ICCAGRA USGS Update

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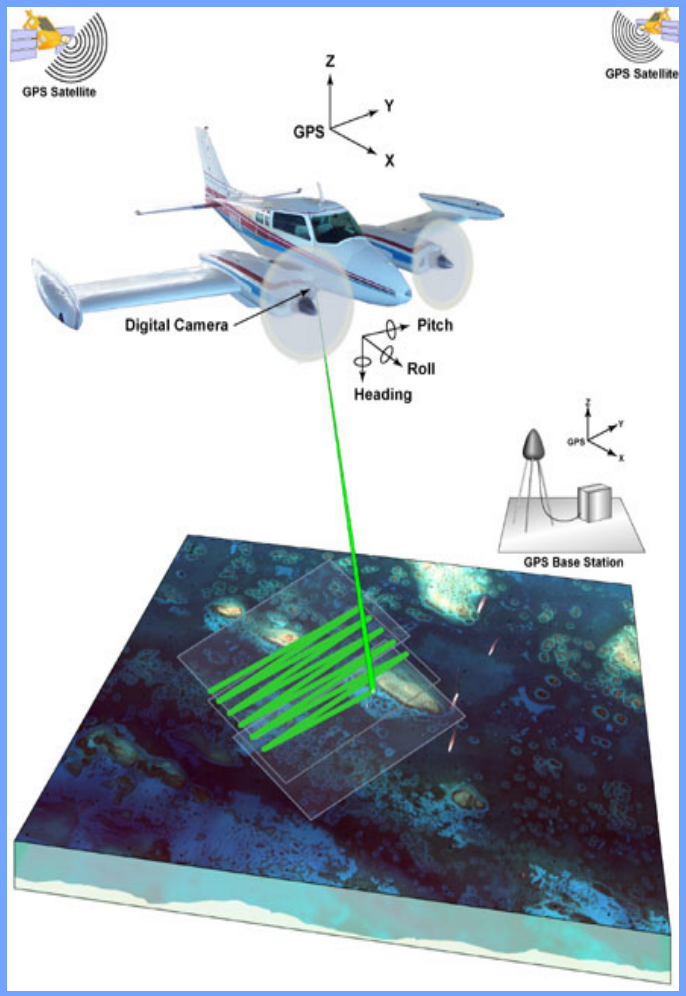
U.S. Department of the Interior
U.S. Geological Survey

EAARL Specifications



- Raster scanning 'full waveform', low power (70µJ) green-only (532nm) cross environment (topo/veg/ bathy) lidar
- Peak Pulse Rate = 5000Hz
- Short pulse (< 2ns FWHM) and small 15-20 cm diameter footprint
- Digitizer sample interval 1ns (15cm in air, 11cm in water)
- One Hz 15cm CIR and 40cm RGB digital imagery
- Planned system upgrades in 2010
  - 6x (30kHz) “effective” pulse rate with 2x increase in data volume
  - Sub nanosecond laser pulse width
  - Enhanced shallow and deep bathymetry performance

Experimental Advanced Airborne Research Lidar

USGS

EAARL Schedule (2010-2011)

Color / Font scheme:	EAARL 1	EAARL 2	Completed surveys / Tasks	*Unconfirmed surveys (italics)*							
2009											
September	October	November	December								
Frasier Forest, CO (USFS / Jim McKean)	EAARL Upgrades (w/ R. Russel)	Nor'Ida surveys (Cape Henlopen to Okracoke Inlet for Abby; CAHA, FIIS and Sandy Hook for NPS)									
2010											
January	February	March	April	May	June	July	August	September	October	November	December
Shenandoah River	NGOM region										
EAARL upgrades (development of EAARL 2)											
		ALPS software development for EAARL 2									
						Hurricane Season - Surveys as needed					
		ASIS - (NPS NCBN)			PAIS / BITH - (NPS-GULN)						
		Suncook River, Buzzards Bay					Cape Canaveral	Lemhi River - BPA	Cape Cod	*NGOM lower Atchafalaya Survey*	
								Southern Colorado River (NPS SCPN)		*FL Keys Great White Heron NWR*	
Potential (unconfirmed) EAARL Surveys											
St. Thomas, USVI	1 month	Summer/Fall									
SCPN - Colorado	3 weeks	Summer w/ Lemhi River									
Suncook River, NH	1 week	Fall w/ Buzzards Bay, Cape Cod									
FL Keys GWH NWR	3 weeks	Fall/Winter									
Cape Canaveral	1 week	Spring/Summer									
2011											
January	February	March	April	May	June	July	August	September	October	November	December
	St. Thomas Survey on NOAA aircraft										
FL Keys Great White Heron NWR											
						Hurricane Season - Surveys as needed					

