

# Technical, Operational, and Political Challenges to Development of a Regional CORS Network along the Gulf Coast

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# Talking Points

A regional CORS network is vital to the economies, safety, and survival of states of the Gulf Coast.

**WHY?** The Gulf Coast is the site of the largest natural disaster in the 21<sup>st</sup> century. It is the result of mainly natural land subsidence and is exacerbated by eustatic sea level rise.  
→ Example, >15,000 squ. km of land in Louisiana will be fall below sea level by 2100.

## **SO WHAT?**

Subsidence has ruined the state's system of elevation control. Highways are being designed and built using wrong elevations. Flood zone maps are inaccurate, slab elevations are off, elevations of evacuation roads and levee tops are wrong. The scientific paradigm underpinning plans to mitigate land loss is faulty.



# Talking Points (cont.)

**WHAT IS BEING DONE?** New system is based on CORS.

Re-establishment of correct elevations in the region has difficult technical, operational, and political challenges that have to be overcome.

*Technical* → Establishing and maintaining orthometric heights on CORS antennas.

*Operational* → Field methods that will achieve desired precision under local weather conditions.  
Communications at remote sites.

*Political* → \$\$

→ Agency inertia

→ Some people don't want correct elevations.

→ Some agencies and people don't want the science paradigm overturned.

# 3-D Positioning in LA is messed up



## National Height Modernization Study

Report to Congress

Executive Summary



U.S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
National Ocean Service  
National Geodetic Survey

June 1998

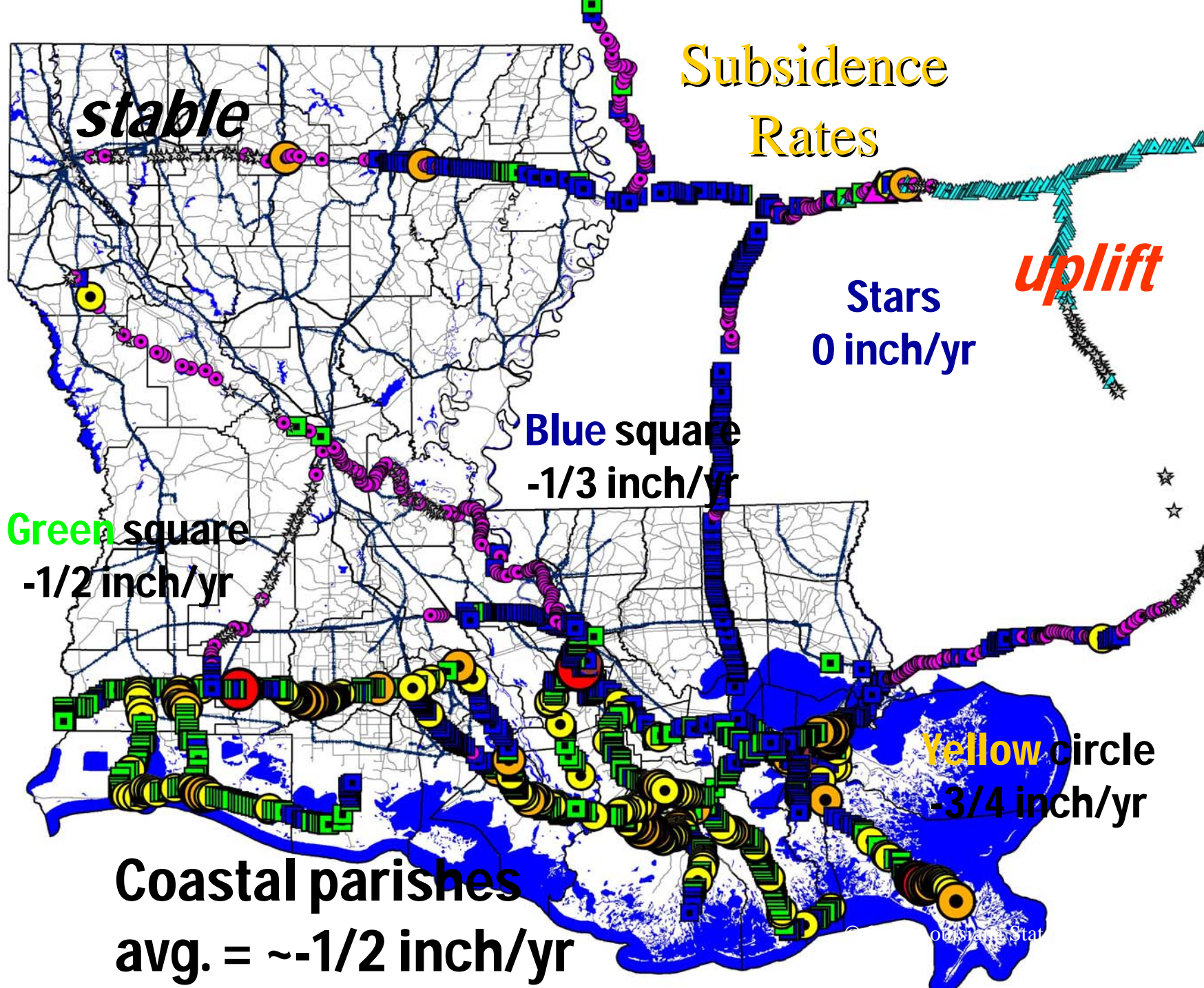
NOAA told Louisiana in 2001 that the system we use to measure elevations is,

