Gulf of Mexico Pilot Prediction Project (GOMEX-PPP)
RPSEA-TAC, SAN RAMON, CA
19 OCT 10

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Portland, Oregon
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Cort Cooper, Chevron, Co-PI
Dave Driver, BP America, Co-PI
Sponsor: RPSEA; Cost Share: CASE, Chevron, & BP America
Duration: 30 mos; Total Funding: $1.56M; Start: 10 MAR 10

GULF OF MEXICO – PILOT PREDICTION PROJECT (FRAMEWORK)

- SOCIETAL MOTIVATIONS
  - OFFSHORE INDUSTRIES NEED CURRENT FORECASTS FOR SAFETY & EFFICIENCY
  - ENVIRONMENTAL & EMERGENCY MANAGERS (IOOS: GCOOS & SECOORA) NEED CURRENT FORECASTS TO UNDERPIN ECOLOGICAL FORECASTS
  - NAVY & NOAA NEED CURRENT FORECASTS TO SUPPORT MANDATED MISSIONS

- TECHNICAL DELIVERABLES
  - EVALUATION OF MULTIPLE DATA-ASSIMILATIVE CIRCULATION MODELS
  - DEMONSTRATION OF PROTOTYPE MESOSCALE OCEAN PREDICTION SYSTEMS
  - RECOMMENDATION OF A CONCEPT OF OPERATIONS (CONOPS)

- APPROACH
  - PHASES
  - EXPERIMENTS
  - PARTICIPANTS

PHASES

- FIRST (18 MOS.), RUN & EVALUATE FORECAST EXPERIMENTS; SELECT “BEST” PATH TO OPERATIONAL SYSTEM: SINGLE MODEL VICE ENSEMBLE OF MODELS?
- SECOND (12 MOS.), RUN PROTOYPE OPERATIONAL SYSTEM IN REAL-TIME; OBTAIN USER/STAKEHOLDER BUY-IN
- THROUGHOUT, DEVELOP CONCEPT OF OPERATIONS (CONOPS) TO FOSTER TRANSITION FROM R&D TO OPERATIONS

STATUS OF TASKS

TASK	COST	SKED	DELIVERABLES
1. PMP & “KICK-OFF” MTG	$30K	AUG 10	RPT
2. ASSESS TECH STATUS	$10K	AUG 10	RPT
3. PLAN TECH TRSFR	$10K	AUG 10	RPT
4. ROUTINE RPTS	$100K	OCT 10	RPTS
5. IDENTIFY USER NEEDS	$50K	NOV 10	RPT
6. SELECT MODEL (S)	$746K	SEP 11	RPT & MSS
7. DEMO OPNL FCSTS	$300K	END PHASE II	DEMO, RPT, & MSS
8. FINALIZE MODELING SYS & TECH TRSFR	$314	END PHASE II	RPT
	TOTAL		
	$1,560K		

EXPERIMENTAL PLAN; I.E., ESTABLISH MODEL TESTBED

- FOCAL PHENOMENA:
  - LOOP CURRENT,EDDY-SHEDDING,FRONTAL EDDIES
  - TROPICAL CYCLONE RESPONSE
  - PARTICLE TRAJECTORIES (SPILL DISPERSION)
- FOCAL PERIOD: 2009 & 2010

  (USE BOEM (x-MMS) & OTHER DATA ARRAYS)
- SKILL ASSESSMENT METRICS
  - BASIC DYNAMICS (e.g., EDDY-SHEDDING)
  - RIG IMPACT RISK (LCE CPA)
  - IMPACT OF DOWNSCALING ON SHELF MODELS

R&D PARTICIPANTS (SUB-CONTRACTORS & CONTRACTOR)

- DONG-SHAN KO, NAVAL RES. LAB (NCOM)
- LEO OEY, PRINCETON U. (POM)
- RUOYING HE, NCSU (ROMS)
- YI CHAO, JPL & UCLA (ROMS & 3DVAR)
- MATT HOWARD, STEVE DiMARCO, & ANN JOCHENS, TAMU (DATA MGMT & ANALYSIS)
- CHRIS MOOERS & ED ZARON, PSU

FEDERAL OPERATIONAL PARTNERS

- FRANK BUB, NAVAL OCEAN. OFFICE (NCOM)

  {PLUS JOHN HARDING, NORTHERN GULF INSTITUTE/MSU & JERRY WIGGERT,USM}
- HENDRIK TOLMAN & AVICHAL MEHRA, NOAA/NWS/NCEP (HYCOM)
- RICH PATCHEN, NOAA/NOS/CSDL (POM)

PROJECT INTEGRATING ACTIVITIES

- CONSTRUCTION OF GOMEX-PPP WEBSITE
- PARTICIPATION IN MULTI-MODEL GOMEX OCEAN PREDICTION EXPERIMENTS
- COLLECTIVE SKILL ASSESSMENT OF MODEL PERFORMANCE IN THE EXPERIMENTS
- CONTRIBUTIONS TO MULTI-AUTHORED PEER-REVIEWED MSS
- PARTICIPATION IN OUTREACH, ETC. WORKSHOPS

MATT HOWARD, STEVE DIMARCO,
&
ANN JOCHENS, TAMU

DATA MANAGEMENT, MODEL SKILL ASSESSMENT, & GCOOS LIAISON

TAMU Provides Modeling Resources

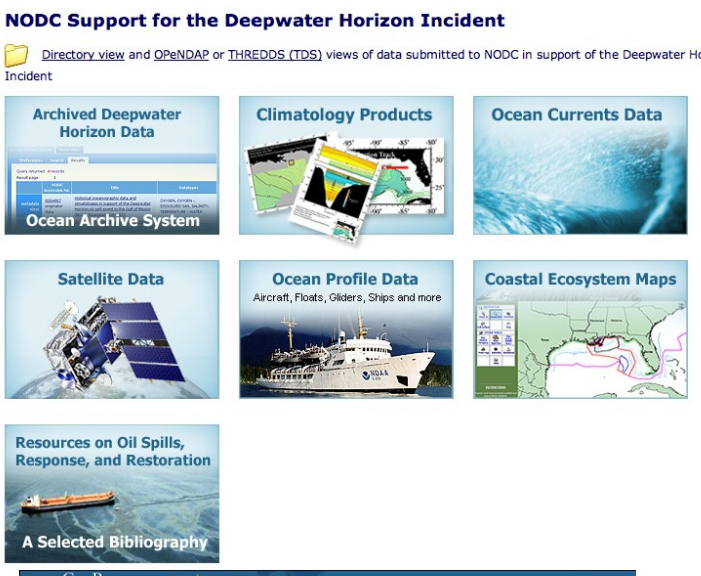
Mean Temp & Salinity Profile (GDEM V3)

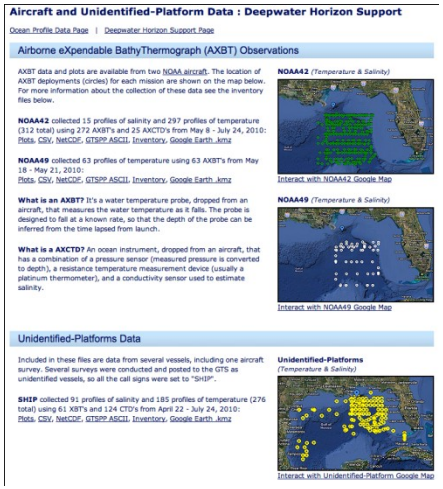
Temp & Salinity Profile (WOA 05)

Temp & Salinity Profile (with SSHA)

Naval Research Laboratory's Generalized Digital Environment Model (GDEM V3.0)
National Ocean Data Center's World Ocean Atlas Data Base (2005) Climatologies
Dynalysis of Princeton's Synthesized Temperature and Salinity Profiles from SSHA

Deepwater Horizon Data





ERMA Datasets Included in the Public ERMA Website

http://ww.geoplatform.gov/gulfresponse

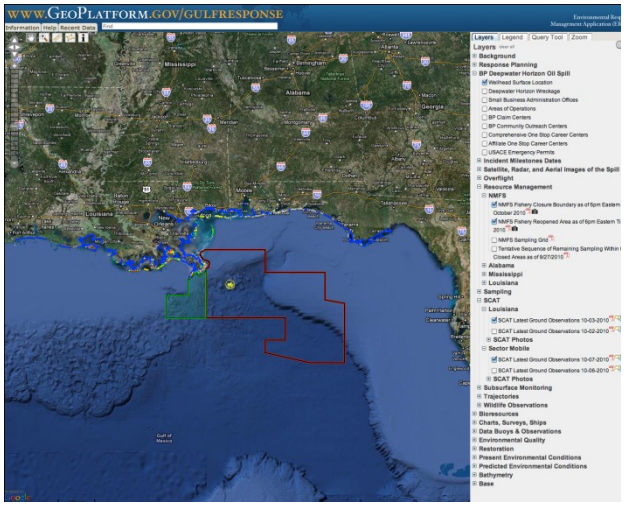
September 9th, 2010

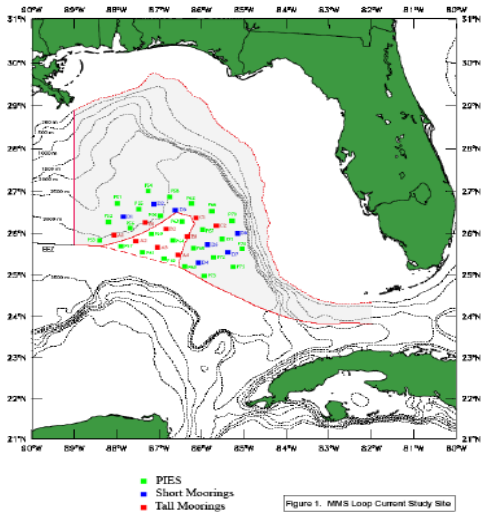
Deepwater Horizon Data Sets

NOAA is currently serving over 800 data layers to the public ERMA site. Data sources include those generated through the Incident Command Structure, and several federal, state and local agencies. Below is a summarized list of data layers and frequency of updating. Currently, the public site is updated once daily.

