Presentation Outline

- Airborne Sensors Used in Oil Spill Research
- Spaceborne Sensors Used in Oil Spill Research
- NASA's Gulf of Mexico Initiative
- Sources for More Oil Spill Information
- DEVELOP Overview / Internship Opportunity

NASA Airborne Sensors

HSRL

- High Spectral Resolution LiDAR
- Aerosol sensor (green and NIR wavelengths)
- Flew aboard NASA's King Air (May 9-10; July 9-10)
- Experiments with sub-surface oil analysis

Technician Checks Out King Air During Oil Spill Deployment. Image Credit: NASA

HSRL Deployed in NASA Langley's King Air B200
Image Credit: NASA

HSRL

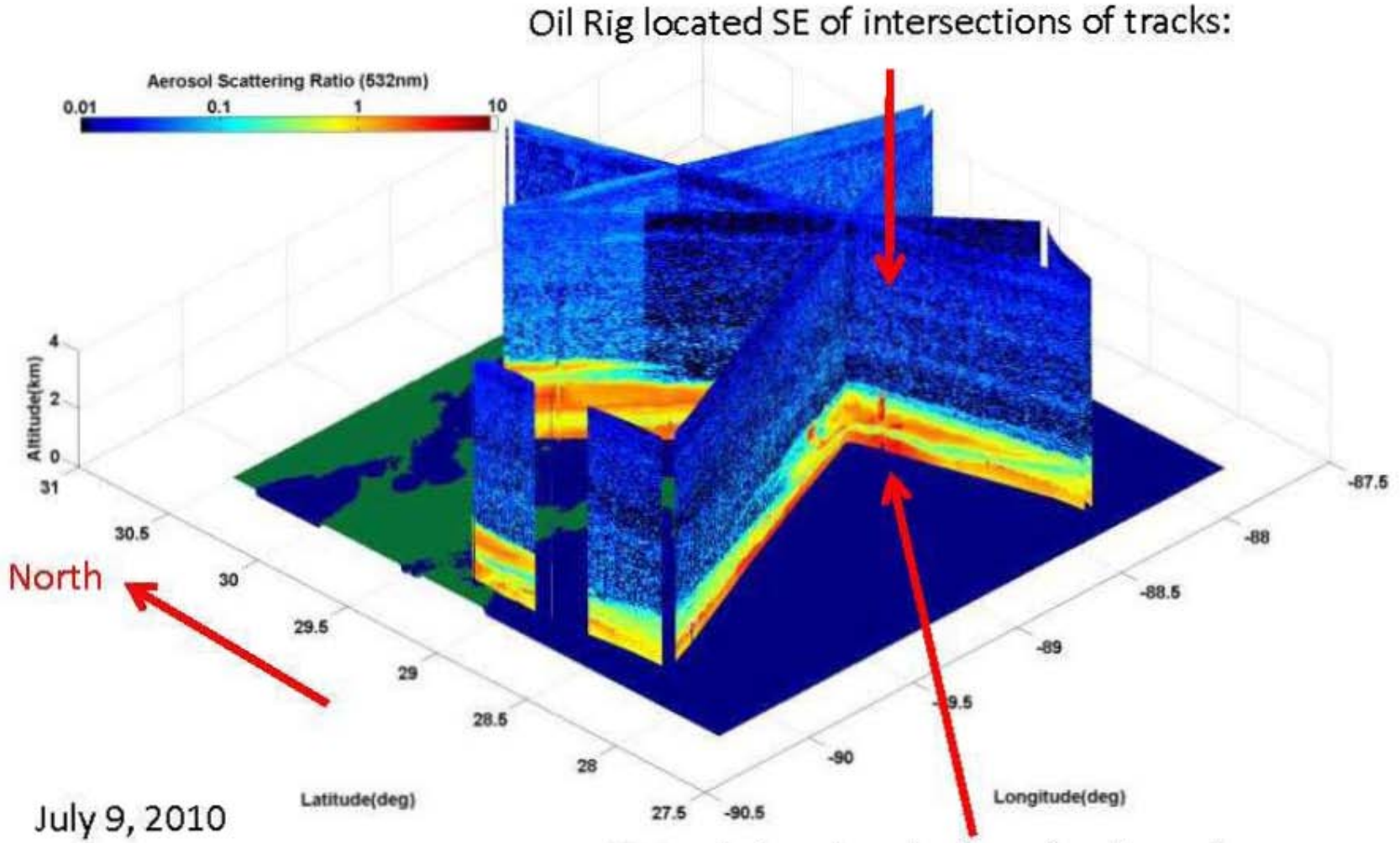


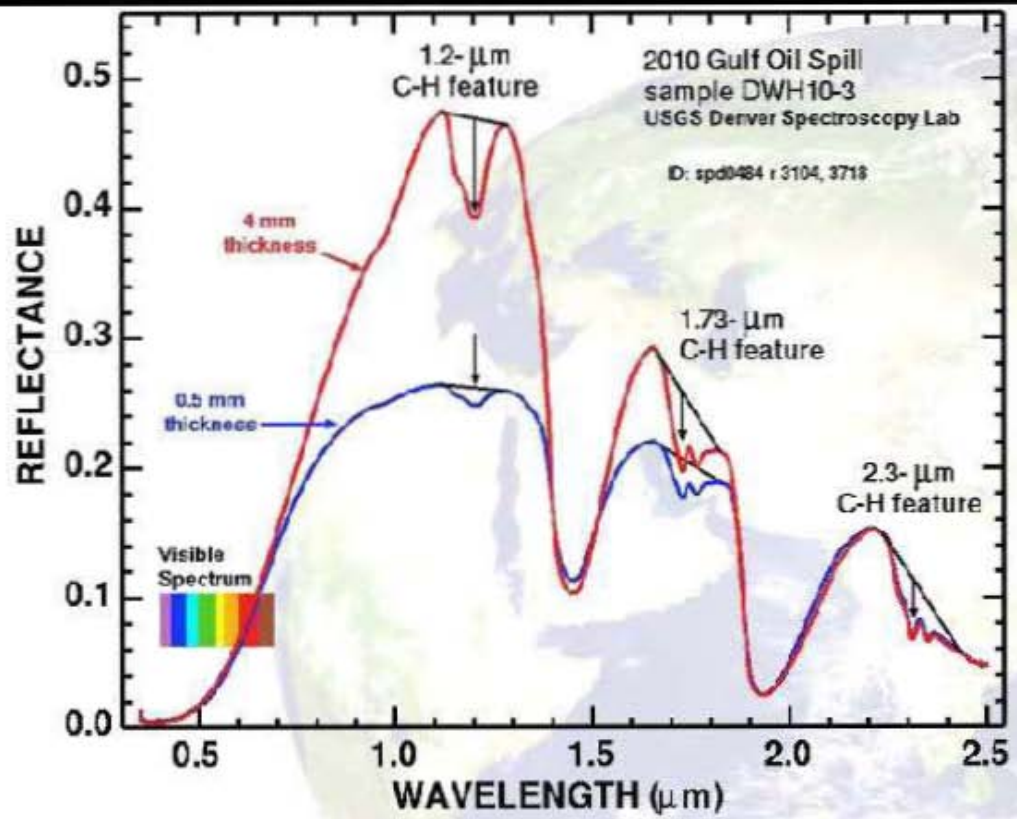
Image Credit: Mike Ohland
NASA Langley Research Center

AVIRIS

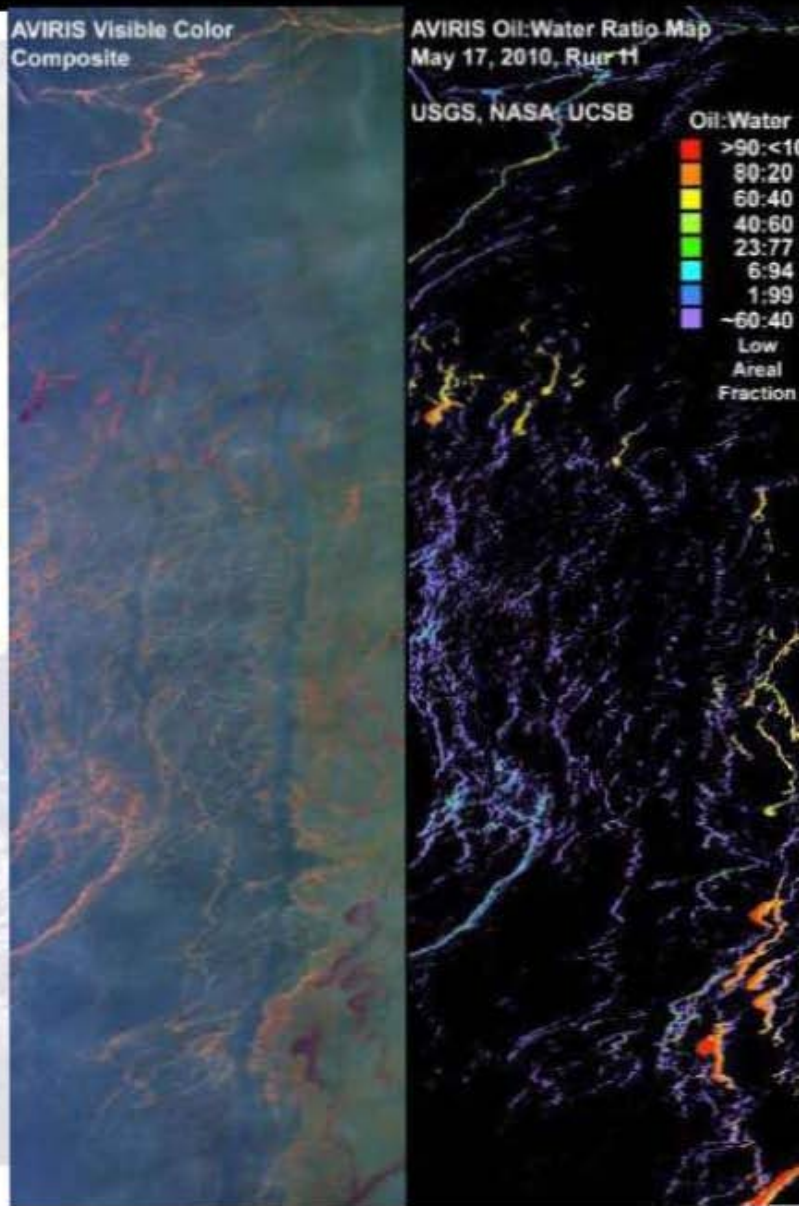
- Airborne Visible / Infrared Imaging Spectrometer
- Hyperspectral sensor – numerous wavelengths
- Spatial resolution: 3 m – 20 m (based on altitude)
- Flights in May, July, and August
- Oil thickness mapping – USGS, NASA, UCSB
- Wetland monitoring – UCDavis, UCSB, USGS

ER-2 Aircraft Carrying the AVIRIS Sensor. Image Credit: NASA

AVIRIS

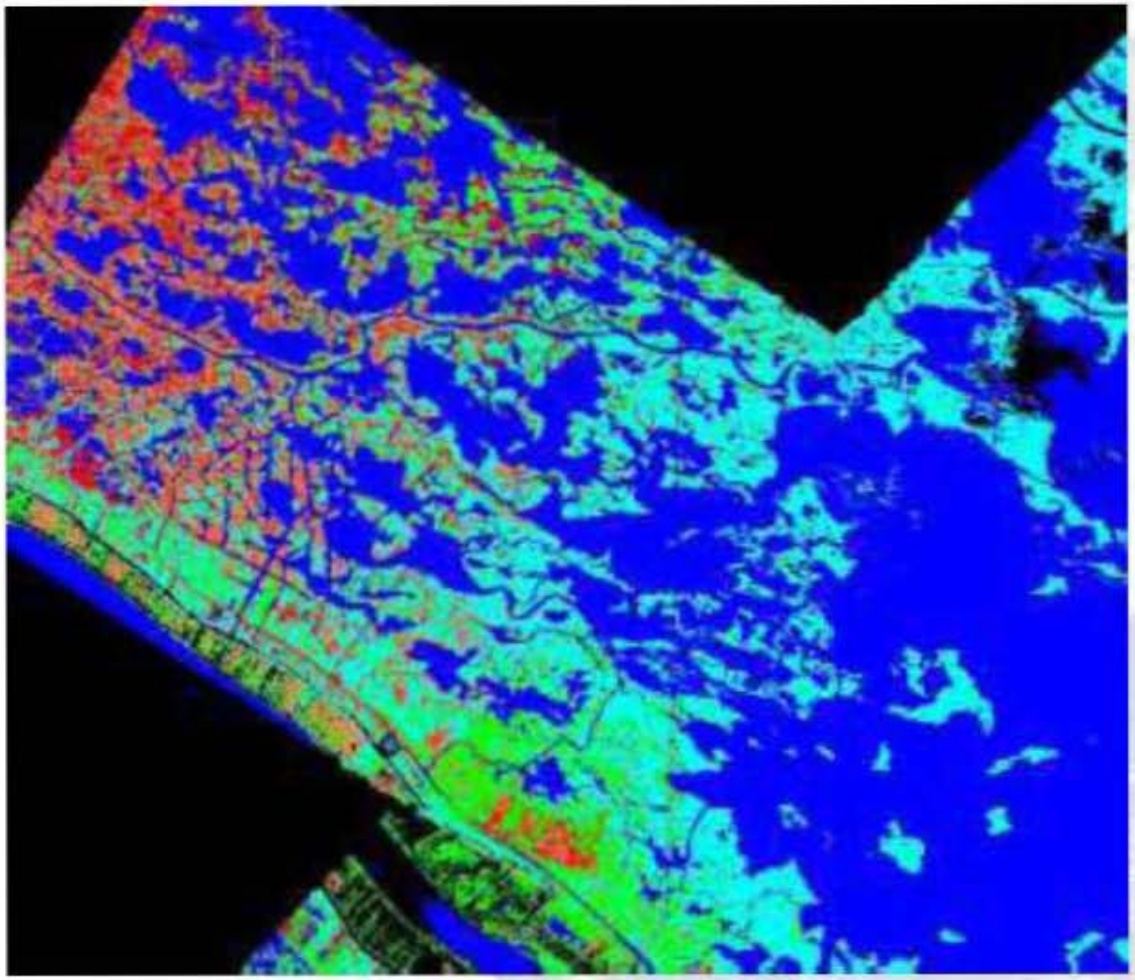


Spectral Signature of Gulf Oil Sample (Above)
Source: USGS
http://pubs.usgs.gov/of/2010/1101/



Oil to Water Ratio Map (Right)
Source: USGS
http://pubs.usgs.gov/of/2010/1167/

AVIRIS



Water / Glint

Phragmites australis

Spartina alterniflora

Spartina patens

Vigna luteola

Background

Wetlands Vegetation Species Maps Generated from 16-meter Resolution AVIRIS Imagery
Acquired over Southeast Louisiana on May 6, 2010.
Image Credit: Dr. Dar A. Roberts et al., UCSB