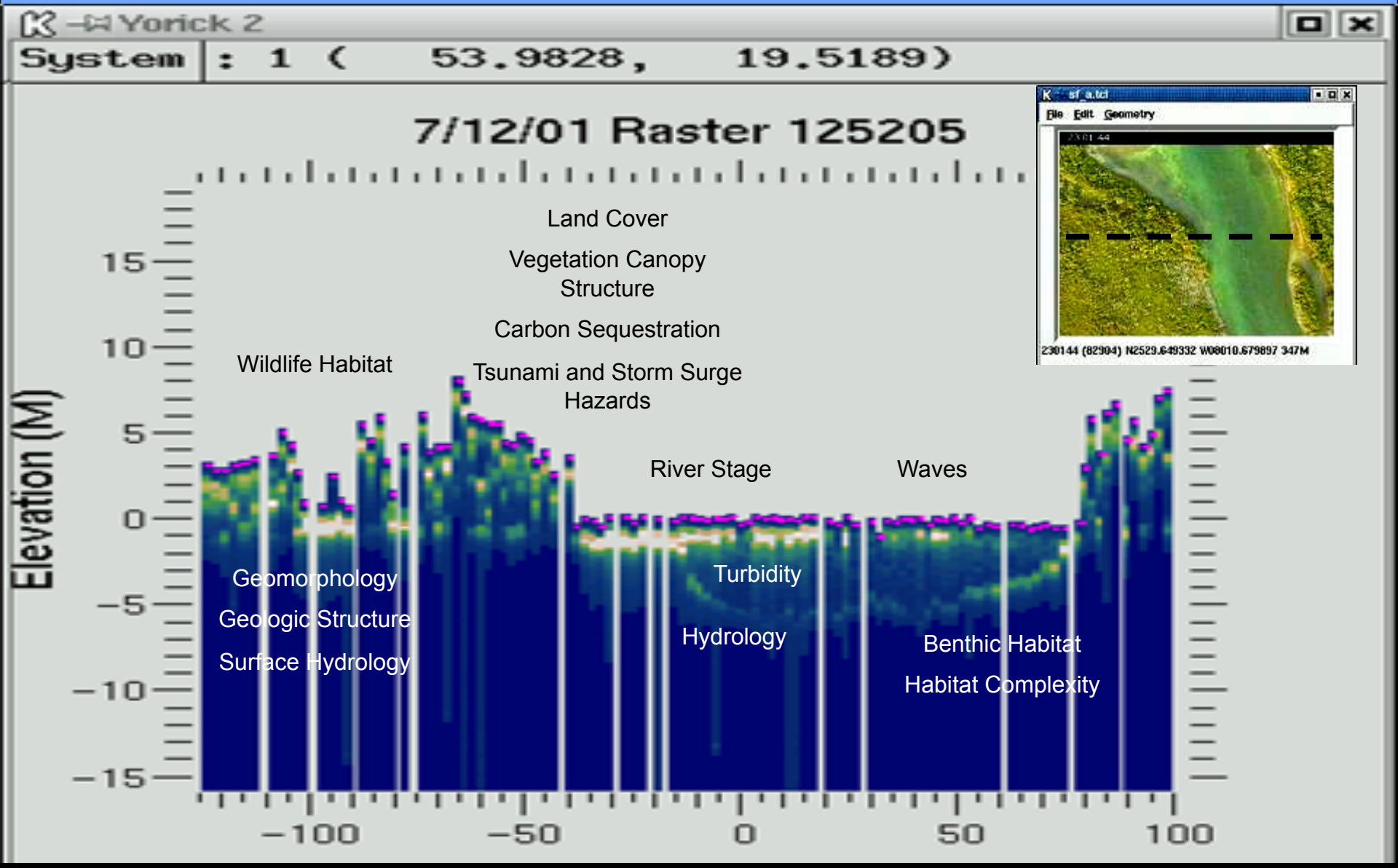
The 1st Generation EAARL (2002 – 2009)

Baseline coral reef geomorphology
Coral reef ecology
Coral reef genesis and sea level rise
SLR and coastal inundation forecasts
Coastal change hazards
Mapping depositional environments
Vegetation canopy mapping
Wetland vegetation mapping
Wetland hydrology
Fluvial channel mapping

USGS – NASA Collaboration → USGS Research Lidar Infrastructure

Lidar Fosters Integrated - Interdisciplinary Science

(especially “waveform lidar”)



Lidar is a “Back to the Future” Technology for the USGS

The 2nd Generation EAARL (2010 - ?)

EAARL+ will have greatly enhanced capabilities for surveys of:

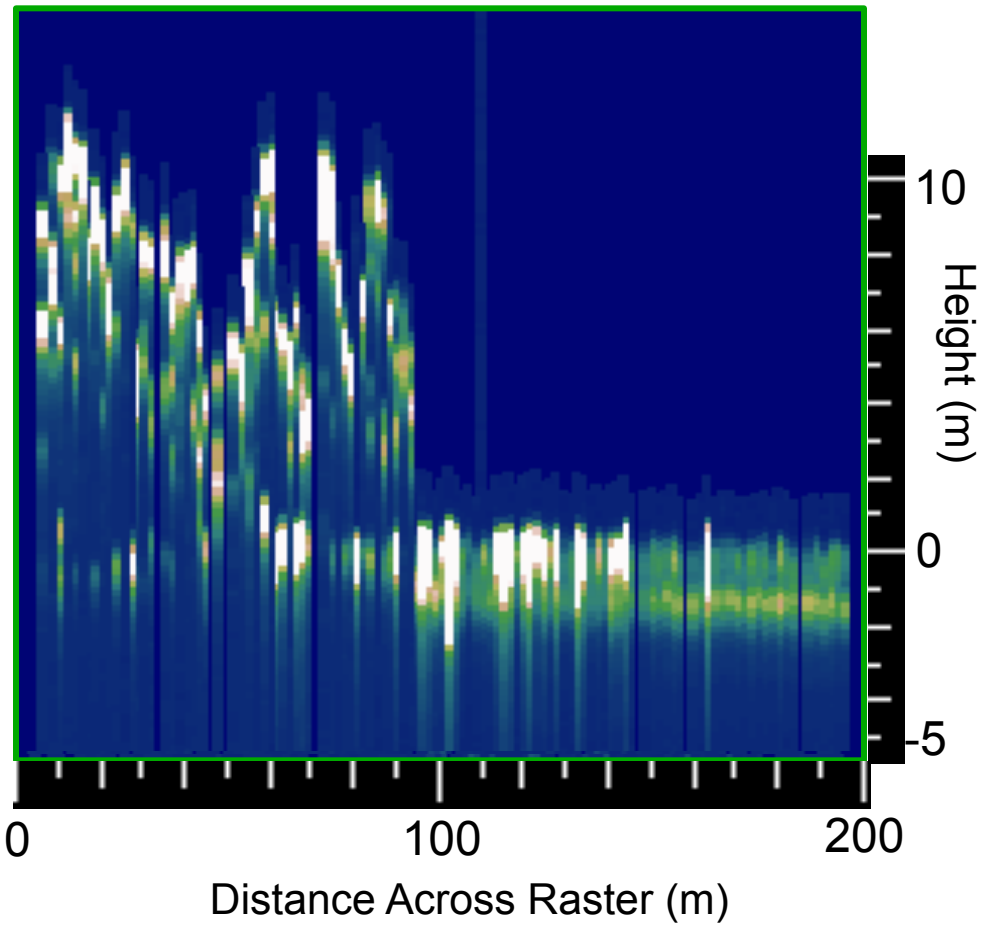
The 0 to -10m coastal "gap" in bathymetry coverage
River channels and adjacent ecological corridors
"Deep" (20 – 40 m) bathymetric coverage
Sounding over dark substrates at all water depths
Vegetation canopy structure

