

# Multiple observational platform analysis of recent Gulf hurricanes

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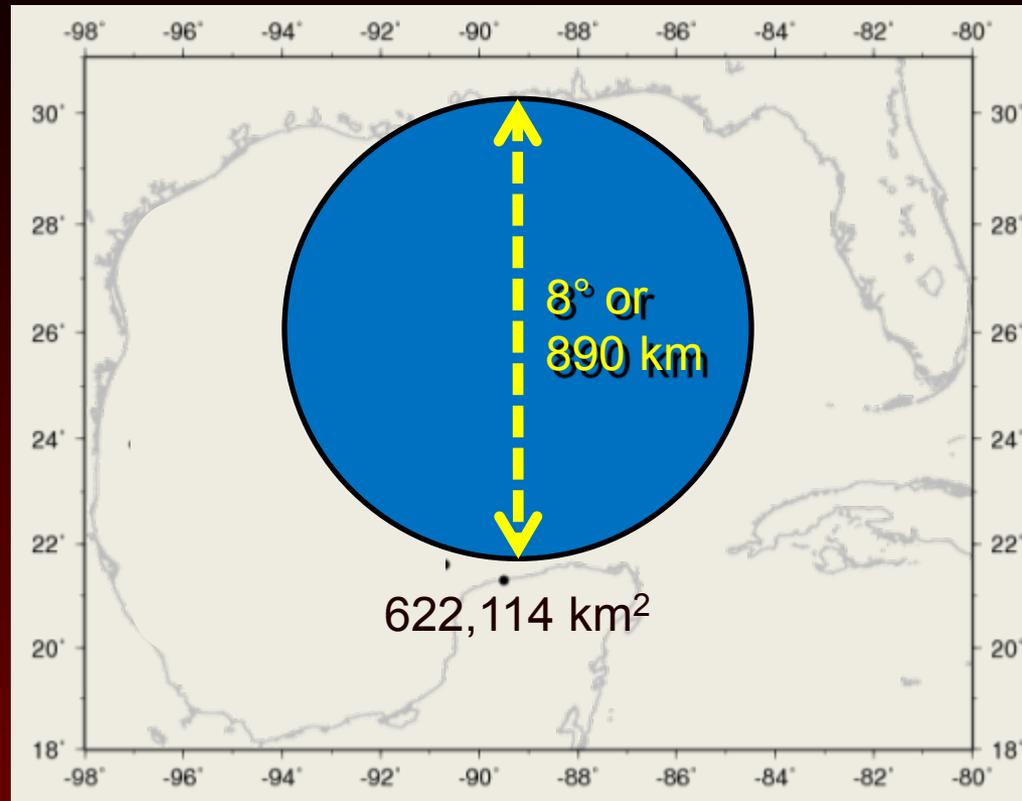
Geosystems Research Institute  
Mississippi State University  
Stennis Space Center, MS

2011 Northern Gulf Institute Annual Conference

May 18, 2011

# Gulf distribution of tropical cyclone size

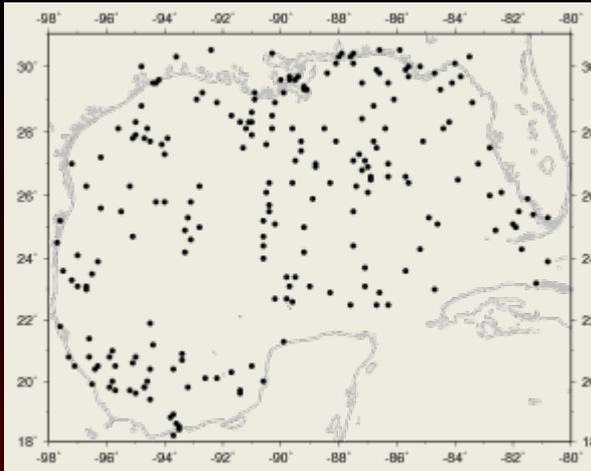
(measured here as area of sustained wind  $\geq 34$  knots)



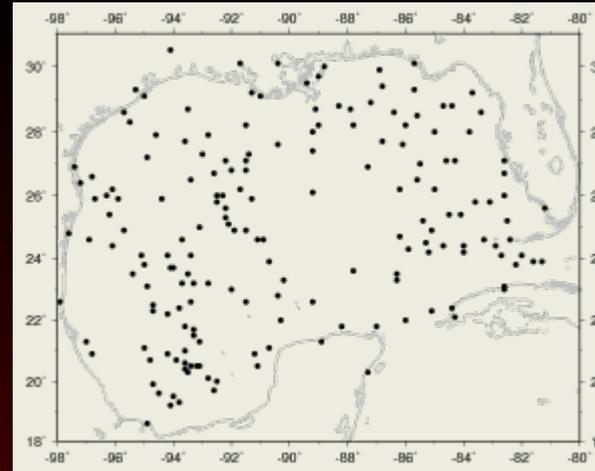
Largest circular area covering only water and marshland  
(where wind field is least inhibited)