“inaccurate  
and  
obsolete.”

# *Technical Challenges*

- Vertical and horizontal control networks have been corrupted by subsidence.
- Establishing and maintaining orthometric heights on CORS antennas.





*stable*

Subsidence Rates

*uplift*

Stars  
0 inch/yr

Blue square  
-1/3 inch/yr

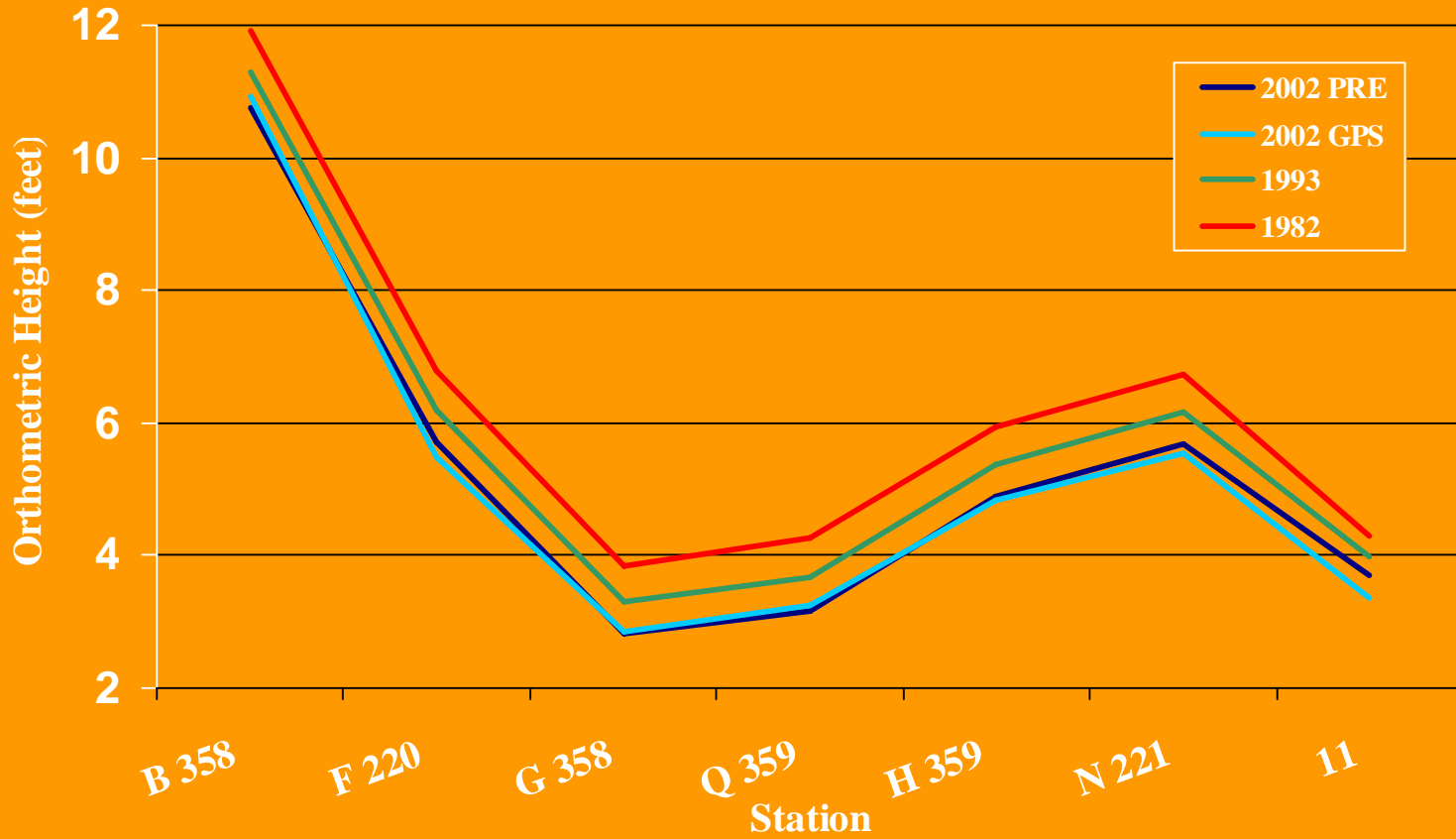
Green square  
-1/2 inch/yr

Yellow circle  
-3/4 inch/yr

Coastal parishes  
avg. = ~-1/2 inch/yr