Slated Improvements:

- 6x increase in sampling density
- 30,000 Peak samples/second (previously (5K/sec)
- Only 2x increase in data volume
- Enhanced shallow bathymetry performance
- Enhanced deep (20-40m) bathymetry performance
- Sample spacing reduced from 2m x 3.0m to 1m x 1.5m

2 – 3 EAARLs could be operational within the next several years

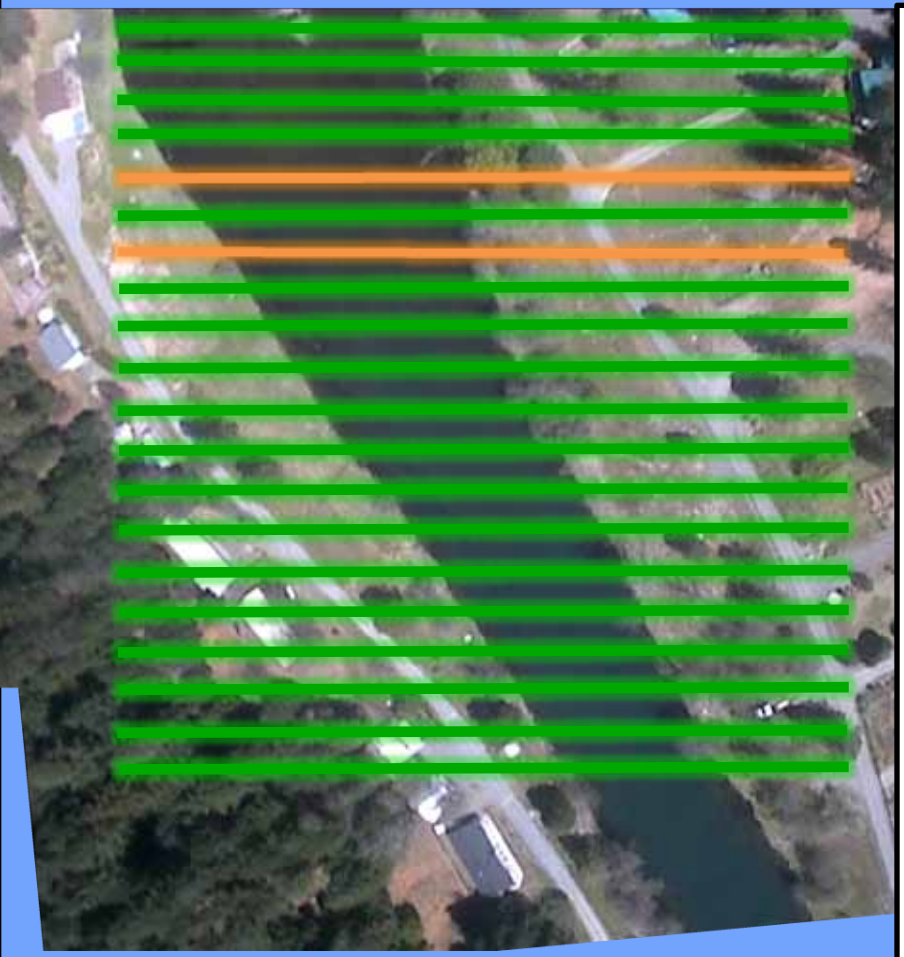
Current Capabilities and Upgrades:
Bathymetric Sounding over Very Shallow Substrates
Example from Tampa Bay, Florida

