

Use of in-situ and remote sensors, sampling, and systems for assessing extent, fate, impact, and mitigation of oil and dispersants

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and the In-Situ and Satellite Observation Panel:
Vernon Asper (USM), Mitchell Roffer (ROFFSTM), Dan Runick (SIO), Amy Merten (NOAA/ORR), Ray Kokaly (USGS), Matt Howard (TAMU)

Joint Subcommittee on Ocean Science and Technology
Deepwater Horizon Principal Investigator Meeting
St. Petersburg, Florida
October 5-6 2010

Goals

Provide an overview of some of the observations (in the water column and sediments) that were made to monitor and assess the extent of the oil and dispersants, and also used to investigate and assess their impact on ecosystems in the open ocean and coastal areas.

Provide an introduction for further discussions in the breakout group.



In Situ observations

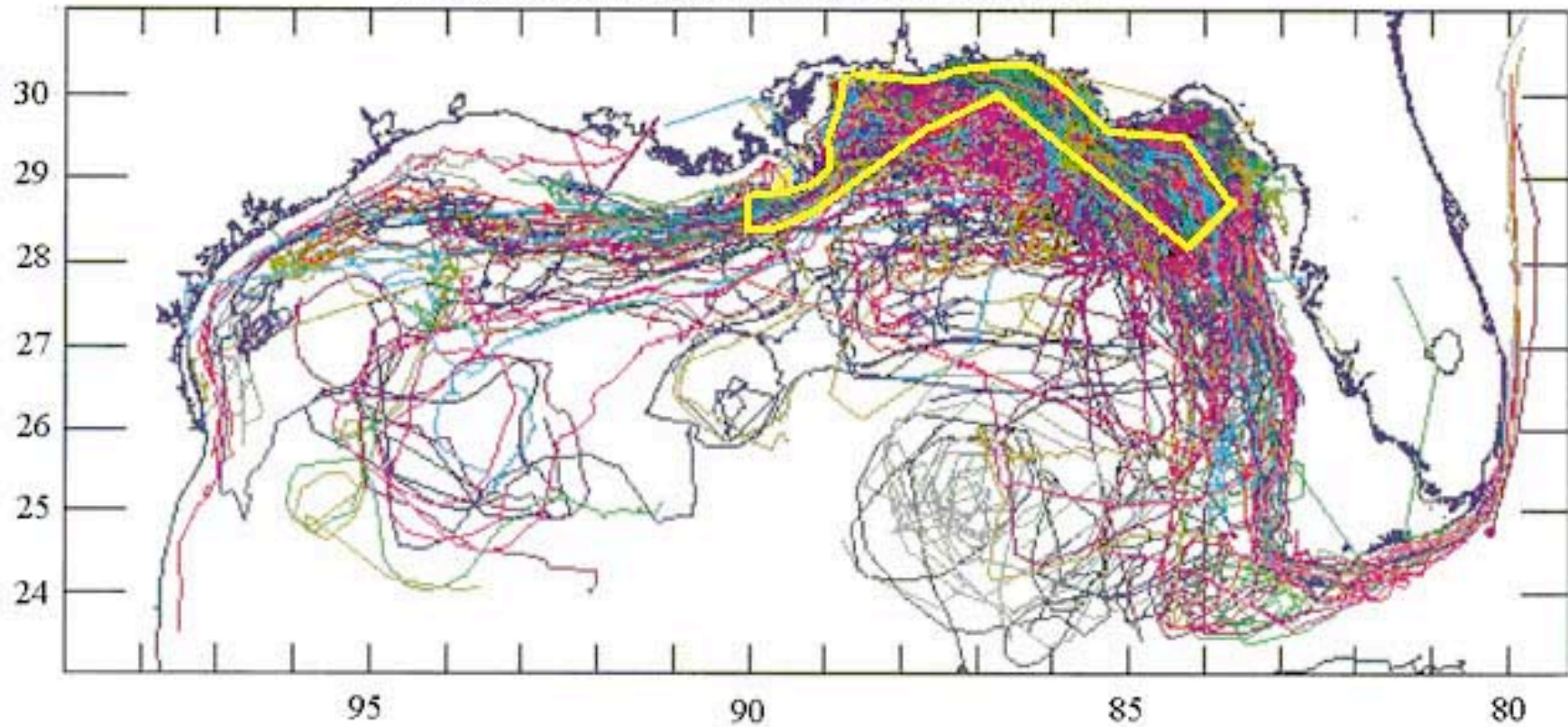
Platforms

sensors



Surface drifter observations

Paths of 194 drifting probes, Feb 1996 - Feb 1997

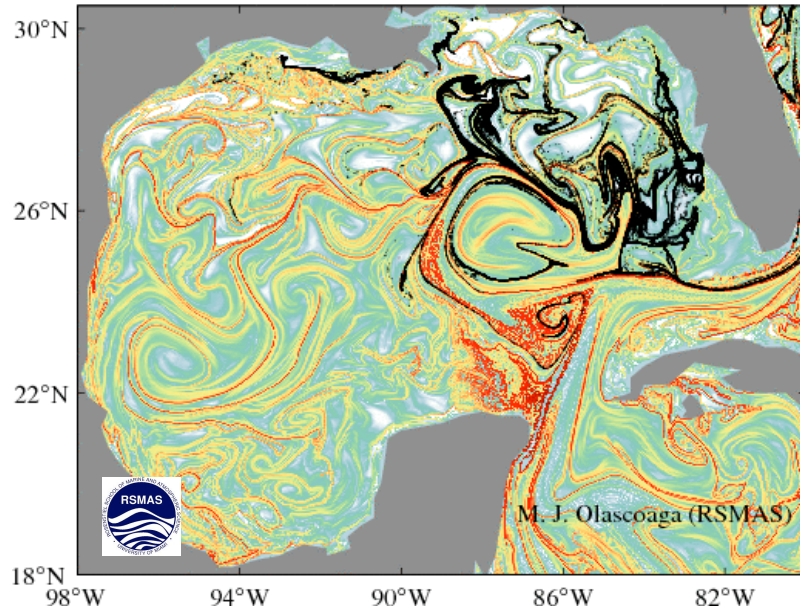


From Yang, H., R. Weisberg, P. Niiler, W. Sturges, and W. Johnson, 1999.



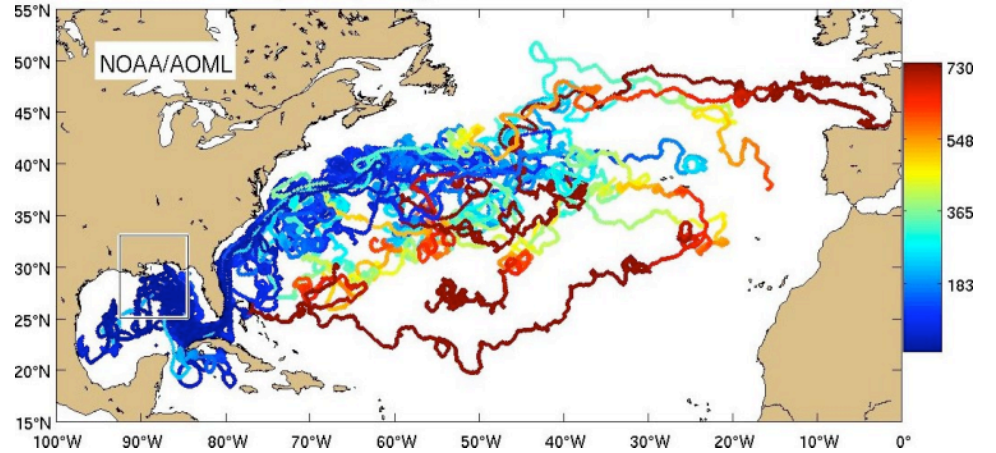
Model and Observations

01-Jul-2010



Map courtesy of M. J. Olascoaga
(University of Miami/RSMAS)

