

IMPACTS OF HURRICANE KATRINA DUE TO STORM SURGE AND TOPOGRAPHIC CONDITIONS: WHY ONLY WIND USED TO CATEGORIZE HURRICANES?

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ENGINEERING & SCIENCE STUDENT DESIGN SHOWCASE

FLORIDA TECH

INTRODUCTION

- ❑ Costliest hurricane in the U.S
- ❑ 180.3 billion
- ❑ 1392 casualties (Knabb et al, 2023)
- ❑ Formed in Bahamas, Cat 1 over Florida, into Cat 5, weakening into Cat 3 once hit land
- ❑ Examine meteorological intricacies for advancing strategies in hurricane forecasting.

BACKGROUND

- ❑ Subtropical region
- ❑ Humid and warm
- ❑ Marshes and Swamps
- ❑ Unique elevation
- ❑ 161 Tropical cyclones
- ❑ Entering El-Nino
- ❑ Levee Failures

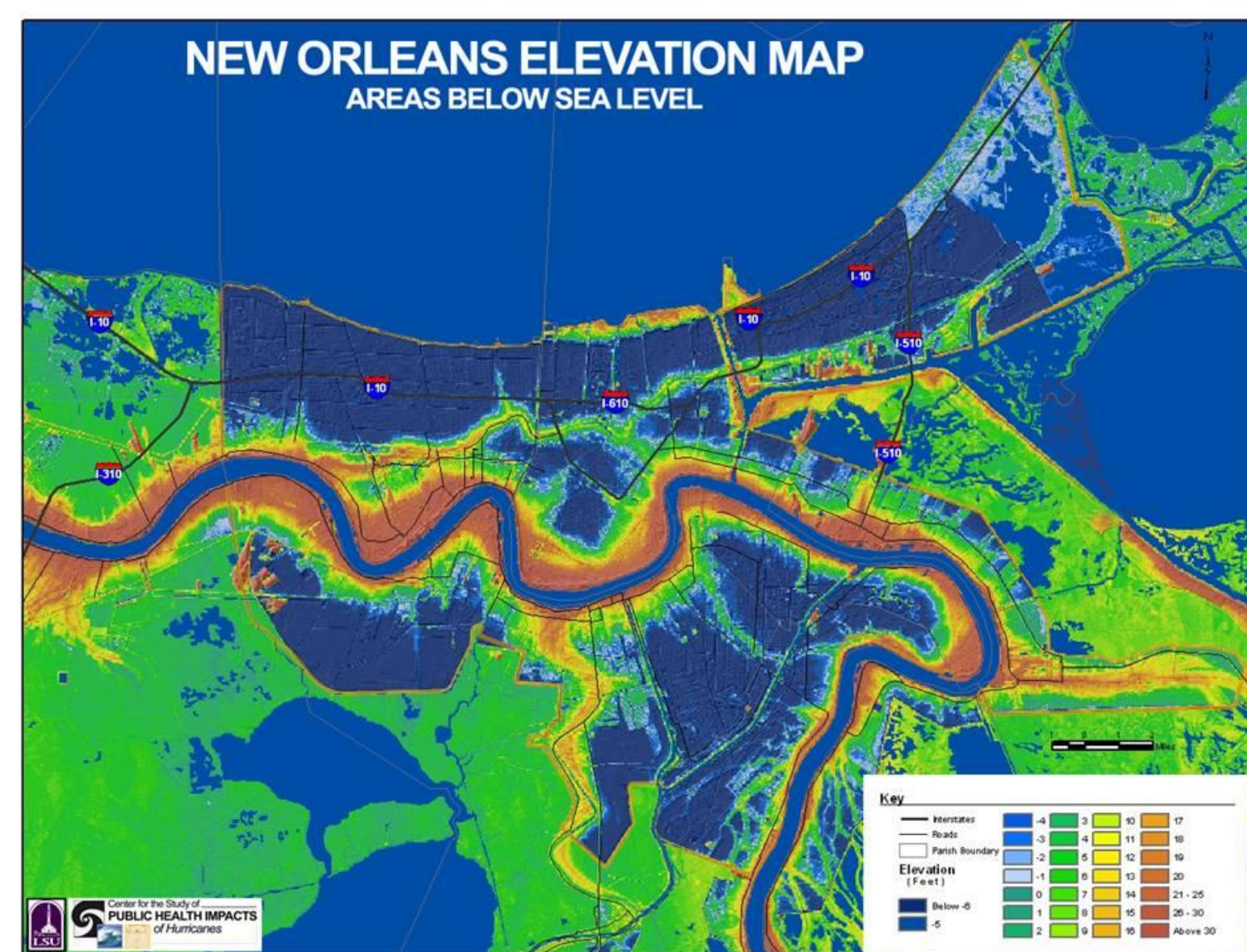


Figure 1. New Orleans Elevation Map, LSU Study of Public Health Impacts of Hurricanes

METHODS

- Extensive review of:
- ❑ Storm Surge
 - ❑ Pressure Tendencies
 - ❑ Surrounding systems
 - ❑ Sea Surface Temperatures (SSTs)
 - ❑ Forecast Tracks
 - ❑ Satellite and Radar Images

