How High Did the Water Get?
Storm Surge Data Analysis at the National Hurricane Center

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Purpose of Post-Storm Analyses

NHC Tropical Cyclone Reports **01**

Documenting storm hazards and impacts

Forecast and Modeling Verification **02**

Evaluating operational storm surge forecasts, watches/warnings, and modeling

Support Recovery **03**

Identify hardest-hit areas immediately after the storm

Input for Disaster Declarations **04**
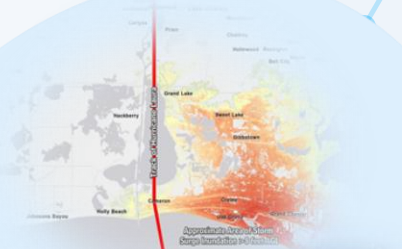
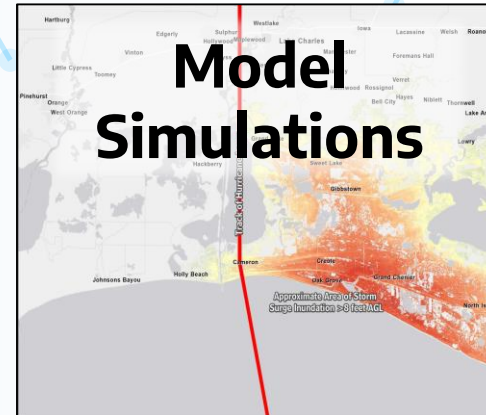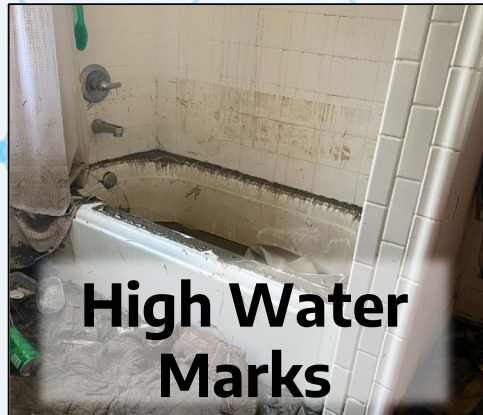Facilitate disaster declarations for federal assistance

The Job of a Sleuth

Determine how high the water got ***above normally dry ground*** (inundation) by reconciling differences among available storm surge data, and filling the gaps between them.

Types of Data

Tide/Stream Gauges

Pressure Sensors

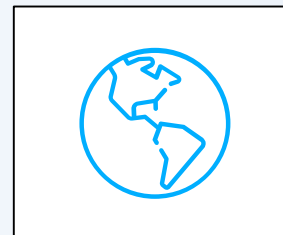High Water Marks

Model Simulations

Datums

Tidal

A reference level defined by a certain phase of the tide

Mean Sea Level, Mean Lower Low Water, Mean Higher High Water, etc.

Geodetic / Orthometric

Reference level based on an abstract coordinate system, representing the shape of the Earth