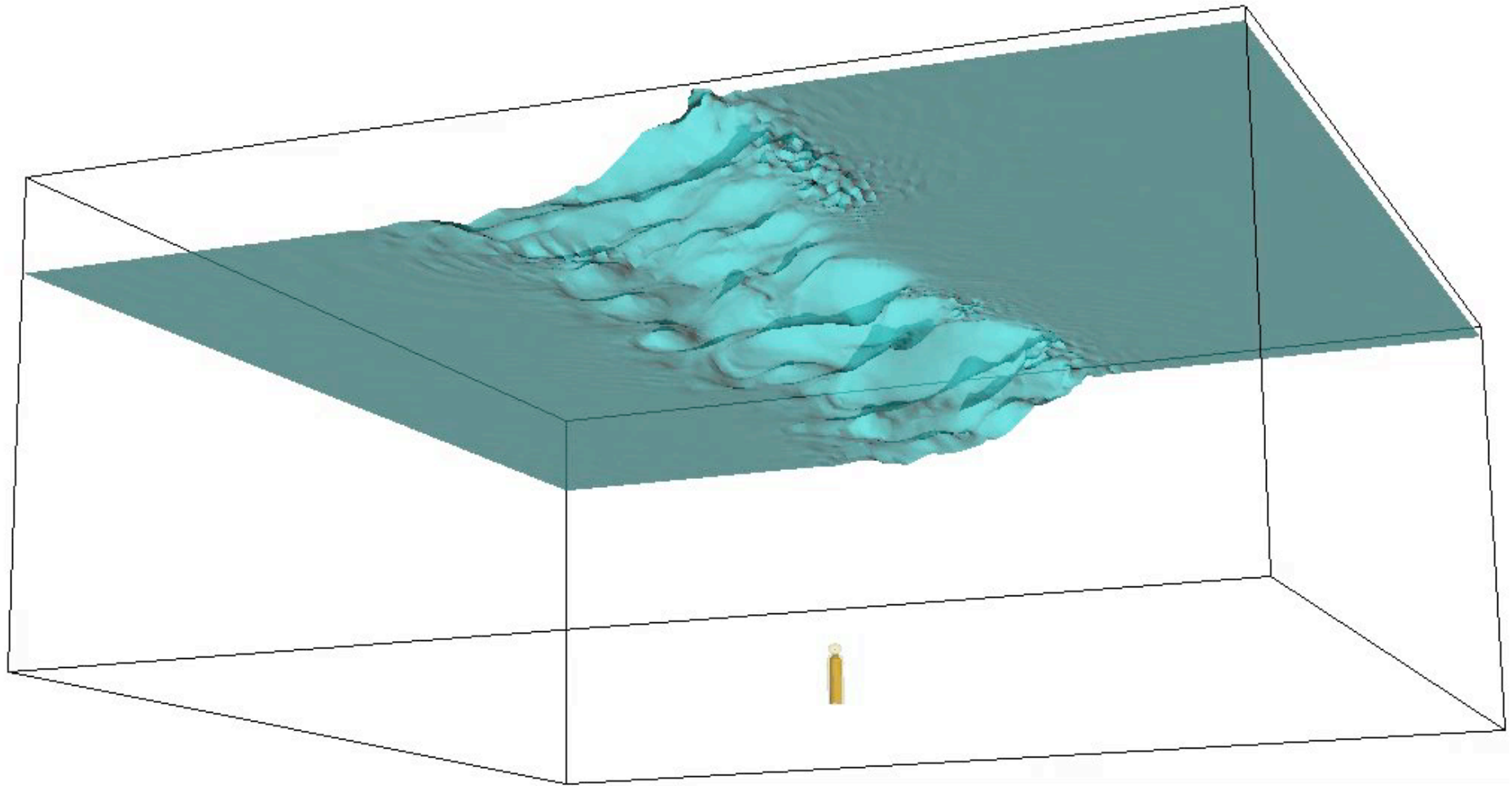
Days after passing closest to center of Gulf box



Map courtesy of R. Lumpkin
(NOAA/AOML)



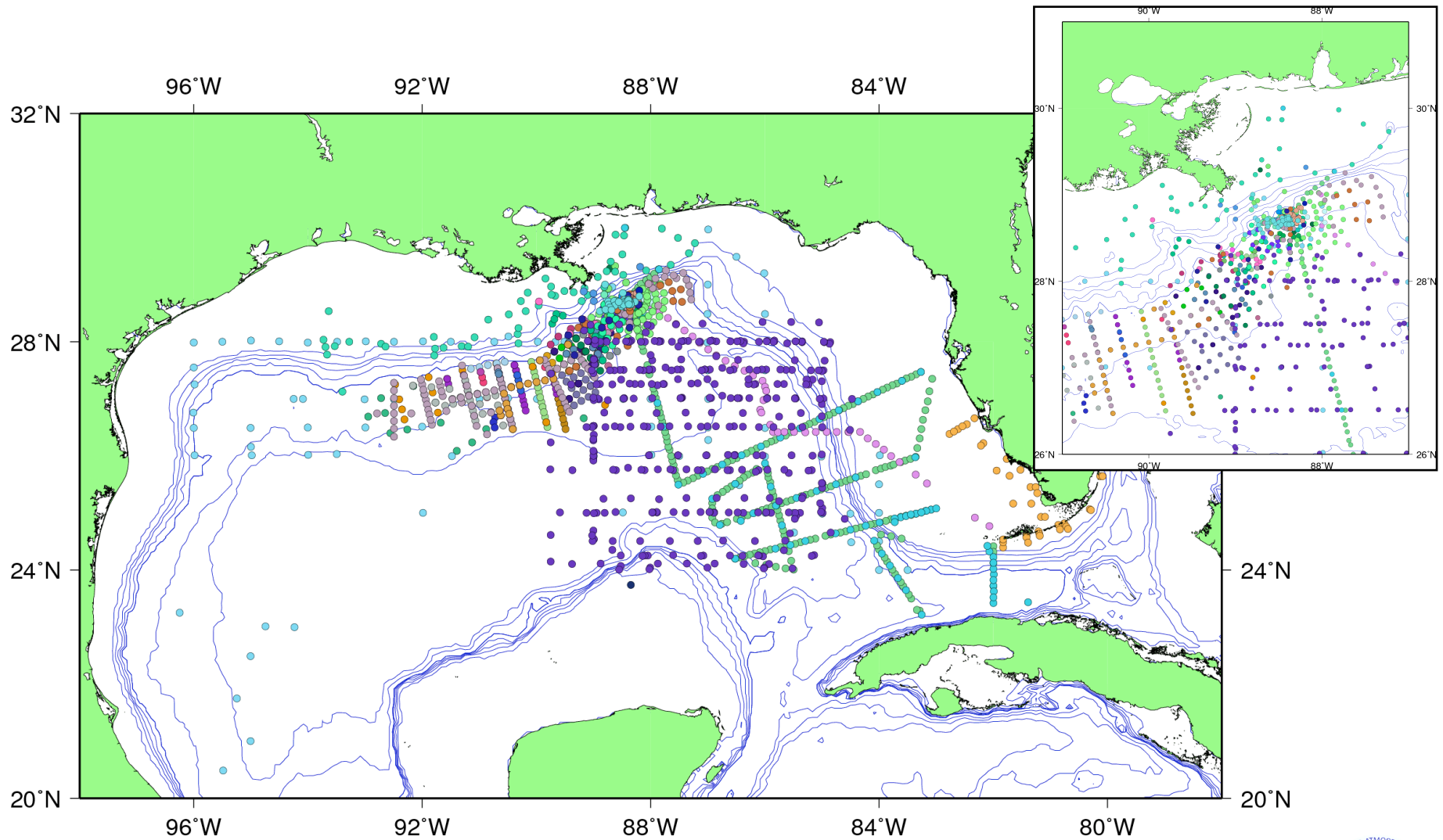
A 3-Dimensional Problem



Courtesy of Tamay Ozgokmen (University of Miami/RSMAS)



In Situ Ocean Observations



Source of observation
locations: NOAA/NODC



Field Sampling GEOPLATFORM

Research ships

Courtesy of NOAA/ORR

Weather conditions

Field sampling

Field photos

Data reports

Documentation

WWW.GEOPLATFORM.GOV/GULFRESPONSE

Information Help Recent Data

Layers Legend Query Tool Zoom

Reopening Samples

- Fish, Sep 03, 2010
- Fish, Sep 02, 2010
- Shrimp, Sep 02, 2010
- Fish, Aug 27, 2010
- Shrimp, Aug 27, 2010
- Fish, Aug 10, 2010
- Fish, Jul 22, 2010

All Subsurface Data for the Gulf of Mexico, September 9th 2010 By Vessel (Stable Only)

- ▲ Brooks McCall
- ▲ Cape Hatteras
- ▲ Delaware II
- ▲ Endeavor
- ▲ Ferrel
- ▲ Gordon Gunter
- ▲ Henry Bigelow
- ▲ HOS Davis
- ▲ Jack Fitz
- ▲ Nancy Foster
- ▲ Ocean Veritas
- ▲ Pisces
- ▲ Thomas Jefferson
- ▲ Walton Smith
- ▲ Wes Bordelon
- ▲ Bunny Bordelon
- ▲ Max Skansi

Scale: 1: 7M Zoom Level: 6 Location: 32.06396°,-82.37549°

National Oceanic and Atmospheric Administration | Environmental Protection Agency
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Satellite observations: Oil extension

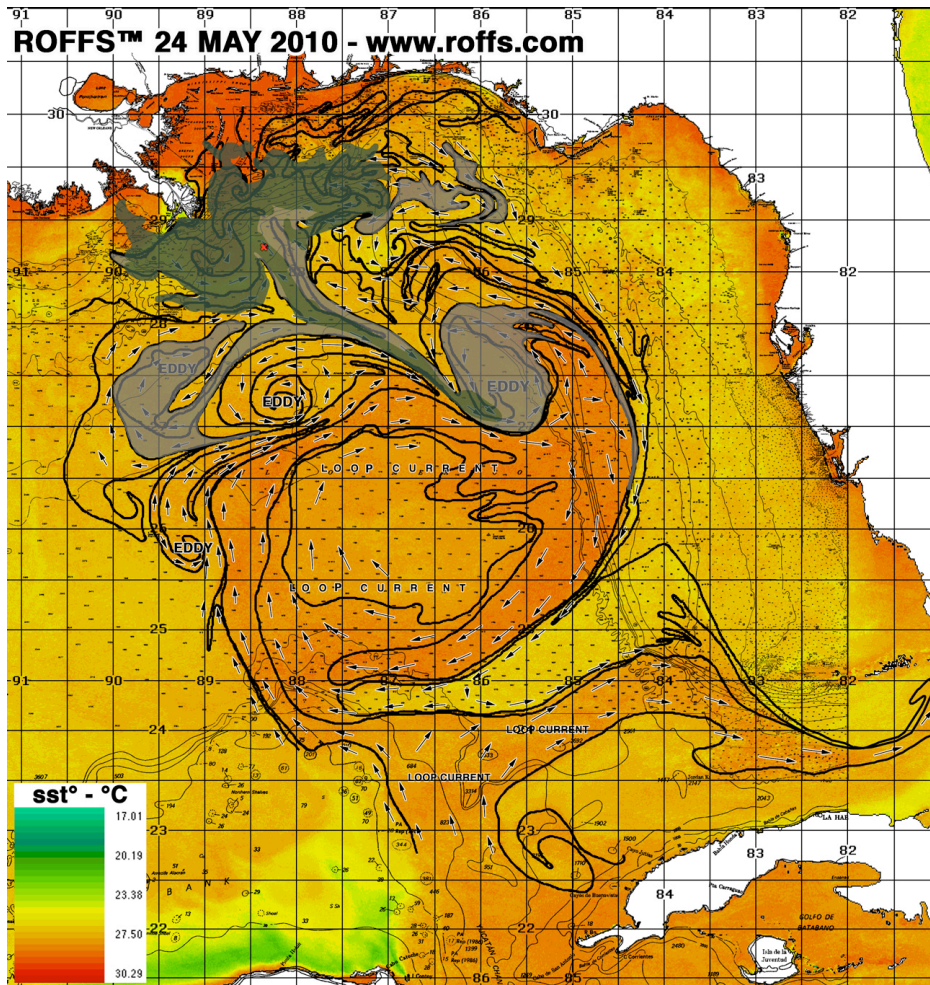
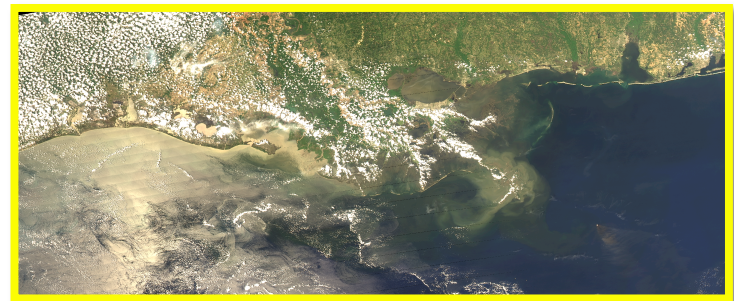


