



Local NWS Tropical and Marine Products/Services and Operational Challenges

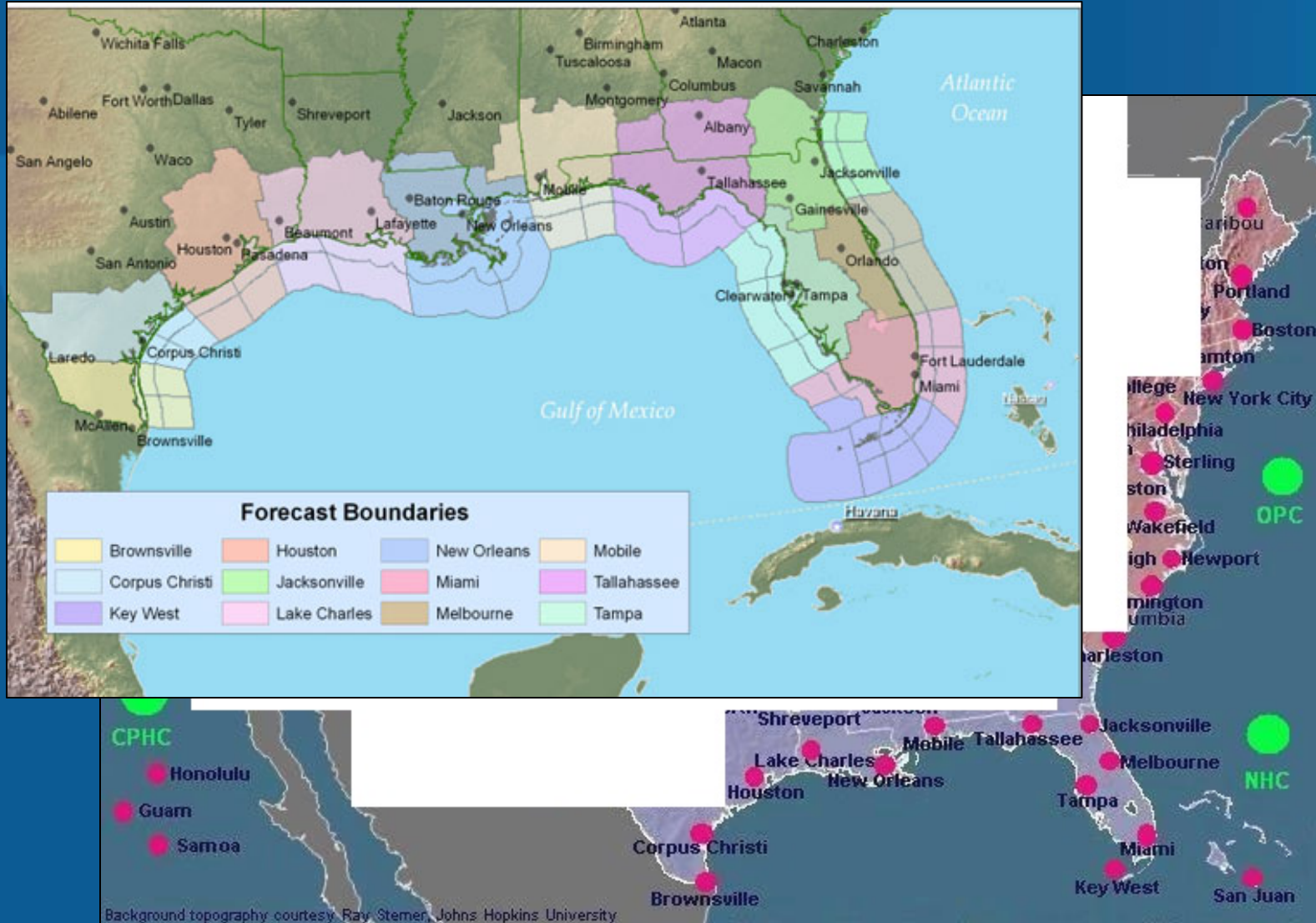
Matt Moreland
Chip Kasper
Andy Devanas

Florida Keys National Weather Service Office

2nd JCOMM Scientific and Technical Symposium on Storm Surges
14th International Workshop on Wave Hindcasting and Forecasting
November 12, 2015



NWS Local Coastal Offices



Background topography courtesy Ray Stemer, Johns Hopkins University



National Hurricane Center – FIU Campus



- Responsible for assessment of current storm intensity, movement, and structure.
- Responsible for prediction of storm track and intensity through 120 hours.



Role of the Local NWS Office

Provides information relative to specific impacts for the area of responsibility:

- Time of arrival for wind velocity thresholds for various locations
- Timing and magnitudes of storm surge and resulting inundation
- Flooding rainfall and tornado/waterspout threat assessments