Ocean State

# RACELAND to GRAND ISLE 1982, 1993, 2002 Observed Heights 2002 Predicted Heights

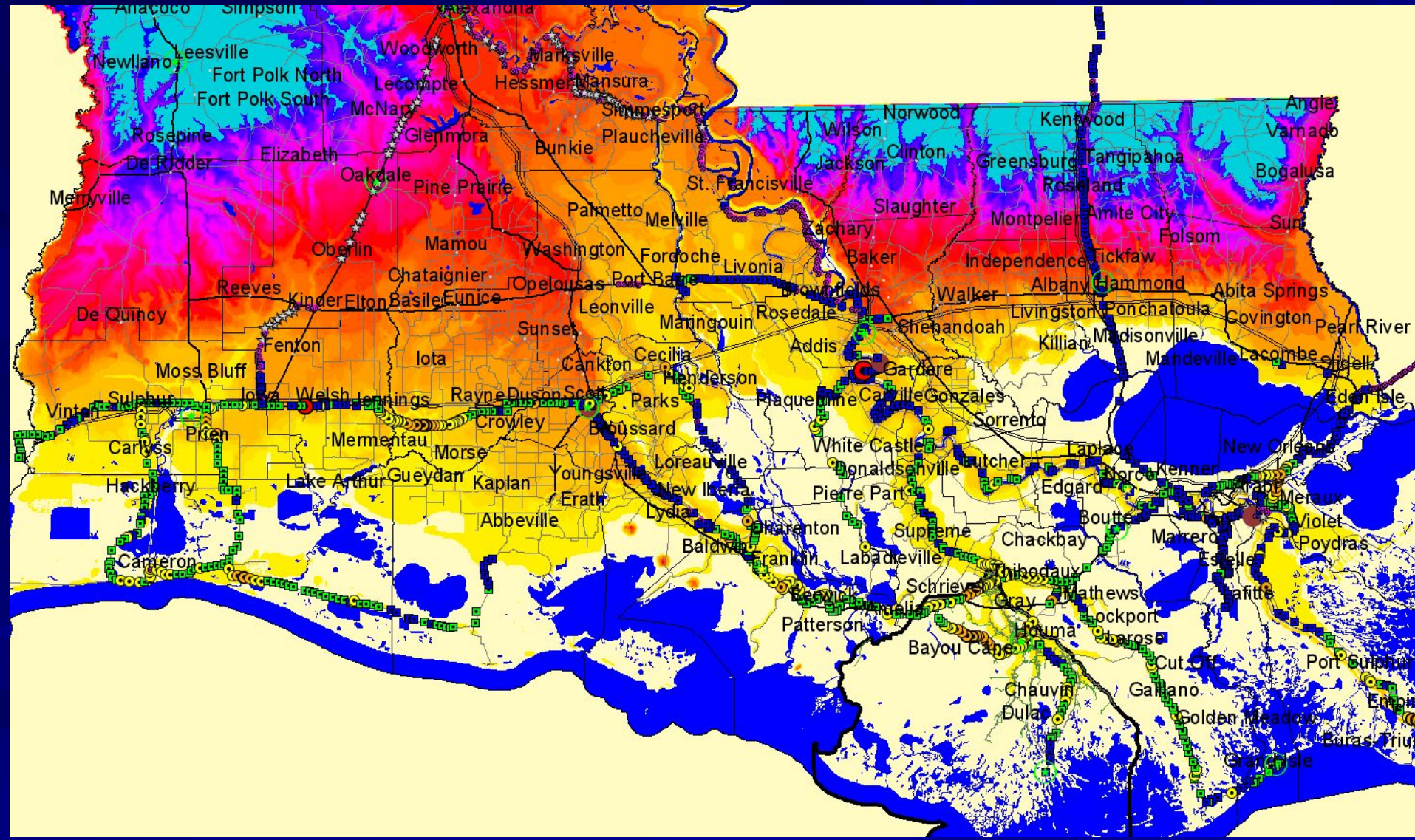


# Practical Implications of Changing Elevations

- Most areas of coastal parishes will be lost by 2075. It is worth ~\$140B + revenue.
- Nothing can be built to a correct elevation. Levees, highways, etc.
- Maps and coastal charts are wrong.
- Levees are lower because of subsidence.