Figure by Mitchell A. Roffer (ROFFS™)

NASA MODIS imagery

April 21, 2010



May 10, 2010



Images courtesy of F. Muller-Karger (USF)



Oil Trajectory Maps

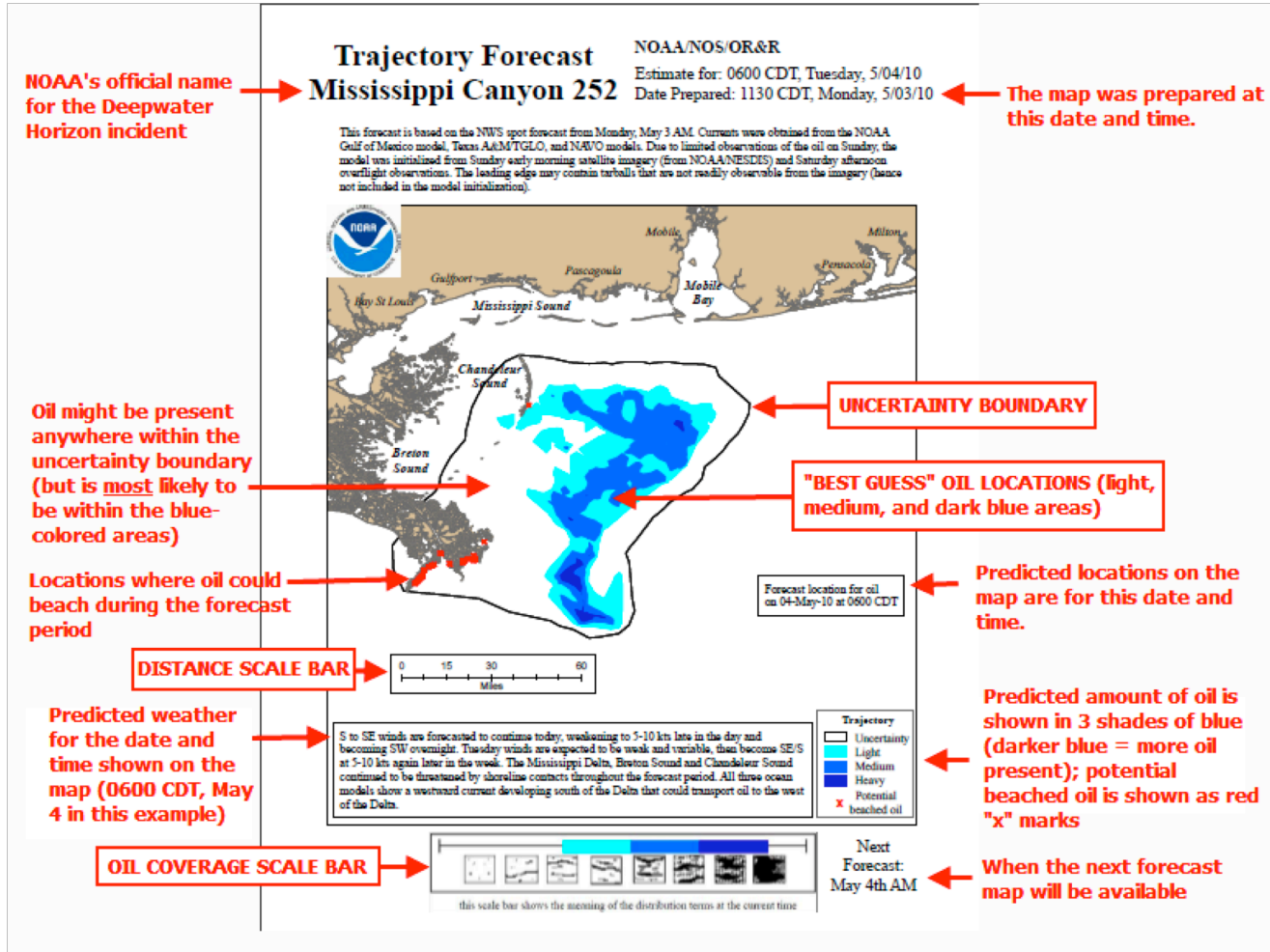


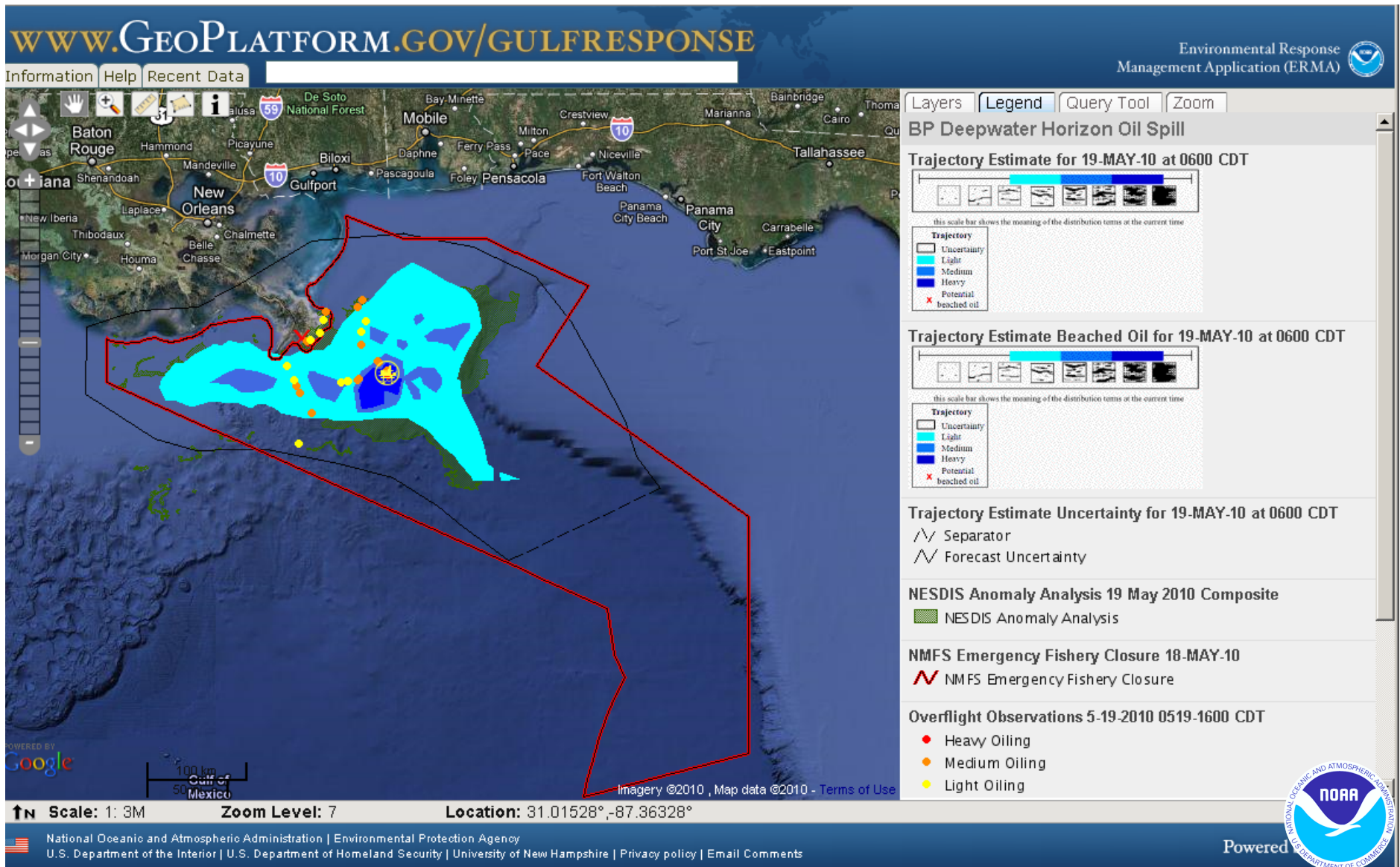
Figure by NOAA/ORR



Oil Trajectory Maps

May 19th, oil reaches LA

Courtesy of NOAA/ORR



Surface and subsurface currents

Satellite and drifter observations

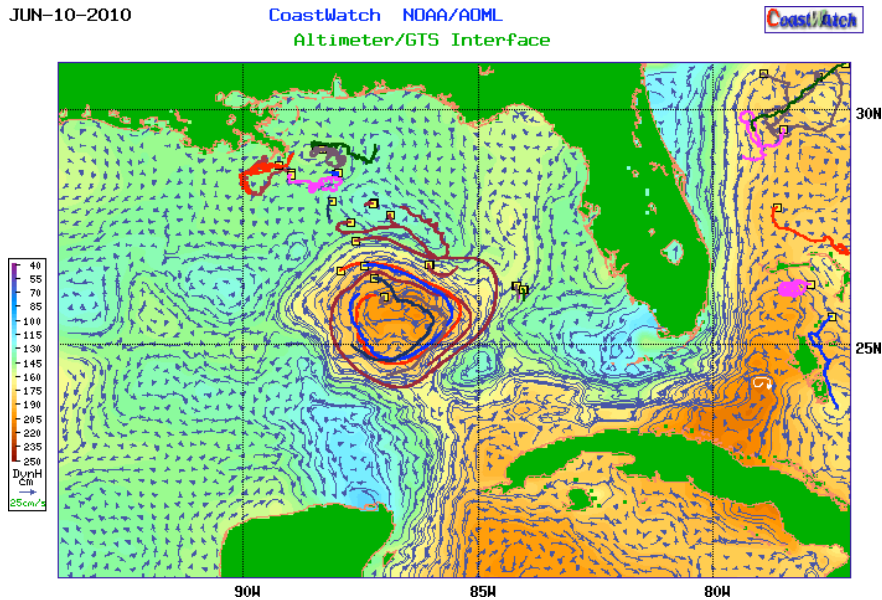


Figure from NOAA/AOML and NOAA/CoastWatch web page

Numerical Models and temperature sections

