# Climate and Coastal Inundation: Making Informed Decisions on the Coast

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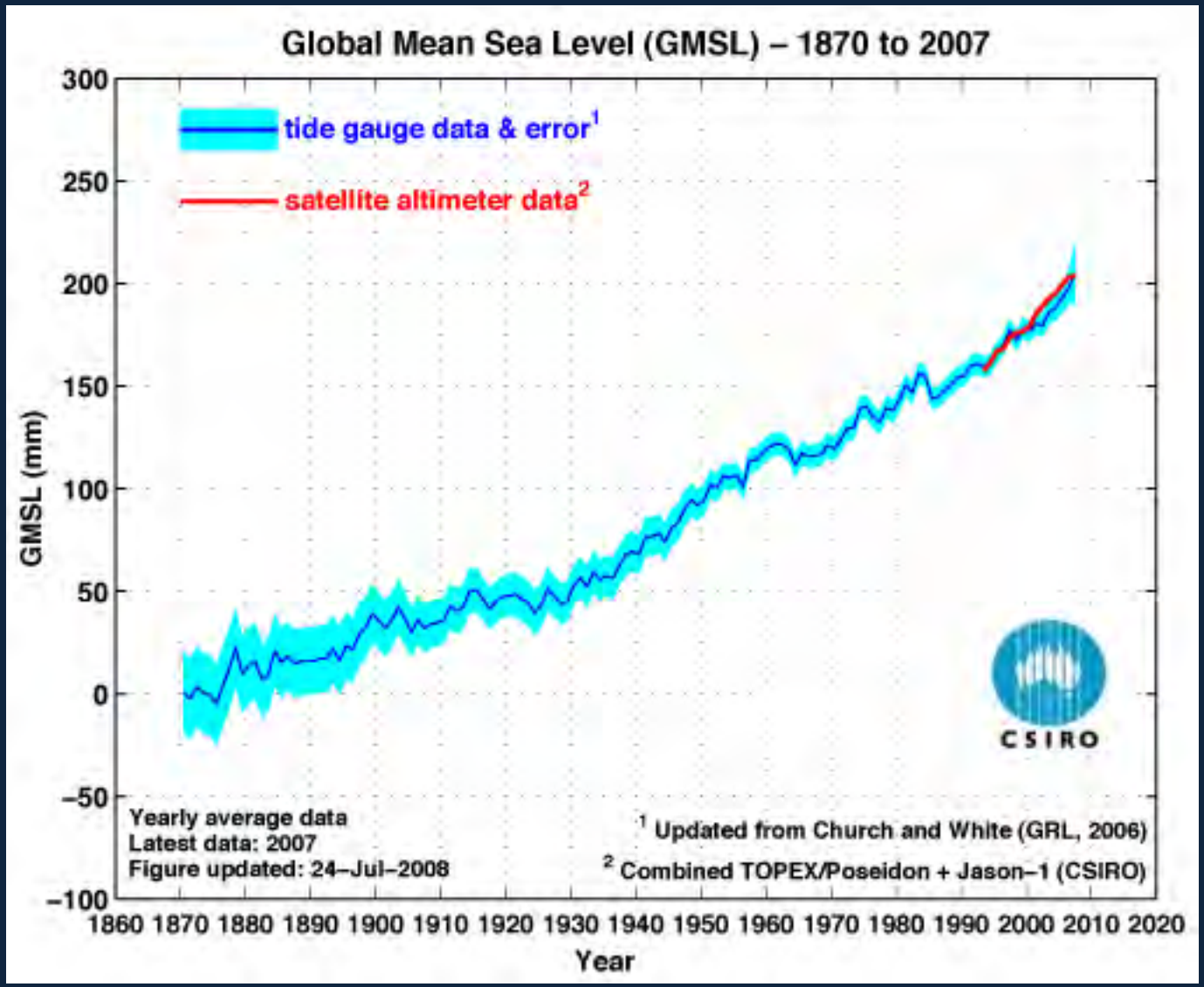
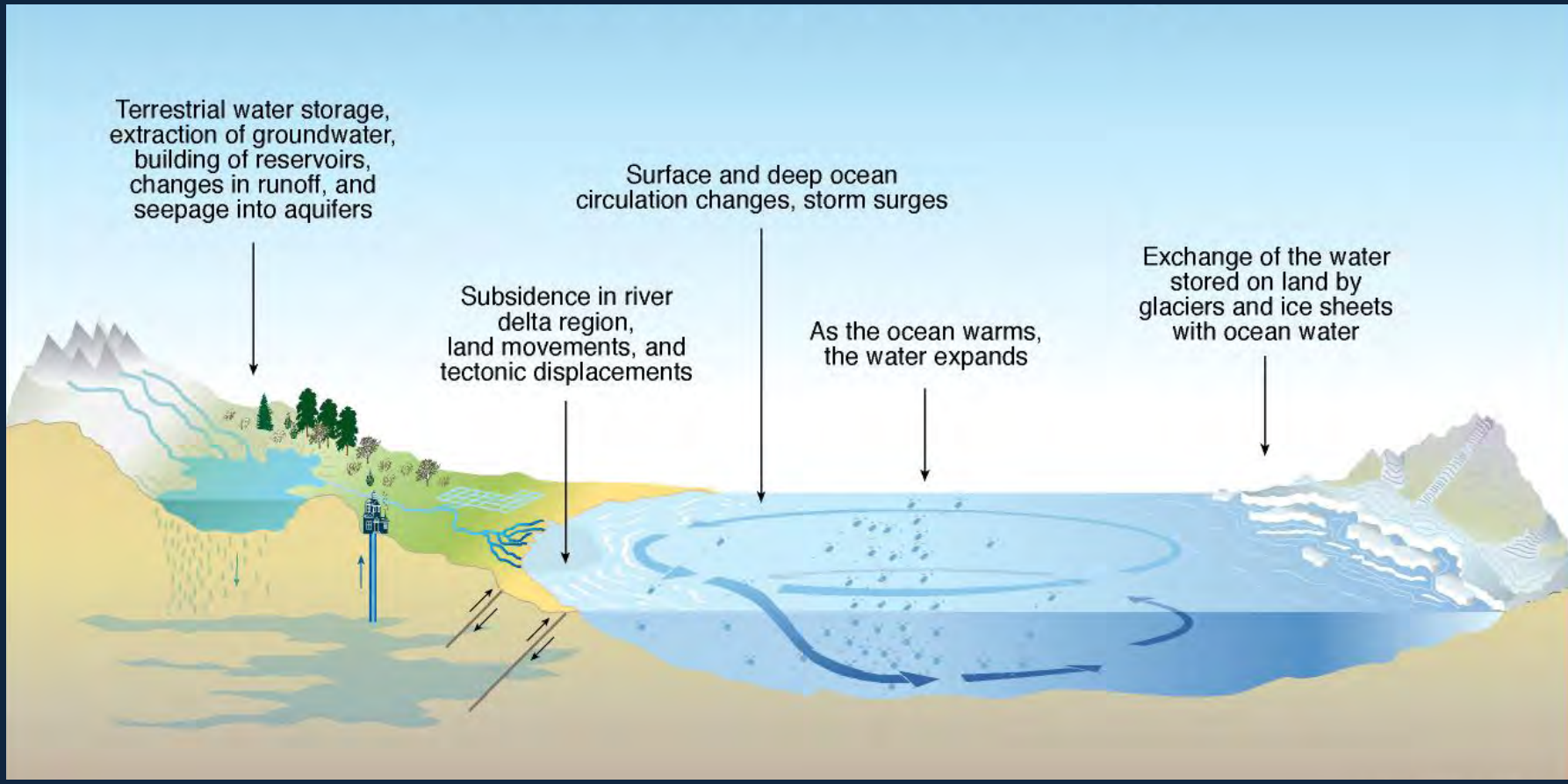
# Outline

