The background of the slide is a scientific map of the Northern Slope, likely in the North Atlantic. It features bathymetric contours and a color-coded overlay representing deepwater currents. The colors range from purple and blue in the upper left to green and yellow in the middle right, and brown in the lower right. The text is overlaid on this map.

Deepwater Currents over the Northern Slope, below 1000 m, from Moorings and Drifters

Peter Hamilton

Science Applications International Corporation

Outline

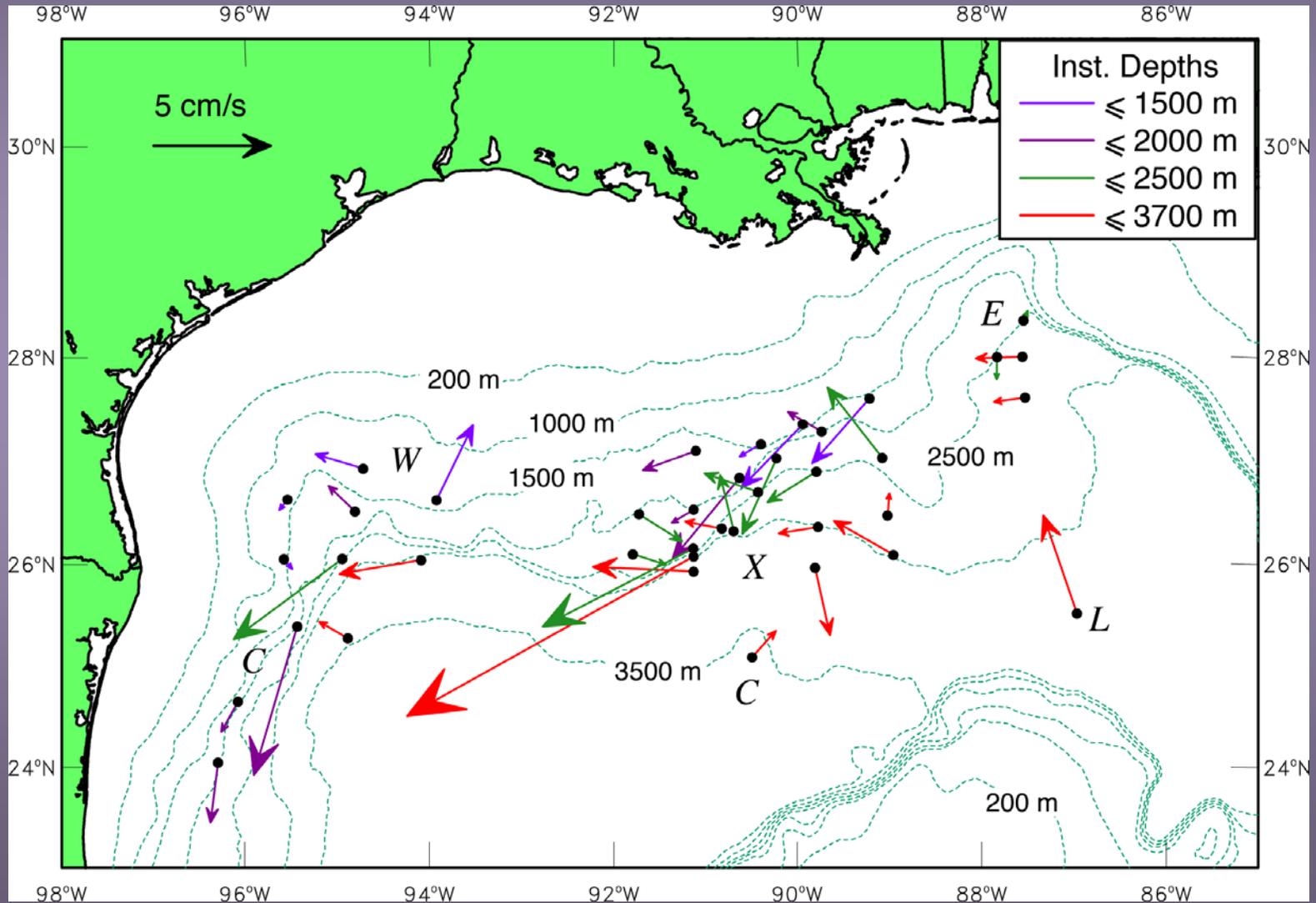
Programs

- Eastern Gulf – E Gulf (EHI) & LC Mooring (LSU - M. Inoue)
- Central Gulf – Exploratory Program (SAIC)
- Western Gulf – NW Gulf (SAIC) & Mexican Slope (CICESE)

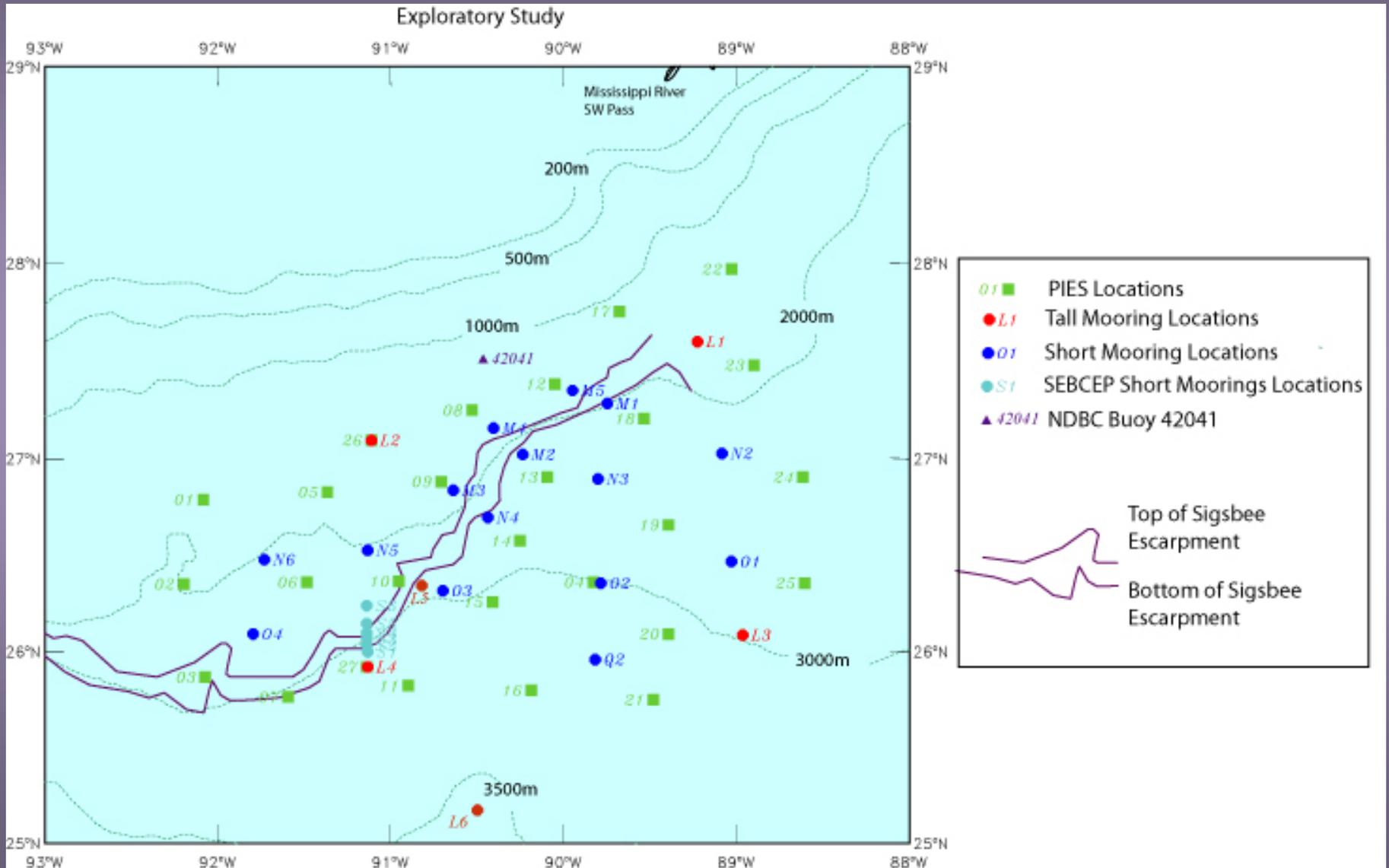
Processes

- Topographic Rossby Waves
 - Propagation, Refraction & Reflection
 - Genesis
- Deep Eddies
 - Do they exist?

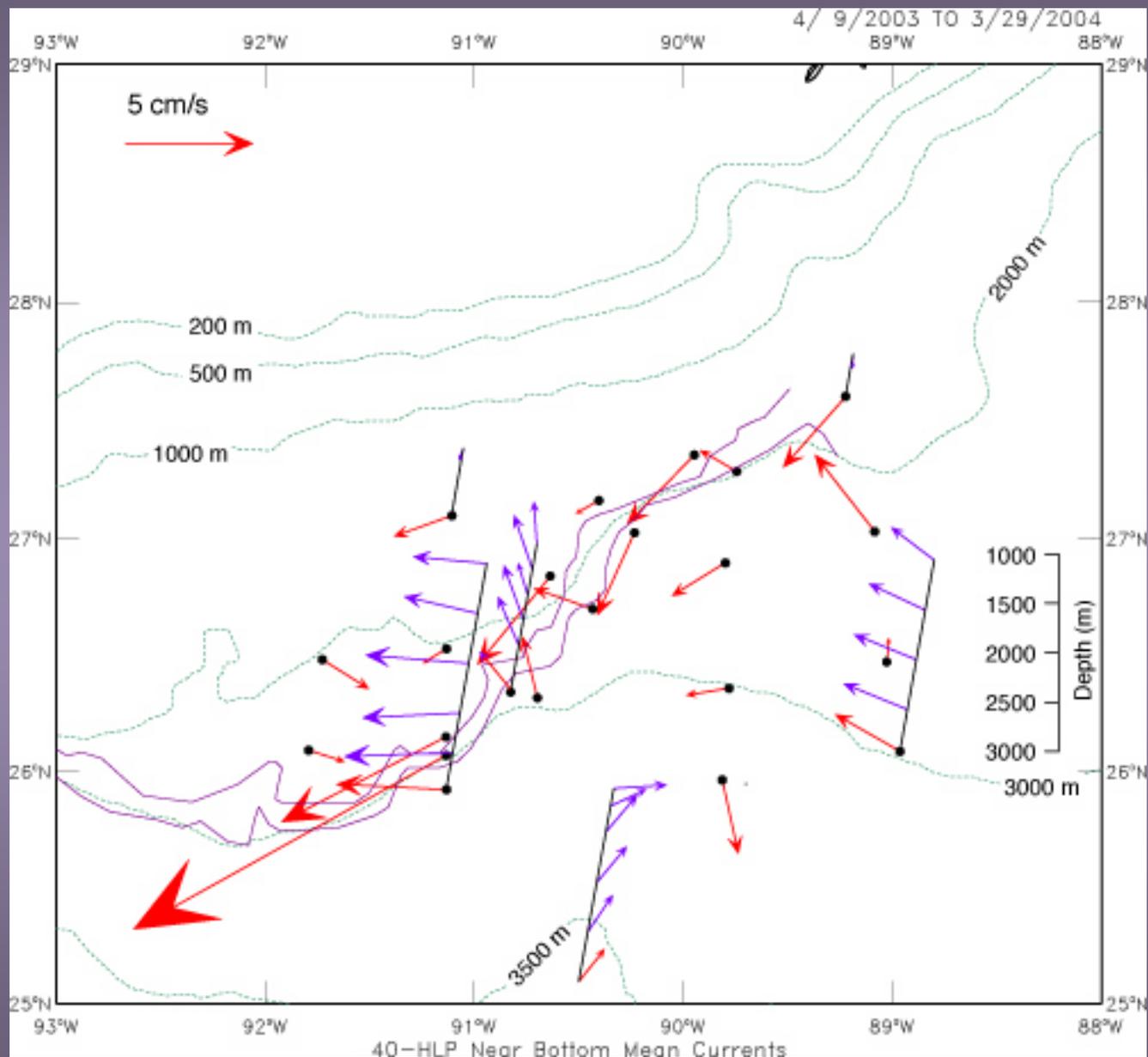
Programs Moorings with Instruments > 1000 m



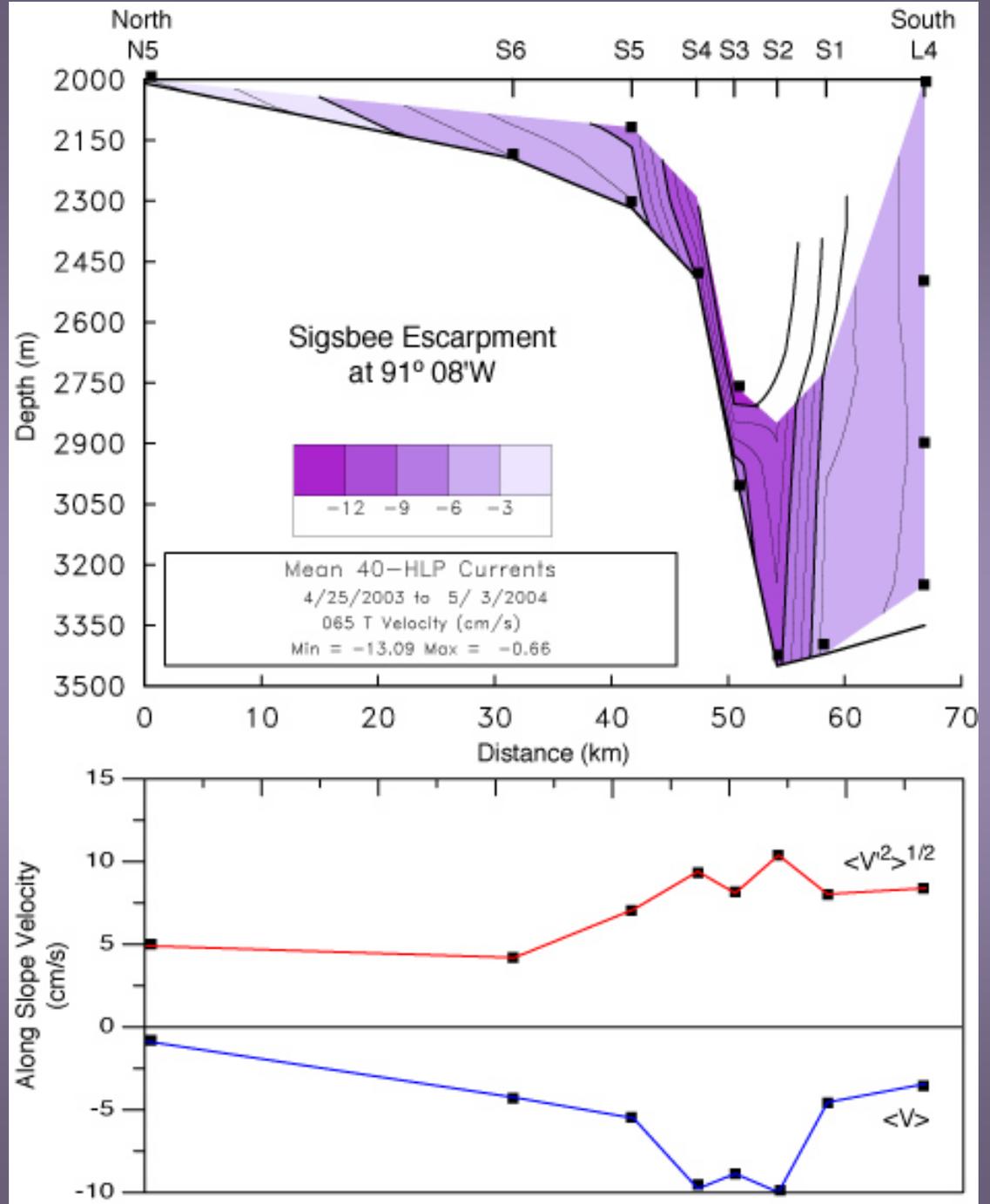
Map of Instrument Locations



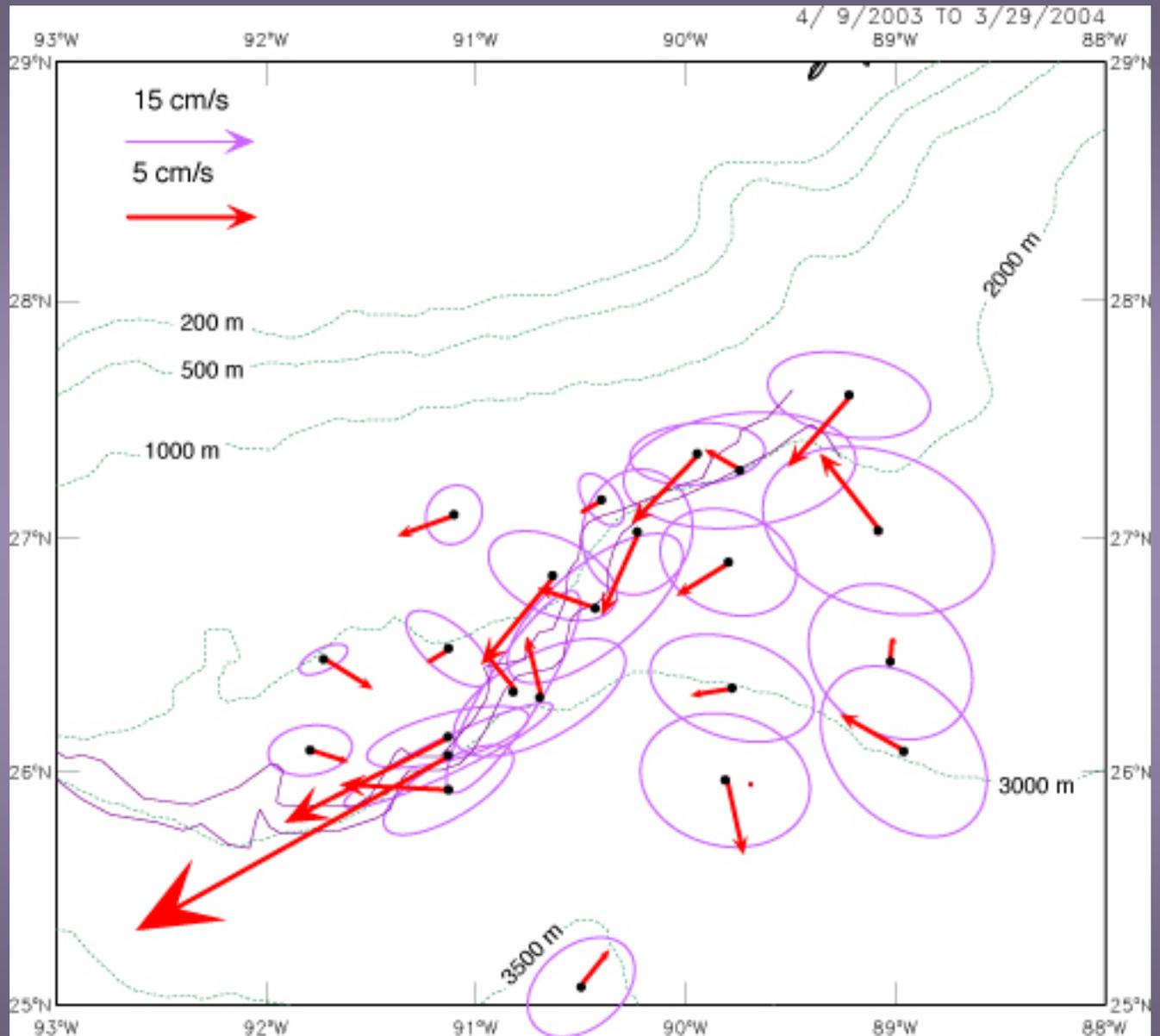
Lower Layer Mean Currents



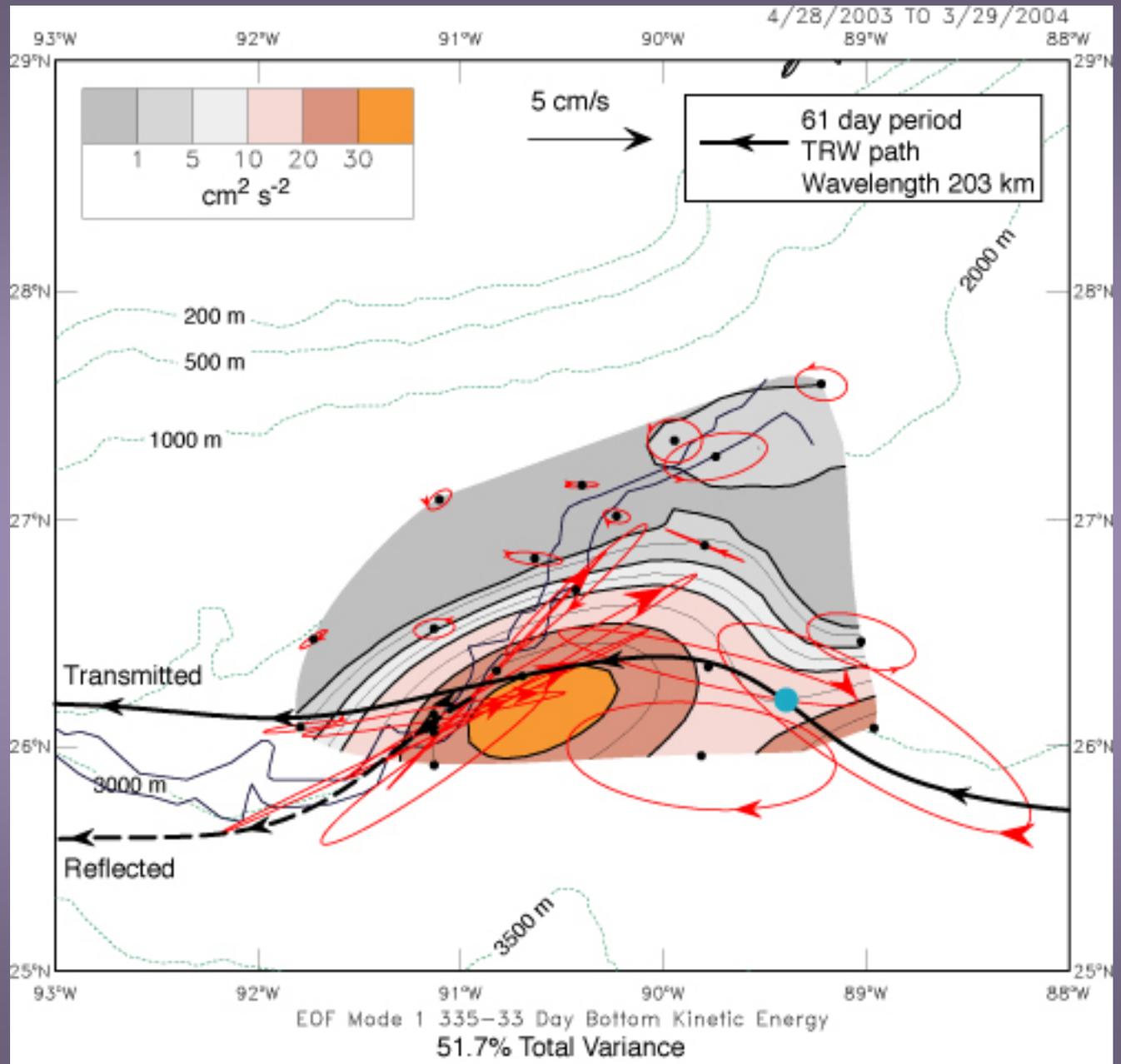
Mean Along-Slope Currents across the Escarpment