# Gulf distribution of tropical cyclone size: 1988 - 2008

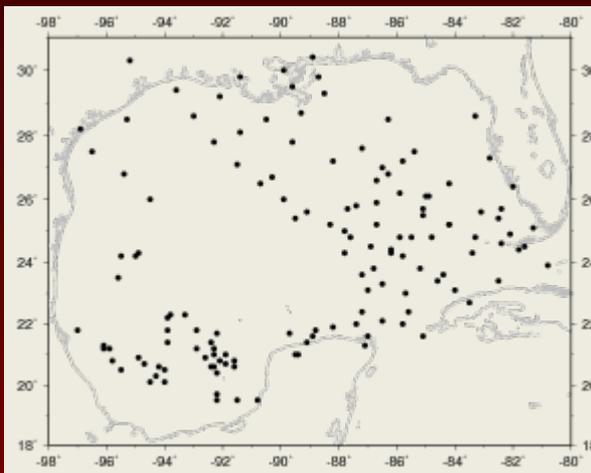
< 10% of GoM circle



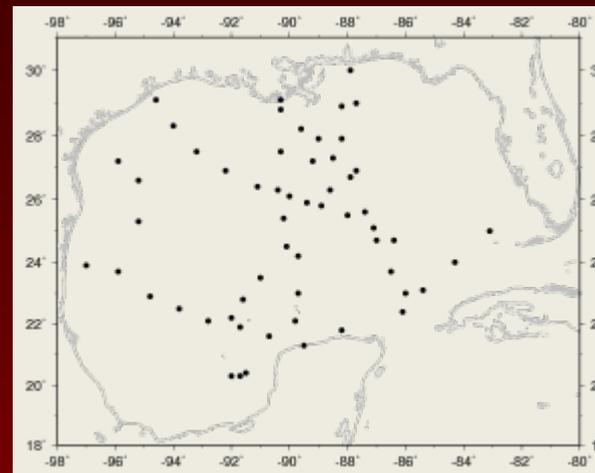
10% - 25% of GoM circle



25% - 50% of GoM circle



> 50% of GoM circle



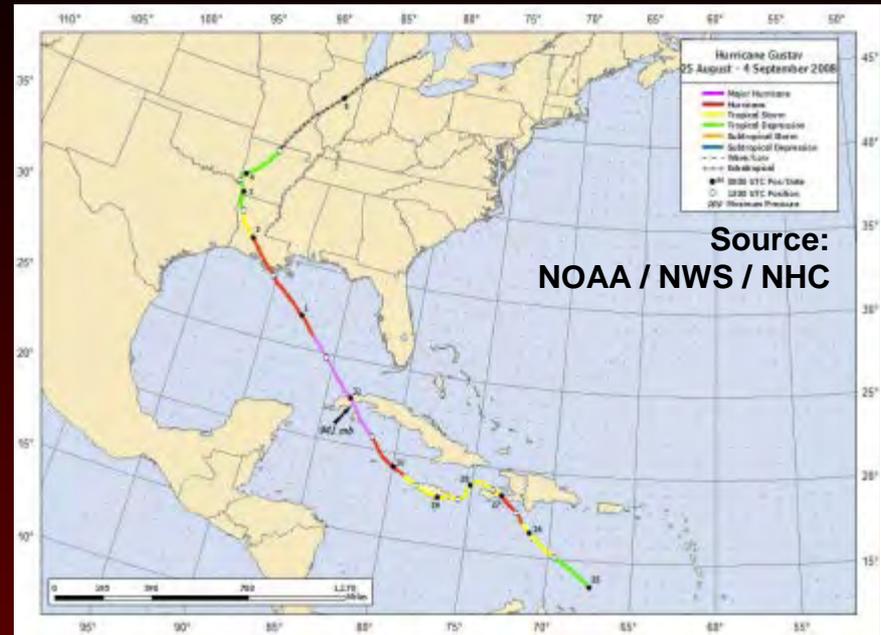
wind field size calculated from data provided by NOAA/CIRA/RAMMB

# Recent examples of large hurricane impact in the Gulf: Hurricane Gustav (2008)



**Hurricane Gustav (2008)**  
58% of GoM circle

Wind field doubled in area  
over the Gulf



\$4.3 billion damage in U.S.

52 deaths in U.S. directly and indirectly  
attributed to Gustav

# Surge impact of Gustav 2008

34-knot wind area: 359,833 km<sup>2</sup> (58% of GoM circle)



Storm surge values compiled by the National Hurricane Center

# Wind impact of Gustav 2008

34-knot wind area: 359,833 km<sup>2</sup> (58% of GoM circle)

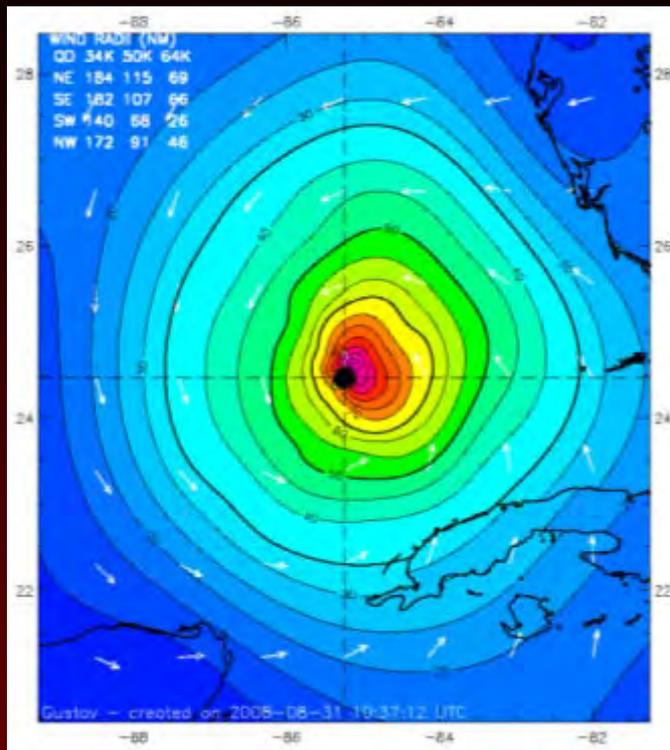


Maximum sustained wind values compiled by the National Hurricane Center

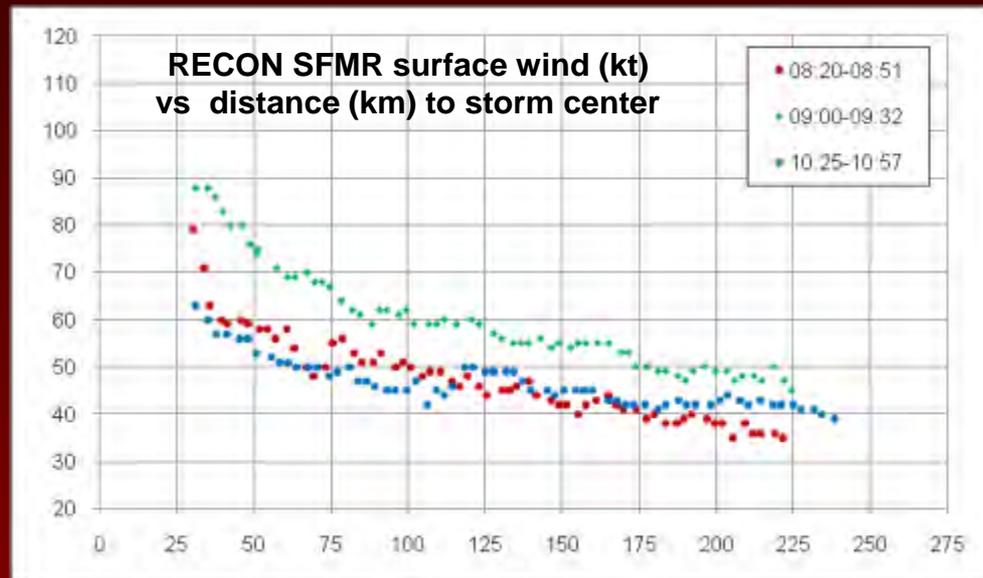
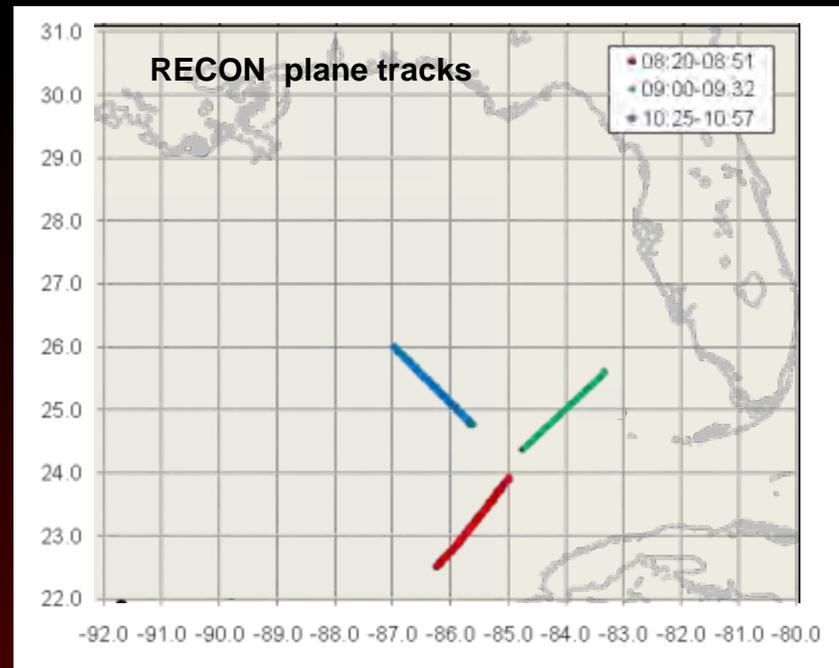
0820-1057 UTC 31 Aug 2008