Flow of Local Impact Information



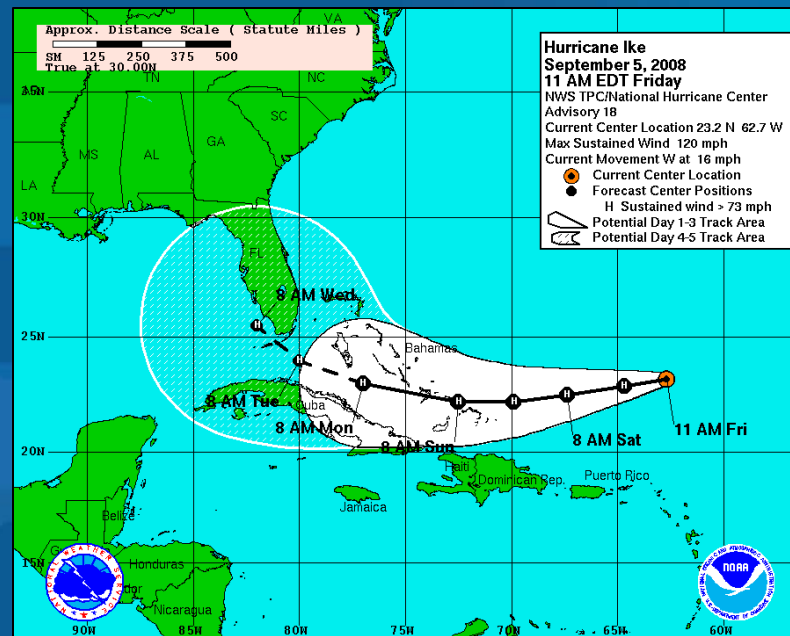
General Public





Timing of Decision Thresholds in the Keys

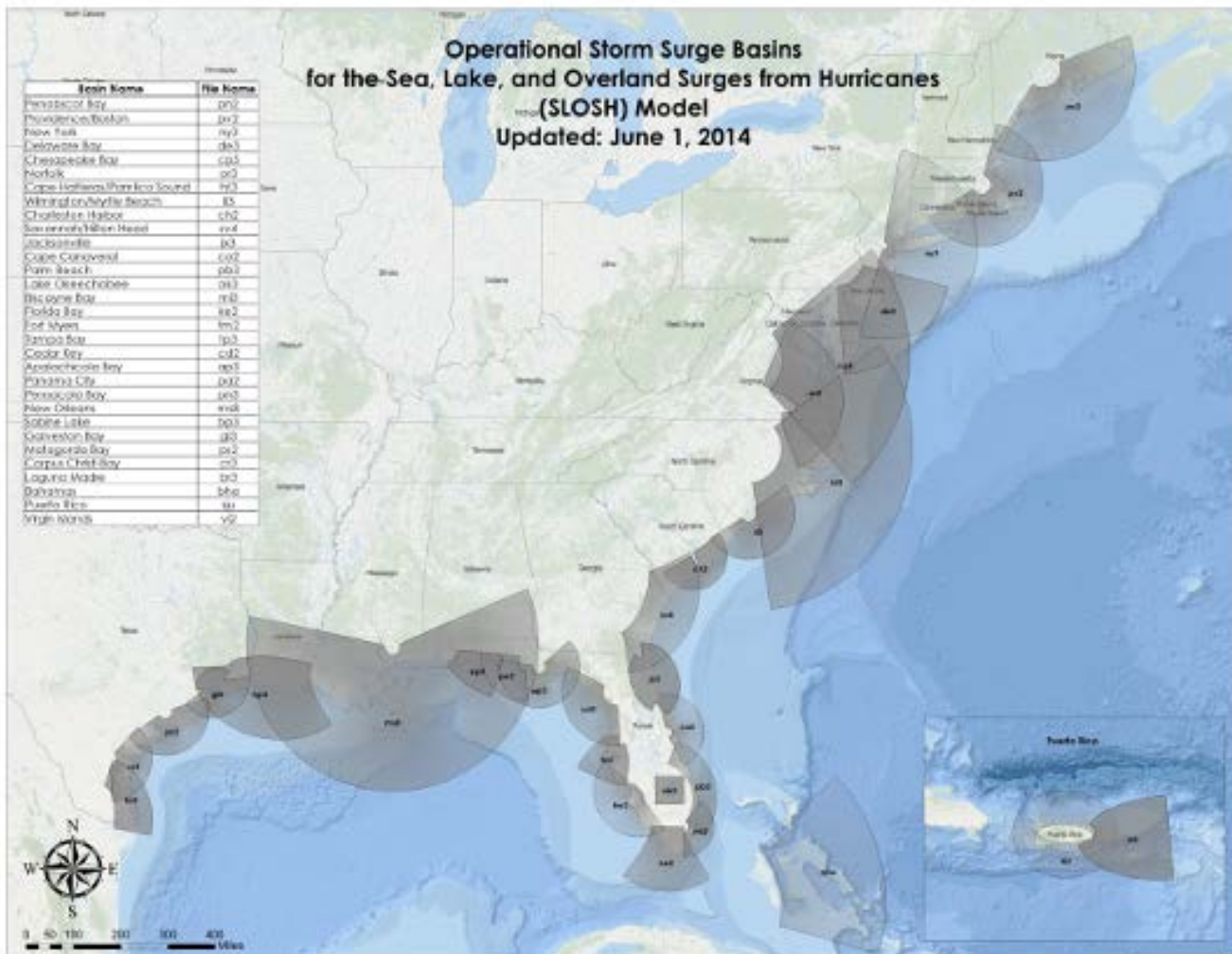
- 84 hr - C130 to evacuate non ambulatory;
Marinas begin making preparations
- 72 hr – Tourist evacuation (parks)
- 54 hr - Deploy National Guard assets
- 48 hr – Hurricane Watch**
- 48 hr - Mobile home residents
- 36 hr – Hurricane Warning**
- 24 hr – Evacuation of all residents
- 00 hr - Arrival of TS winds - Evacuation Ends
- 00 hr – Opening of Last Resort Refuges



EXAMPLE:
HURRICANE IKE Expected To Impact Florida Keys as
Major Hurricane
Tropical Storm Force in 84hrs



SLOSH Basins (as of June 1, 2014)





Key Points about NWS Storm Surge Messaging (1)

- One storm forecast (generated by NHC) is followed by local NWS forecast offices. The role of the local office is to predict and communicate impacts to the local area.
- Storm surge guidance used in NWS forecasts comes from one model:

Sea, Lake and Overland Surges from Hurricanes (SLOSH)



Key Points about NWS Storm Surge Messaging (2)

- Different approaches/guidance are used based on your location in the decision-making time frame:
 - 48-120 hours: composite approach (SLOSH MEOWs/MOMs)
 - 12-48 hours: probabilistic approach (pSurge/inundation graphic) statistically evaluating a large set of SLOSH model runs based on official NHC forecast
 - 0-12 hours: within 12 hours: deterministic approach (only in certain cases)
- **Forecasts are strongly coordinated among local offices and the National Hurricane Center**
 - Forecast storm surge levels
 - Which MEOWs to use in briefings
 - What exceedance level to use in pSurge
 - Storm Surge Warnings

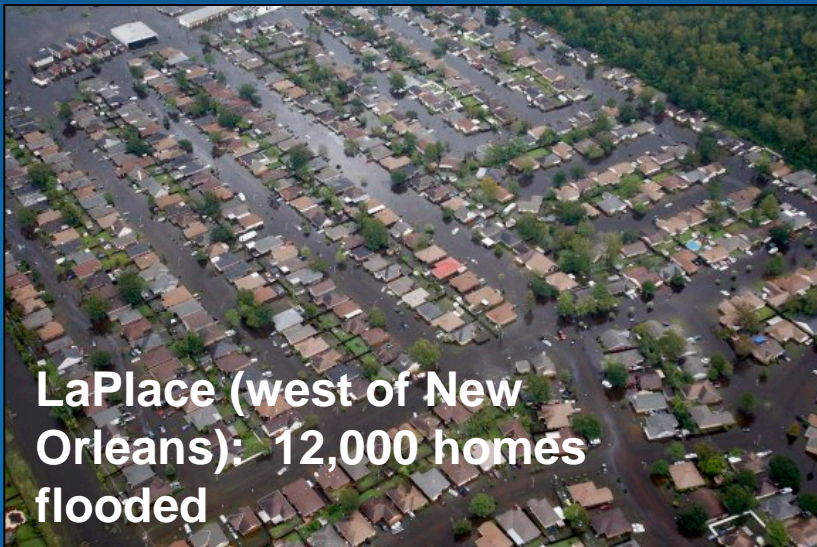


Example:

**Storm Surge Impact Messaging
during Hurricane Isaac**



Hurricane Isaac Coastal Flooding: Southeast Louisiana (Aug/Sep 2012)



LaPlace (west of New Orleans): 12,000 homes flooded



LaPlace: major freeway under water



Braithwaite: locally built levee overtopped



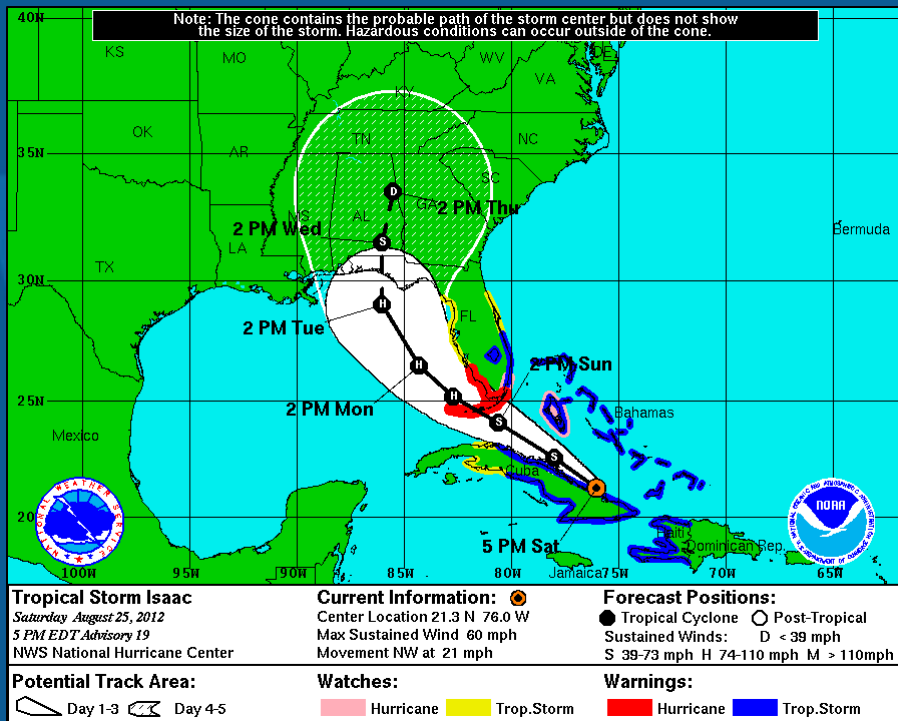
North Shore of Lake Pontchartrain: Major flooding



