Understanding Gulf Ocean Systems, topic 2
Pressure and Current Meters

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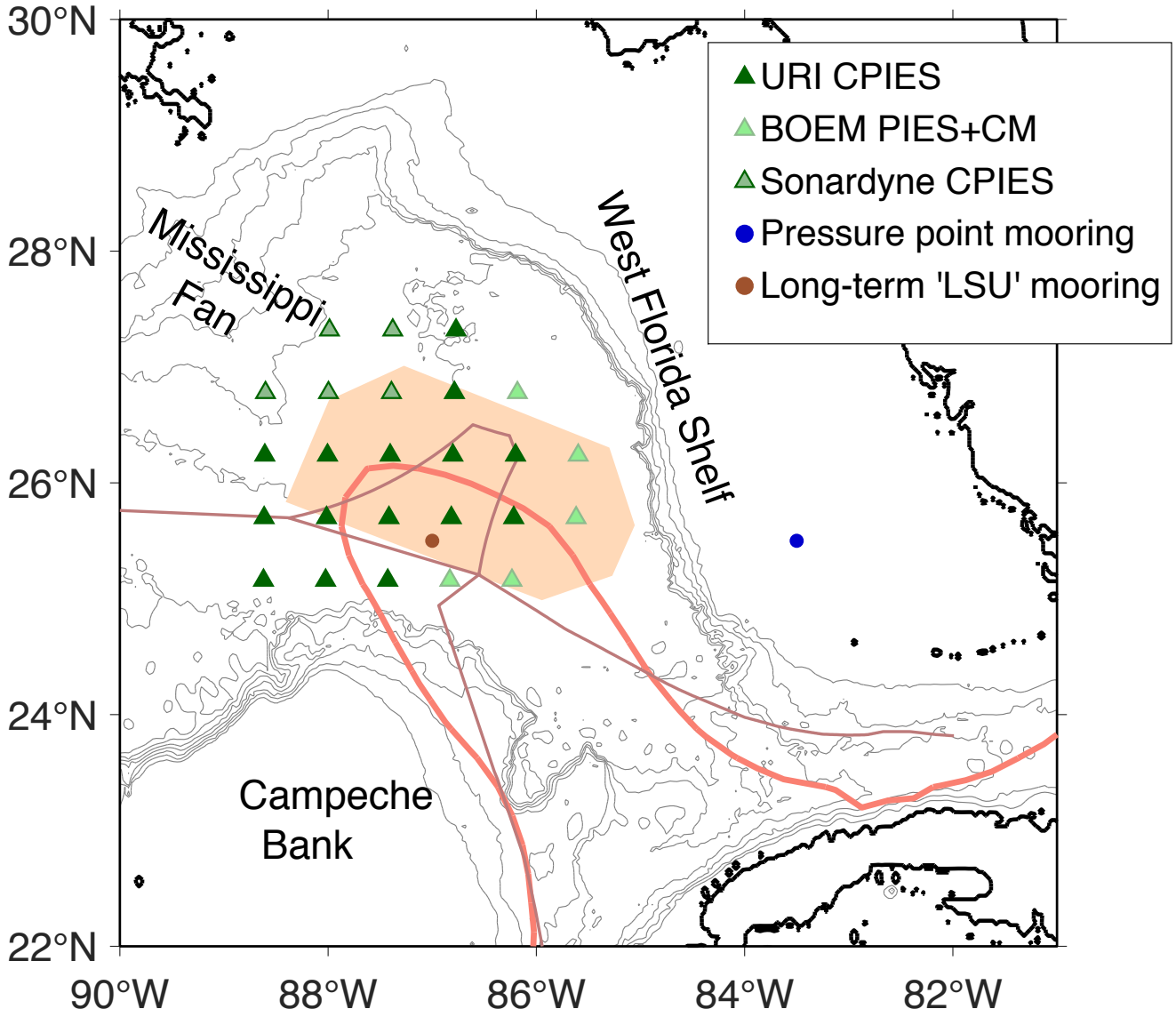