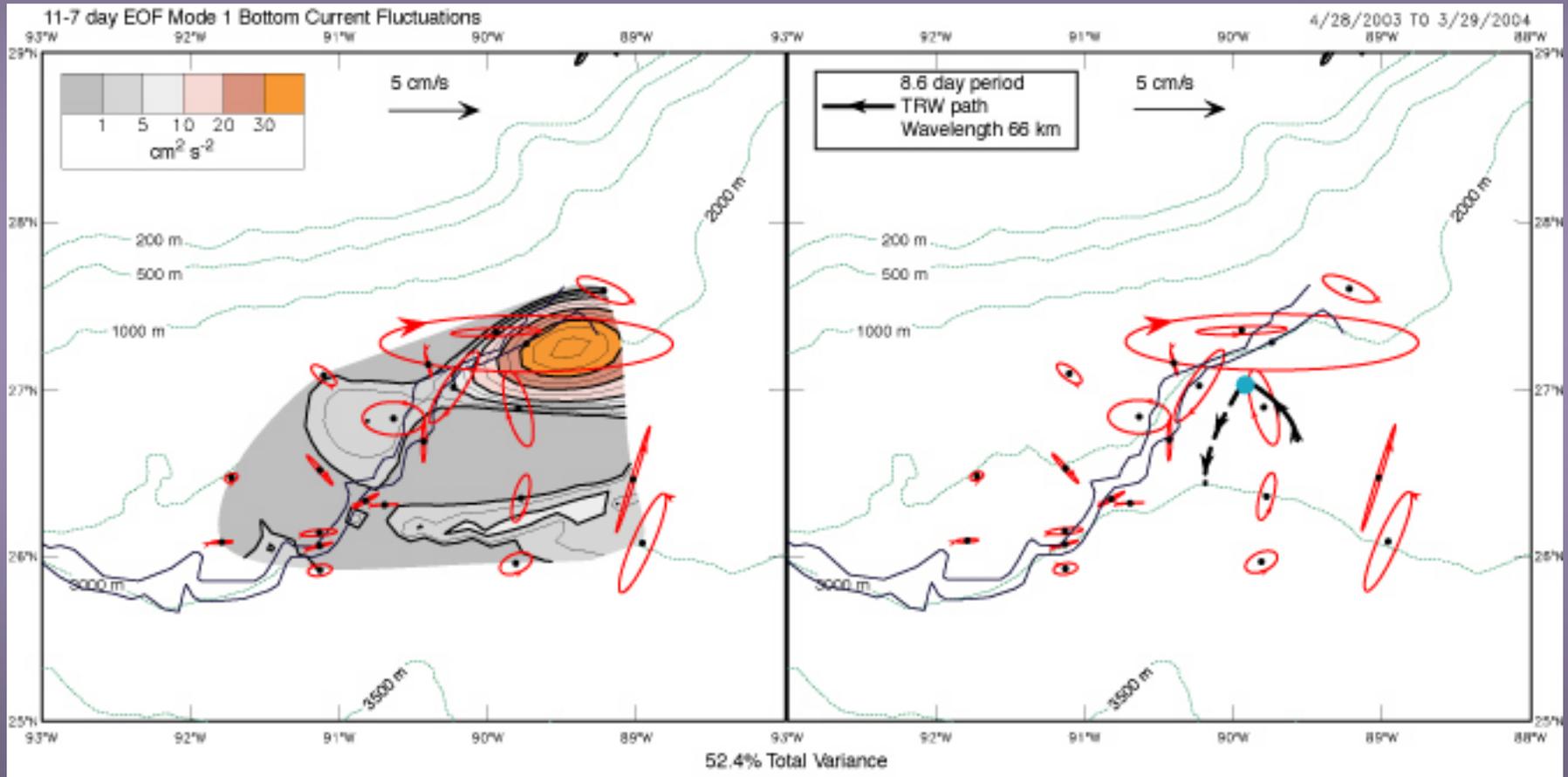
Near-
Bottom
Mean
Currents
and
Standard
Deviation
Ellipses



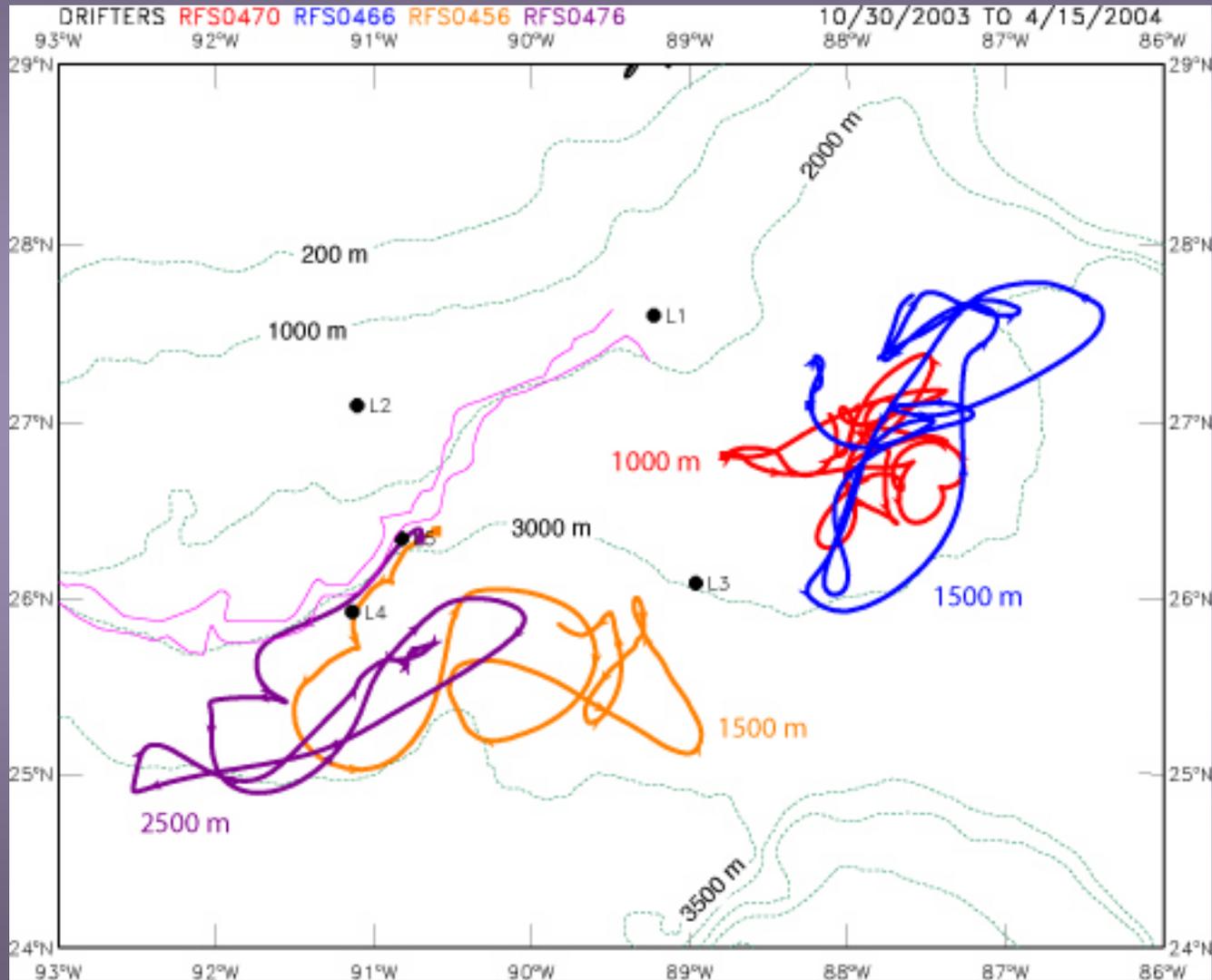
335-33 Day Variability and TRW Path



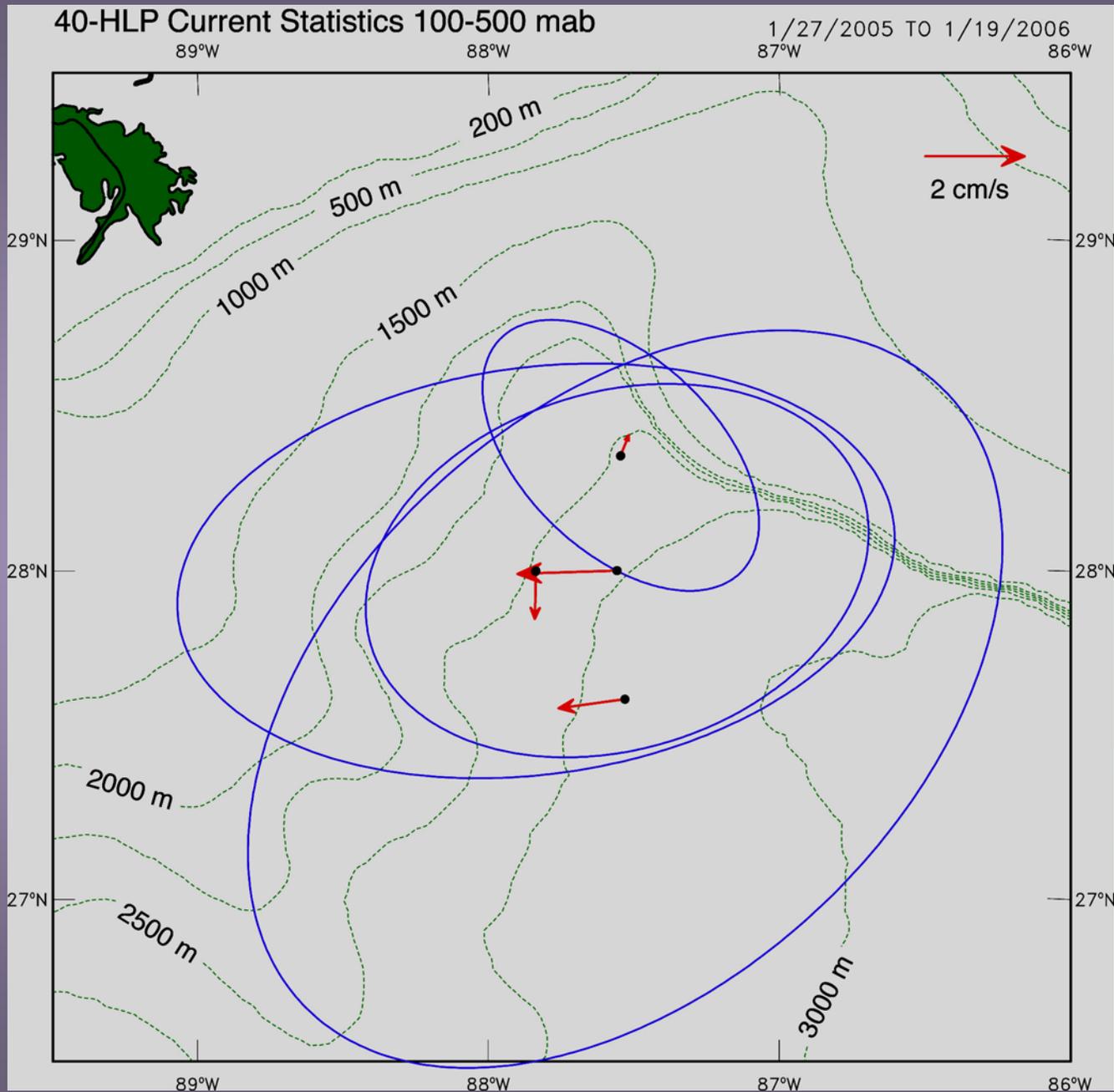
11-7 Day Variability & TRW Path



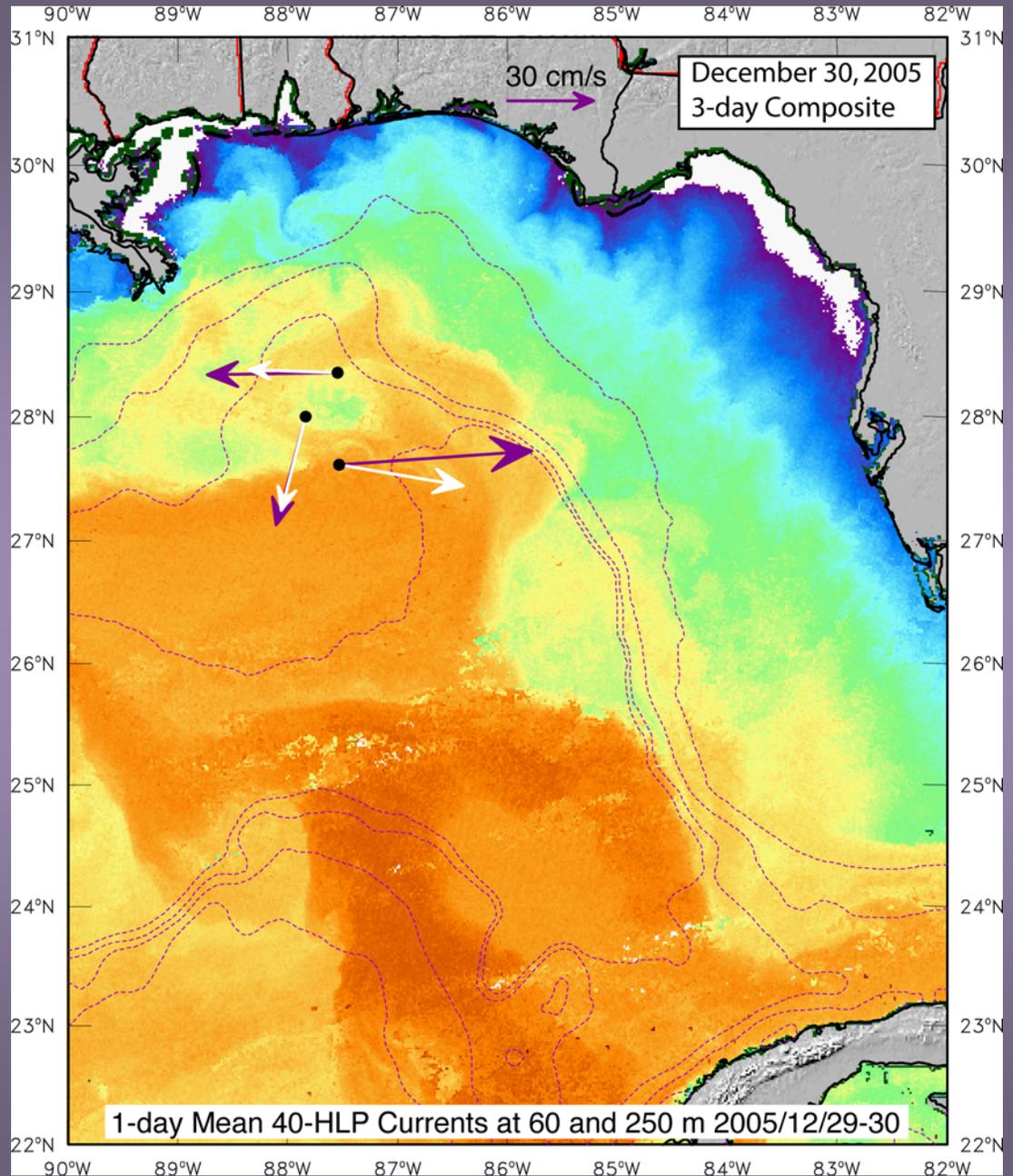
RAFOS Float Trajectories



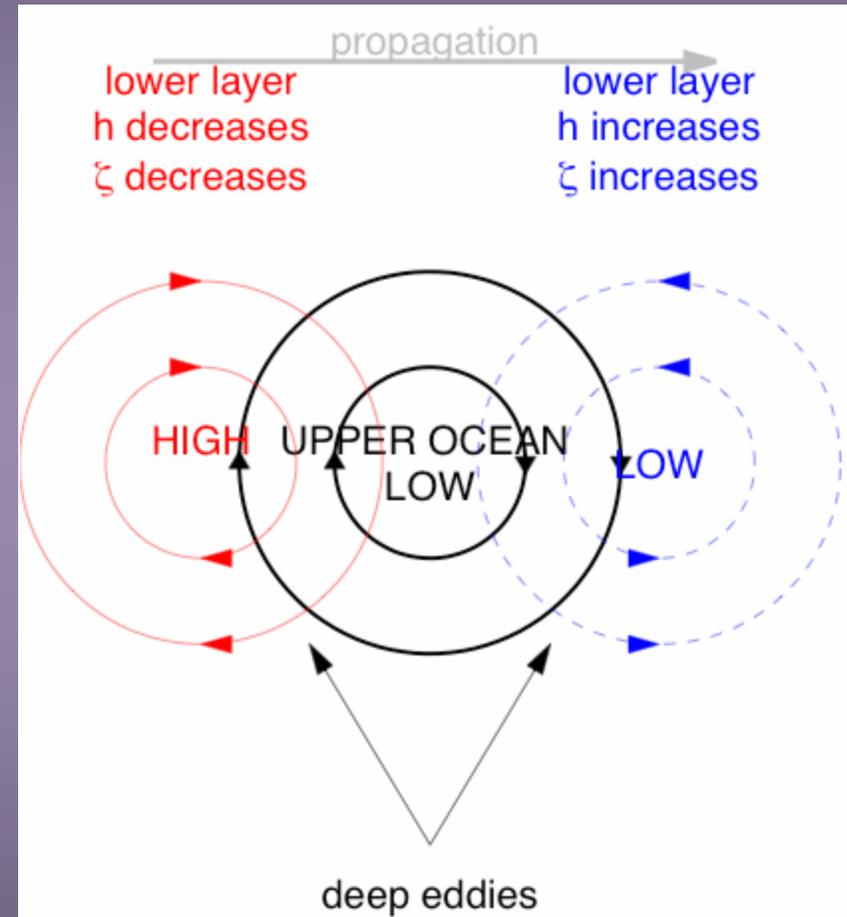
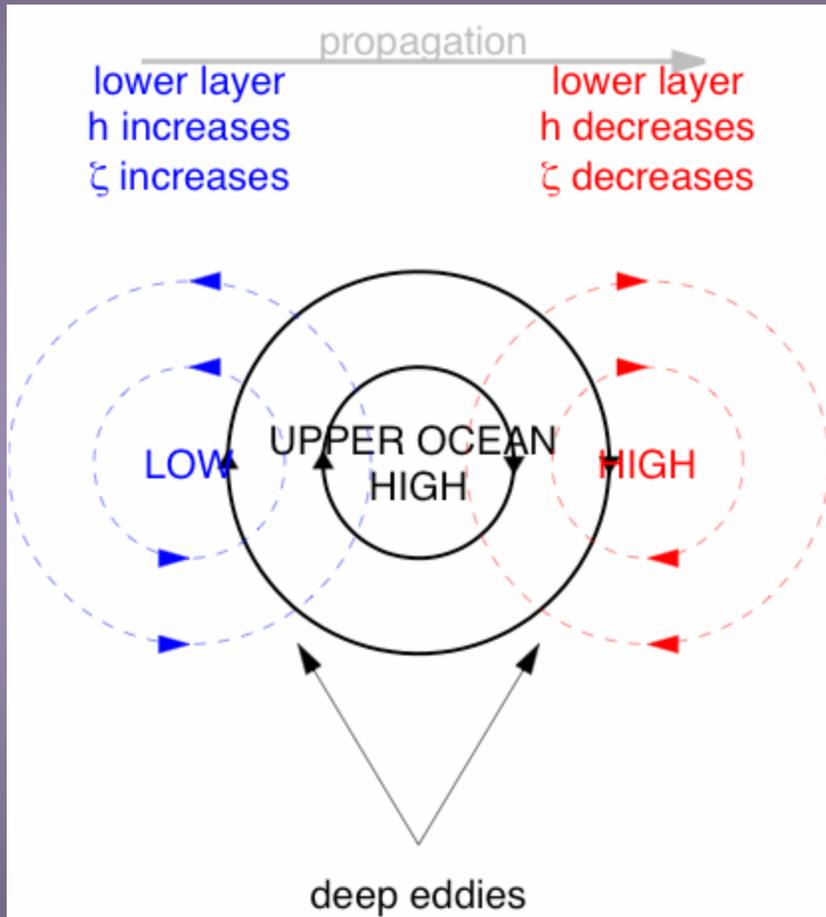
Near-Bottom Current Statistics



Cold
LCFE 30
December
2005

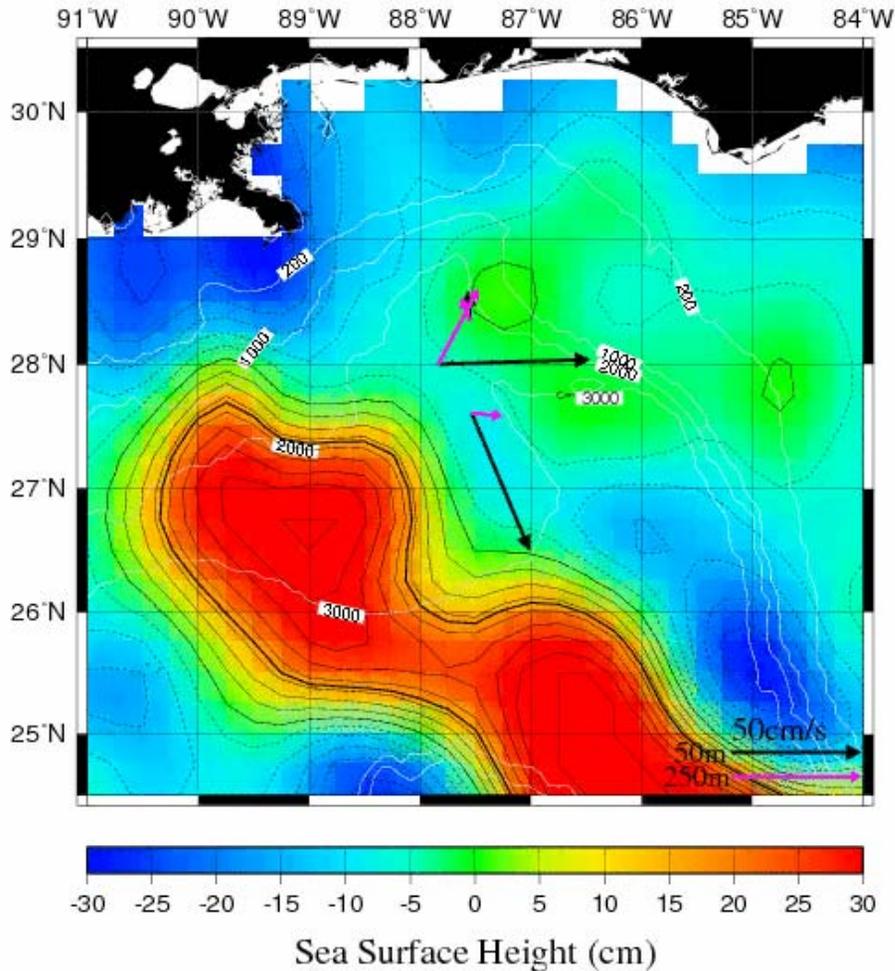


Propagation of strong upper-ocean features stretch/squash lower layer and spin up deep eddies.