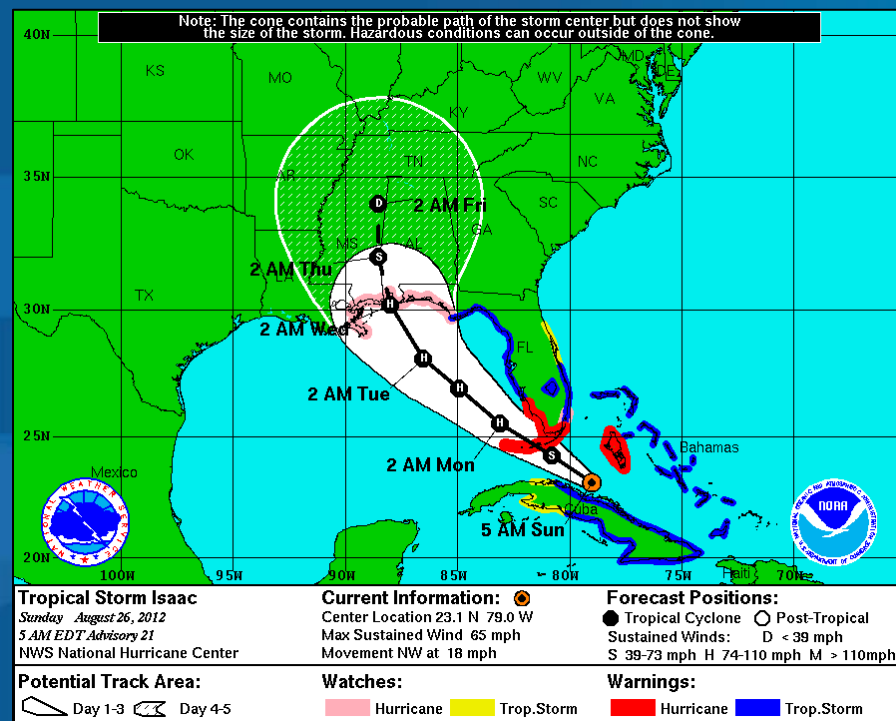
Hurricane Isaac Forecast: Pre-Watch/Warning Phase