HWINDS (NOAA / AOML / HRD)  
vs reconnaissance data

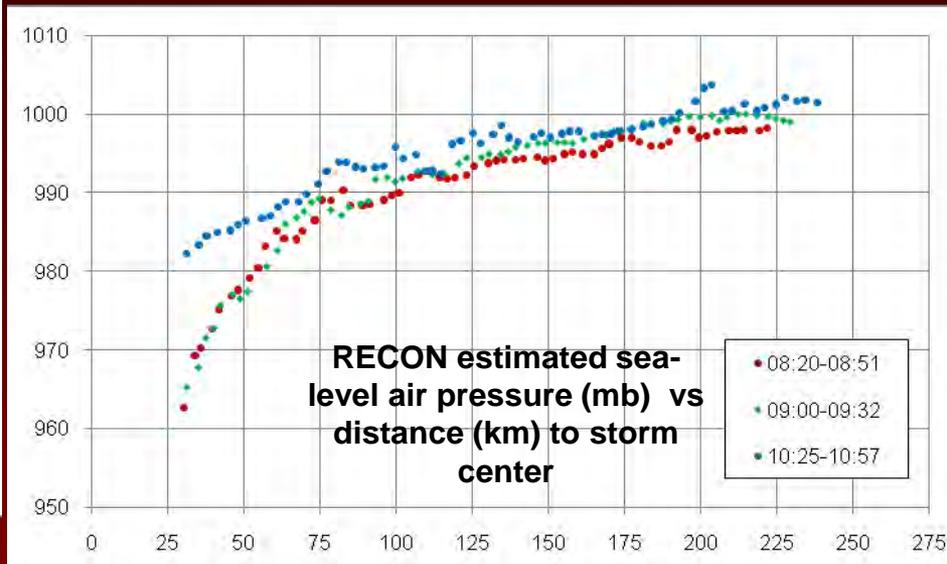
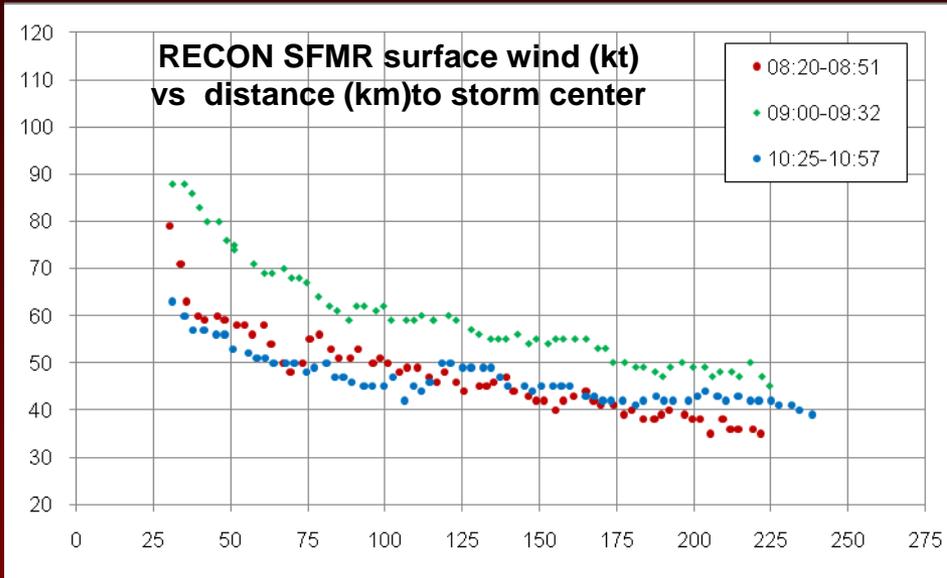
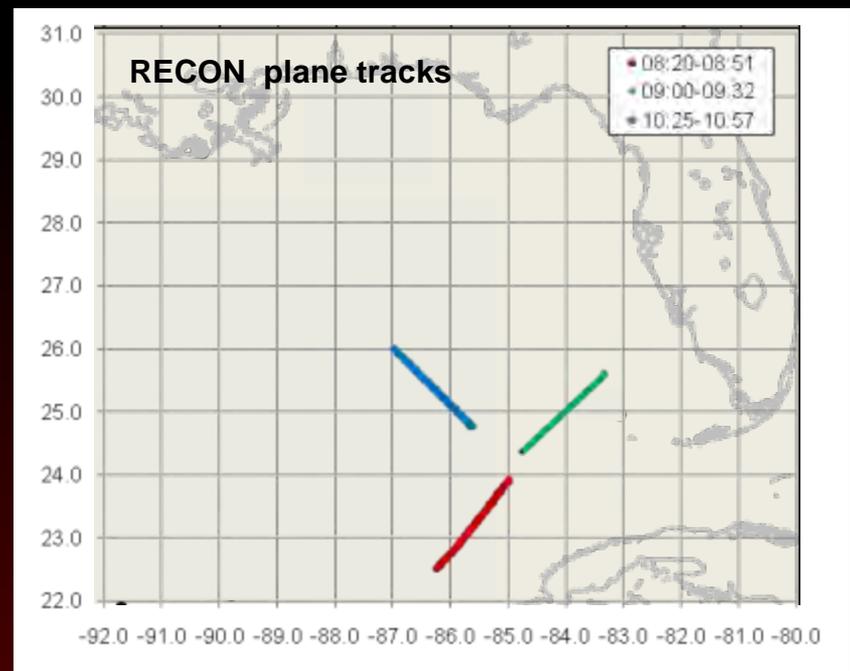
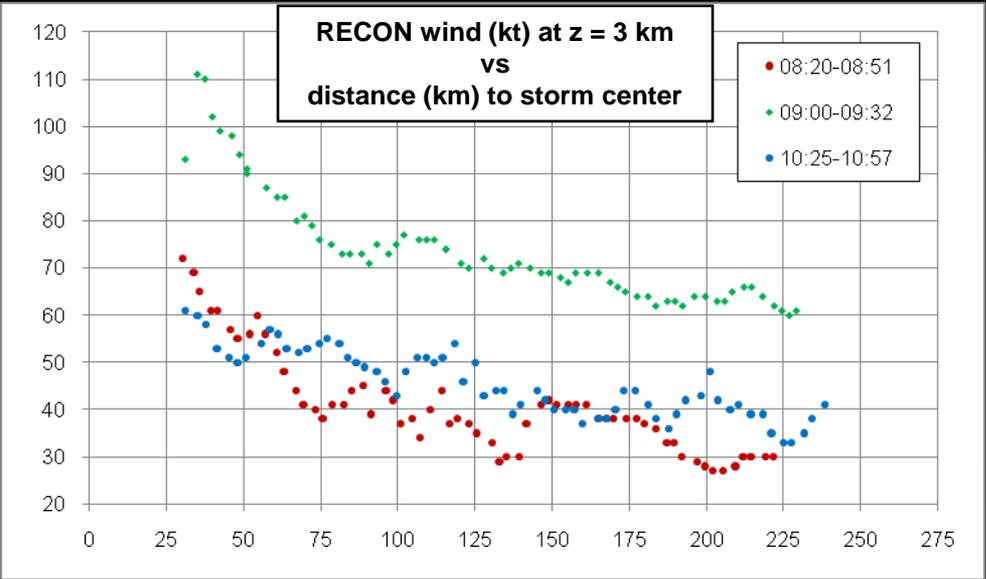
1030 UTC 31 Aug 2008



