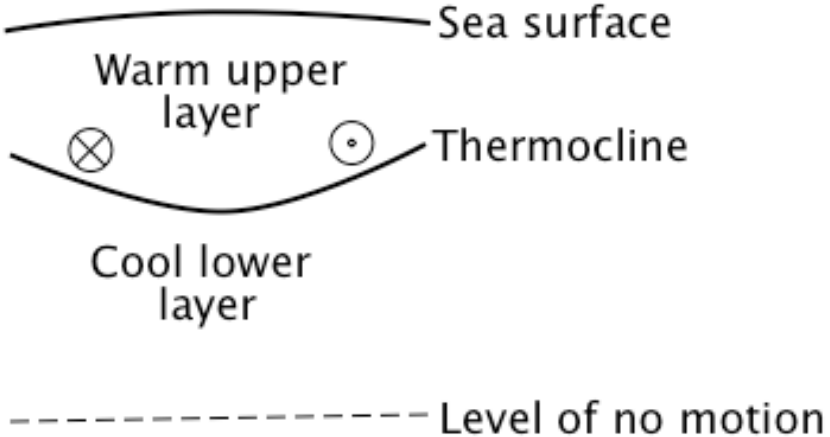
(Northern Hemisphere examples)

Directly-forced currents ("Ekman transport") in the near-surface layer are at right angles to the wind

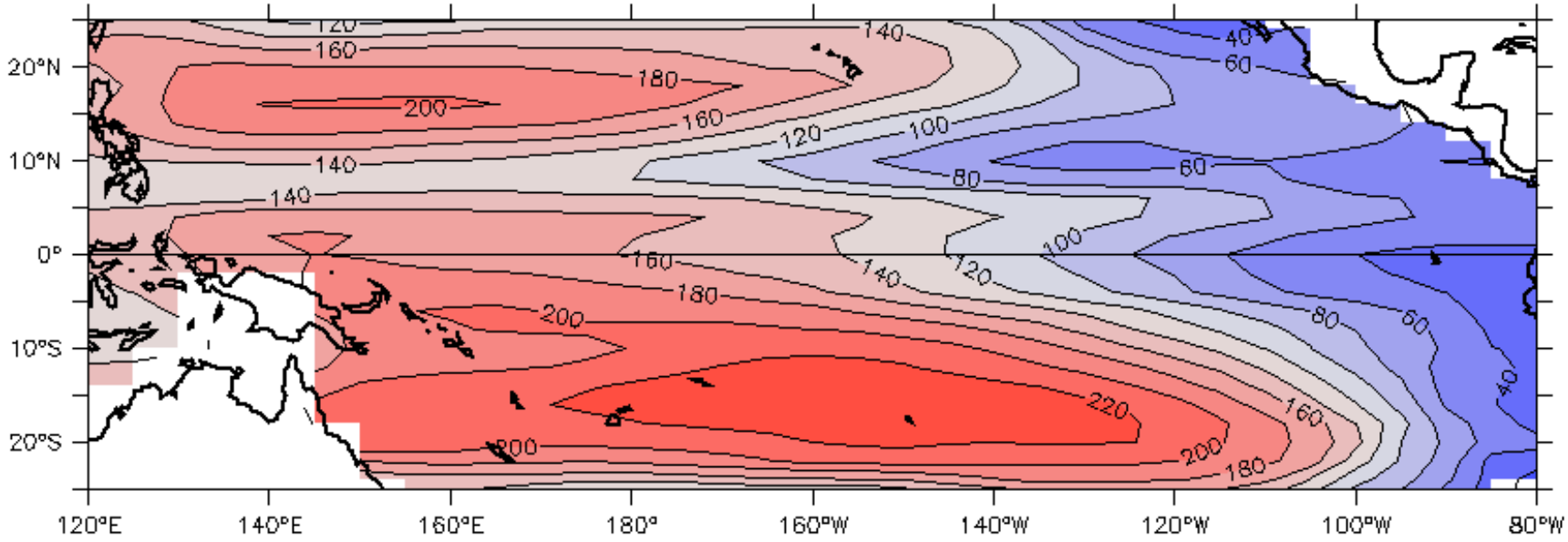


"Geostrophic" (earth-turning) currents are *parallel* to hills and valleys in the thermocline