Forecast Challenges



Saturday, August 25, 4PM
 ~84 hours before actual 2nd
 landfall

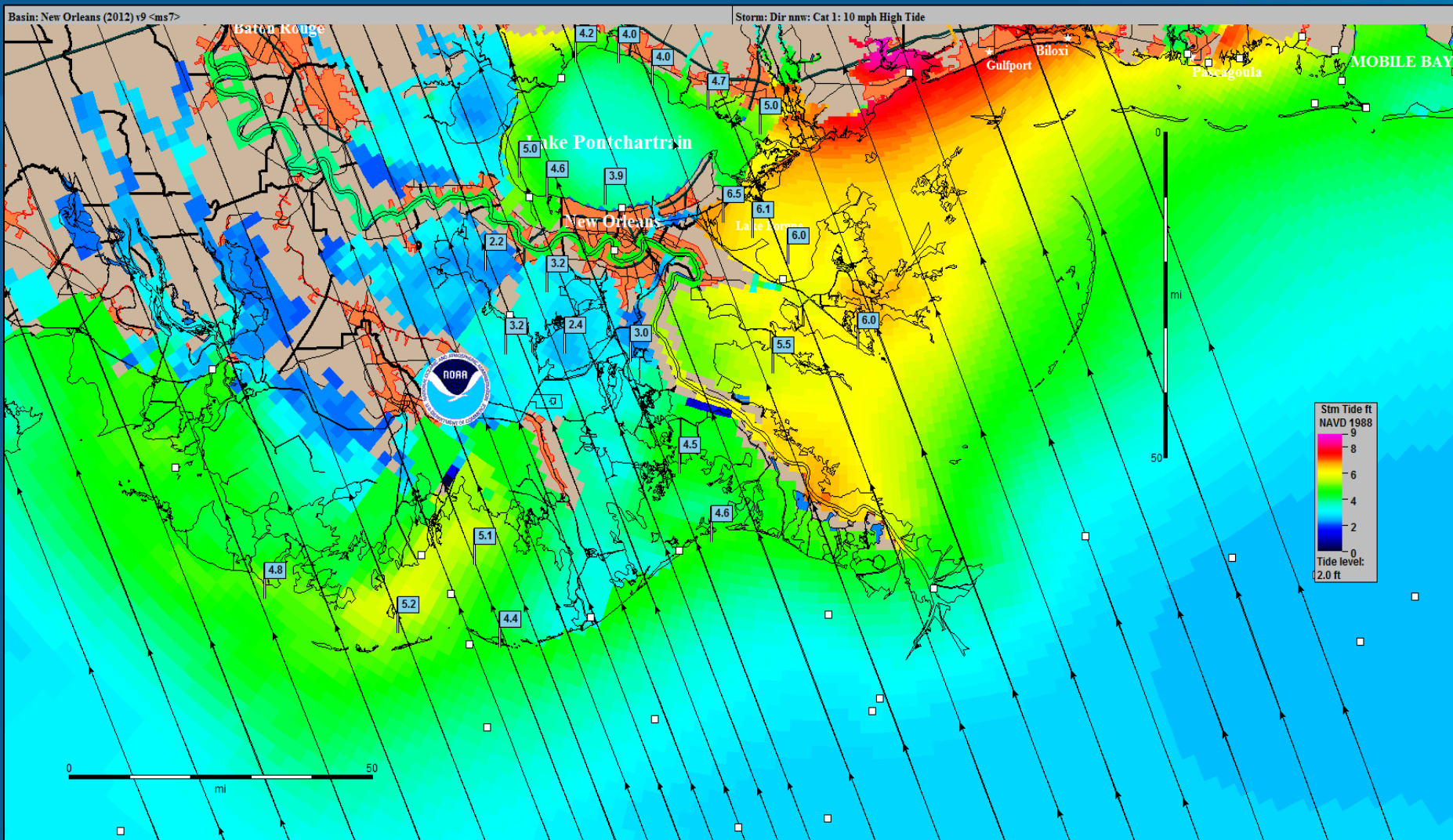


Sunday, August 26, 4AM
 ~72 hours before actual 2nd
 landfall



Two SLOSH MEOWs Used in Briefings

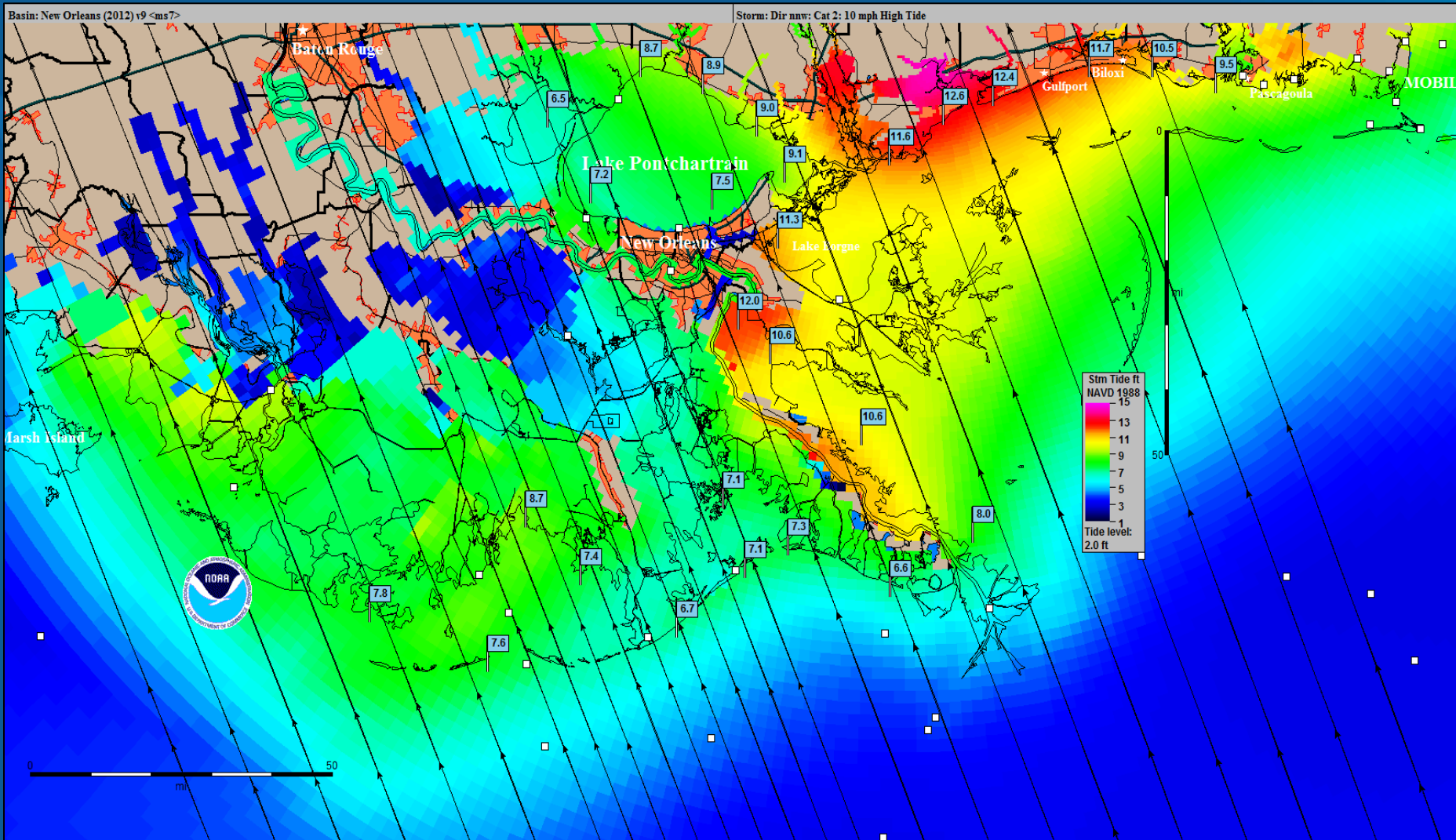
“Lower End” (Cat 1) Hurricane moving NNW 10 MPH





Two SLOSH MEOWs Used in Briefings

“Higher End” (Cat 2) Hurricane moving NNW 10 MPH

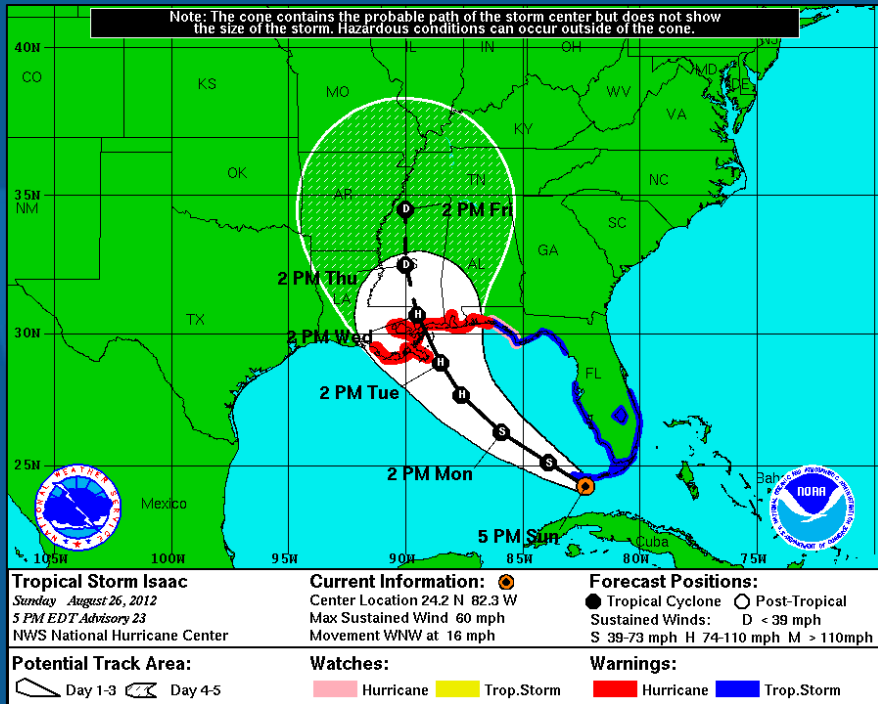




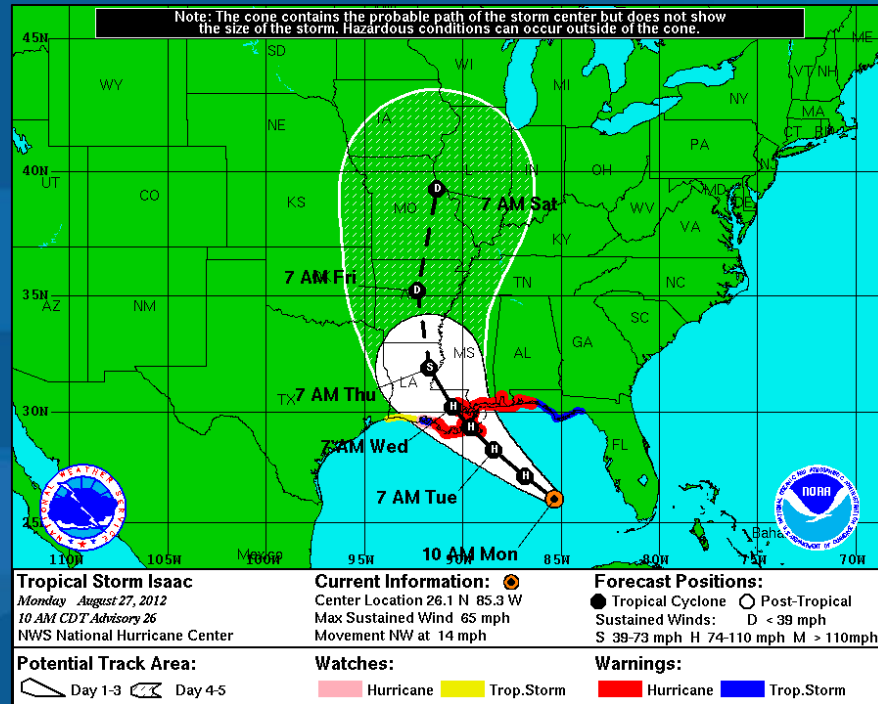
Hurricane Isaac Forecast: Watch/Warning Phase