1. The science of sea level rise
2. How the science is used (or not used)
3. A real world example

# Sea level is rising

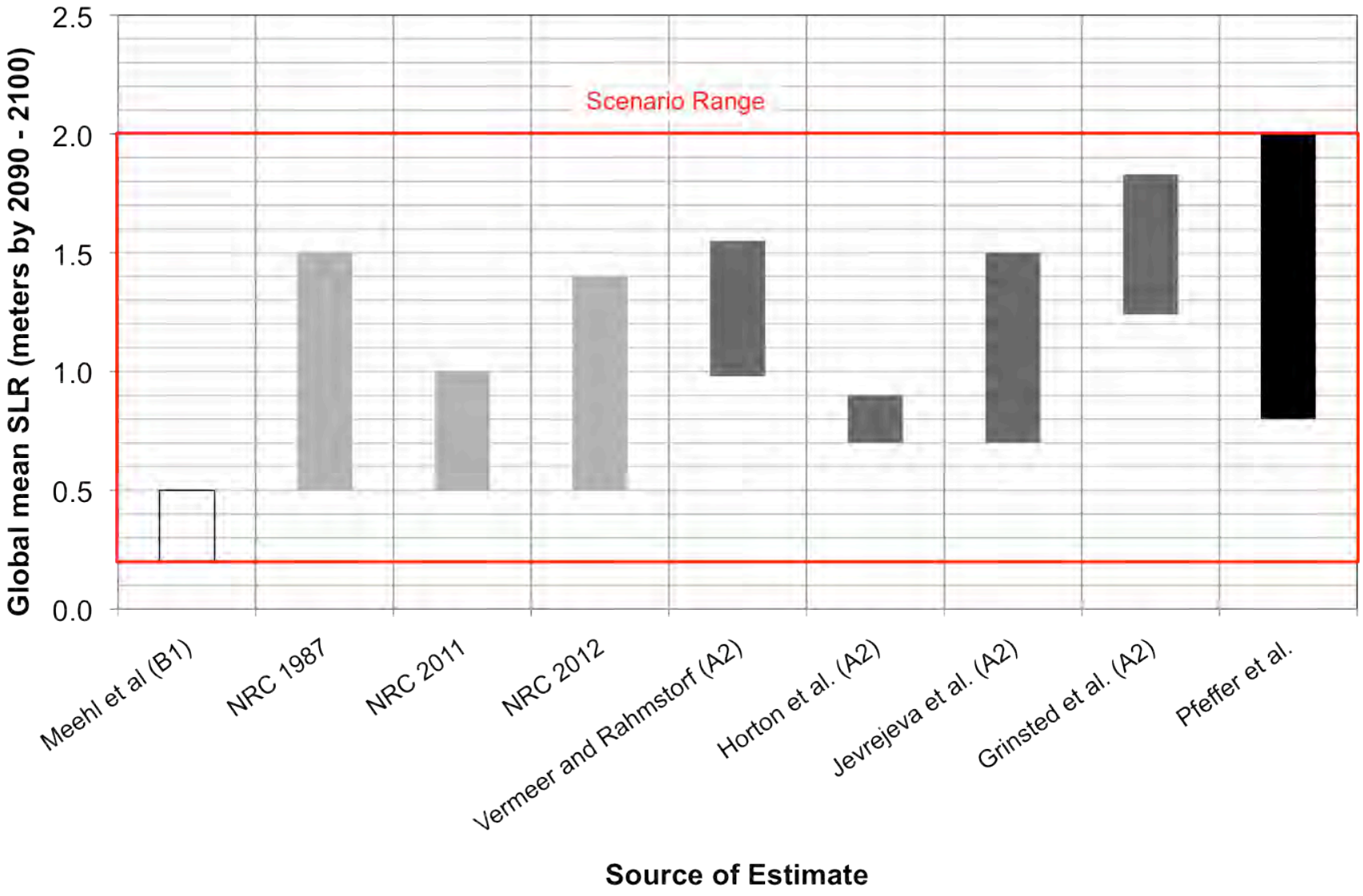


# What causes sea level rise (SLR)?




Source: IPCC TAR

# What do we know about future SLR?



# An Interagency Assessment

Adam Parris, NOAA (Lead)