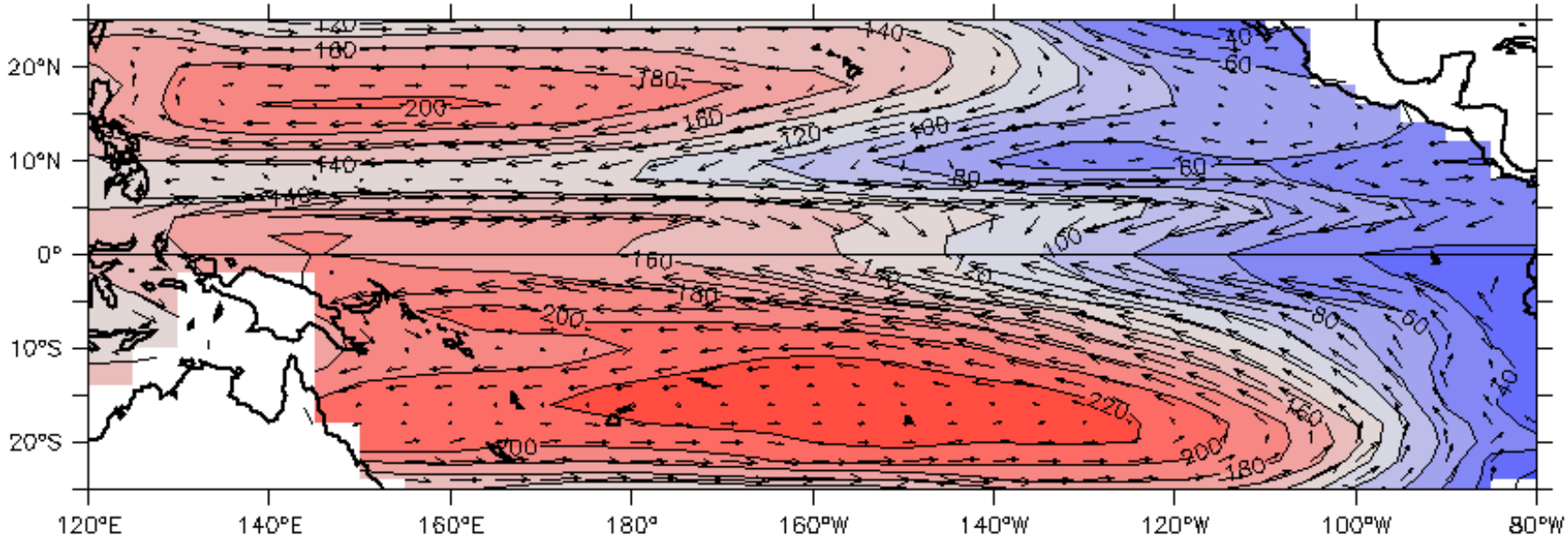


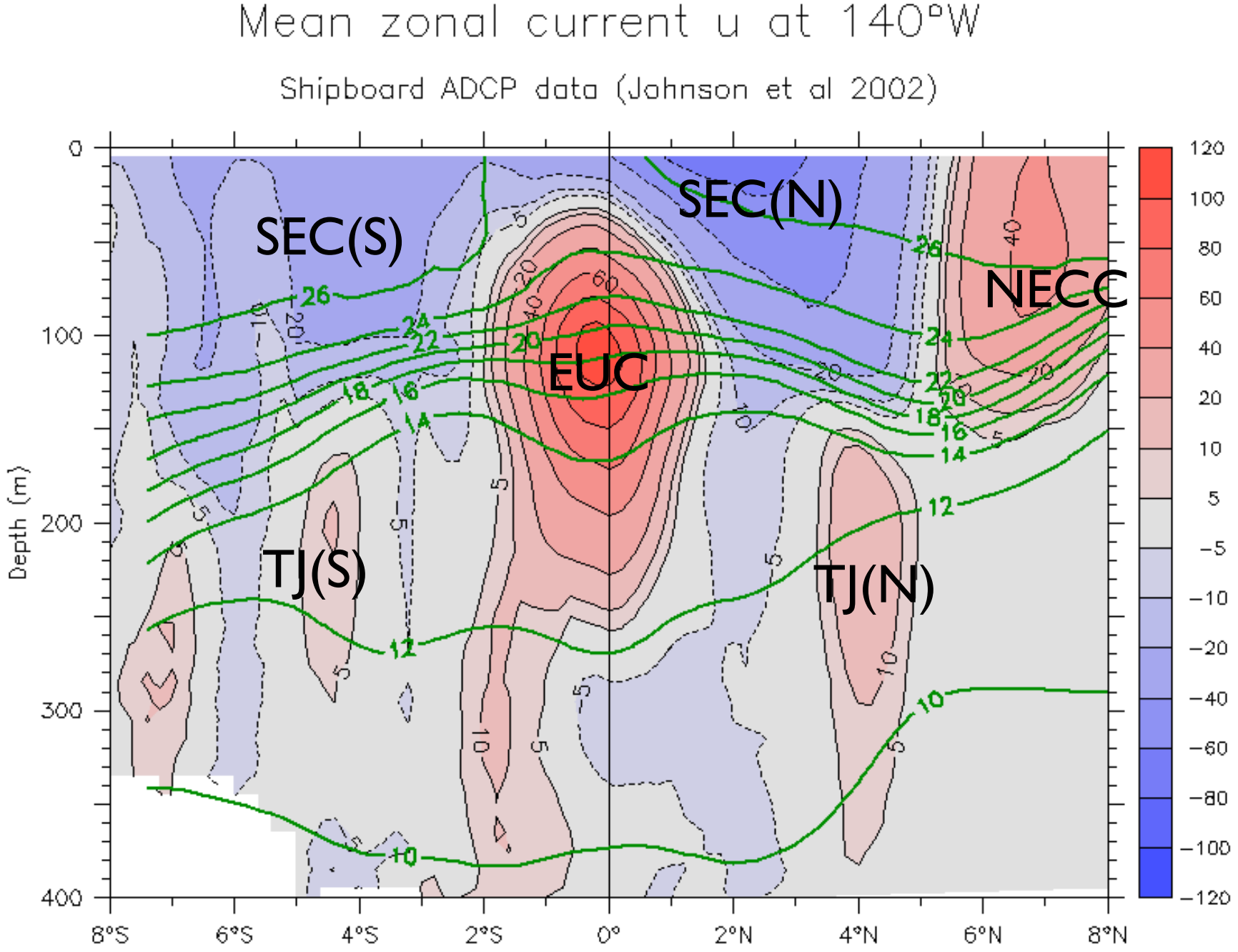
Mean depth of the 20°C isotherm



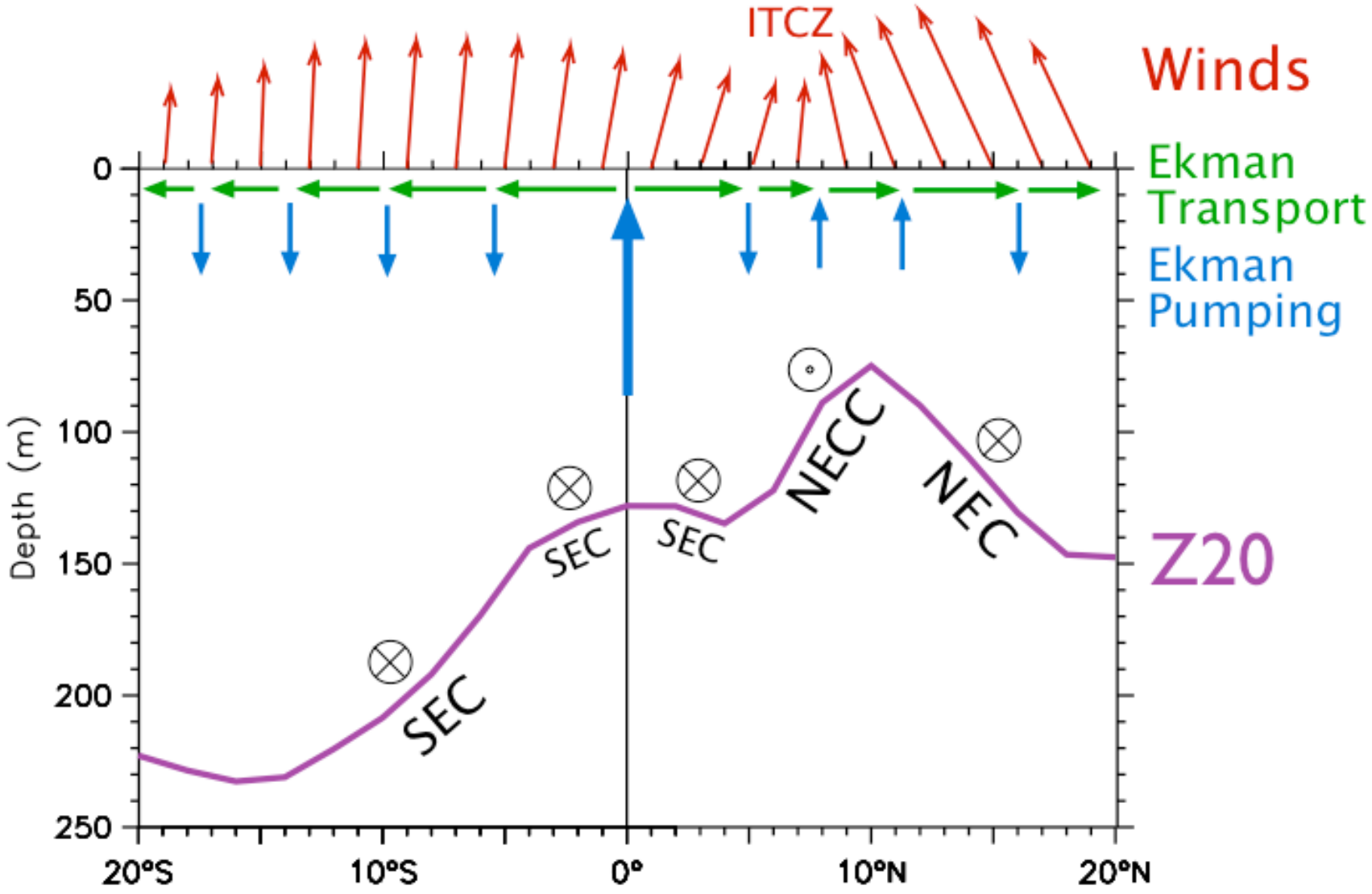
Mean depth of the 20°C isotherm

Overlay geostrophic velocity




Mean zonal current u at 140°W
Shipboard ADCP data (Johnson et al 2002)
SEC(S)
SEC(N)
NECC
EUC
TJ(S)
TJ(N)
Depth (m)
0
100
200
300
400
8°S
6°S
4°S
2°S
0°
2°N
4°N
6°N
8°N
120
100
80
60
40
20
10
5
−5
−10
−20
−40
−60
−80
−100
−120

The indirect path from winds to currents:
(Why the NECC flows against the wind)