Forecast Challenges



Sunday, August 26, 5PM EDT
~60 hours before actual 2nd landfall



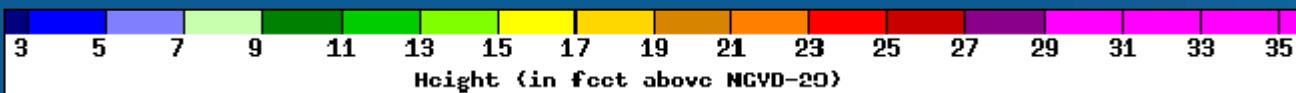
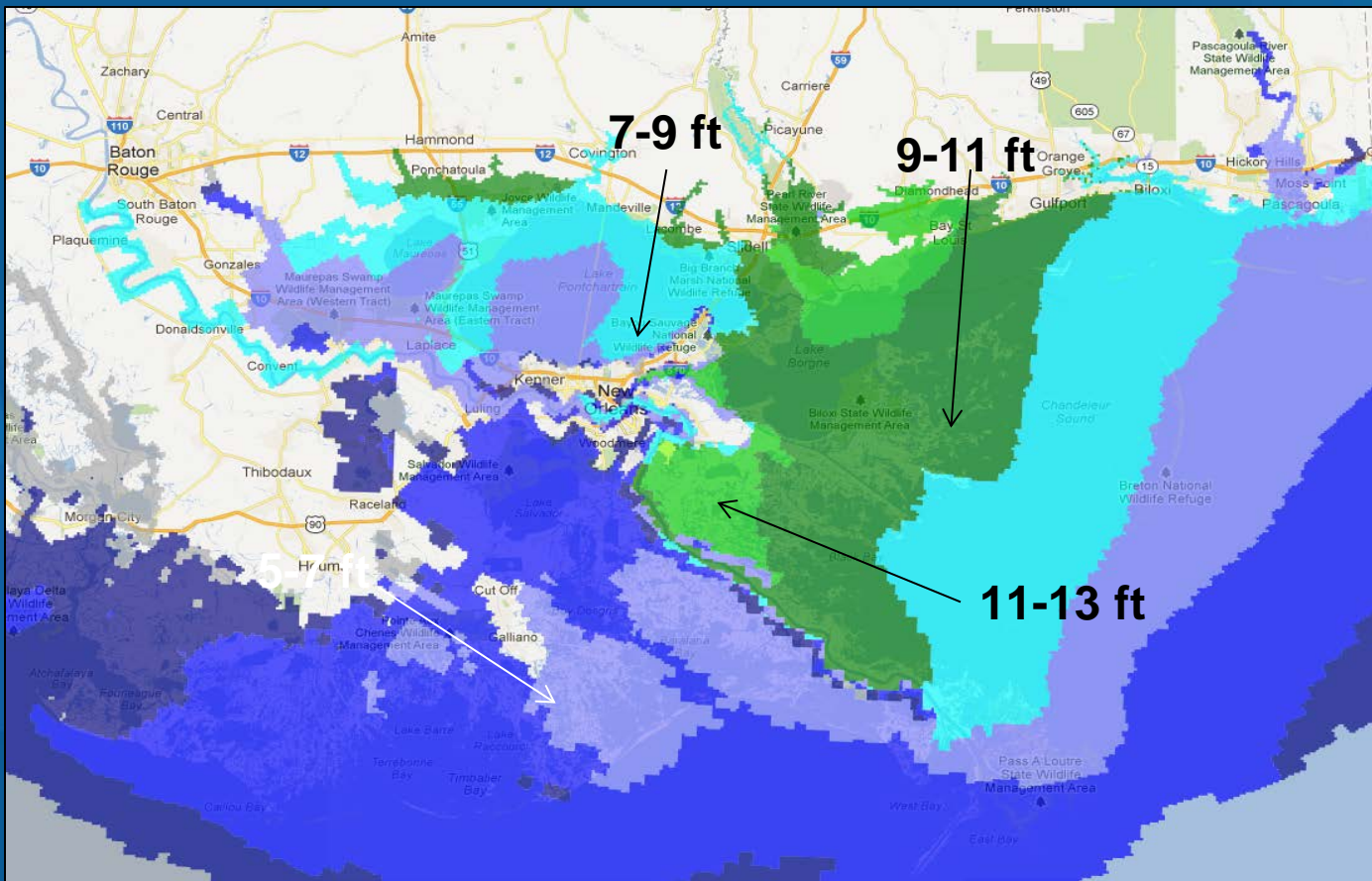
Monday, August 27, 10AM CDT
~42 hours before actual 2nd landfall



pSurge 10% Exceedance Heights

~42 hours before landfall

This example: above datum



“Plausible worst case scenario”



pSurge Storm Surge Probability (this example: ≥ 4 feet above datum)

~42 hours before landfall

“Choosing threshold level” in pSurge → not as good for general briefing package.

Best for those providing embedded support for specific customers.



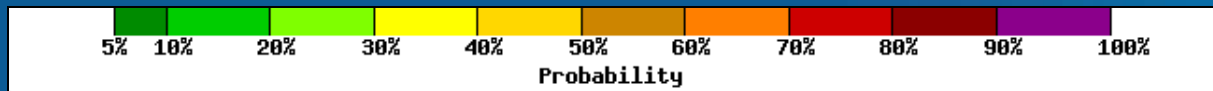
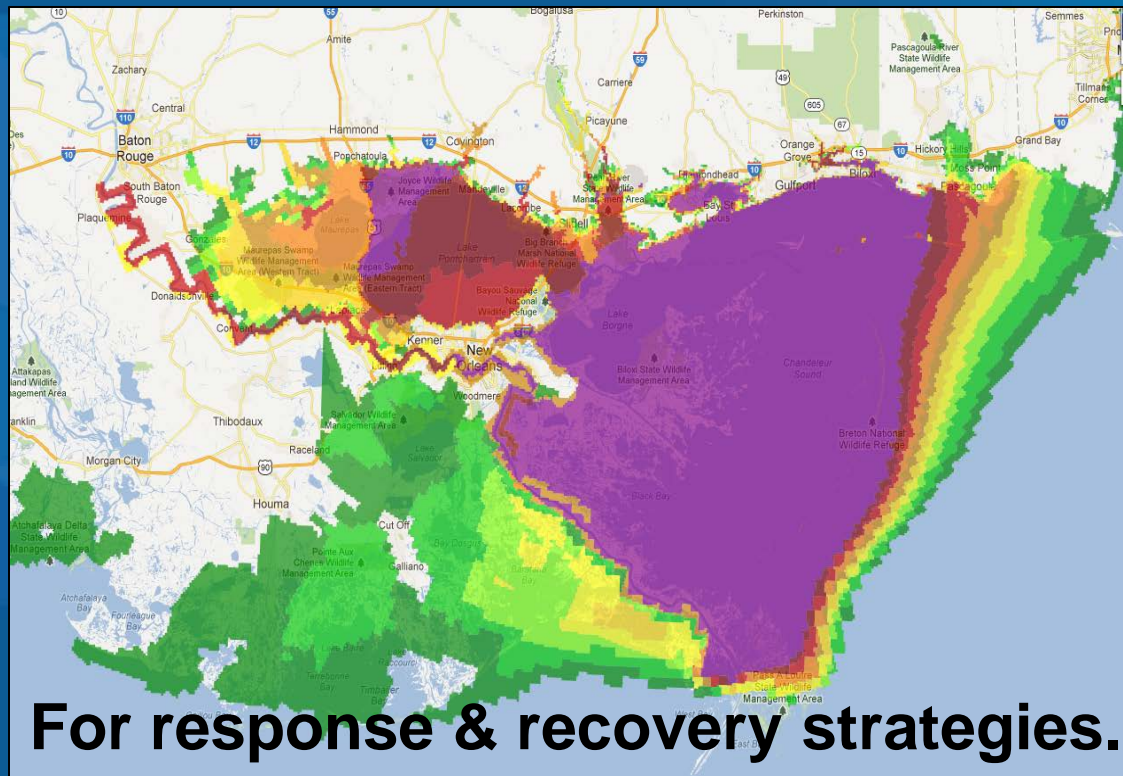


pSurge Storm Surge Probability (this example: ≥ 4 feet above datum)

~12 hours before second landfall

Close to landfall:

As impact period draws near, use the very high probability areas to help specific partners figure out where to focus resources for upcoming response and recovery.