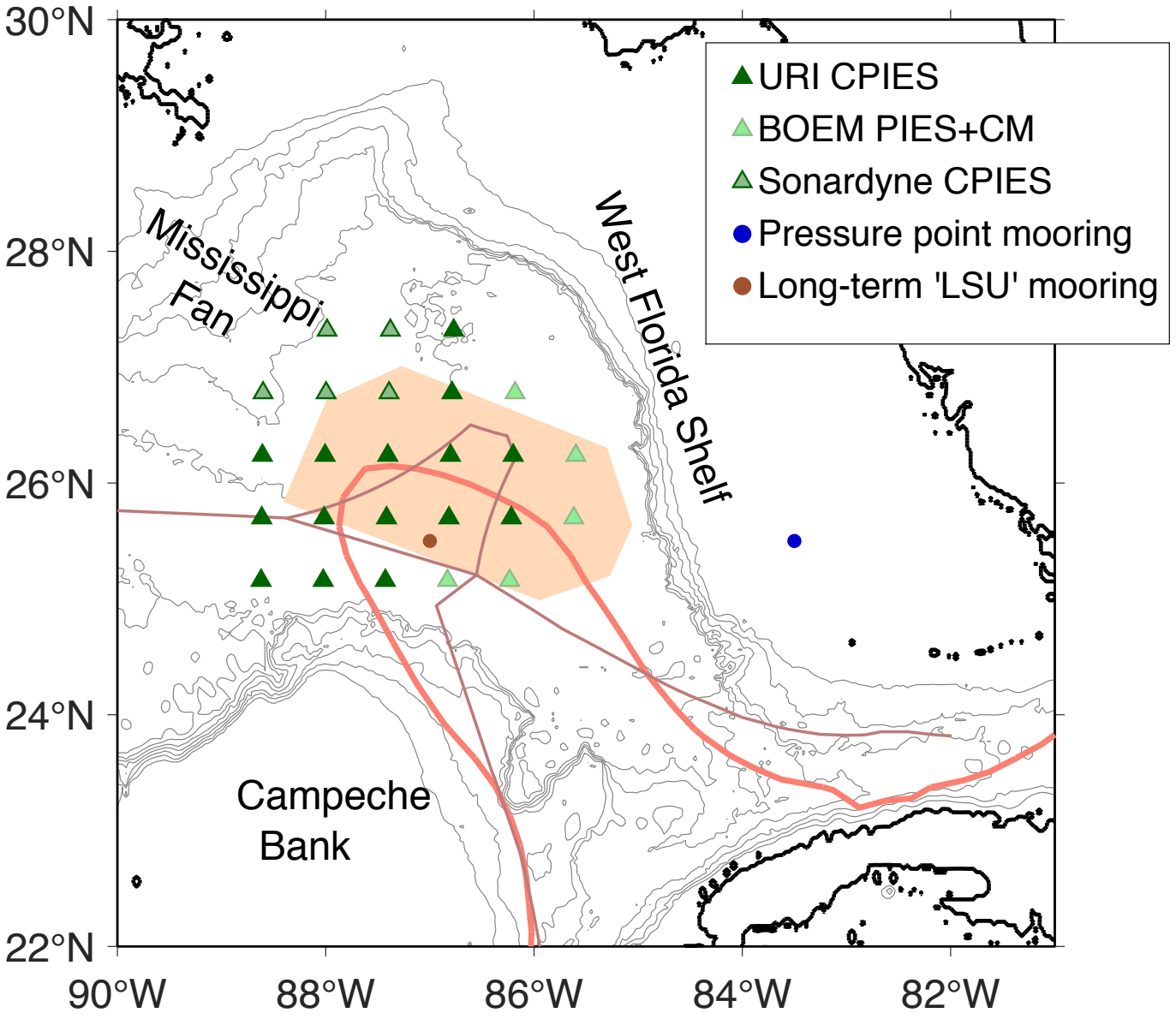
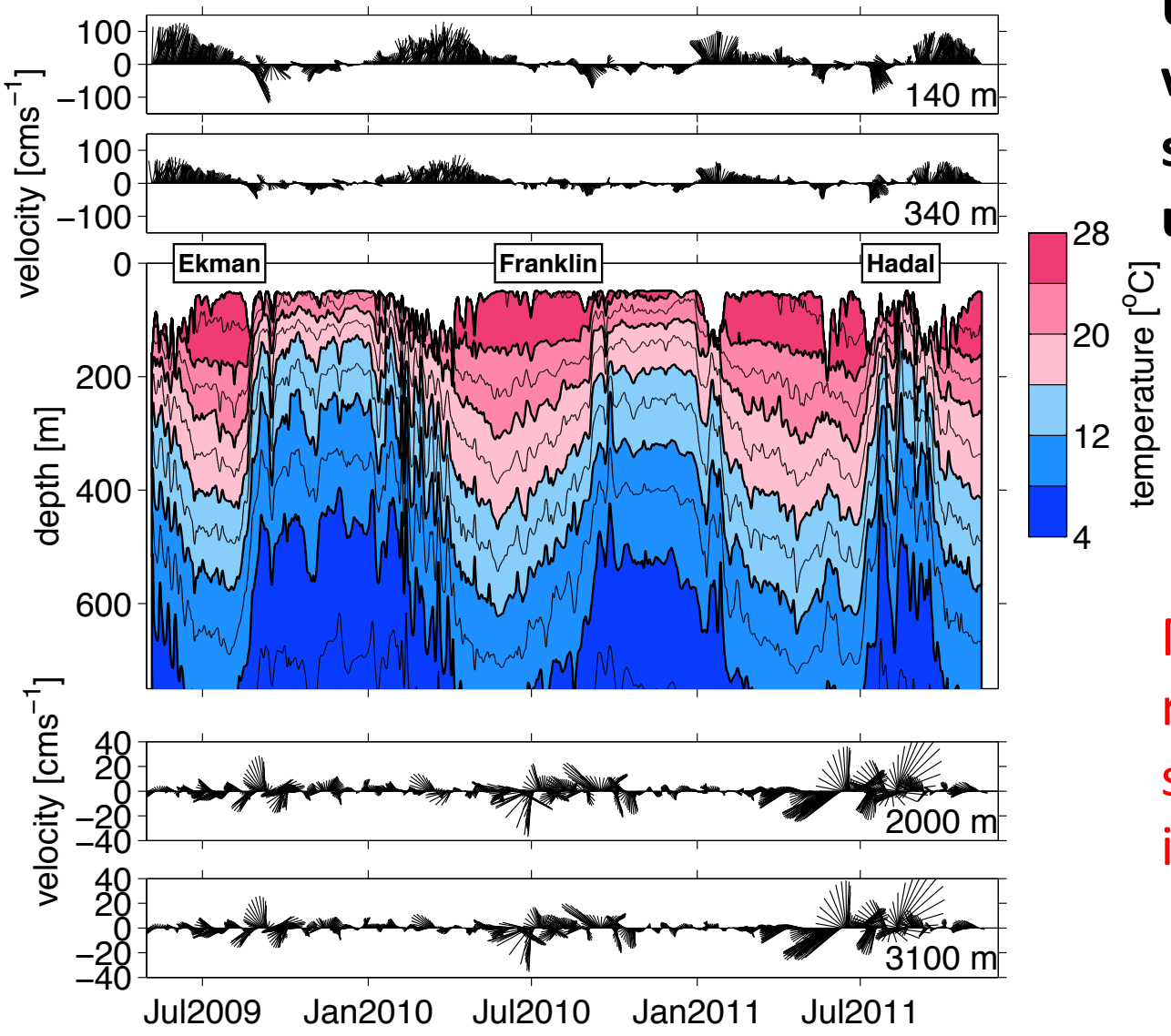
Goals: •increase the understanding of LC separation process
•inform LC forecasting efforts