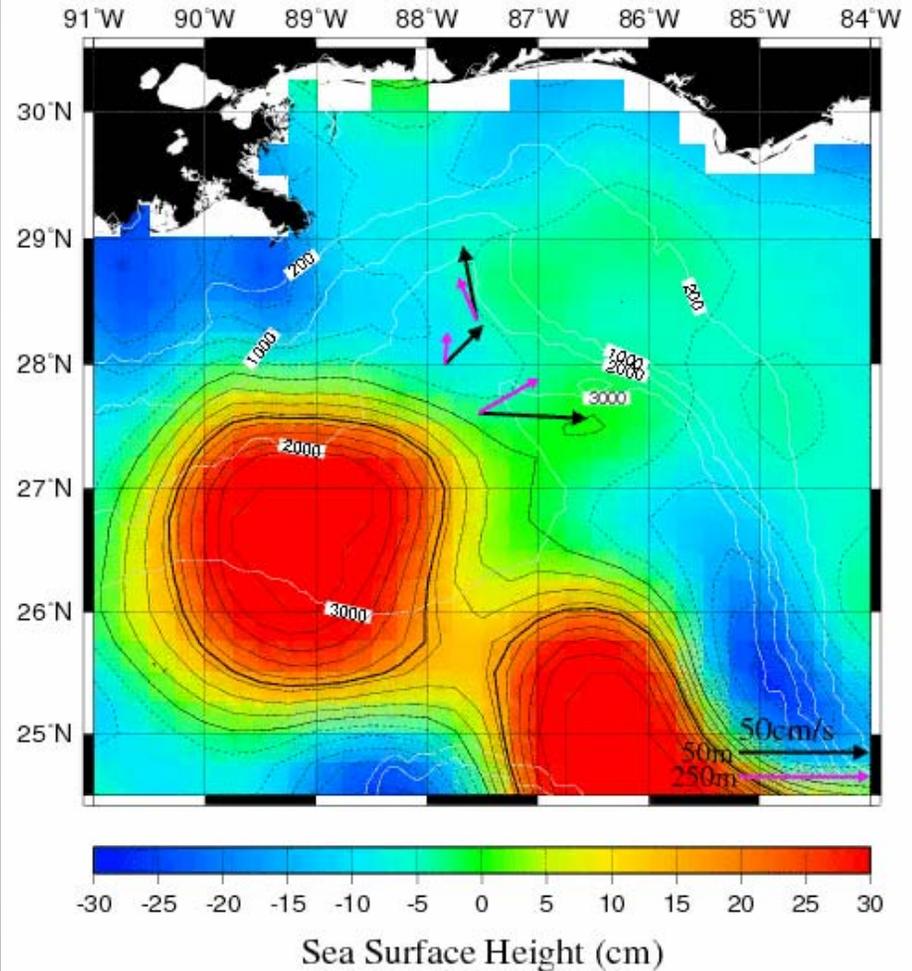


Eddy Vortex SSH

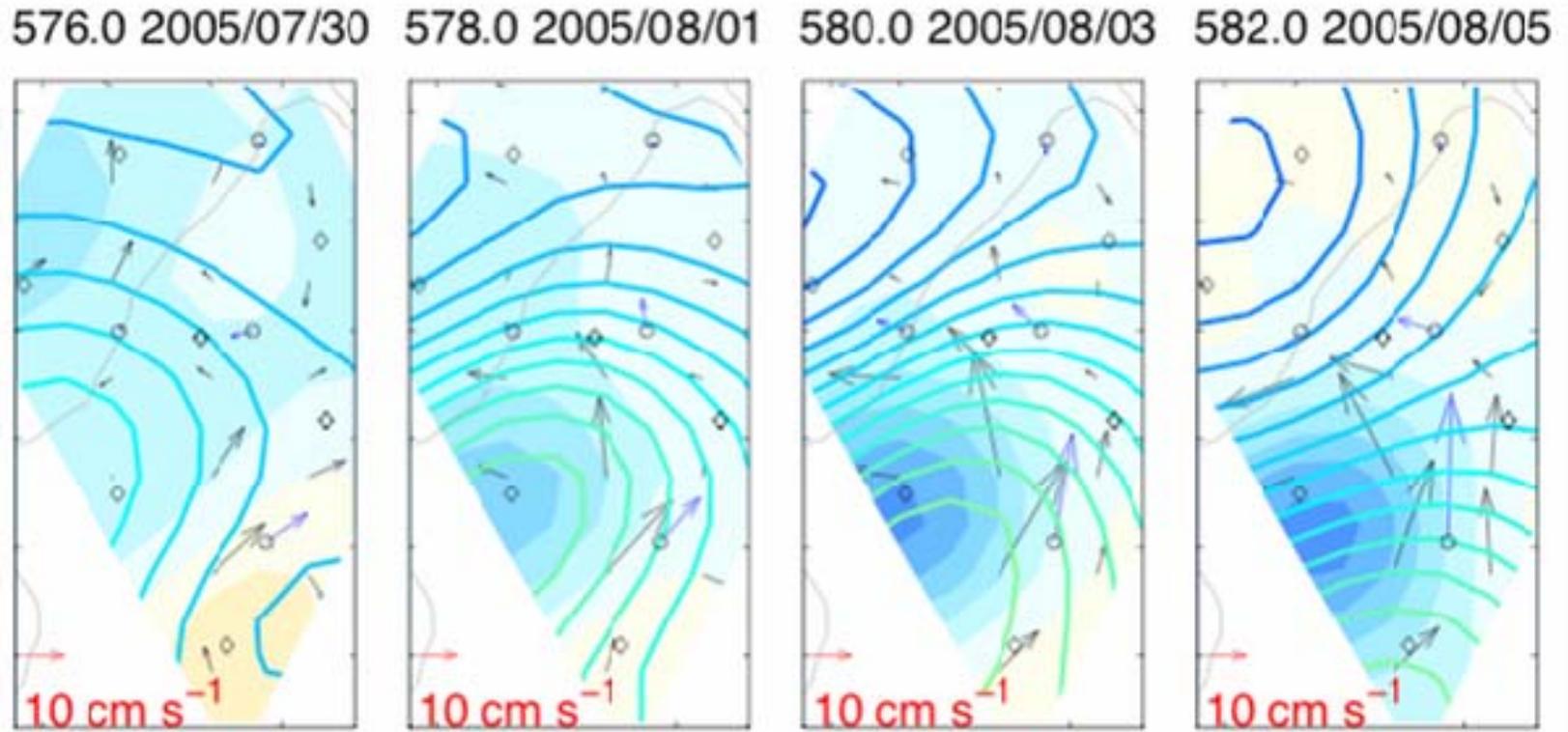
31 July 2005



4 August 2005



Vertical coupling! Propagation of LCE lead to leading deep anticyclone and trailing cyclone.



Five Additional Events:

19–29 May 2005

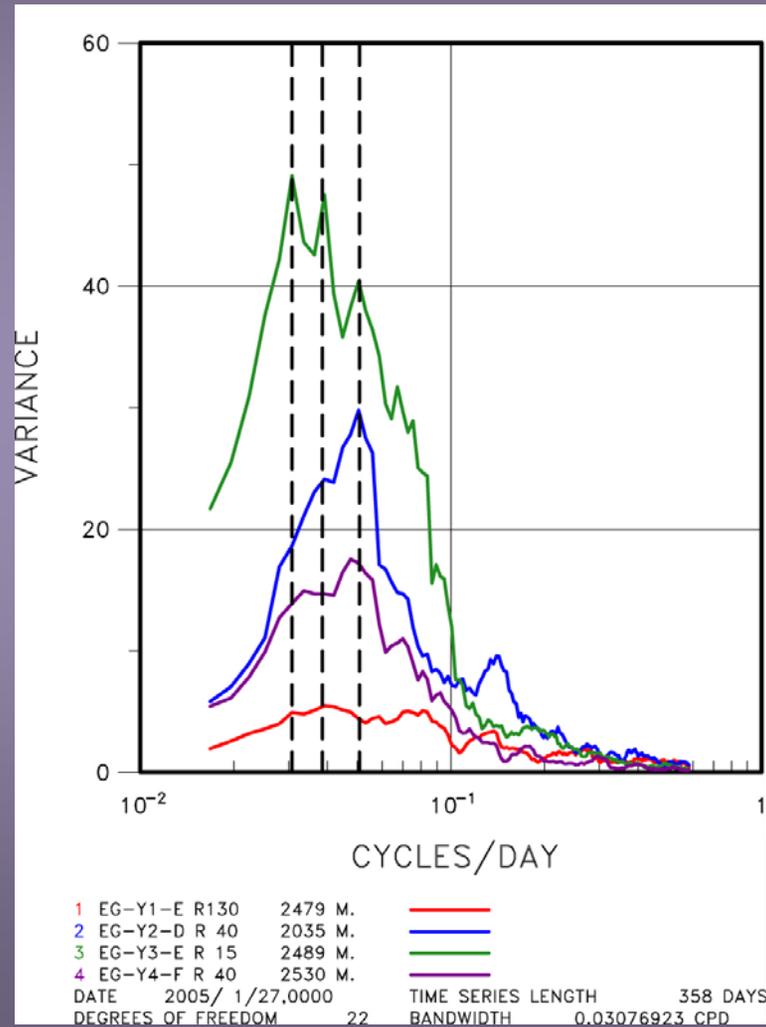
16–22 June 2005

29 July 29 – 12 August 2005

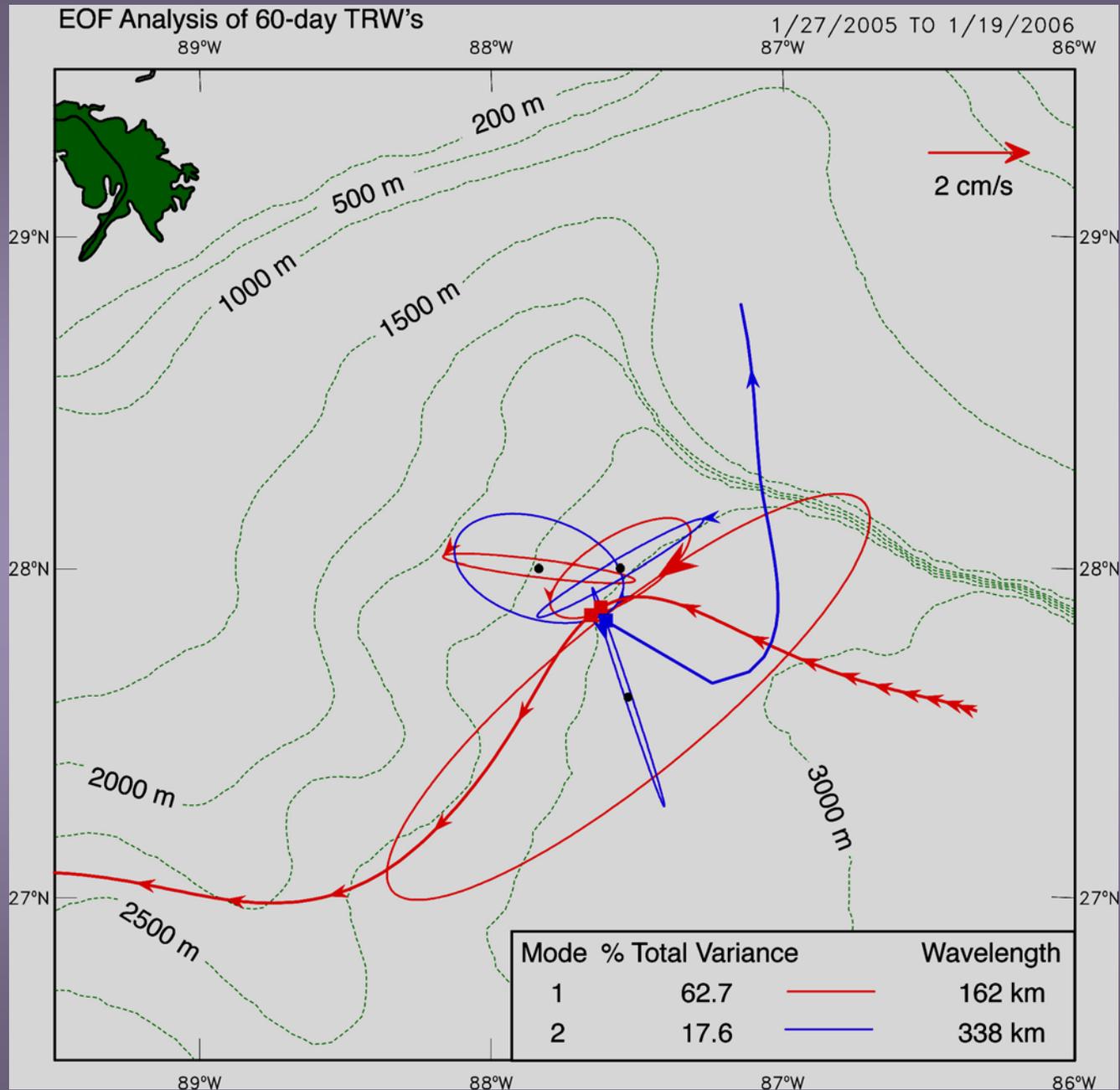
21–28 Oct 2005

6–14 Dec 2005

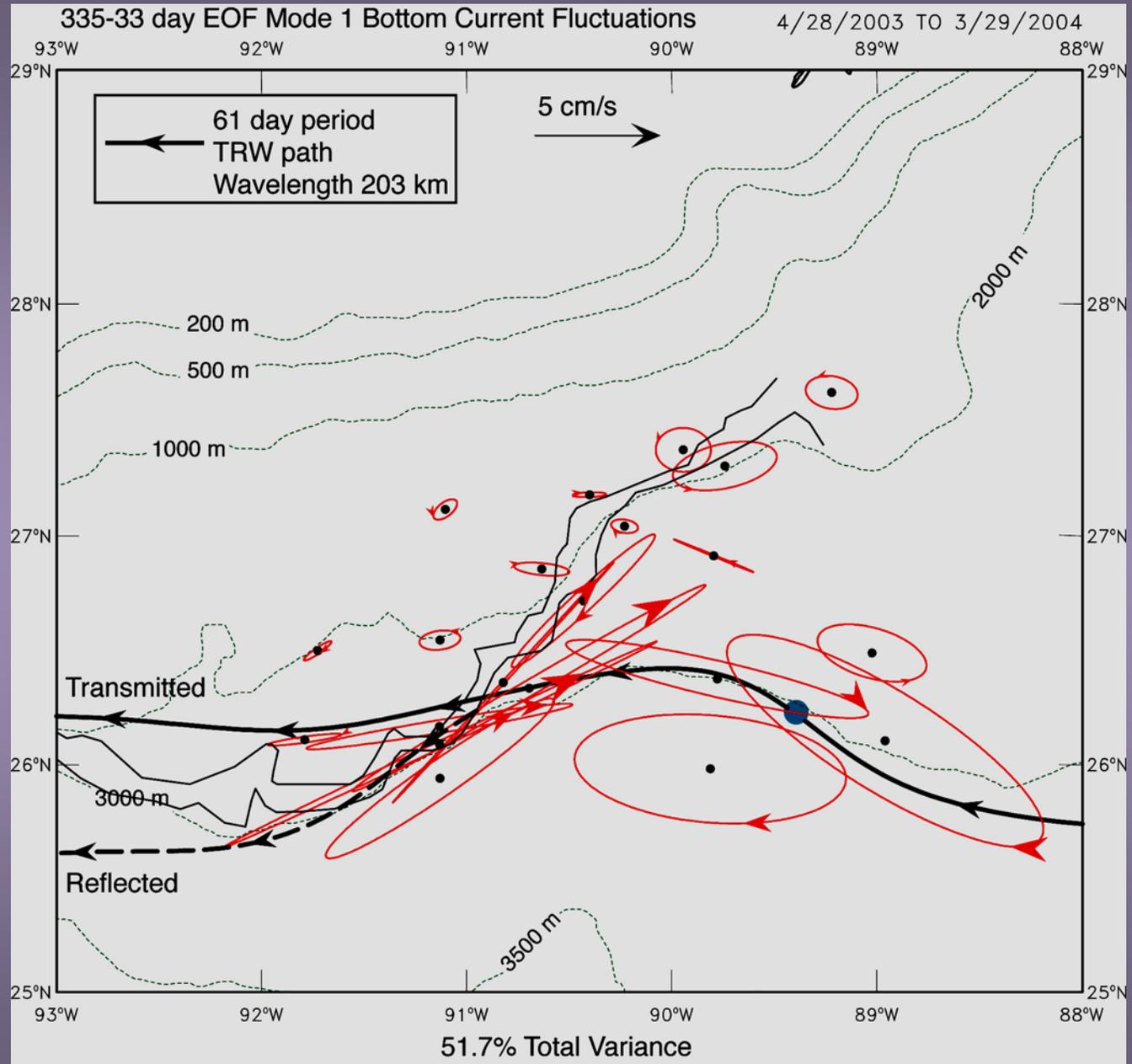
KE Spectra for Near-Bottom Currents at All Four Moorings