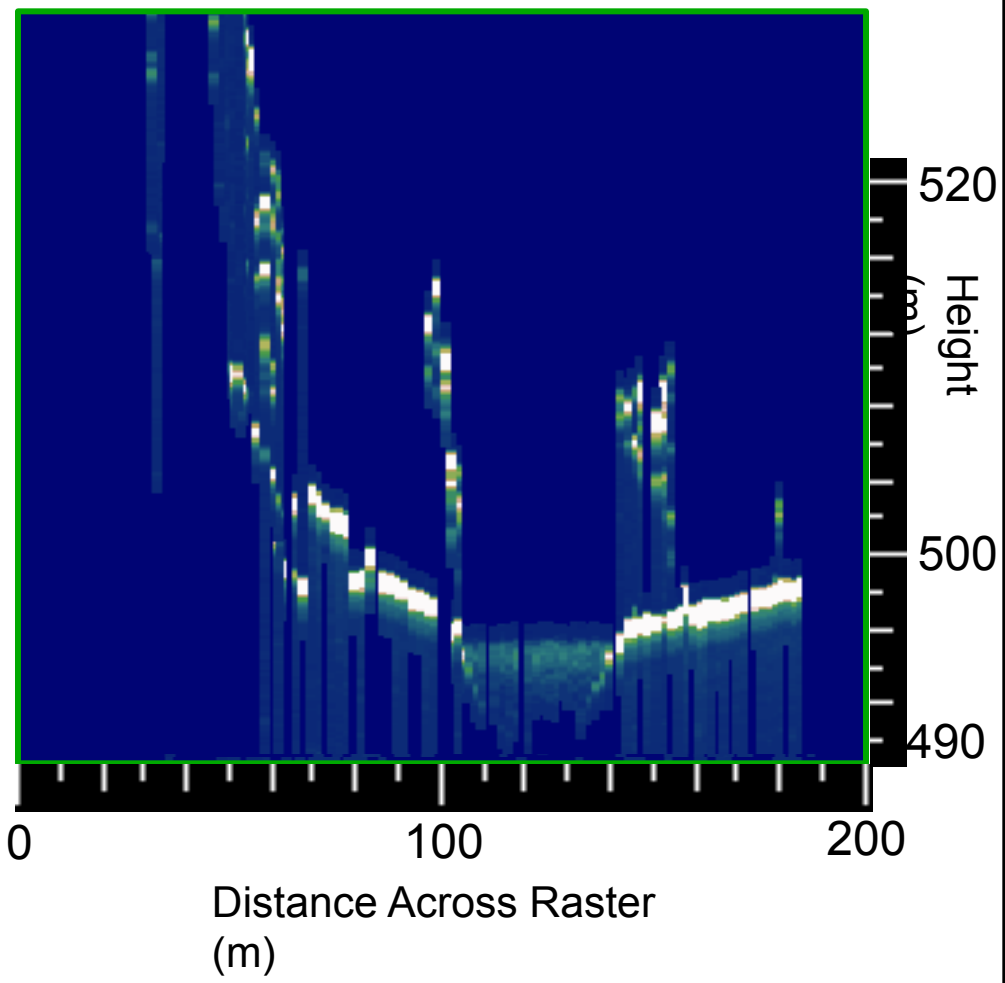


Current Capabilities and Upgrades:

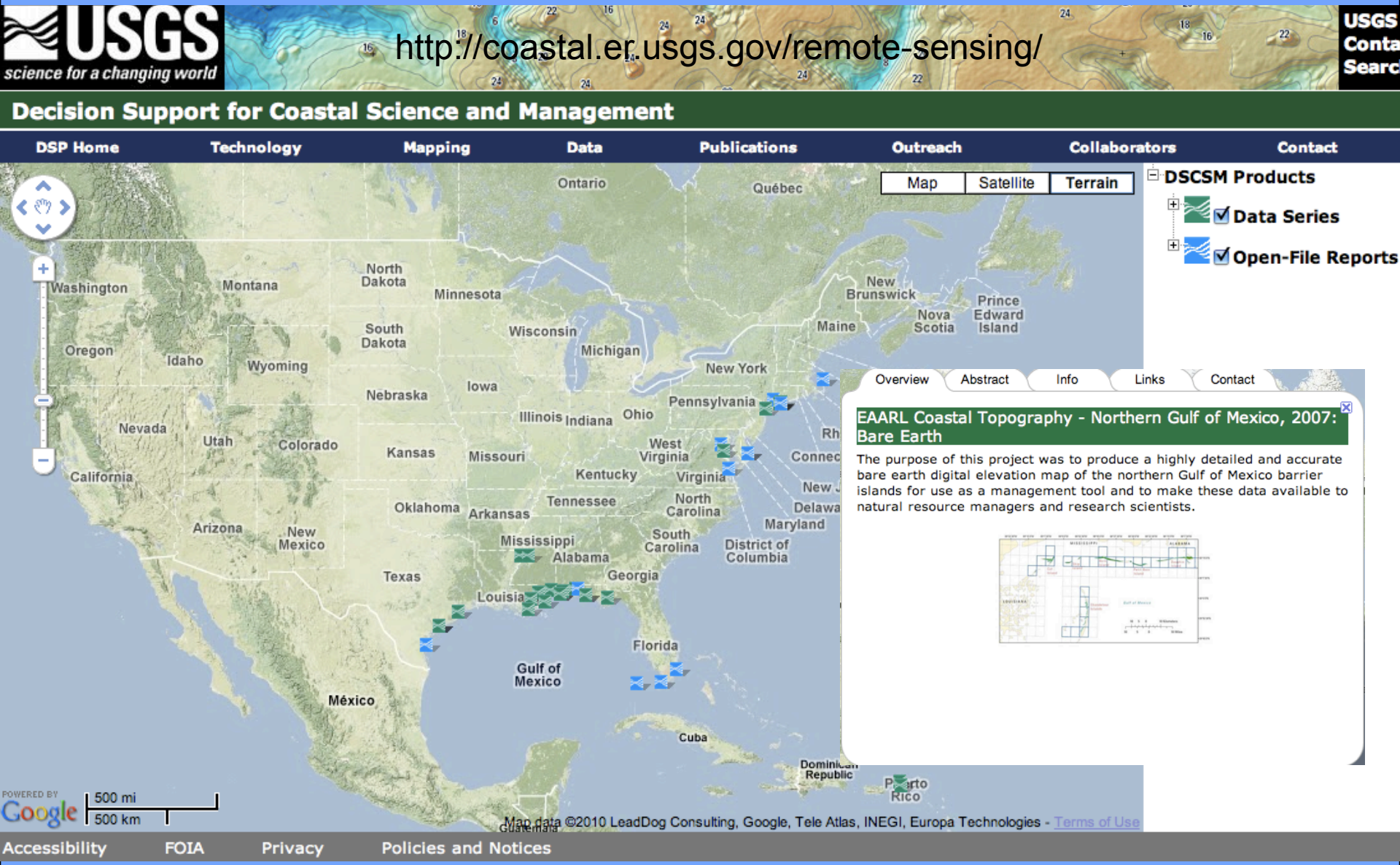
River Channels and Adjacent Topography and Vegetation Canopies