Motivation for array design/placement

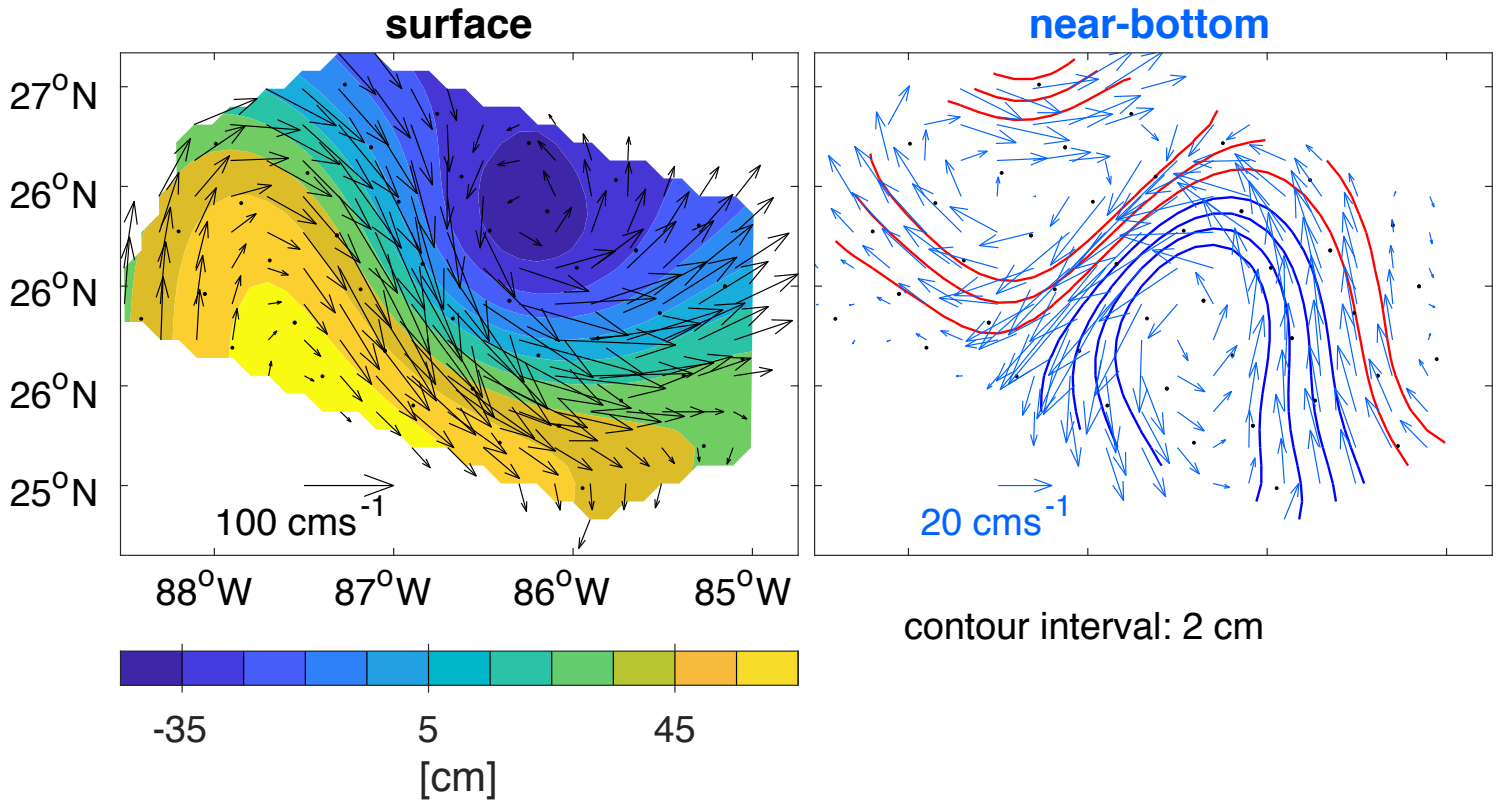




Upper and deep velocities appear, at a single mooring, to be uncoupled.

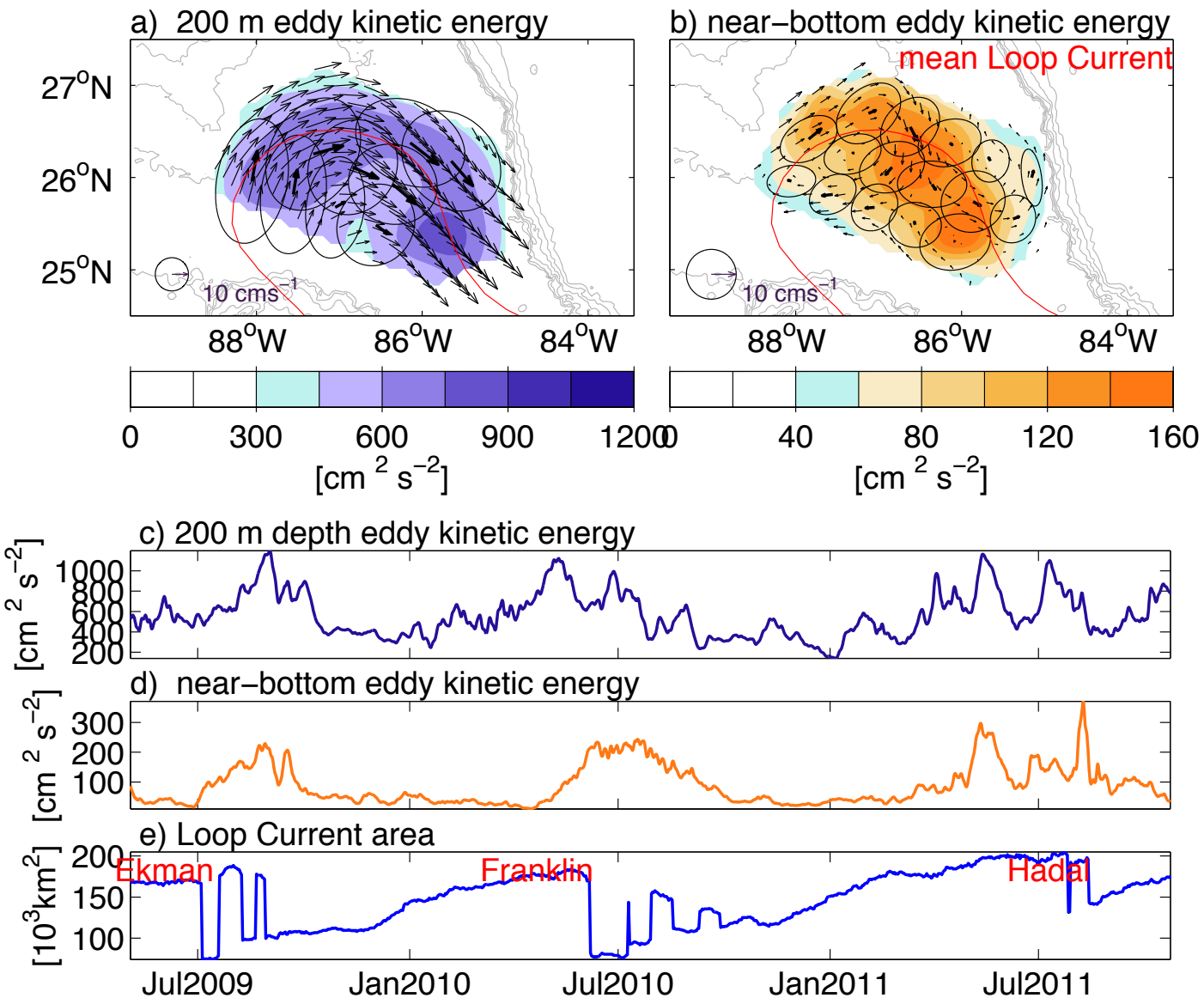
Mapped circulation reveals coupling & signature of baroclinic instability.