more variability with the raw data



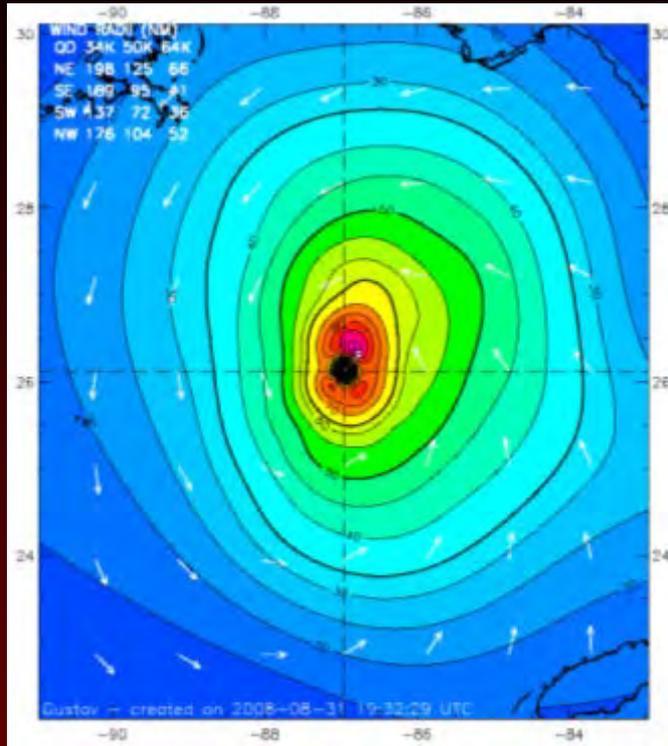
# Reconnaissance data for Gustav 0820-1057 UTC 31 Aug 2008



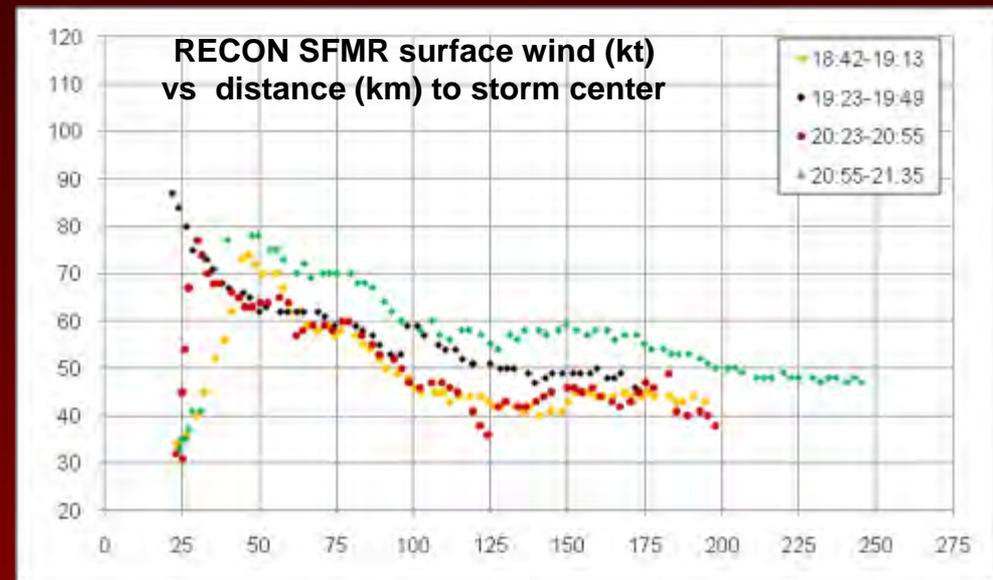
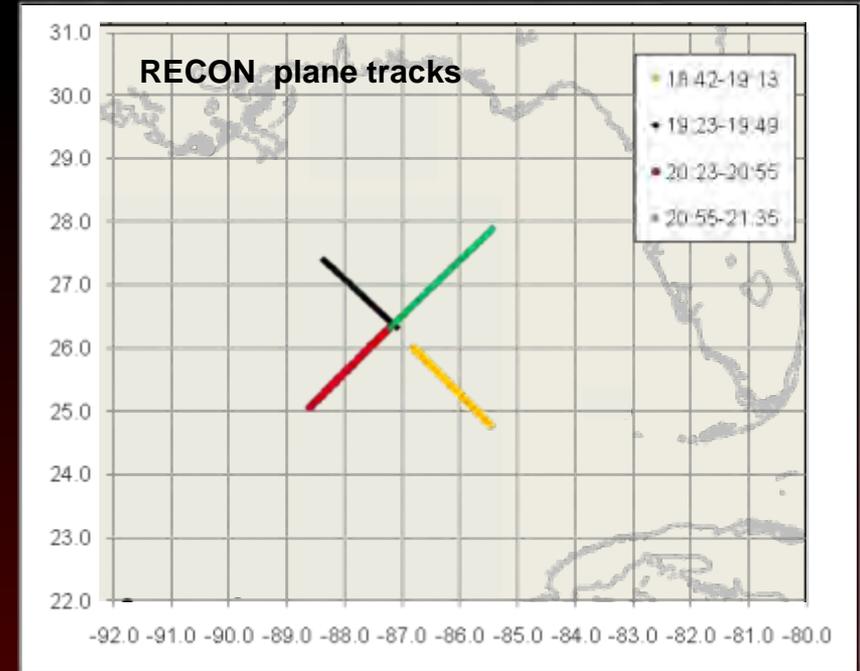
1842-2135 UTC 31 Aug 2008