NAVD88, NGVD29, etc.
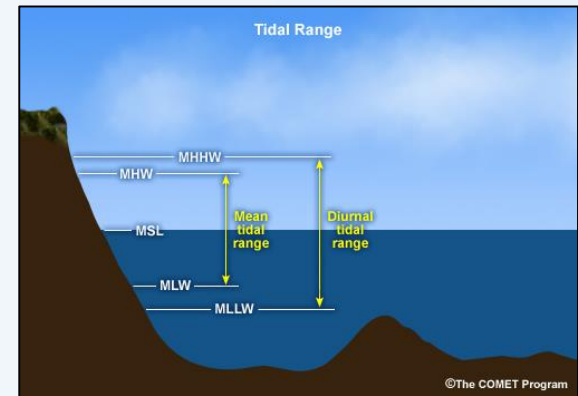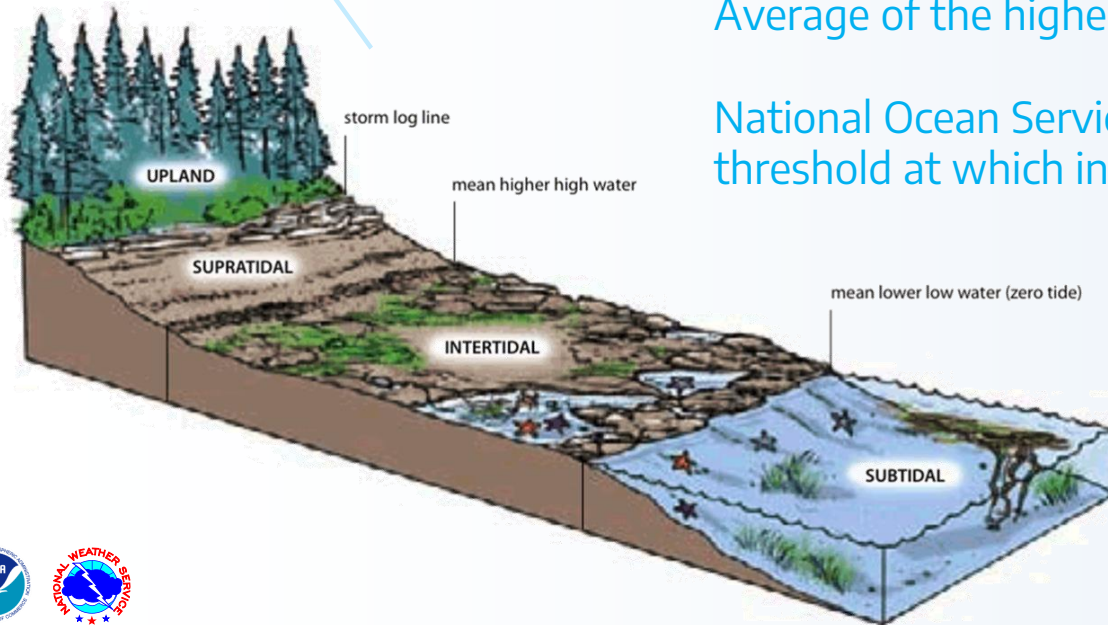
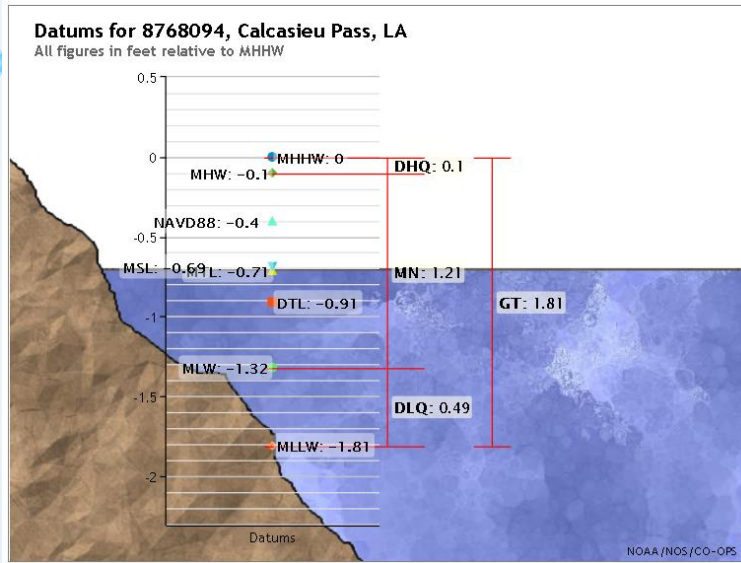# Inundation and Mean Higher High Water (MHHW)

Inundation
Height of water above normally dry ground

Mean Higher High Water (MHHW)
Average of the highest high tides each day

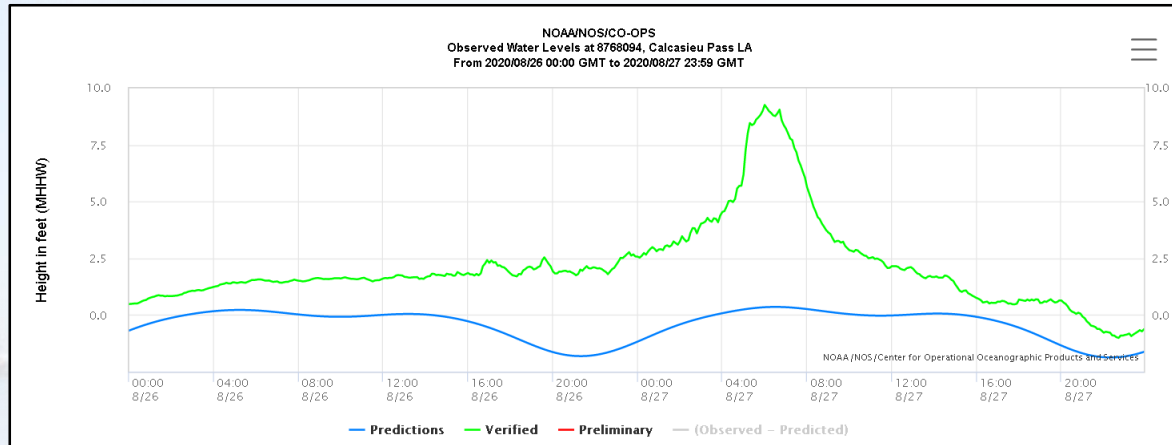National Ocean Service: best approximation for the threshold at which inundation *can begin to occur*