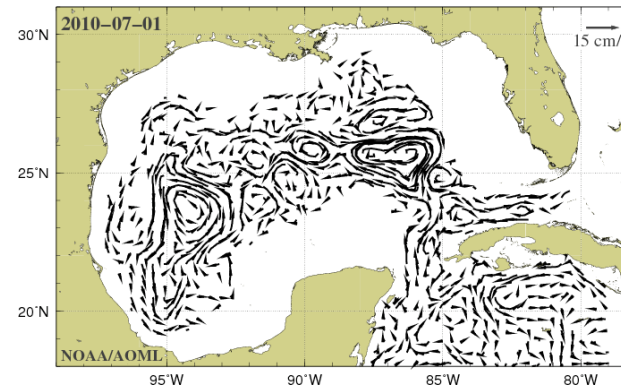


Figure by NOAA/AOML: Ocean currents at 1000m depth from IASNFS model.

AXBT Temperature section at 25.75°N 2010-06-11

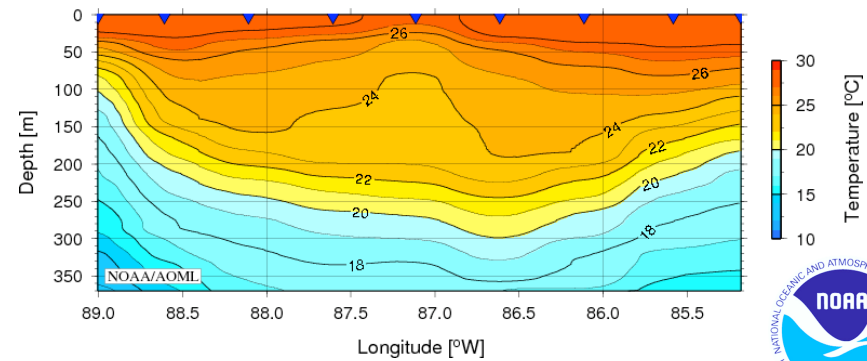
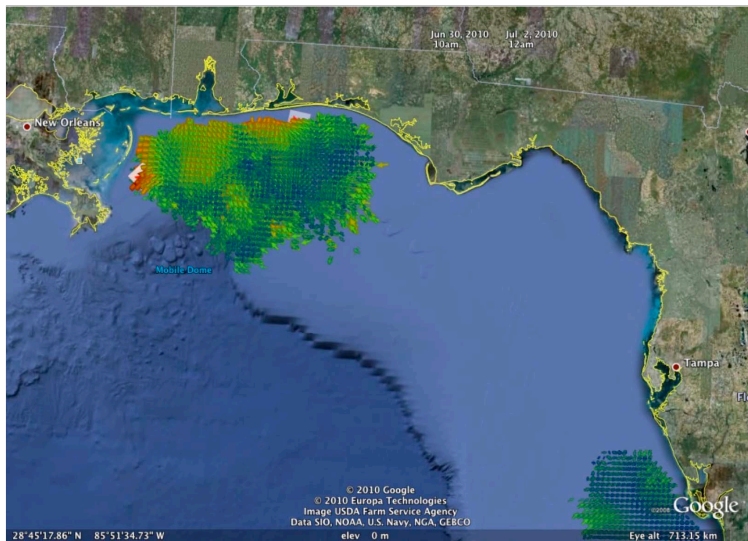


Figure by NOAA/AOML, P3 flights by RSMAS and NOAA/AOML



Surface and subsurface currents

HF Radars



Map from Rutgers; web page by USM and USF

gliders

June 7 - July 26, 2010

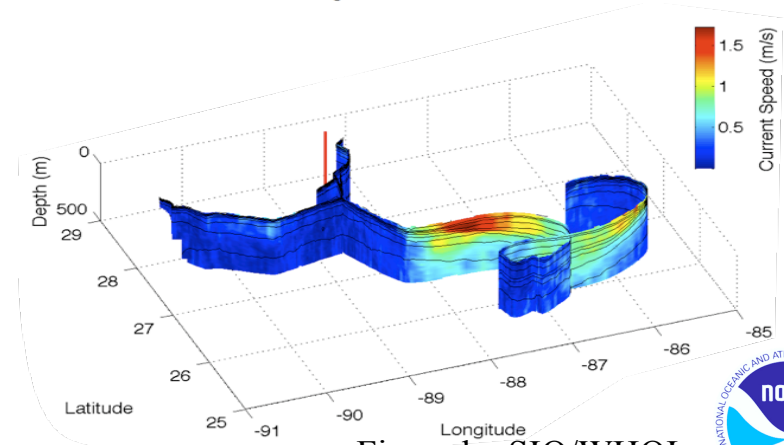
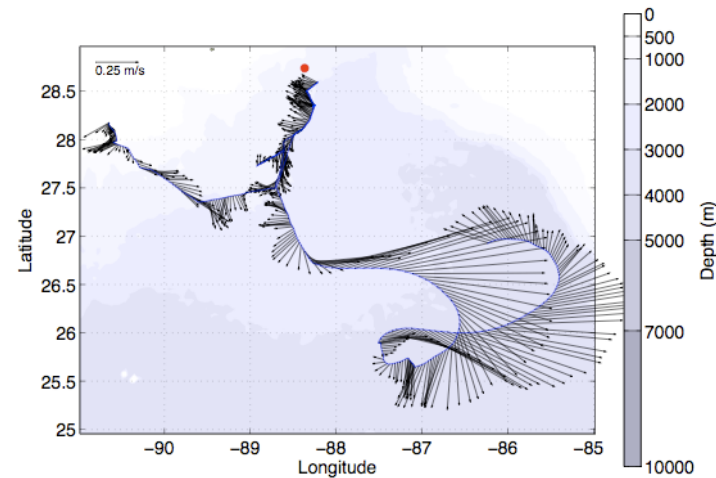