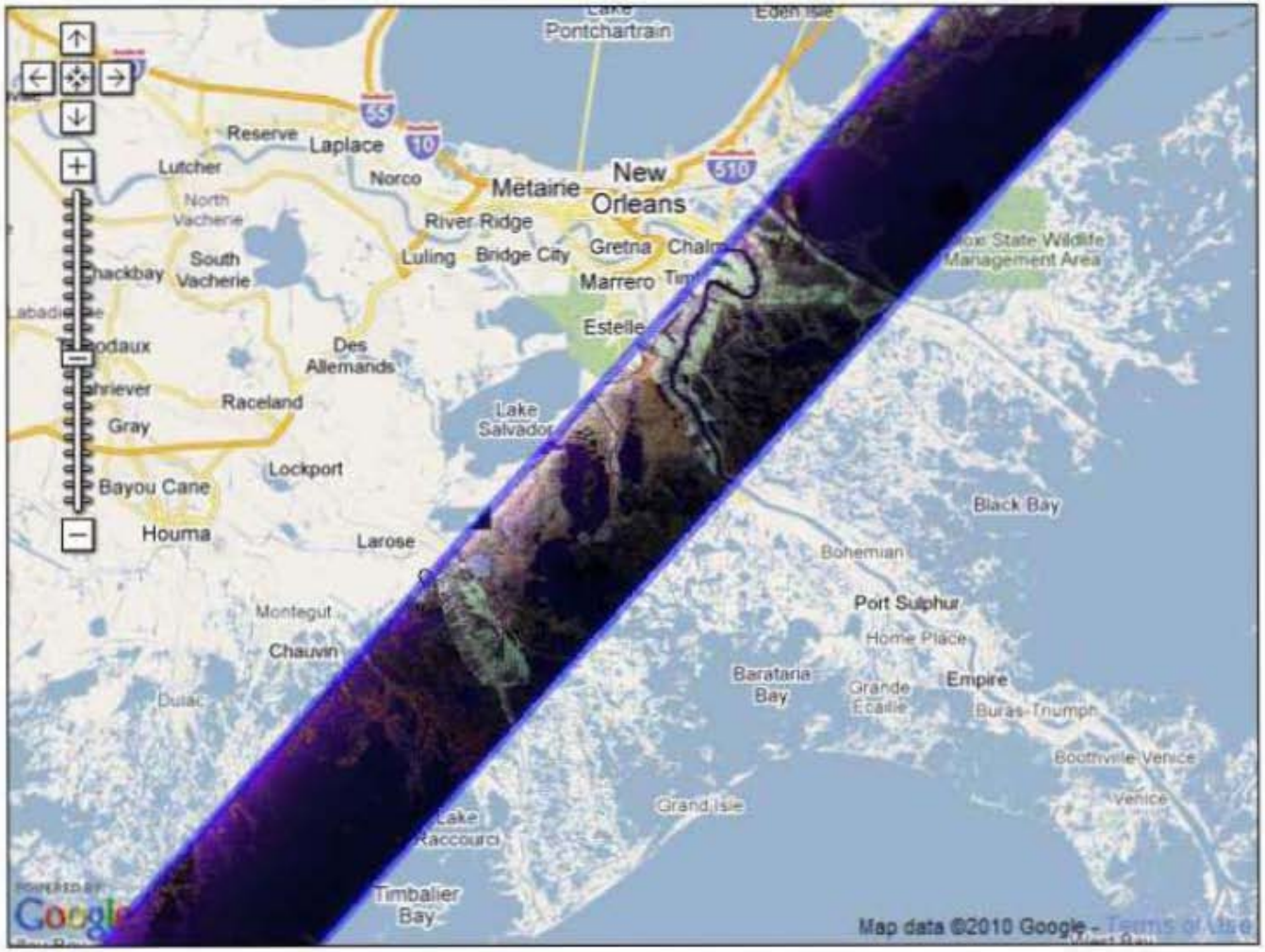
UAVSAR

- Uninhabited Aerial Vehicle Synthetic Aperture Radar
- Flown aboard NASA's Gulfstream G-III aircraft
- L-band radar: experimental analysis of marsh oiling

NASA's Gulfstream G-III Aircraft with UAVSAR Mounted Underneath
Image Credit: NASA

UAVSAR

Polarimetric Image of Louisiana Marsh - Mississippi Delta, LA (June 22, 2010)

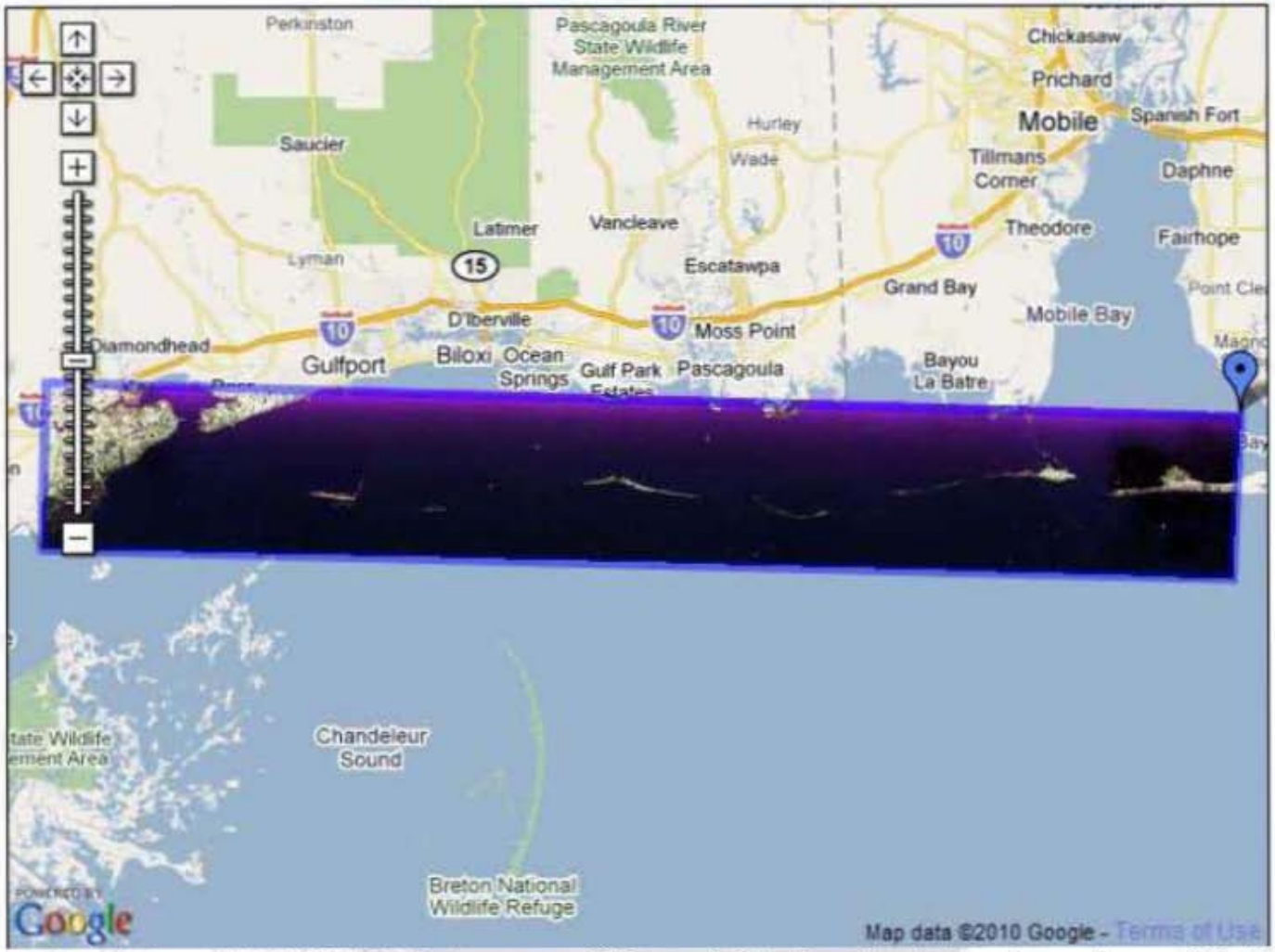


Example Strip of UAVSAR Data Acquired over Southeast Louisiana, June 22, 2010

Image Credit: NASA

UAVSAR

Polarimetric Image of Barrier Islands, MS (June 22, 2010)



Example Strip of UAVSAR Data over MS and AL Barrier Islands – June 22, 2010.

Image Credit: NASA

Examples of NASA Spaceborne Sensors Used in Deepwater Horizon Oil Spill Research

NASA's Oil Spill Imagery: MODIS

- Moderate Resolution Imaging Spectroradiometer
- Flies over twice daily (*Aqua* and *Terra* satellites)
- Surface oil visible in sun glint