Updated daily when available

- Shoreline Cleanup and Assessment Team (SCAT) results
- Satellite interpretations for potential oil foot print
- Field photos
- Various spill related sampling data – seafood safety, EPA monitoring, Subsurface Monitoring analytical chemistry
- Subsurface Monitoring Data
  - Subsurface Sample Stations
  - Cumulative Sample Stations for Science Cruises
  - Cumulative Location by Vessel
  - Provisional Response Data
  - Conductivity, Temperature and Depth Sampling
  - Oil Presence/Absence Monitoring
  - Sub Surface Monitoring Report
  - Daily Dissolved Oxygen
- Wildlife Observations
- Fisheries closures for federal and state waters
- Research Cruise sample locations
- Research, government and response ships tracking
- Satellite - (NASA/ MODIS)
- Shoreline Over flight imagery- (NOAA, EPA, NASA)
- Navigational caution areas for mariners
- Data Buoys- tides, water level, currents, ACDP data
- Present environmental conditions – wind, wave, NEXRAD radar, HF radar, NWS warnings
- Predicted Environmental Conditions- wind, wave, precipitation, Tropical weather forecasts





GOMEX-PPP.ORG

GOMEX-PPP

Gulf of Mexico 3-D Operational Ocean Forecast System Pilot Project

Gulf of Mexico Pilot Prediction Project

Posted on September 6, 2010 by admin

GOMEX-PPP is a 2.5 year, $1.56 M project to evaluate and demonstrate a computer modeling system for the operational prediction of the circulation of the Gulf of Mexico. The modeling system will be comprised of either a single superior computer model or a multi-model ensemble.

Project Partners

The participants in the project are modelers from Princeton University, North Carolina State University, Jet Propulsion Laboratory/University of California- Los Angeles, Naval Research Laboratory, Naval Oceanographic Office, National Ocean Service, and National Weather Service, plus data analysts from Texas A & M University and Portland State University.

Project Sponsorship

The project is sponsored by the Department of Energy via the Research Partnership to Secure Energy for America (RPSEA), a consortium of several dozen universities and energy companies, plus CASE-EJIP, a consortium of several offshore oil & gas companies. Chris Mooers of Department of Civil & Environmental Engineering Portland State University is the Principal Investigator.

The project commenced in March 2010. The first phase ends in September 2011.

Press Releases

Three press releases were prepared for three target audiences.
GOMEX-PPP press release for general interest media (12 JUN 10)
GOMEX-PPP PR for ocean science peer newsletters, etc. (16 JUN 10)
GOMEX-PPP PR for offshore oil & gas industry, etc. (16 JUN 10)

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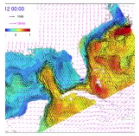
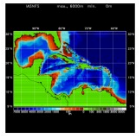
Protected: KickOff Meeting Presentations

The GOMEX-PPP Kickoff meeting was held 12-14 May 2010 at the Crowne Plaza Houston North – Greenspoint.

GOMEX-PPP Kick-off Meeting Agenda (5 MAY 10)

Presentations

Achival Mehra
Bob Leben
Chris Mooers
Cort Cooper
Dong-Shan Ko
Frank Bub
Leo Oye
Matthew Howard
Peter Brickley
Ruoying He
Yi Chao

Name	Ruoying He	Leo Oey	Dong S. Ko
Institution	NC State University	Princeton University	NRL
Model engine	ROMS	POM	NCOM
Specific name	SABGOM	PROFS	IASNFS
Website	SABGOM	PROFS	IASNFS
Operational status	quasi-operational	quasi-operational	quasi-operational
Geographic domain	South Atlantic Bight and Gulf of Mexico	Western Atlantic/GOM/Caribbean	Western Atlantic/GOM/Caribbean
Horizontal grid Type/Resolution	curvilinear structured/5-km	Nested curvillinear/~10km&5km	Lat-Lon square grid/~6km
Vertical Grid Type/Resolution	terrain following/36 layers	sigma/26 levels	sigma-Z/41 levels
Surface condition	free-surface	free-surface	free-surface
External/Internal mode	10 sec/300 sec	15 sec/600 sec	na/300sec
Numerical integration scheme	third order predictor (Leap-Frog) and corrector (Adams-Molton) time-stepping	Leap-frog w/4th order pressure gradient scheme	Implicit free_surface/Like POM
Equations assumptions approximations	hydrostatic/Boussinesq/constancy/conserving	primative eq/hydrostatic/Boussinesq	Same as POM
Graphics domain/grids			

Project Participants

Management
Chris Mooers (PSU), Cort Cooper (Chevron), Dave Driver

Subcontractors
Yi Chao (UCLA/JPL), Ruoying He (NCSU), D.S. Ko, (NRL
Howard (TAMU), Steve DiMarco (TAMU), Ann Jochens (

Other Modelers
Rich Patchen (NOS), Hendrik Tolman (NWS), Ed Zaron (
Sergei Frolov (WX), Frank Bub (NAVO).

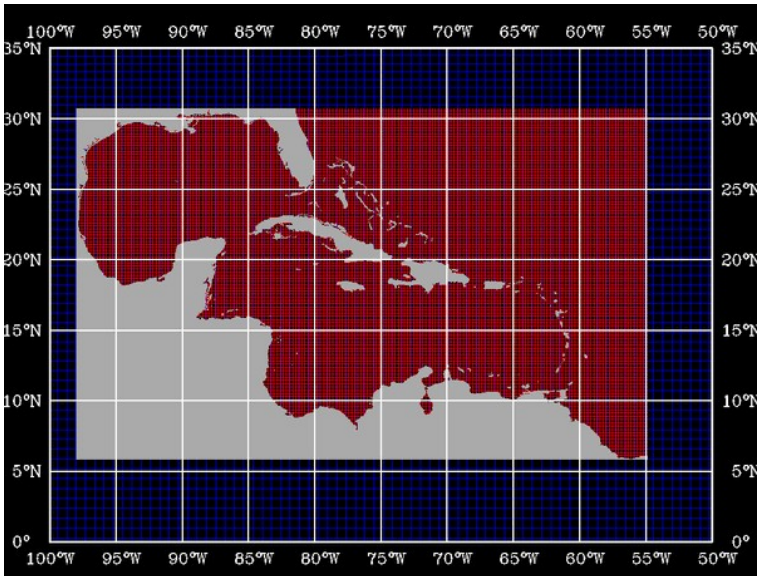
Science Advisory Committee
John Allen (OSU), Bill Schmitz (Harte Inst.), Bob Leben (U.Colorado), A. Lugo-Fernandez (MMS), Steve Payne (CNMOC), Gregg Jacobs (NRL), Buzz Martin (TGLO), Steve Anderson (Arete Associates), Peter Brinckley (Horizon Marine), Michael Vogel (Shell), Dave Peters (Conoco), Bob Weisberg (USF), John Harding (NGI), Frank Aikman (NOS)