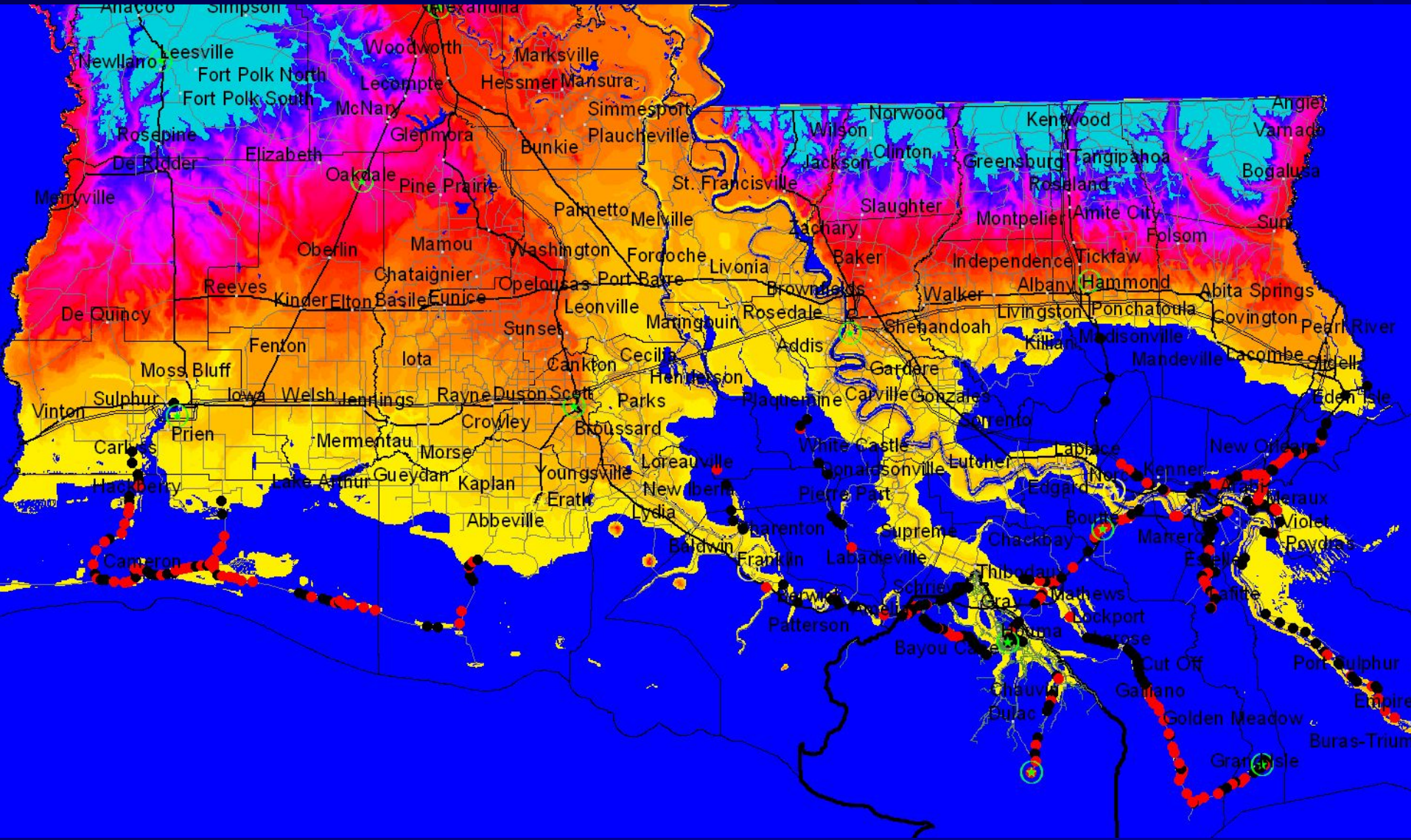


# Today





# 2075 assuming nothing is done



# How do you fix a reference system?

Traditional method:

- *run geodetic levels from a known point to benchmarks.*