June 24, 2010 – just before Eddy Franklin separation



Large Loop Current meander has developed.
Deep cyclone beneath Loop Current trough.

During LC detachment/formation, marked increase in deep EKE



-deep eke is high along northeastern periphery of mean LC position

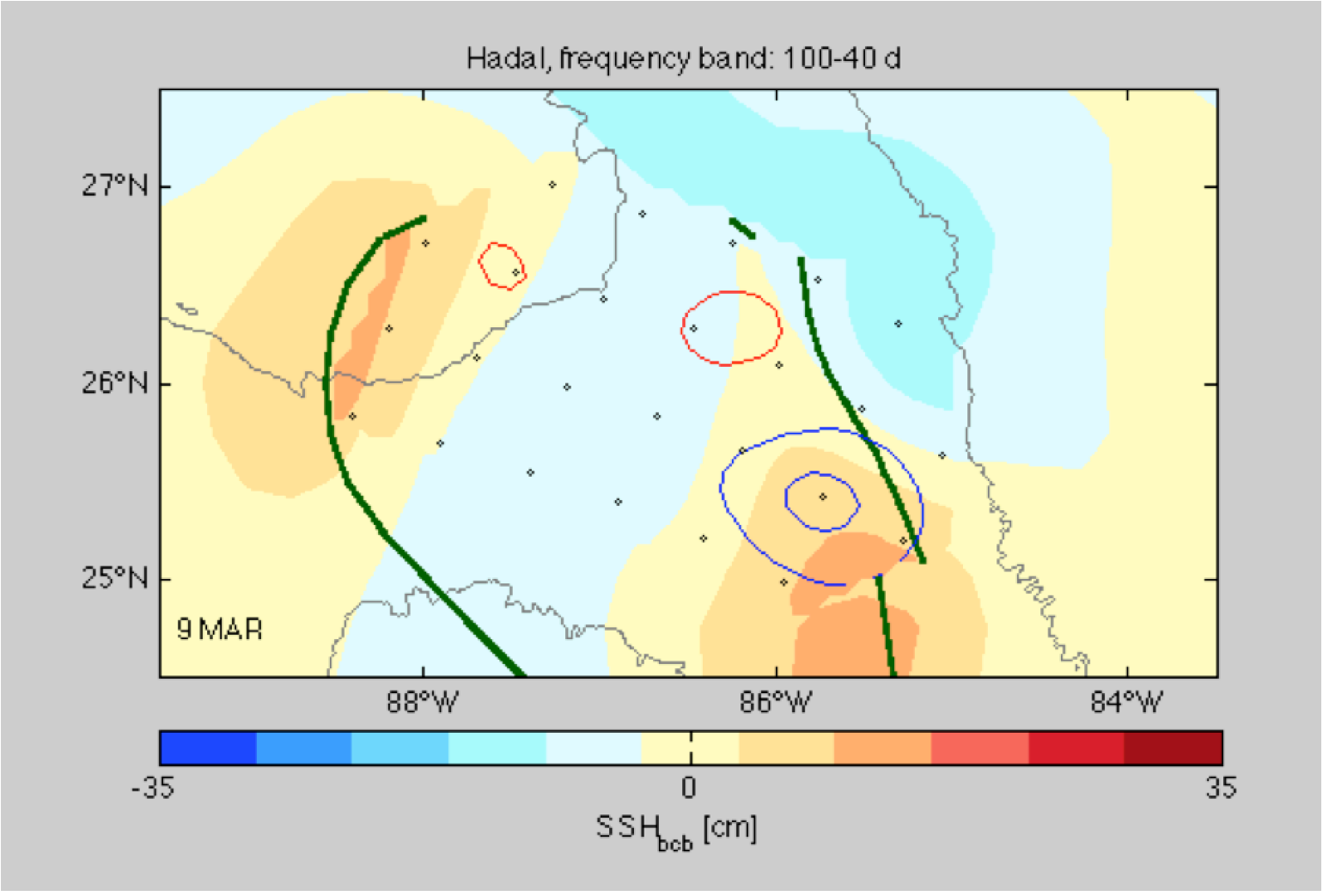
-deep eke increases occur with the development of large-scale meanders.