Tide Gauges

Datums for 8768094, Calcasieu Pass, LA
All figures in feet relative to MHHW

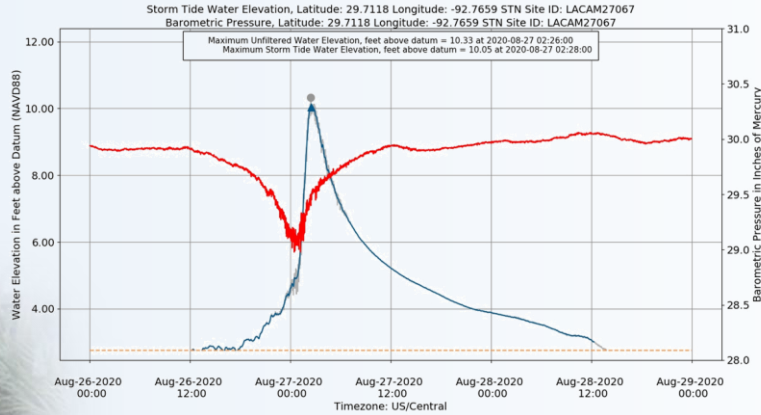Peak water level relative to MHHW is a proxy for maximum inundation in the vicinity of the gauge

Calcasieu Pass during Laura:
11.00 ft MLLW
9.19 ft MHHW

Pressure Sensors
(Typically NAVD88)

EXPLANATION
- Unfiltered Water Elevation
- Storm Tide (Lowpass Filtered) Water Elevation
- Minimum Recordable Water Elevation
- Barometric Pressure
- Maximum Unfiltered Water Elevation
- Maximum Storm Tide Water Elevation
Combined Instrument Error (ft): 0.140000

Storm Tide Water Elevation, Latitude: 29.7118 Longitude: -92.7659 STN Site ID: LACAM27067
Barometric Pressure, Latitude: 29.7118 Longitude: -92.7659 STN Site ID: LACAM27067

Maximum Unfiltered Water Elevation, feet above datum = 10.33 at 2020-08-27 02:26:00
Maximum Storm Tide Water Elevation, feet above datum = 10.05 at 2020-08-27 02:28:00

Hurricane Laura
Rockefeller National Wildlife Refuge

10.05 ft NAVD88 = **9.1 ft MHHW**

Considerations:

Is the sensor located
- within the intertidal zone?
- on normally dry ground?

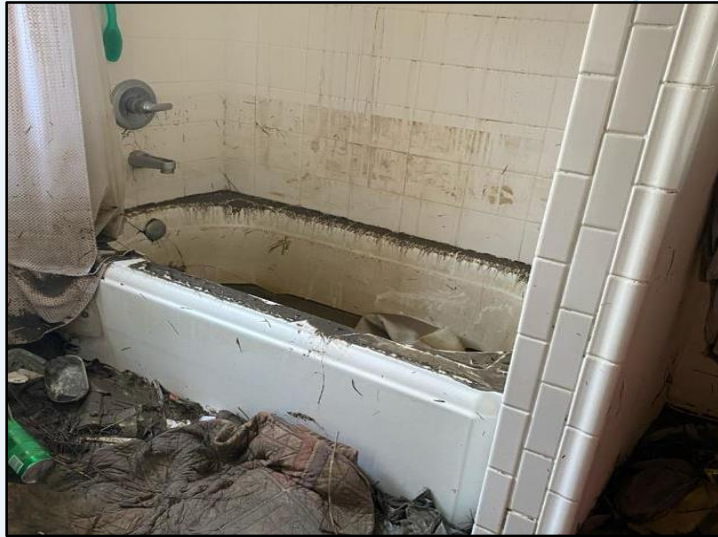Unfiltered or filtered for waves?