- *\$1000-\$2000/km. 10,000 benchmarks in Louisiana.*
- *benchmarks must be recalibrated if they move more than 2cm. Viability lasts a few years in many areas.*

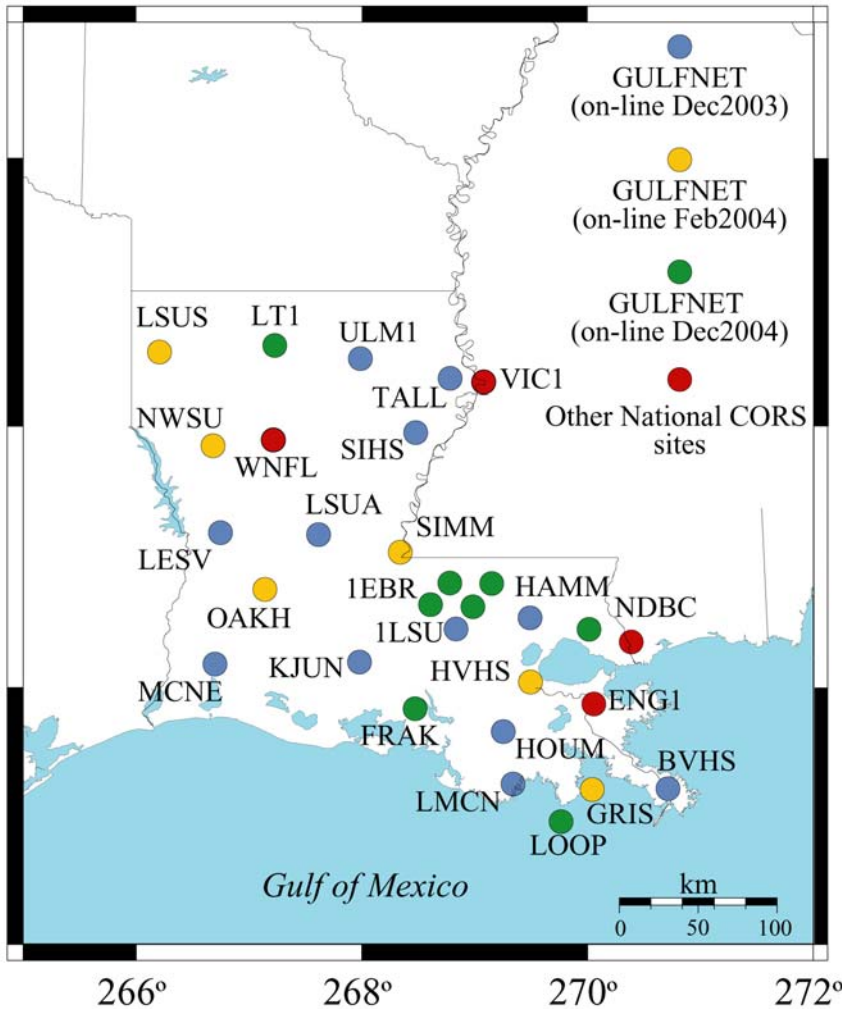
LSRC method:

- *analyze all previous NGS 1<sup>st</sup> order leveling data.*
- *calculate velocities and model 2004 elevations.*
- *validate predicted elevations with new observations.*
- *build a CORS network.*
- *transfer elevations from updated benchmarks to CORS antennas using GPS leveling.*



# Steps to Self-Sustaining Height Mod

- Analysis of NGS 1st order leveling data to compute vertical velocities and predicted 2004 NAVD88 elevations. Validate with GPS observations that are part of a network. Of 10,000 benchmarks in LA, only a few hundred will have updated elevations. These define the Louisiana Base Network (LBN).
- The role of LBN is to allow for periodic calibration of GULFNET using static surveys and starting points for local projects.
- Creation of regional density GULFNET. Cities will have high density. Transfer NAVD88 elevations from LBN to CORS. Virtual benchmarks are possible within 10 km from CORS. LBN will be maintained to provide local POBs for local height modernization.



# GULFNet CORS

Phase 1—  
Regional network completed.

Phase 2—  
City densification

Phase 3—  
Regional chains of CORS  
completed

# *Operational Challenges*

→ Monumentation.

→ Atmospheric conditions.

→ Communication issues.



Monumentation schema developed for  
arid environments don't work in  
south Louisiana

All GULFNet CORS are on pile-driven  
buildings, some that extend down 250 ft

or

older (>40 years) buildings that have  
settled.

# Political Challenges

Surprisingly, there are many groups and individuals that don't want correct elevations.

- Some surveyors who don't want to move to GPS.
- Private land owners who don't want hear that their property is actually in the flood zone.
- A few federal and state agencies and scientists involved in coastal restoration that have reputations and budgets that will be adversely affected because of new insights.

Fortunately, the political pressure for accurate elevations is growing from:

- people who live along the coast.
- consumers and towns who are tired of flooding.
- professional groups.
- US Army Corps of Engineers.

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A satellite image of a large hurricane over the Gulf of Mexico. The hurricane has a distinct eye and is surrounded by dense, swirling clouds. The surrounding ocean is a deep blue, and the landmasses of North and South America are visible at the edges of the frame.