DONG-SHAN KO, NRL

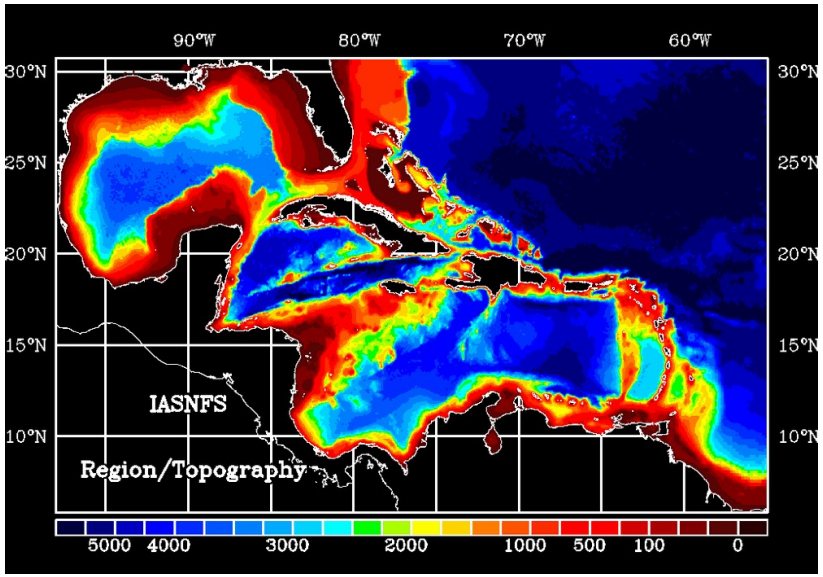
IAS/NFS NCOM

IASNFS Model Grid and Topography

Model Grid



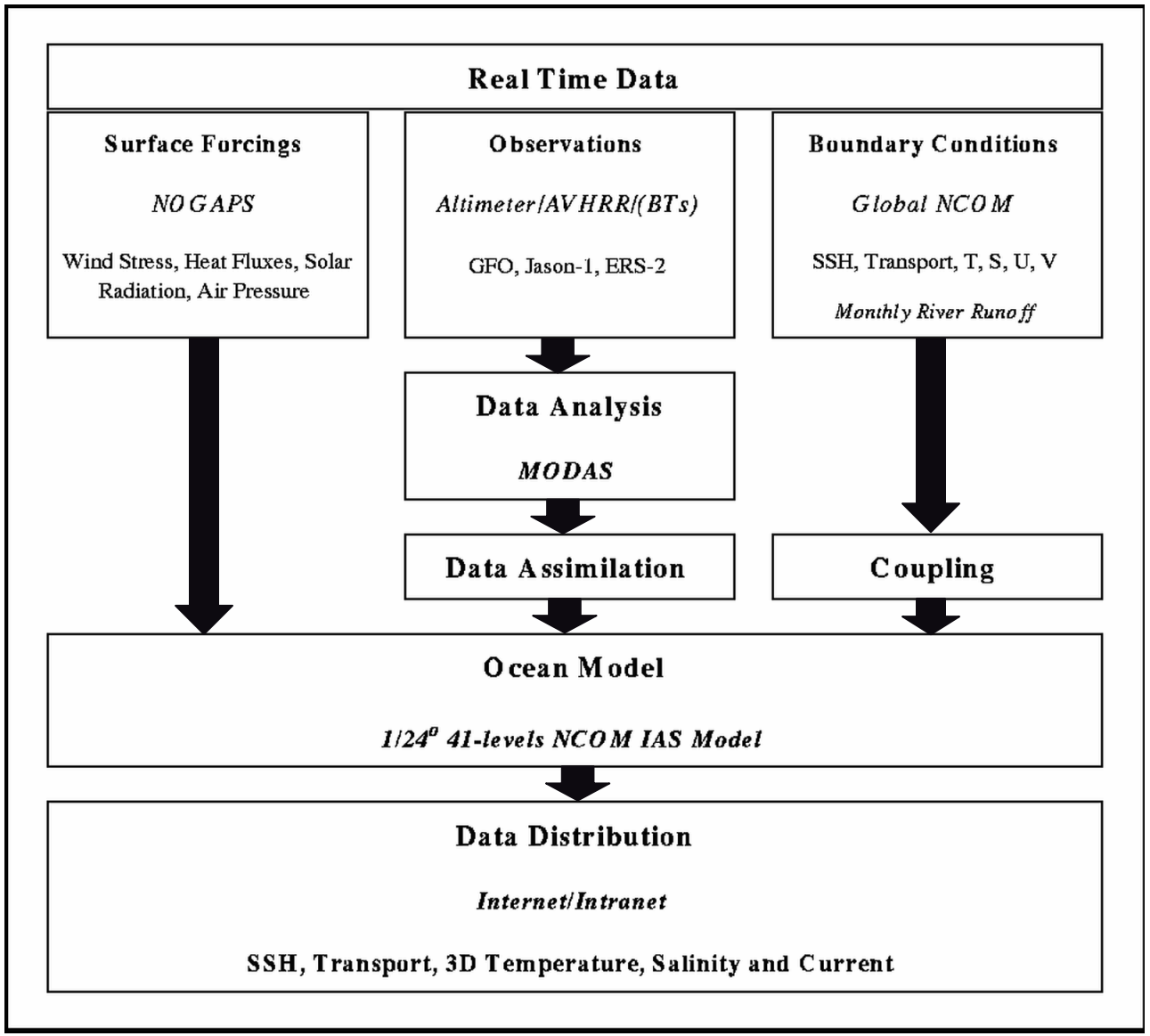
Model Topography
from NRL DBDB2



- Longitude : 98 W – 55 W; Latitude : 5 N – 31 N
- Horizontal Resolution : 1/24 Degree (~ 6 km)
- Vertical Resolution : 40 Layers (19 Layers on the shelf)
- Forced with NOGAPS Wind, Air Pressure and Heat Fluxes (Solar Radiation)
- Coupled to NRL Global NCOM
- Assimilation of Satellite Altimetry and MODIS SST/SSS
- 140 River Discharges

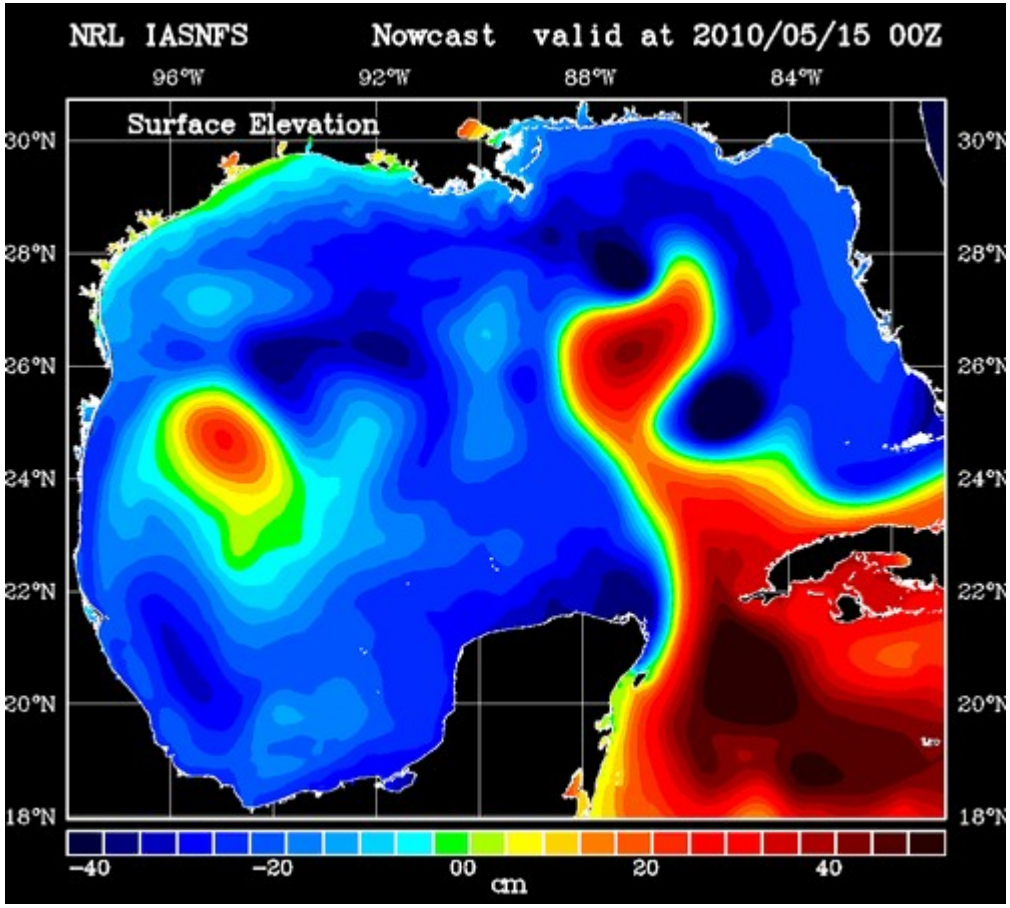
Ko, D.S., R.H. Preller, and P.J. Martin, An Experimental Real-Time Intra Americas Sea Ocean Nowcast/Forecast System for Coastal Prediction, Proceedings, AMS 5th Conference on Coastal Atmospheric & Oceanic Prediction & Processes, 97-100, 2003.