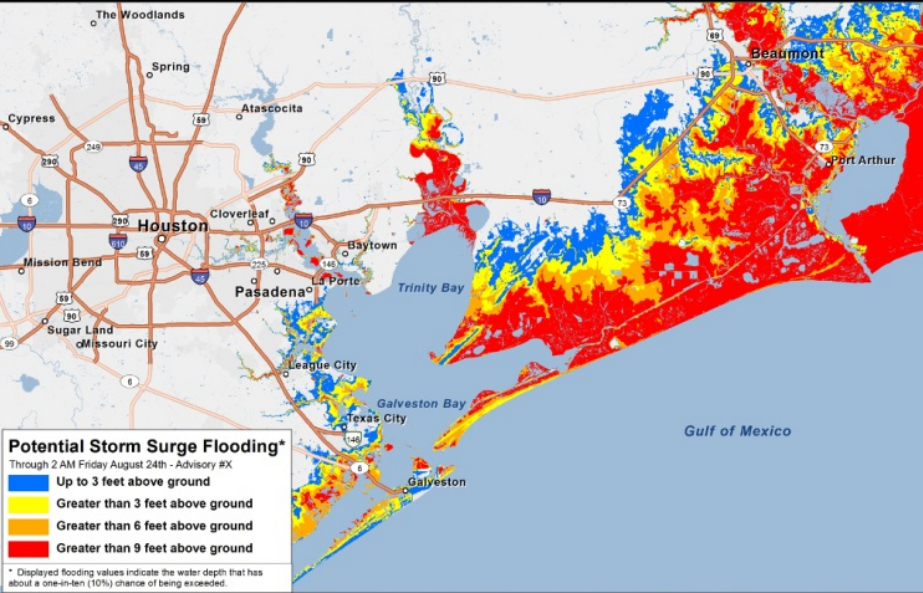




NHC Potential Storm Surge Flooding Map

Hurricane X

0 6 12 18 Miles

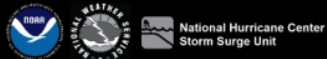


Potential Storm Surge Flooding*

Through 2 AM Friday August 24th - Advisory #X

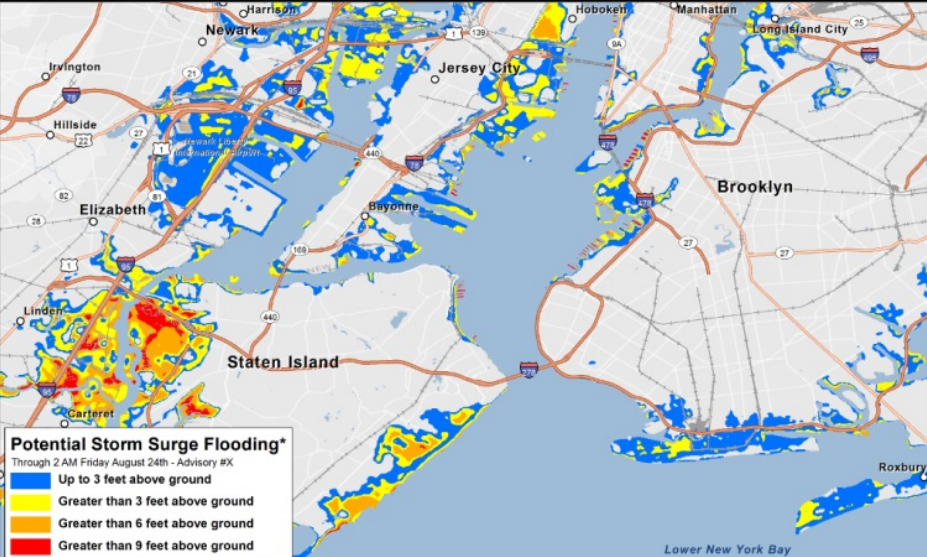
- Up to 3 feet above ground
- Greater than 3 feet above ground
- Greater than 6 feet above ground
- Greater than 9 feet above ground

* Displayed flooding values indicate the water depth that has about a one-in-ten (10%) chance of being exceeded.



Hurricane X

0 2 4 Miles



Potential Storm Surge Flooding*

Through 2 AM Friday August 24th - Advisory #X

- Up to 3 feet above ground
- Greater than 3 feet above ground
- Greater than 6 feet above ground
- Greater than 9 feet above ground

* Displayed flooding values indicate the water depth that has about a one-in-ten (10%) chance of being exceeded.







Experimental Storm Surge Watch/Warning

Hurricane X Advisory #00



Experimental Storm Surge Watch/Warning Graphic*

Valid Through 11 AM Friday October 9th

-  Prototype Storm Surge Warning
-  Prototype Storm Surge Watch

* This graphic displays areas that would qualify for inclusion in a storm surge watch or warning system being developed by the National Weather Service. A storm surge warning would mean that there is a danger of life-threatening inundation from rising water moving inland from the shoreline somewhere within the specified area, generally within 36 hours. A storm surge watch would mean that life-threatening inundation is possible somewhere within the specified area, generally within 48 hours. Persons located within the warning areas should take all necessary actions to protect life and property from rising water and the potential for other dangerous conditions. Promptly follow evacuation and other instructions from local officials.





Hurricane Wilma (October 2005)