**"Elevation is our salvation from inundation"**

**Let's finish by looking at what a CAT 2 Hurricane will do to New Orleans. Remember: the levees were built at elevations to withstand a CAT 3.**



Basin: New Orleans <ms2>

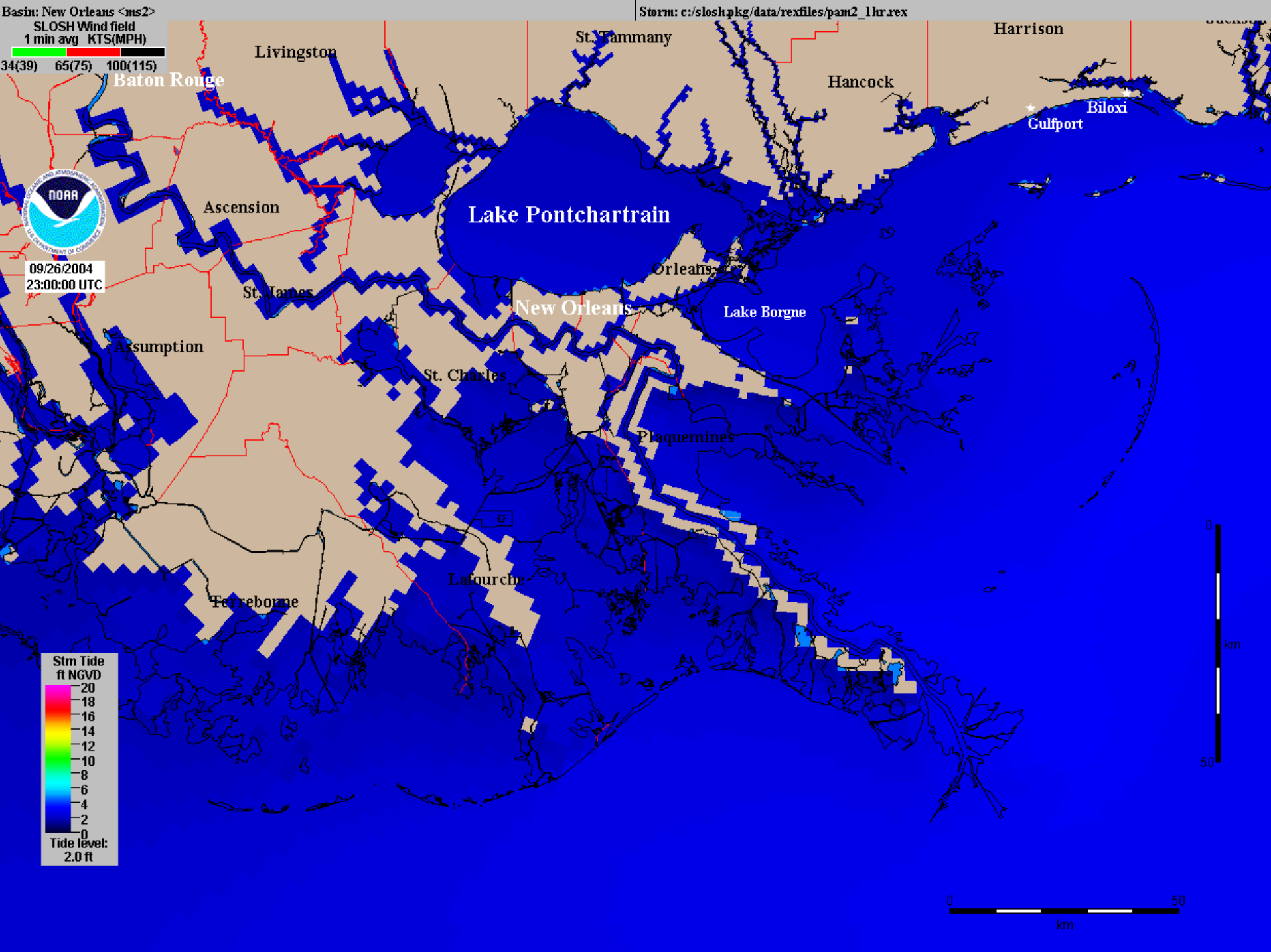
SLOSH Wind field  
1 min avg KTS(MPH)

34(39) 65(75) 100(115)

Storm: c:/slosh/pkg/data/rexfiles/pam2\_1hr.rex



09/26/2004  
23:00:00 UTC



Stm Tide  
ft NGVD

20
18
16
14
12
10
8
6
4
2
0

Tide level:  
2.0 ft

0 50  
km

0  
50  
km