Figure by SIO/WHOI



Maps of analysis of surface currents

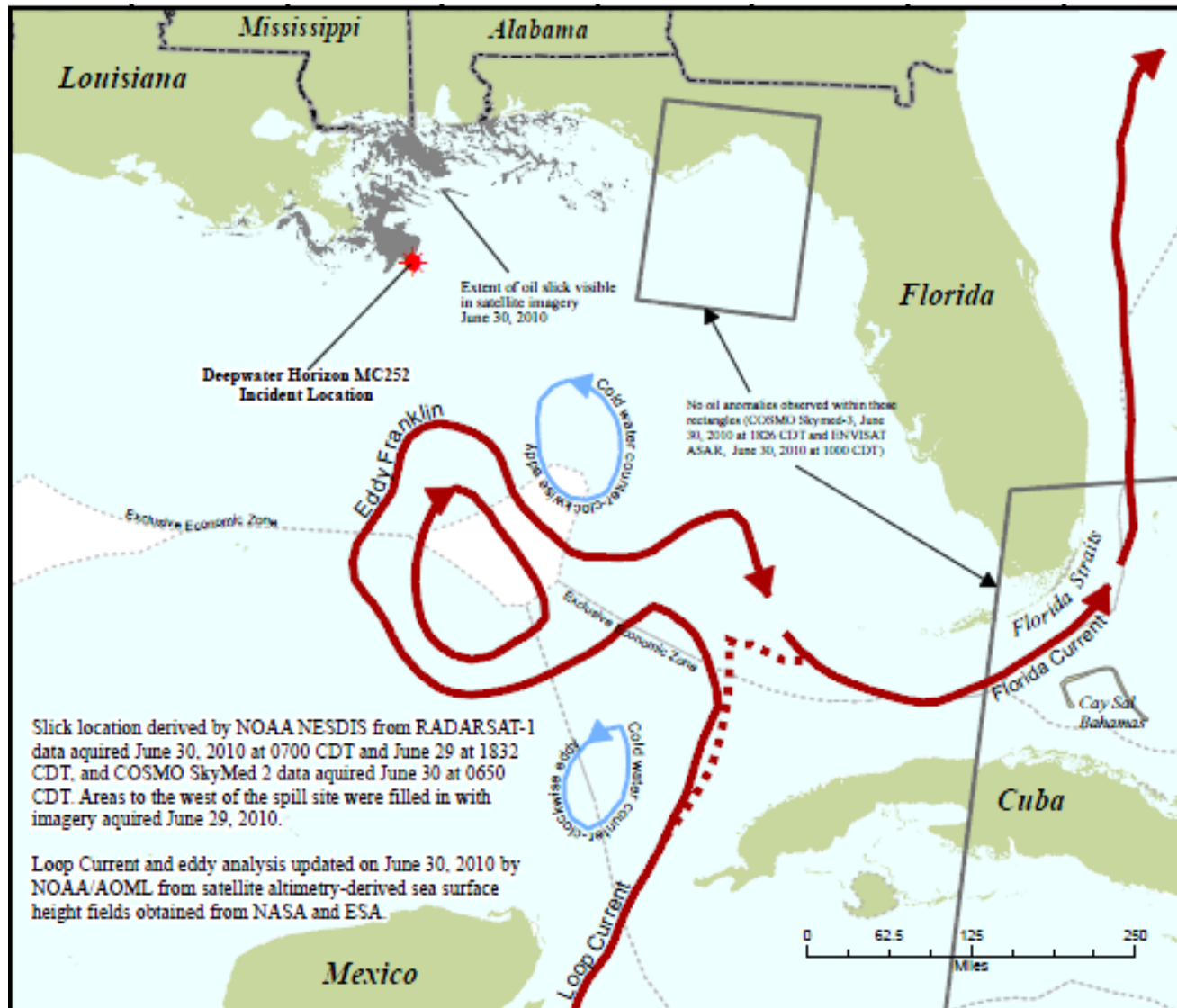


Figure by NOAA/ORR and NOAA/AOML



F. G. Walton Smith Cruise (May 21- June 6, 2010): Subsurface oil with CDOM and oxygen

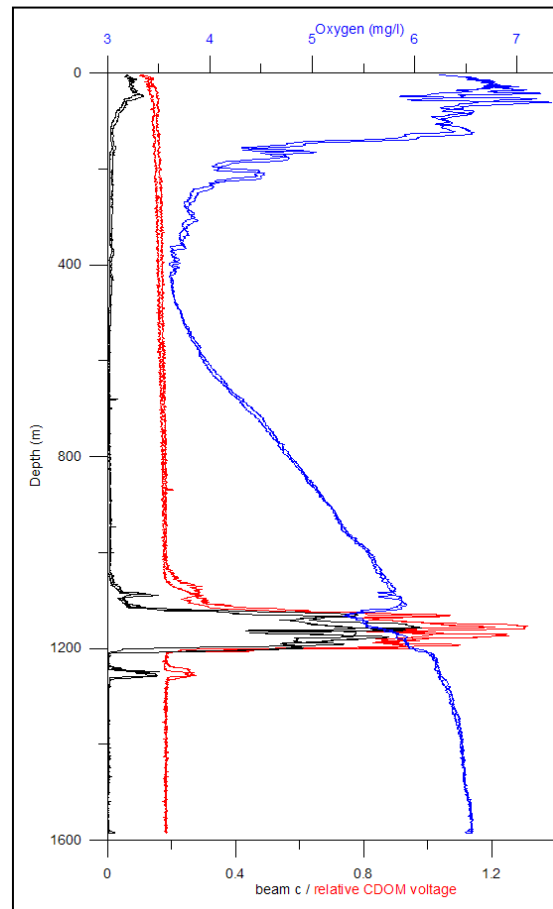


Figure by Vernon Asper (USM)



Oxygen and Oil observations

August Pisces cruise; Weatherbird Oil Analysis

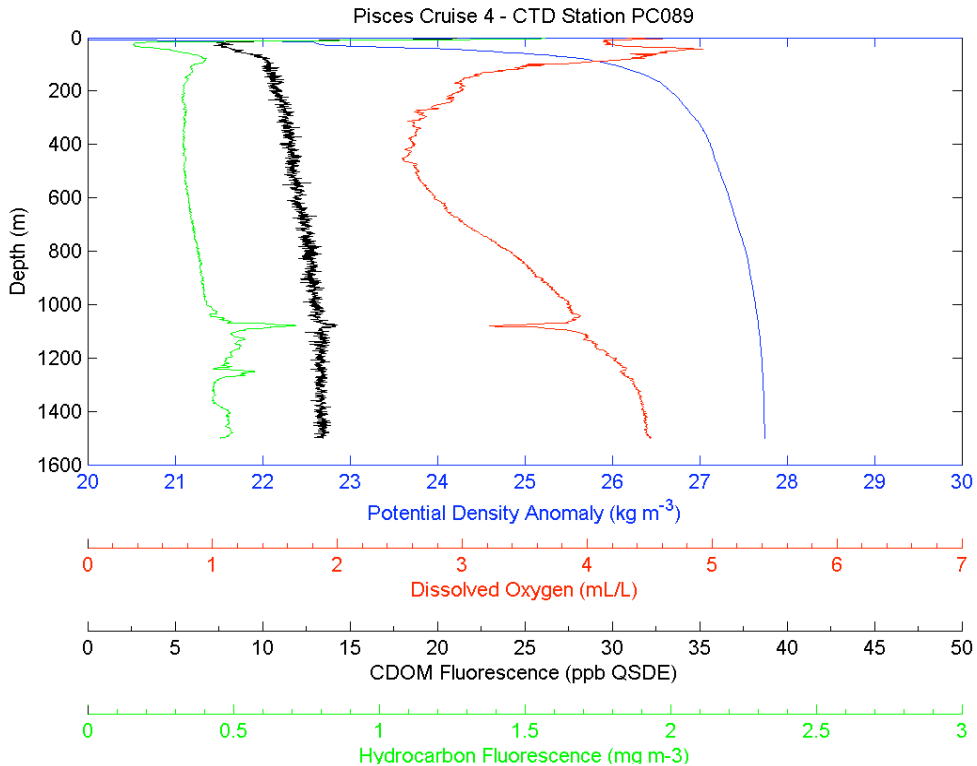
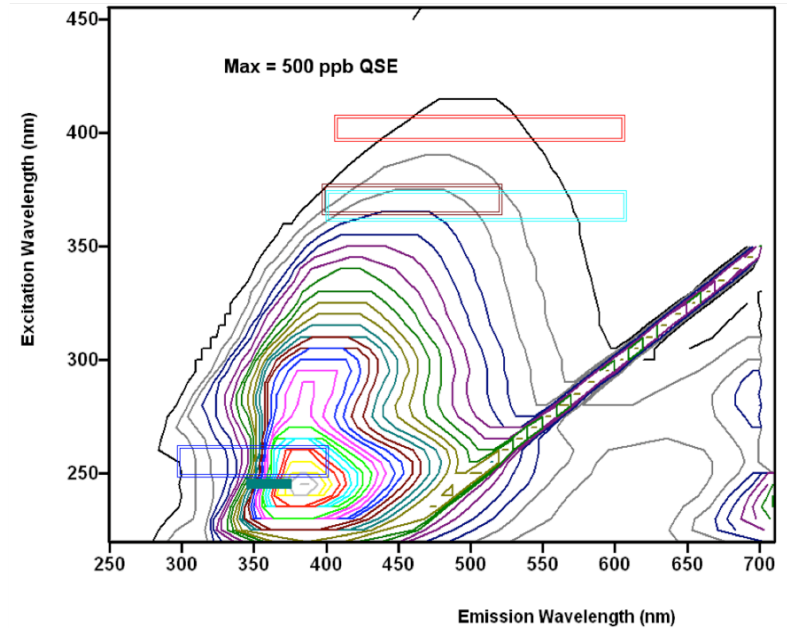


Figure by Arthur (Rost) Parsons
(NOAA/NODC)

Water from oil mousse



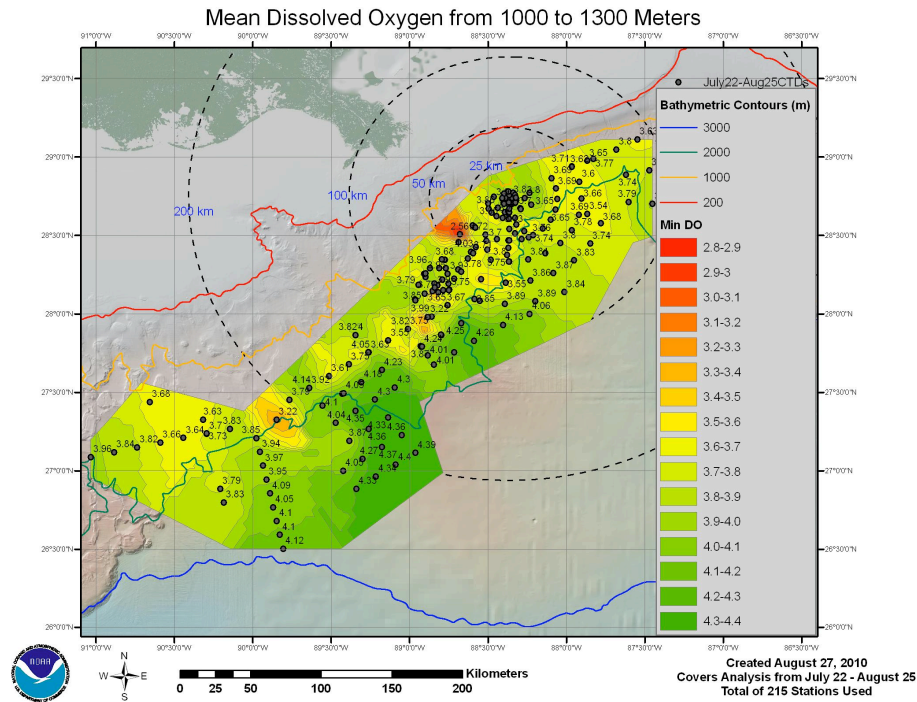
File# 2=DH003FG#1 @220 Nanometers

Figure by Paula Coble (USF),
contours are fluorescence yield,
colored boxes show region of
detection for different fluorometers