NRL Nowcast/Forecast System (IASNFS)



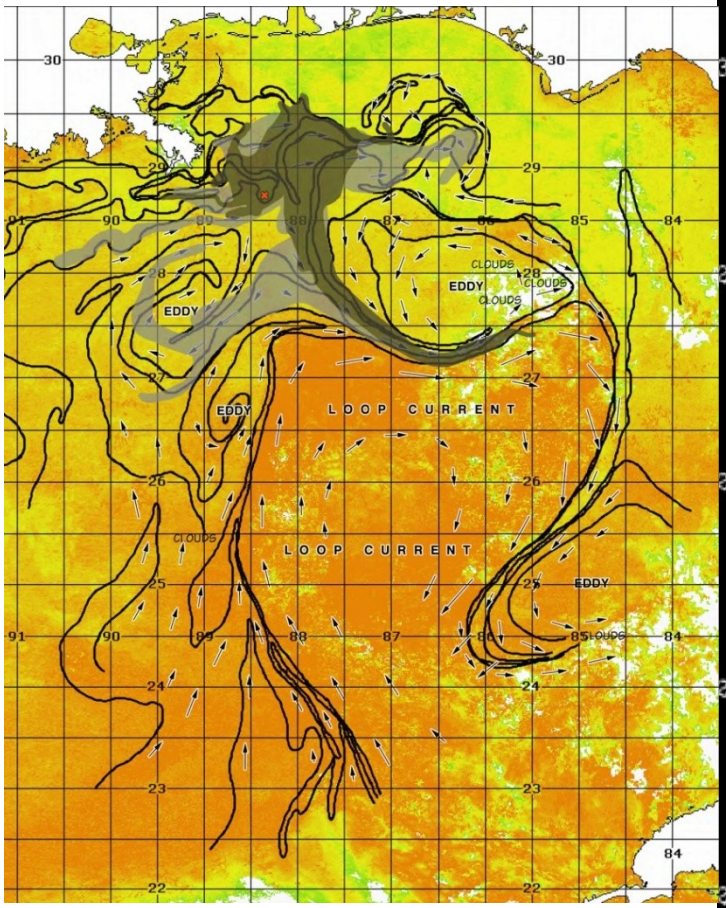
IASNFS Real-Time Prediction

Sea Surface Elevation

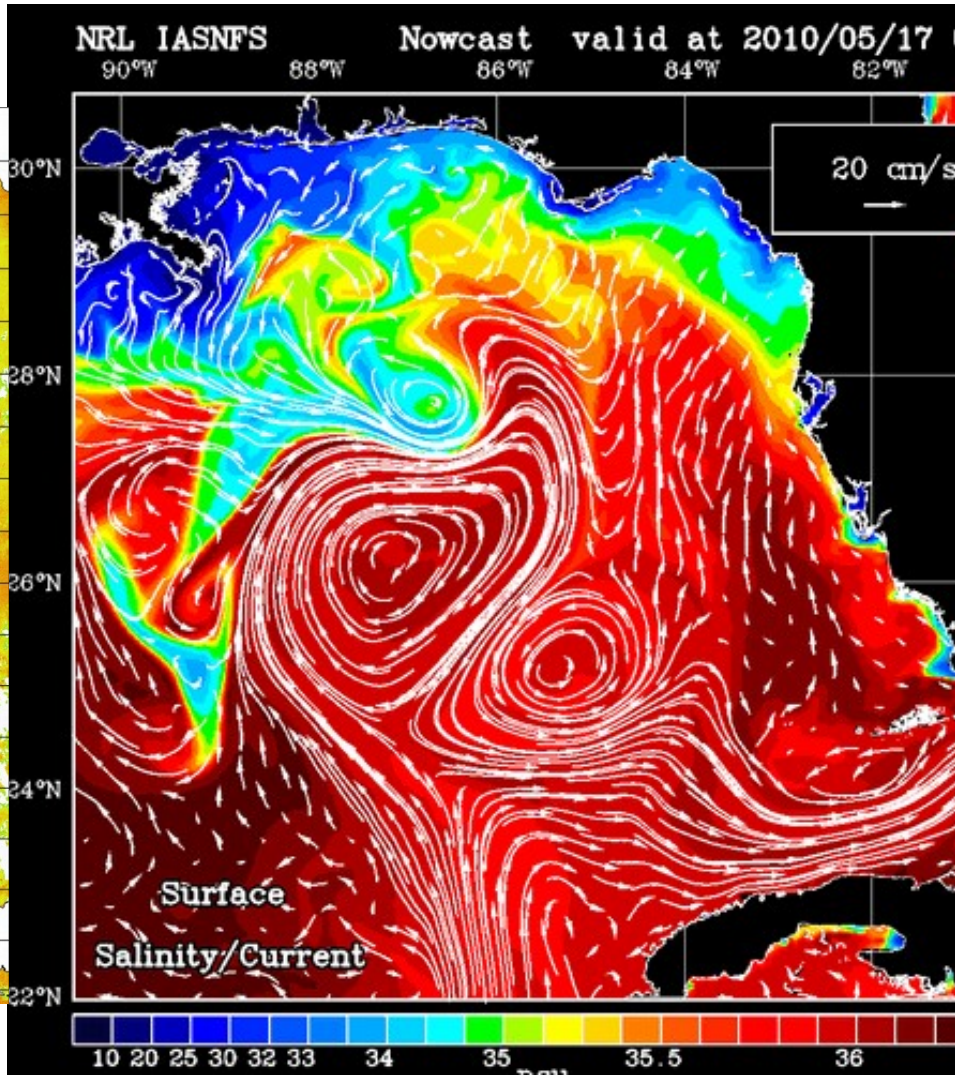


IASNFS Real-Time Prediction

Loop Current/Eddy frontal location based on satellite thermo image

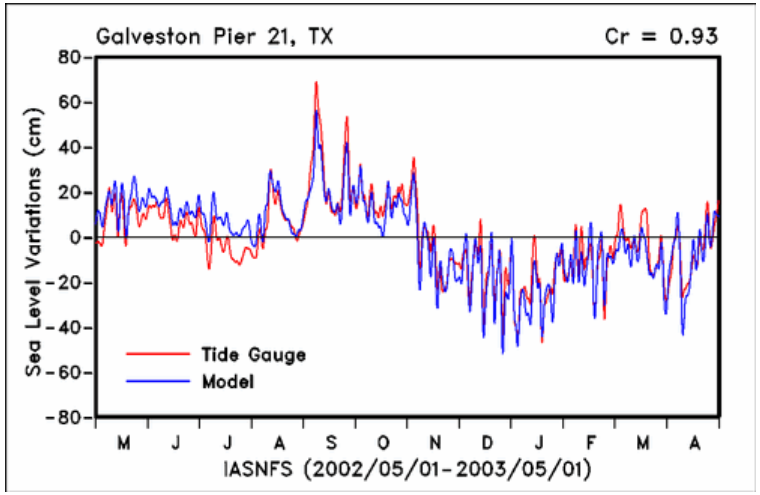


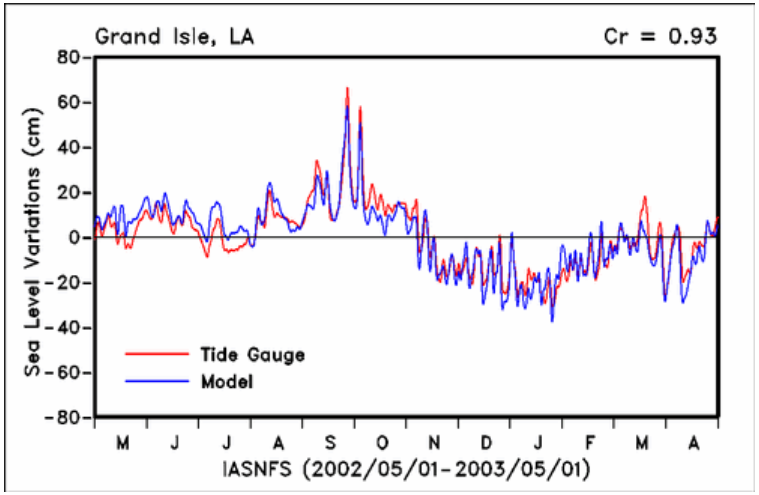
Sea Surface Salinity/Current

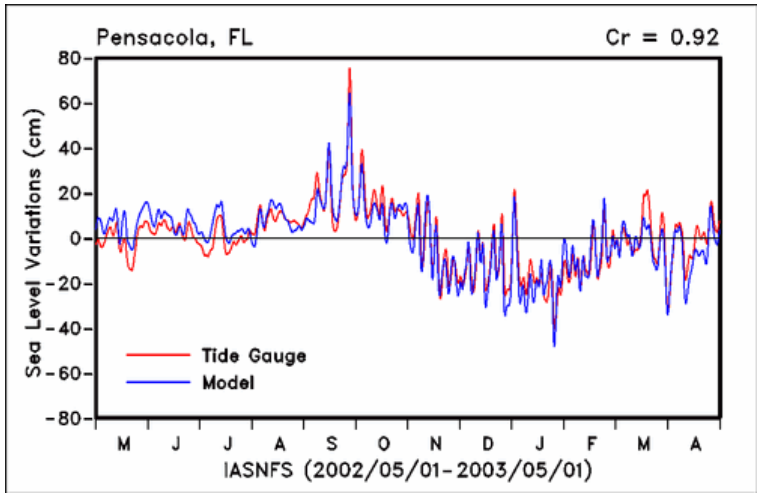