Terra MODIS Image of Deepwater Horizon Oil Spill – April 29, 2010

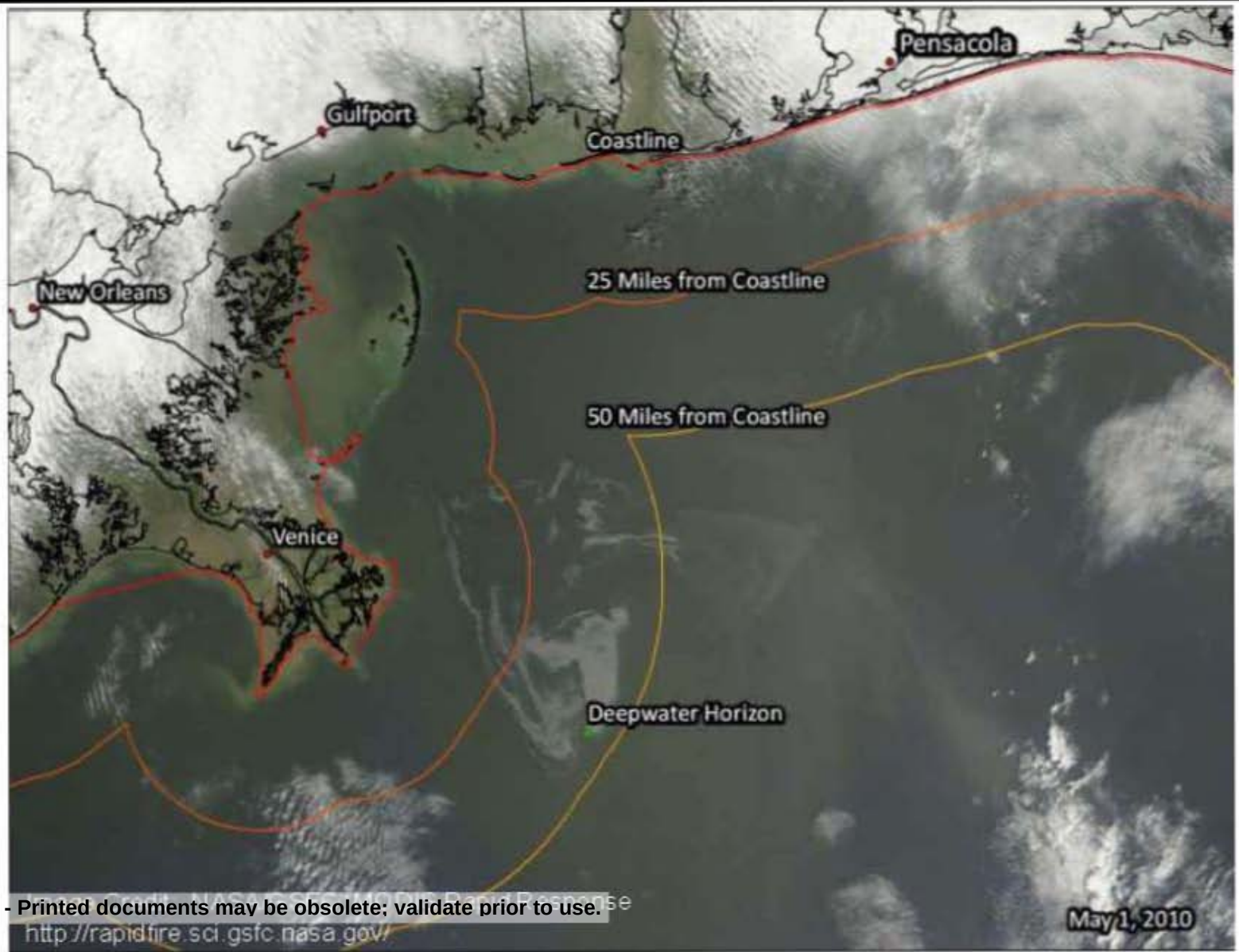
Image Credit: NASA

MODIS – April 21, 2010

MODIS – April 25, 2010

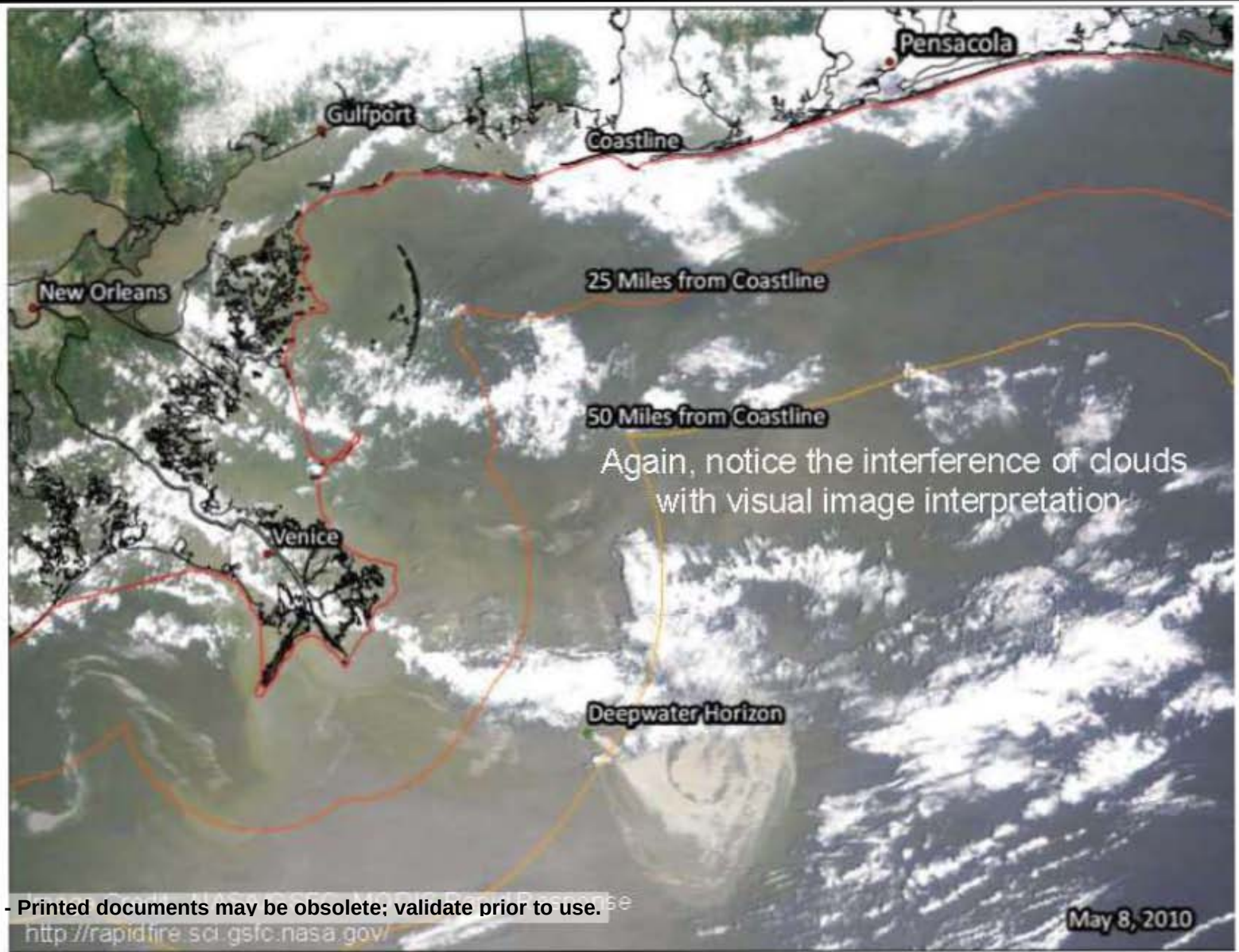
MODIS – April 29, 2010

MODIS – May 1, 2010

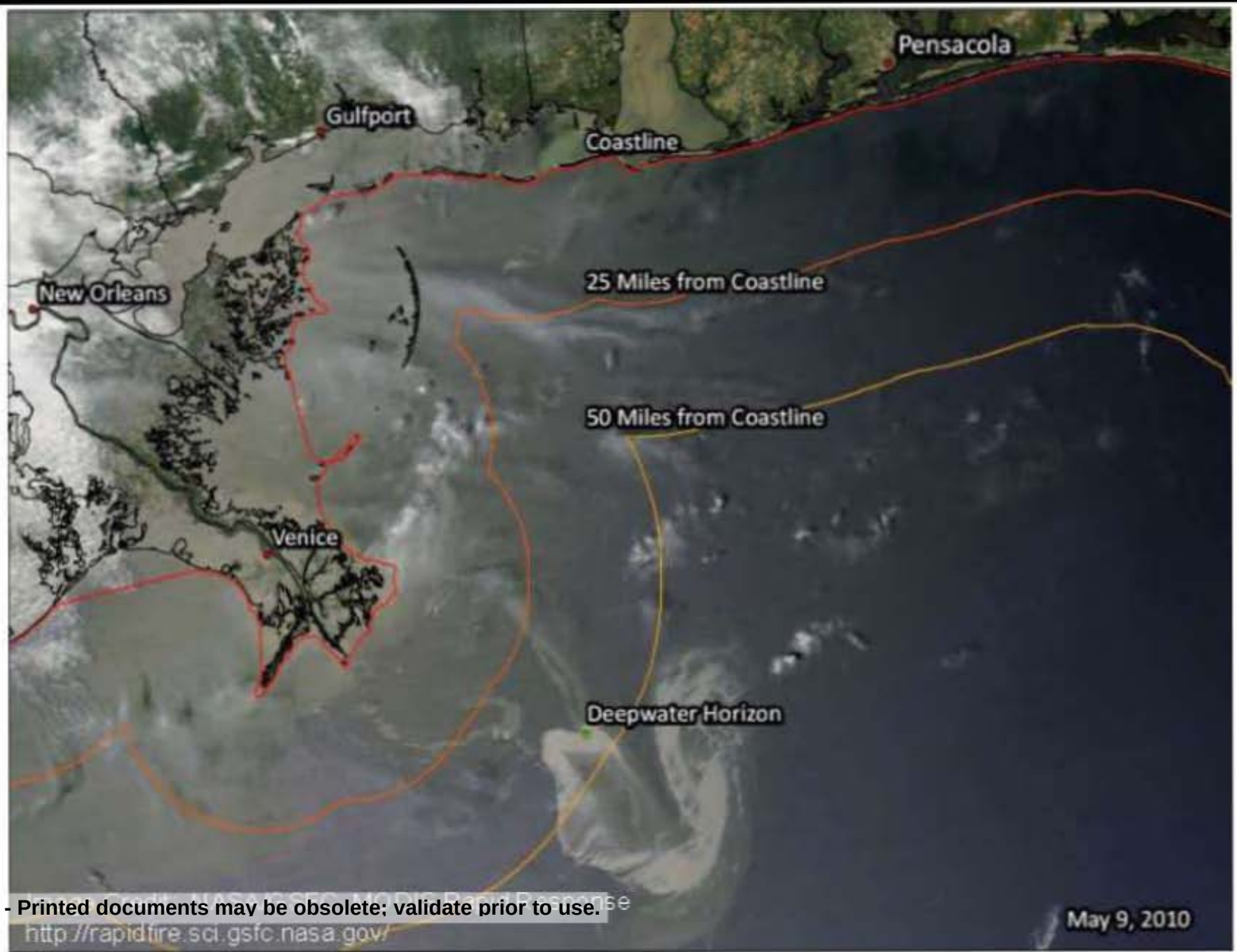


MODIS – May 4, 2010

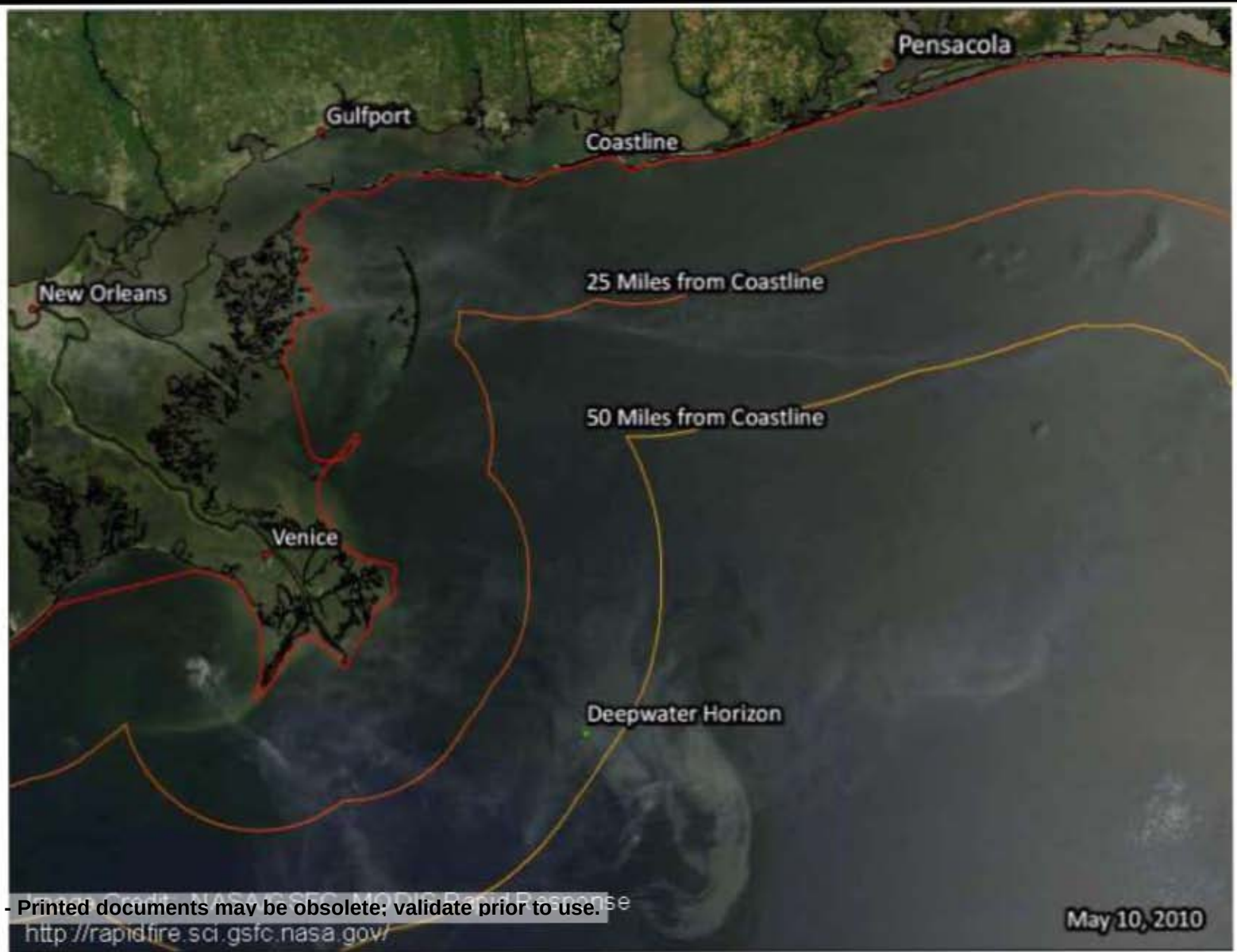
MODIS – May 8, 2010



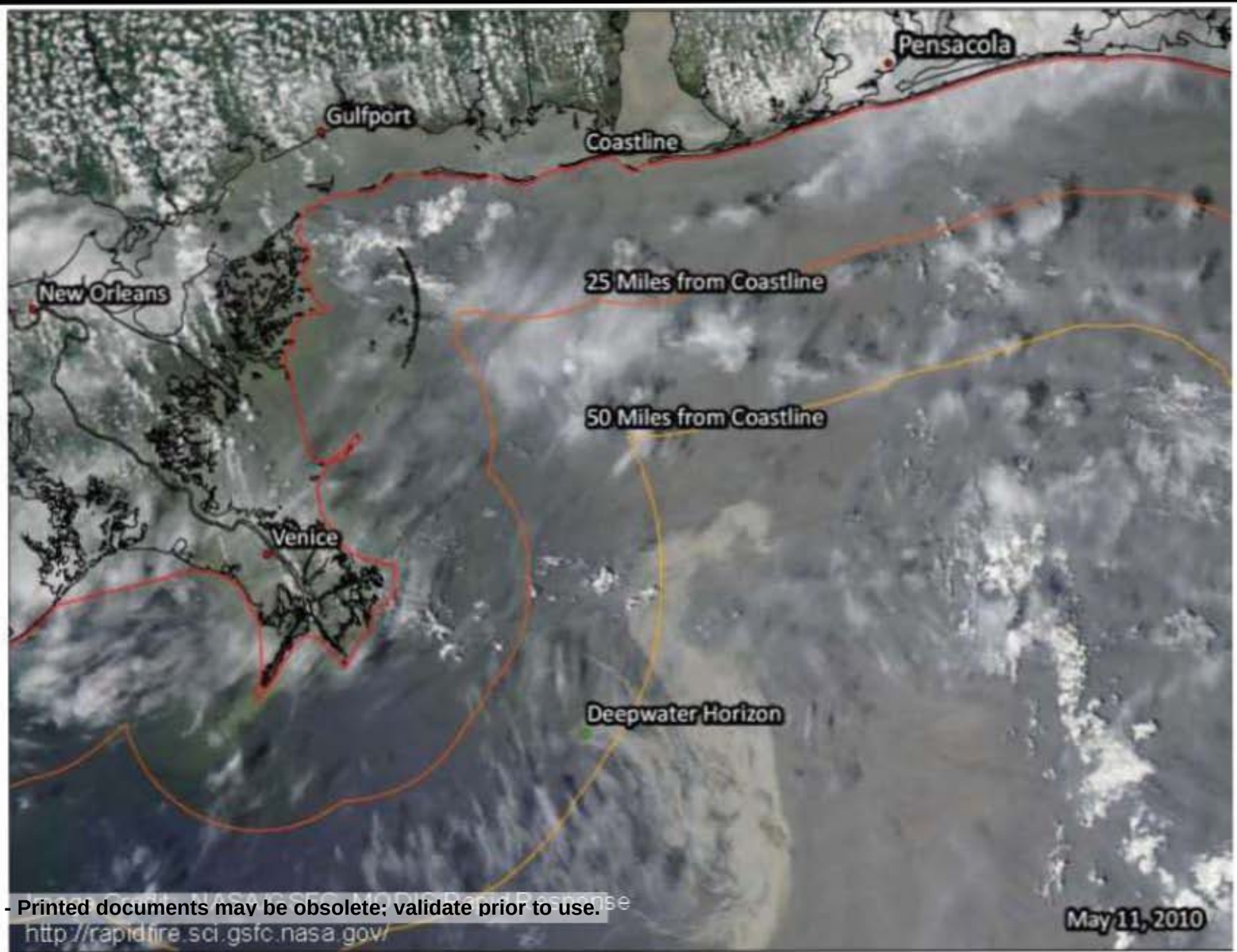
MODIS – May 9, 2010



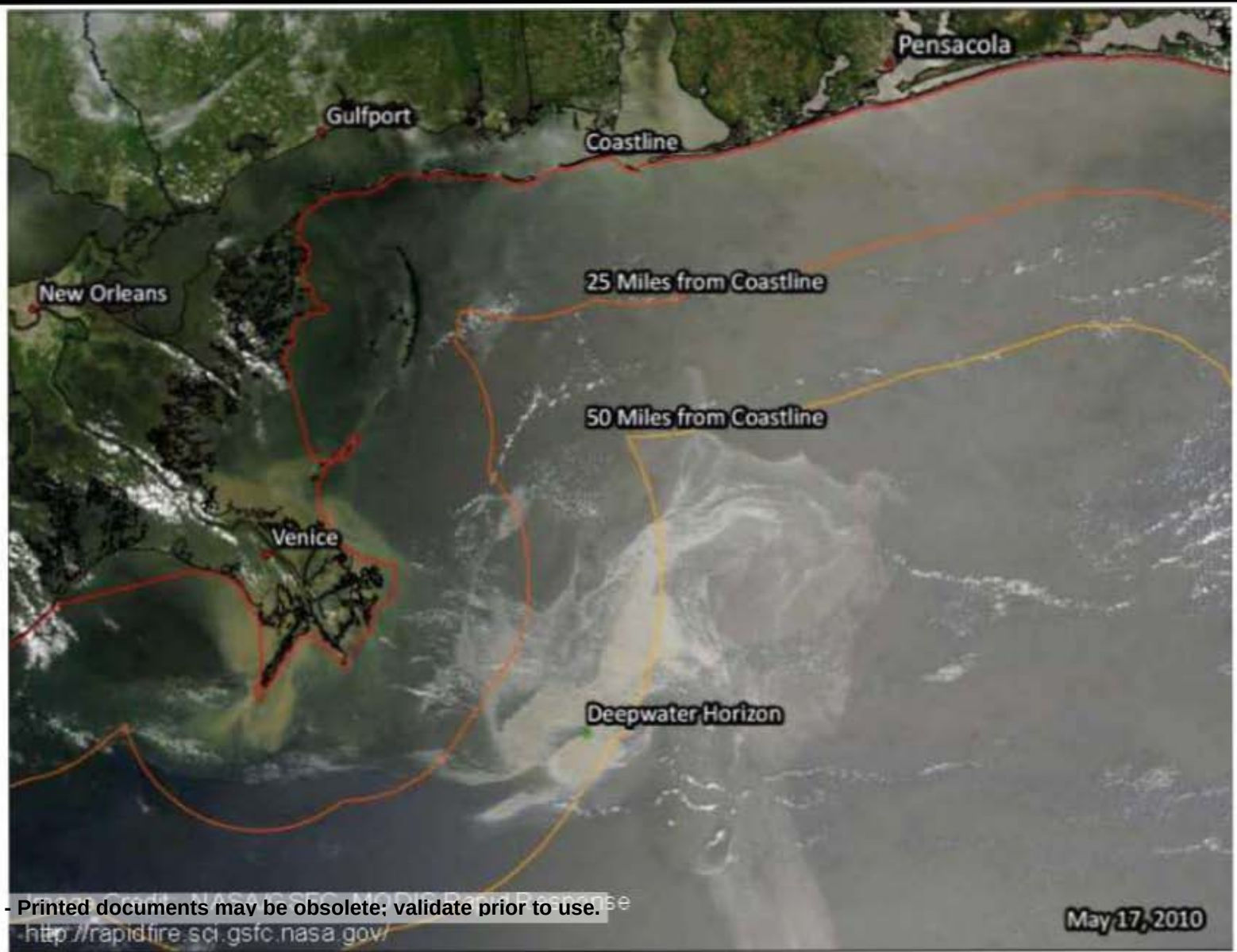
MODIS – May 10, 2010



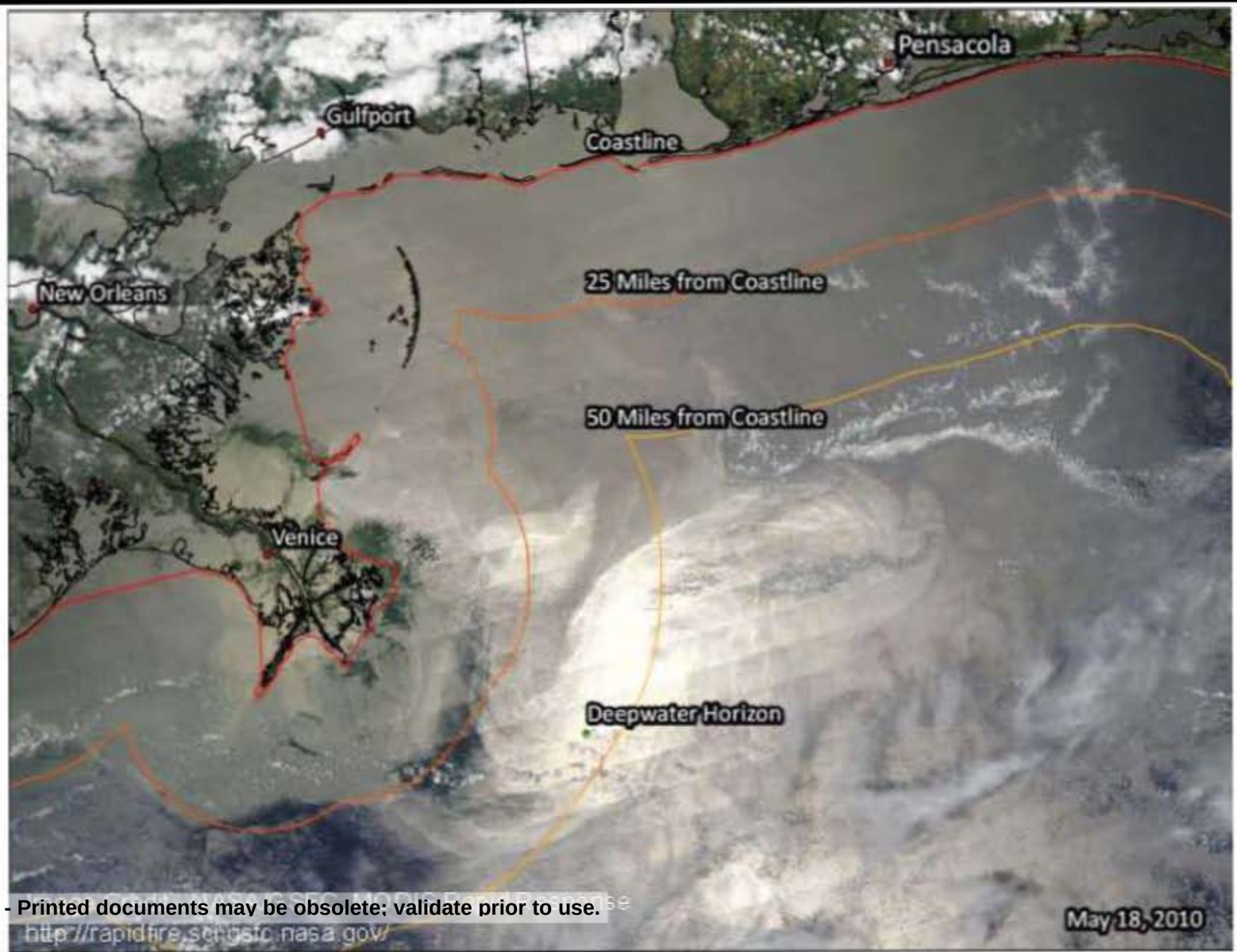
MODIS – May 11, 2010



MODIS – May 17, 2010

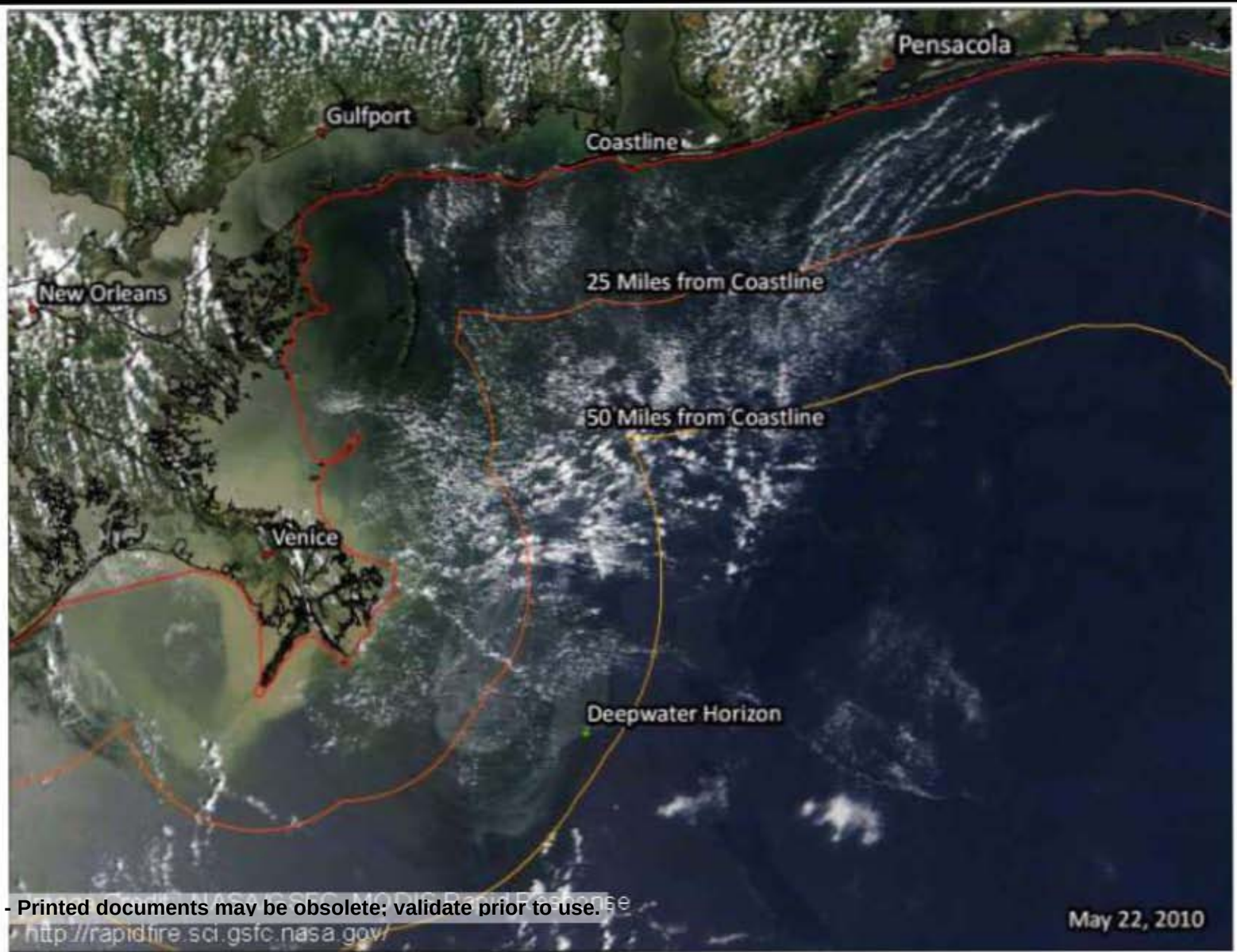


MODIS – May 18, 2010



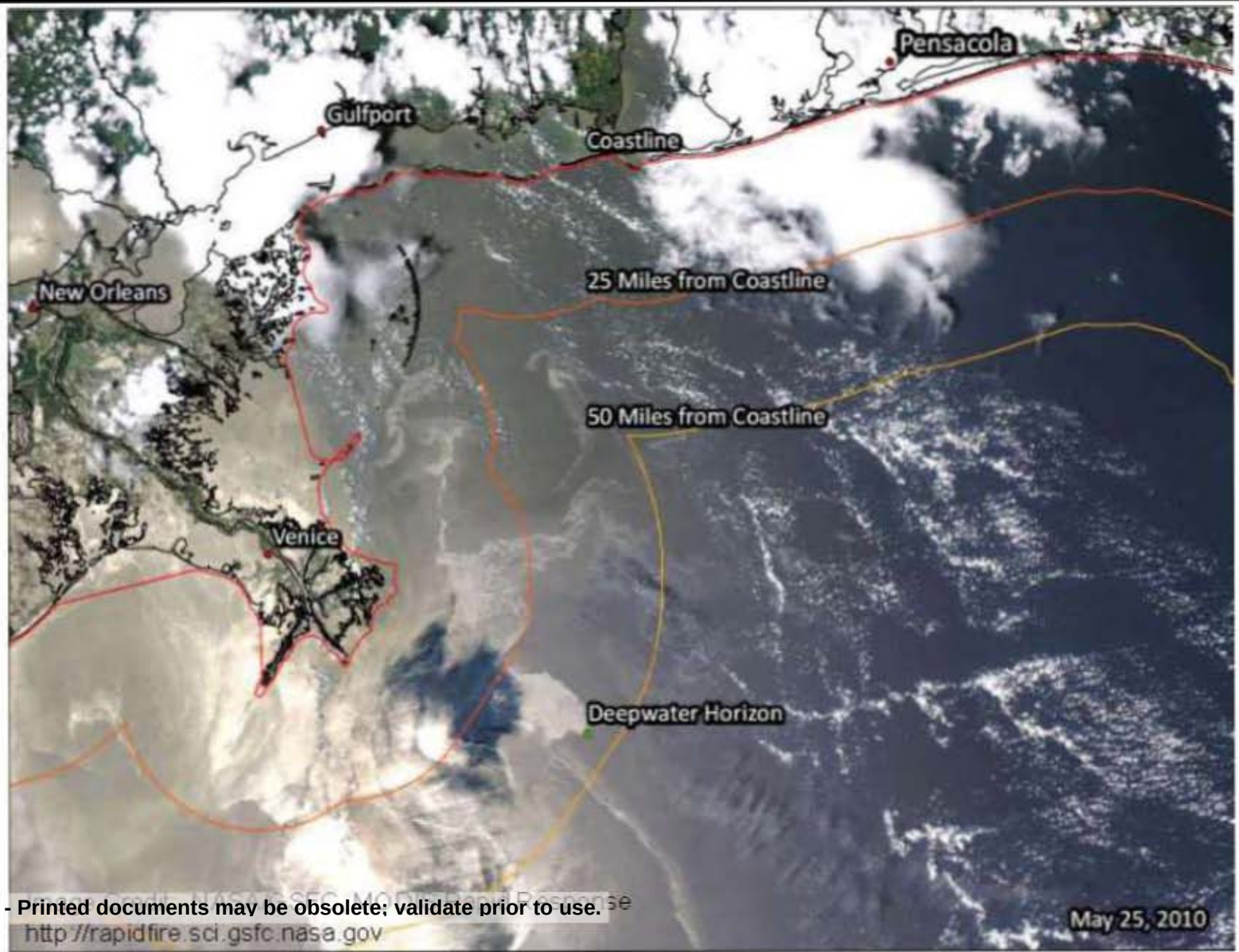
MODIS – May 20, 2010

MODIS – May 22, 2010



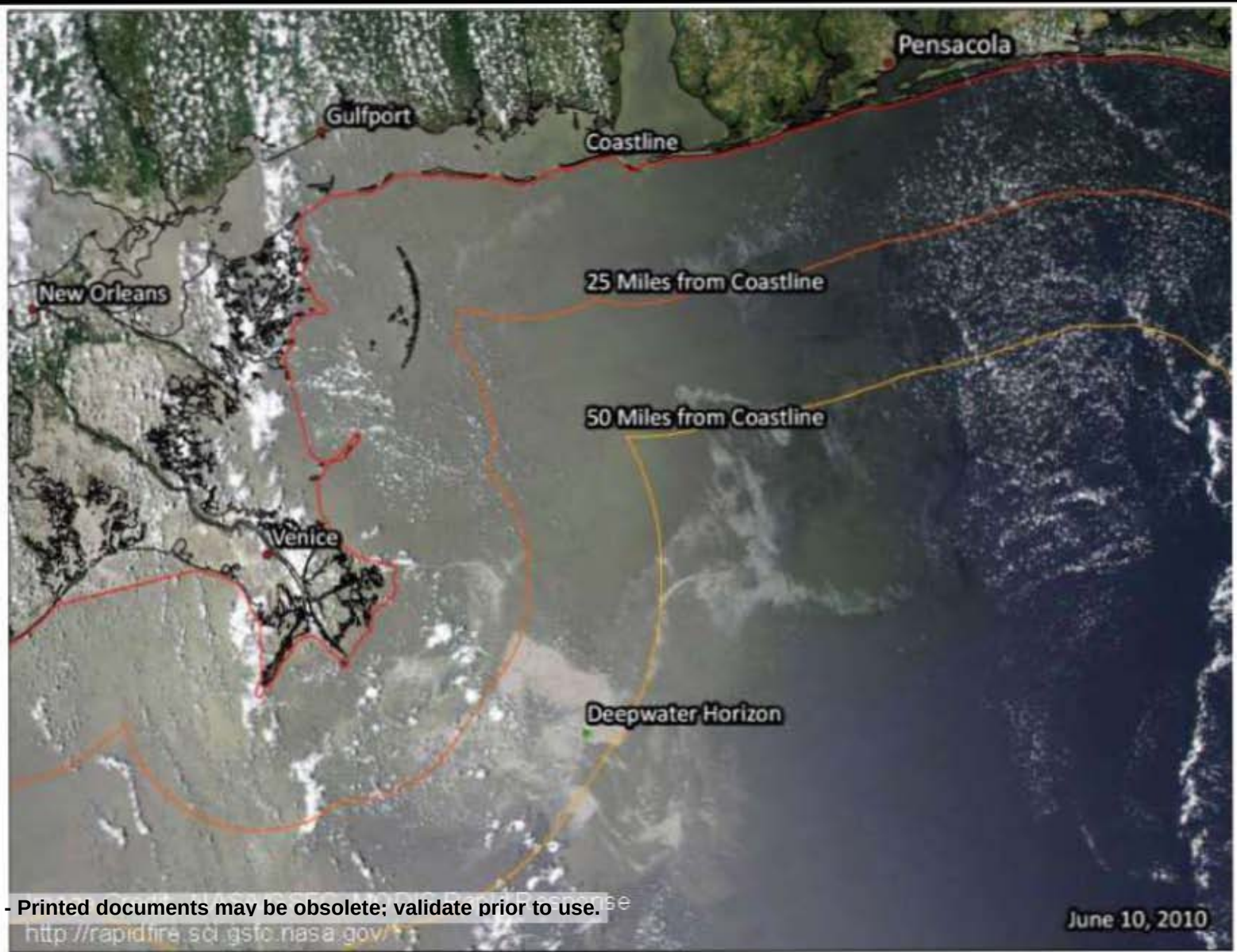
MODIS – May 24, 2010

MODIS – May 25, 2010

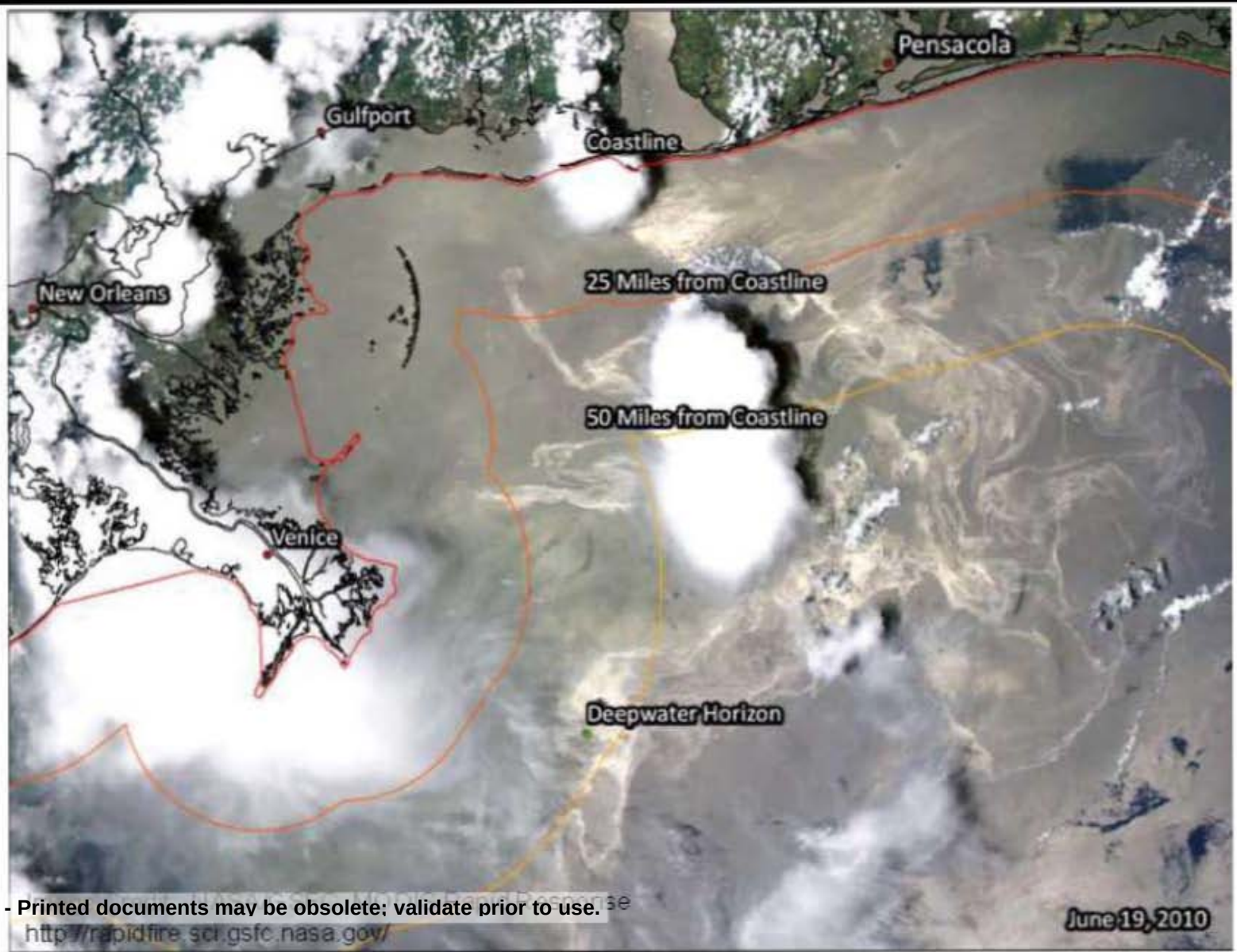


MODIS – May 27, 2010

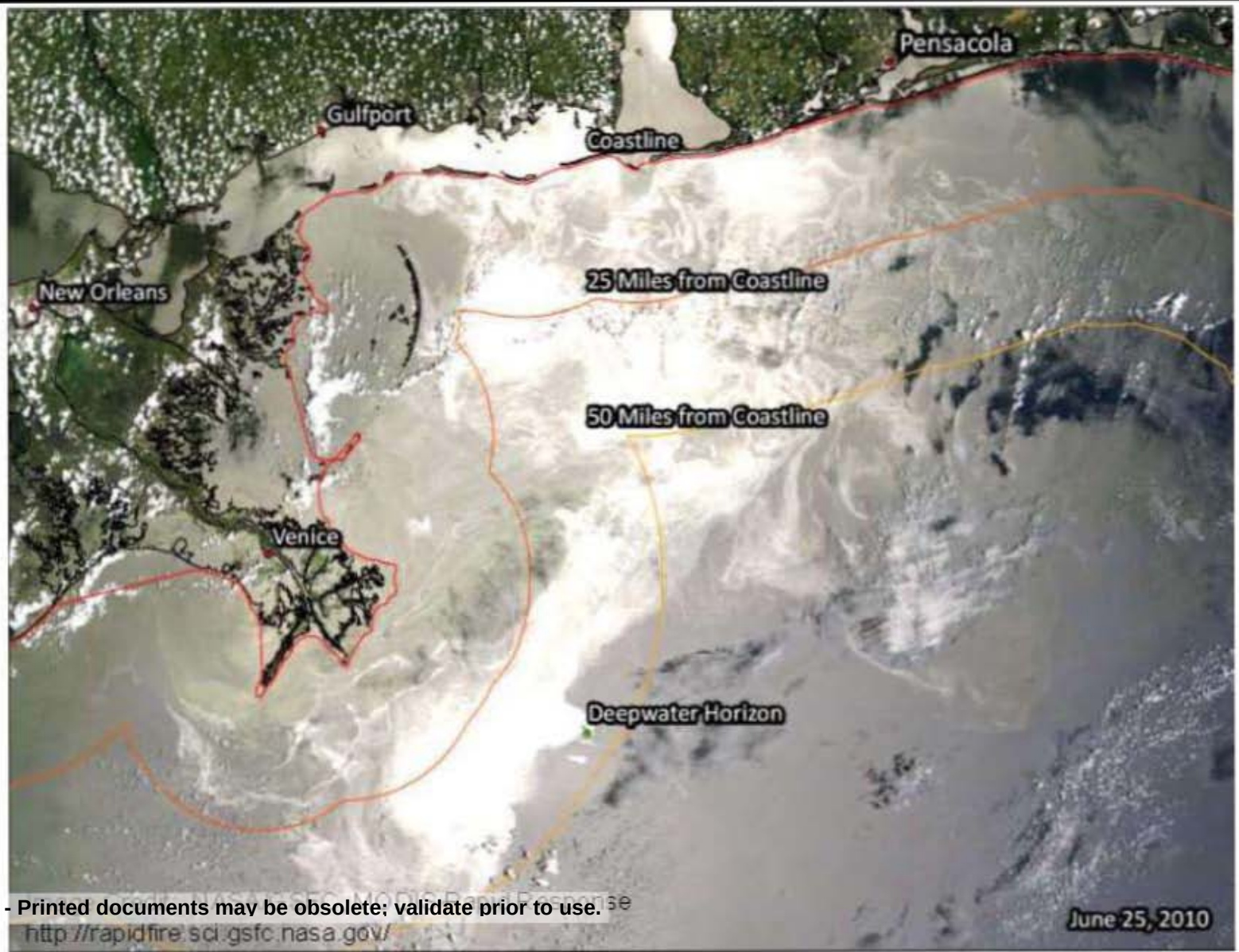
MODIS – June 10, 2010



MODIS – June 19, 2010