Peter Bromirski, Scripps Institution of Oceanography

Virginia Burkett, USGS

Dan Cayan, Scripps Institution of Oceanography & USGS

Mary Culver, NOAA

John Hall, DOD

Radley Horton, Columbia University

Kevin Knuuti, USACE

Richard Moss, University of Maryland, PNNL

Jayantha Obeysekera, South Florida Water Management District

Abby Sallenger, USGS

Jeremy Weiss, University of Arizona

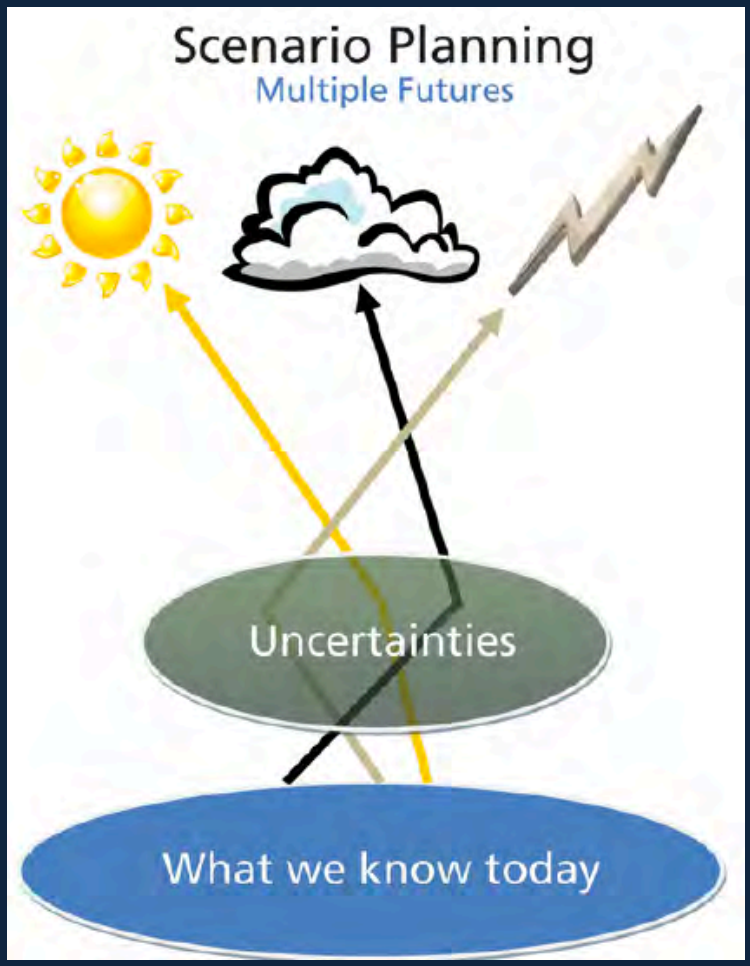
# SCENARIOS…

…**ARE** trajectories of environmental change for the purpose of risk and vulnerability assessment to inform the development of robust adaptation options

…**ARE NOT** predictions or projections of what will happen

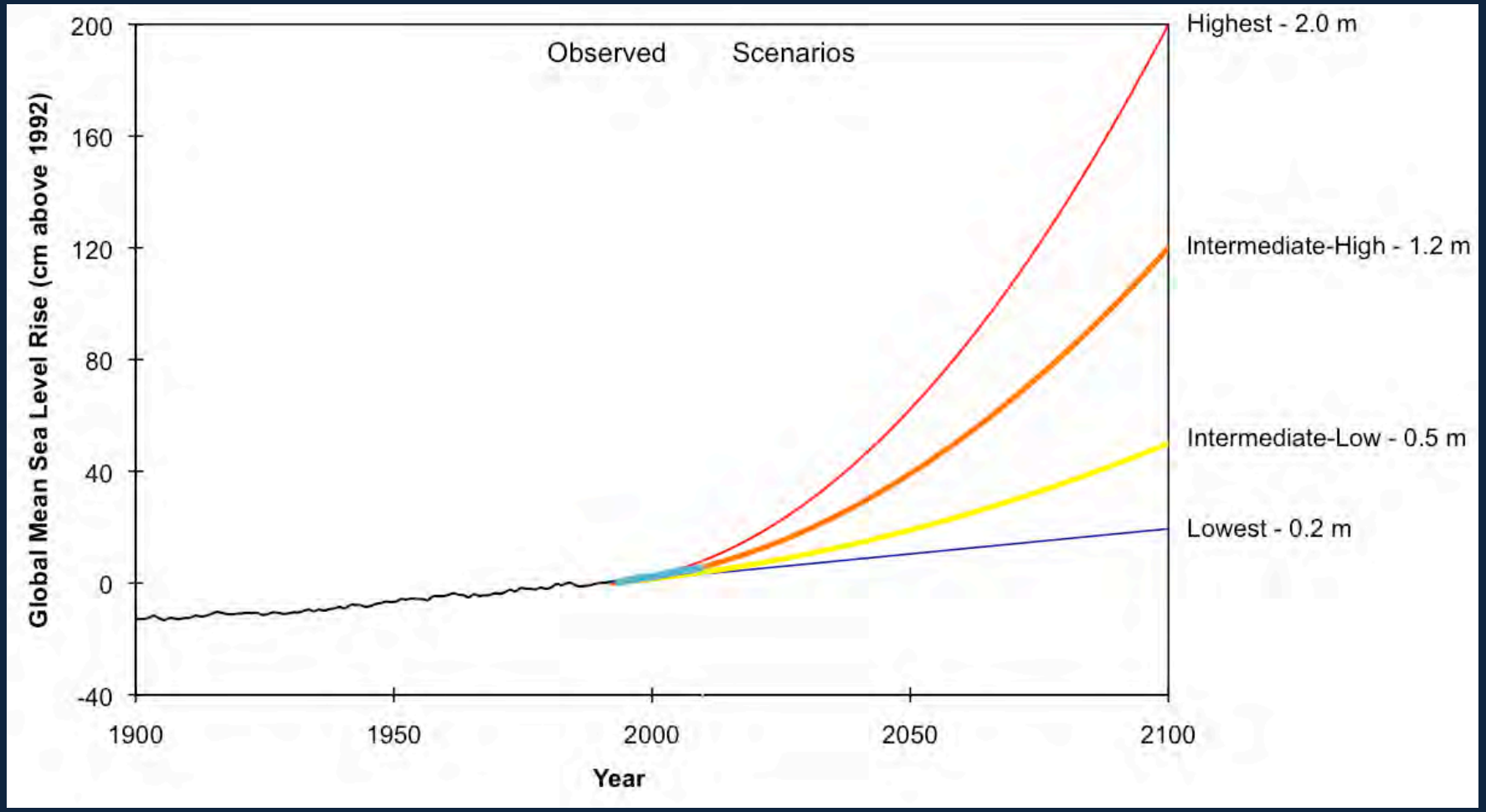
…**ARE NOT** formed under the assumption of reducing uncertainty