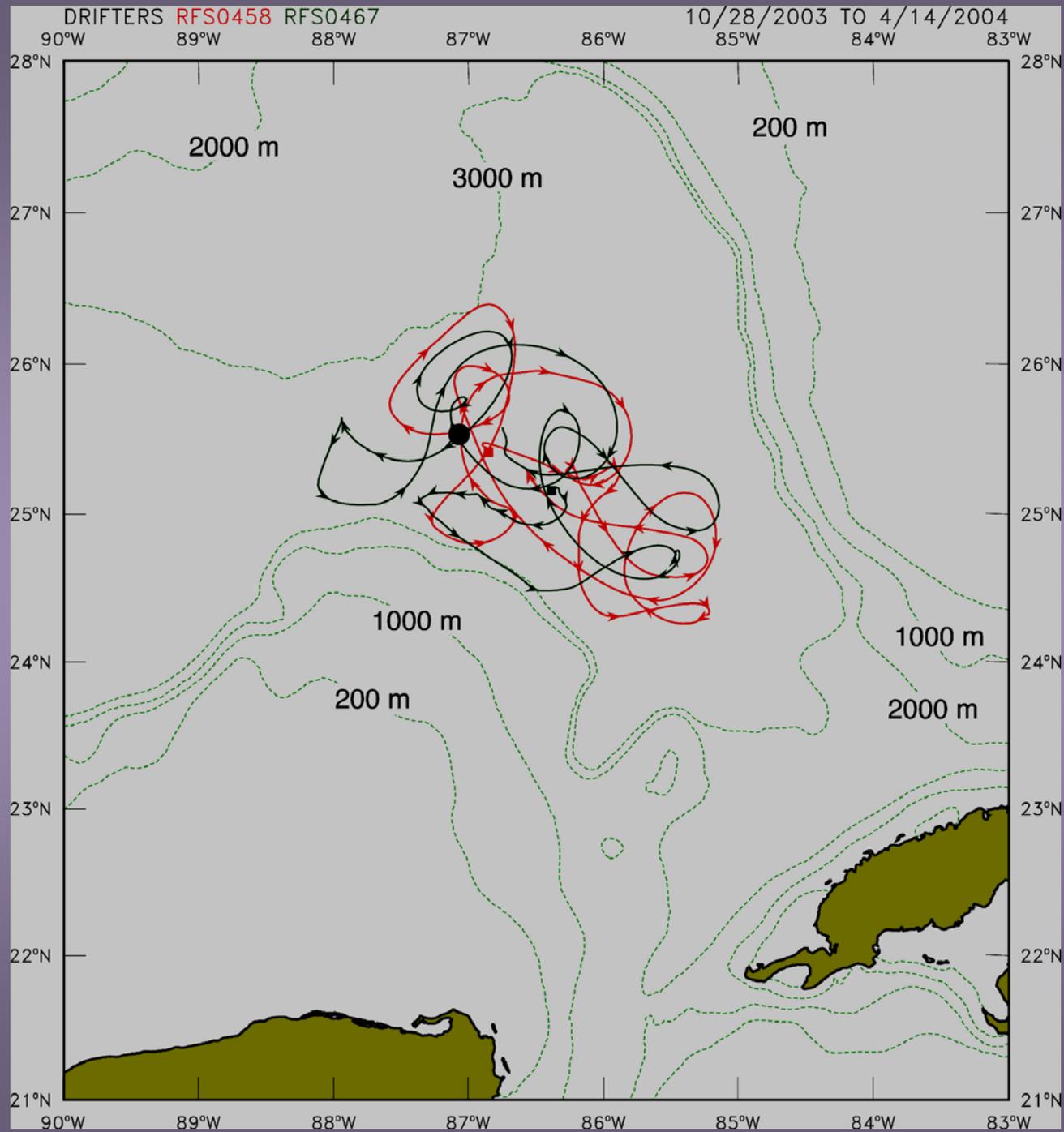
60-day TRW Analysis



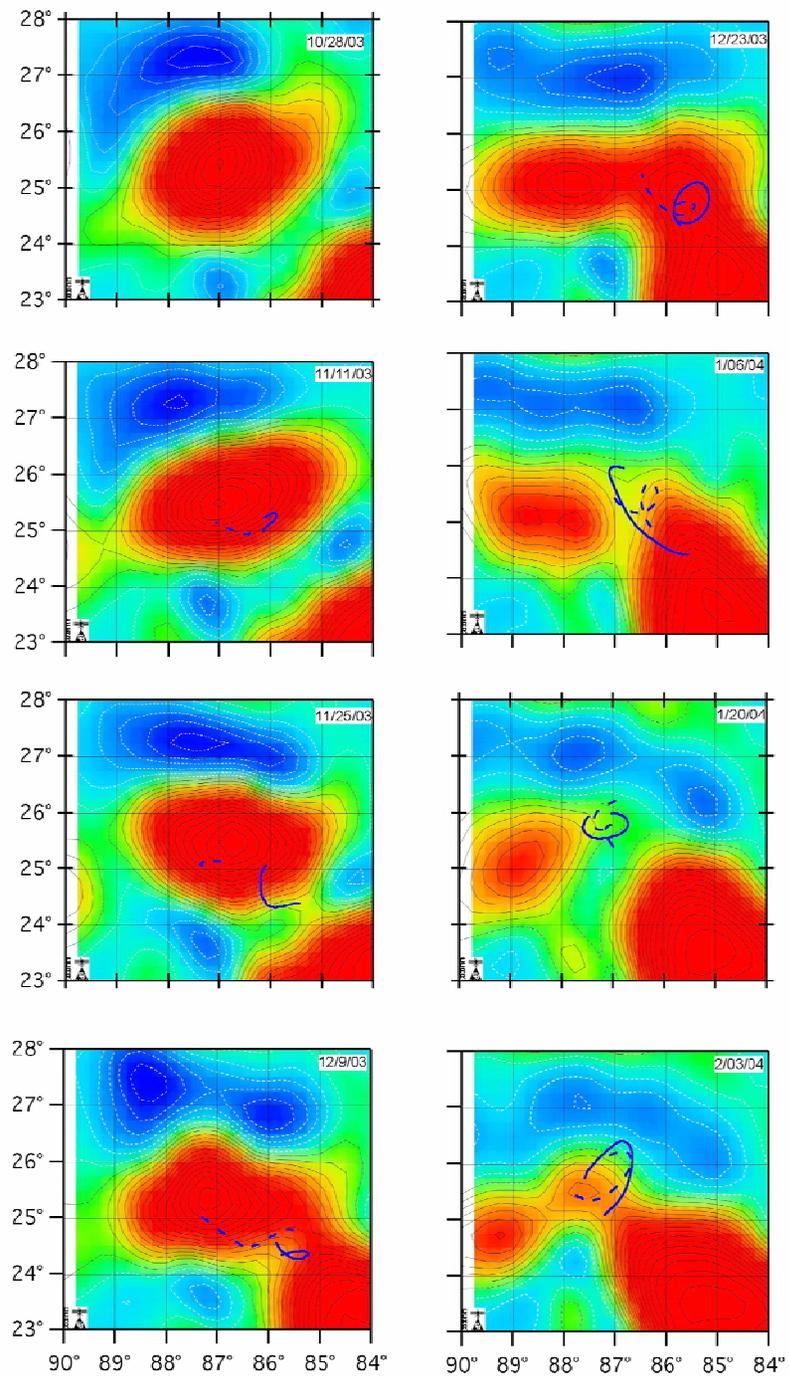
61-day TRW Analysis Exploratory Program



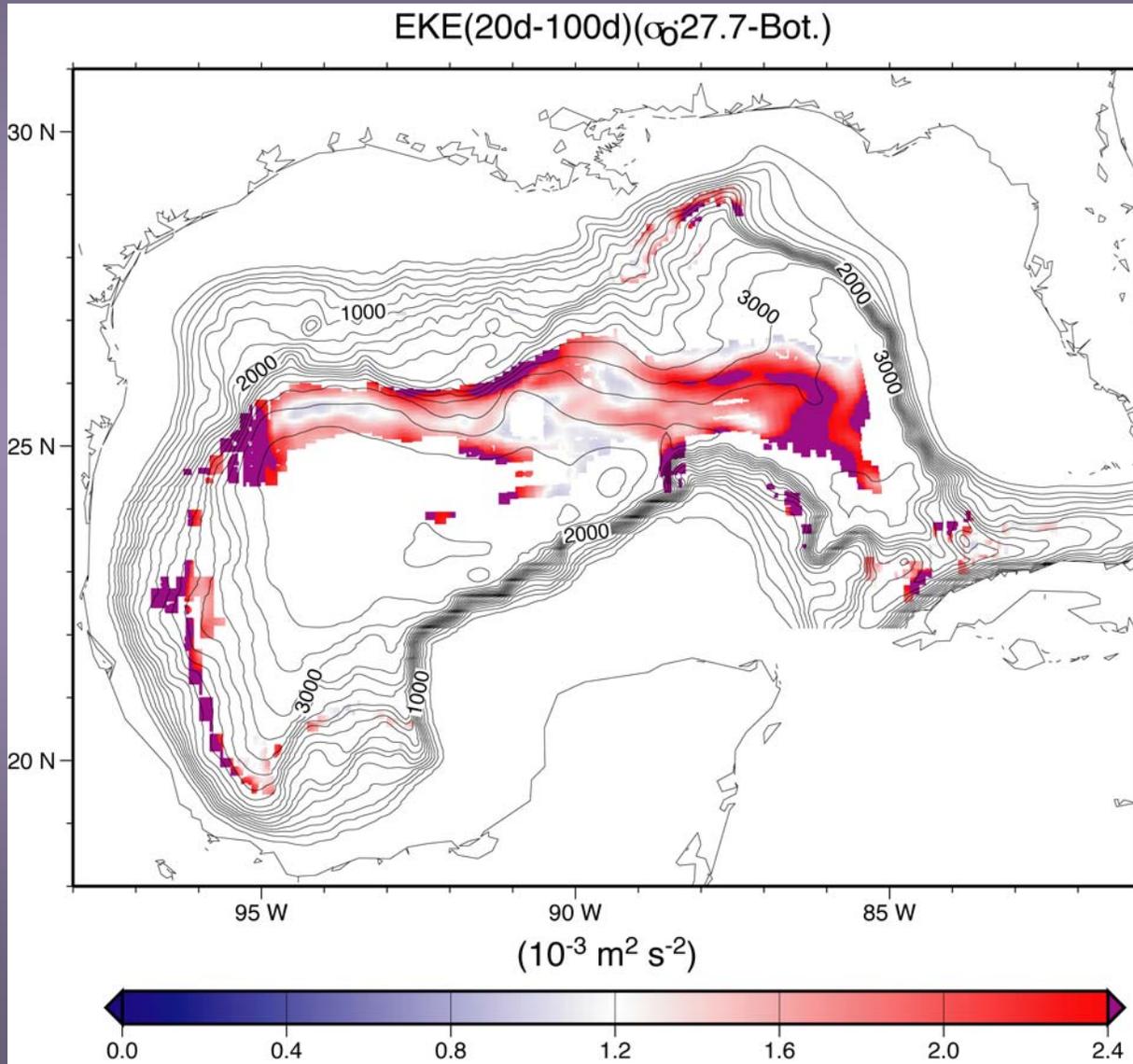
Rafos
Floats at
1500 m
under the
Loop
Current