Which datum was used?

Types of High Water Marks
(Typically AGL or NAVD88)

Mud, Foam, Stain, or Seed Lines (Vertical)

Those that tell you how high the water got
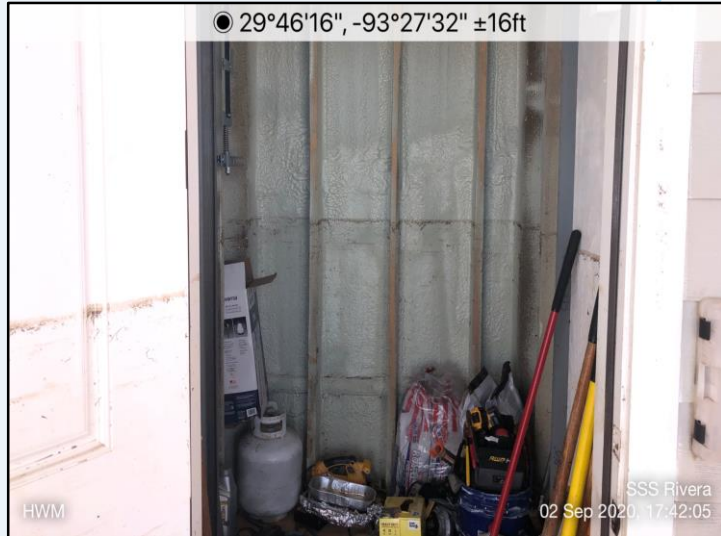
Debris Lines (Horizontal)