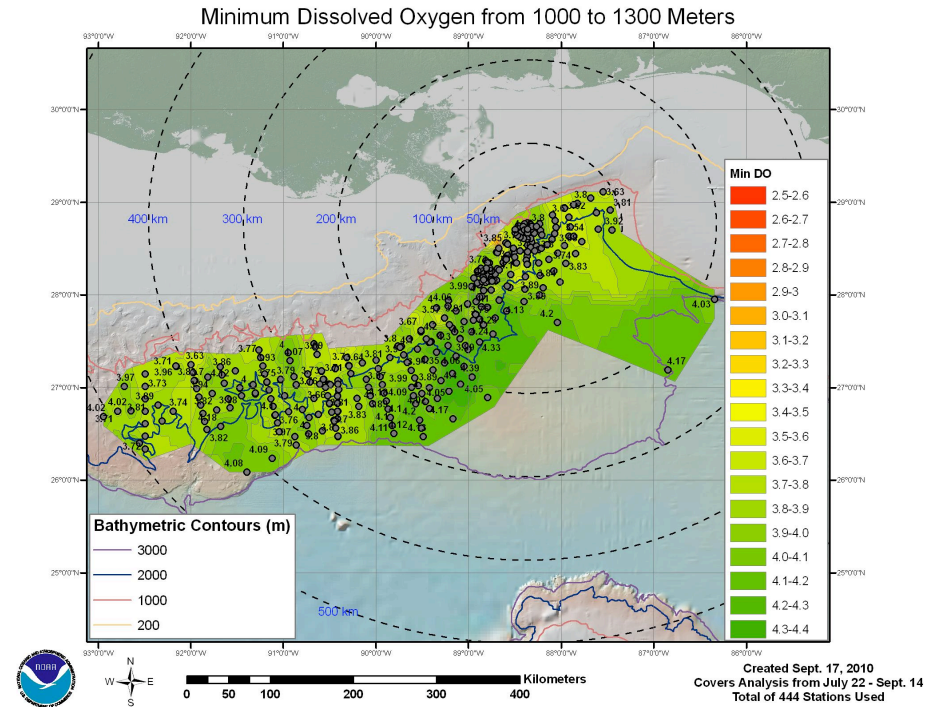


Oxygen observations

Through August 25



Through September 14



Figures by Arthur (Rost) Parsons (NOAA/NODC)



F. G. Walton Smith Cruise (June 7-10, 2010)

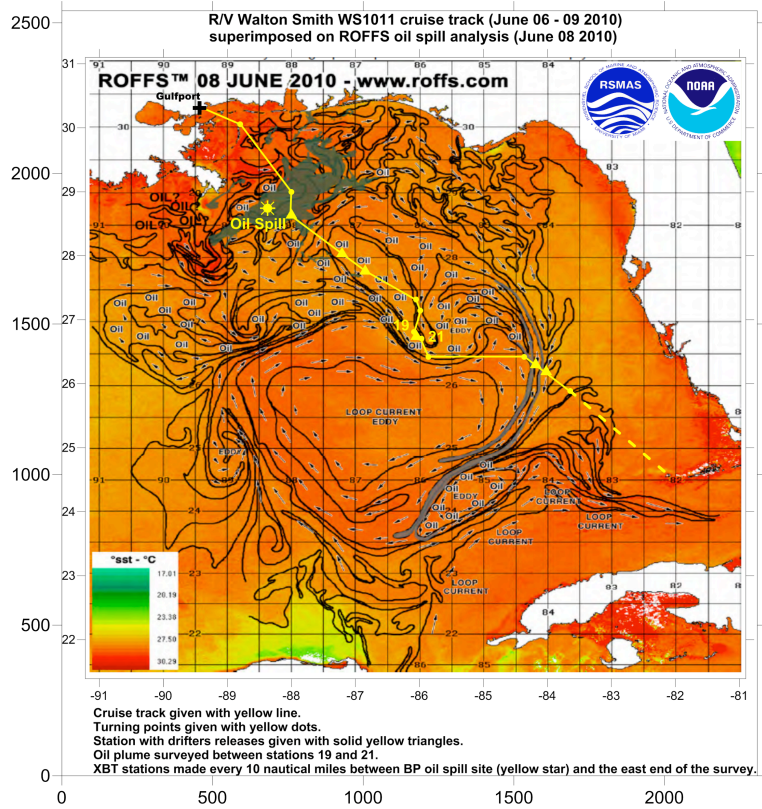


Figure by Mitchell Roffer (ROFFS™)

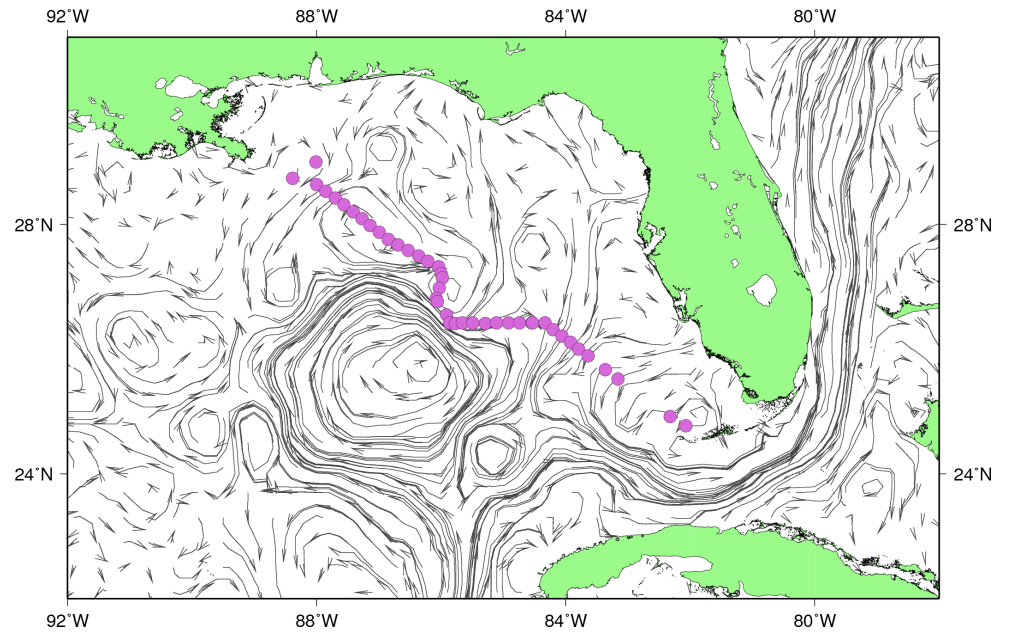


Figure by Joaquin Trinanes (NOAA/AOML and NOAA/CoastWatch)



NOAA SHIP Nancy Foster cruise

(June 30 – July 18)