# Why use multiple scenarios?


Source: Global Business Network  Weeks et al 2011

# Global SLR Scenarios



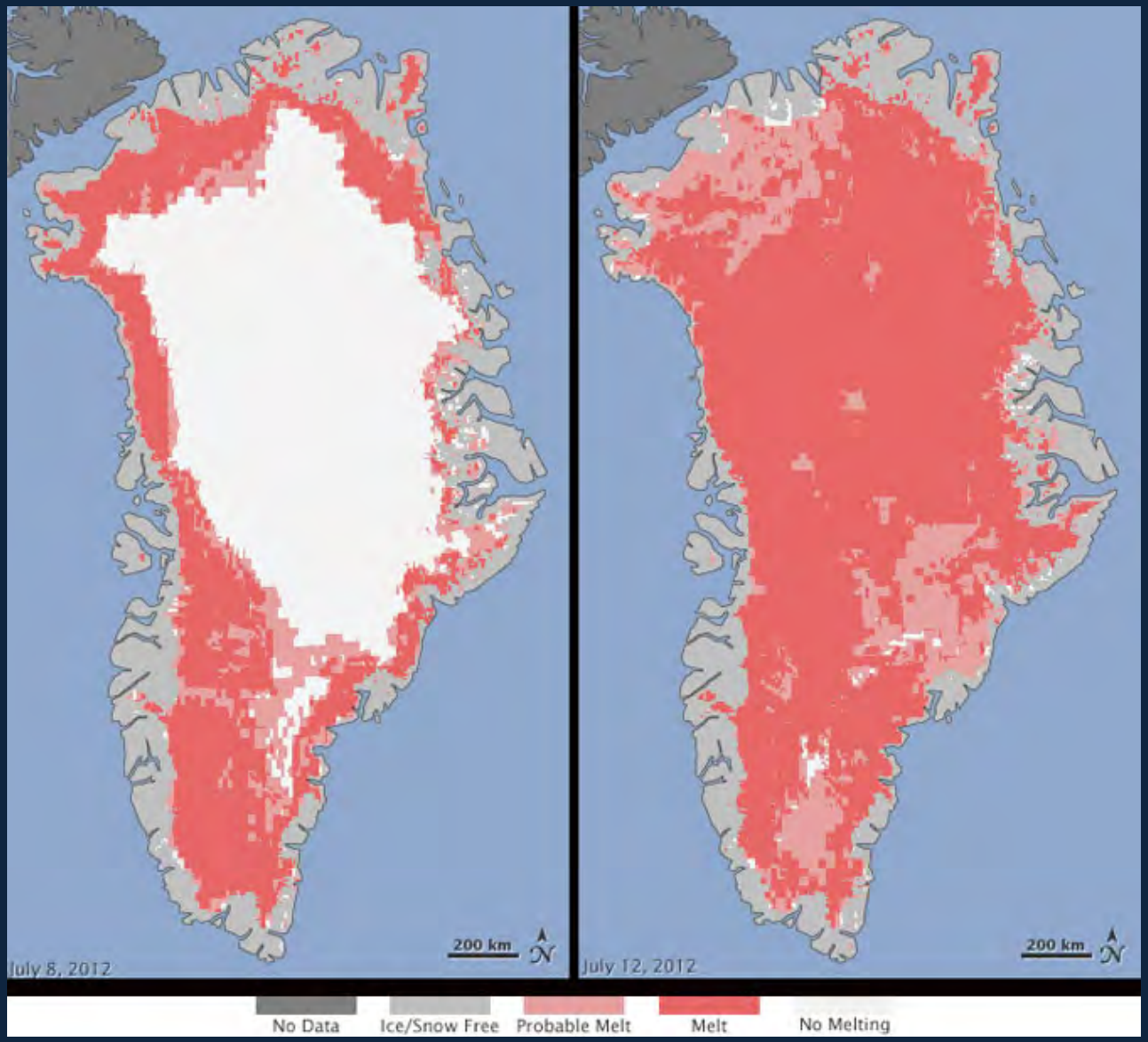
Source: LAWSON PARKER, NGM STAFF. SOURCES: JOSH WILLIS, NASA/JPL; JOHN CHURCH AND NEIL WHITE, COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION; ANDREW KEMP ET AL., 2011; R. STEVEN NEREM ET AL., 2010; Parris et al 2013

# Risk-based framing

We have very high confidence (>9 in 10 chance) that global mean sea level will rise at least 0.2 meters (8 inches) and no more than 2.0 meters (6.6 feet) by 2100.