Those that tell you how far inland the water penetrated

Quality of High Water Marks

Stillwater

Best stillwater marks found inside structures

Wave/Current Influenced

Quality of debris snags depends on exposure

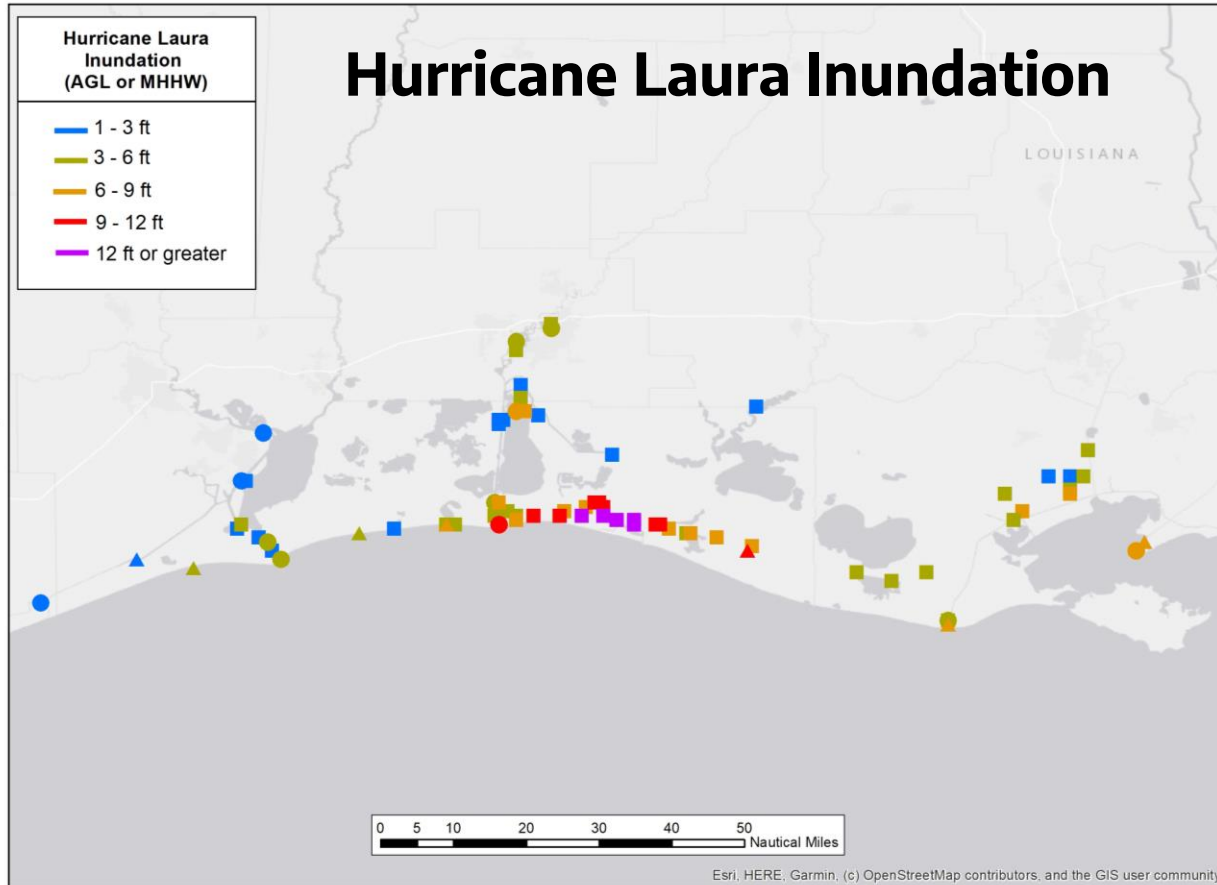# Datum Conversion In/Near Tidal Areas

NOAA's VDatum Conversion Tool

Used to convert data from one datum to another within applicable areas

Putting It All Together

Hurricane Laura Inundation
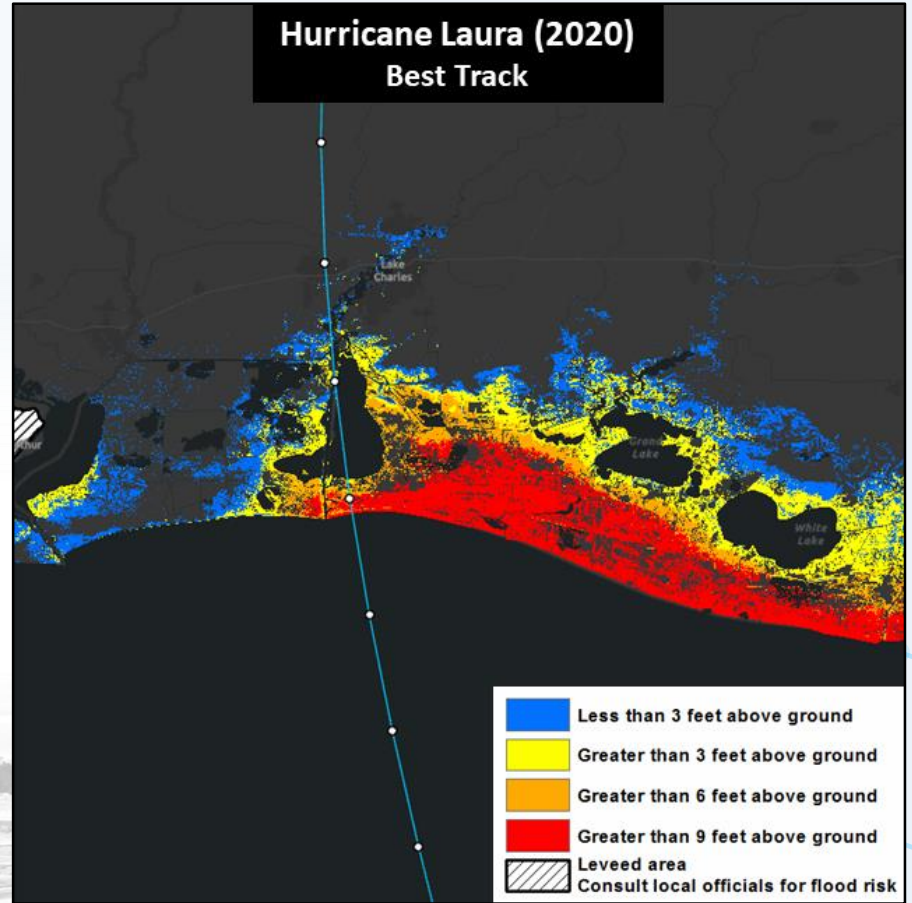
Post-Storm Simulations

Conducted by the NHC Storm Surge Unit to Meet Interagency Requirements with FEMA

Used to fill in the gaps where there are no *in situ* observations

Hurricane Laura (2020)
Best Track

Less than 3 feet above ground

Greater than 3 feet above ground

Greater than 6 feet above ground

Greater than 9 feet above ground

Leveed area
Consult local officials for flood risk

A Few Things To Keep in Mind

Instrument-based observations rarely (never?) capture peak inundation

01

Datums, datums, datum, and oh yeah, datums

02

Watch out for Waves

03

Highest inundation may not be where people actually live

04

Questions?

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