Example from Trinity River, California

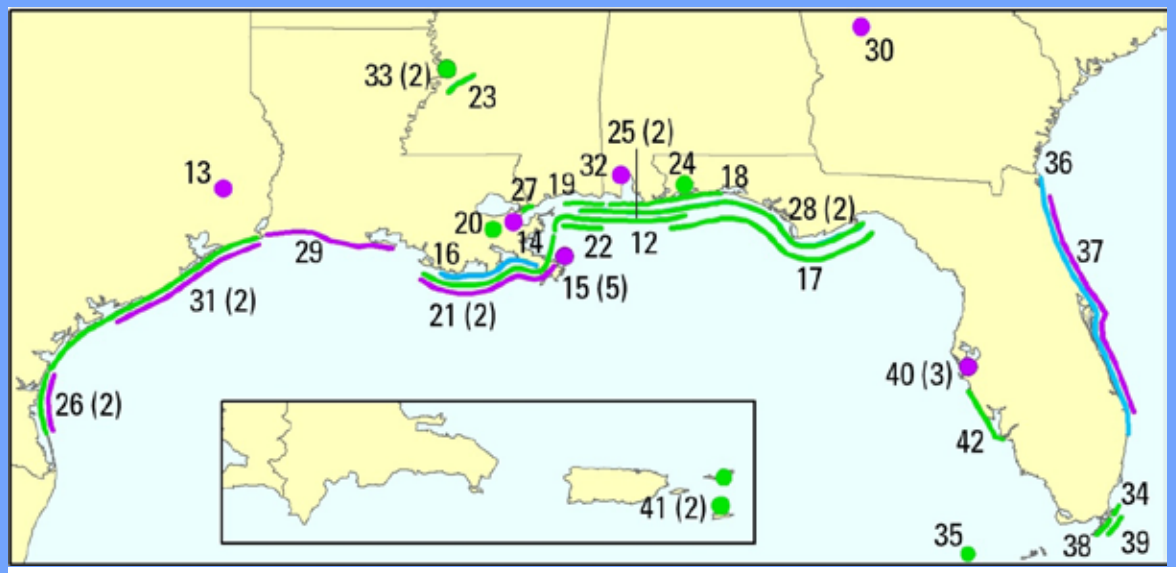


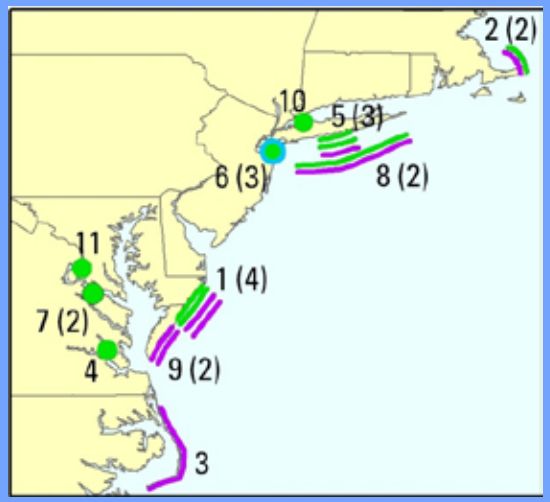


Publication of USGS CMGP lidar data



Published Lidar Data Products





Survey Areas

- Published
- In Review
- Planned

> 30 billion lidar waveforms processed

NORTHEAST

1: Assateague Island NS; 2004, 2008, 2009, 2010 (4)
2: Cape Cod NS; 2002, 2005 (2)
3: Cape Hatteras NS; 2009
4: Colonial NHS; 2005
5: Fire Island NS; 2005, 2007, 2009 (3)
6: Gateway NP/ Sandy Hook; 2005, 2007, 2009 (3)
7: George Washington Birthplace NM; 2005, 2008 (2)
8: NE Barrier Islands; 2007, 2009 (2)
9: NE Virginia; 2003, 2009 (2)
10: Sagamore Hills NHS; 2005
11: Thomas Stone NHS; 2005