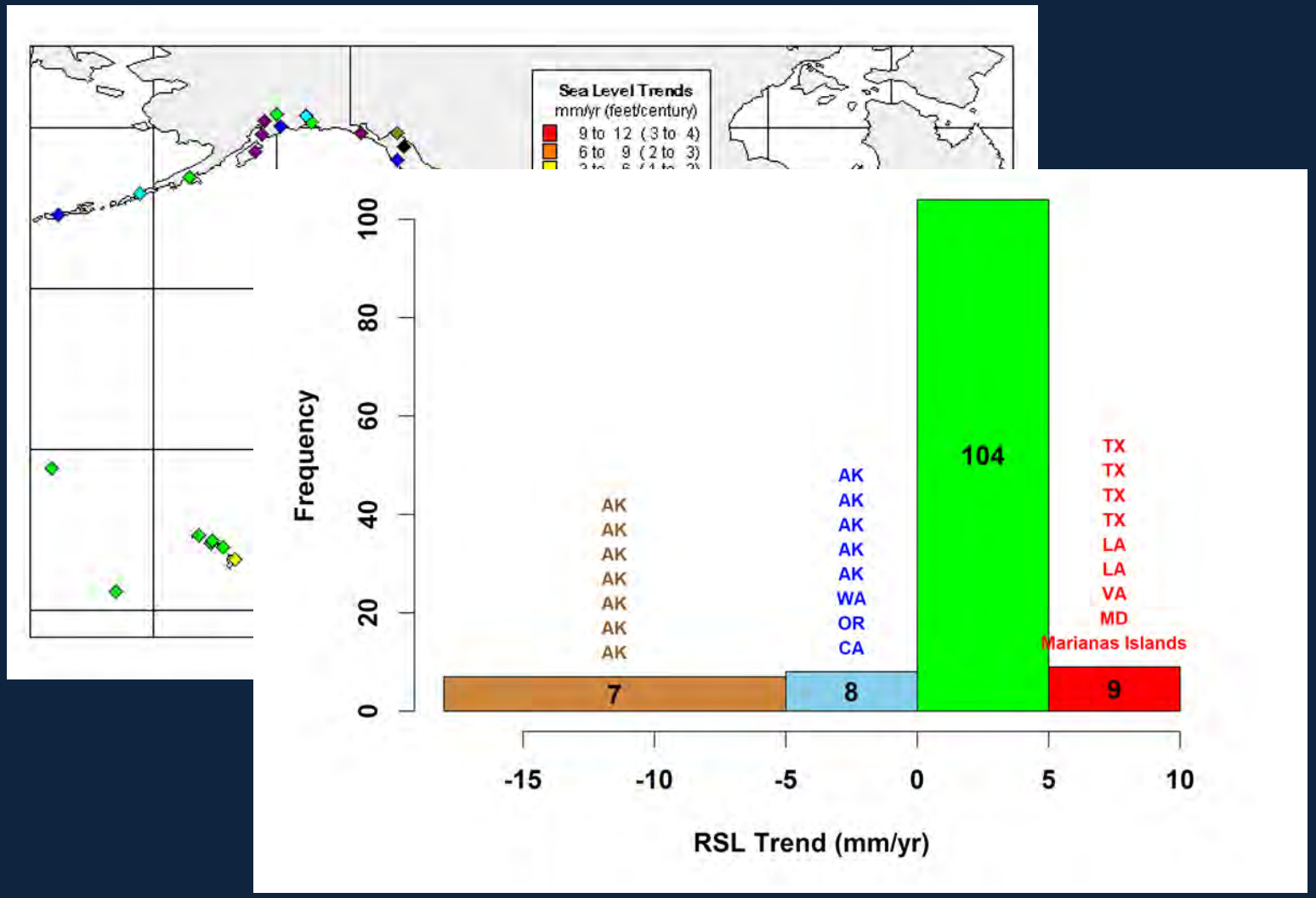
| Confidence Level | Possible Contributing Factors |
|---|---|
| Very High | Strong evidence (established theory, multiple sources, consistent results, well documented and accepted methods, etc), high consensus |
| High | Moderate evidence (several sources, some consistency, methods vary and/or documentation limited, etc.), medium consensus |
| Medium | Suggestive evidence (a few sources, limited consistency, models incomplete, methods emerging, etc.), competing schools of thought |
| Low | Inconclusive evidence (limited sources, extrapolations, inconsistent findings, poor documentation and/or methods not tested, etc.), disagreement or lack of opinions among experts |