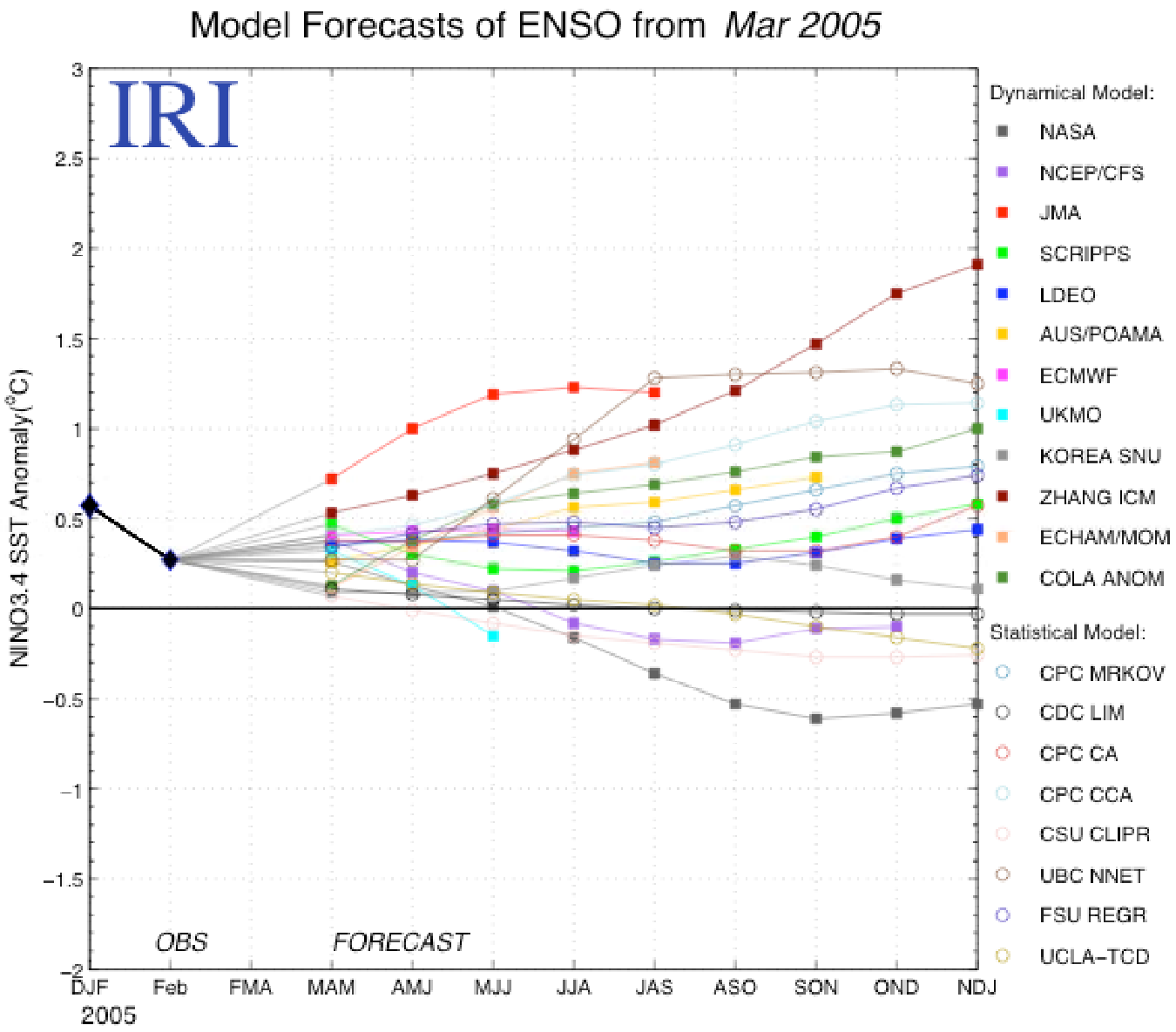


The current El Niño (?)