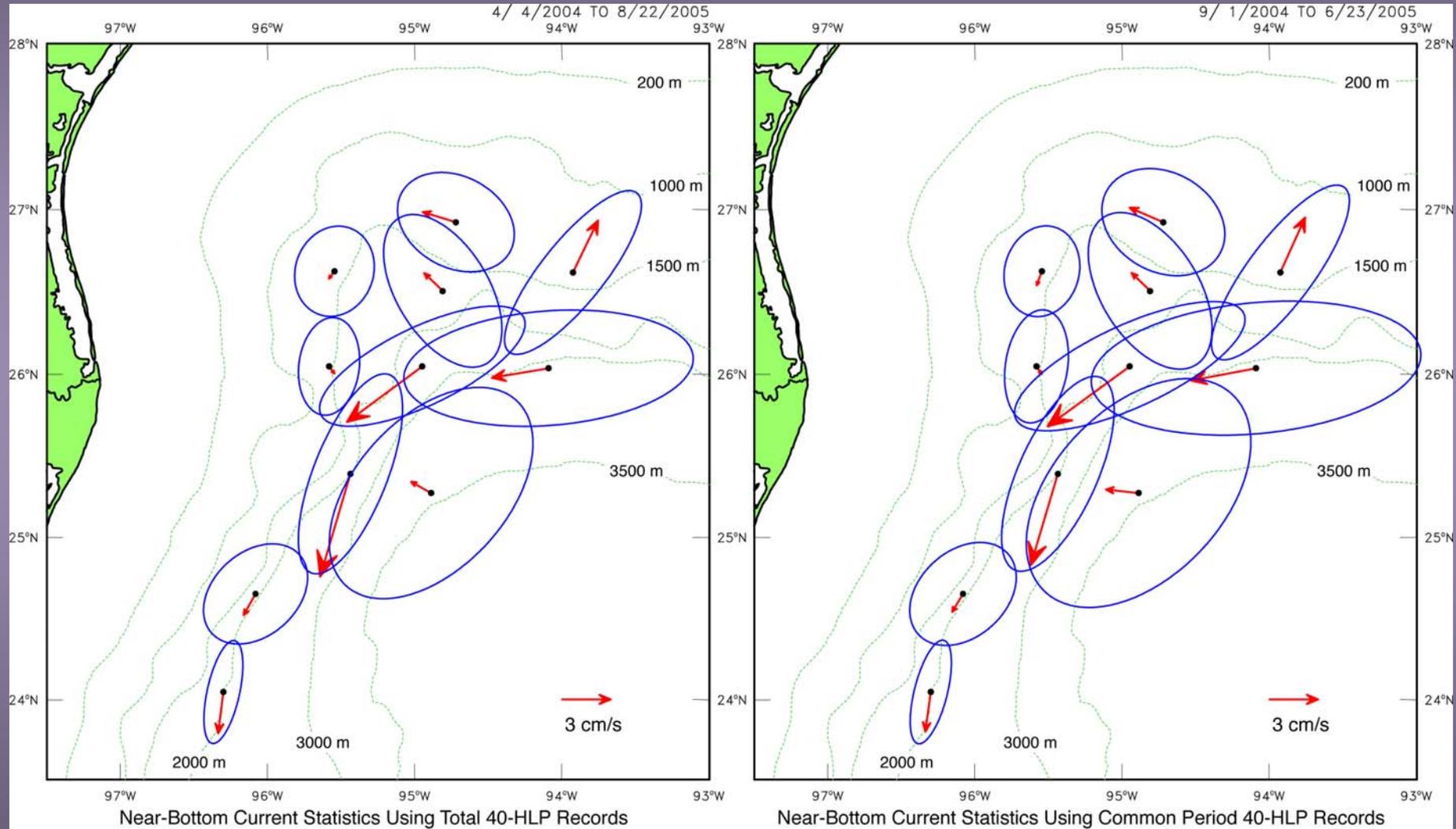
Floats below LC and Eddy Titan



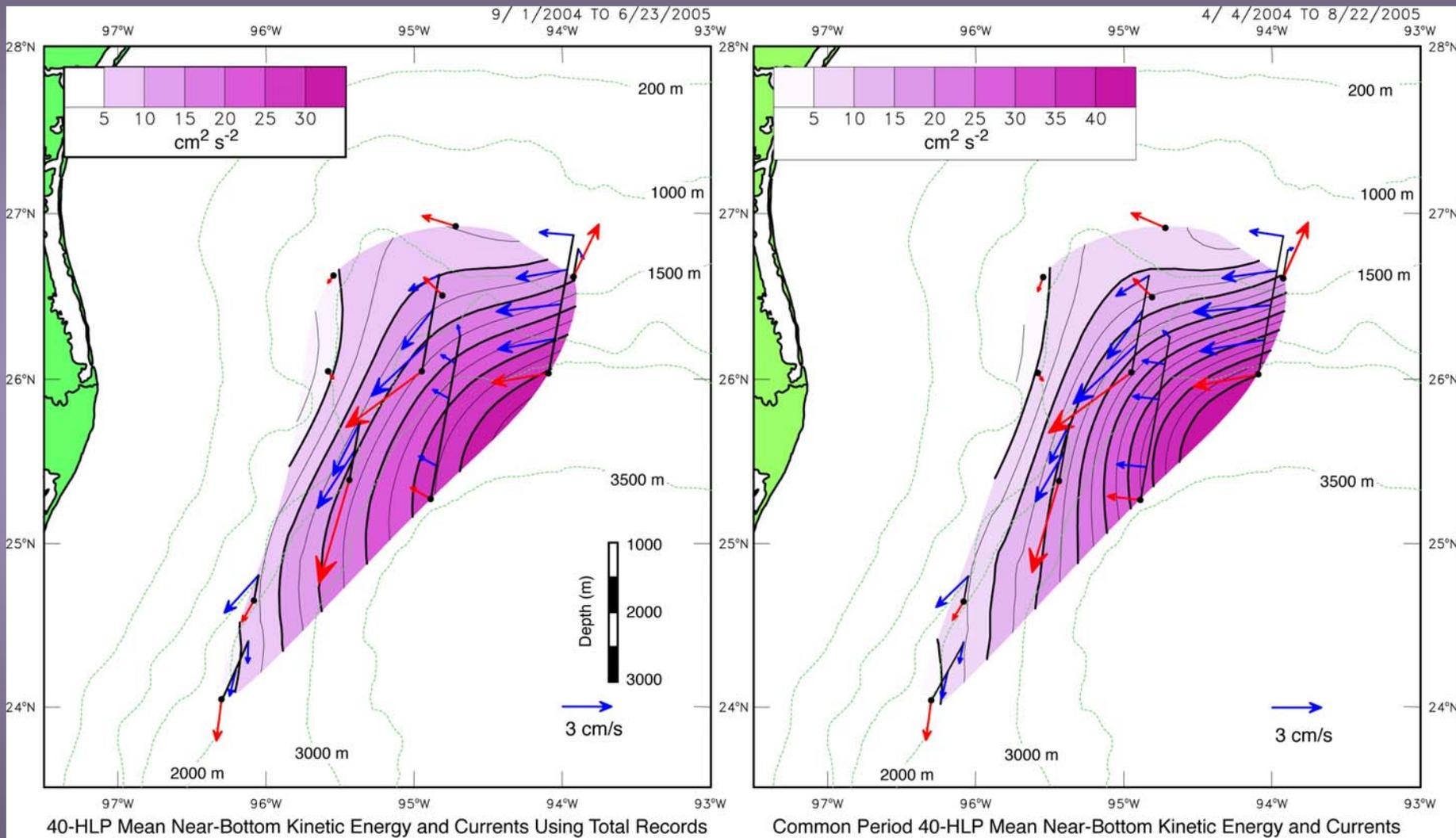
Model Deep EKE with TRW Characteristics



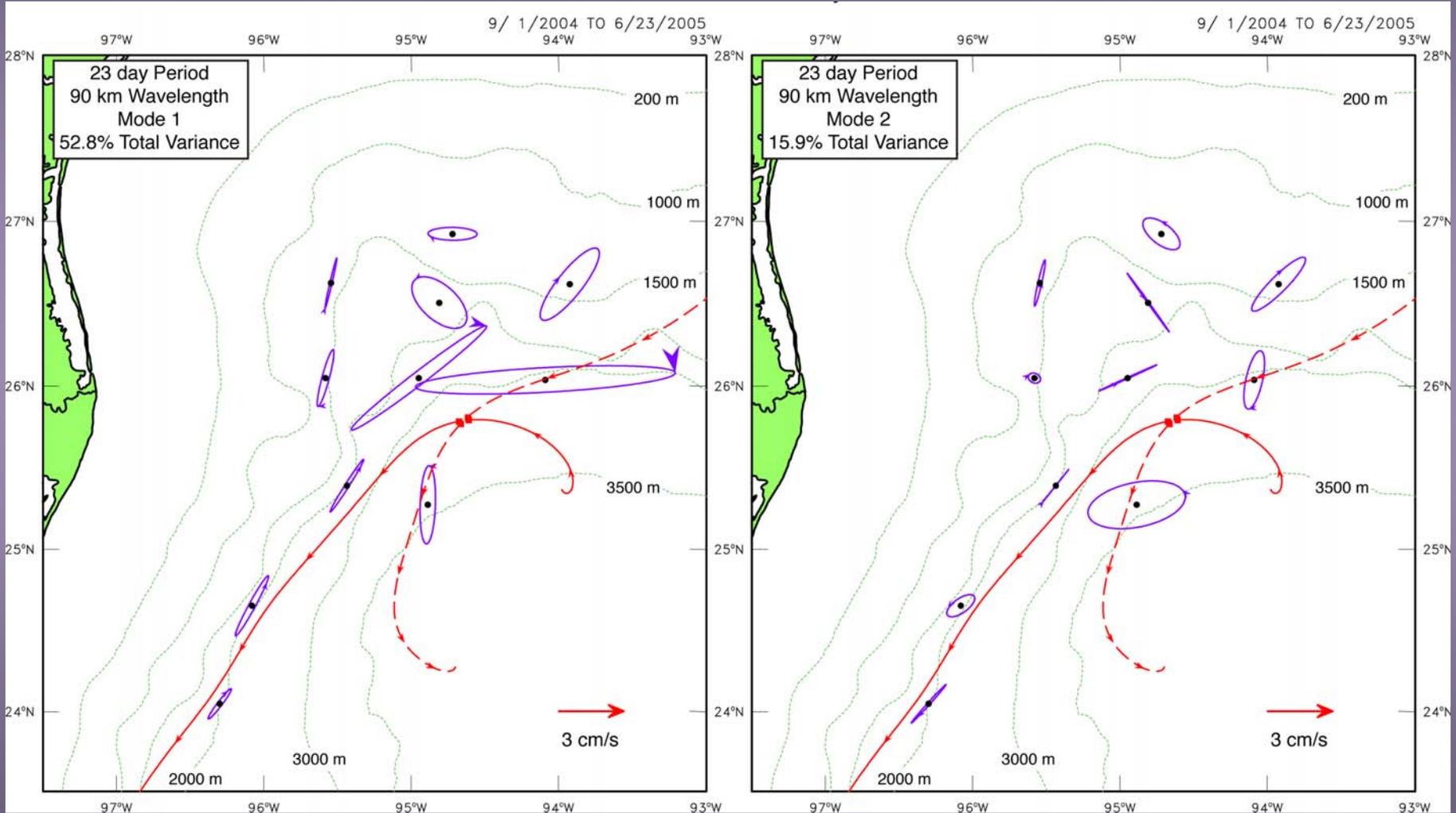
Near-Bottom Current Statistics



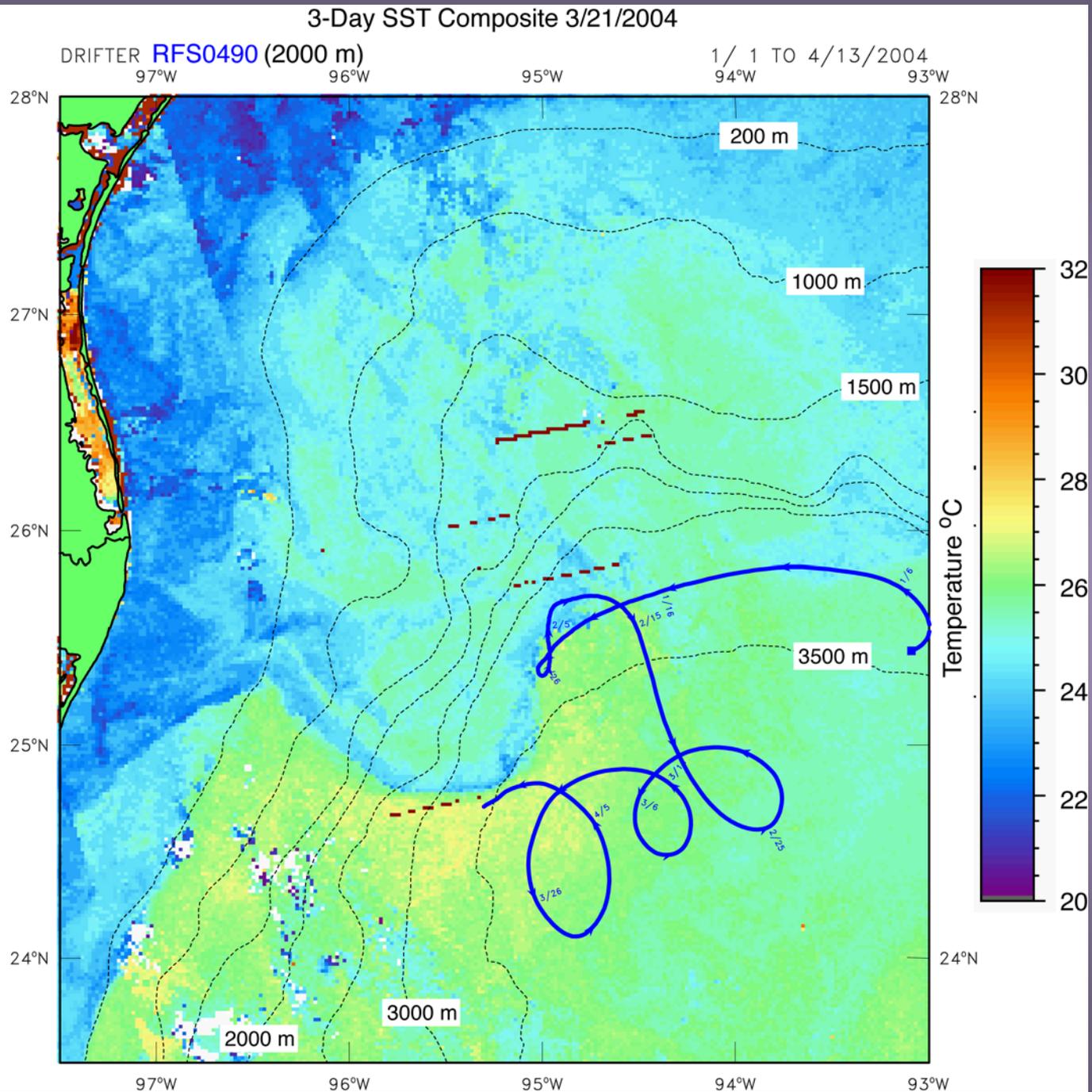
Lower Layer Mean Current Profiles

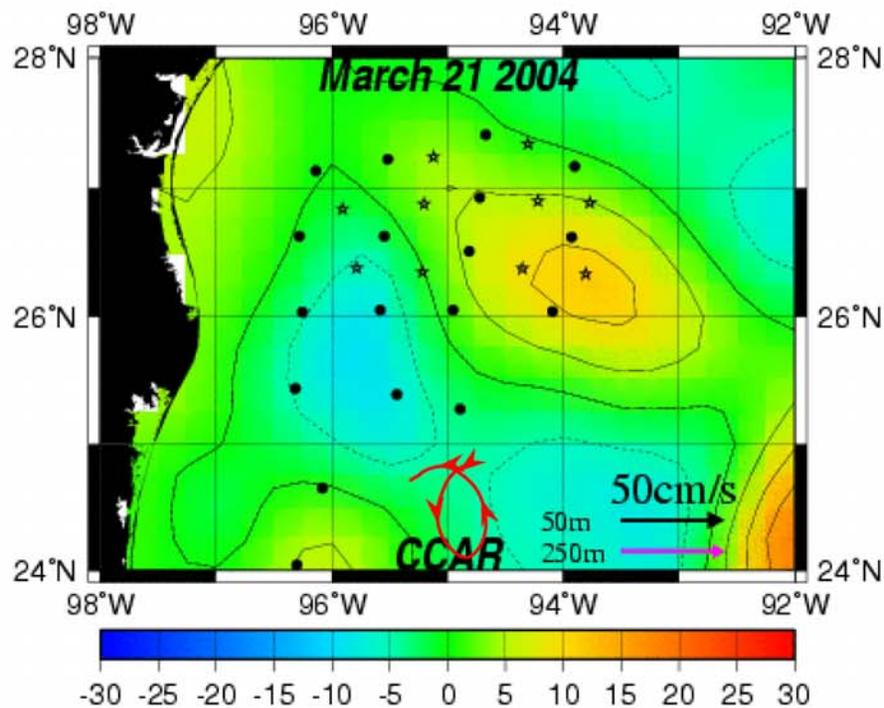
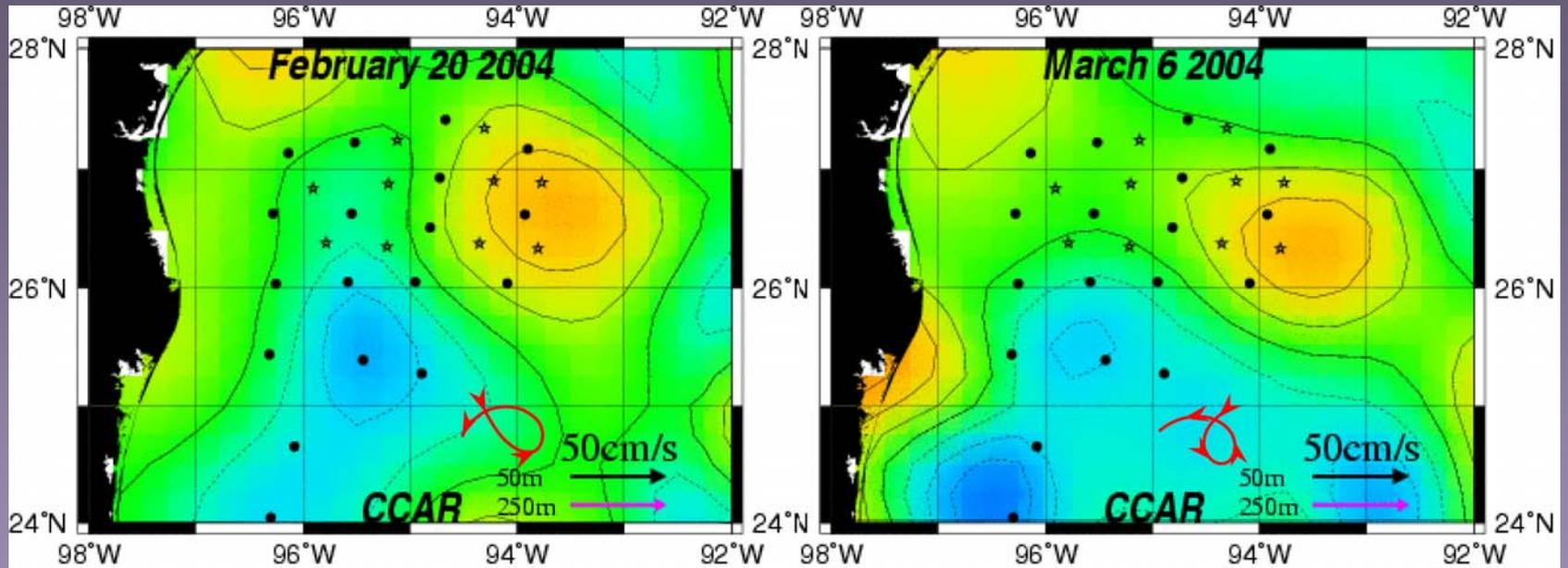


23-day TRW Analysis



Deep Cyclonic Eddy



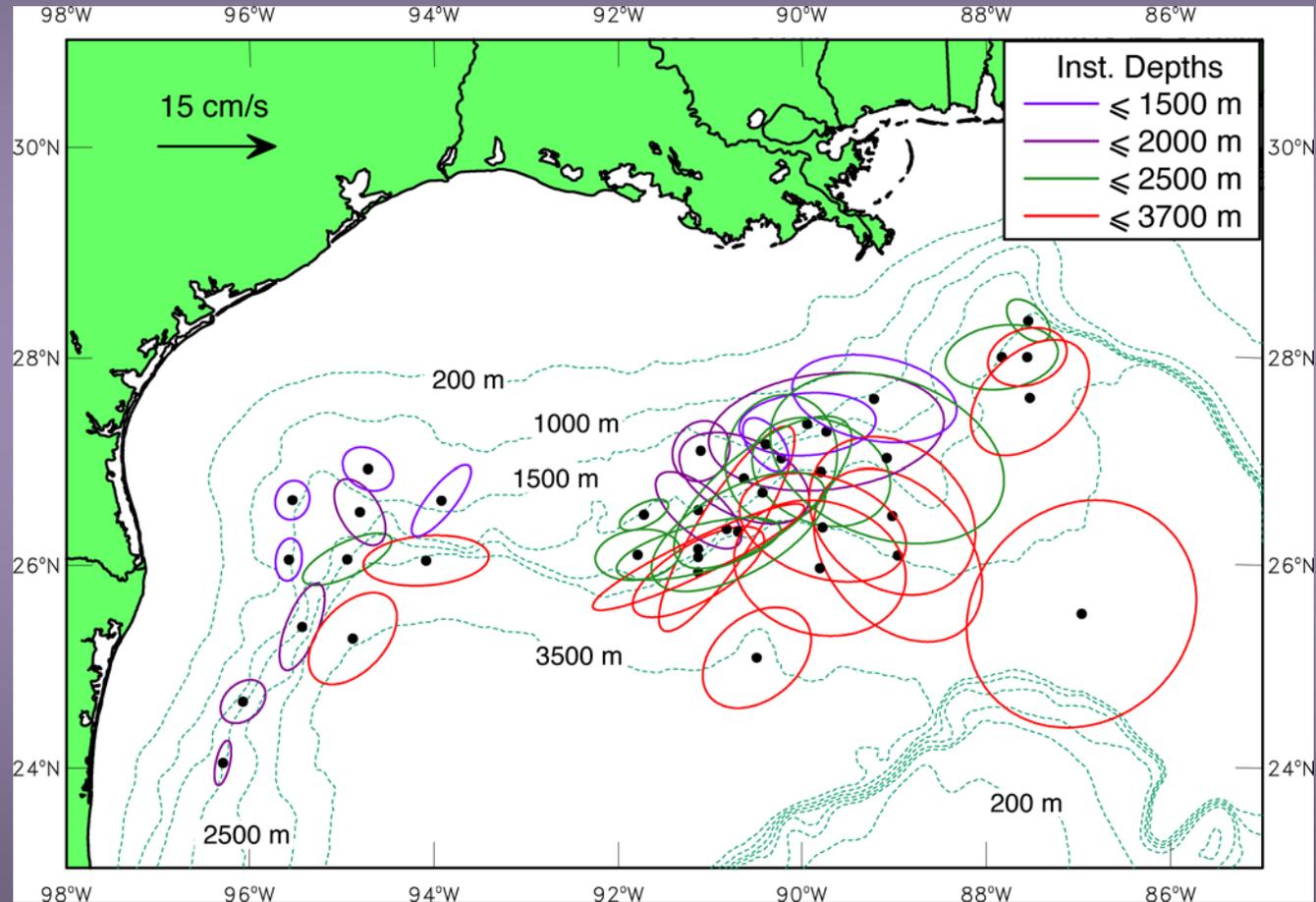


Deep Cyclone & Surface Eddies

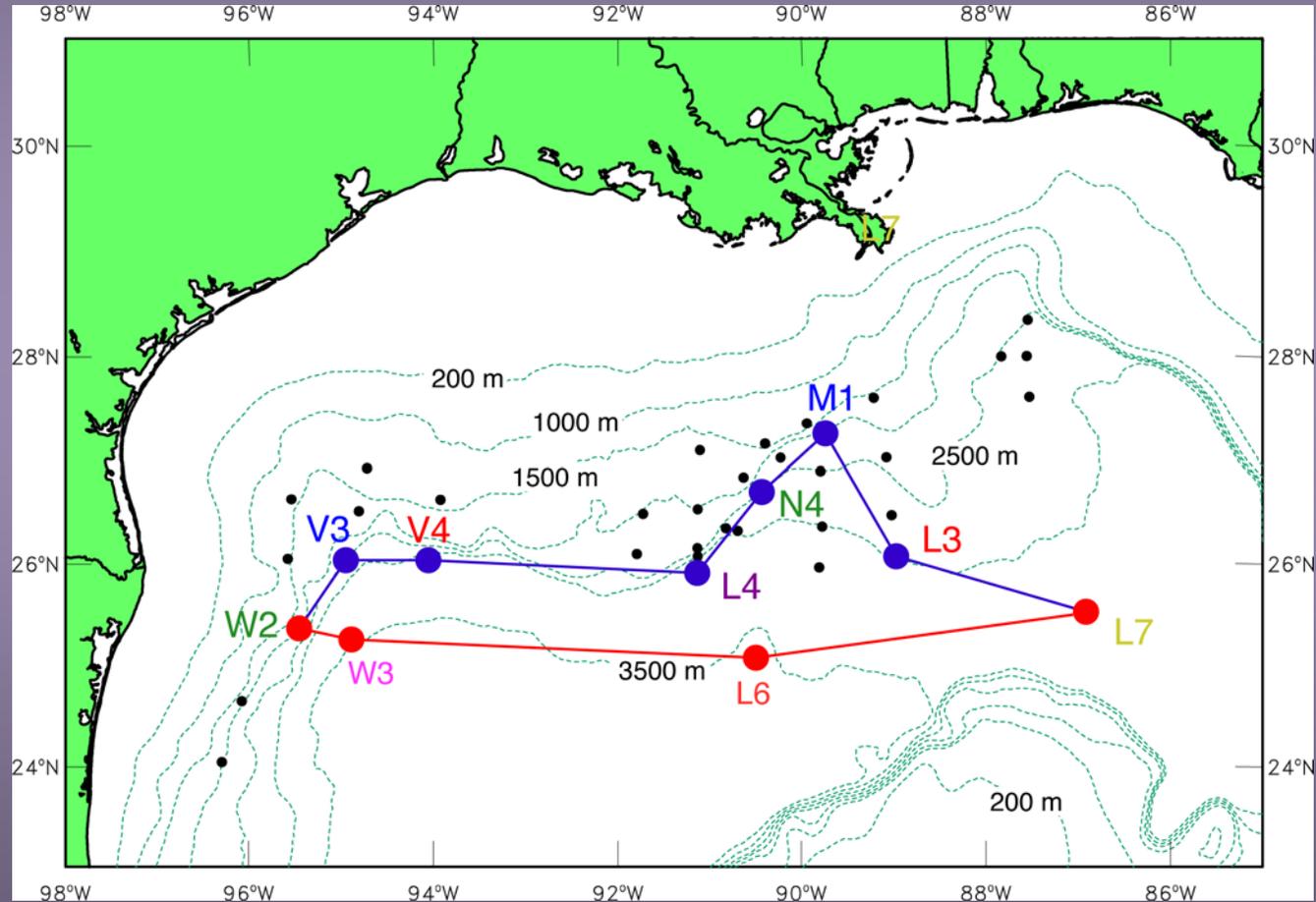
-30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30

Sea Surface Height (cm)

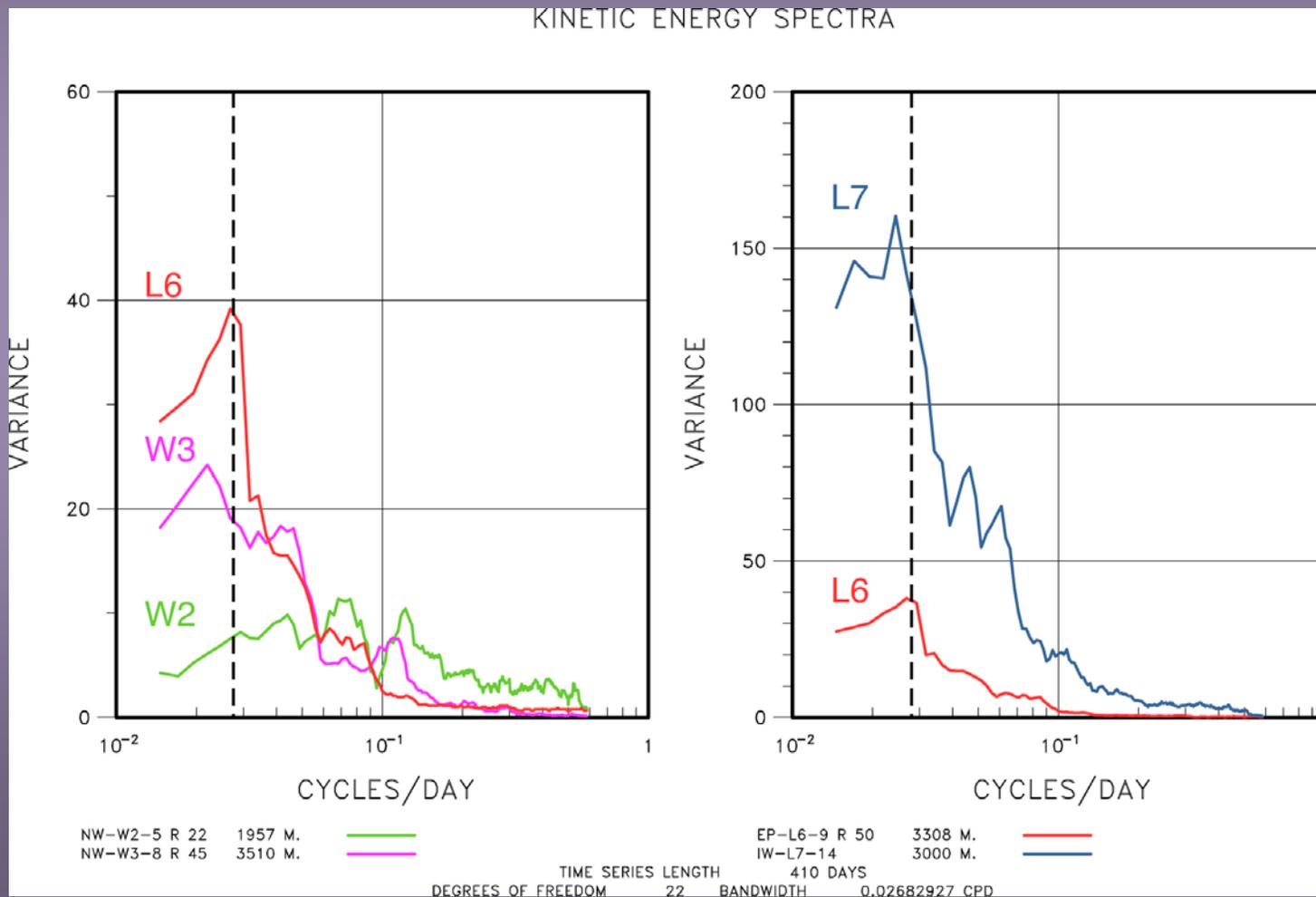
Standard Deviation Ellipses ~ 100 – 500 mab



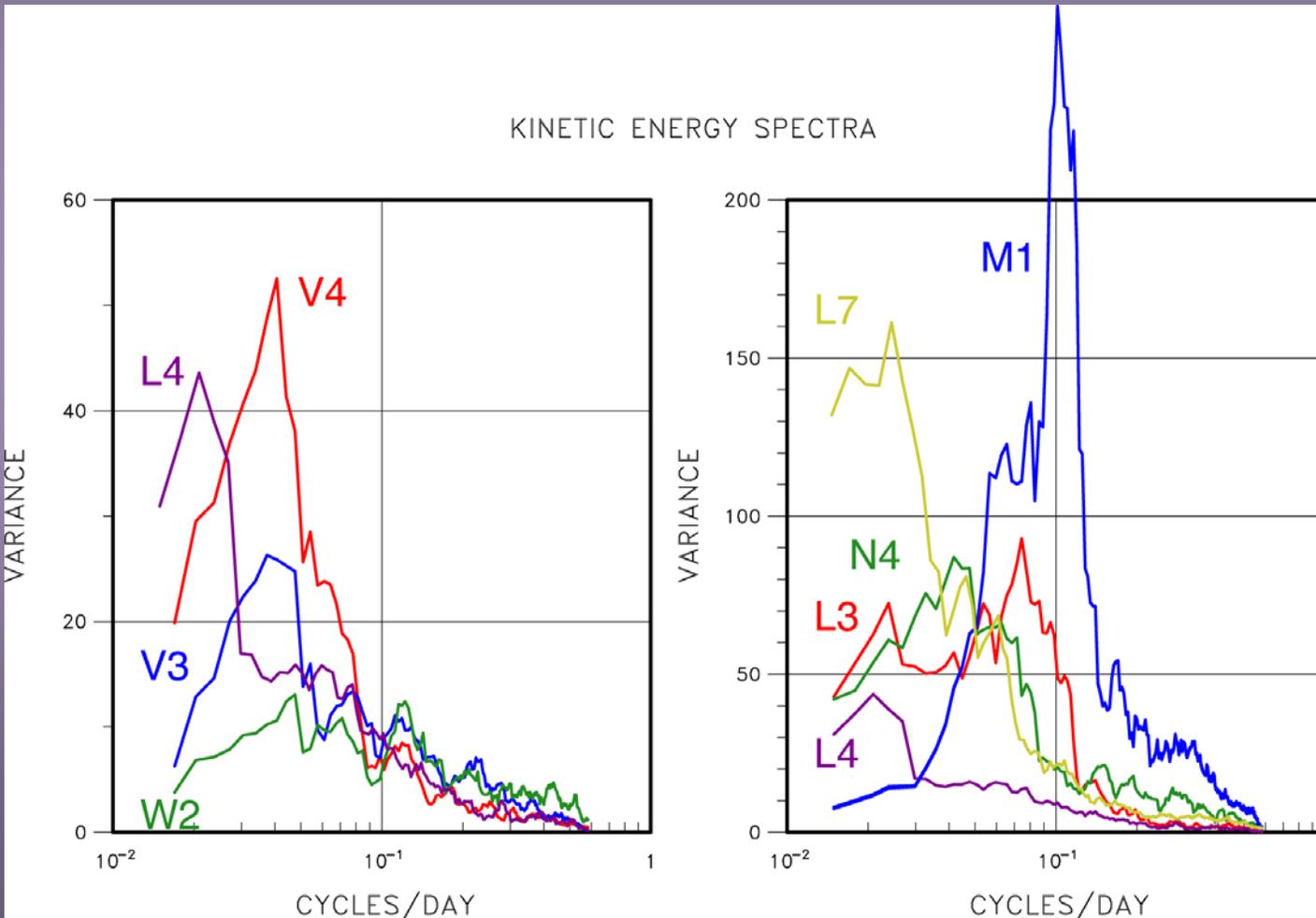
Map of KE Spectra Locations



KE Spectra across the Gulf – 1



KE Spectra across the Gulf – 2



Summary

Lower-layer currents show:

- Spatial variability in kinetic energy & periodicities
- High energy in center may have sources on east side of LC
- Steep escarpments are barriers to energy transfer to slope
- Escarpment is location of enhanced westward mean flows
- Western and northeastern less energetic than central
- Direct coupling of upper eddy & lower layers in east
- Deep float tracks generally consistent with TRW's
- Float track in west, only instance of deep cyclonic eddy