# Greatest source of uncertainty?



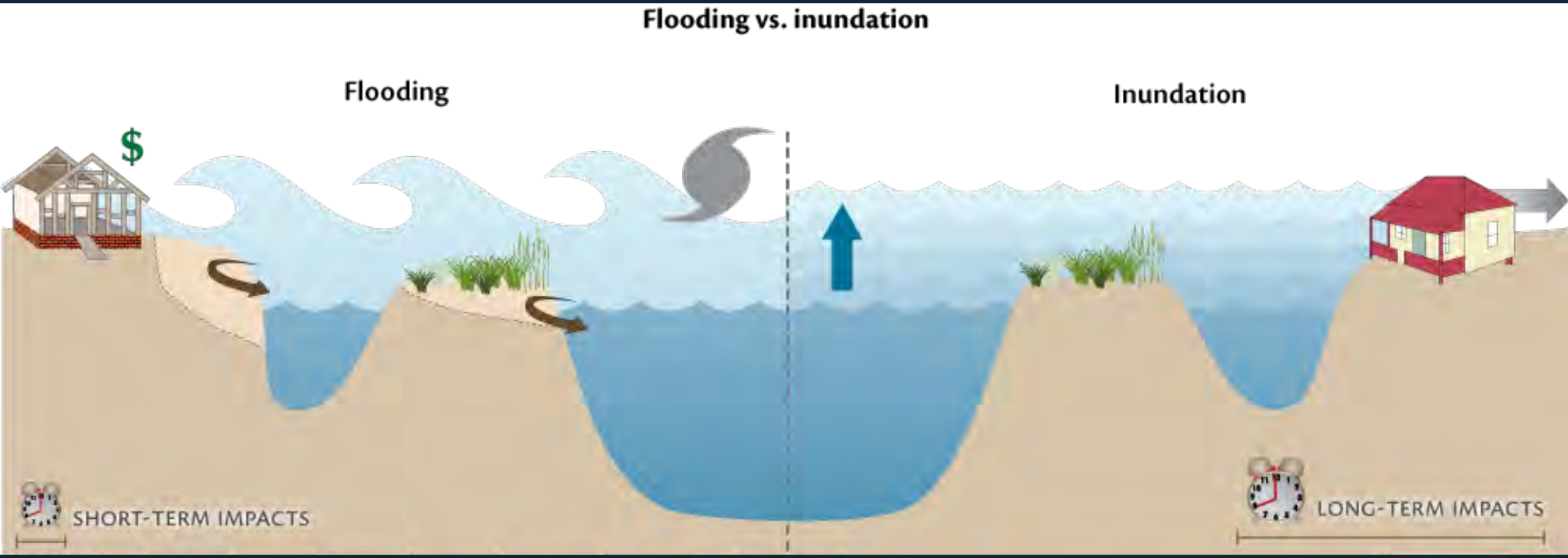

Source: NASA

# Sea level change will vary regionally and locally



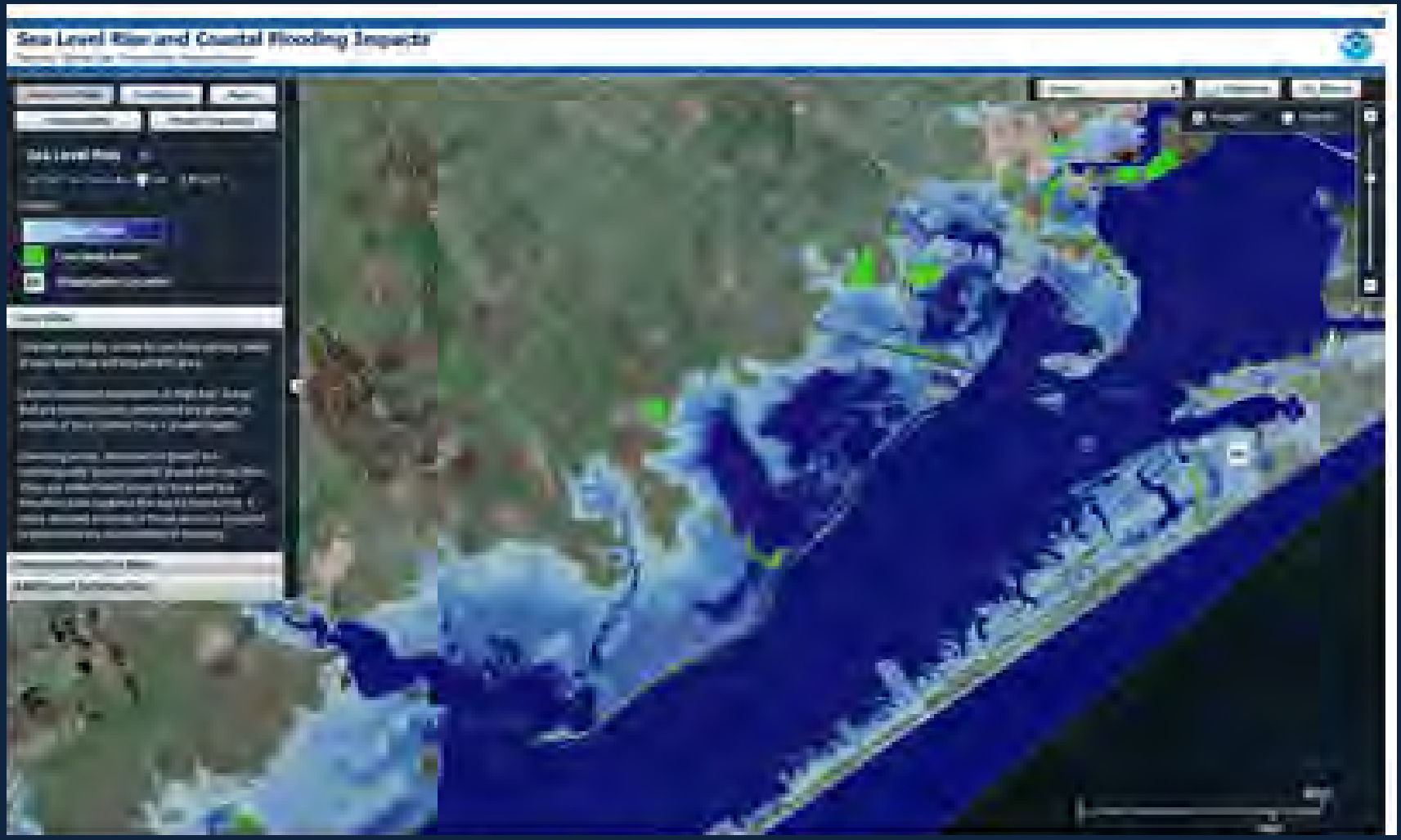

Data Source: NOAA CO-OPS

# How will SLR impact us?




Data Source: Jane Thomas, Ian Image Library, http://ian.umces.edu/imagelibrary/

# Higher mean sea level = More coastal flooding



# Discussion Questions

1. Why is everyone so uncertain about sea level rise?

# Outline

1. ~~The science of sea level rise~~
2. How the science is used (or not used)
3. A real world example