What we learned:

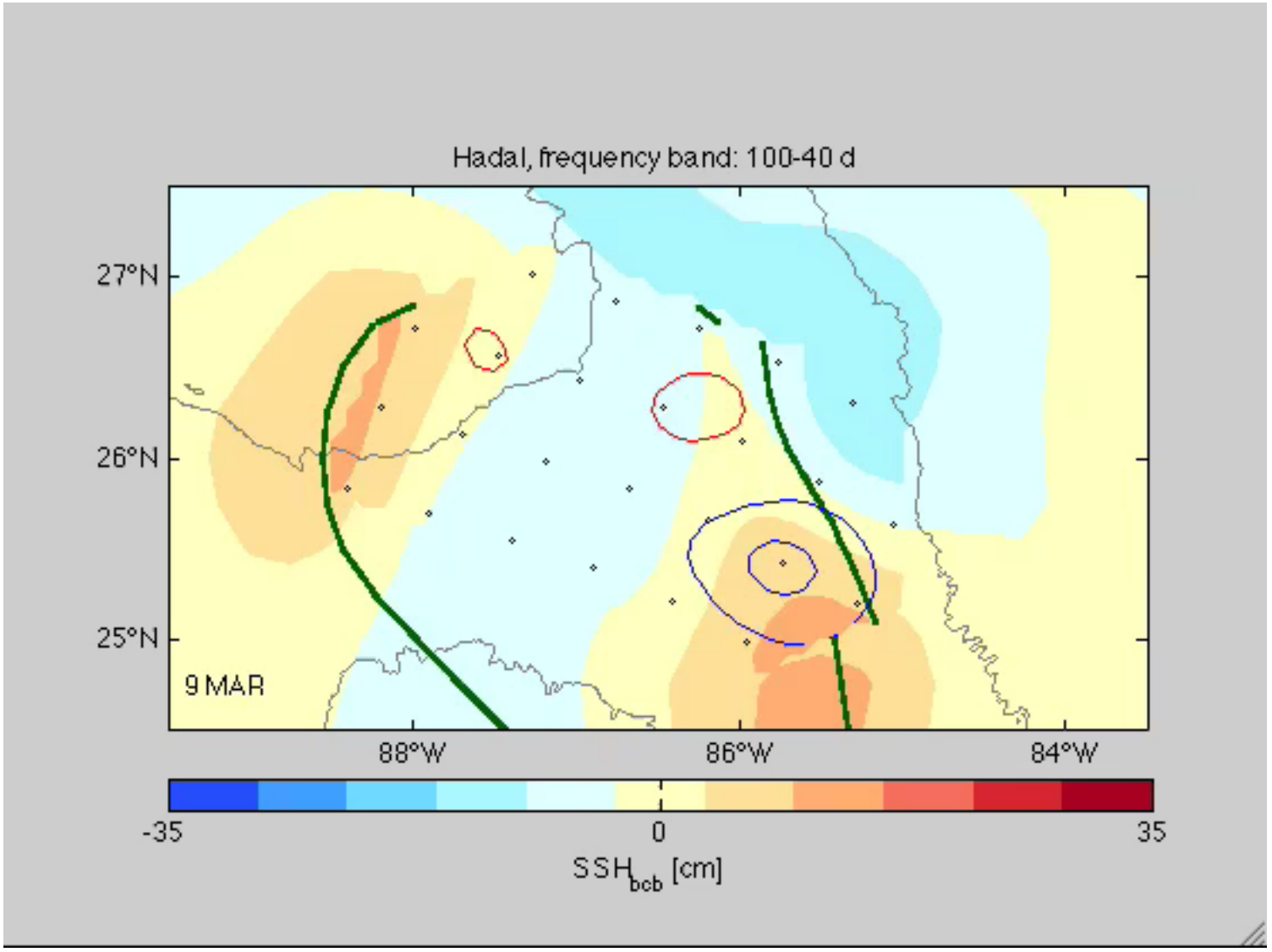
- Large Loop Current meanders develop prior to separation as deep eddy energy grows.
- A train of upper-deep eddy interactions leads to each Loop Current Eddy separation.
- Deep eddies develop in a pattern consistent with baroclinic instability.

What to watch for:

- Upper and deep propagate together -- deep leads upper by ¼ wavelength.
- A few (2-3) deep eddies enter along NNE side



Upper Loop Current--- filled contours Deep eddy field --- lines



Implication for forecasting Loop Current system:

-baroclinic instability prior to separation is essential to the timing of eddy separation

-requires simultaneous information about the upper and deep circulation

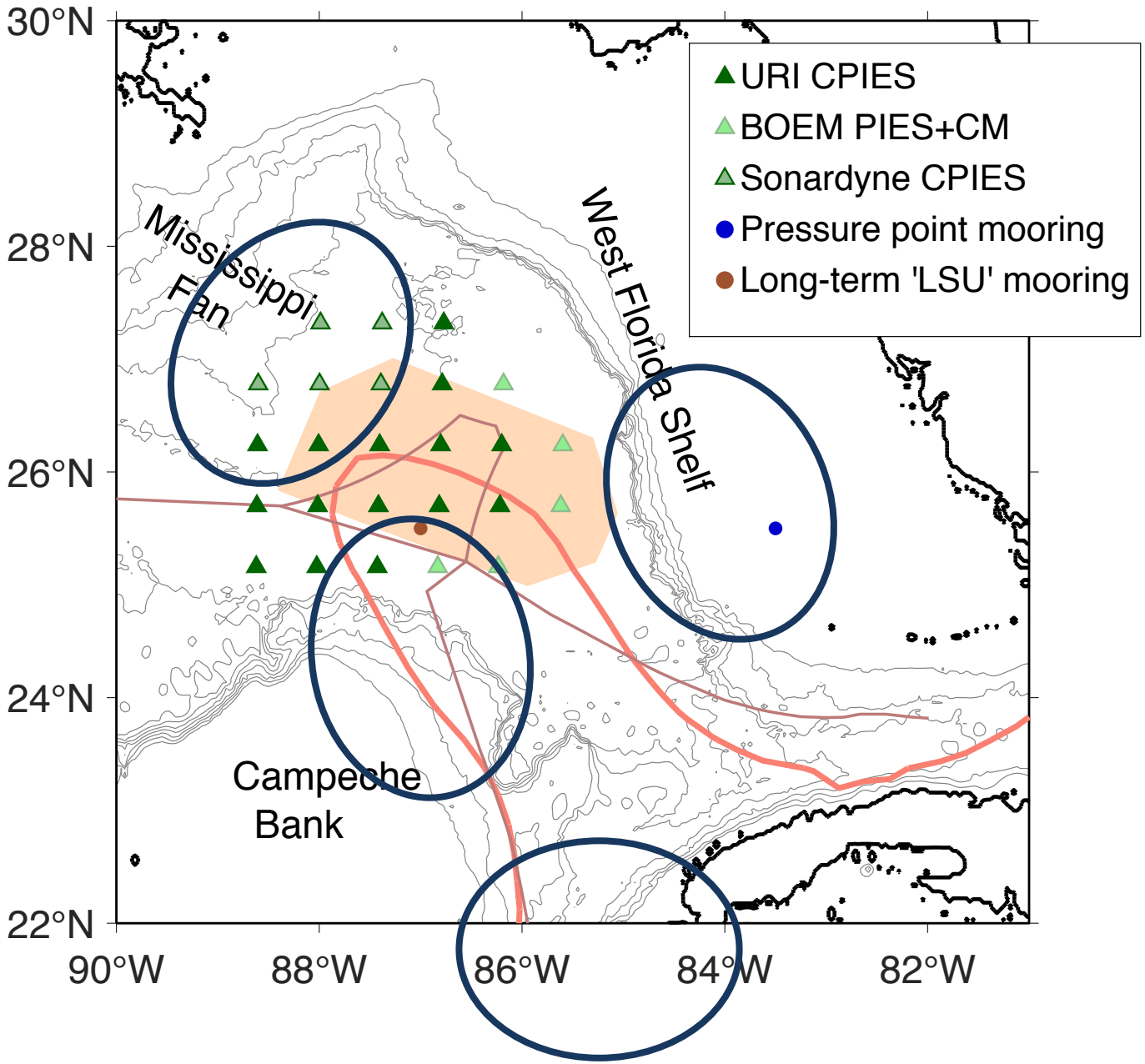
Amplification of meander trough:

-small disturbances can initiate baroclinic instability

-train of upper-deep eddy interaction precedes the separation

-joint intensification is intermittent – lasting tens of days

Deep energy production regions internal and external to GOM have been suggested



Hypothesis:

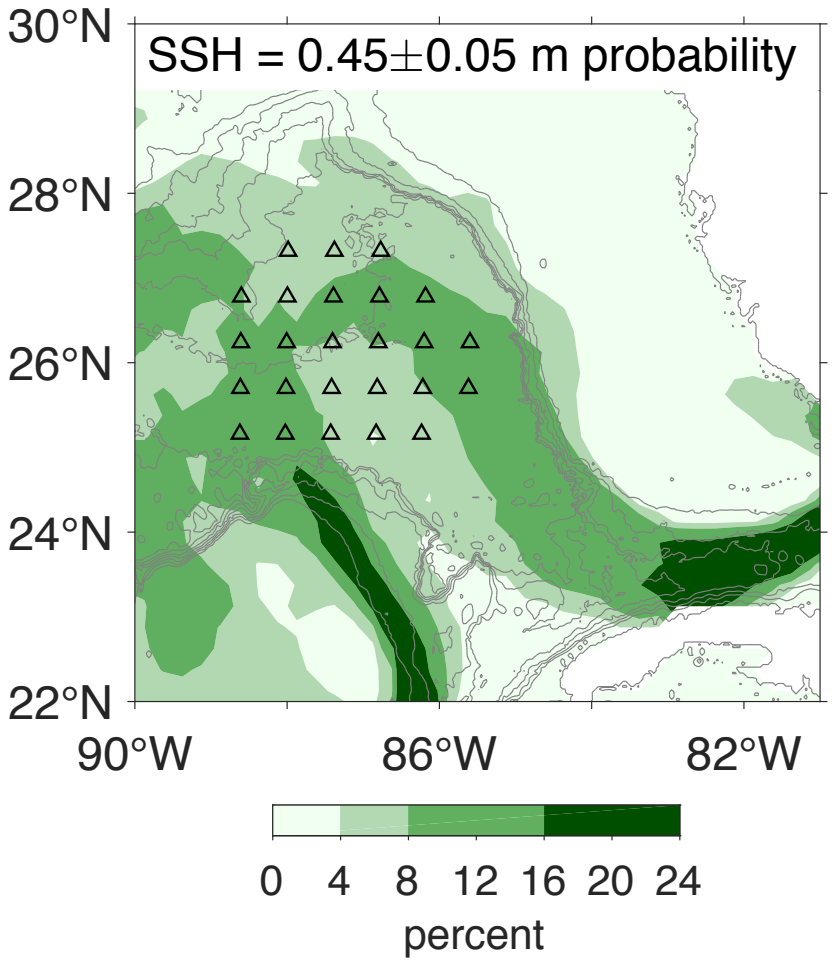
As the LC flows northward off the Campeche Bank small meanders develop coupled with deep perturbations and they jointly strengthen due to vortex stretching.

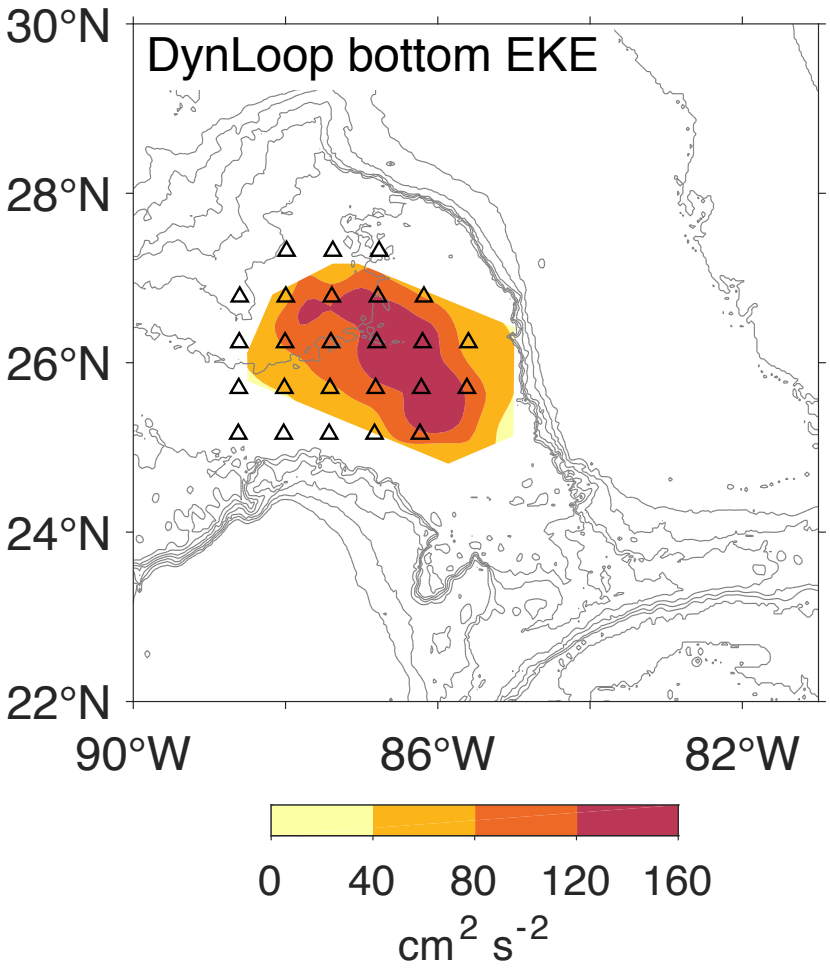
At the Mississippi Fan squashing and re-stretching occur, again coupling deep eddies and upper meanders of the LC.