GULF COAST

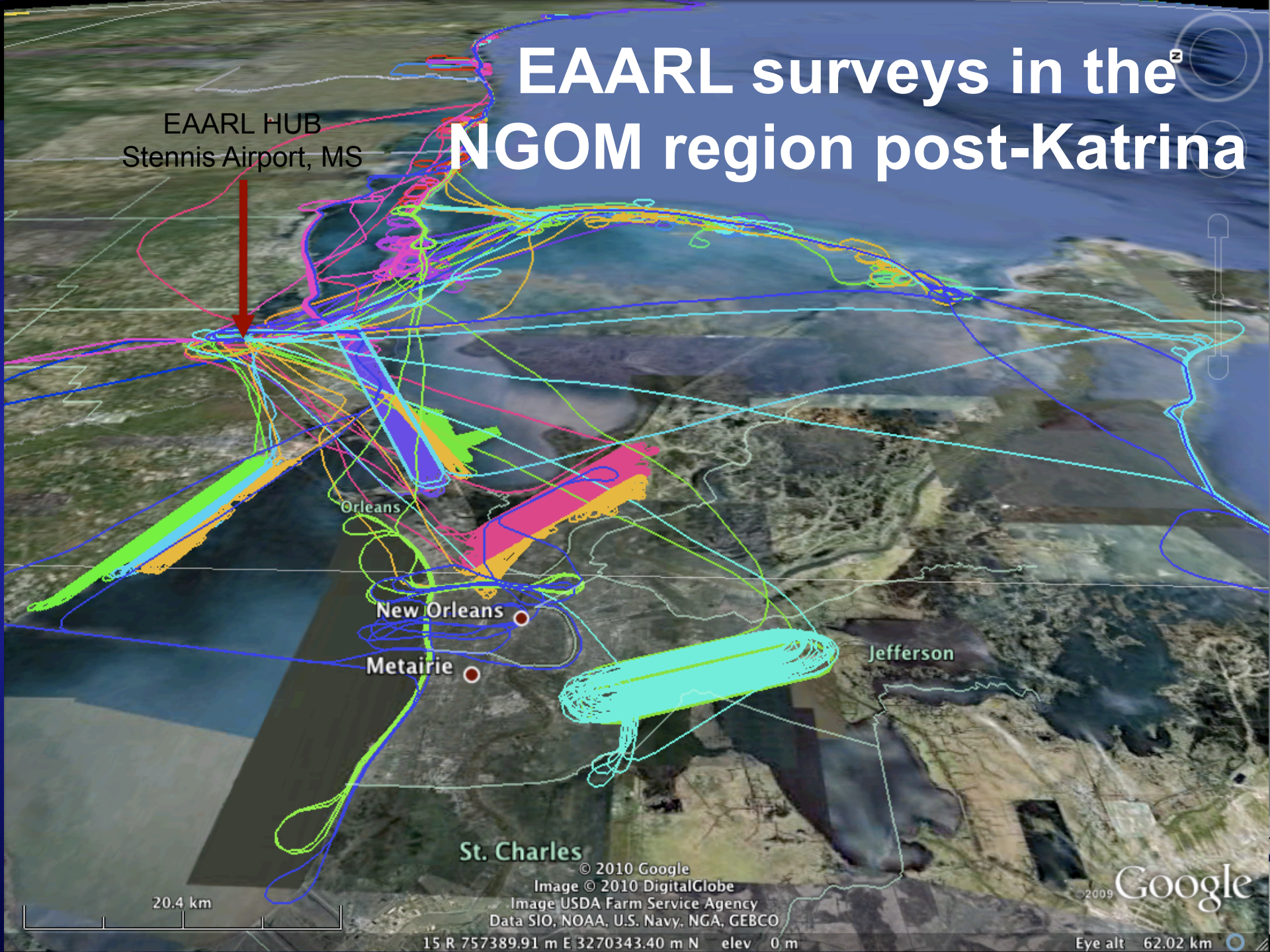
12: Alabama Coast; 2001
13: Big Thicket NP; 2010
14: LA Central Wetlands; 2010
15: Chandeleur Islands; 2005, 2006, 2007, 2008, 2010 (5)
16: Eastern Louisiana; 2008
17: Florida Coast; 2001
18: Gulf Islands NS–FL; 2005
19: Gulf Islands NS–MS; 2005
20: Jean Lafitte NHP&P; 2006
21: Louisiana Coast; 2001, 2008 (2)
22: Mississippi Coast; 2001
23: Natchez Trace Pkwy; 2007
24: Naval Live Oaks, 2007
25: Northern Gulf of Mexico; 2007, 2008 (2)
26: Padre Island NS; 2005, 2010 (2)
27: Pearl River Delta; 2008
28: Post-Ivan, Post-Katrina; 2004, 2005 (2)
29: Post-Rita; 2005
30: Potato Creek Watershed; 2010
31: Texas Coast; 2001, 2008 (2)
32: Three Mile Creek; 2010
33: Vicksburg NMP; 2007, 2008 (2)

FLORIDA and the CARIBBEAN

34: Biscayne NP; 2001-2002
35: Dry Tortugas NP; 2004
36: Eastern Florida, Post-Frances; 2004
37: Eastern Florida, Post-Jeanne; 2004
38: Florida Keys NMS; 2006
39: N FL Reef Tract; 2001-2002
40: Tampa Bay; 2002, 2003, 2004 (3)
41: U.S. Virgin Islands, St. John, St. Croix, Buck Island; 2003 (2)
42: Western Florida, Post-Charley; 2004

