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# Why is sea level rising in Hampton Roads?

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# Why is sea level rising in Hampton Roads?

The Science Team

# The Science Team

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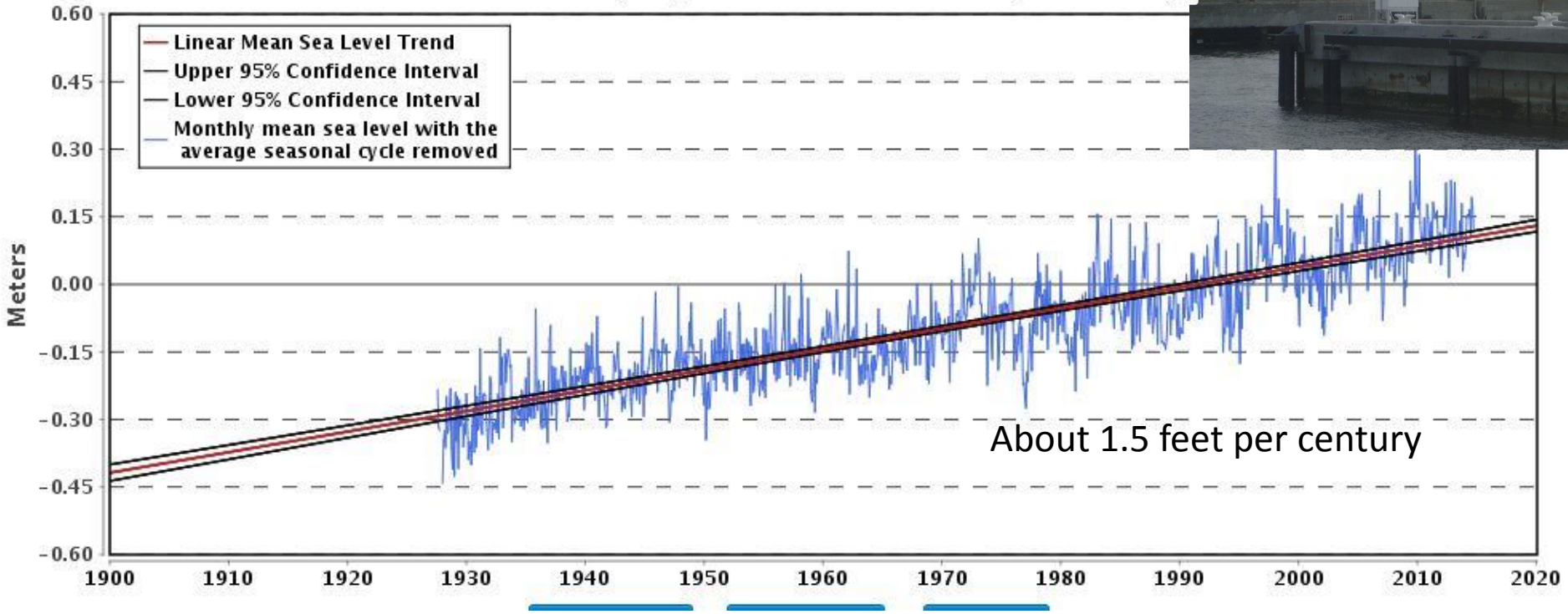
# Sea level is trending upward at all NOAA tide gauge stations in the region