Hurricane Wilma: Monroe County Actions

Wed 19 October

0800 – Local state of emergency declared

1200 – Mandatory evacuation of non-residents ordered

Thu 20 October

0800 – Voluntary evacuation of residents encouraged

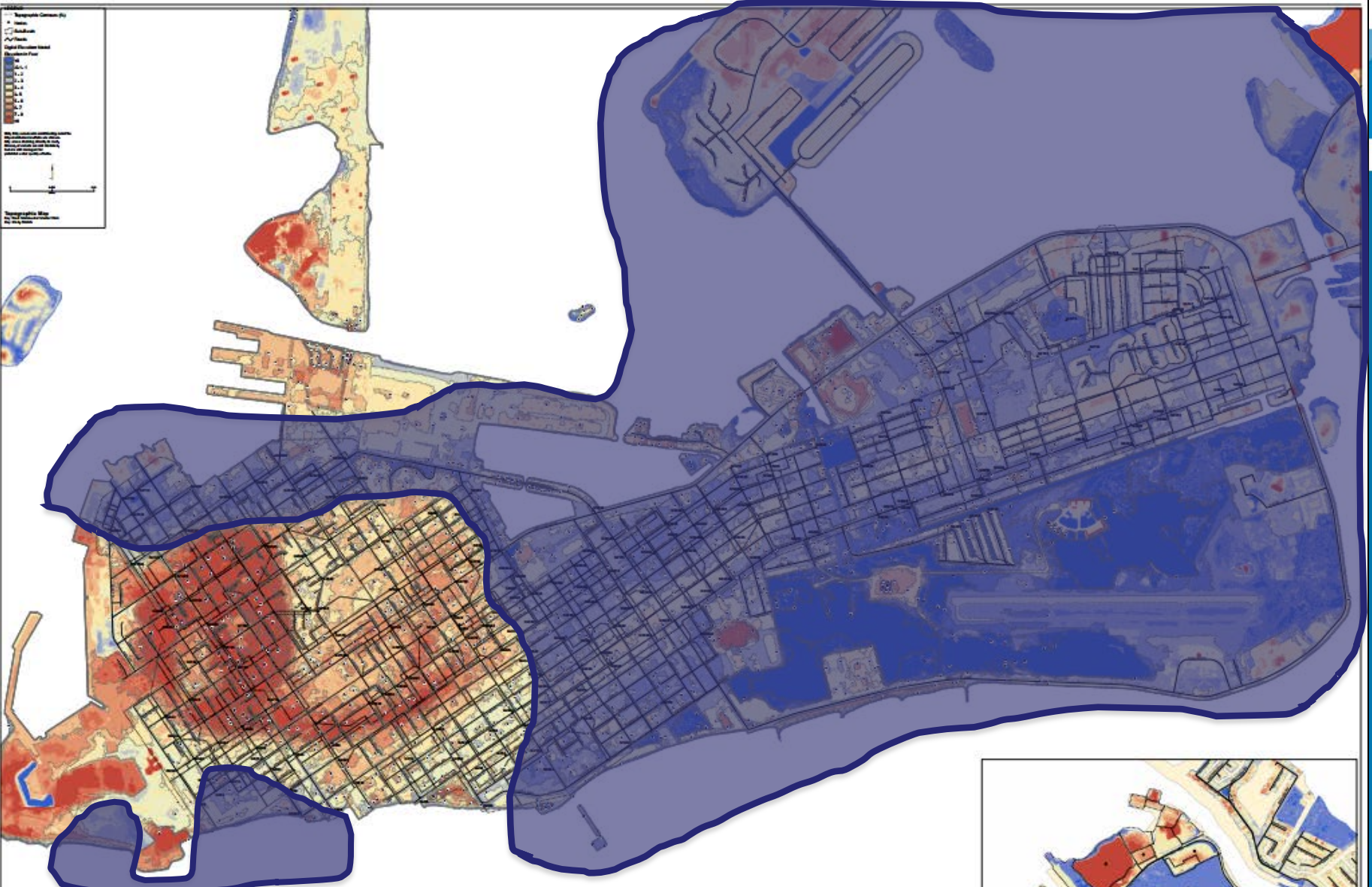
Sat 22 October

1200 – Mandatory evacuation of residents

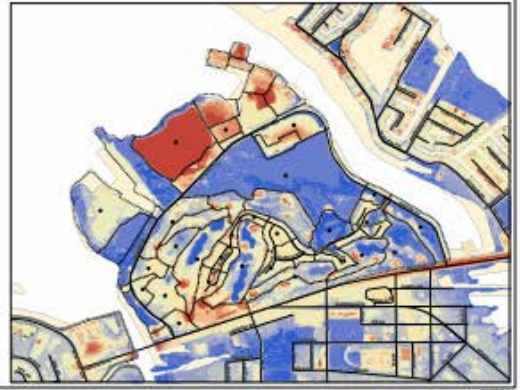


Storm Surge Flooding in Key West





**Key West Inundation Estimate
7:00 to 9:00 AM EDT**





Florida Keys NWS Office



22,752 square miles of water
163 square miles of islands



Facts About the Florida Keys

FACT: Population ~ 80,000 (swells to ~ 150,000 in season)
~ 4,000,000 tourists annually

FACT: 40% of world maritime commerce passes through Straits of Florida shipping lanes (WFO Key West marine service area)

FACT: Florida Keys commercial fishing industry #2 nationwide (value)

FACT: Only barrier reef in continental U.S. (third largest in world)

FACT: NOAA/Florida Keys National Marine Sanctuary protects ~2,900 square nautical miles of marine habitat (estimated 6,000 species of marine life + numerous cultural resources (shipwrecks))

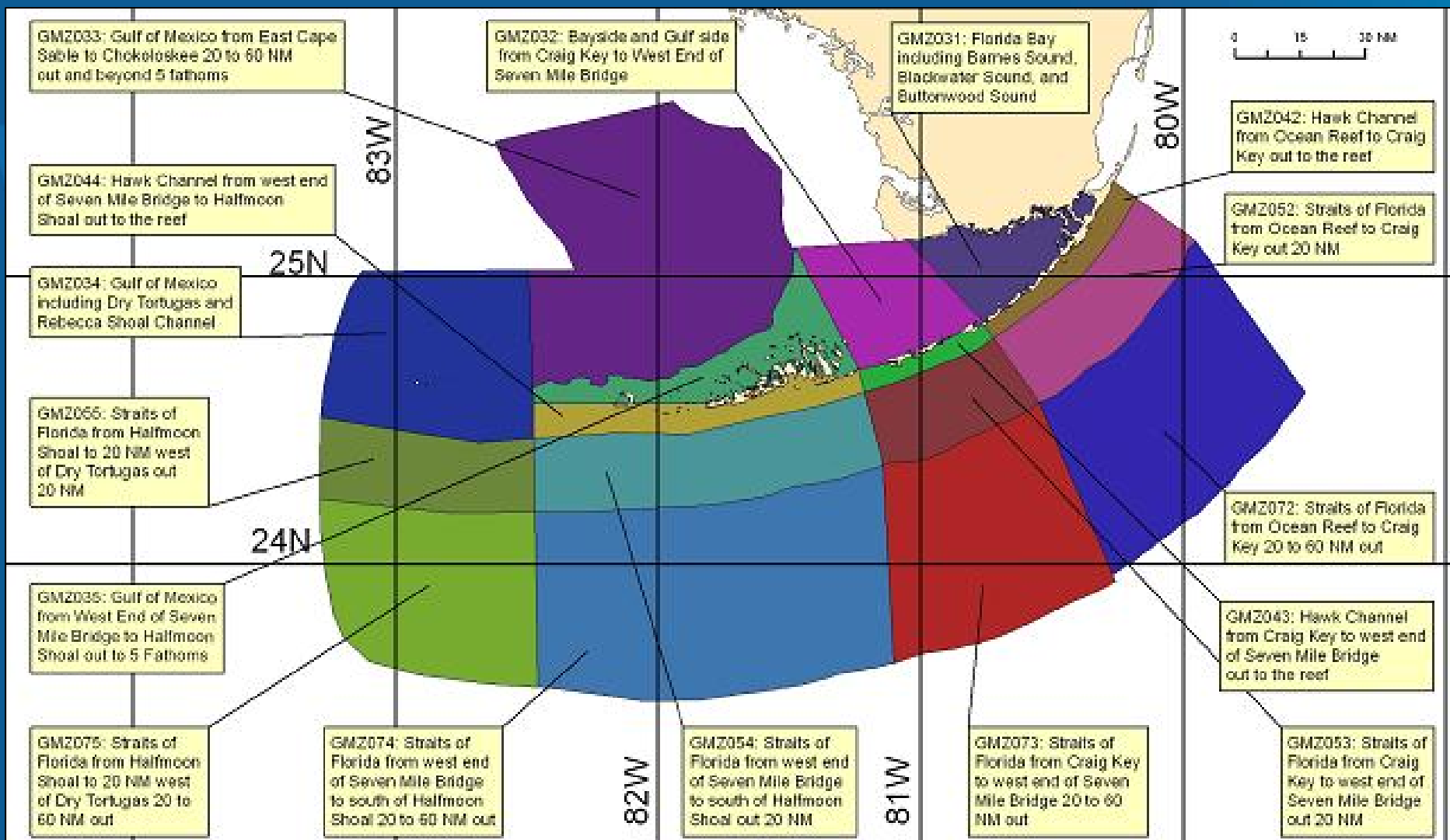
FACT: > 100 marinas; scores of charter fishing and diving operations

FACT: One of the largest “live-aboard” communities in the U.S.
(Boot Key Harbor near Marathon)



Florida Keys NWS Marine Service Area

~ 23,000 SQUARE MILES





We Need A Buoy!