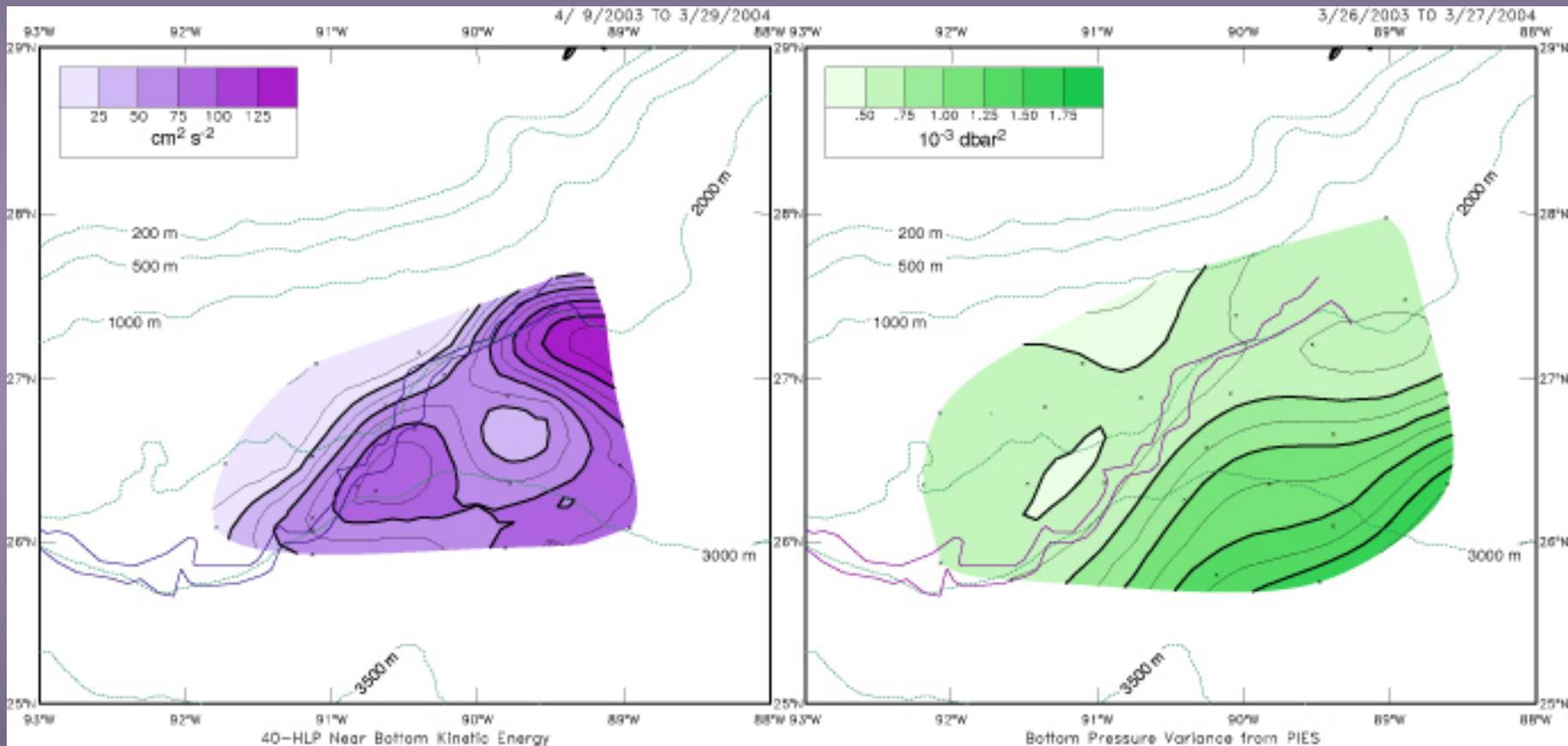
Spares

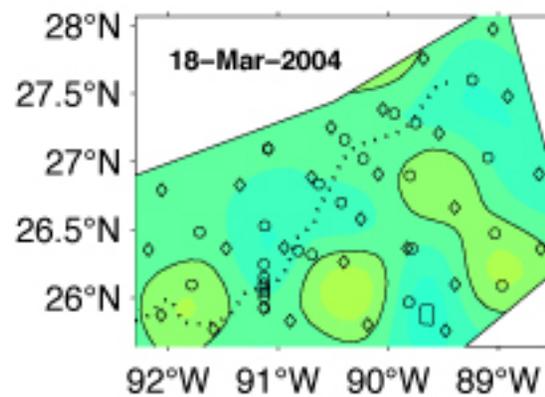
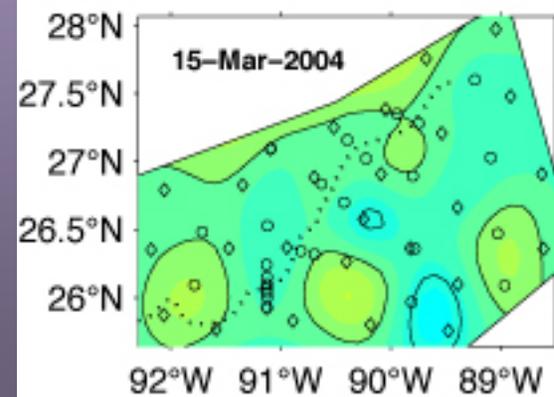
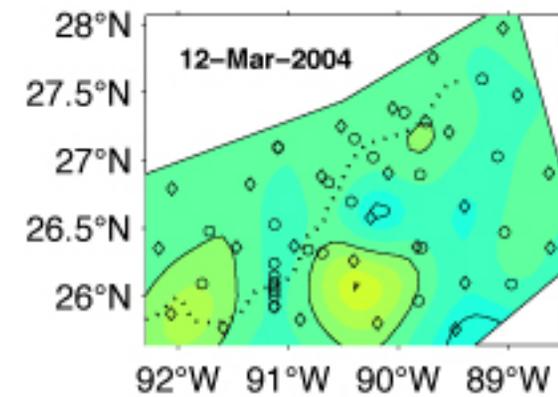
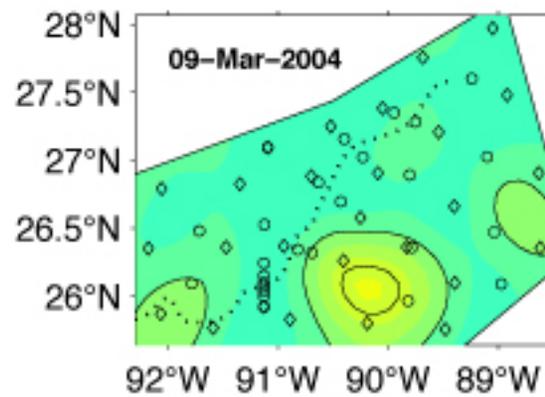
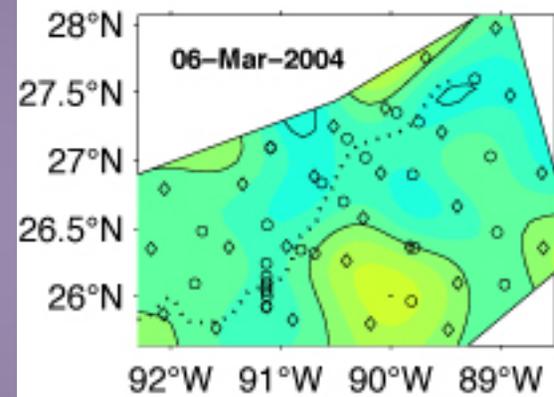
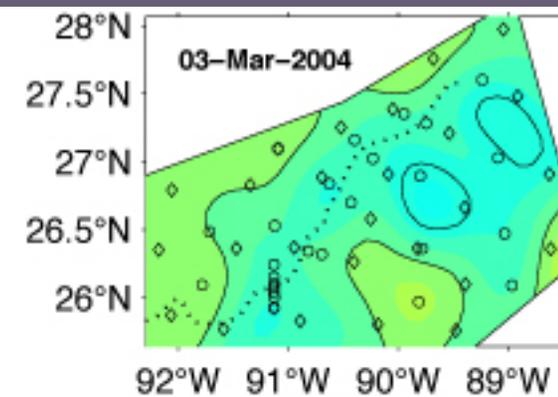
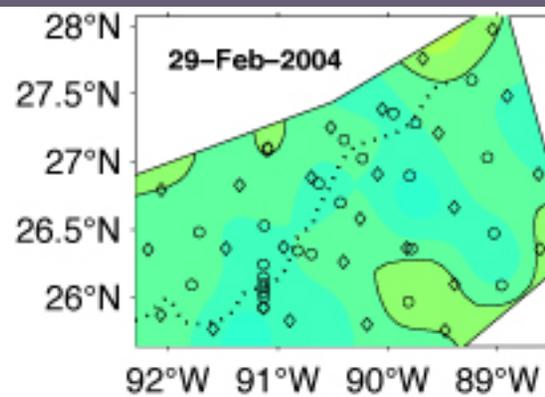
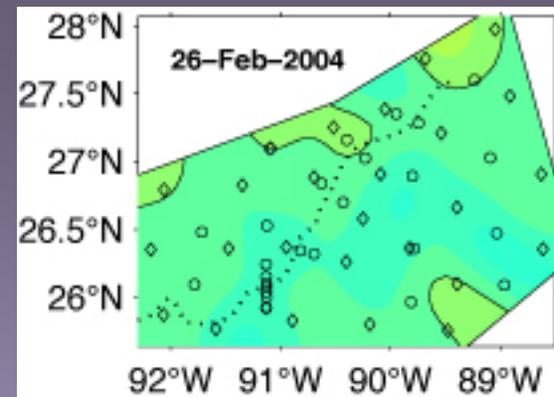
Deep-Current Summary

- TRW's below Escarpment – energy highest in NW
- 25–30 day and 50–80 day dominant periods
- Longer periods most evident in deep water
- Evidence of reflection from slope
- Less energetic than in Central Gulf
- Large mean flows along the Escarpment
- Exploratory SOFAR float shows only instance of deep cyclonic eddy
- No clear relation with upper-layer eddies

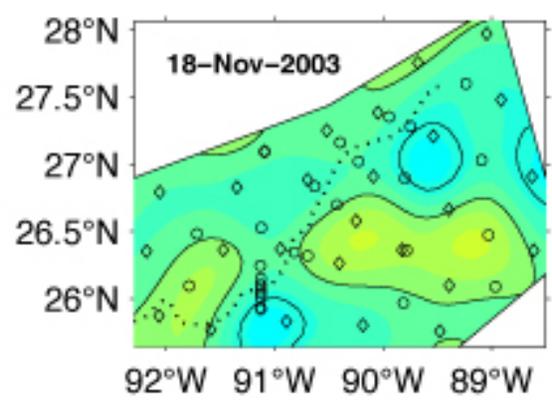
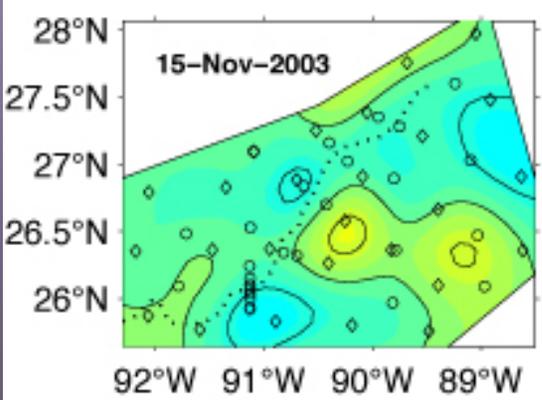
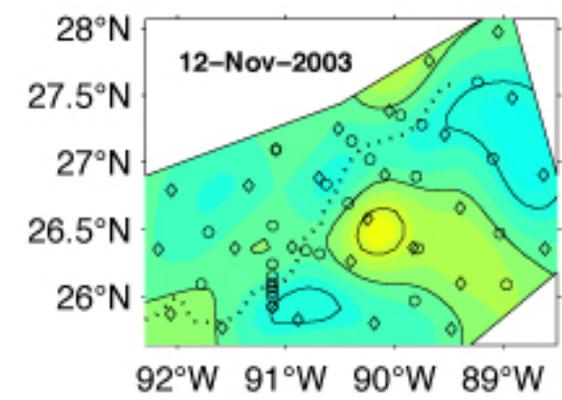
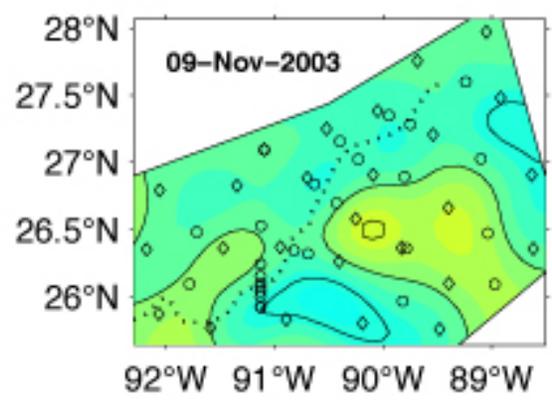
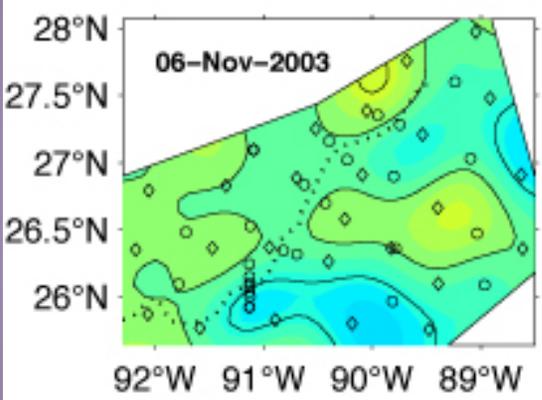
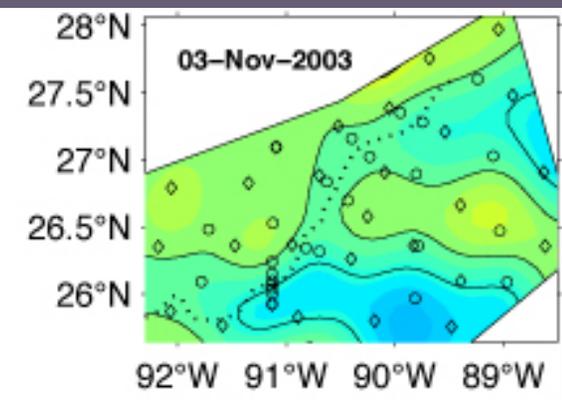
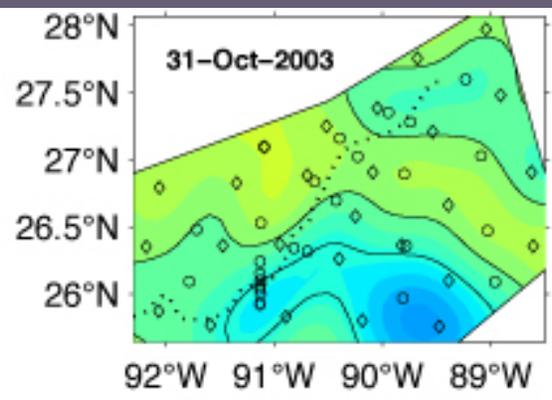
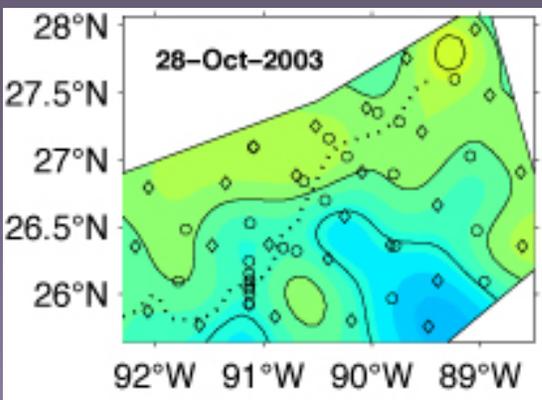
Near-Bottom Kinetic Energy