Mean Sea Level Trend  
8638610 Sewells Point, Virginia

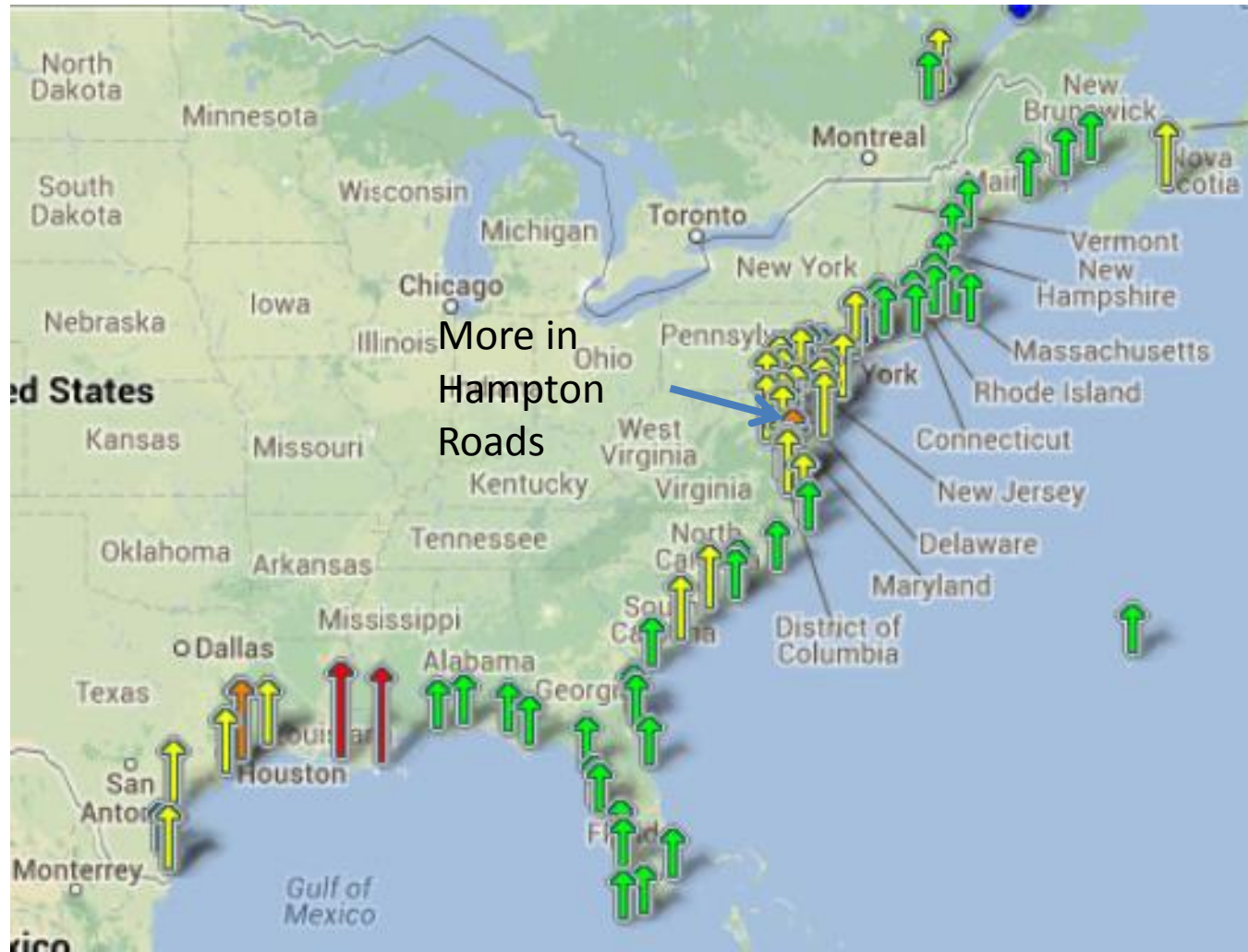


8638610 Sewells Point, Virginia

4.57 +/- 0.24 mm/y.