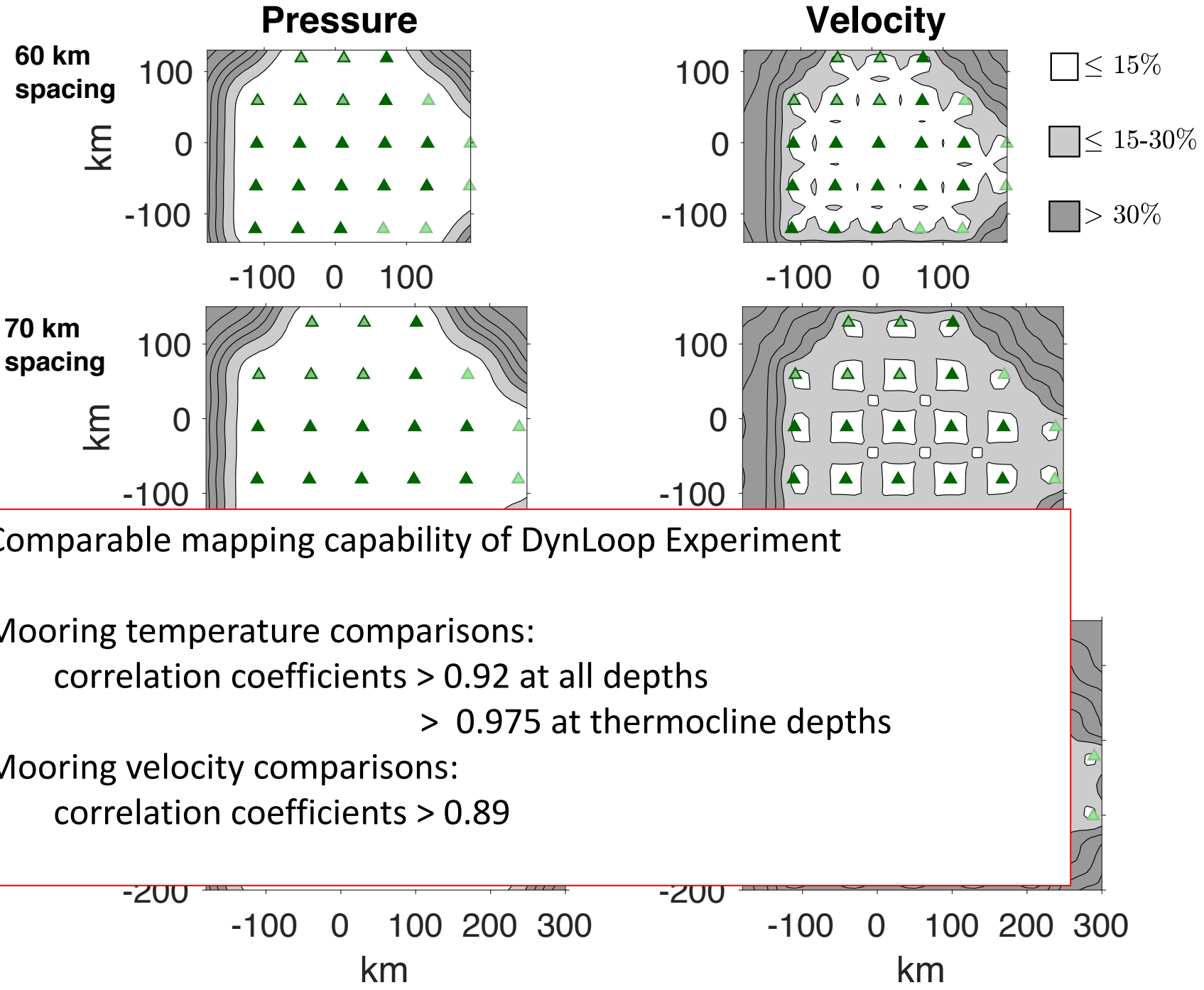
Vertically-coupled topographic interactions provide the trigger mechanism for baroclinic instability that precedes and effectuates LC eddy separation.

Design:

- lateral spacing resolves the mesoscale
- extended coverage
  - southward to capture LC as it moves off Campeche Bank
  - northwestward to observe interaction of the LC with Mississippi Fan
- spatial extent encompasses LC and observe deep eddy energy during LC separation