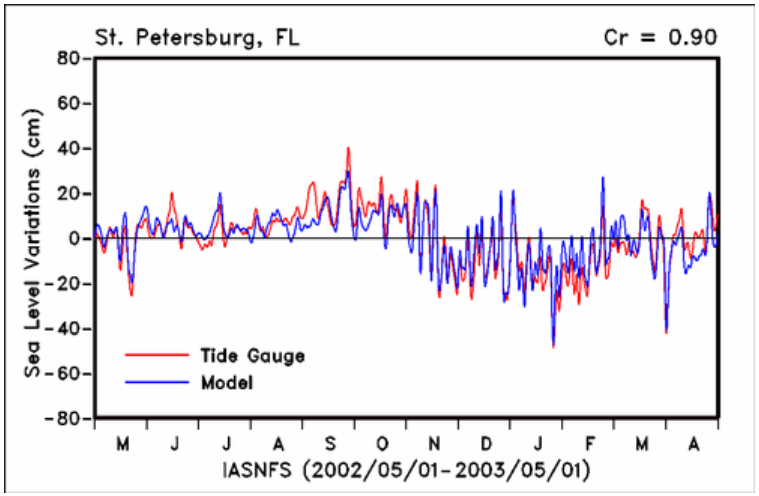
Coastal Sea Level Variation

vs. NOS Tide Gauge



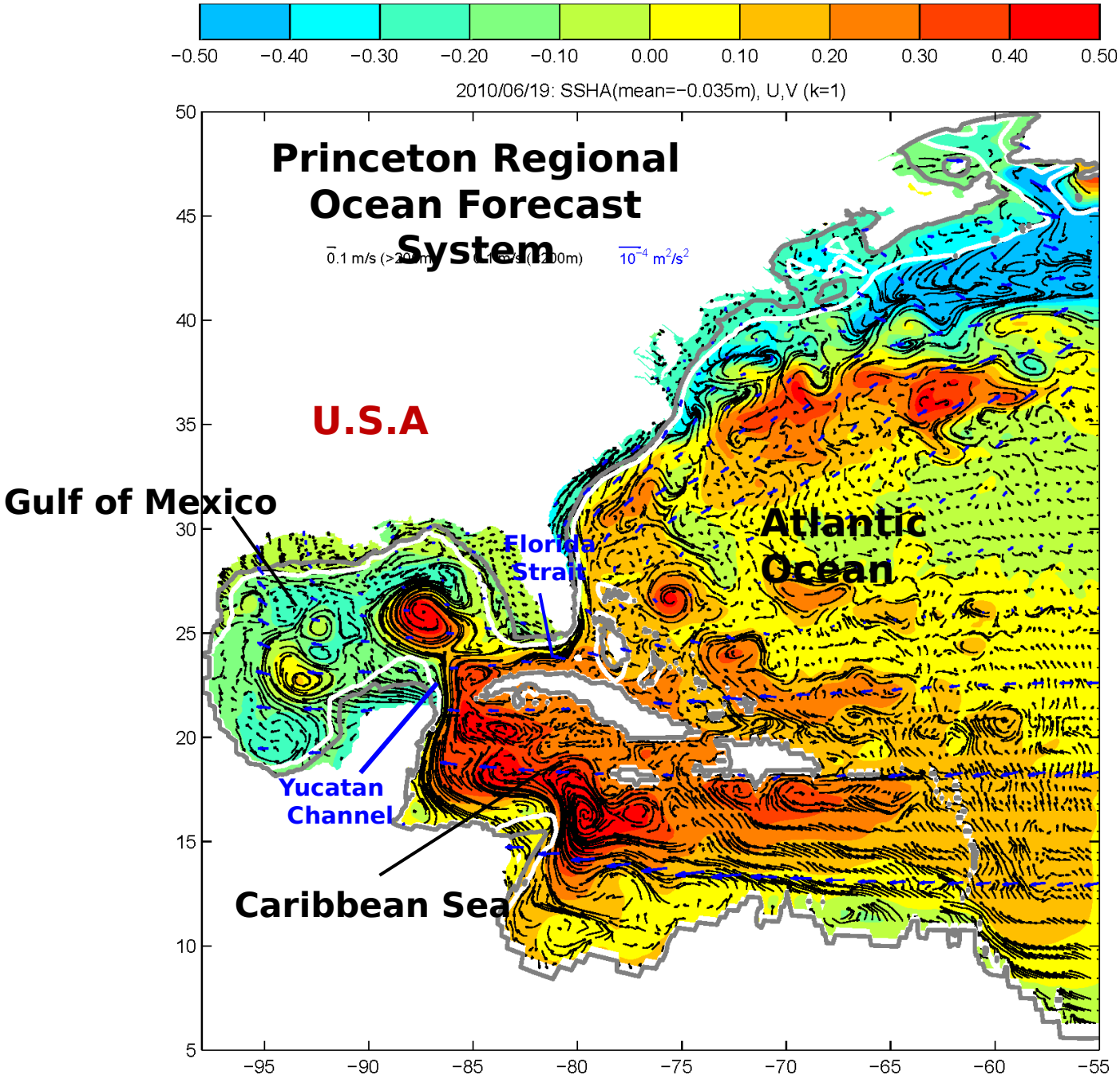


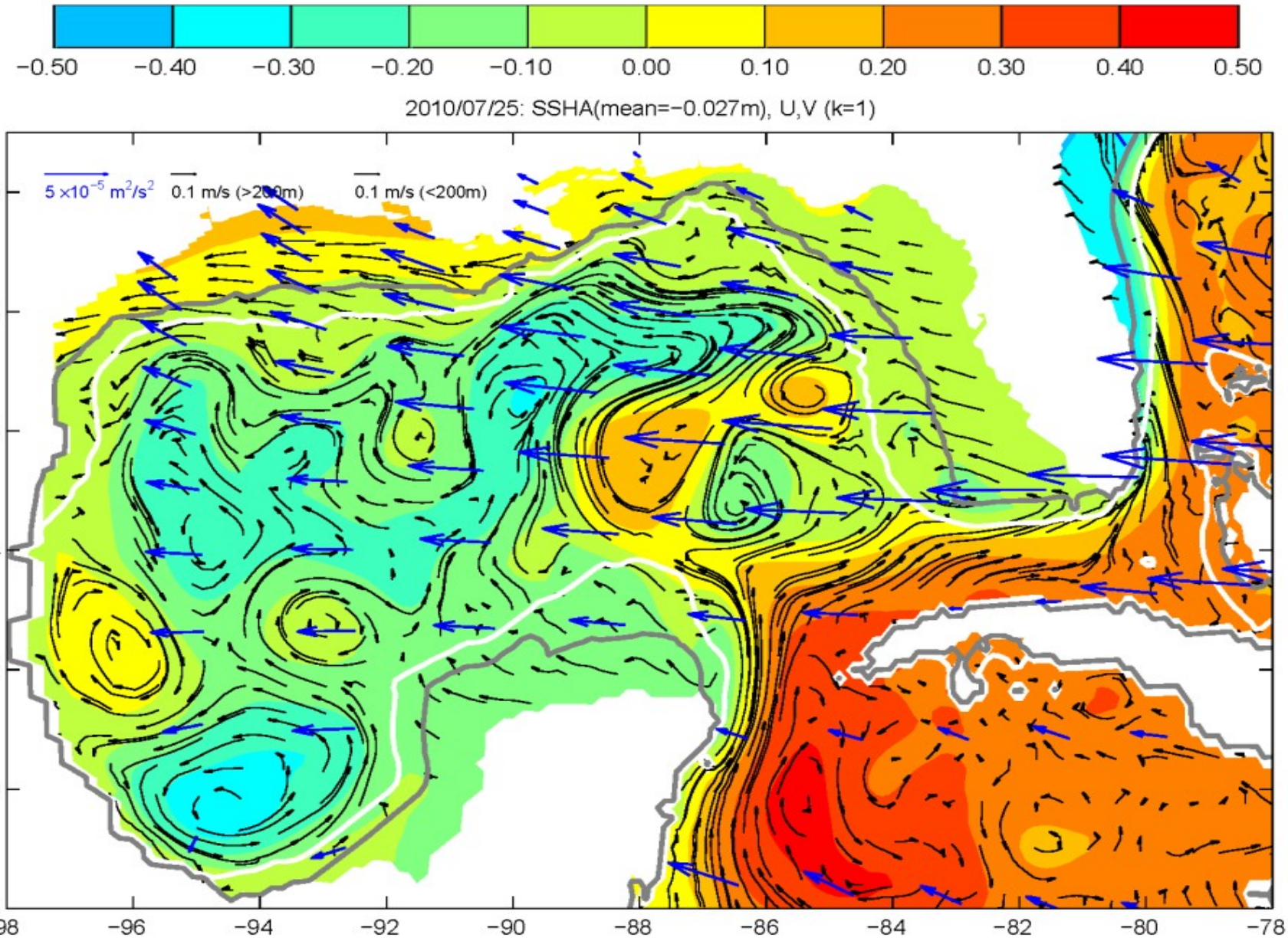


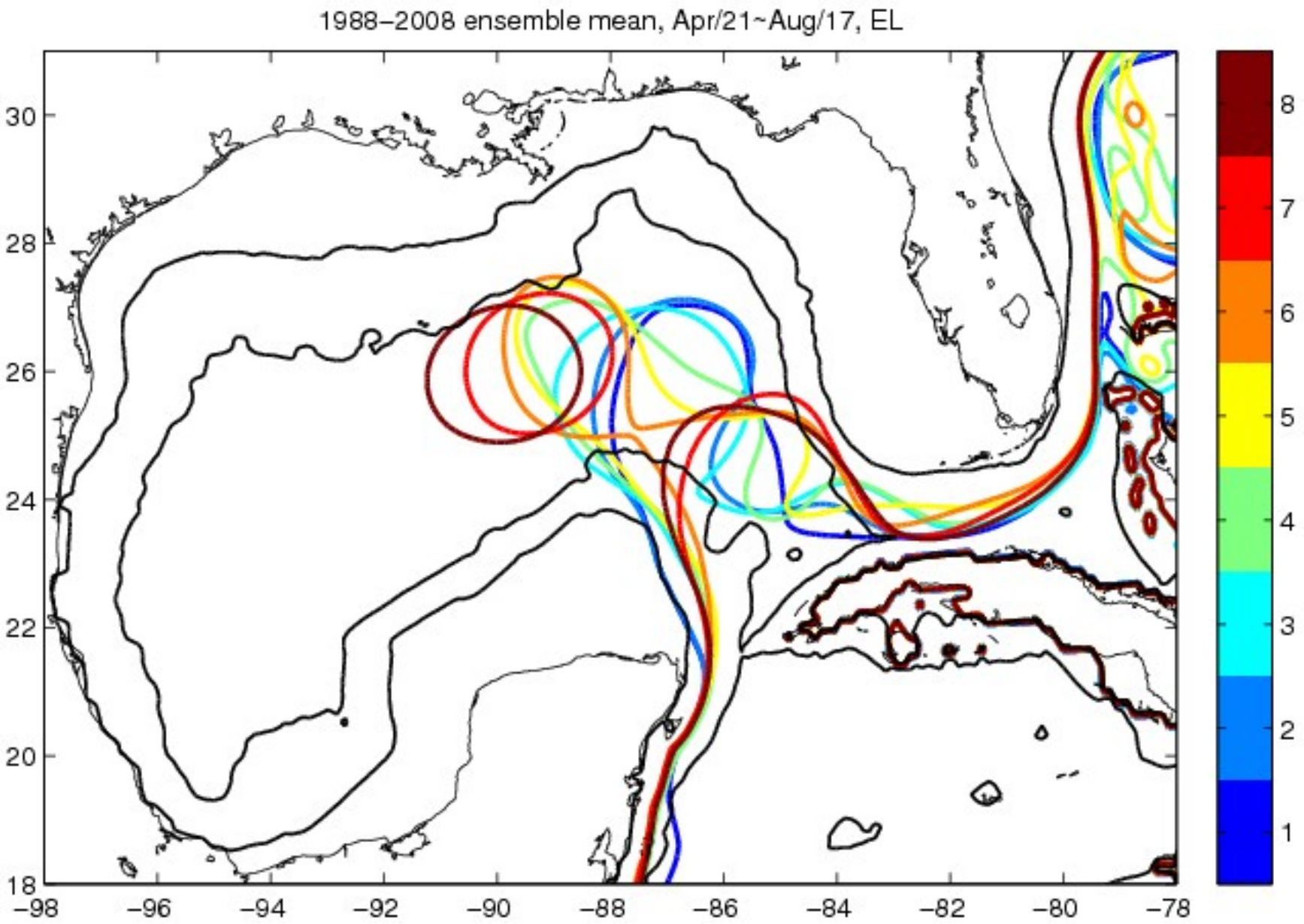


LEO OEY, PRINCETON UNIVERSITY

POM


−0.50 −0.40 −0.30 −0.20 −0.10 0.00 0.10 0.20 0.30 0.40 0.50
2010/06/19: SSHA(mean=−0.035m), U,V (k=1)
Princeton Regional Ocean Forecast System
0.1 m/s (>20m)
0.1 m/s (1200m)
10^{-4} m^2/s^2
U.S.A
Gulf of Mexico
Florida Strait
Atlantic Ocean
Yucatan Channel
Caribbean Sea
50
45
40
35
30
25
20
15
10
5
−95 −90 −85 −80 −75 −70 −65 −60 −55


−0.50 −0.40 −0.30 −0.20 −0.10 0.00 0.10 0.20 0.30 0.40 0.50
2010/07/25: SSHA(mean=−0.027m), U,V (k=1)
5 ×10−5 m2/s2
0.1 m/s (>200m)
0.1 m/s (<200m)
30
28
26
24
22
20
18
−98 −96 −94 −92 −90 −88 −86 −84 −82 −80 −78