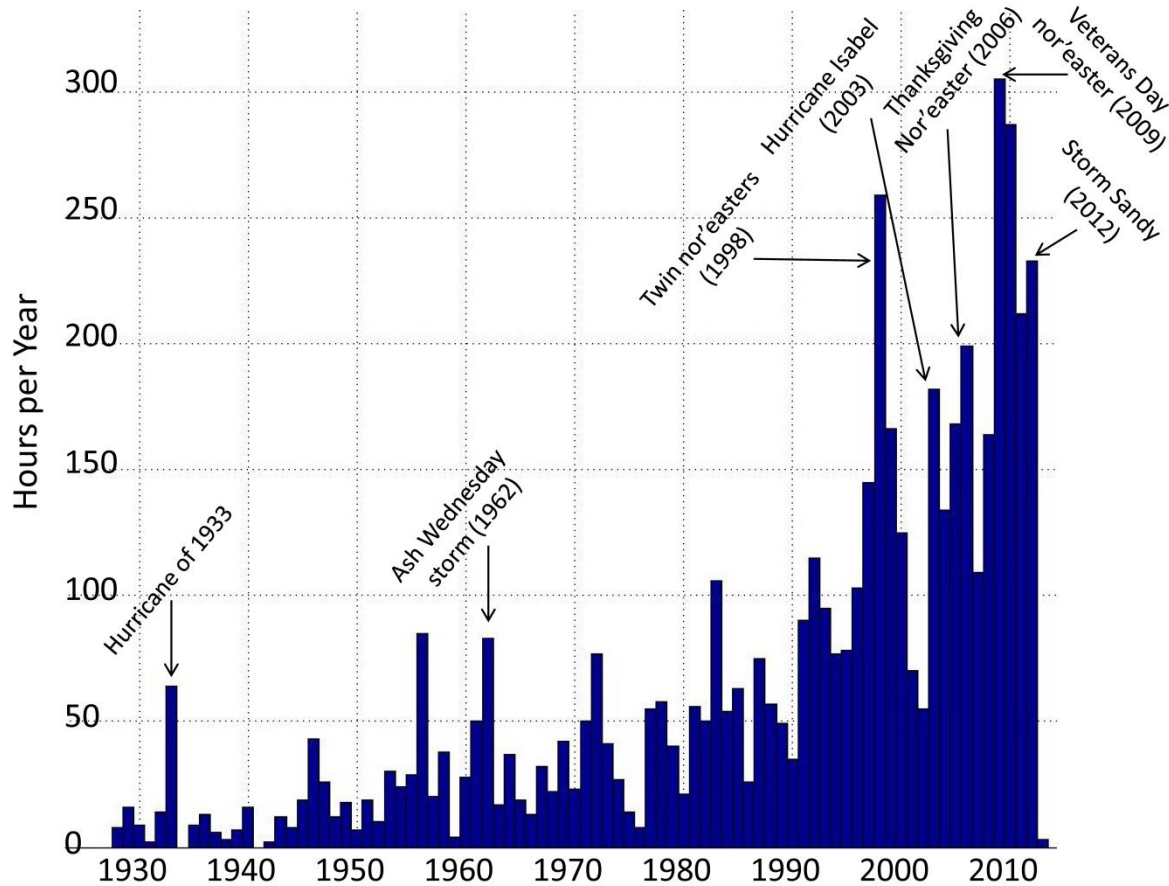


It's not just here – all NOAA Tide Gauges on east coast and Gulf show rising.