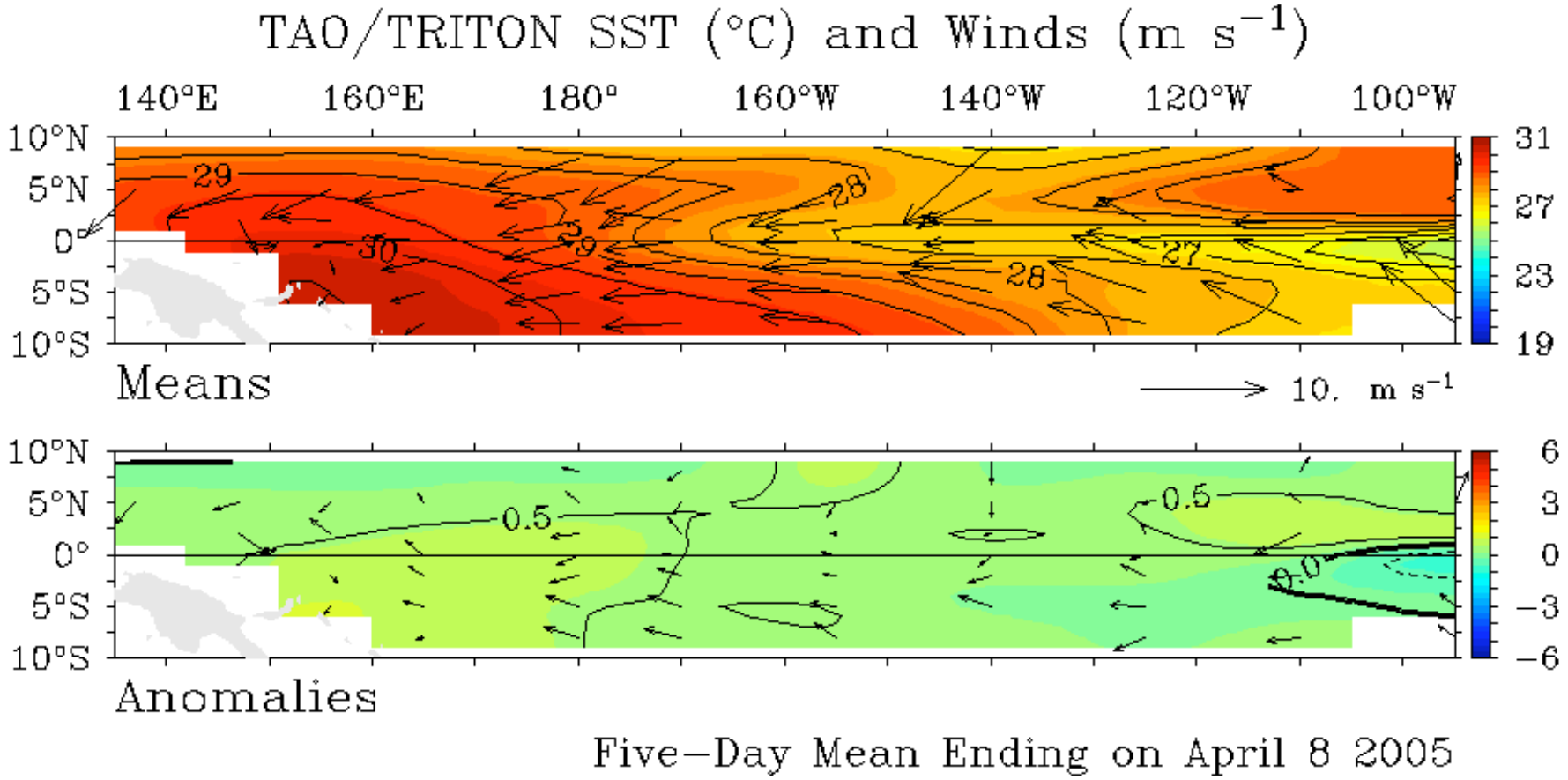
What's happening?