**Total number of moored buoys,
WFO Key West + WFO Miami
marine service areas =**

0

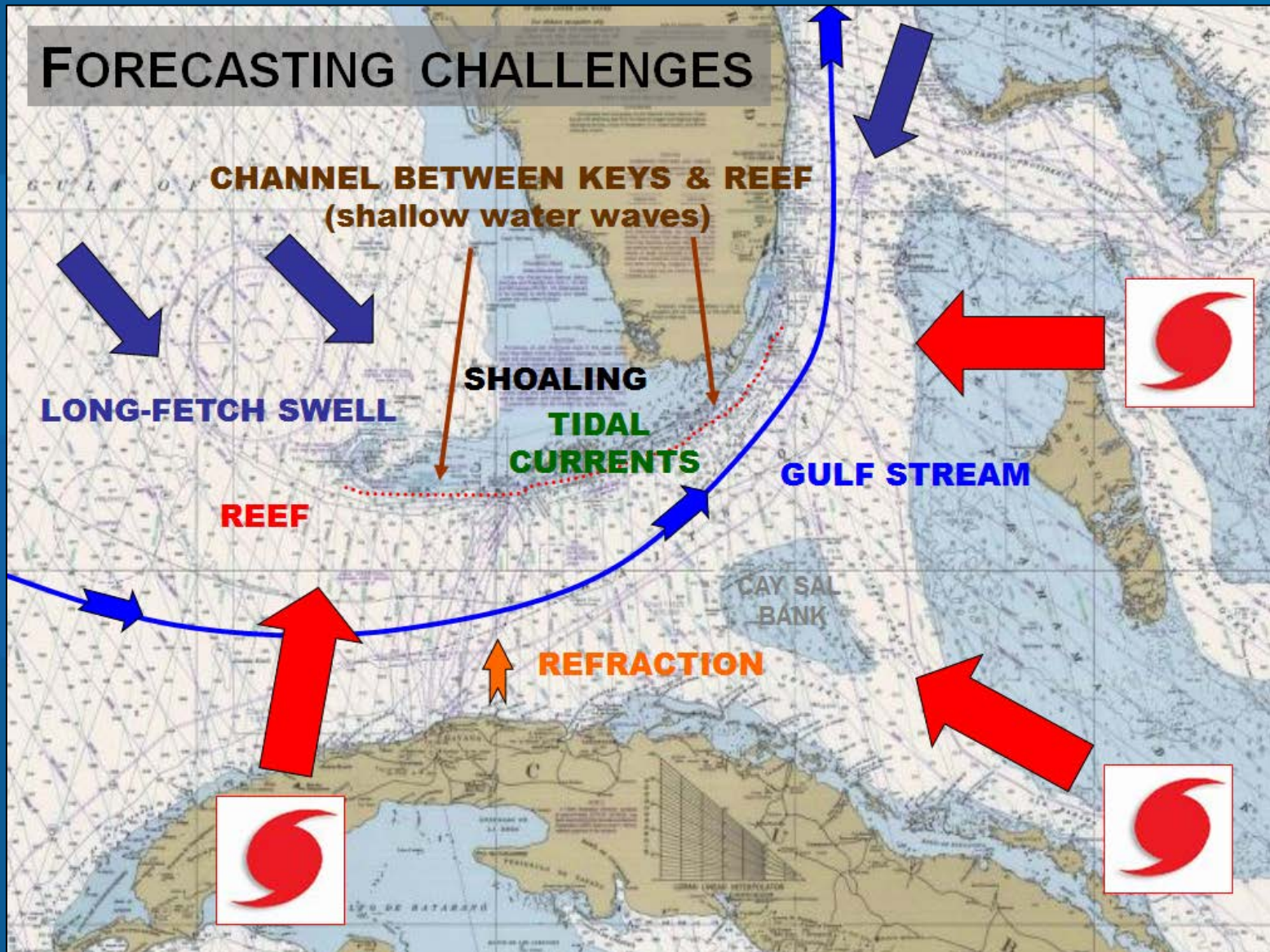


Weather-Sensitive Operations

- Search and Rescue
- Vessel Groundings
- Hazardous Materials Spills
- Migrant Interdiction
- Law Enforcement
- Munitions/Explosives Unloading
- Dive Operations
- Exercises



Marine Forecasting Challenges





Example of Marine Decision Support

Florida Keys Wednesday, 12 June 2013
Joseph M. Cudahy (25.0228 N -82.7563 W)

Forecast Discussion

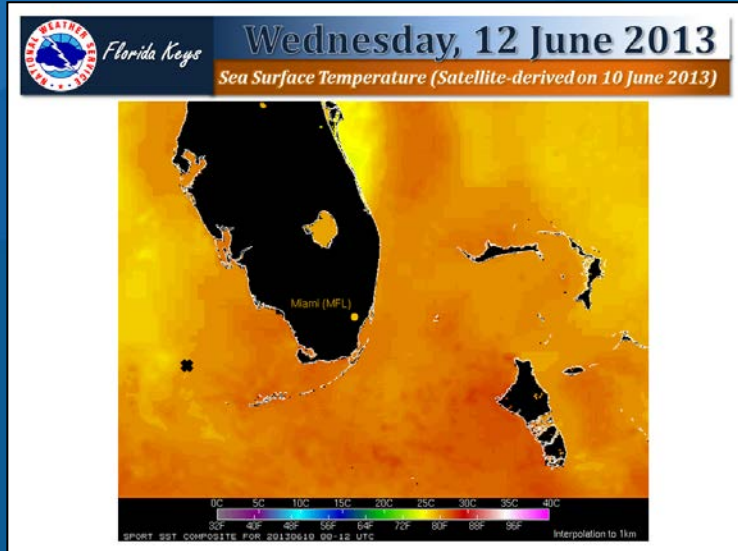
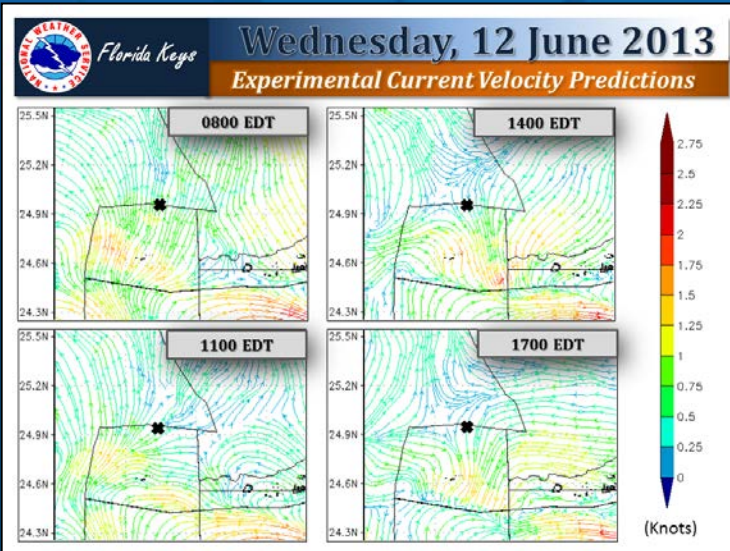
The weather over the extreme southeastern Gulf of Mexico on Wednesday will feature rather typical mid-June conditions, with light breezes outside of scattered showers and isolated thunderstorms. A weak pressure pattern will be in place, meaning that a light northeast breeze will prevail, averaging 5-10 knots or less. Seas will average around 1 foot. However, the coverage of showers and thunderstorms will be slightly above normal, with a chance of rain around 40-50% between 0600 and 1800 EDT. The chance for lightning strikes within 25 nautical miles of the wreck will be about 30% (0600-1800 EDT). Both wind direction and wind speed may vary depending on your location with respect to showers, thunderstorms, and the gust fronts they generate (cool air brought down by rain spreads out in all directions at the surface, and can result in locally gusty and shifting winds). Also, seas could be locally higher and confused in the vicinity of showers and storms. However, wave heights generally will range between flat calm and 2 feet. During the return trip to Key West (1500-1800 EDT), showers and storms may be somewhat more concentrated adjacent to the heated islands of the lower Keys.

Florida Keys Wednesday, 12 June 2013
Joseph M. Cudahy (25.0228 N -82.7563 W)

WIND	0500: NE 5 G 8 KT 0800: NE 5 G 7 KT 1100: NE 5 G 6 KT 1400: ENE 6 G 8 KT 1700: ENE 6 G 9 KT	
SEAS	0500: 1-2 FT 0800: 1-2 FT 1100: 1-2 FT 1400: 1-2 FT 1700: 1-2 FT	
TIDES (Loggerhead Key)	High: 0159 EDT Low: 0552 EDT High: 1230 EDT Low: 1957 EDT	
Sunrise/Sunset	Sunrise: 0641 EDT Sunset: 2021 EDT	

UV Index
11 (Extreme)

Rain Chance = 40-50%
Winds & Seas Higher and Variable in and Near Scattered Showers and Thunderstorms





Florida Keys Marina Sign Project

NATIONAL WEATHER SERVICE

NOAA
NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

Call **(305) 295-1316**

CH: 2 or CH: 5
162.400 MHz 162.450 MHz

WEATHER INFO

f **t**

US National Weather Service Key West Florida

Scan here to visit our website, weather.gov/key

@NWSKeyWest





Any Questions????

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