# Residents notice streets flooded more often

Hours per year that streets start to flood in the Hague, Norfolk, VA

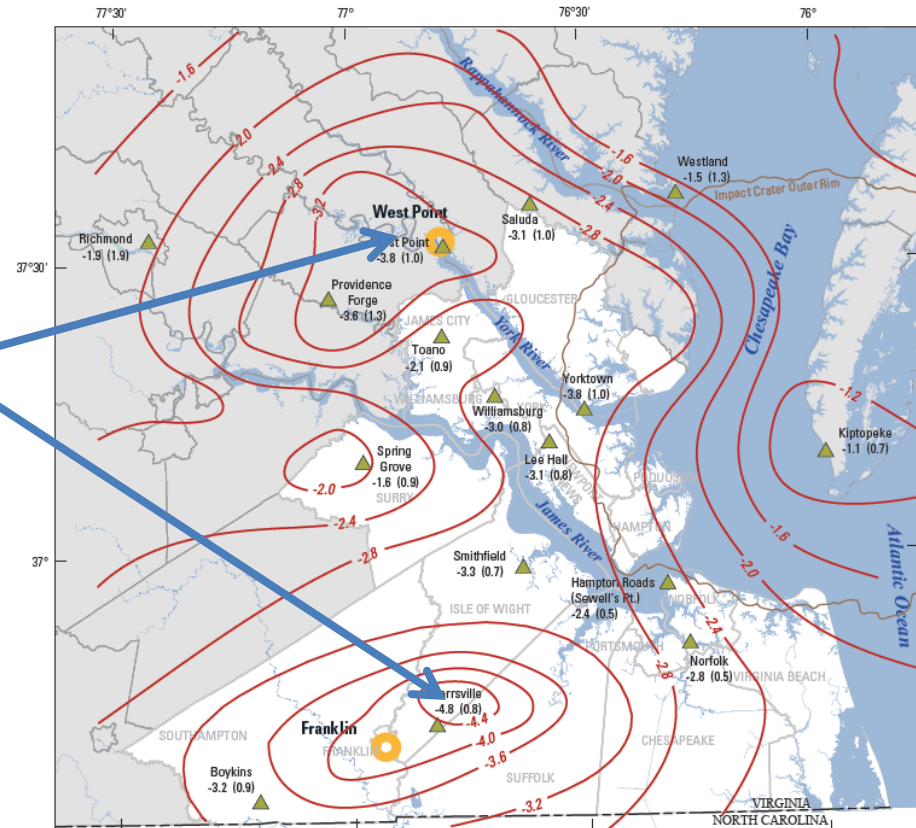




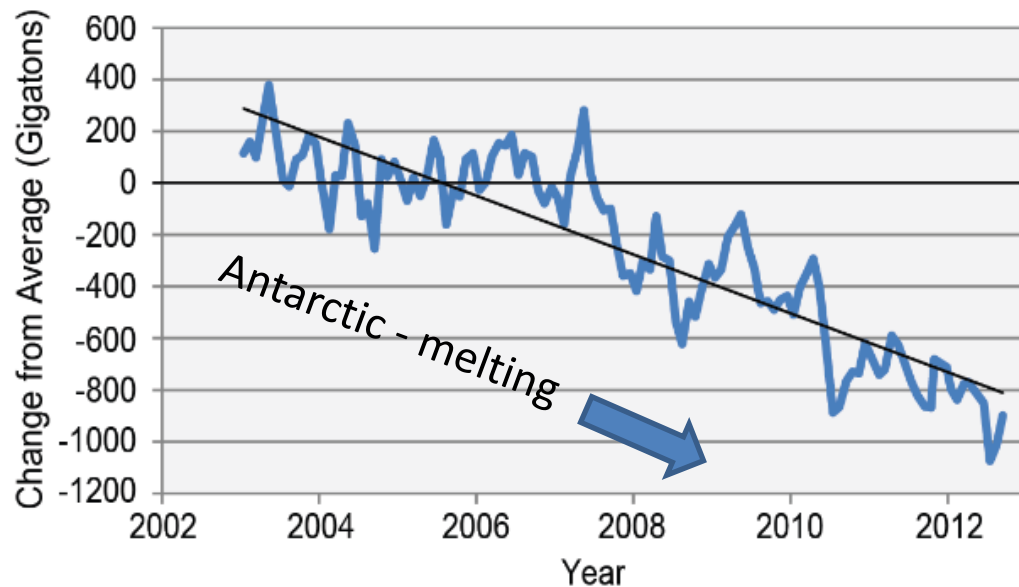
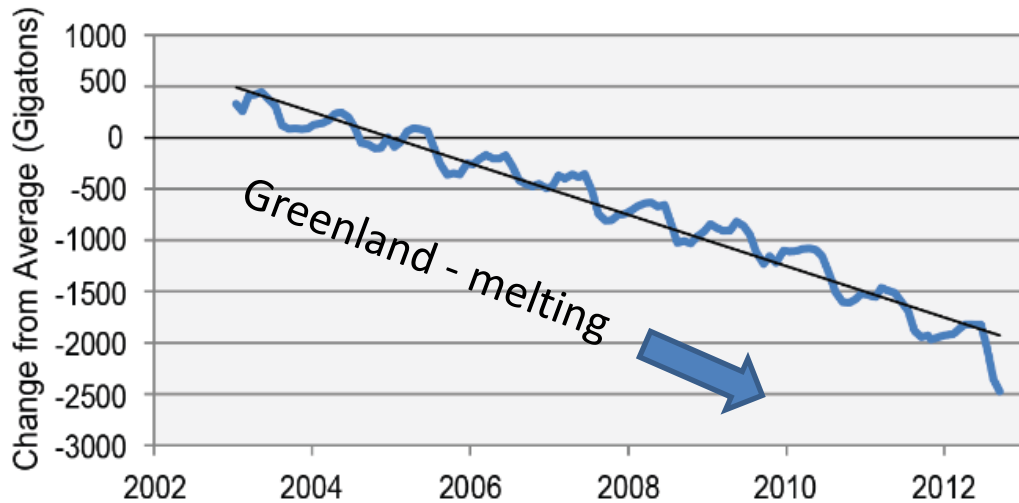
# Why is sea level rising?