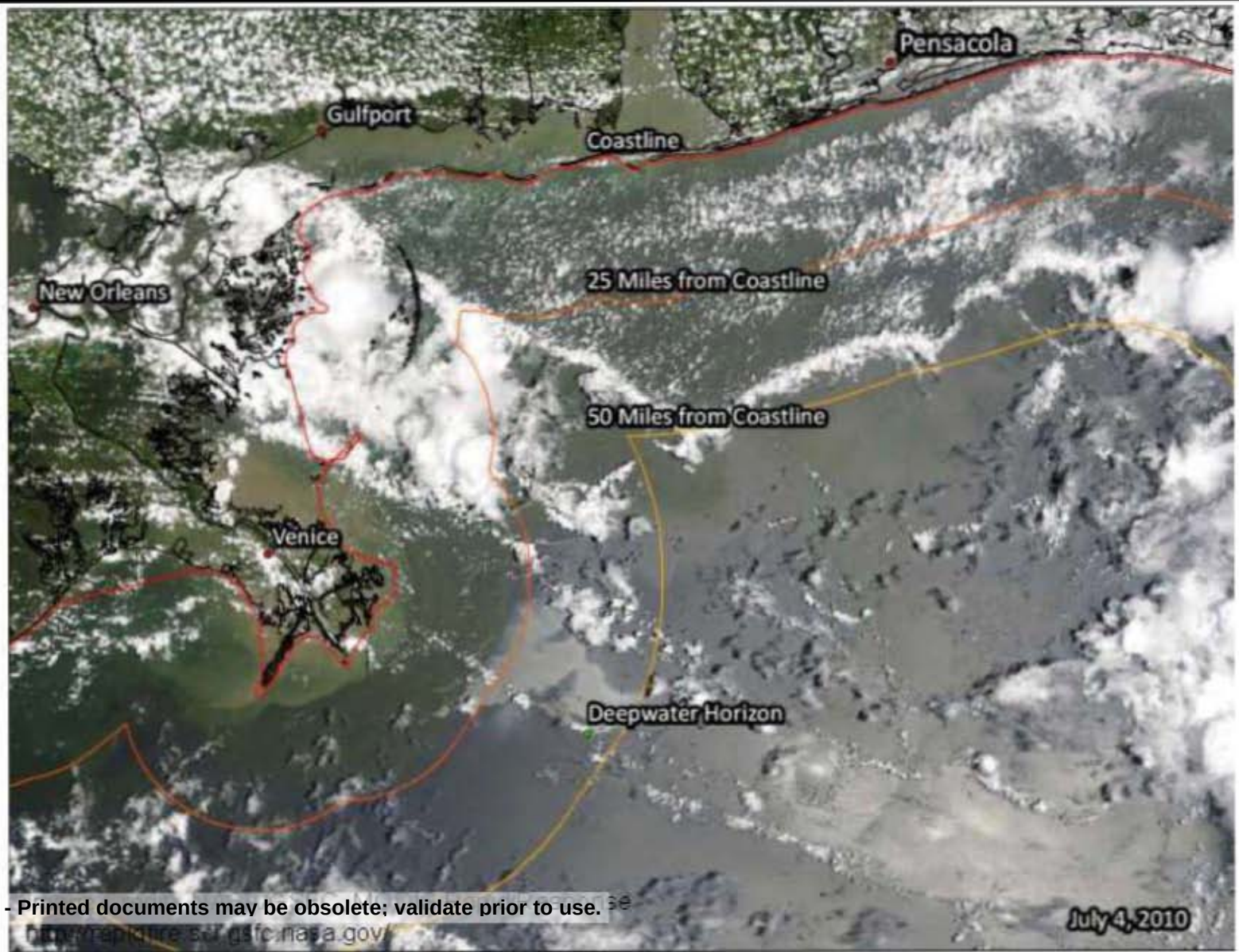


MODIS – June 25, 2010

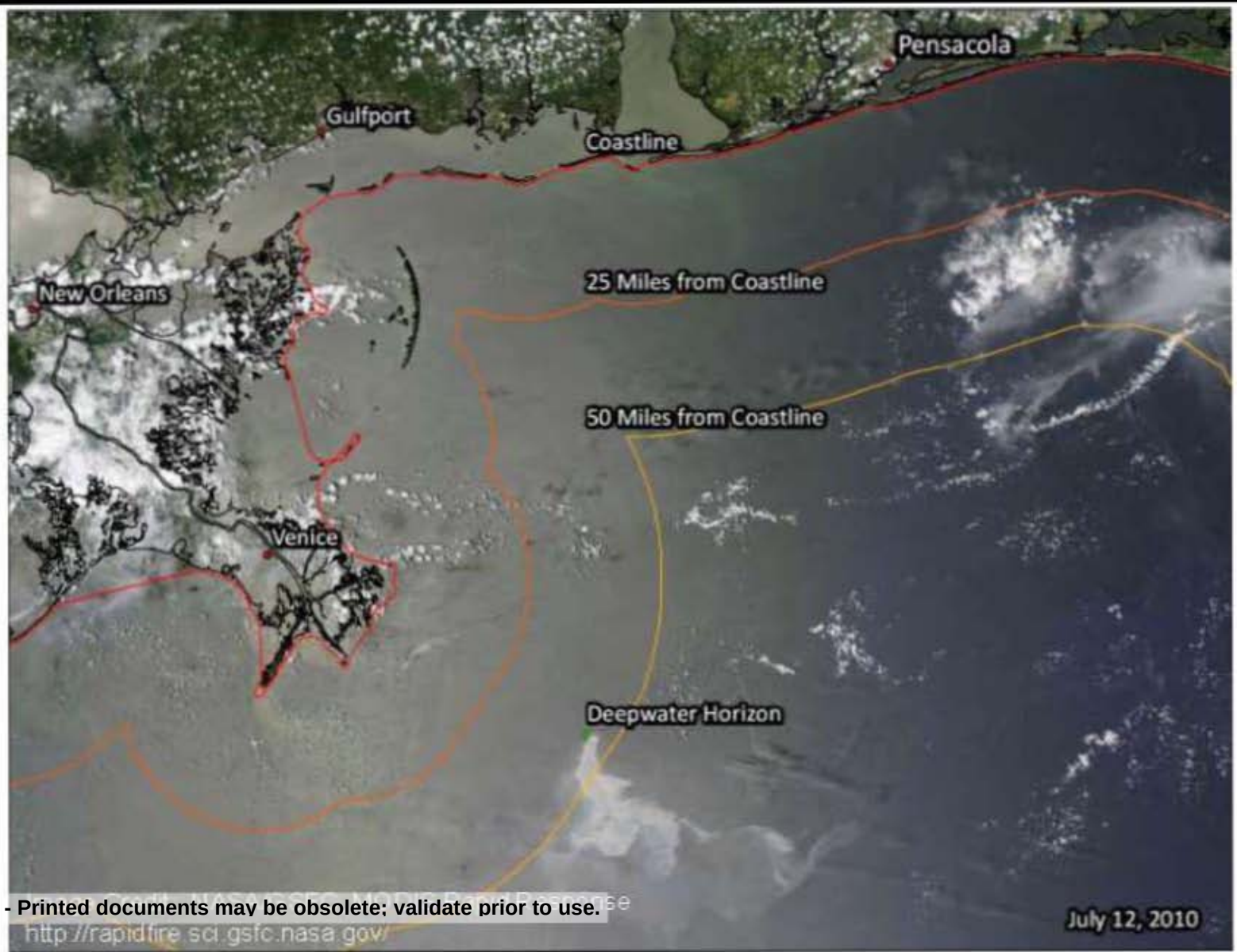


MODIS – June 26, 2010

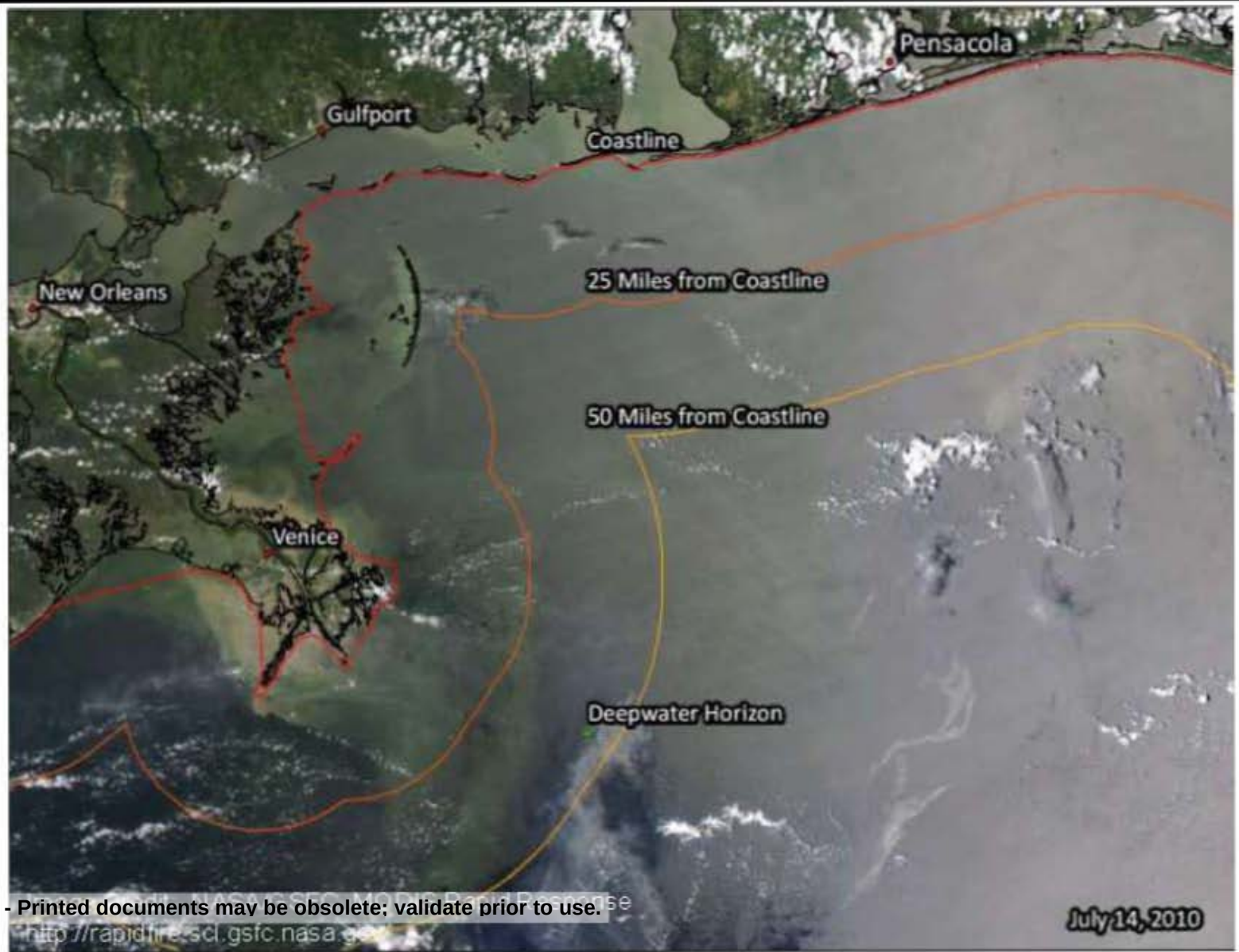
MODIS – July 4, 2010



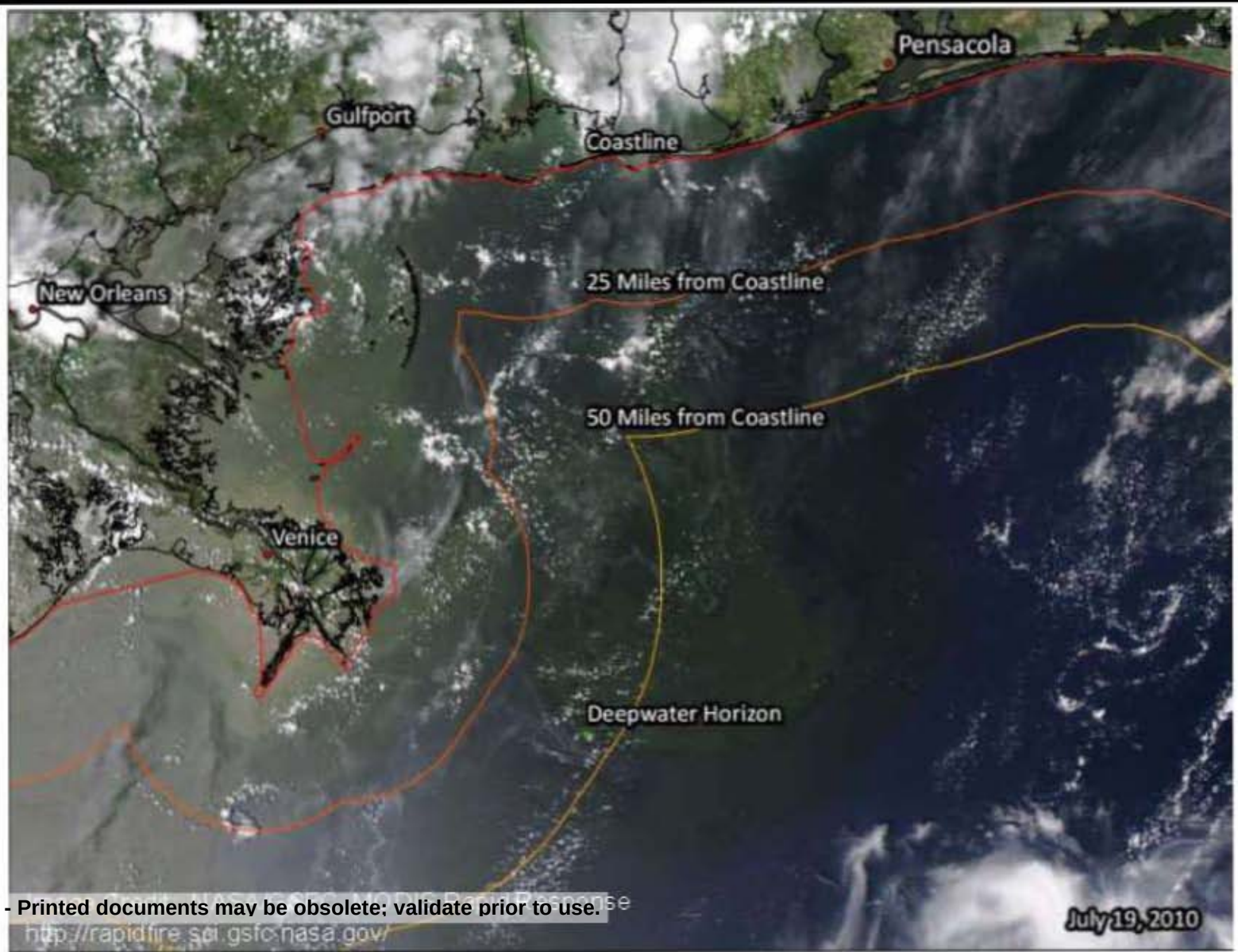
MODIS – July 12, 2010



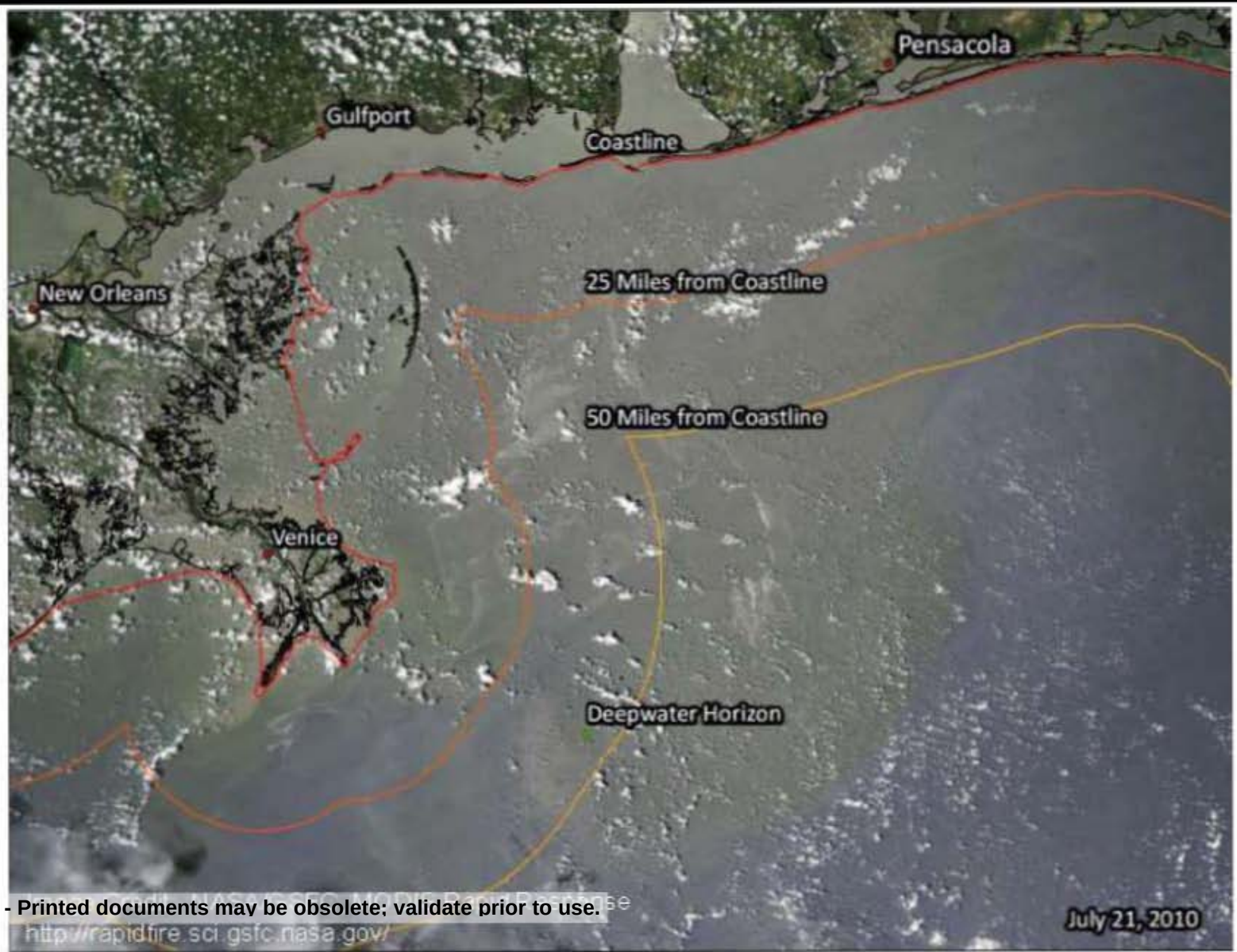
MODIS – July 14, 2010



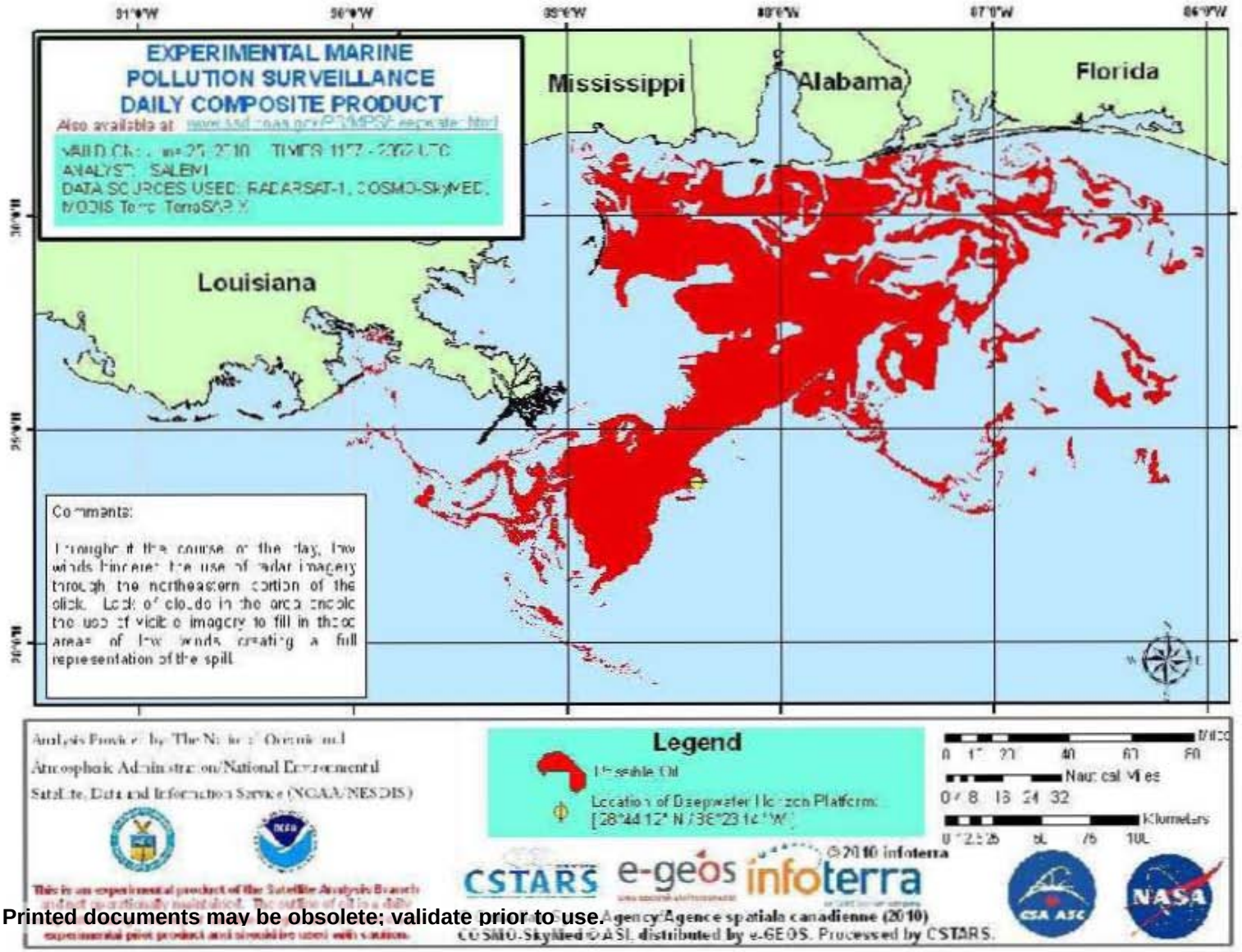
MODIS – July 19, 2010



MODIS – July 21, 2010

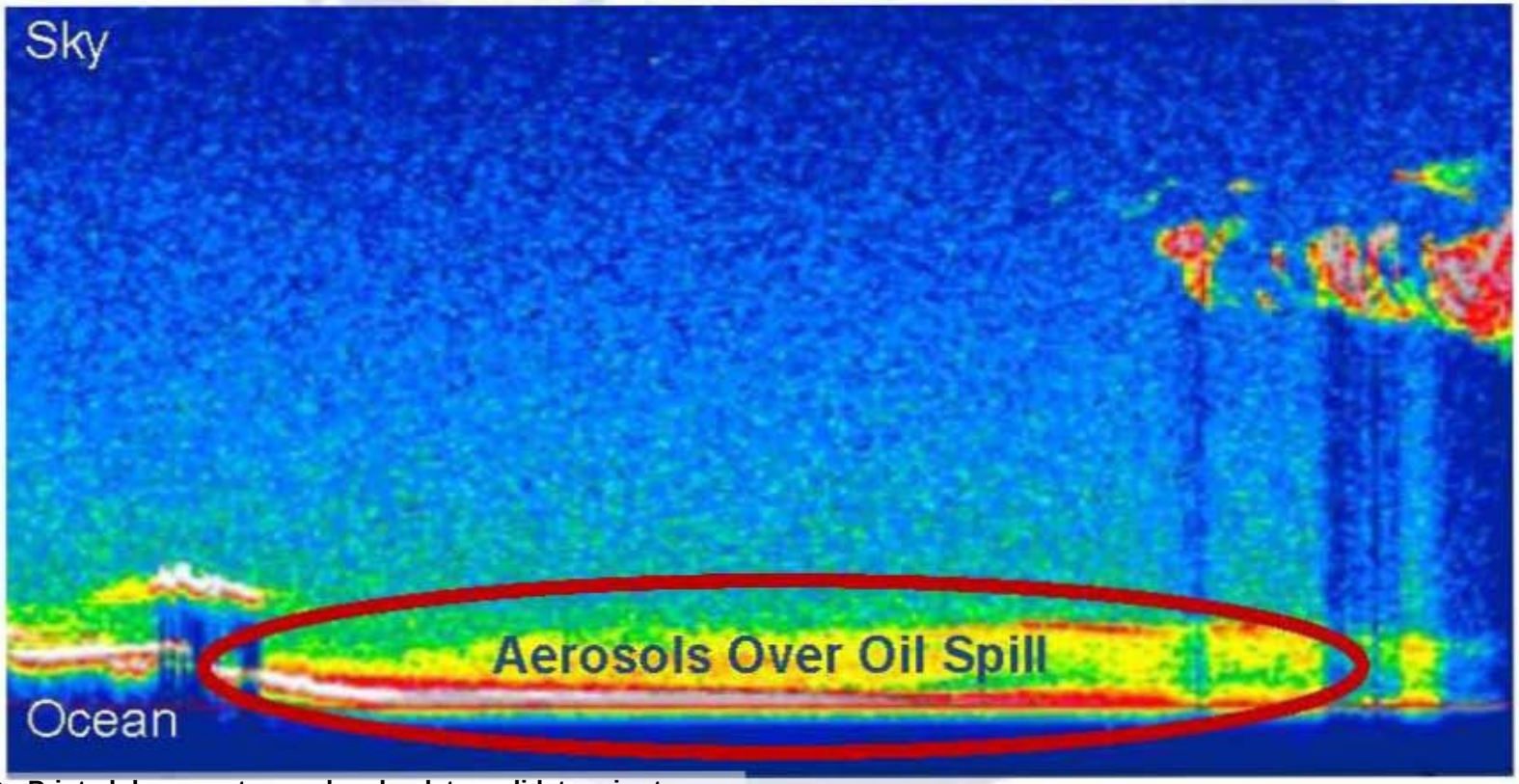


Example of a MODIS-derived Product



CALIOP

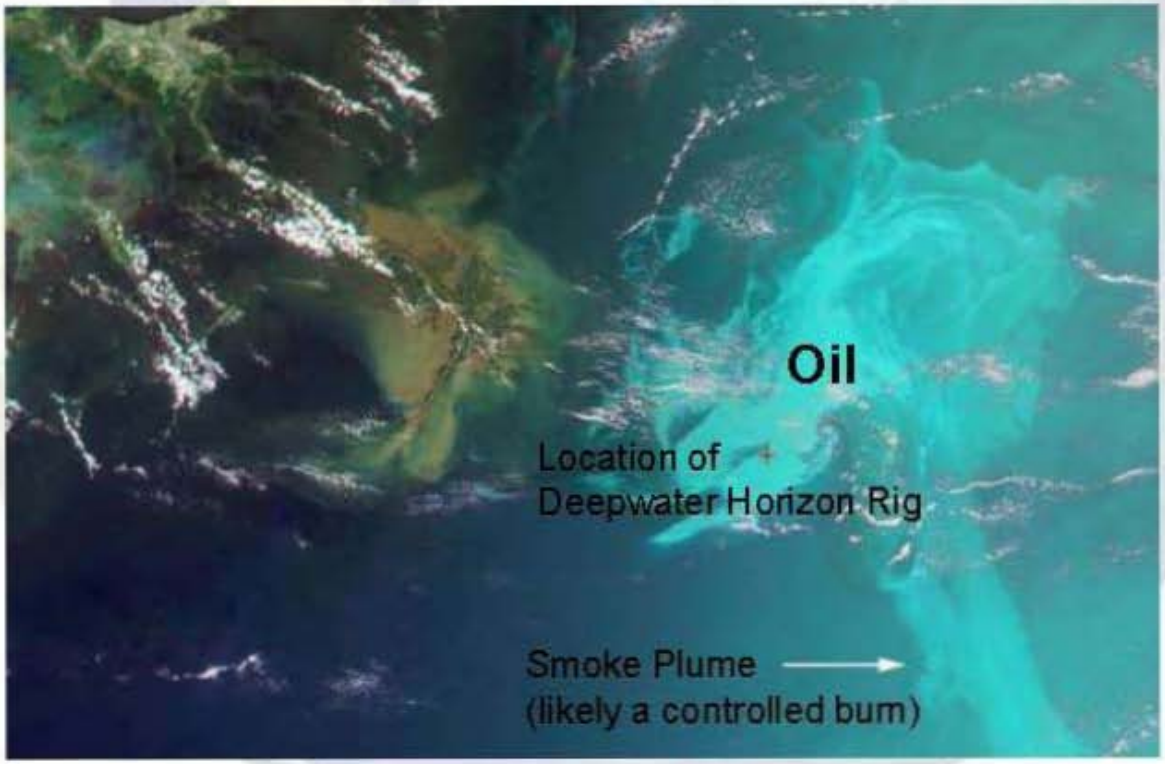
- Cloud-Aerosol LiDAR with Orthogonal Polarization
- Onboard the *CALIPSO* satellite
- NASA / CNES (French) joint sensor mission



Cross-Section View of CALIOP Data – May 2, 2010. Image Credit: NASA

MISR

- Multi-angle Imaging SpectroRadiometer
- Nine cameras with different view angles
- Experimental use for surface oil detection



MISR Image. May 17, 2010. Image Credit: NASA
Red Band (26° Forward-Viewing) + Blue and Green Bands (Nadir)

ASTER