HWINDS (NOAA / AOML / HRD)  
vs reconnaissance data

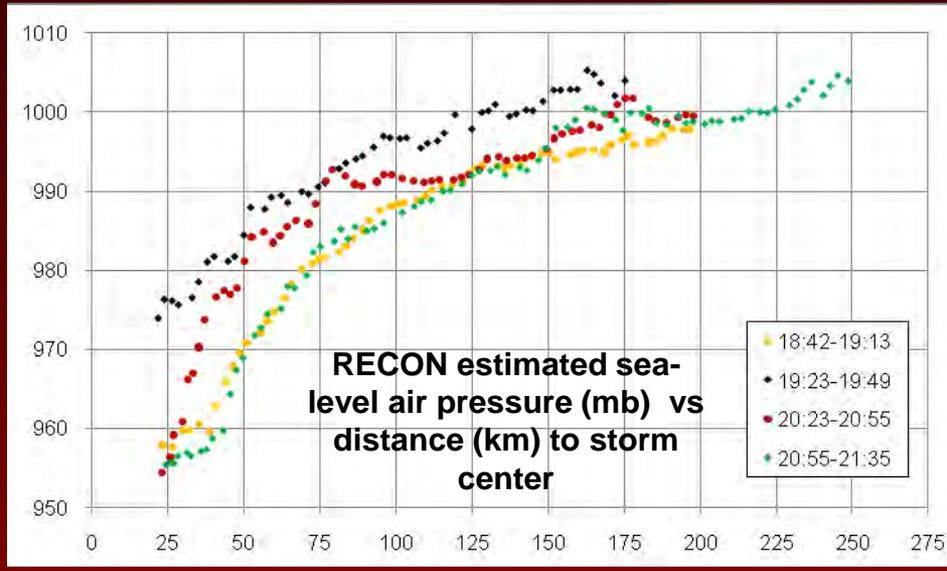
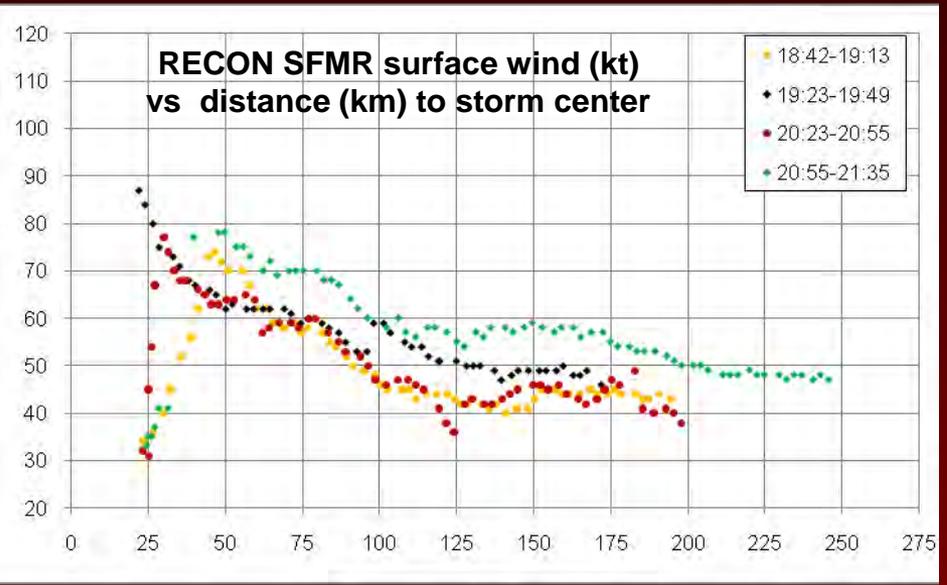
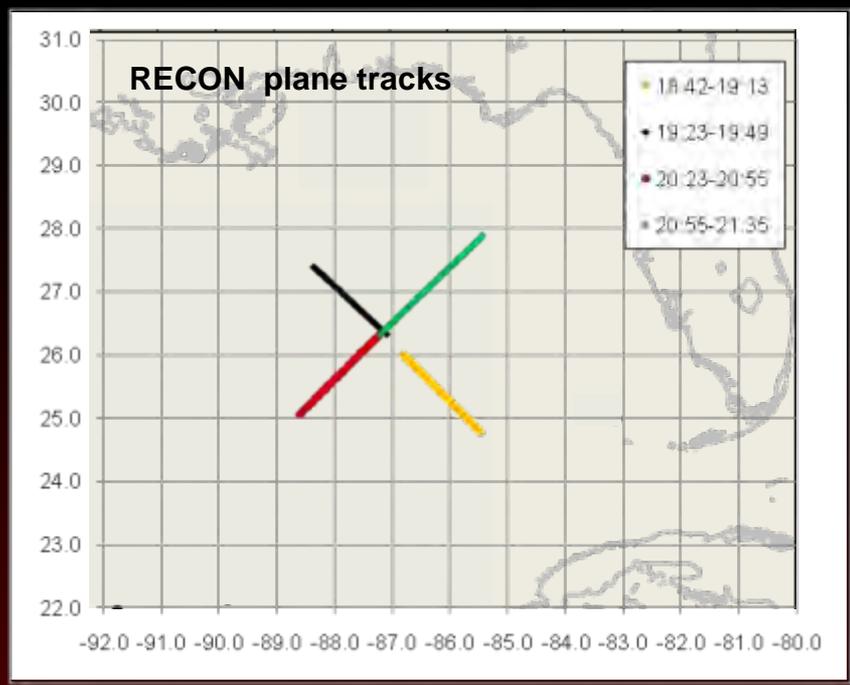
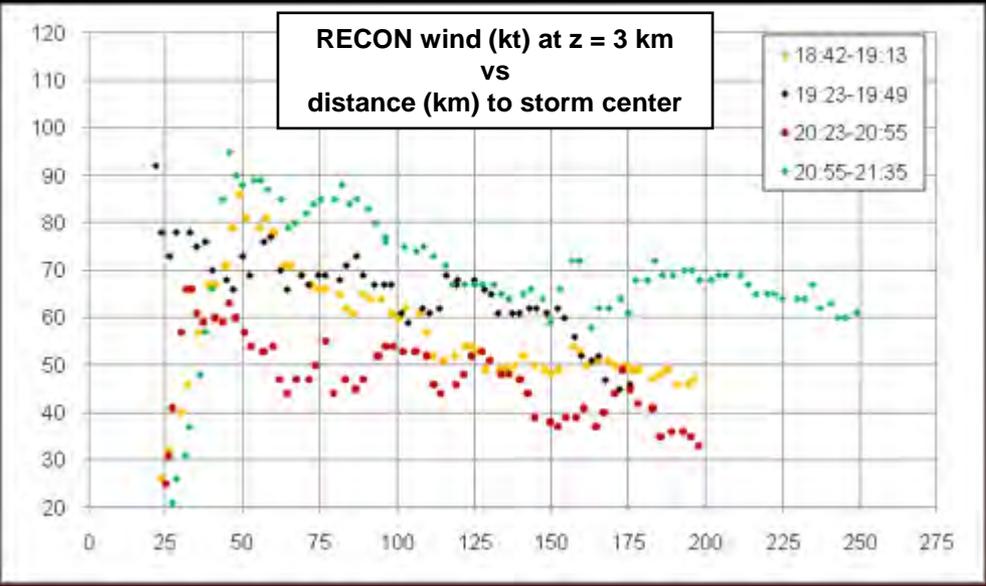
1930 UTC 31 Aug 2008