1988–2008 ensemble mean, Apr/21~Aug/17, EL
30
28
26
24
22
20
18
−98
−96
−94
−92
−90
−88
−86
−84
−82
−80
−78
8
7
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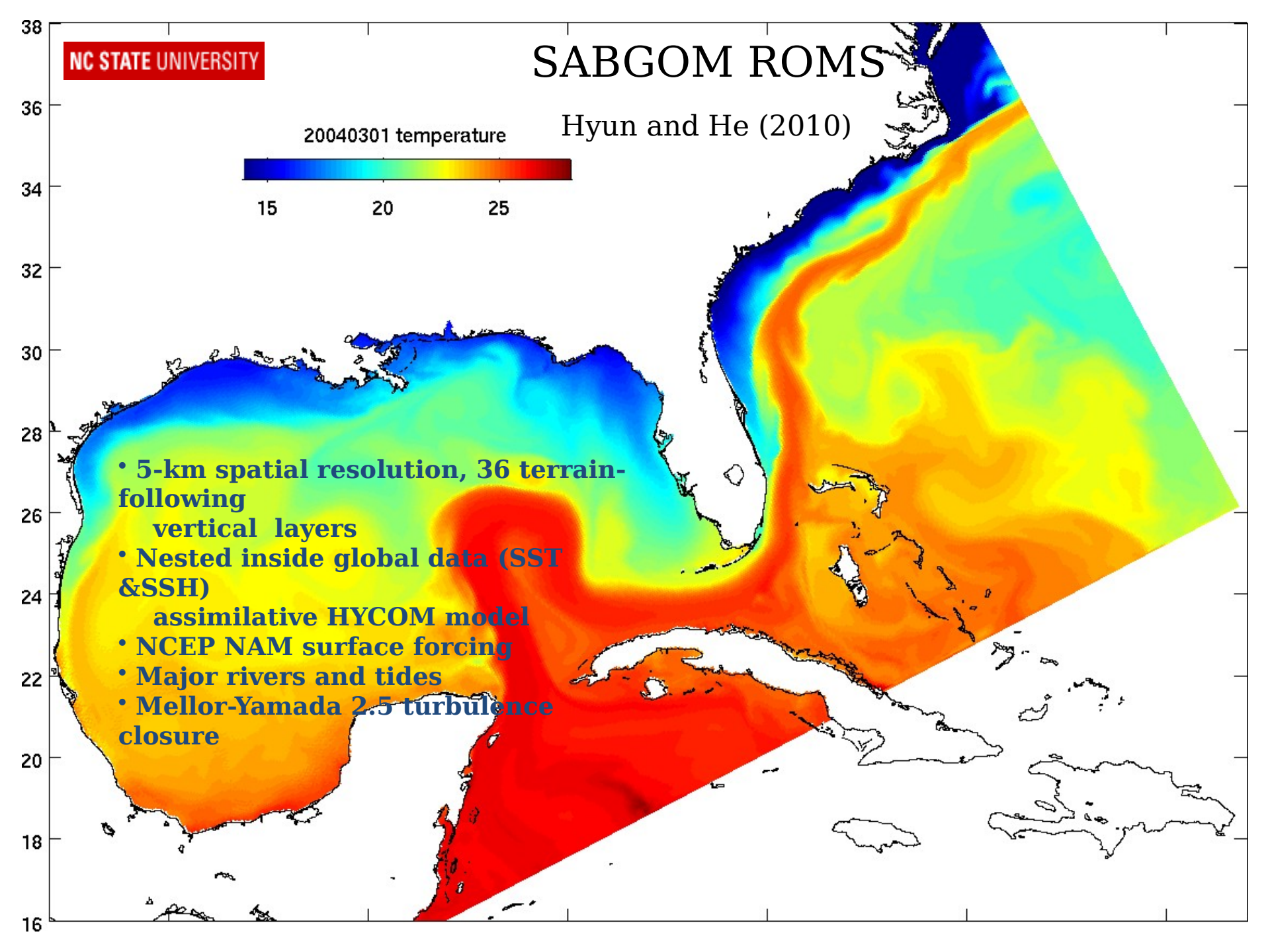
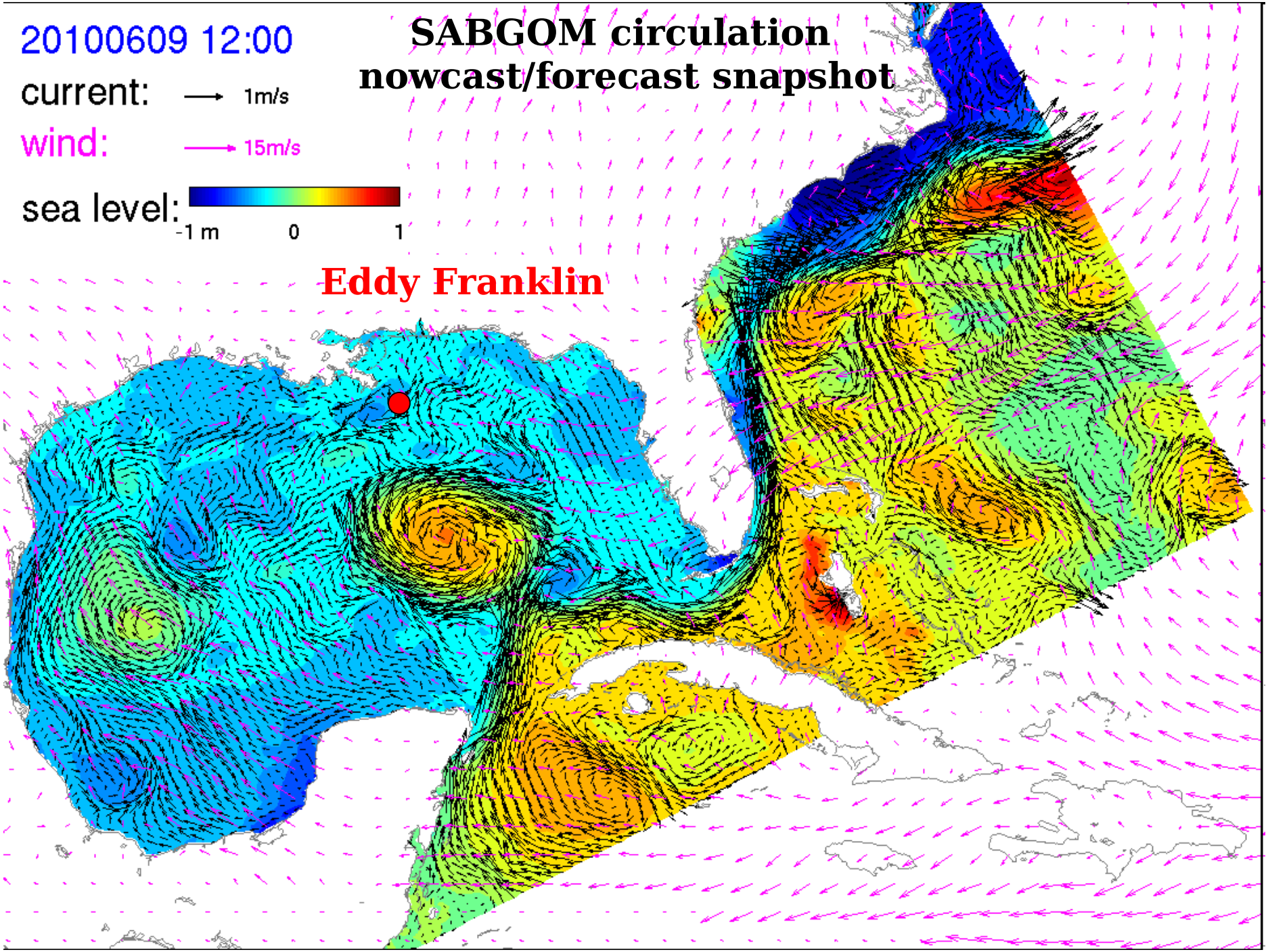
RUOYING HE, NCSU
&
YI CHAO, JPL & UCLA

ROMS, DATA ASSIMILATION, & ENSEMBLE MODELING


NC STATE UNIVERSITY
SABGOM ROMS
Hyun and He (2010)
20040301 temperature
15
20
25
38
36
34
32
30
28
26
24
22
20
18
16
• 5-km spatial resolution, 36 terrain-following
vertical layers
• Nested inside global data (SST &SSH)
assimilative HYCOM model
• NCEP NAM surface forcing
• Major rivers and tides
• Mellor-Yamada 2.5 turbulence closure

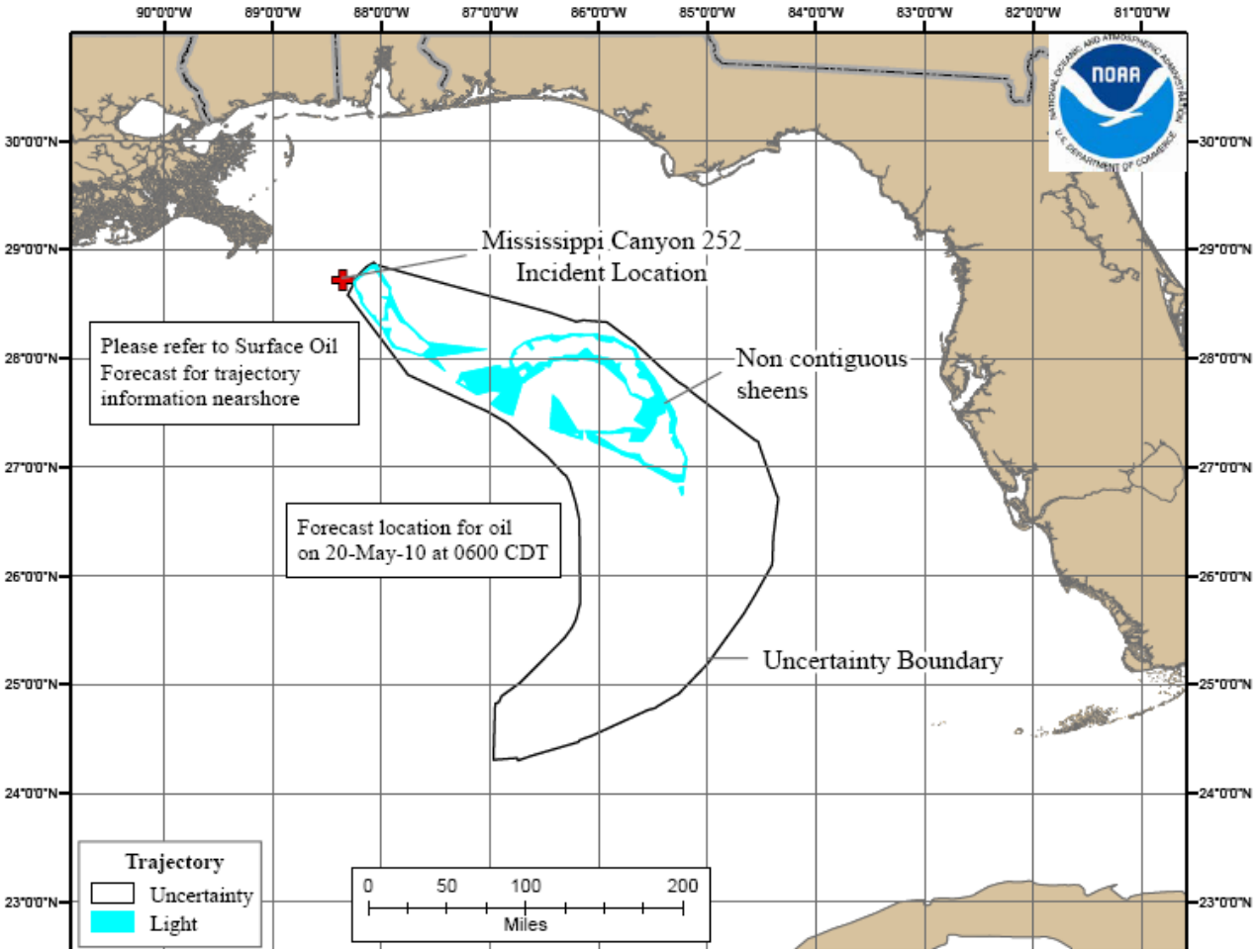

20100609 12:00
SABGOM circulation
nowcast/forecast snapshot
current: 1m/s
wind: 15m/s
sea level:
-1 m
0
1
Eddy Franklin