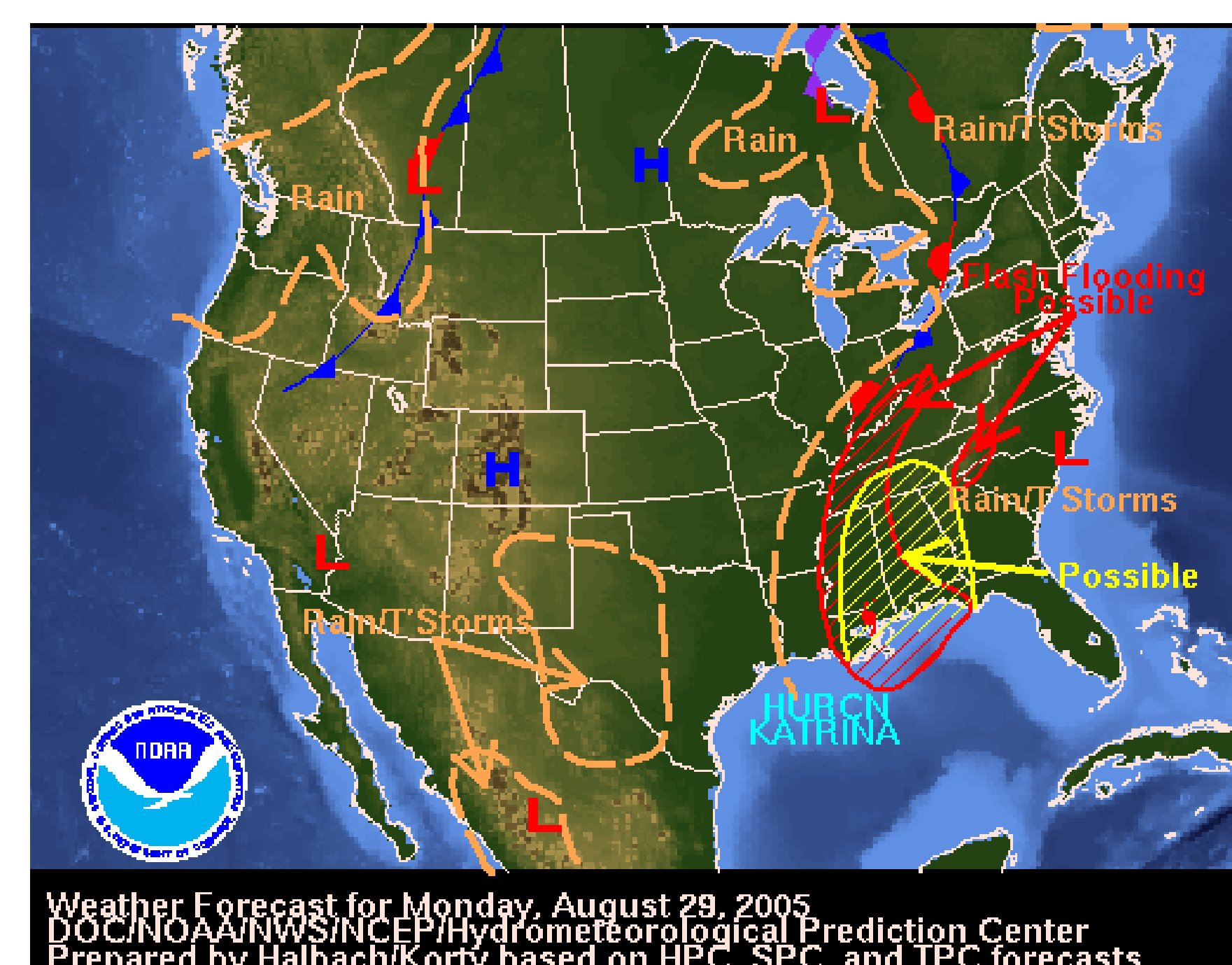
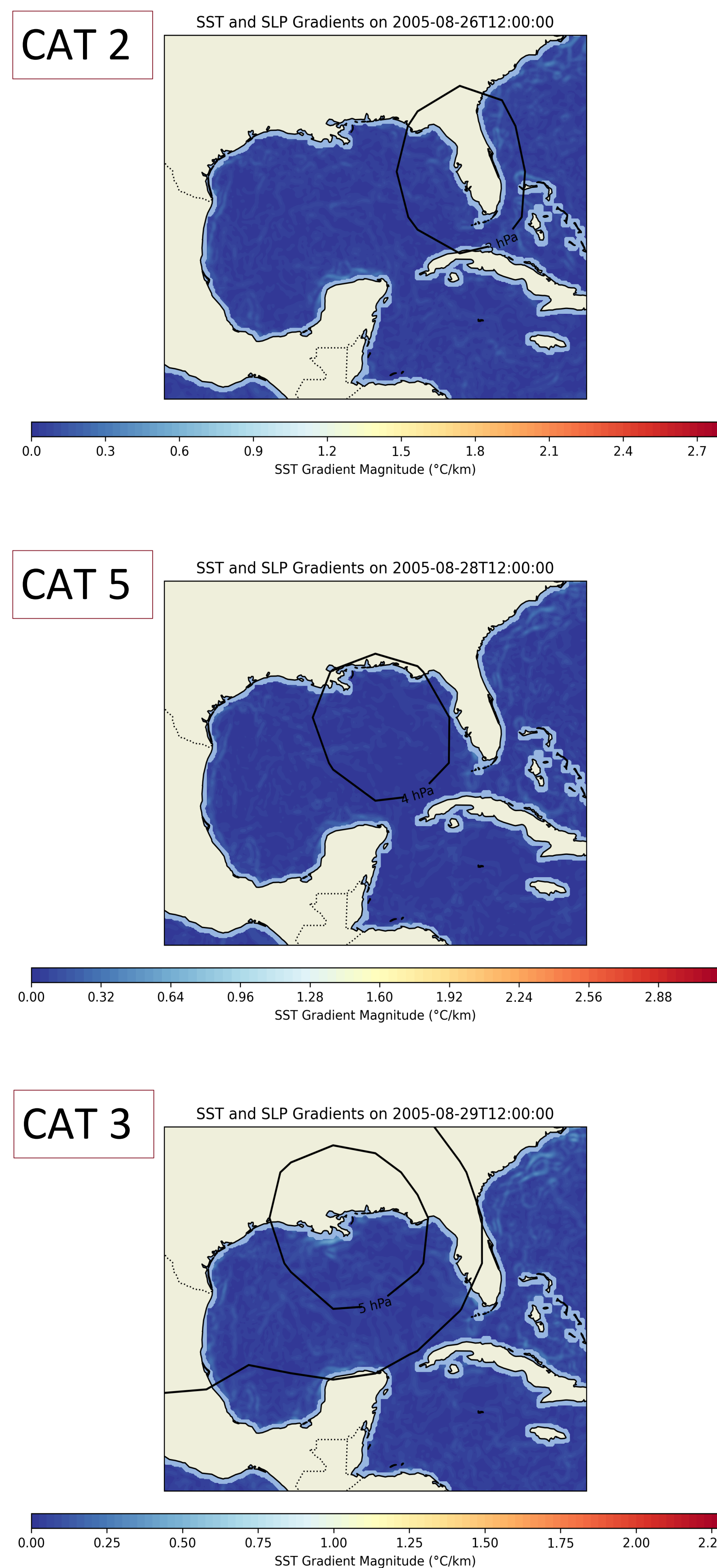


Figure 4. Surface Weather Forecast for Monday, August 29, 2005. (NOAA, 2005)

RESULTS

Figure 2. (Left) Gradients of SST [$^{\circ}Ckm^{-1}$] and Sea Level Pressure (SLP) [hPa] at 12Z for August 26th, 28th, and 29th 2005 for top, middle and bottom, respectively. SST (SLP) gradients are shaded (black lines) with color bar below. SLP data (Kalnay et al, 1996) & SST data (Hersbach et al, 2023) are coded in JupyterLab.