TOTAL SURVEYS = 66

EAARL surveys in the NGOM region post-Katrina



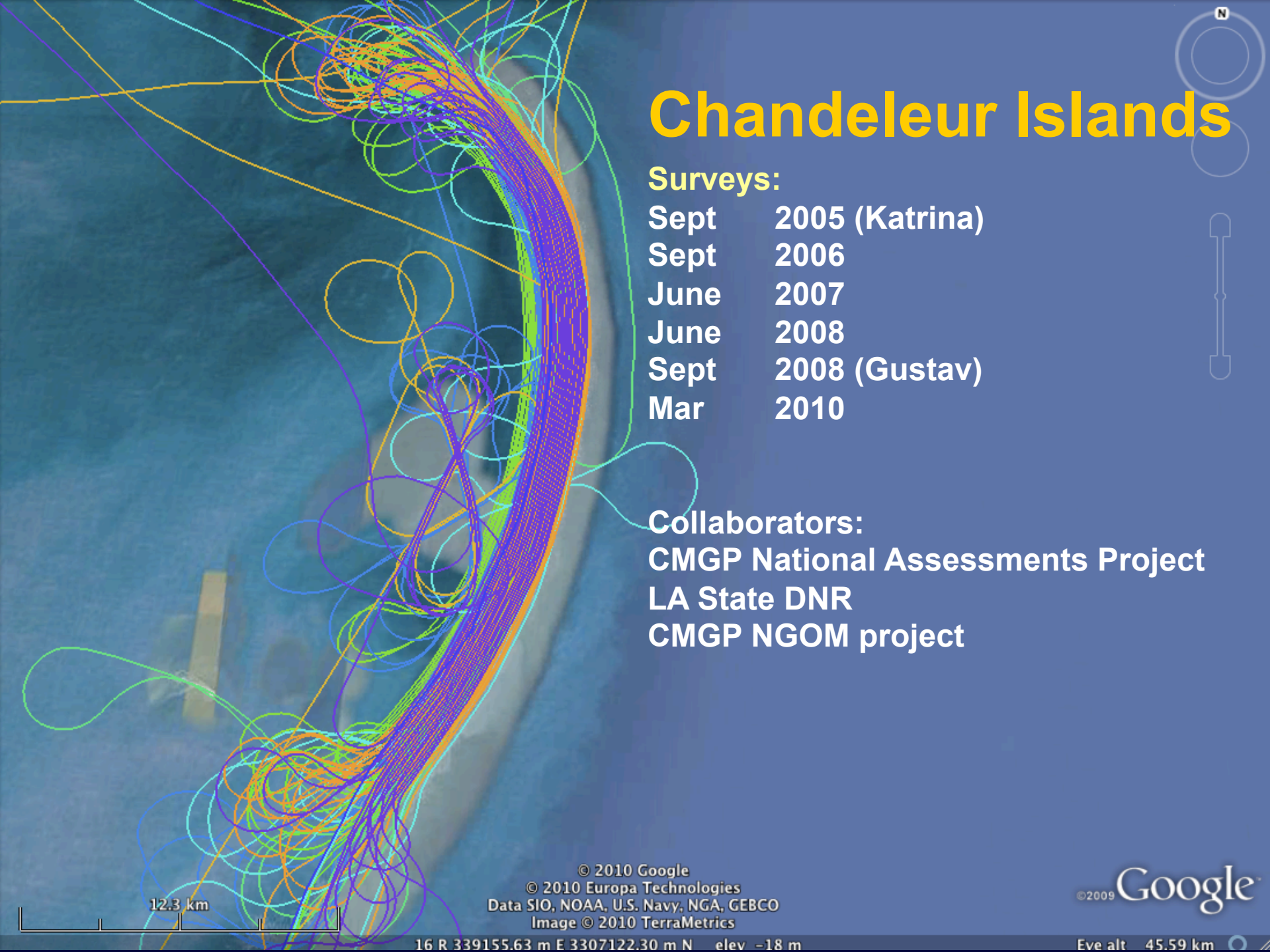
LA Barrier Islands

Surveys:
March 2008; pre-Gustav
Sept 2008; post-Gustav

Collaborators:
CMGP NGOM project
CMGP National Assessments Project

LSU GulfNet GPS Network

2009 Google



Chandeleur Islands

Surveys:

Sept	2005 (Katrina)
Sept	2006
June	2007
June	2008
Sept	2008 (Gustav)
Mar	2010

Collaborators:

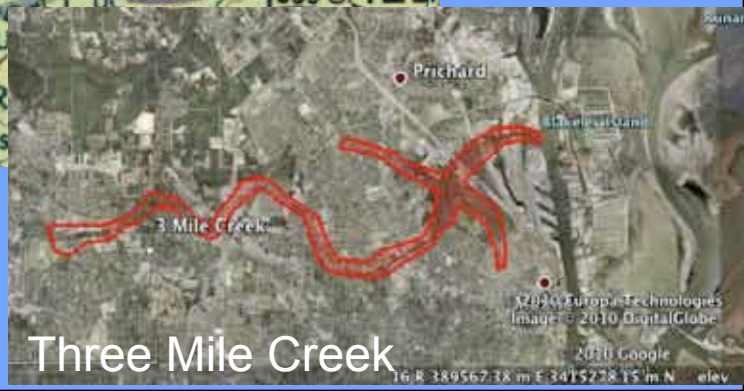
CMGP National Assessments Project
LA State DNR
CMGP NGOM project

NGOM 2010 Survey

4 sites selected:

1 Potato Creek Watershed, GA (J Jones, USGS EGSC). Characterize stream habitat distribution and riparian zone vegetation structure.

2 Three-Mile Creek and section of the Mobile-Tensaw delta (Athena Clark; USGS AL WSC): landform geomorphology and elevation; aquatic vegetation abundance, tree canopy structure.