## Land is sinking - subsidence

- Subsidence = half the relative sea-level rise
  - Ground water pumping = one-half the subsidence.
  - Glacial isostatic adjustment and other processes make up the rest of subsidence.



# Why is sea level rising? Land Ice Sheets Melting

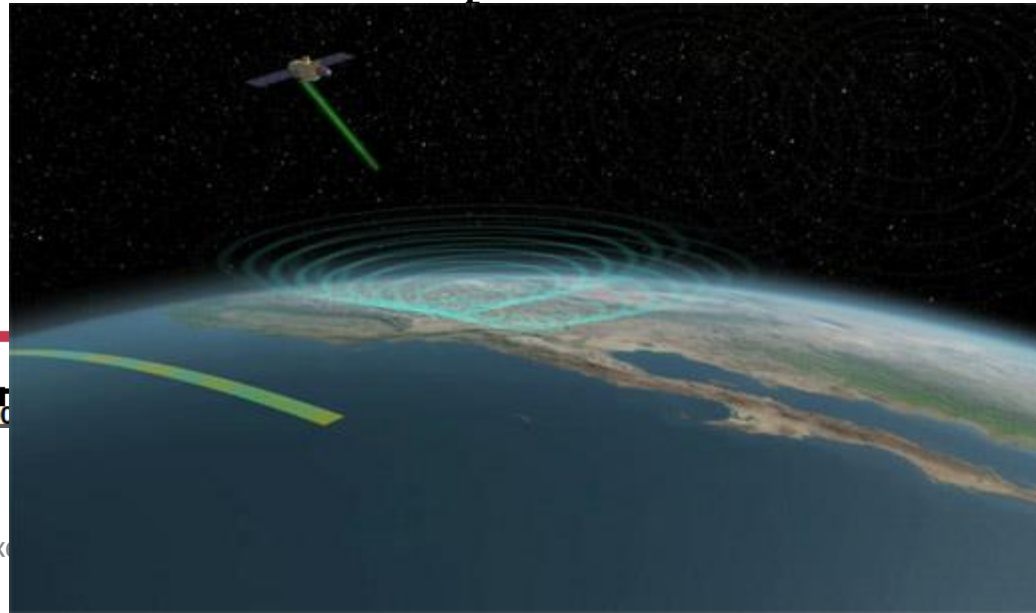
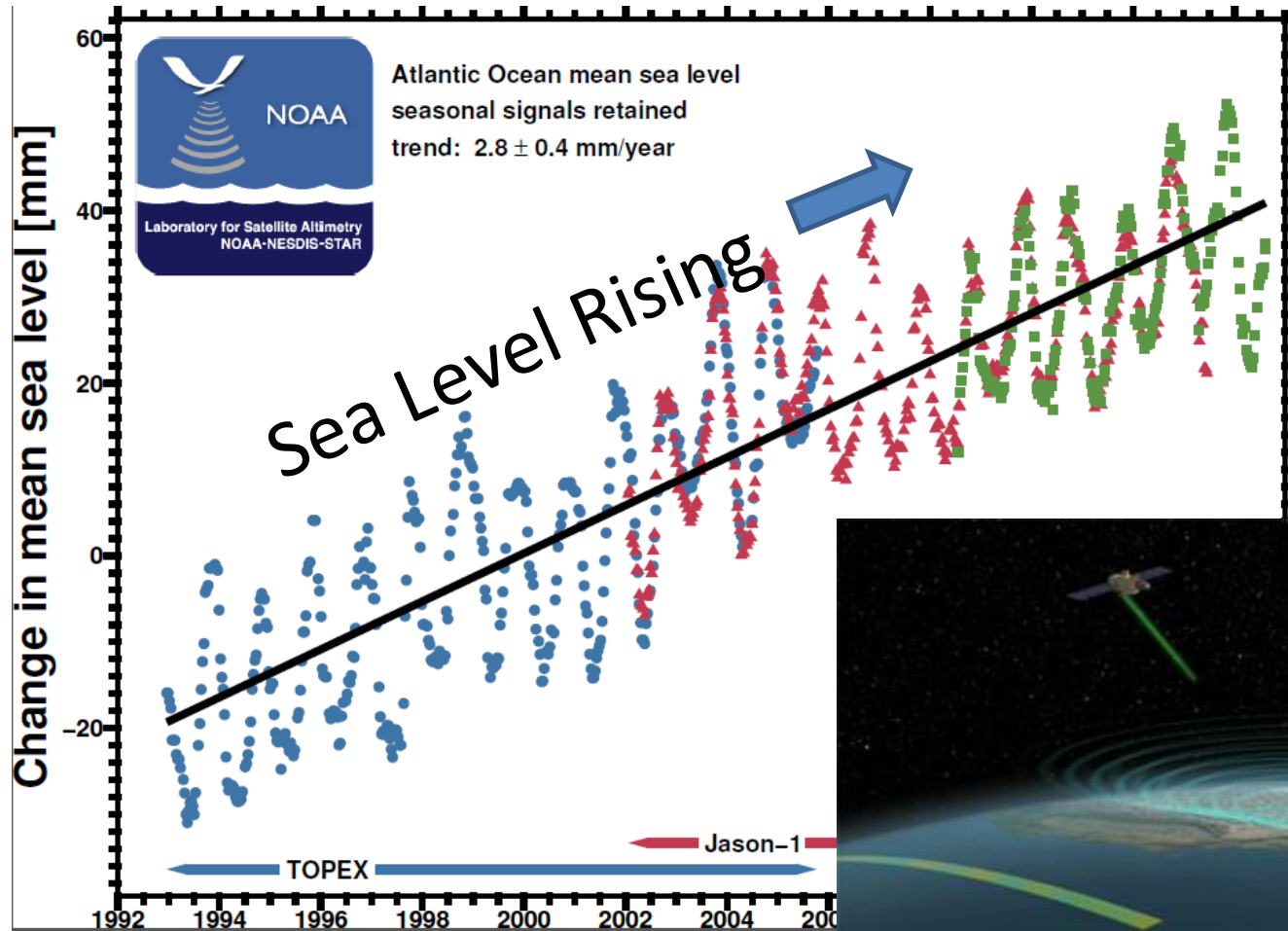


Roads

Photo NASA GISS



# Why is sea level rising? Ocean is warming and expanding



# Why is sea level rising?

## Ocean Circulation is Changing

The ocean surface is not flat – the ‘ocean is in motion’