- Advanced Spaceborne Thermal Emission and Reflection Radiometer onboard *Terra*
- NASA / METI (Japanese) joint sensor mission

ASTER Image of Mississippi River Delta. May 24, 2010.
Image Credit: NASA

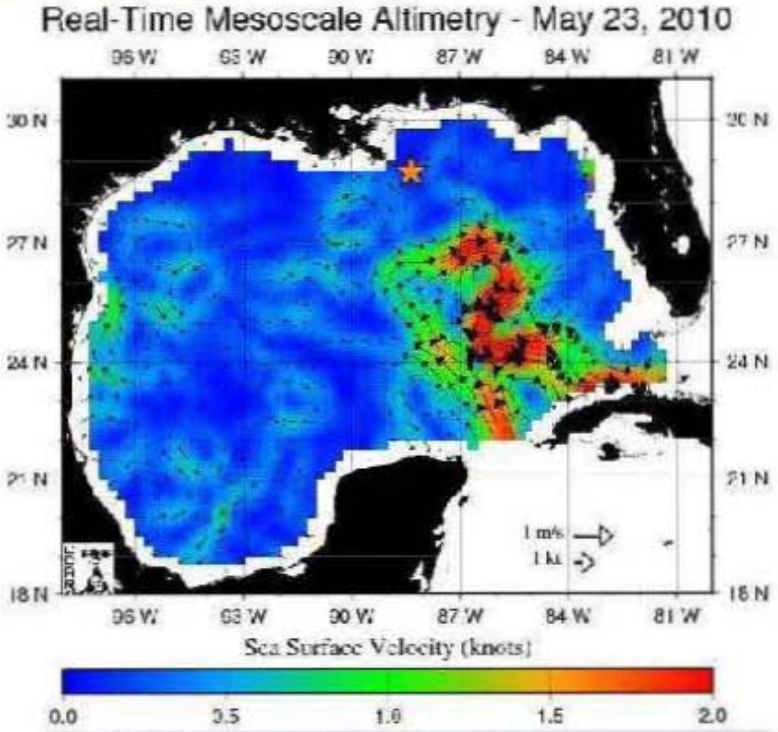
TM, ETM+, and ALI

- Thematic Mapper onboard *Landsat 5* (USGS / NASA)
- Enhanced TM+ onboard *Landsat 7* (USGS / NASA)
- Advanced Land Imager onboard *EO-1*

Landsat 5 TM Image of MS River Delta. May 5, 2009
Image Credit: USGS / NASA

Jason-1 and OSTM / Jason-2

- Jason-1 and Ocean Surface Topography Mission
- NASA / CNES (French) joint missions
- Radar altimeters – ocean surface heights



Gulf of Mexico Currents Derived from Radar Altimetry. May 23, 2010.
Image Credit: NASA/JPL/ University of Colorado

International Space Station Photography

- Astronaut photographs
- Oblique angles

Astronaut Photograph of Deepwater Horizon Oil Spill. May 4, 2010.
Image Credit: NASA

NASA Sensor Coastal Application Summary

NASA Airborne Sensors:

Sensor	Applications