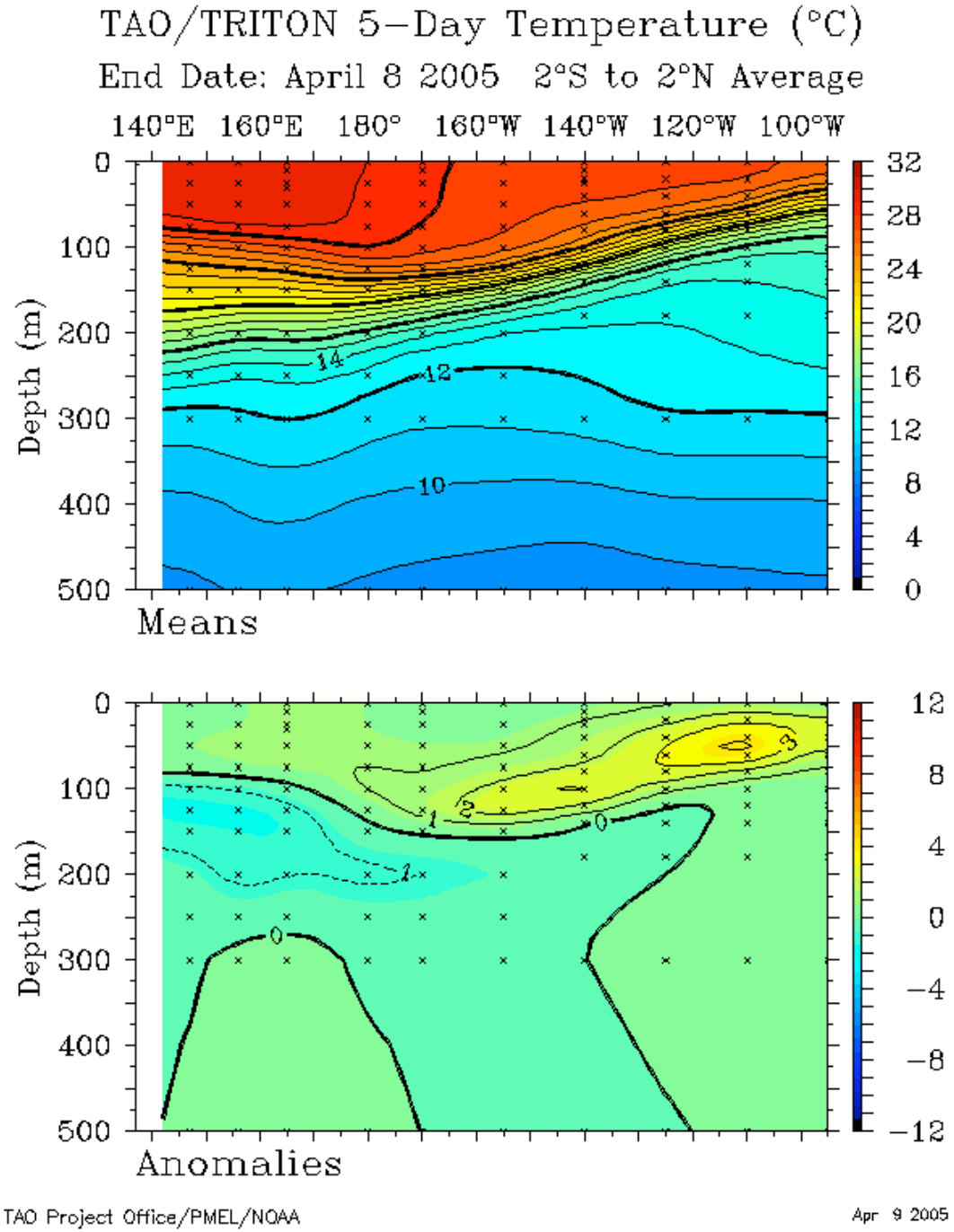
(Beats me!?!)