Variable radius of maximum  
sustained winds.



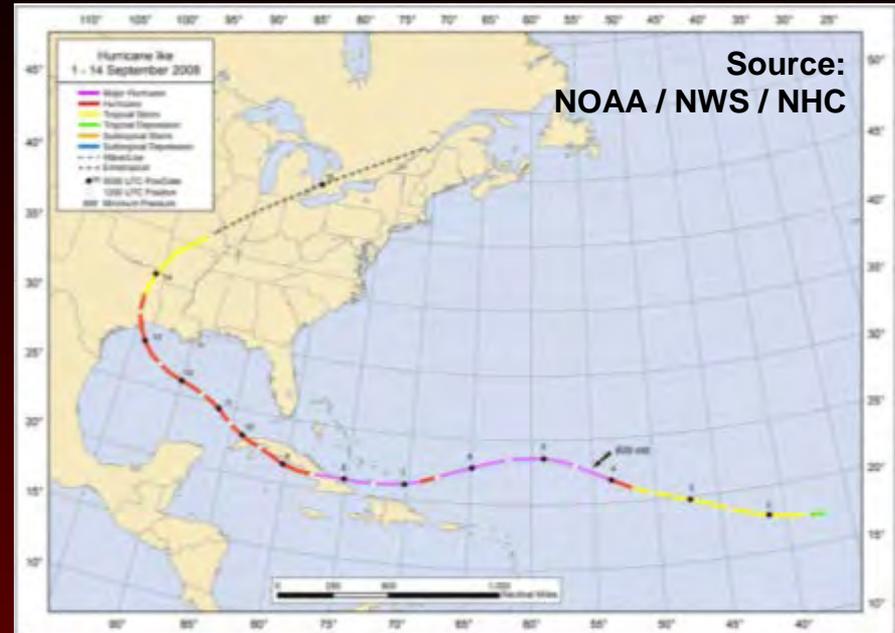
# Reconnaissance data for Gustav 1842-2135 UTC 31 Aug 2008



# Recent examples of large hurricane impact in the Gulf: Hurricane Ike (2008)



**Hurricane Ike (2008)**  
74% of GoM circle  
grew 96% while over Gulf

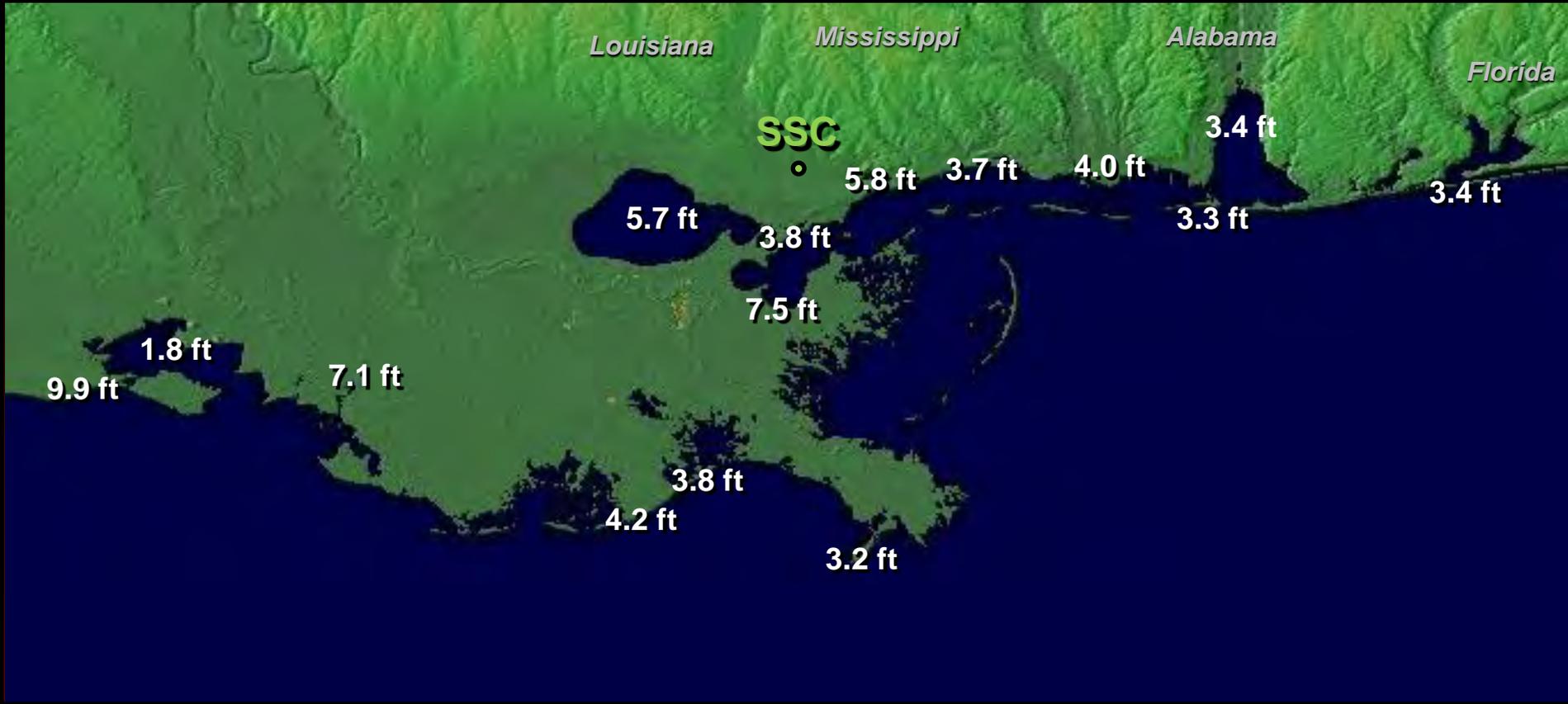


\$19.3 billion damage in U.S.