Gulf Stream

Sea Level

Speeds up



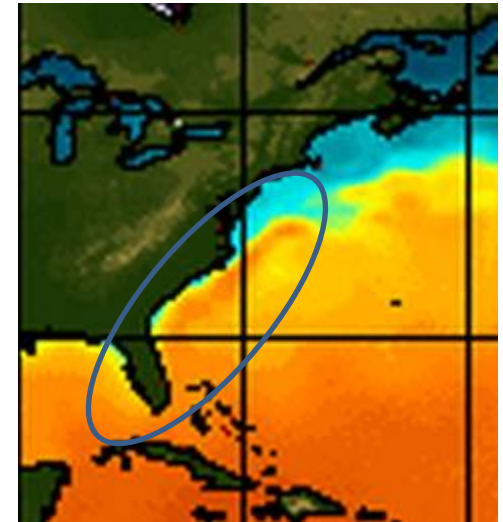
Goes Down



Slows down



Comes up



We are seeing a lot of slowing down  
and accelerating rise rates

# RISK & INSURANCE

Emerging Strategies for Risk

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- EXCESS CASUALTY & UMBRELLA
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- ENVIRONMENTAL
- RAILROAD
- PRODUCT RECALL
- PRODUCT CONTAMINATION
- PROFESSIONAL LIABILITY
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- KIDNAP, RANSOM & EXTORTION
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## CLIMATE: The Slowing Gulf Stream

*Coastal events like Superstorm Sandy will become more problematic due to higher sea levels from a slowing Gulf Stream.*



By Gregory Morris

**Scenario:** For most of the U.S. the iconic image from Superstorm Sandy was the beloved roller coaster at Seaside Heights, NJ, half submerged in the Atlantic Ocean after the pier upon which it stood collapsed. For New Yorkers, however, the images seared in mind from the super storm were from Breezy Point, at the very tip of the Rockaway Peninsula, which became practically an island. Hurricane, tidal surge, and raging fires literally levelled the community. When federal and state aid began flowing to repair the Sandy damage, local and city entities at all levels mobilized. Coney Island, at the south end of Brooklyn, had already had its renaissance, and now it was the turn of the Rockaways.