HSRL	air quality, sub-surface oil (experimental), phytoplankton (experimental)
AVIRIS	surface oil thickness, wetlands health
UAVSAR	marsh oiling (experimental)
Sensor	**Applications**

NASA Spaceborne Sensors:

Sensor	Applications
HSRL	air quality, sub-surface oil (experimental), phytoplankton (experimental)
AVIRIS	surface oil thickness, wetlands health
UAVSAR	marsh oiling (experimental)
Sensor	**Applications**
MODIS	surface oil tracking, wetlands health, HABs, turbidity, etc.
CALIOP	air quality, surface oil detection (experimental)
MISR	surface oil delineation (experimental)
ASTER	wetlands health, surface oil tracking
TM / ETM+	wetlands health, surface oil tracking
ALI	wetlands health, surface oil tracking
Jason-1	sea surface height, ocean currents

Sensor Websites

http://science.larc.nasa.gov/hsrl/index.html - HSRL

http://aviris.jpl.nasa.gov/ - AVIRIS

http://uavsar.jpl.nasa.gov/ - UAVSAR

http://modis.gsfc.nasa.gov/ - MODIS

http://www-calipso.larc.nasa.gov/ - CALIPSO (carries the CALIOP sensor)

http://www-misr.jpl.nasa.gov/ - MISR

http://asterweb.jpl.nasa.gov/ - ASTER

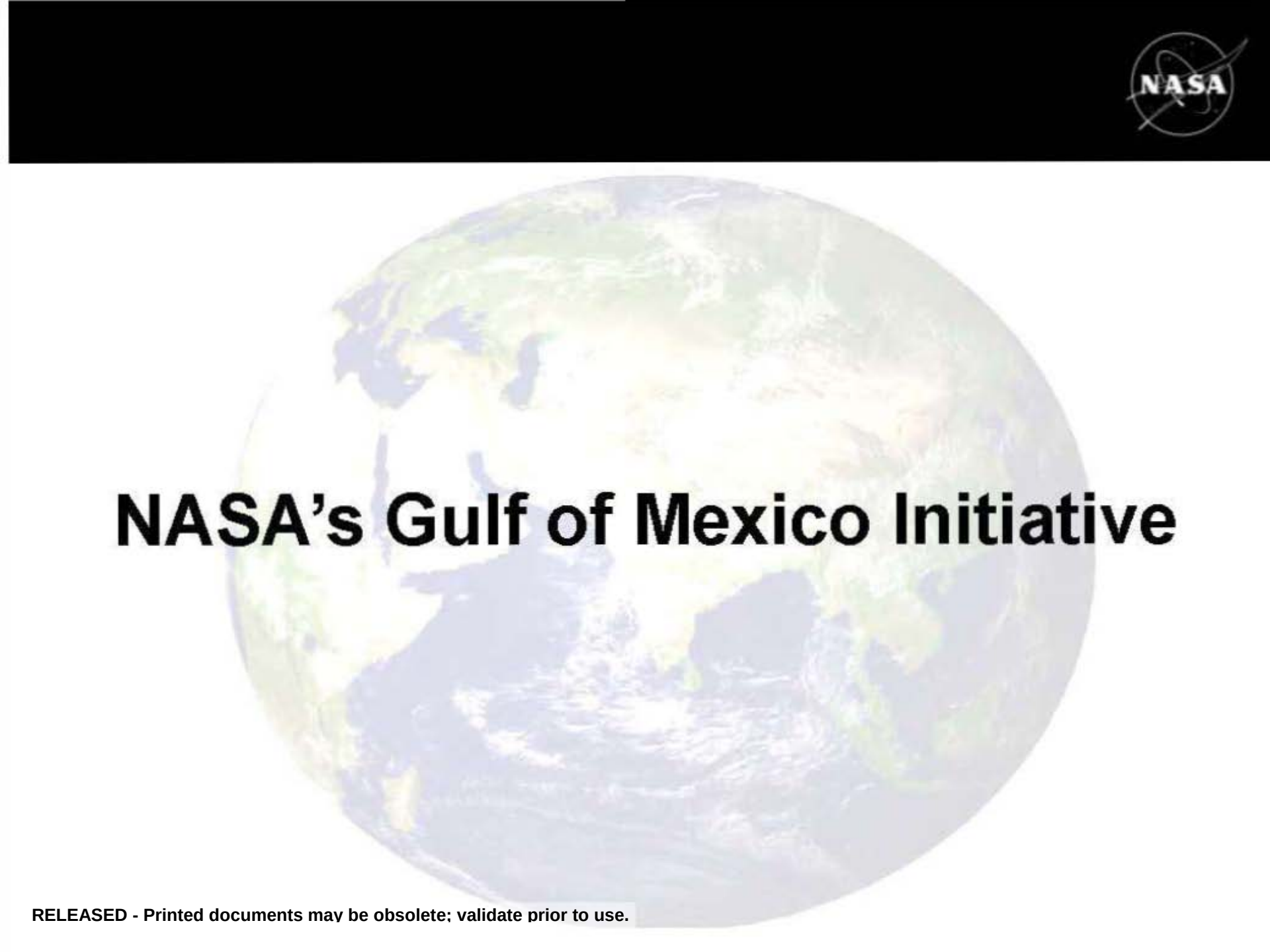
http://landsat.gsfc.nasa.gov/ or http://landsat.usgs.gov/ - Landsat TM and ETM+

http://eo1.gsfc.nasa.gov/Technology/ALIhome1.htm - ALI

http://topex-www.jpl.nasa.gov/mission/jason-1.html - Jason-1 - Jason-1

http://topex-www.jpl.nasa.gov/mission/ostm.html - OSTM/Jason-2

http://eol.jsc.nasa.gov/ or http://spaceflight1.nasa.gov/gallery/ - ISS and Astronaut Photography



NASA's Gulf of Mexico Initiative

NASA's Gulf of Mexico Initiative (GOMI)

- GOMI is managed by the Applied Science and Technology Project Office at Stennis.
- NASA has awarded over $18 million for Gulf of Mexico research since 2008.
- Before the spill, GOMI was conducting 35 projects in all 5 Gulf Coast states.

http://www.coastal.ssc.nasa.gov/

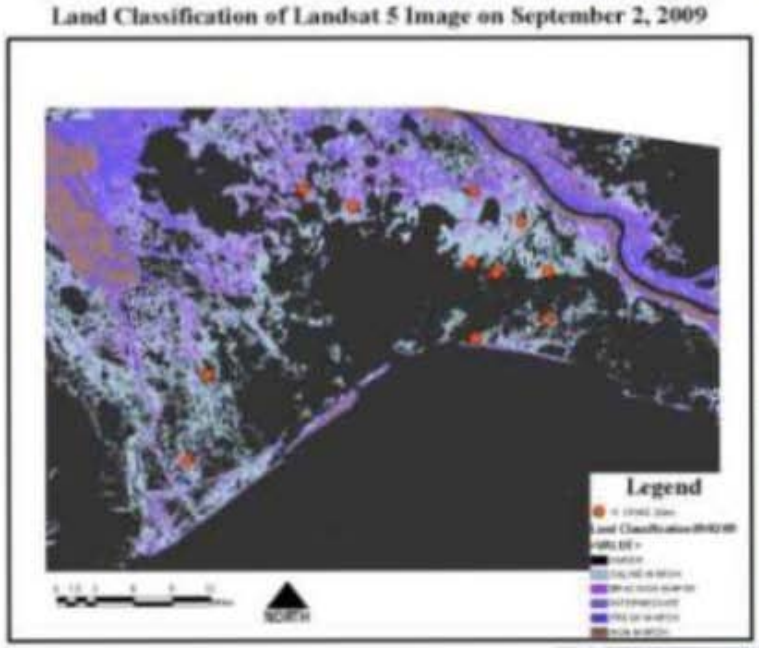
Dan Rather's Visit to Stennis

Duane Armstrong (ASTPO) and Richard Brown (CSC) Meet with Dan Rather.