(And it beats a lot of other people, too ....)



Surface conditions look pretty normal at the moment ....

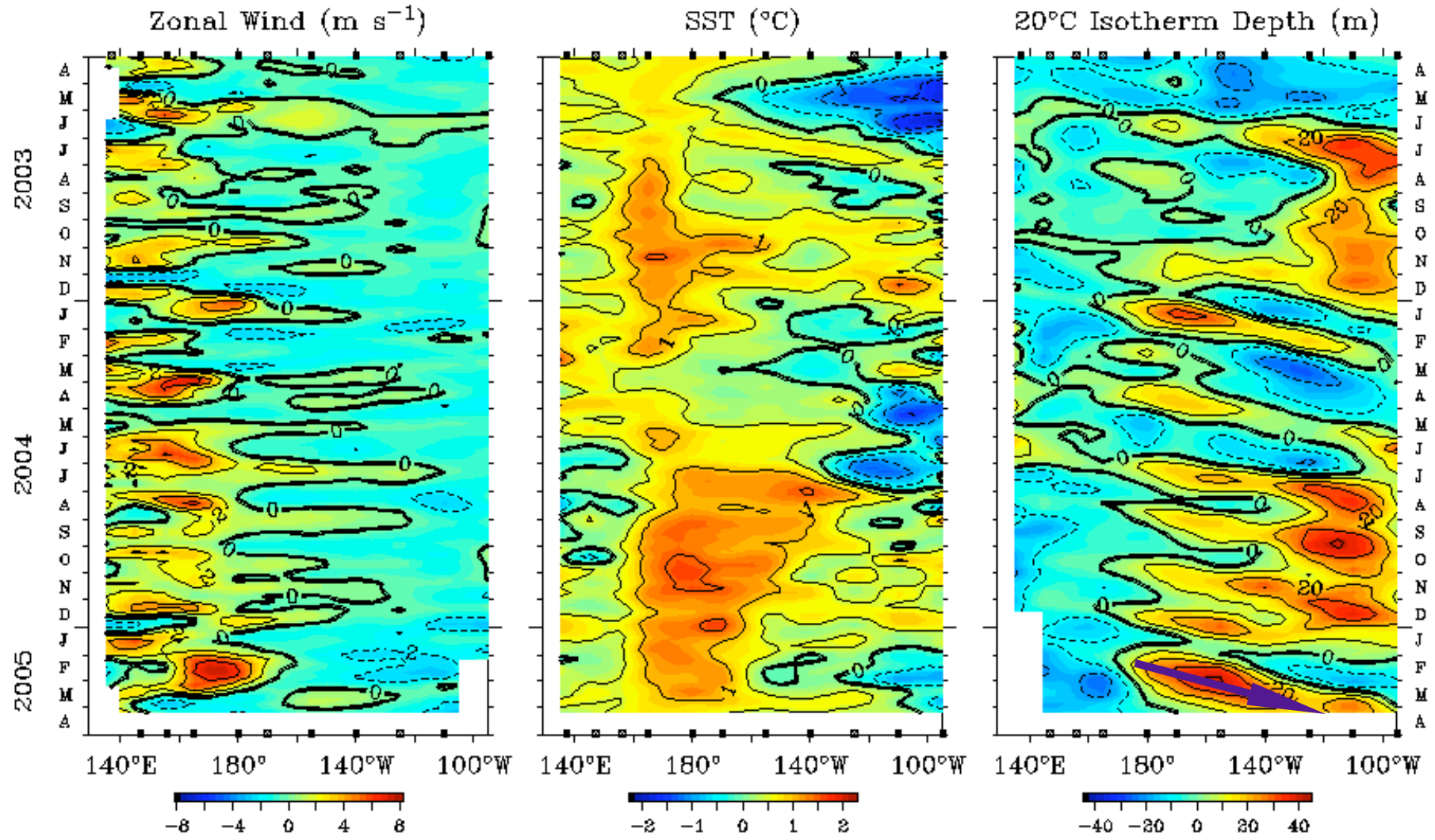




But subsurface, the traces of last month's westerly wind burst remain strong.