84+ deaths in U.S. directly and indirectly  
attributed to Ike

# Surge impact of Ike 2008

34-knot wind area: 458,205 km<sup>2</sup> (74% of GoM circle)



storm center south of map area

Storm surge values compiled by the National Hurricane Center

# Wind impact of Ike 2008

34-knot wind area: 458,205 km<sup>2</sup> (74% of GoM circle)

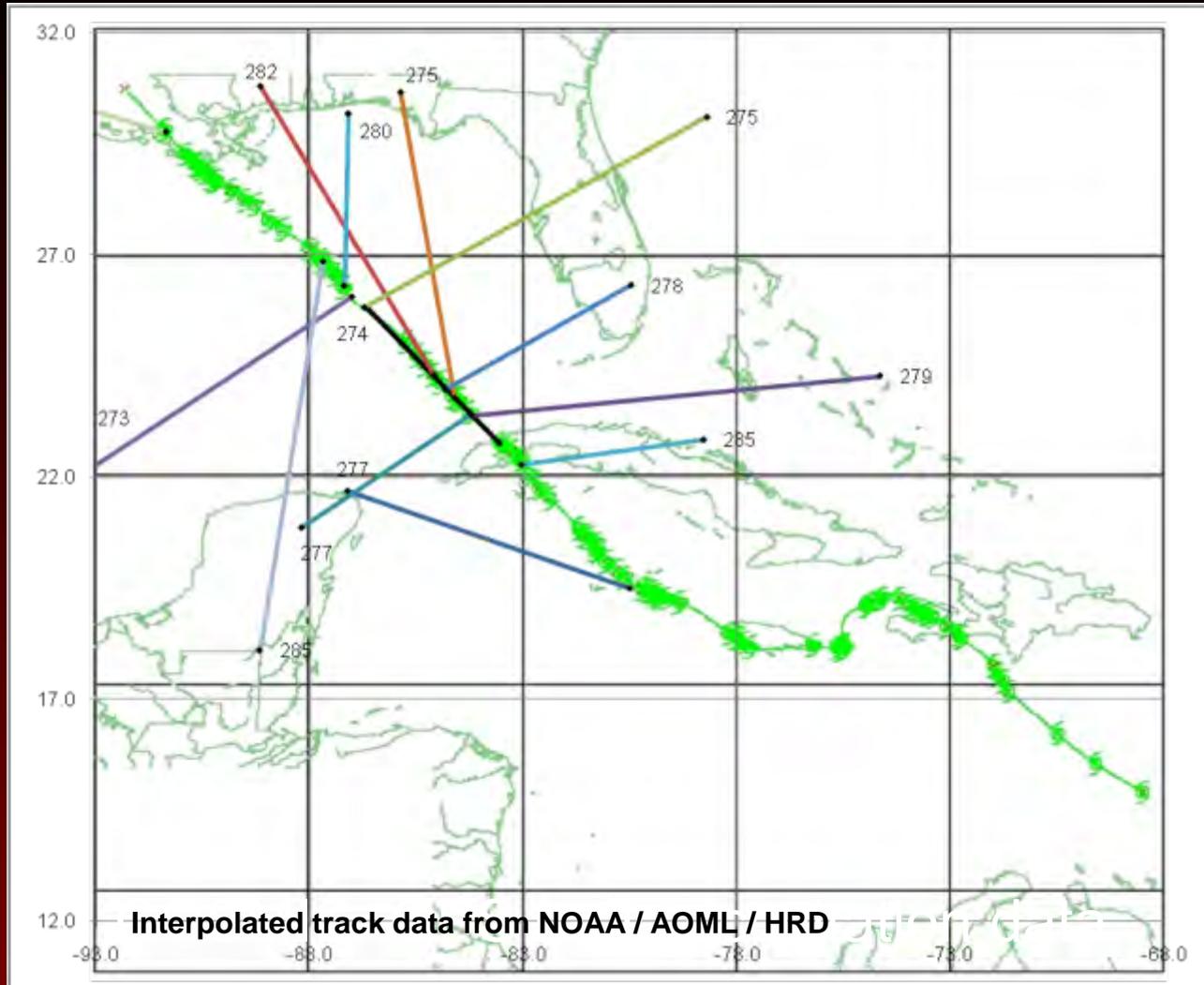


storm center south of map area

Maximum sustained wind values compiled by the National Hurricane Center

# COSMIC GPS radio occultation data

GPS signal refractivity near Gustav at  $z = 2$  km

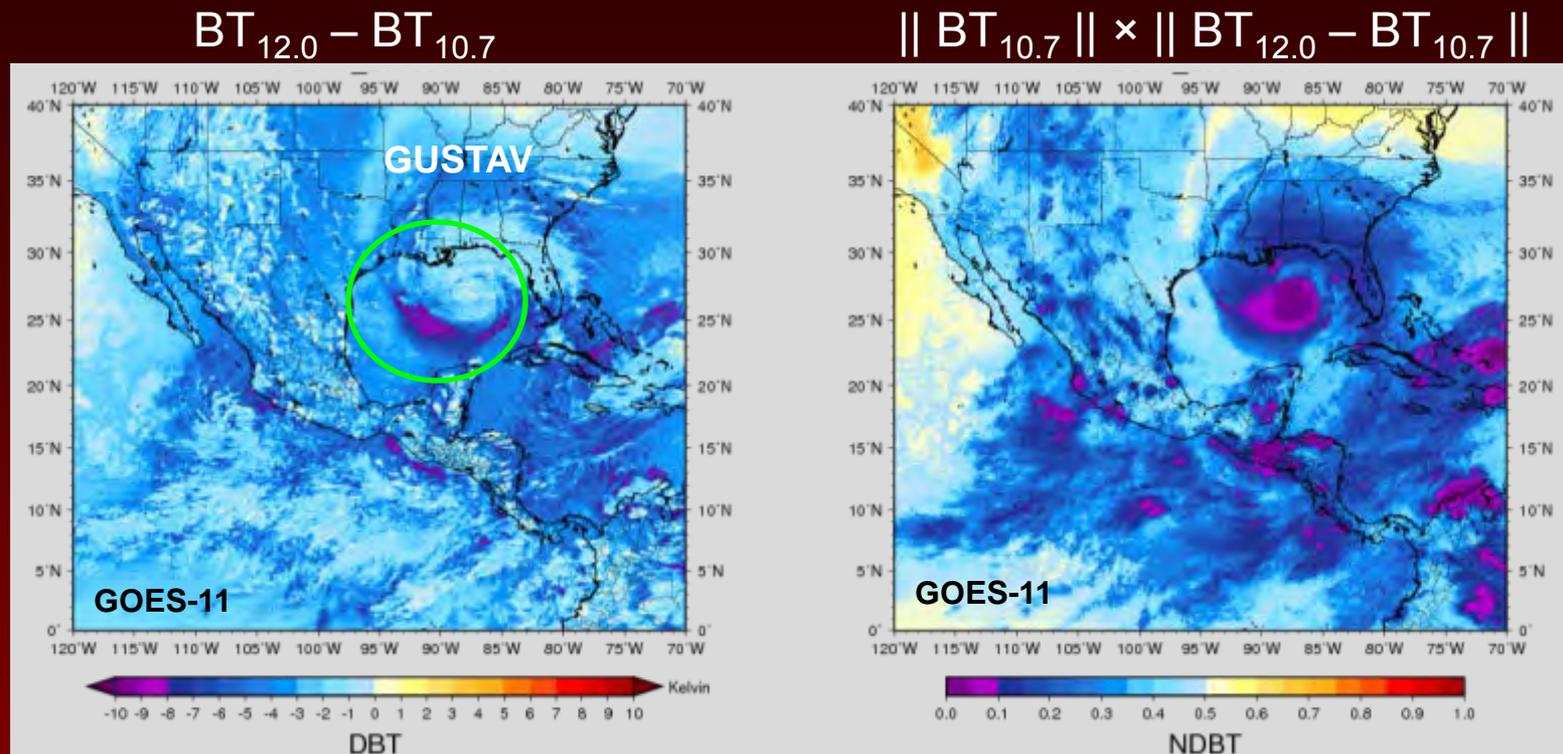


higher values generally translate to higher water vapor content

# Detecting moisture with difference of infrared brightness temperature ( $12.0 \mu\text{m} - 10.7 \mu\text{m}$ )

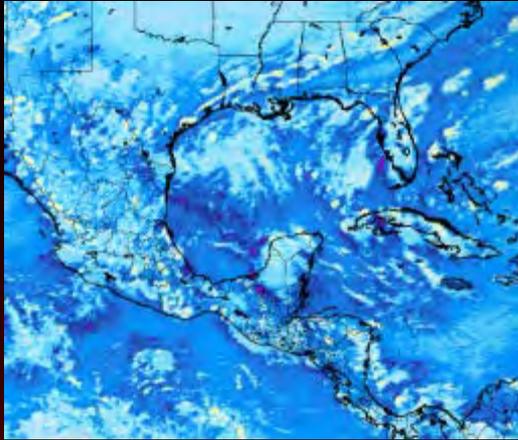