Figure 3. (Right) Wind vectors ($\vec{V} = \sqrt{u^2 + v^2}$) in [ms^{-1}] with magnitude and direction at 12Z for August 26th, 28th, and 29th 2005 for top, middle and bottom, respectively. X-axis (y-axis) is the longitude (latitude). The color of the vectors indicate the wind magnitude. Data was extracted from Copernicus Products (Hersbach et al, 2023) and coded in JupyterLab.

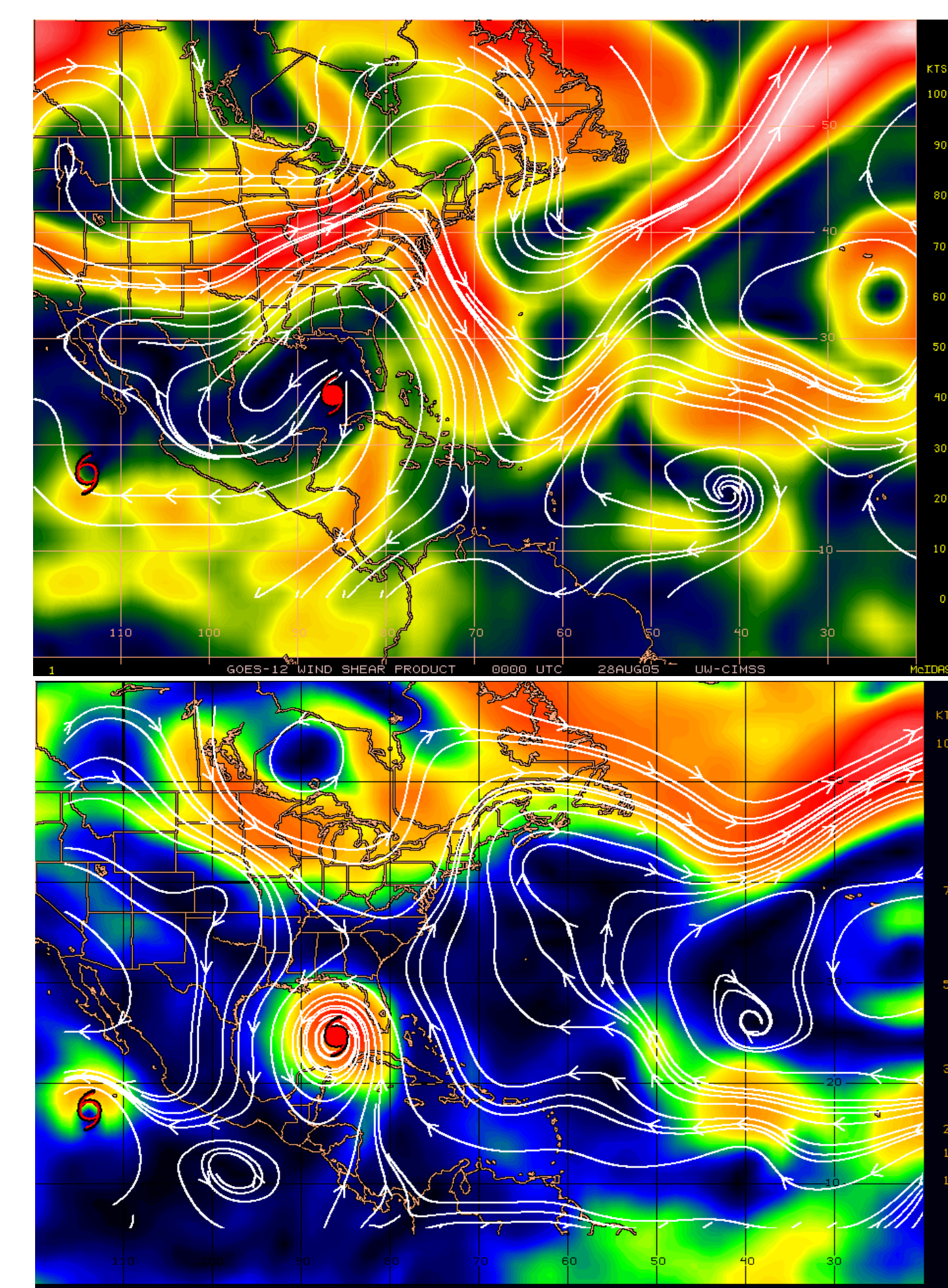
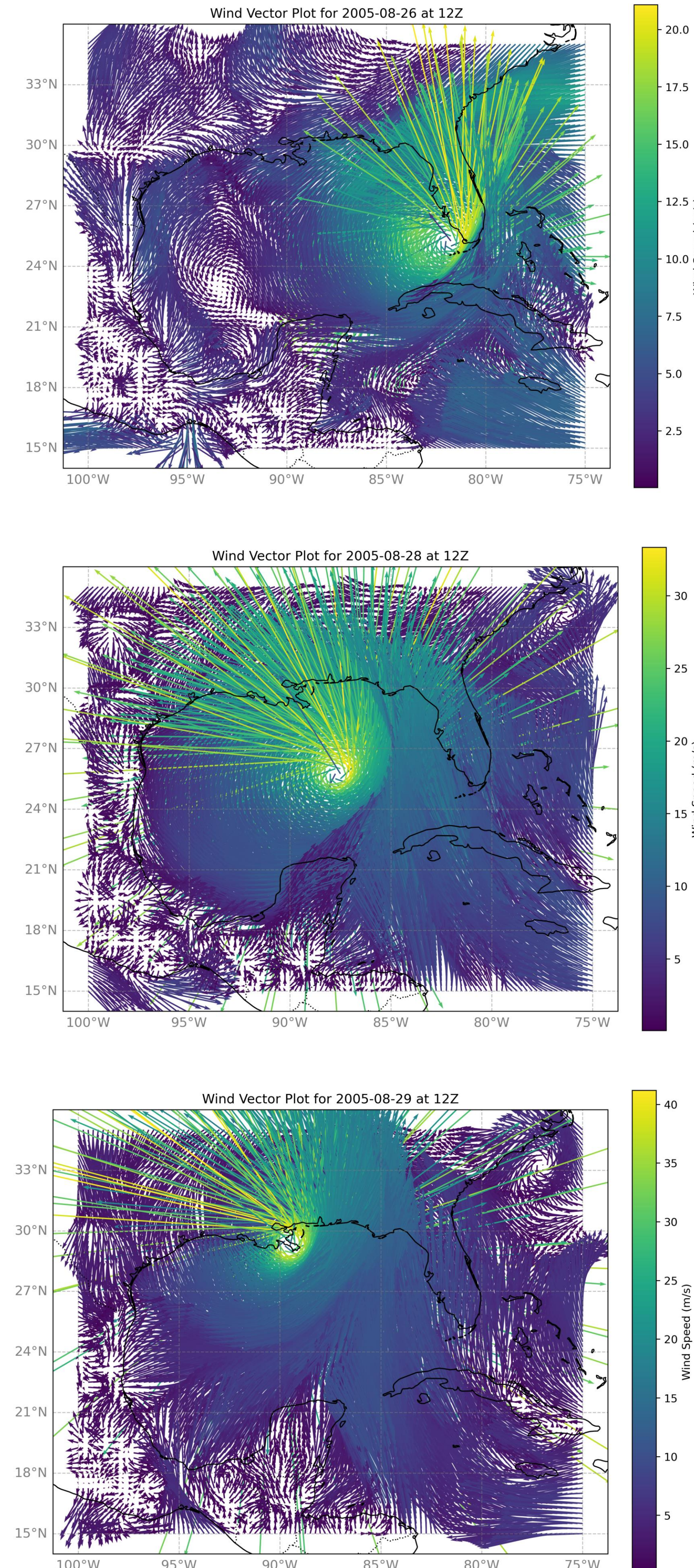


Figure 5. (Top) Wind Shear Product & **(Bottom)** Environmental Steering Product (500-850 hPa layer) at 00Z August 28, 2005. (UW-CIMSS/NESDIS, 2005)