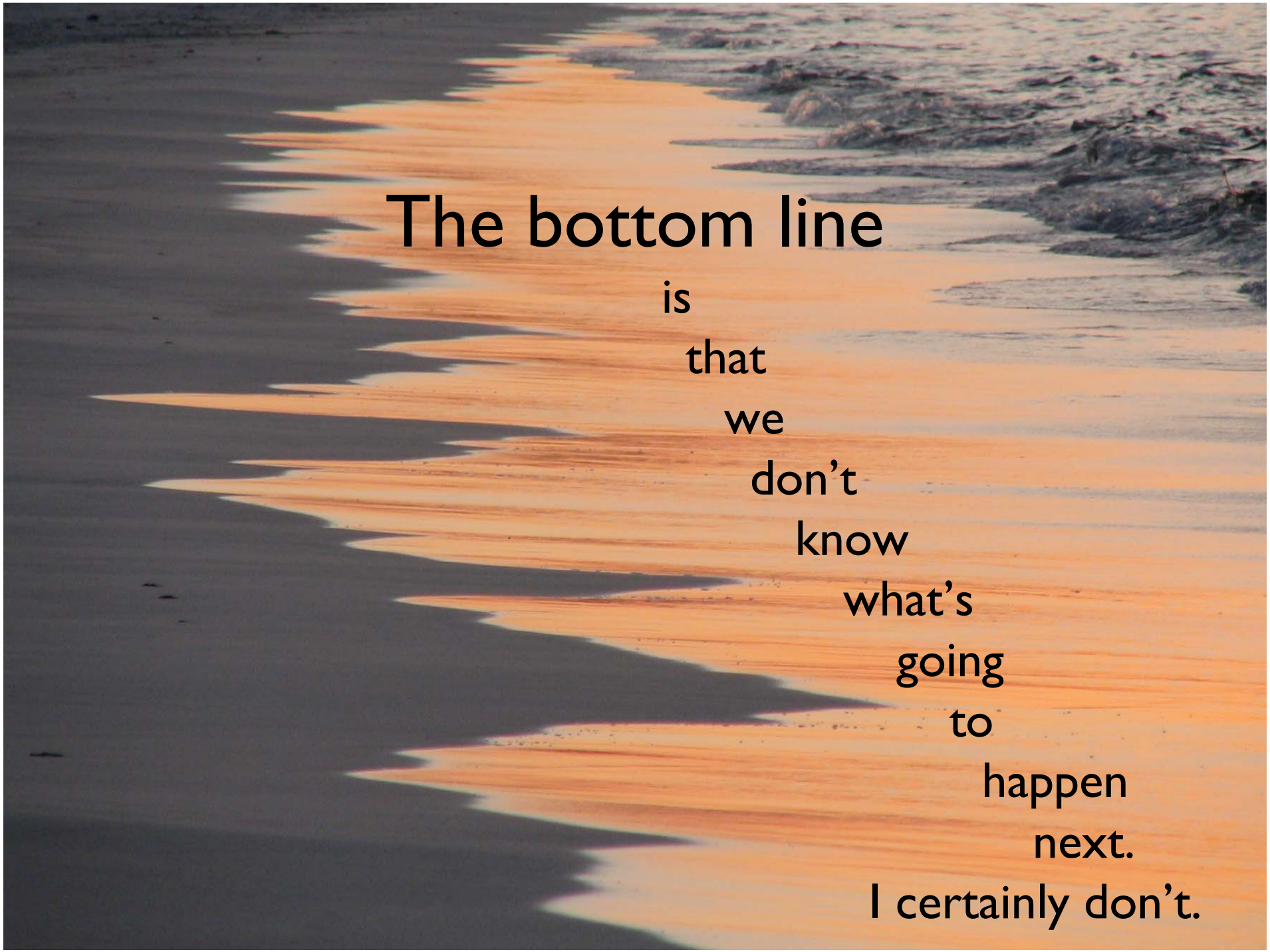
The warm (deep) anomalies in the thermocline continue moving east as a Kelvin wave.

Five Day Zonal Wind, SST, and 20°C Isotherm Depth Anomalies 2°S to 2°N Average



TAO Project Office/PMEL/NOAA

Apr 9 2005


The bottom line
is
that
we
don't
know
what's
going
to
happen
next.
I certainly don't.