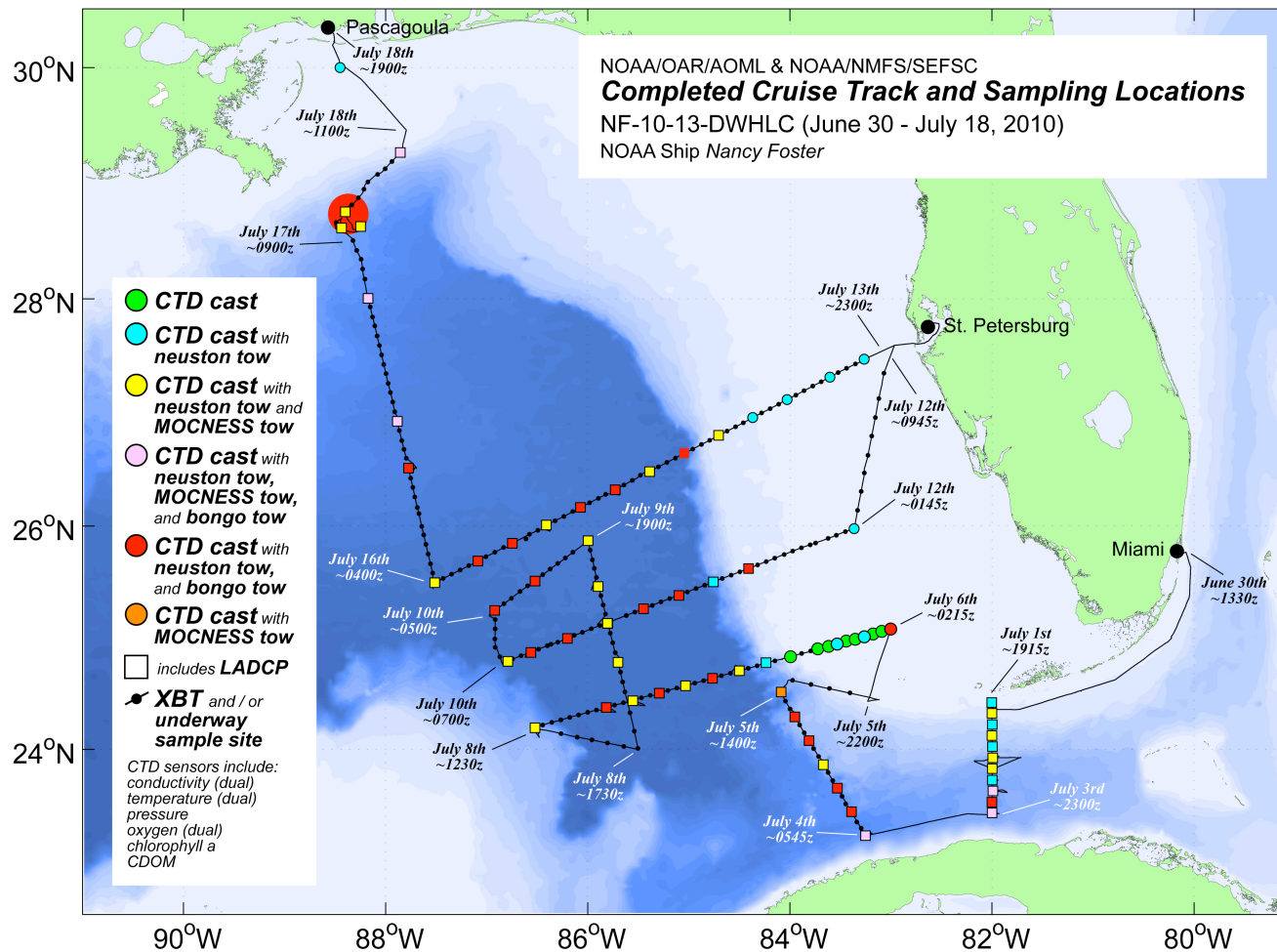


Figure by R. Smith (NOAA/AOML)



NOAA SHIP Nancy Foster cruise (June 30 – July 18)

Observations carried out July 17

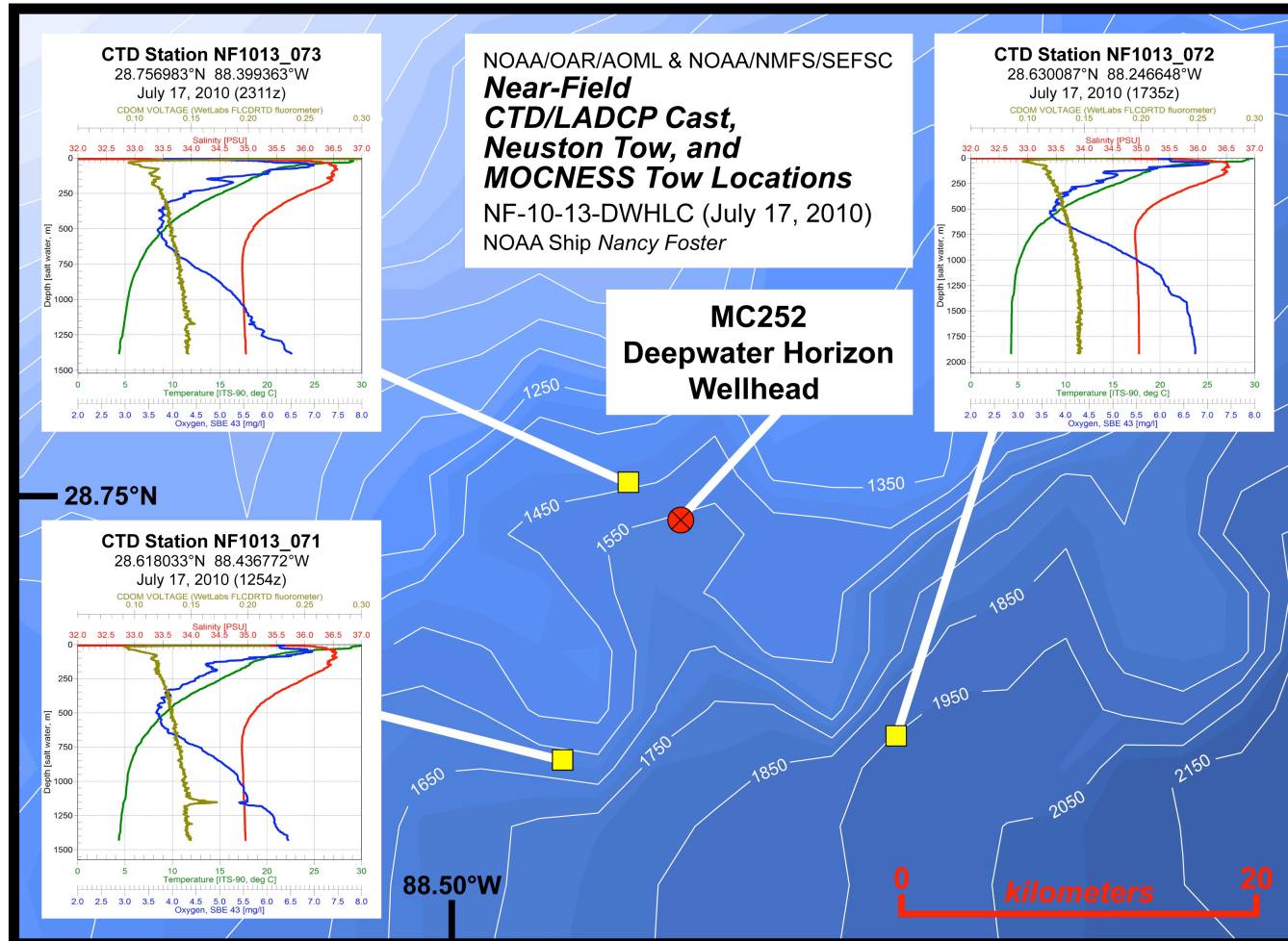
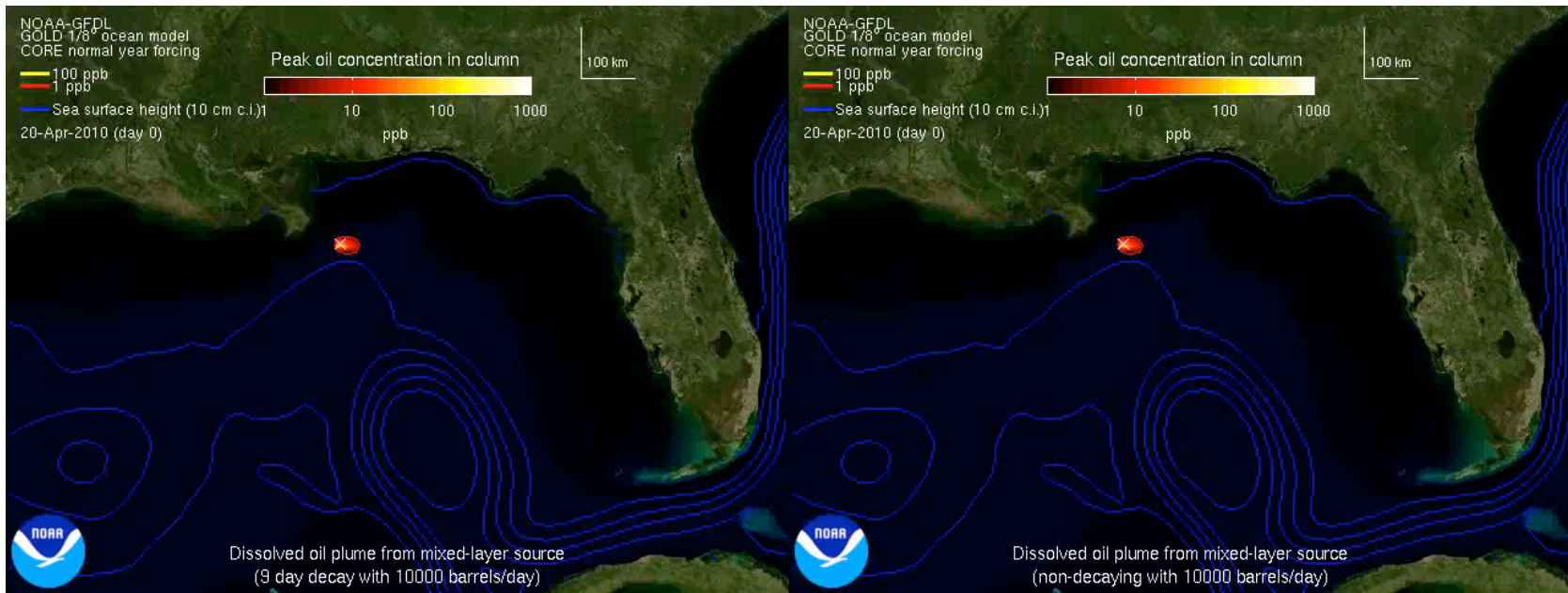


Figure by R. Smith (NOAA/AOML)



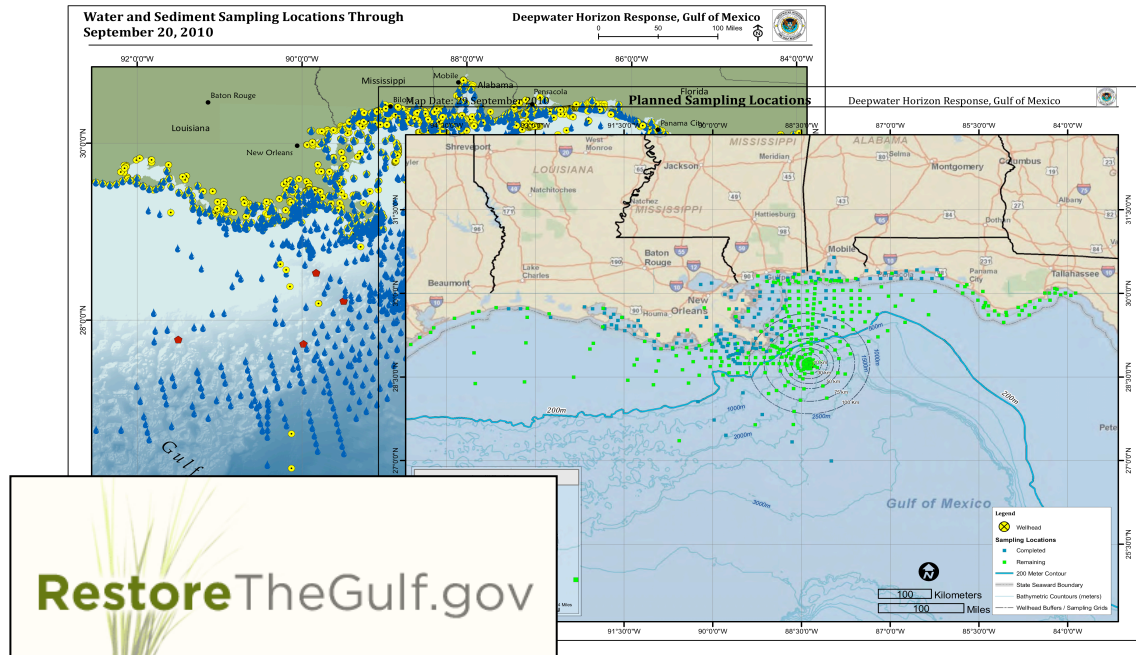
Why the oil/dispersants never reached the Florida Straits ?