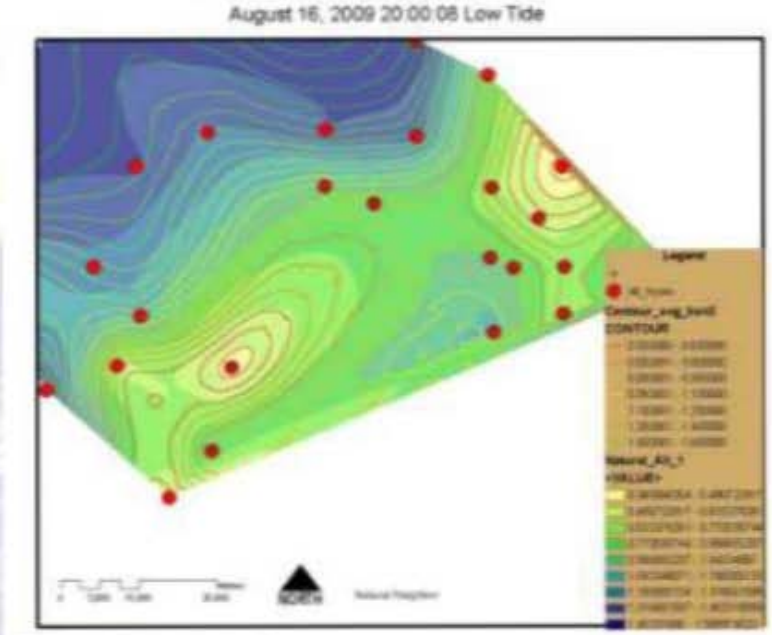
Image Credit: Richard Brown

Student Research at Stennis

- NASA DEVELOP Program
- NASA INSPIRE Program
- NASA ACCESS Program
- NASA USRP Program



Landsat 5 Classification of Barataria Bay
Image Credit: Elizabeth Malczewski



Potential Tidal Influences in Barataria Bay
Image Credit: Elizabeth Malczewski

Sources for More Information Regarding the Deepwater Horizon Oil Spill

Some Useful Websites

http://www.restorethegulf.gov

Official Federal Portal for Oil Spill Response/Recovery

http://www.geoplatform.gov/gulfresponse/

Online Oil Spill Mapping Tool

www.nasa.gov/topics/earth/features/oilspill/index.html

NASA Oil Spill Imagery and Articles

Sources for Geospatial Imagery

http://hdds.usgs.gov/hdds/

USGS Repository of Imagery and Data

ALI

ASTER

AVIRIS

Hyperion

Landsat

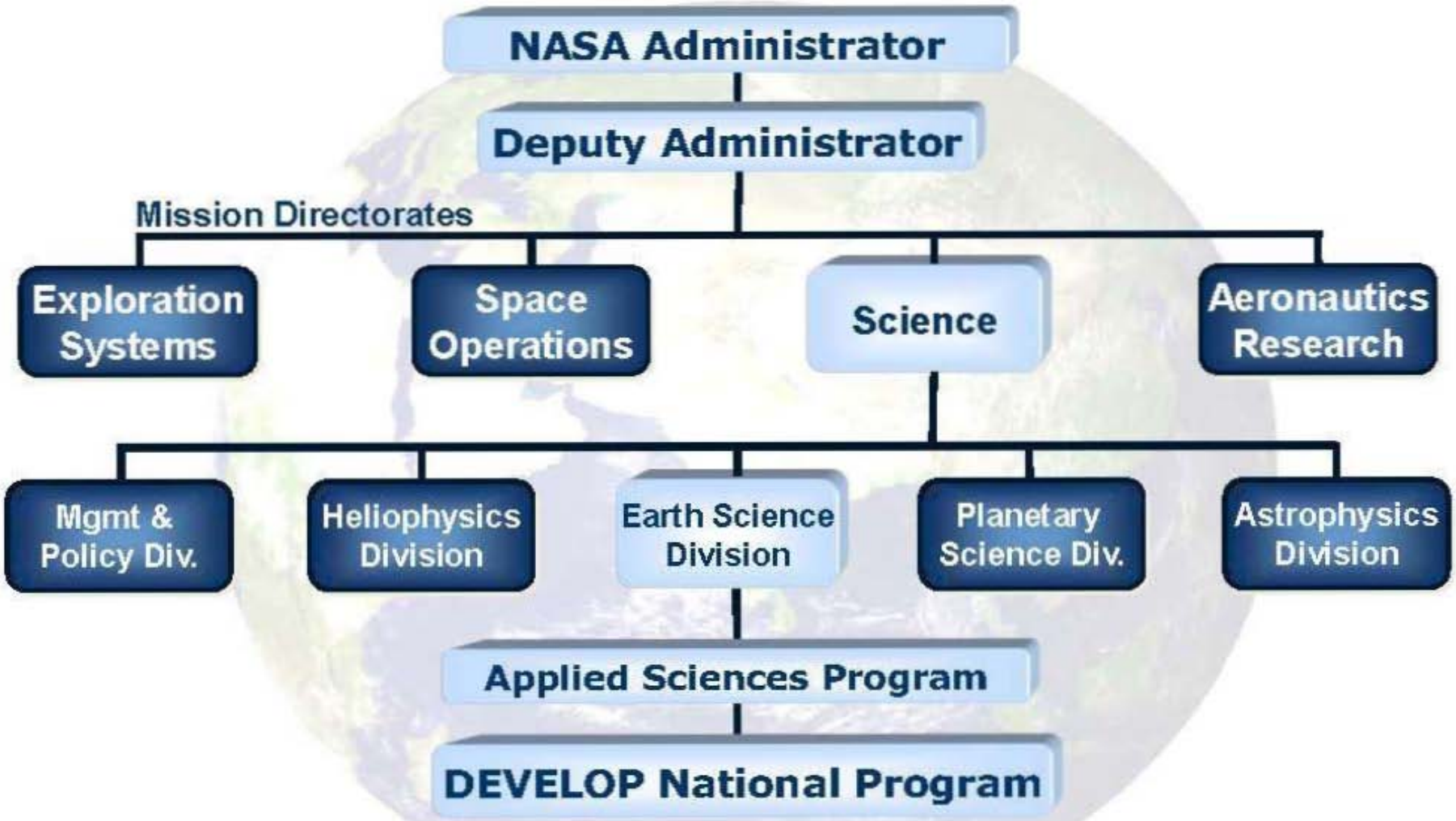
MODIS

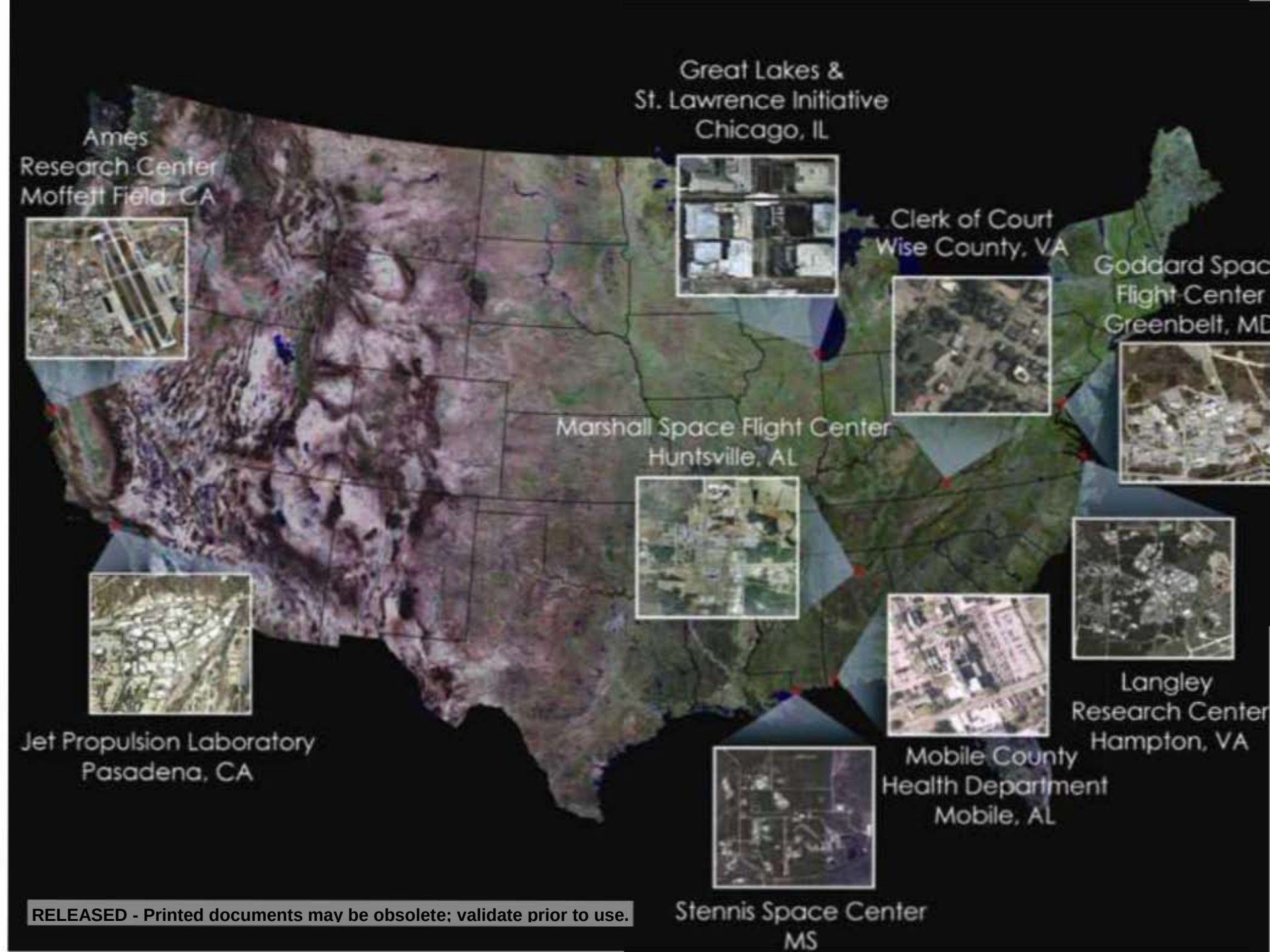
UAVSAR

Others

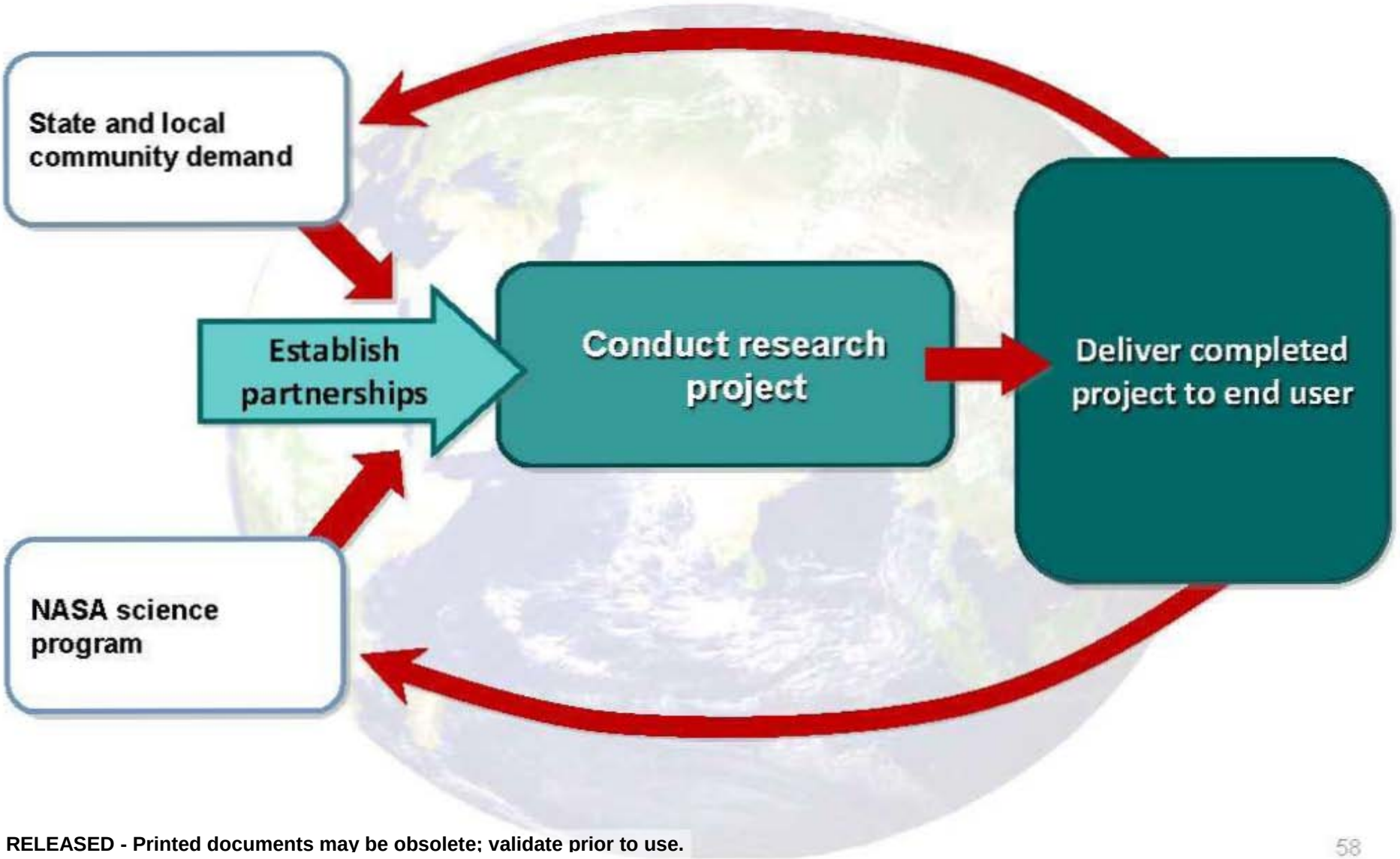
DEVELOP Program Overview and Internship Opportunities

NASA Earth Science





DEVELOP Project Lifecycle



DEVELOP Oil Spill Air Quality Project (Fall 2010)

- Stennis/Mobile/Langley DEVELOP collaboration
- Analyzing potential public health risks from oil fumes
- CALIOP, MODIS, & Ozone Monitoring Instrument
- Correlations with public health data

Example of EPA
Air Now Data for PM 2.5 (left)
Showing Moderate Levels
of PM 2.5 along the Gulf Coast
on May 29, 2010

Image Credit: EPA

Joining DEVELOP

- Spring Term: January 24 – April 1
- Application Deadline: November 15

- Summer Term: June 6 – August 12, 2011
- Application Deadline: February 28, 2011

- Paid internship
- Must have at least a 3.0 GPA on a 4 point scale
- Must be a U.S. citizen to work at a NASA center
- Citizenship not required at extension offices

http://develop.larc.nasa.gov

Questions / Comments

Questions?

Comments?

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5b. GRANT NUMBER

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Stodghill, Josh (2)

5d. PROJECT NUMBER
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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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(2) NASA DEVELOP Program, 251 North Bayou Street, Mobile, AL

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14. ABSTRACT
The Power Point presentation gives an overview of both the airborne and spaceborn remote sensing missions that NASA used to collect imagery and data over the Deepwater Horizon Oil Spill. It also provides basic information about some of the ongoing NASA and university research projects that are utilizing the aforementioned data. The presentation also discusses the importance of NASA's Gulf of Mexico Initiative to research in the Gulf of Mexico. The presentation concludes with information about how students can get involved with NASA-sponsored applied science projects by interning with the NASA DEVELOP student program.

15. SUBJECT TERMS
Geographic Information Systems (GIS), Terra, Nonpoint Source pollution, watersheds, Remote Sensing, Deepwater Horizon Oil Spill, coastal, earth science, airborne, spaceborne, North Alabama University, DEVELOP

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19b. NAME OF RESPONSIBLE PERSON
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