Comparable mapping capability of DynLoop Experiment

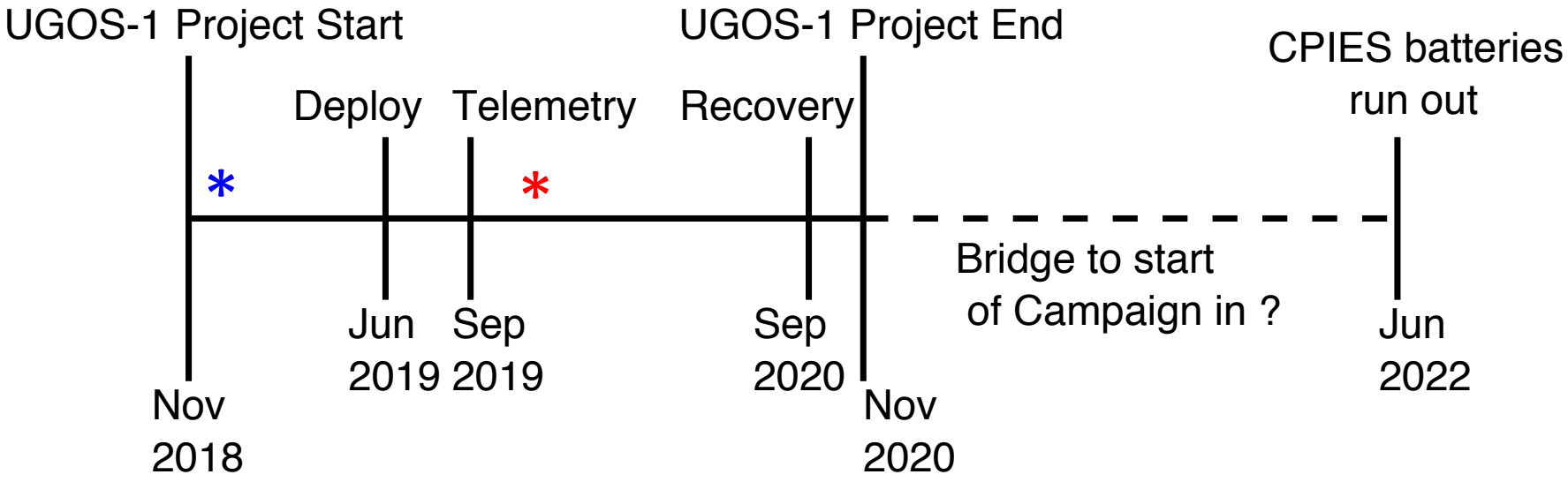
Mooring temperature comparisons:

correlation coefficients > 0.92 at all depths

> 0.975 at thermocline depths

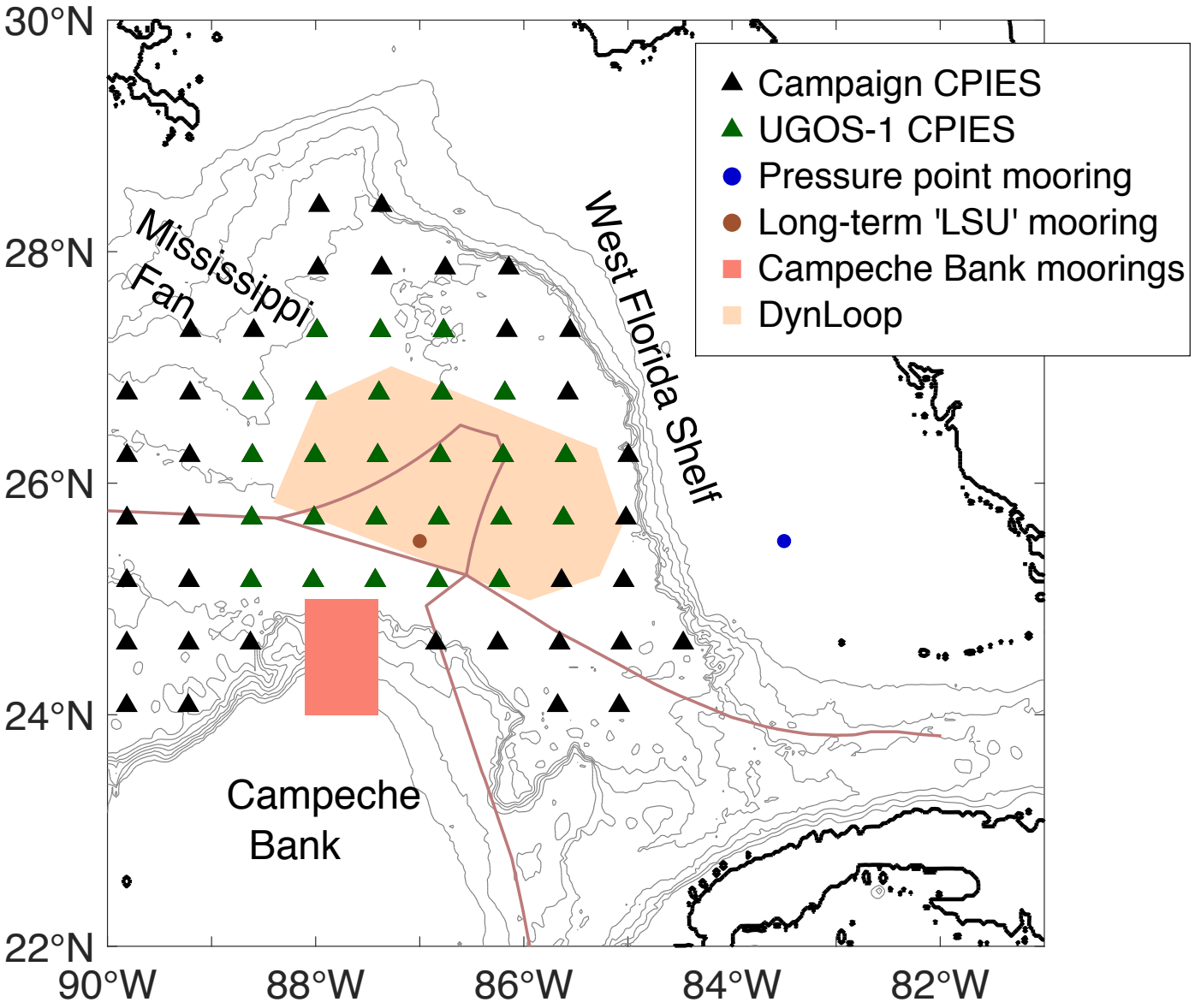
Mooring velocity comparisons:

correlation coefficients > 0.89



*Workshop planned to facilitate collaboration with Mexican colleagues and modeling group.

*Applied for clearance to work in Mexican waters.


30°N
28°N
26°N
24°N
22°N
90°W
88°W
86°W
84°W
82°W
Campaign CPIES
UGOS-1 CPIES
Pressure point mooring
Long-term 'LSU' mooring
Campeche Bank moorings
DynLoop
Mississippi Fan
West Florida Shelf
Campeche Bank

Improved understanding of LC system and predictability requires:

- Network of upper/deep measurements at mesoscale resolution
- Innovative solutions to near-real time data delivery of deep obs.
- Observations in Mexican and Cuban waters – international partners

End of presentation