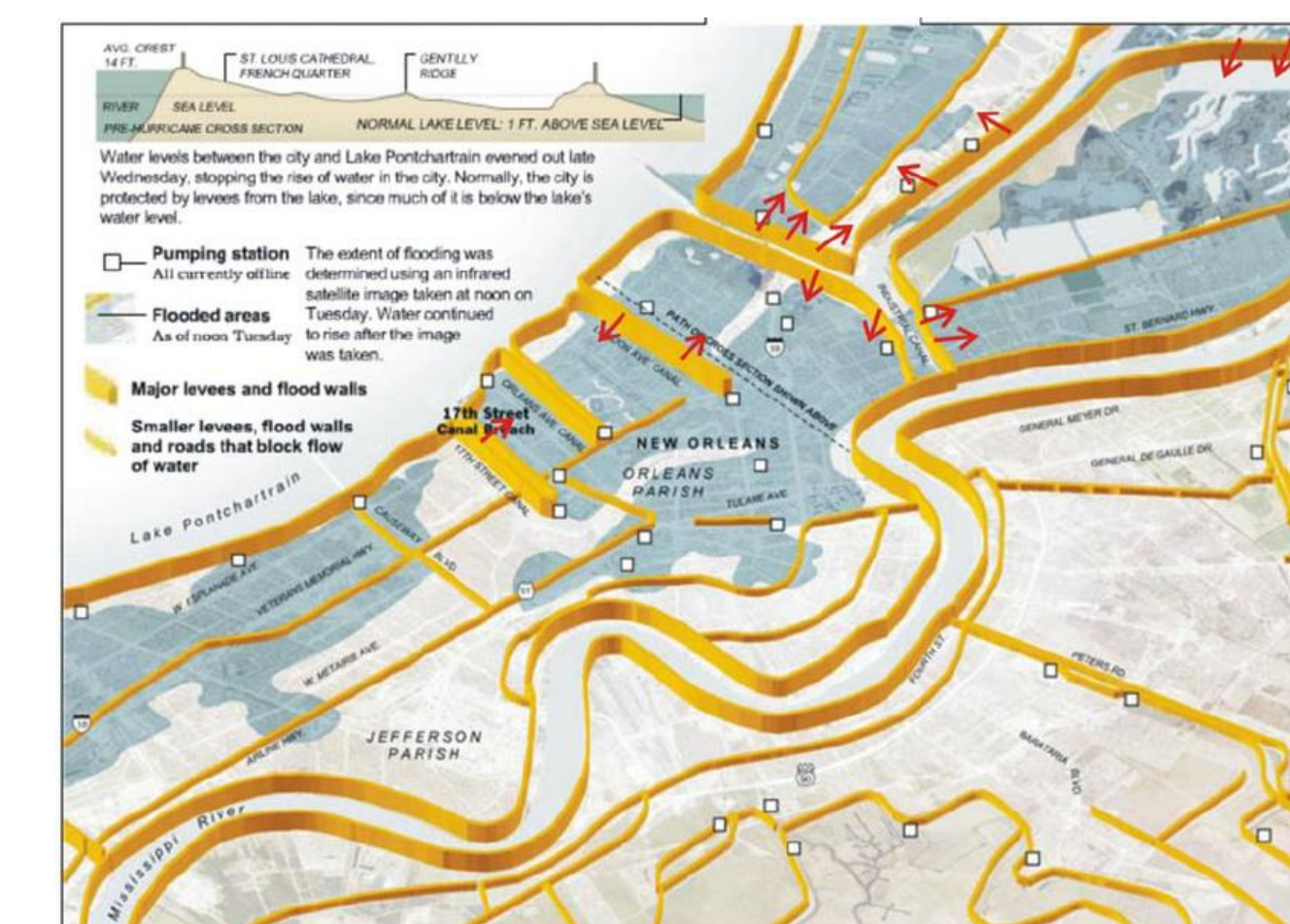
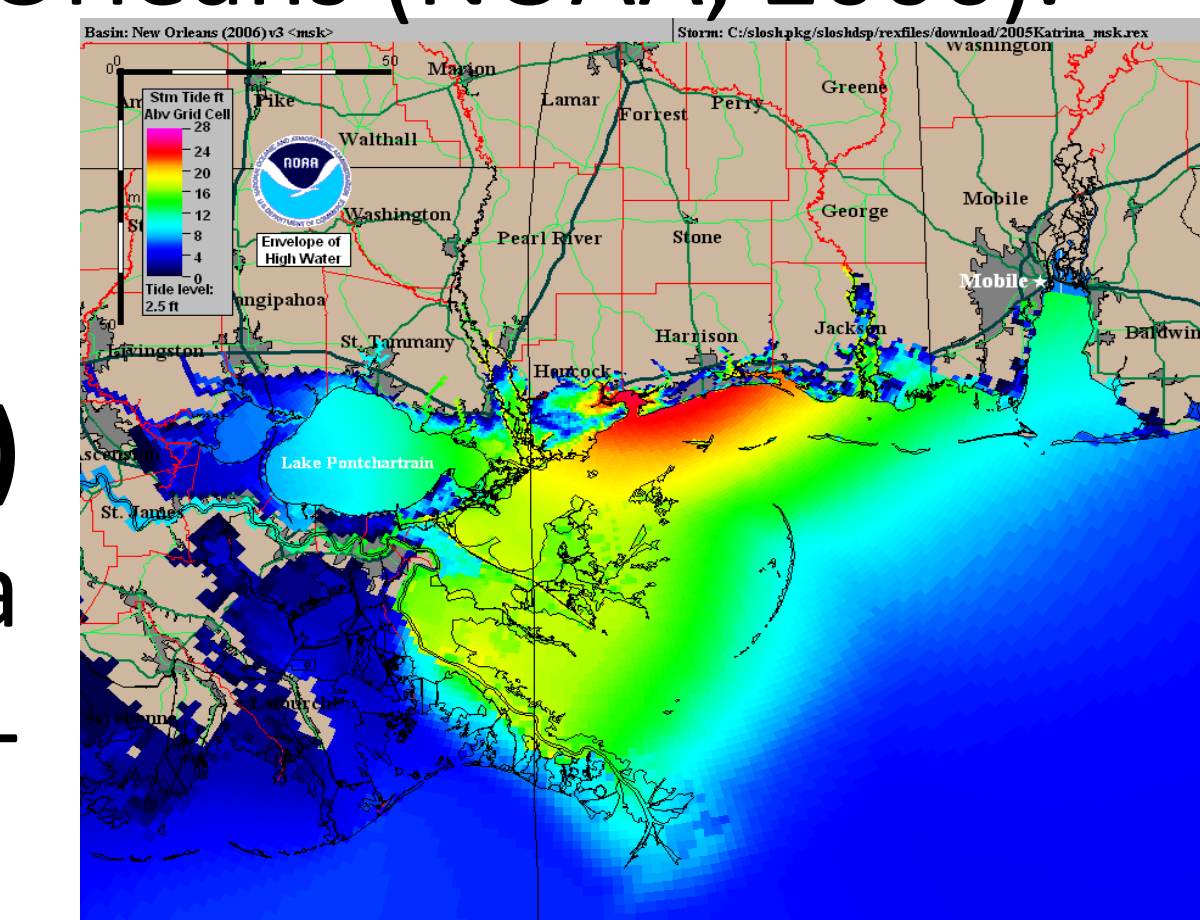


Figure 6. (Top) Levee systems and flood walls (New York Times). **(Bottom)** Storm Surge of the basin of New Orleans (NOAA, 2006).



DISUSSION

- Major hazard was storm surge & the critical parameters are SST and pressure.
- ❑ SSTs were roughly 28 – 32 $^{\circ}C$, or 82.4 – 89.6 $^{\circ}F$.
 - ❑ Pressure drops rapidly where the SSTs were warmer
 - ❑ Area off coast warmer 8/29
 - ❑ Stationary front in NE possibly helped steer, and weaken Katrina on the 31st
 - ❑ Light wind shear and poleward steering product
 - ❑ Storm surge 16-20ft

CONCLUSION

- Improving
- ❑ Weather instruments
 - ❑ Marine buoys to observe SST, winds, and pressure tendencies
- Future research
- ❑ Pressure tendencies to categorize hurricanes
 - ❑ Cross-reference past to present

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