Bottom Pressure Anomaly Variance



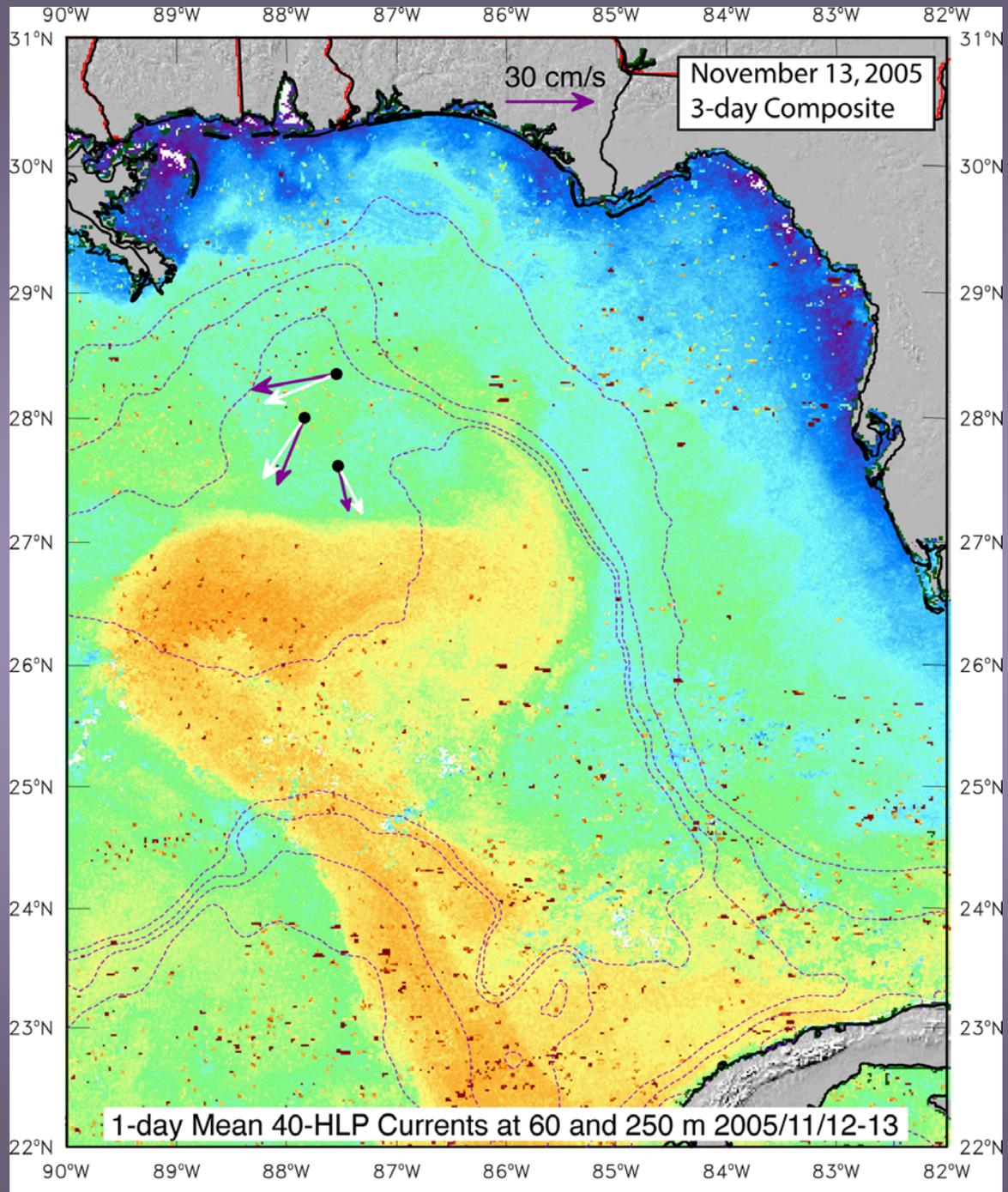


26 February –
18 March
Wave Event

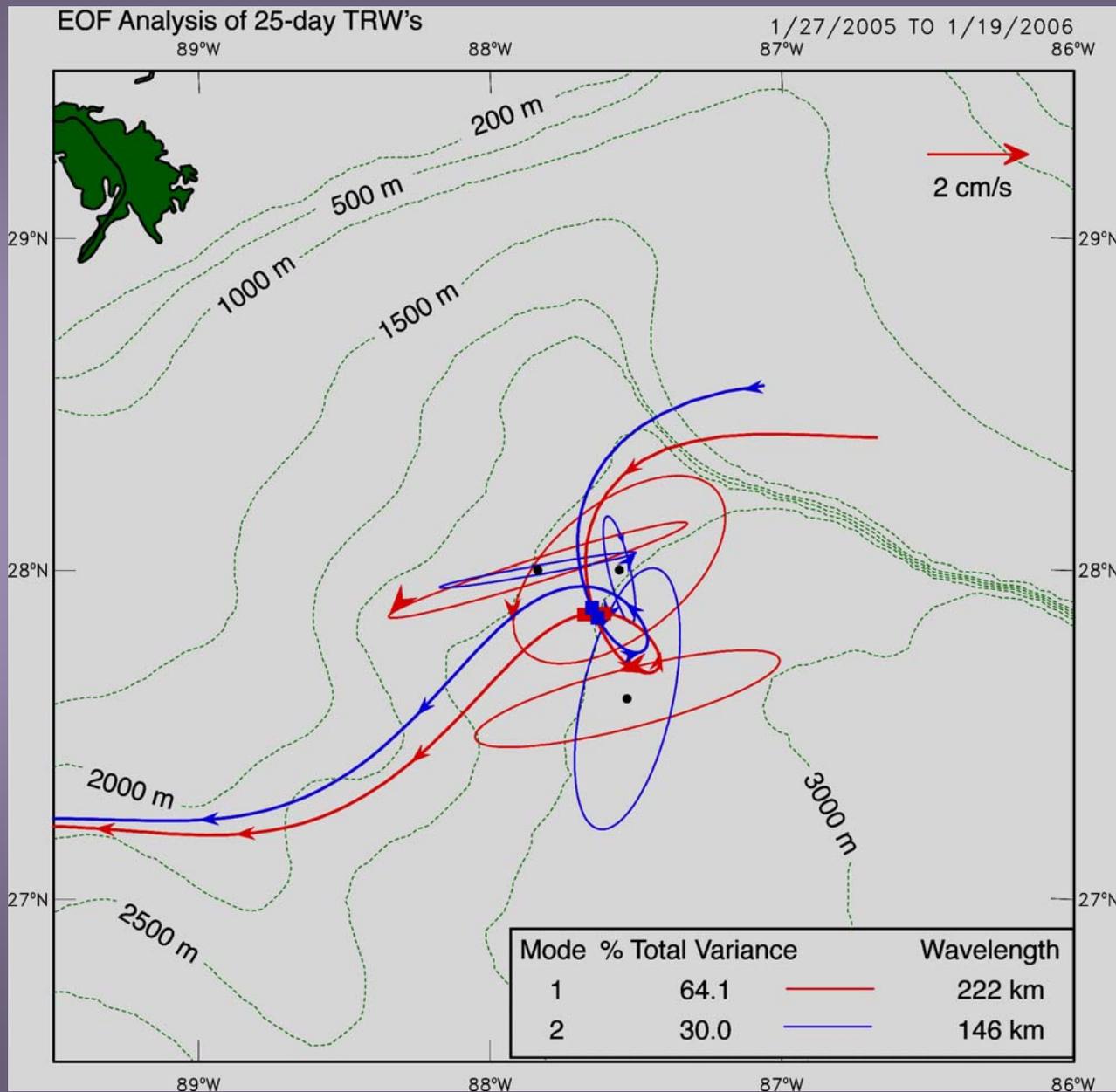


28 October –
18 November
Eddy Event

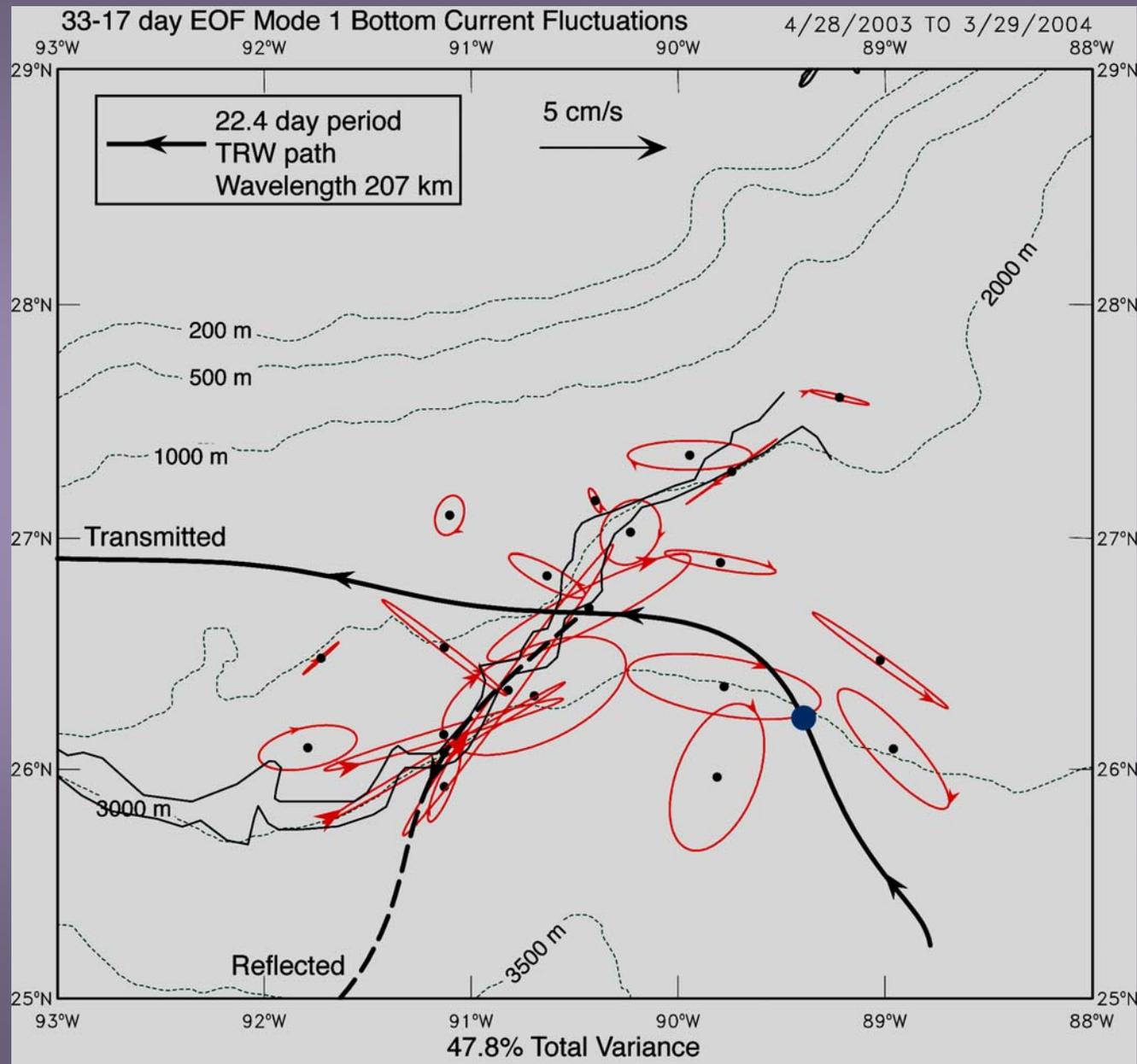
Cold
LCFE
13
November
2005



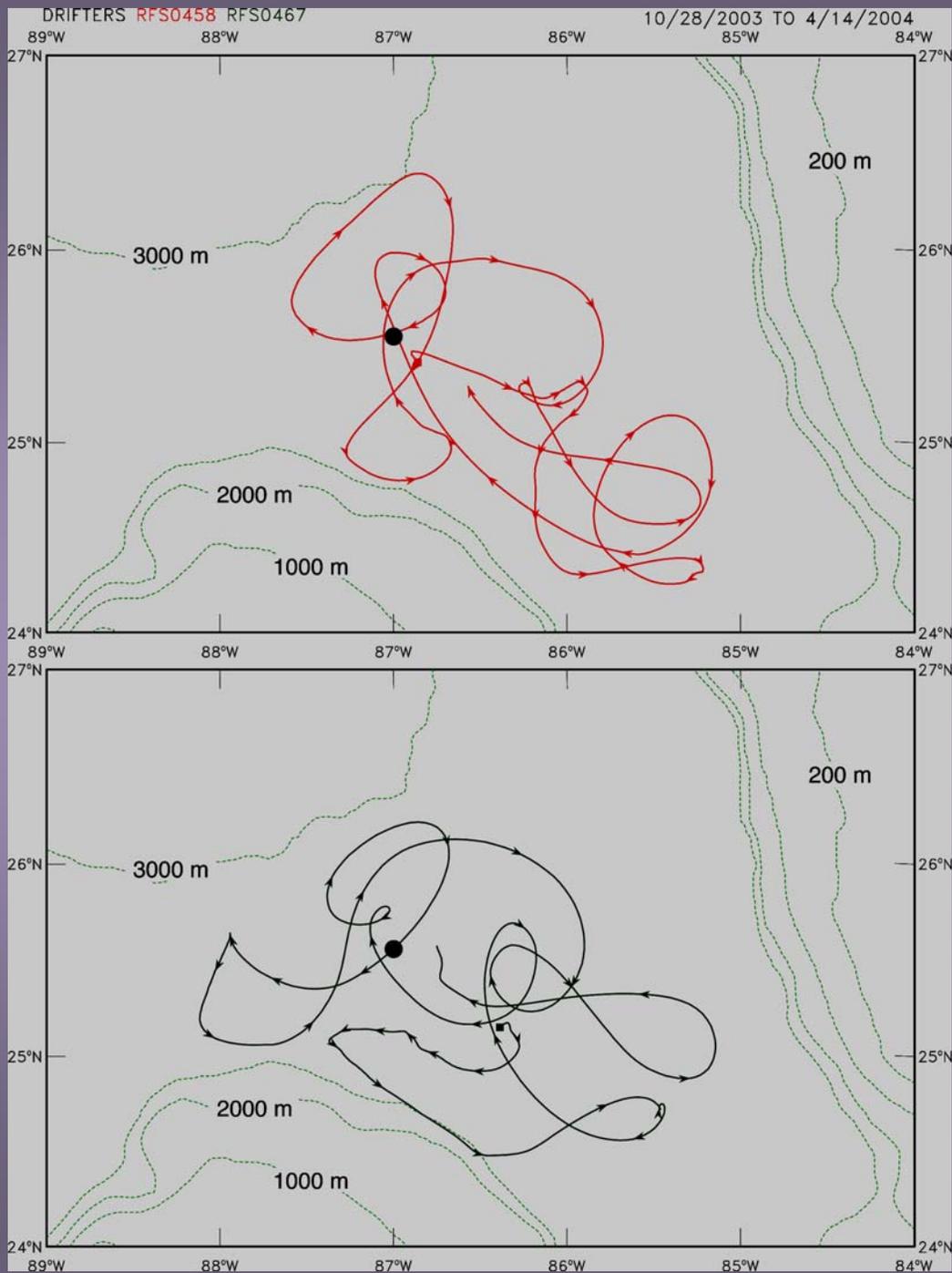
25-Day TRW Analysis



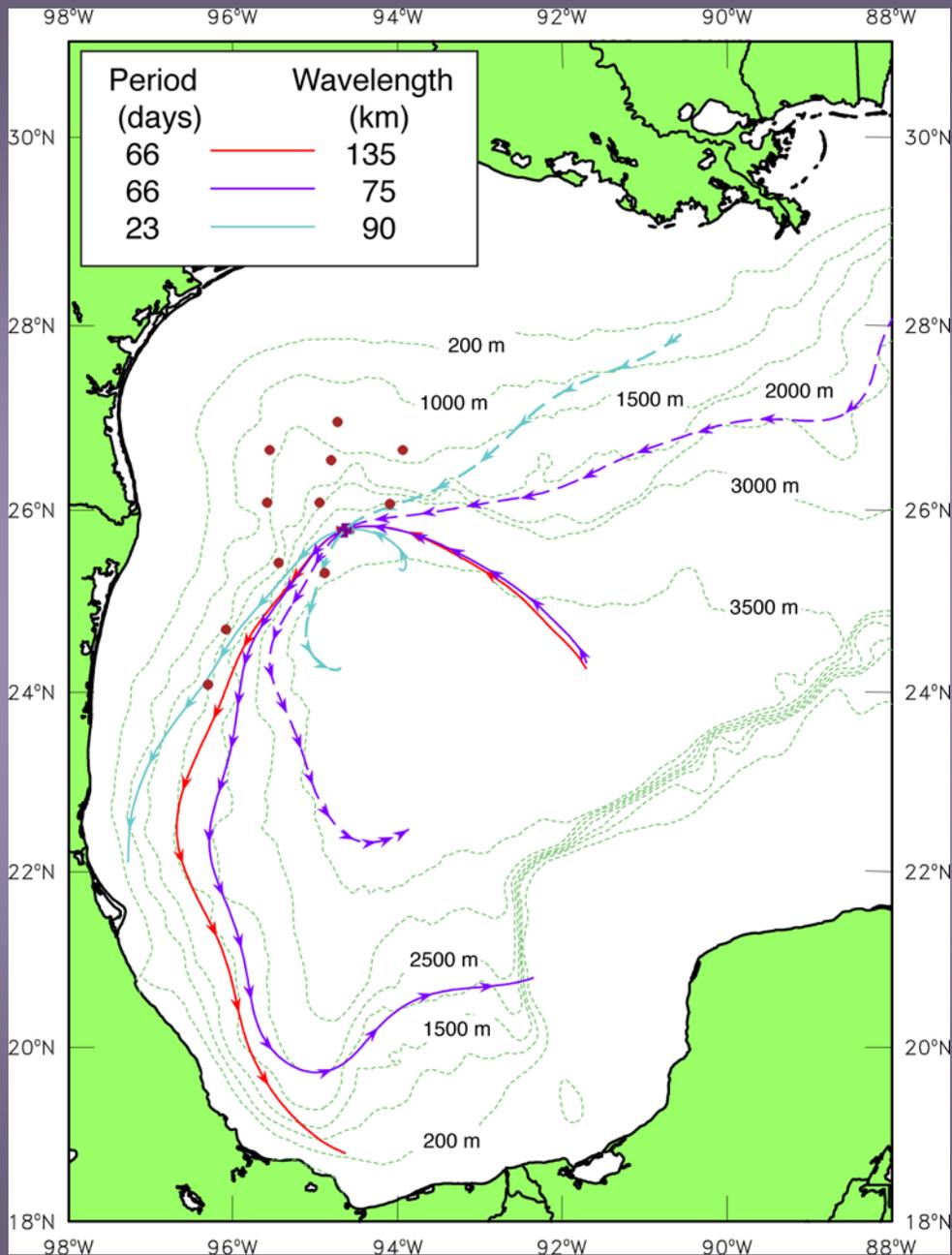
23-Day TRW Analysis Exploratory Program



Details of 1500 m Float Tracks under the Loop Current

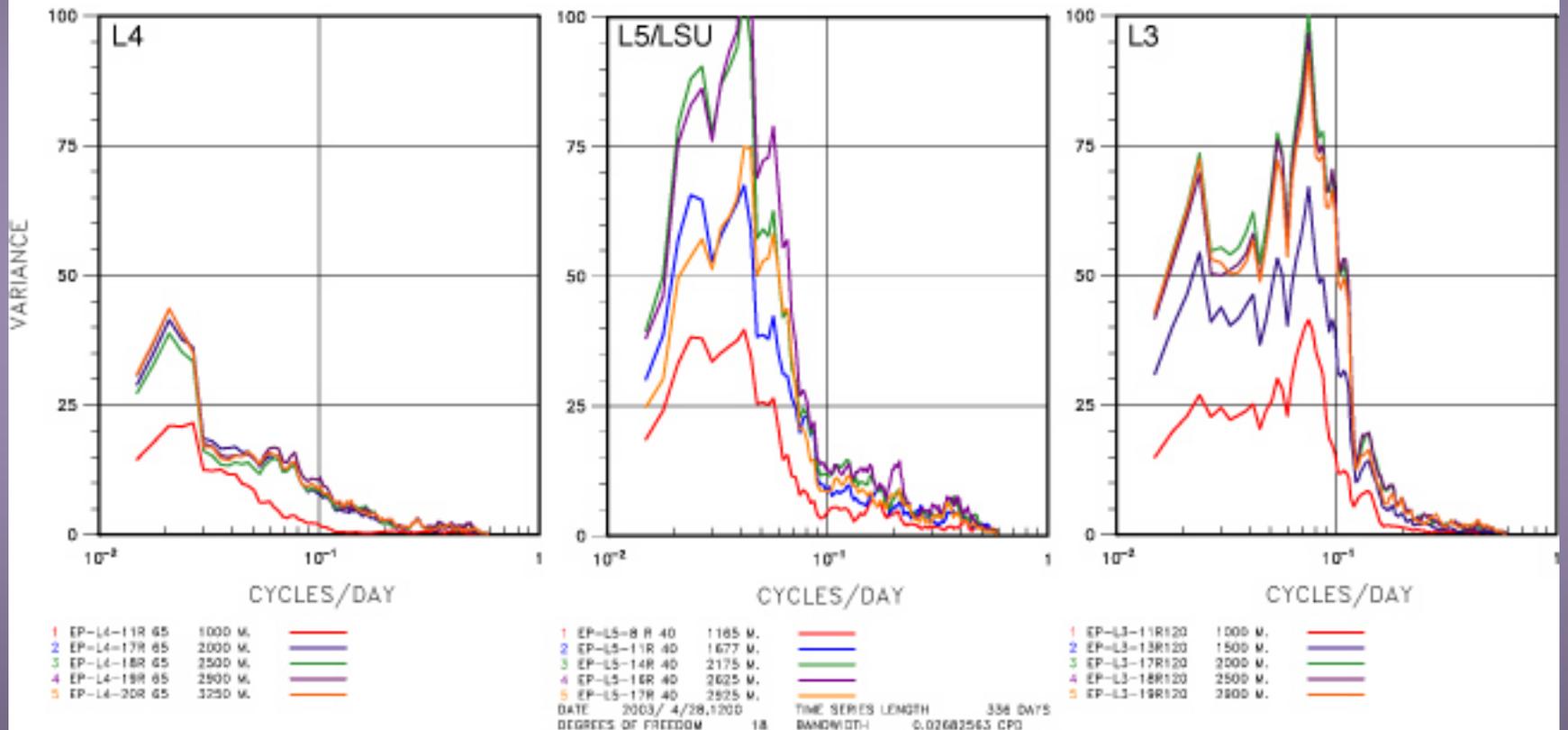


TRW Ray Traces

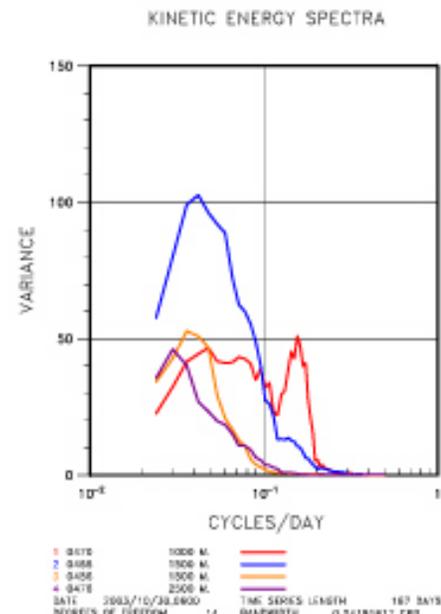
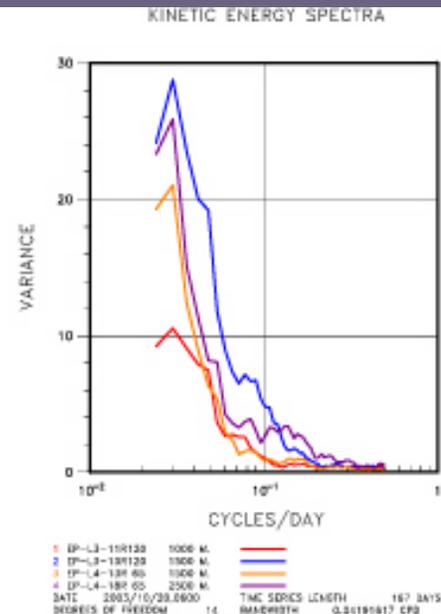
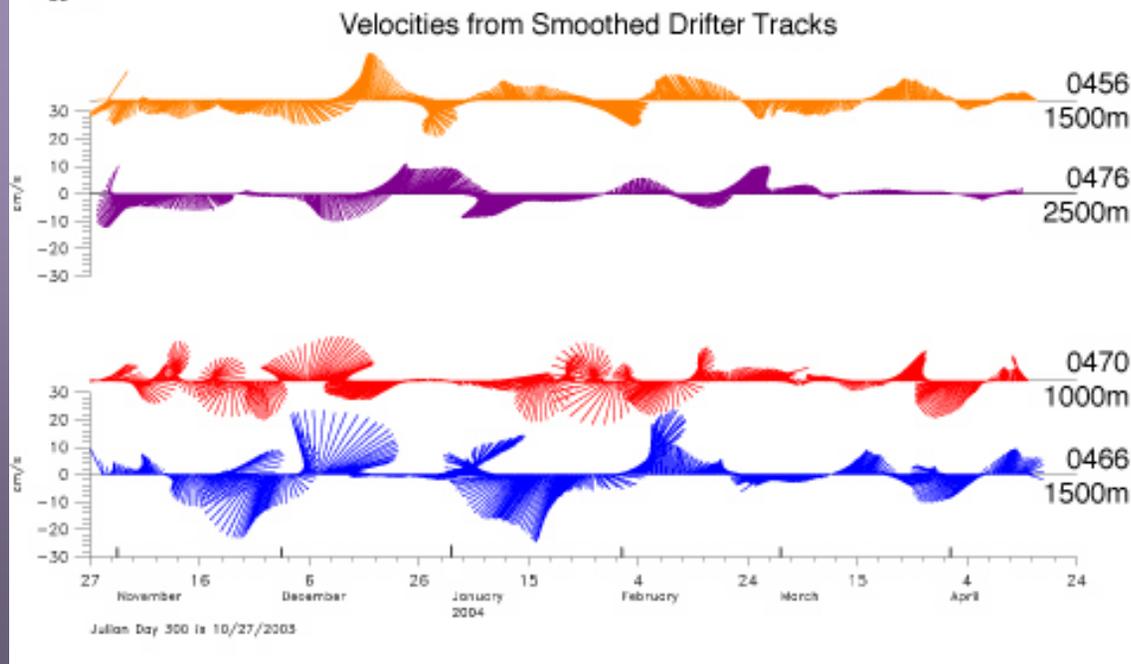
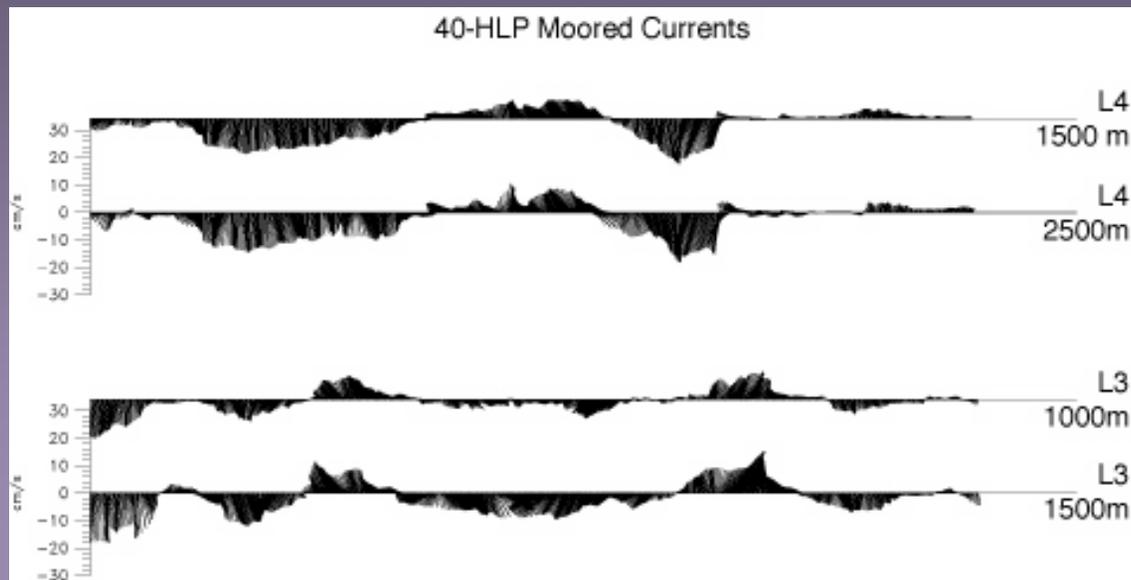