# So how do we project into the future?

## Provide useful information

Determine subsidence rates  
around the region



NOAA image

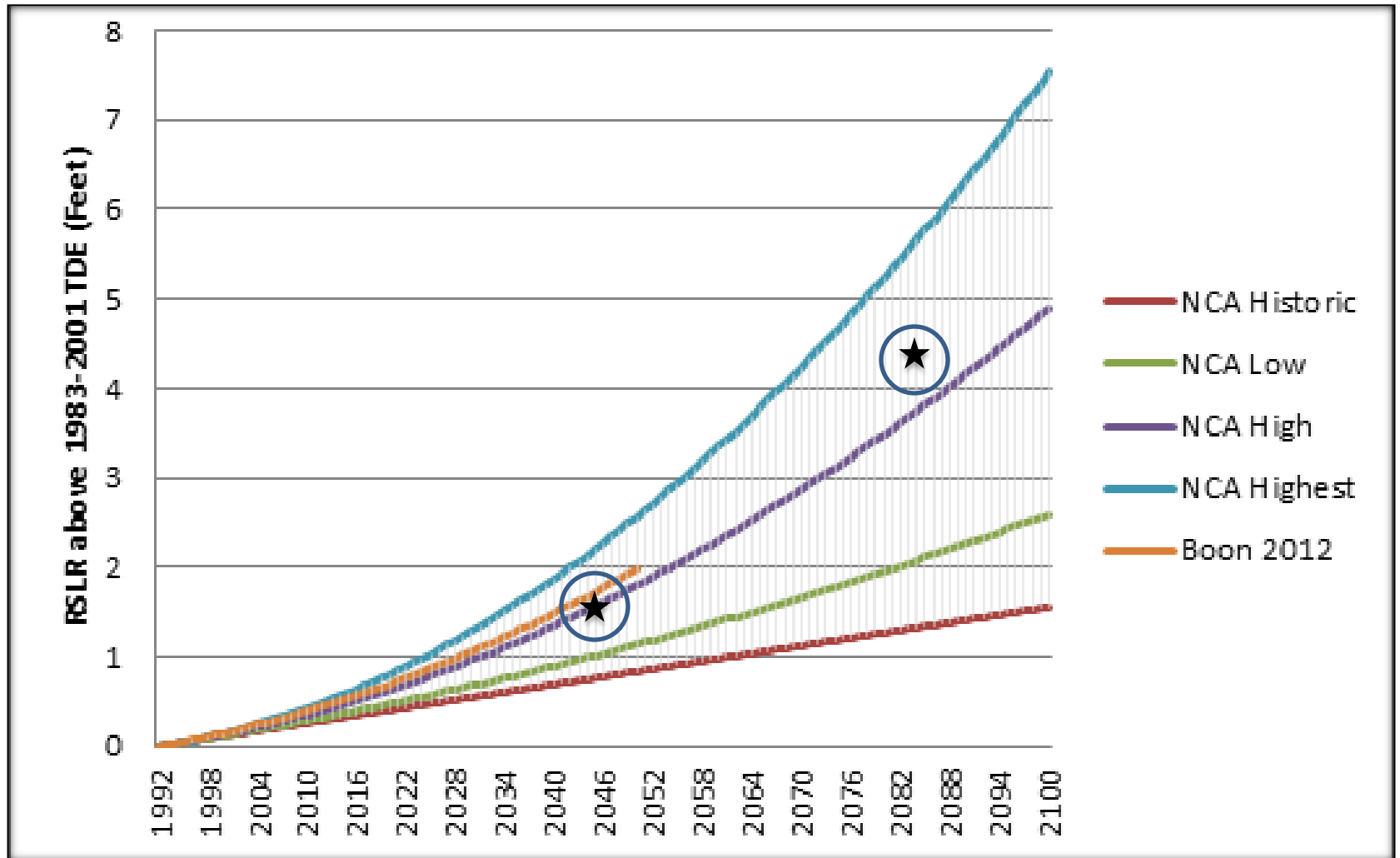
and

Model SLR using different  
scenarios



NASA image

# Projections for Hampton Roads showing the sea levels the discussion today will focus on

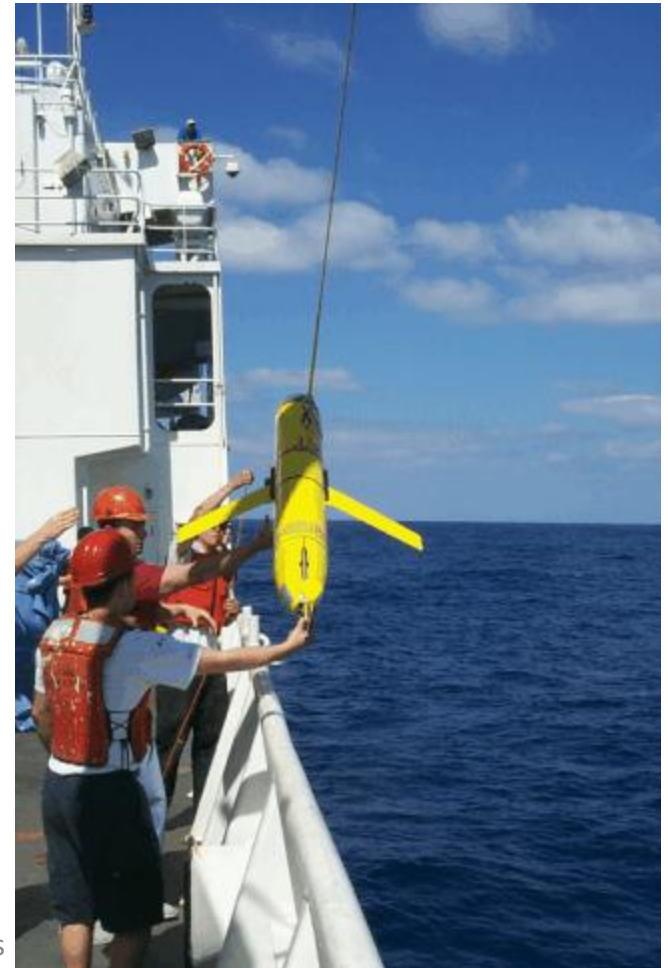


★ Stars indicate exercise dates/SLR of 2044 (1.5 ft) and 2084 (4.5 ft)

# How do we narrow the range of SLR projections?

**Measure Subsidence** –  
integrate city, Commonwealth  
and Fed data – easy and cheap  
and

**Observe the Ocean** - Integrated  
Ocean Observing System – hard  
and expensive.





# And the end result

Better predictions



So we can adapt