Courtesy of Robert Hallberg (NOAA/GFDL)



Monitoring of sediments

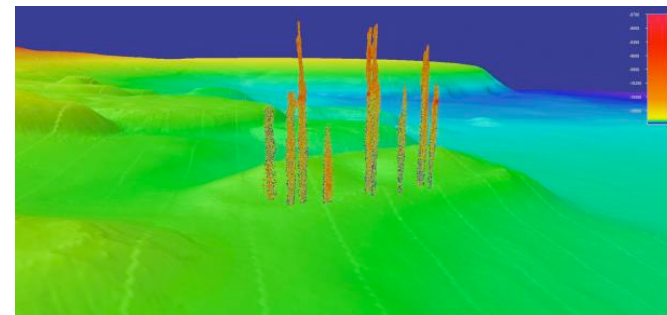


NOAA subsurface monitoring web page



NOAA Ship Pisces:

- CTD
- Core sampling
- Camera-tow operation
- Mapping of natural hydrocarbon seeps



Figures from NOAA/ORR web site

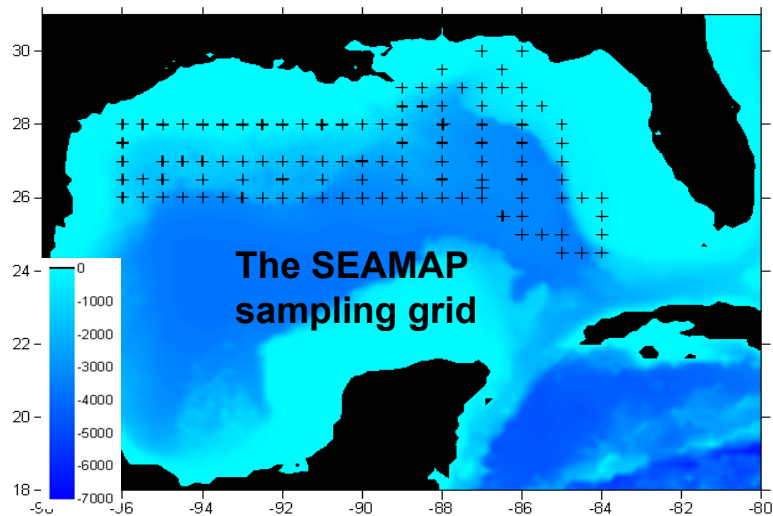


Biological Observations

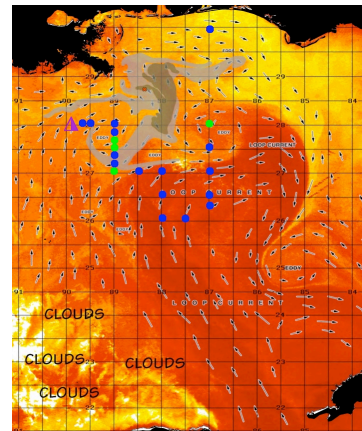
U. S. Fish and Wildlife Service: provide consolidated fish and wildlife reports.

Nancy Foster cruise far field observations: No oil observed

- Convergence zones, ichthyoplankton; birds;
- 12 species of marine birds, very few terrestrial migrant, and marine mammals
- 209 zooplankton samples from 28 MOCNESS, 65 surface neustons, and 29 subsurface tows to investigate physiological condition, abundance, and diversity.
- Larval fish samples were collected to measure bio-indicators of cardiac toxicity of crude oil; bio-indicators were developed at NWFSC over the last 8 years.



John Lamkin (NOAA/SEFSC)



John Lamkin (NOAA/SEFSC).
SST analysis by Mitchell A.
Roffer (ROFFS™)

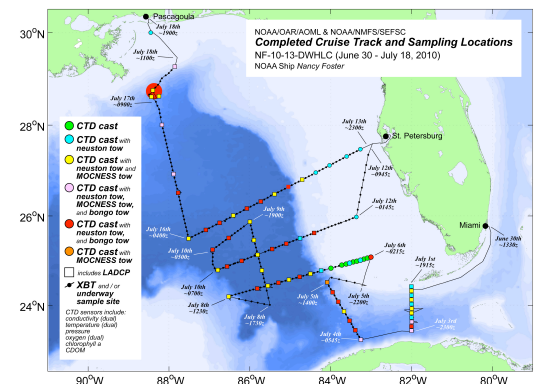


Figure by R. Smith
(NOAA/AOML)



Inventory of observations and data distribution

IOOS - GCOOS

GCOOS Gulf of Mexico Coastal Ocean Observing System

Home About us Data portal Maps

Layers derived from multiple WMS servers show oceanographic parameters. WMS Layer Opacity (Background) Clear each glider selection

Start Point	May	June	July	August	Last 10 days	Last 7 days	End point
<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All
<input type="checkbox"/> 48900	<input type="checkbox"/> 48900	<input type="checkbox"/> 48900	<input type="checkbox"/> 48901	<input type="checkbox"/> 48901	<input type="checkbox"/> 48900	<input type="checkbox"/> 48900	<input type="checkbox"/> 48900
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GCOOS Gulf of Mexico Coastal Ocean Observing System

Home About us Data portal Maps

Who are you?

Oil Spill Satellites Data Portal

Recent Observations Model Forecasts Maps

Bathymetry Shoreline

Phytoplankton time series

Resource Center

Site map

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Integrated Ocean Observing System (IOOS)
 Gulf of Mexico Coastal Ocean Observing System
 (GCOOS)

<http://gcoos.org>

Goal: To develop automated and largely unattended data systems to deliver high-quality data and products to consumers.



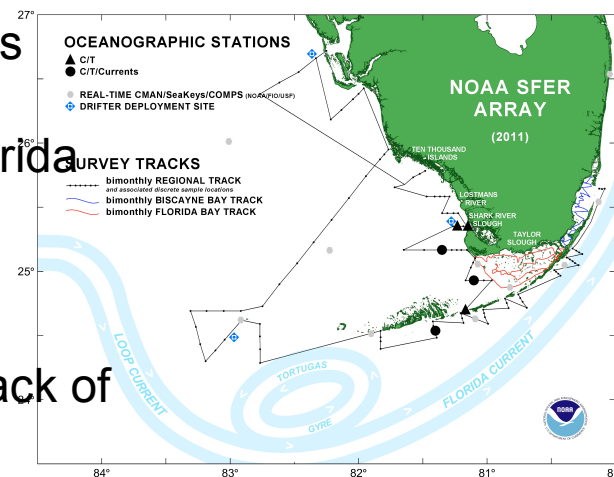
Sustained Environmental observations in the Gulf of Mexico

Need for an interdisciplinary observing system to respond to extreme events (oil spills, hurricanes, harmful algal blooms).

in the near field, to investigate impact of oil on sediments, ecosystems, coastal regions, and
in the far field, to investigate the impact on ecosystems (larvae, fish, mammals, corals, coastal regions, etc.) in areas including the west Florida shelf, Florida keys, Florida Bay, and western Gulf.

Some regional observing systems are already in place, although some risk being discontinued because of lack of funding.

Use current experience as starting point for its design and implementation.



Future Work

- 1) **3D analysis of pathways and extension of oil, dispersants, and tar balls;**
- 2) **Evaluate various instruments to measure oil and conduct val/cal experiment so fluorescence data from response period can be properly interpreted;**
- 3) **Assess impact on ecosystems (near and far field);**
- 4) **Evaluate impact of bacteria in oil decay;**
- 5) **Assess the impact of different observations (including gaps and error estimates):**
 - **Have we measured all the key parameters ?**
 - **Have we measured them correctly ? (right location, right instrumentation, etc)**
 - **Are all the data and metadata properly accounted for and stored ?**
 - **Are we using (or did we use) all available data in the analysis ?**
 - **How have these data contributed to numerical modeling efforts ?**
- 6) **Use gained knowledge for future responses - Sustained ocean observations**



Conclusions and Future Work

The scientific community (government agencies, academia, and private industry) has made an impressive effort responding to DWH oil spill by collecting and analyzing an unprecedented number of interdisciplinary observations.

- **Some observing systems and/or observations already in place to implement observing network in Gulf of Mexico;**
- **Real-time data transmission and analysis;**
- **Blending interdisciplinary observations, including satellite observations;**
- **Need for strong numerical modeling capability.**