Typically used to detect dry, dust-laden air (Dunion and Velden 2004).

When low-level water vapor radiates at a much lower temperature than the Earth's surface, a significant negative difference is observed and high water vapor content is implied.



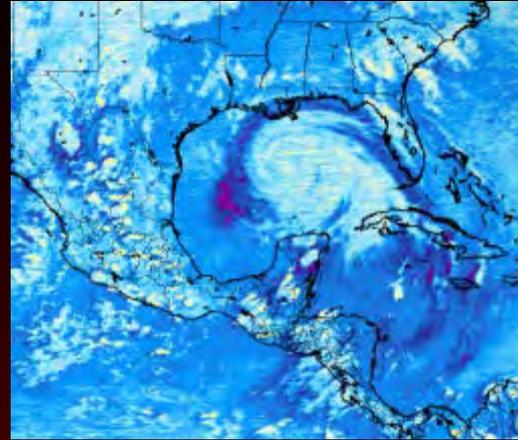
## Humberto 2007

quickly developed into hurricane



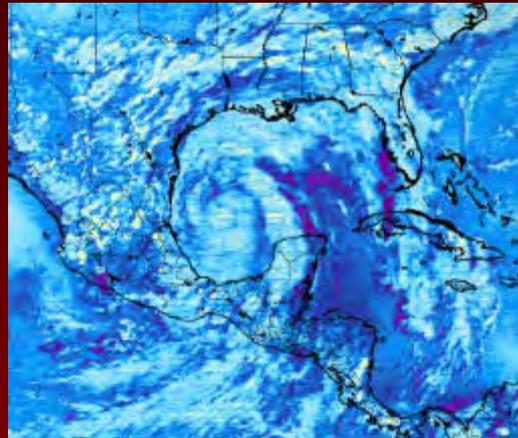
## Ike 2008

maintained intensity over Gulf



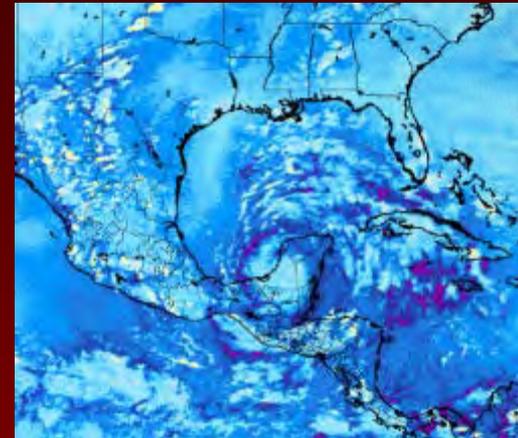
## Alex 2010

intensified over western Gulf



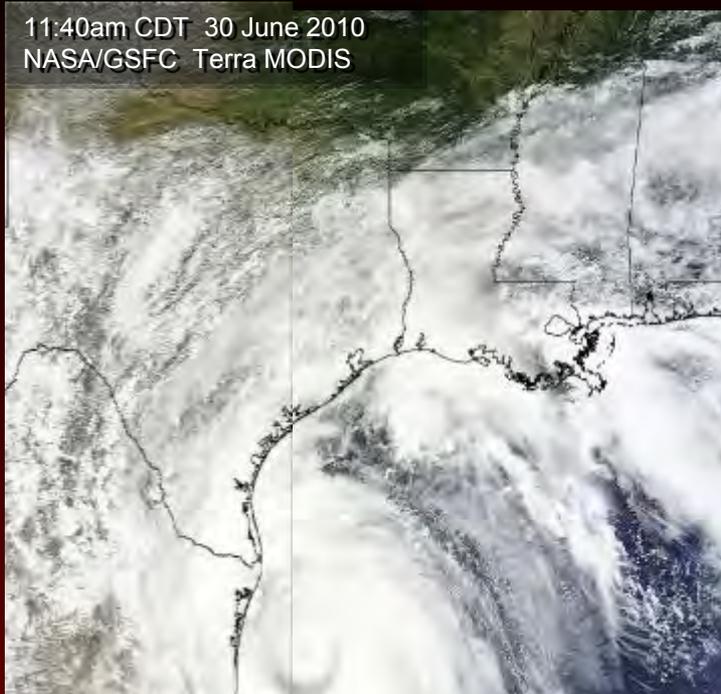
## Karl 2010

intensified over southern Gulf



END

# Recent examples of large hurricane impact in the Gulf: Hurricane Alex (2010)



**Hurricane Alex (2010)**  
41% of GoM circle  
grew 96% while over Gulf



~ 3-foot storm surge along Texas coast