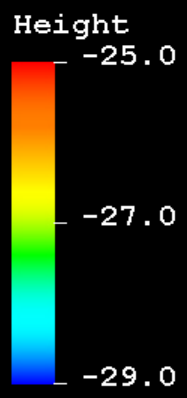
NGOM 2010 Survey

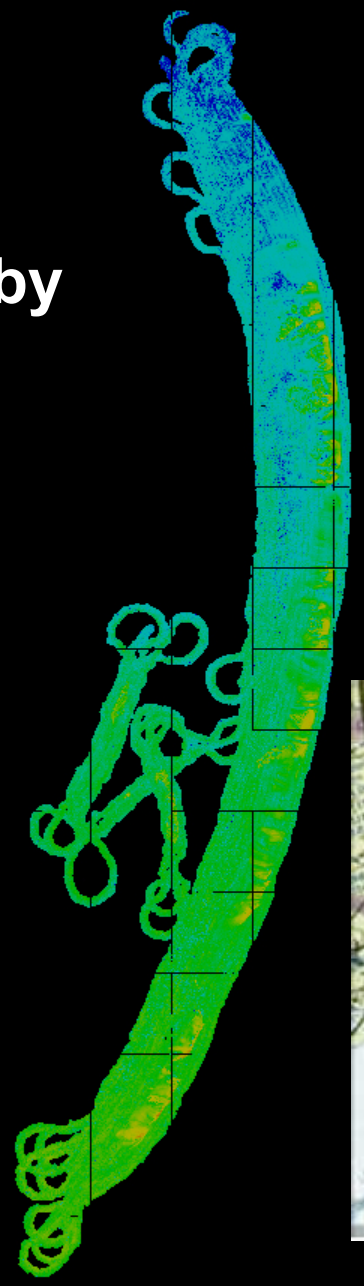
Site 3:

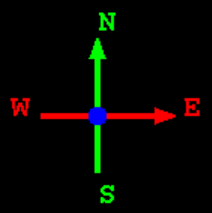
Chandeleur Islands (Abby Sallenger NACCH)

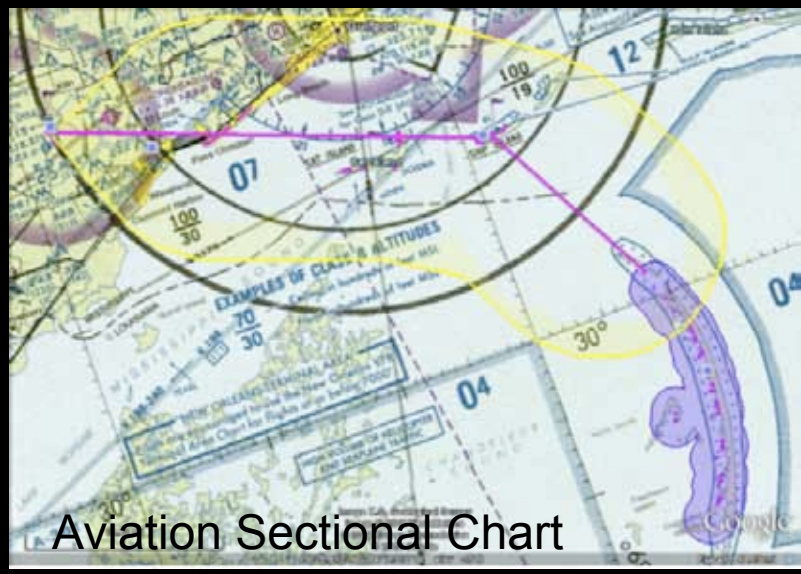
Extend time series of topography on the Chandeleurs.

First post-Gustav data set

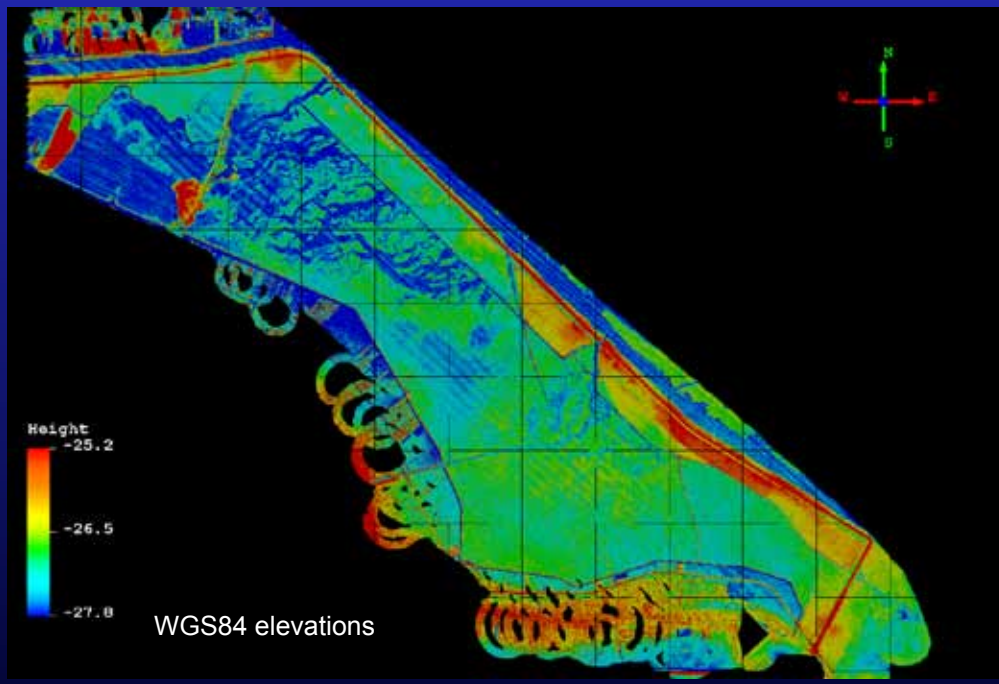








NGOM 2010 Survey

Site 4: NGOM Wetlands survey

- John Barras, USACE & Bob Morton, USGS
- Recent hurricane events,
- Identify shear and scouring
- Advance wetland mapping
- Coincident ground-based lidar survey (Vivian Quieja – USGS EROS)