Kinetic Energy Spectra South of Escarpment

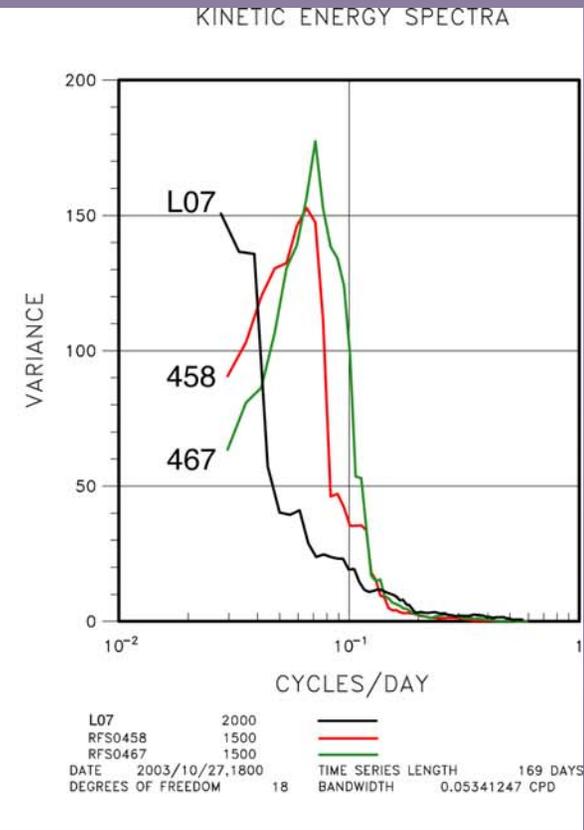
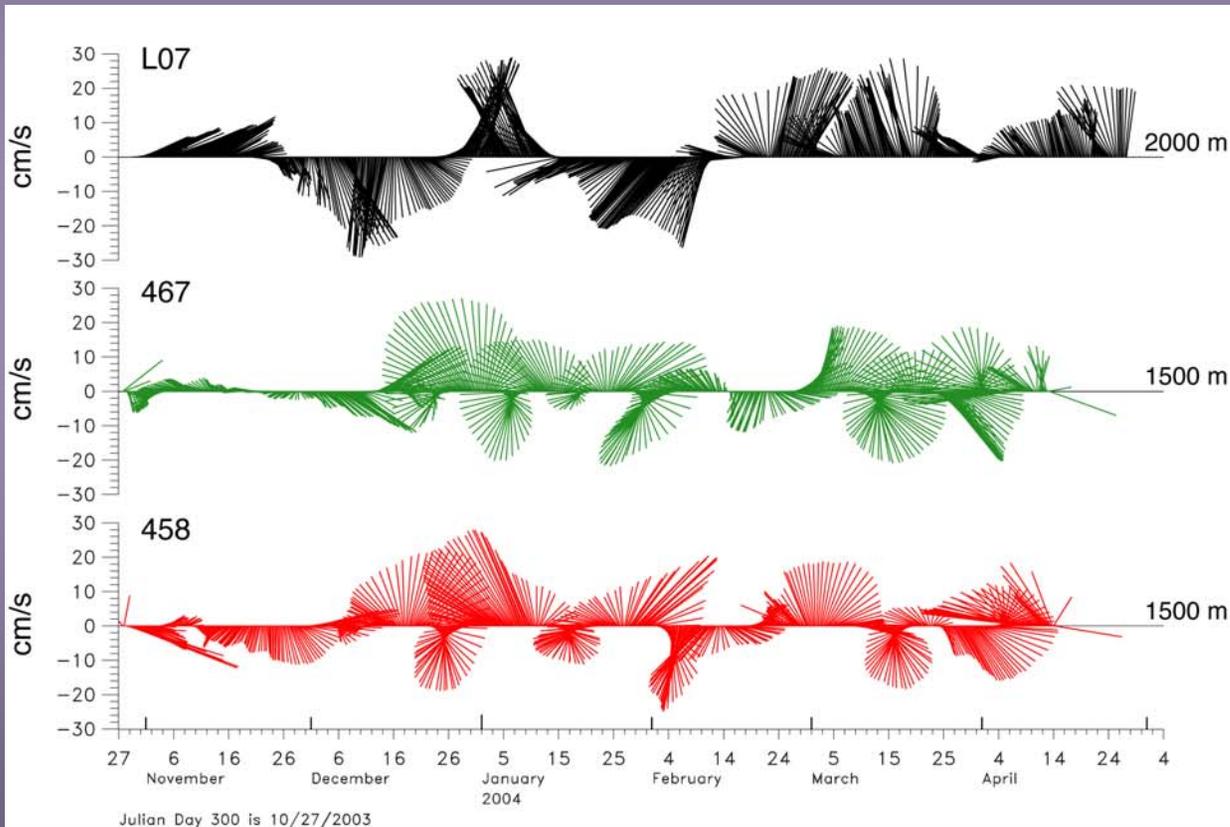
KINETIC ENERGY SPECTRA



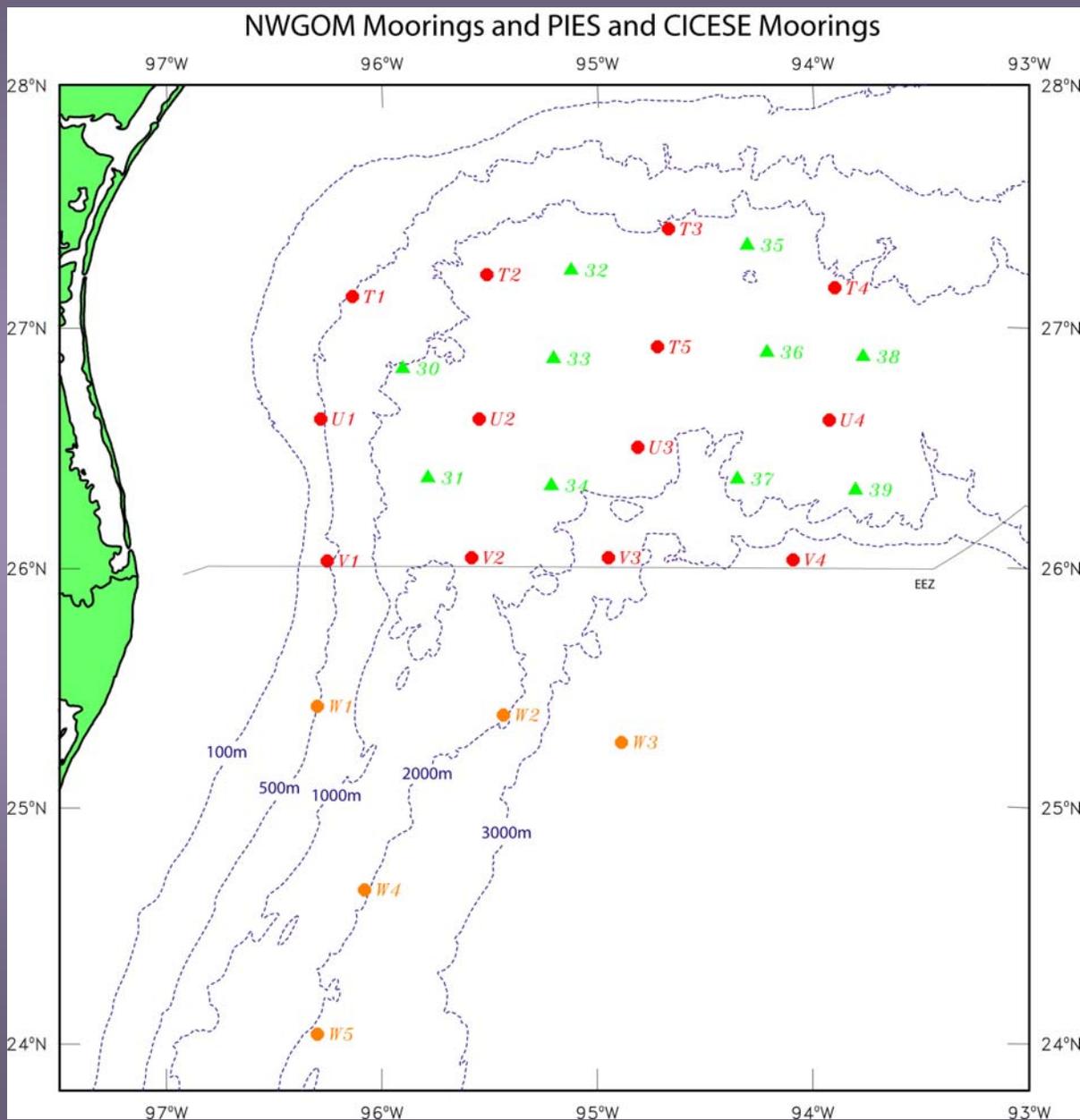
Drifter Velocities vs. Currents



Comparison of Eulerian and Lagrangian Currents from Eastern Gulf

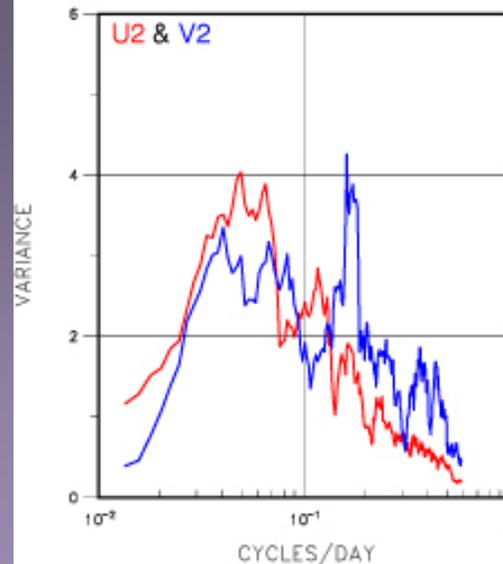


Mooring Map

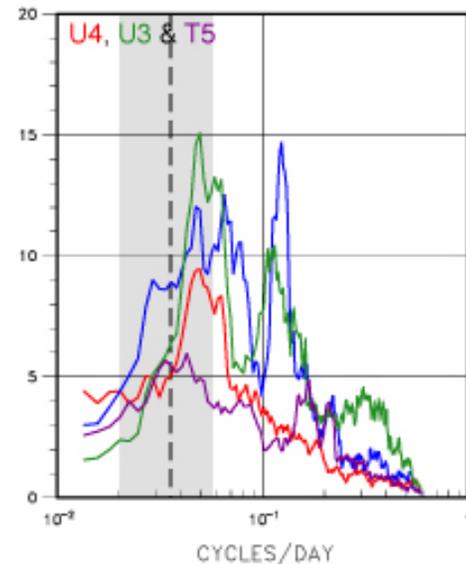


NW Slope Deep Kinetic Energy Spectra

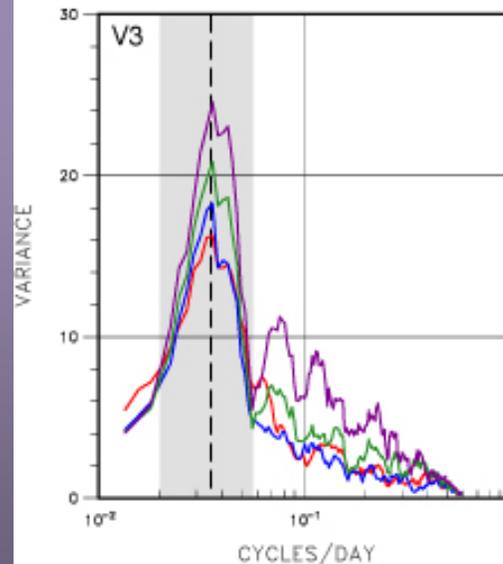
Kinetic Energy Spectra



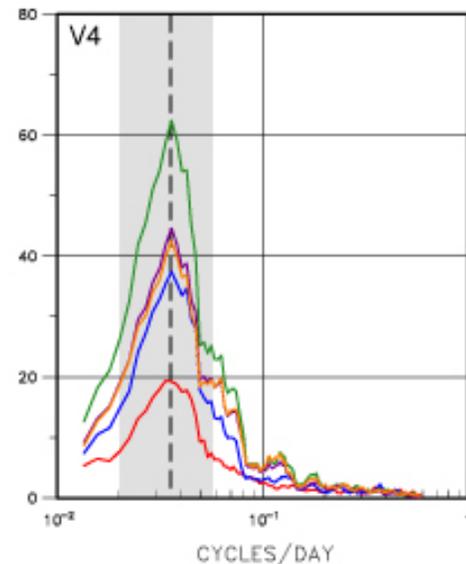
1 NW-U2-11R 20 1400 M. ————
2 NW-V2-11R 5 1400 M. ————



1 NW-U4-9 R 40 1000 M. ————
2 NW-U4-11R 40 1400 M. ————
3 NW-U3-13R150 1600 M. ————
4 NW-T5-11R110 1400 M. ————



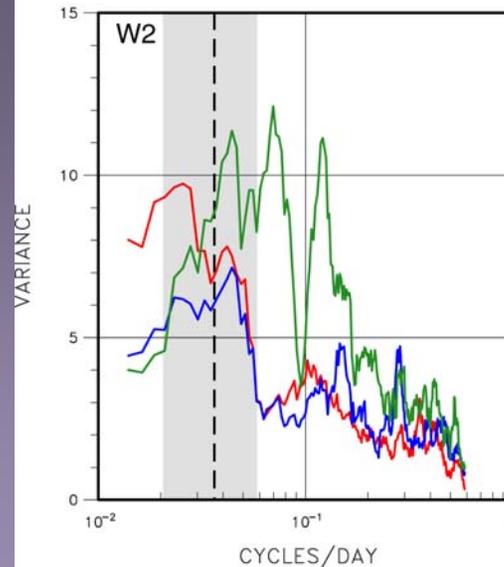
1 NW-V3-9 R 40 1000 M. ————
2 NW-V3-12R 40 1500 M. ————
3 NW-V3-14R 40 2000 M. ————
4 NW-V3-15R 40 2400 M. ————



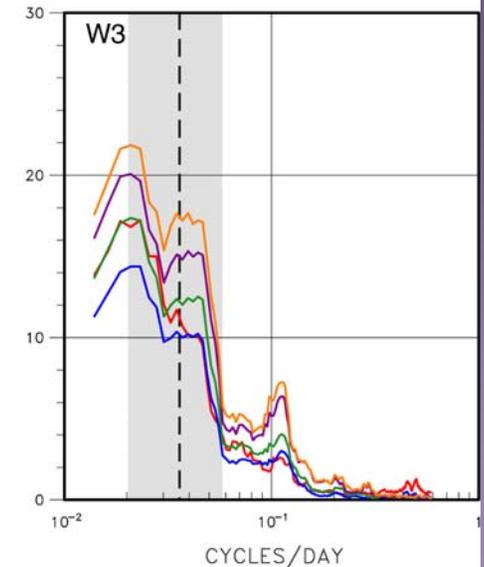
1 NW-V4-9 R 80 1000 M. ————
2 NW-V4-12R 80 1500 M. ————
3 NW-V4-14R 80 2000 M. ————
4 NW-V4-16R 80 2500 M. ————
5 NW-V4-17R 80 3000 M. ————

Mexican Slope Deep Kinetic Energy Spectra

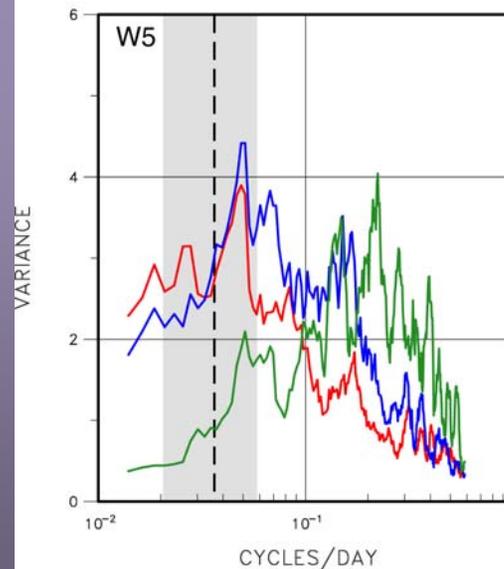
Kinetic Energy Spectra



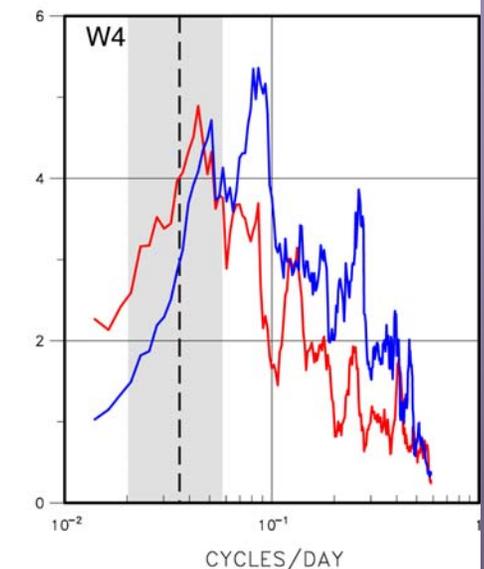
- 1 NW-W2-3 R 22 1140 M. —
- 2 NW-W2-4 R 22 1544 M. —
- 3 NW-W2-5 R 22 1965 M. —



- 1 NW-W3-3 R 45 1147 M. —
- 2 NW-W3-4 R 45 1541 M. —
- 3 NW-W3-5 R 45 2048 M. —
- 4 NW-W3-7 R 45 3038 M. —
- 5 NW-W3-8 R 45 3518 M. —

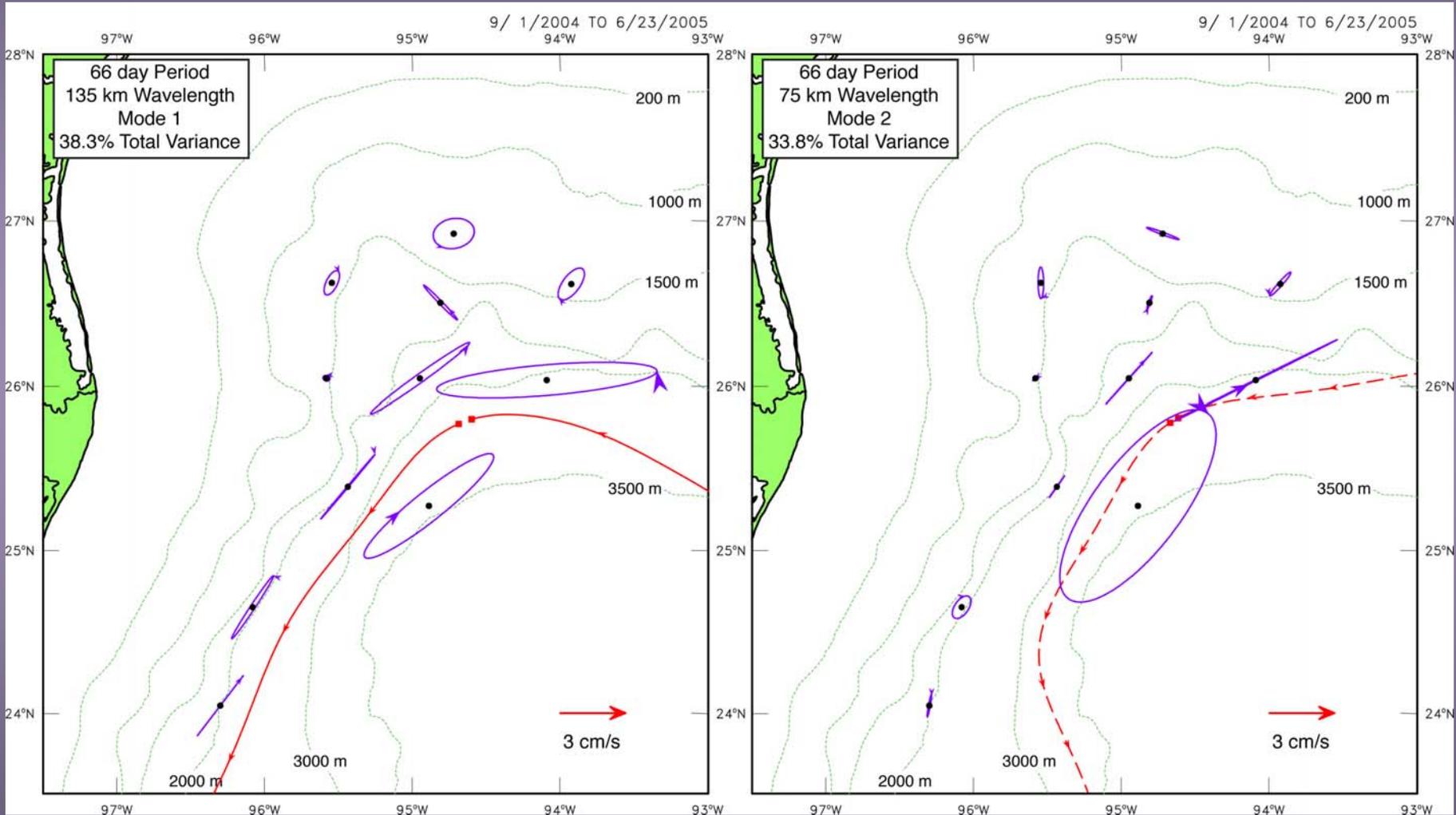


- 1 NW-W5-3 R 27 1145 M. —
- 2 NW-W5-4 R 27 1572 M. —
- 3 NW-W5-5 R 27 1998 M. —



- 1 NW-W4-4 R 25 1572 M. —
- 2 NW-W4-5 R 25 1941 M. —

66-Day TRW Analysis



Mean Currents ~ 100 – 500 mab