SABGOM circulation nowcast/forecast has been used by NOAA OR&R in their official oil plume trajectory prediction

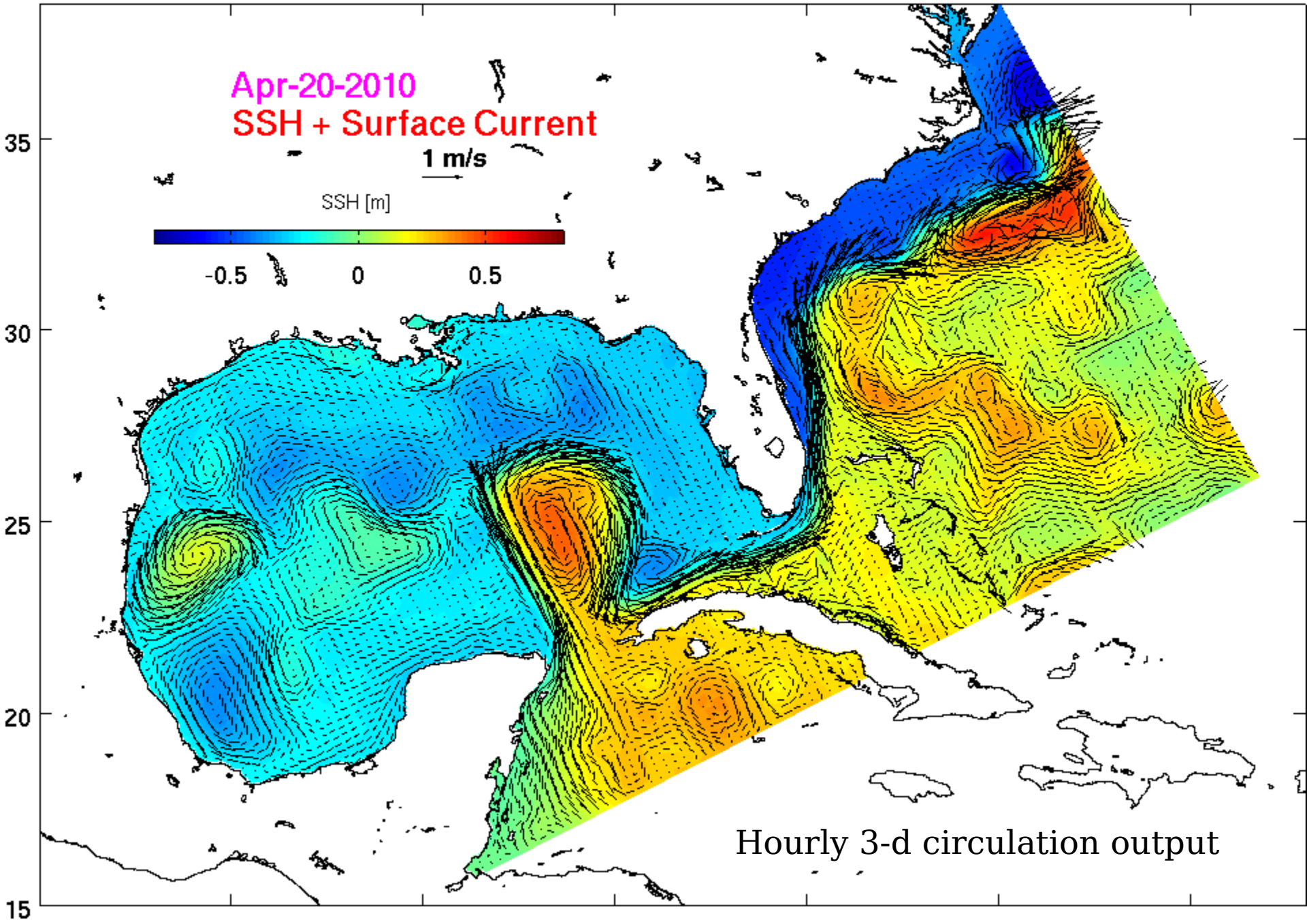
Offshore Surface Oil Forecast Mississippi Canyon 252

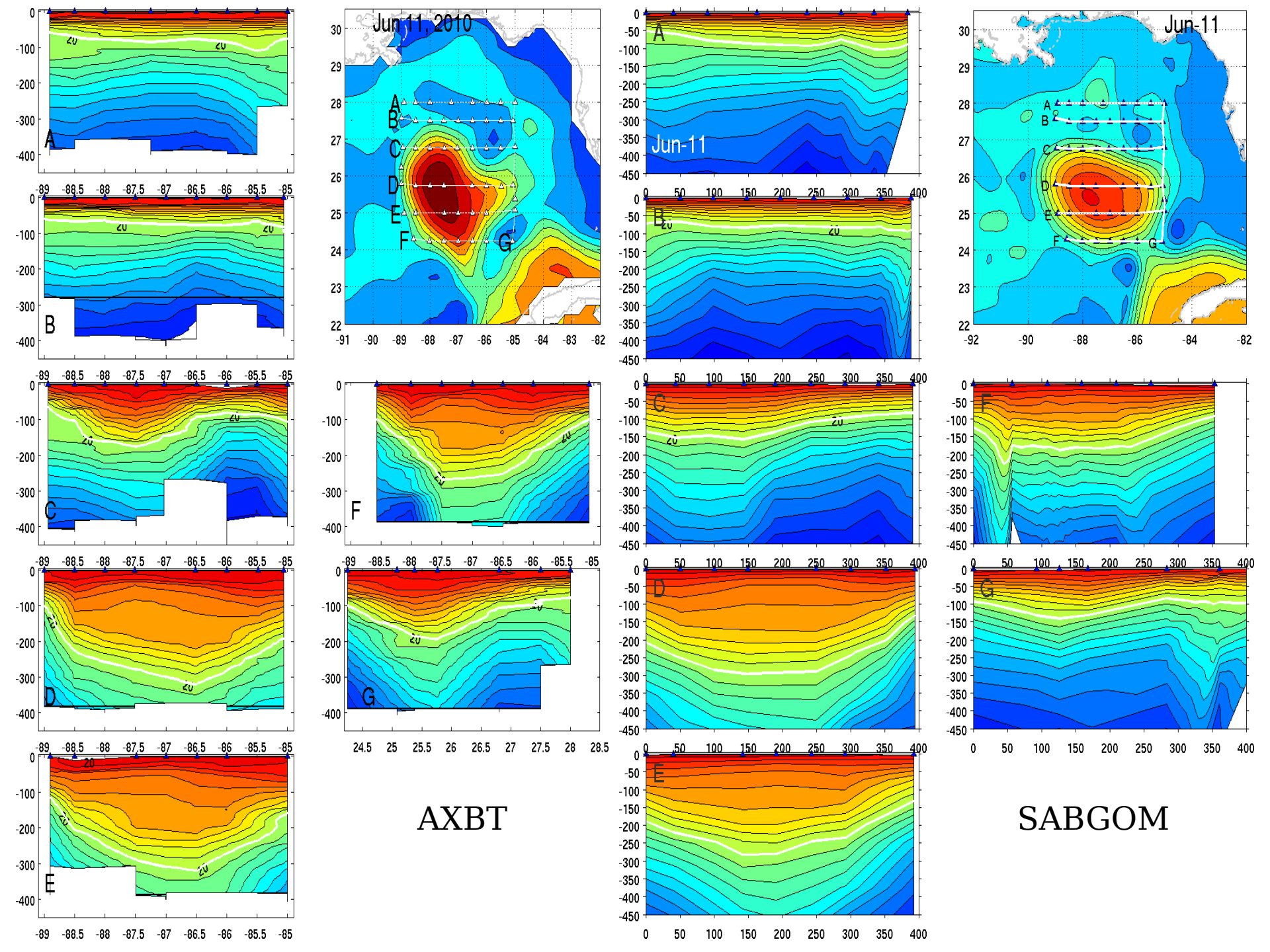
NOAA/NOS/OR&R
Estimate for: 0600 CDT, Thursday, 5/20/10
Date Prepared: 2100 CDT, Tuesday, 5/18/10

This map shows the predicted location of oil that has entered the loop current. Currents were obtained from four models: NOAA Gulf of Mexico, West Florida Shelf/USF, NRL IASNFS and NC State SABGOM. Each include Loop Current dynamics. Gulf wide winds were obtained from the gridded NCEP product. The model was initialized from Tuesday AM satellite imagery analysis (NOAA/NESDIS).



SABGOM Hindcast Simulation (4/20 – 7/29)




Jun 11, 2010
Jun-11
A
B
C
D
E
F
G
AXBT
SABGOM

GOM ROMS Simulated Ocean Response to WRF Forcing Fields during Ka