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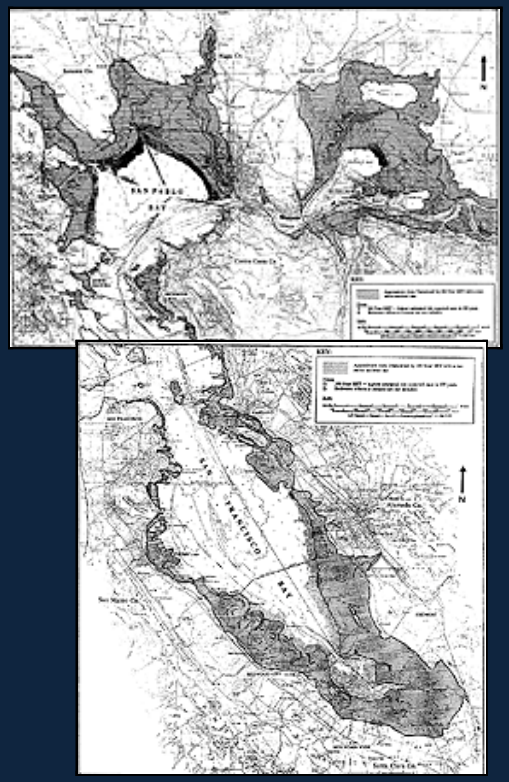
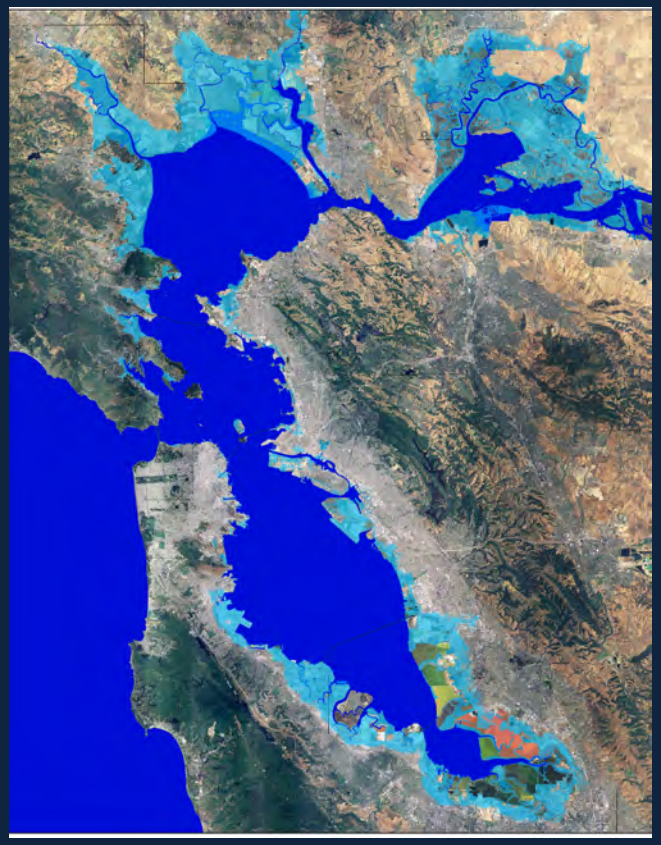
# Focused on getting the flood information right…

Pacific Institute, 1988



BCDC, 2007



USGS, 2009

# A decision analogy

Tomorrow there is a chance of rain, but what do you have planned for tomorrow?

# Why such a large scenario range?

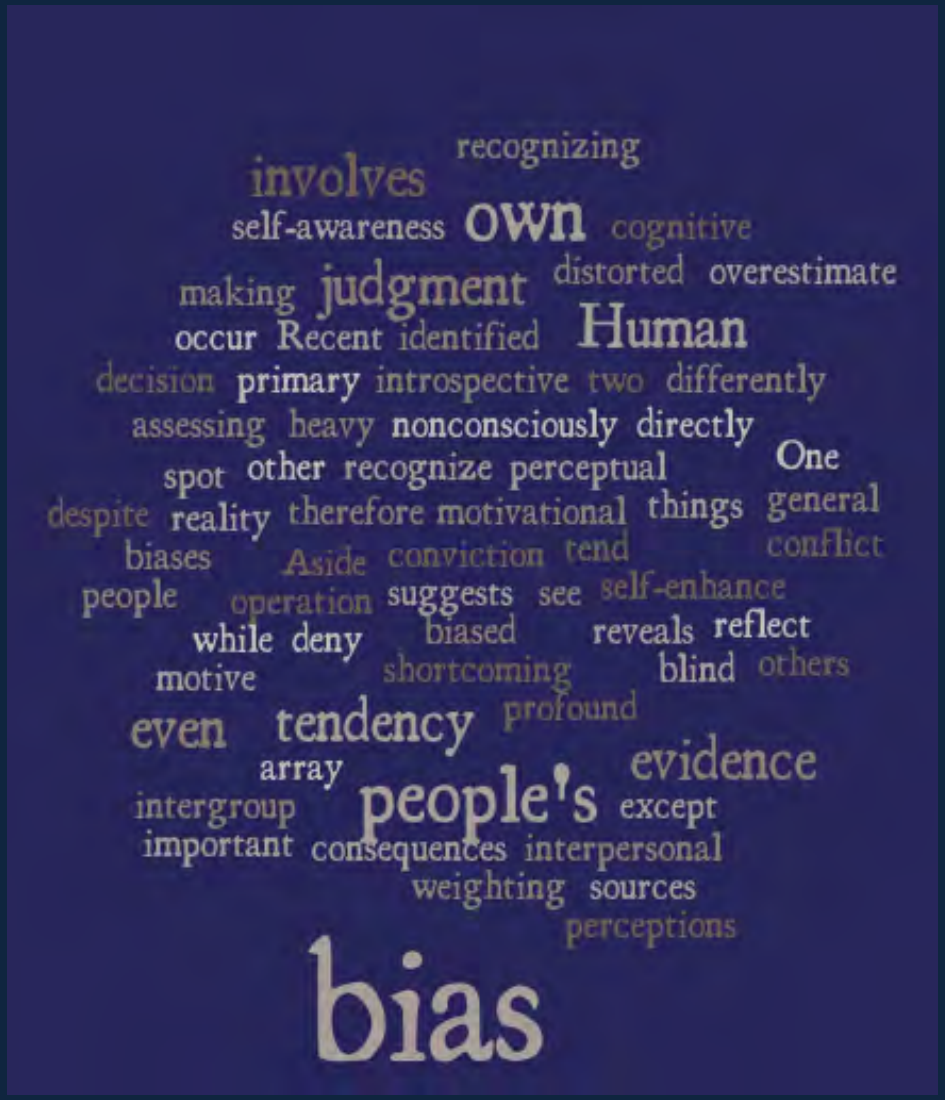
Higher risk tolerance:

- Greater flexibility to accommodate flooding
- Lower consequence
- Ability to change in near term

Lower risk tolerance:

- Little flexibility to accommodate flooding
- Higher consequence
- Inability to change in near term

# Greatest source of uncertainty!



# Discussion Questions

1. Why is everyone so uncertain about sea level rise?

2. How would you decide which number to use?

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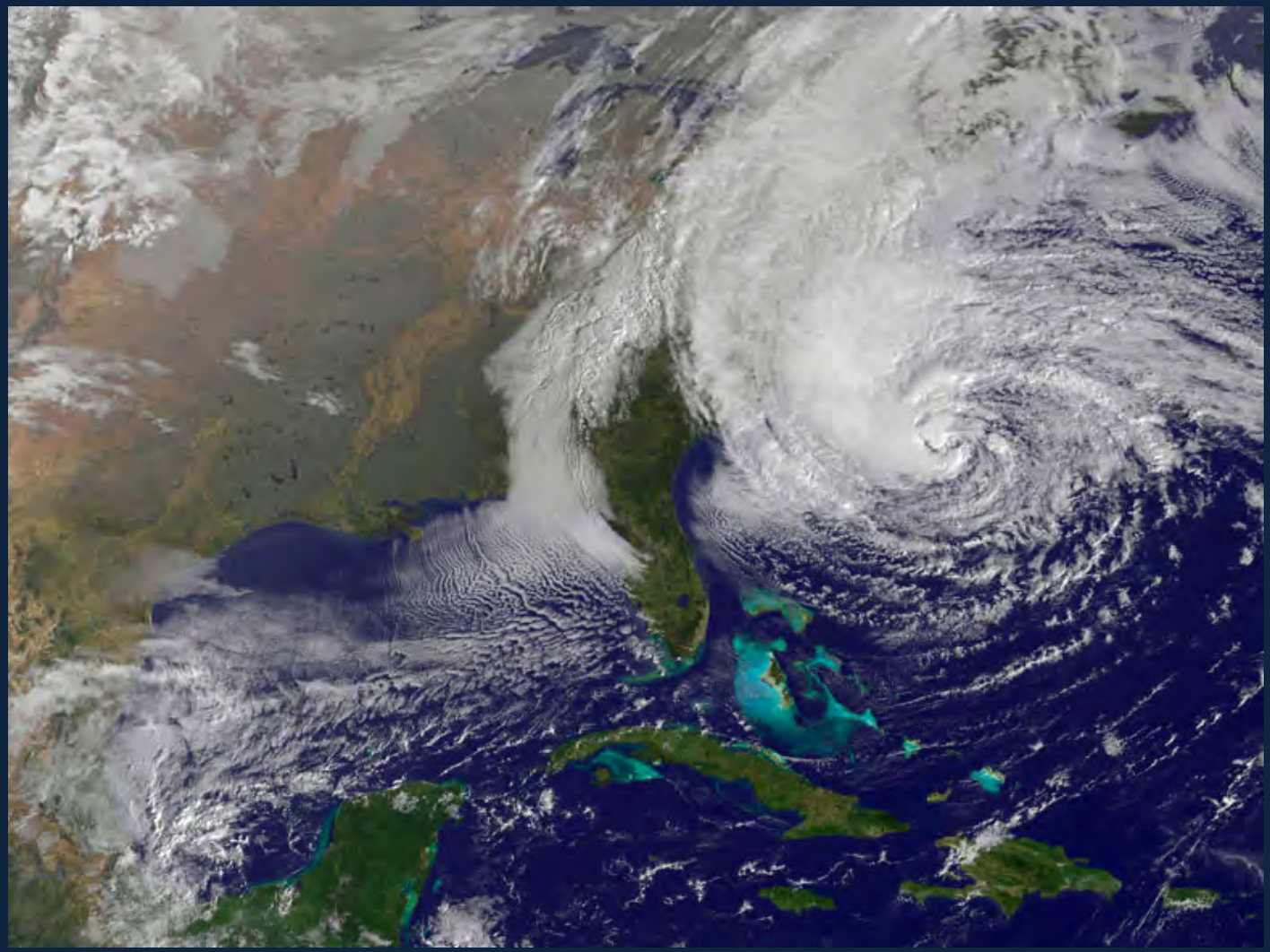
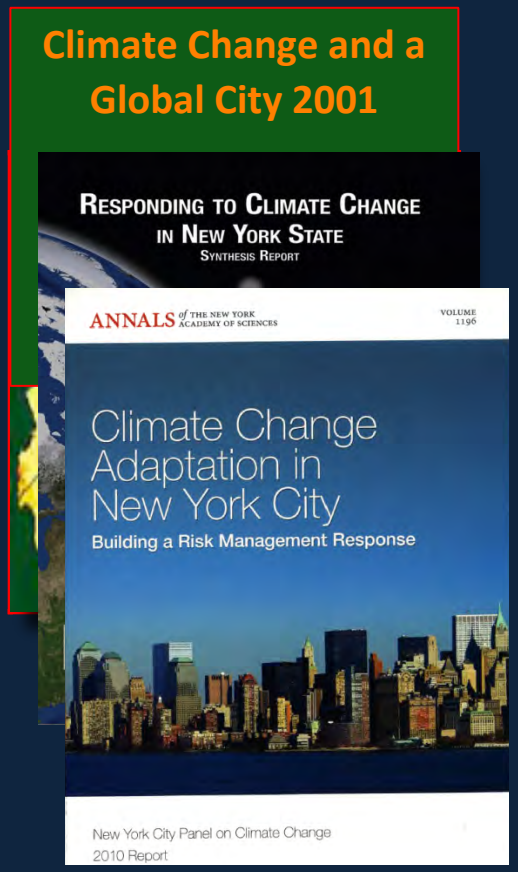
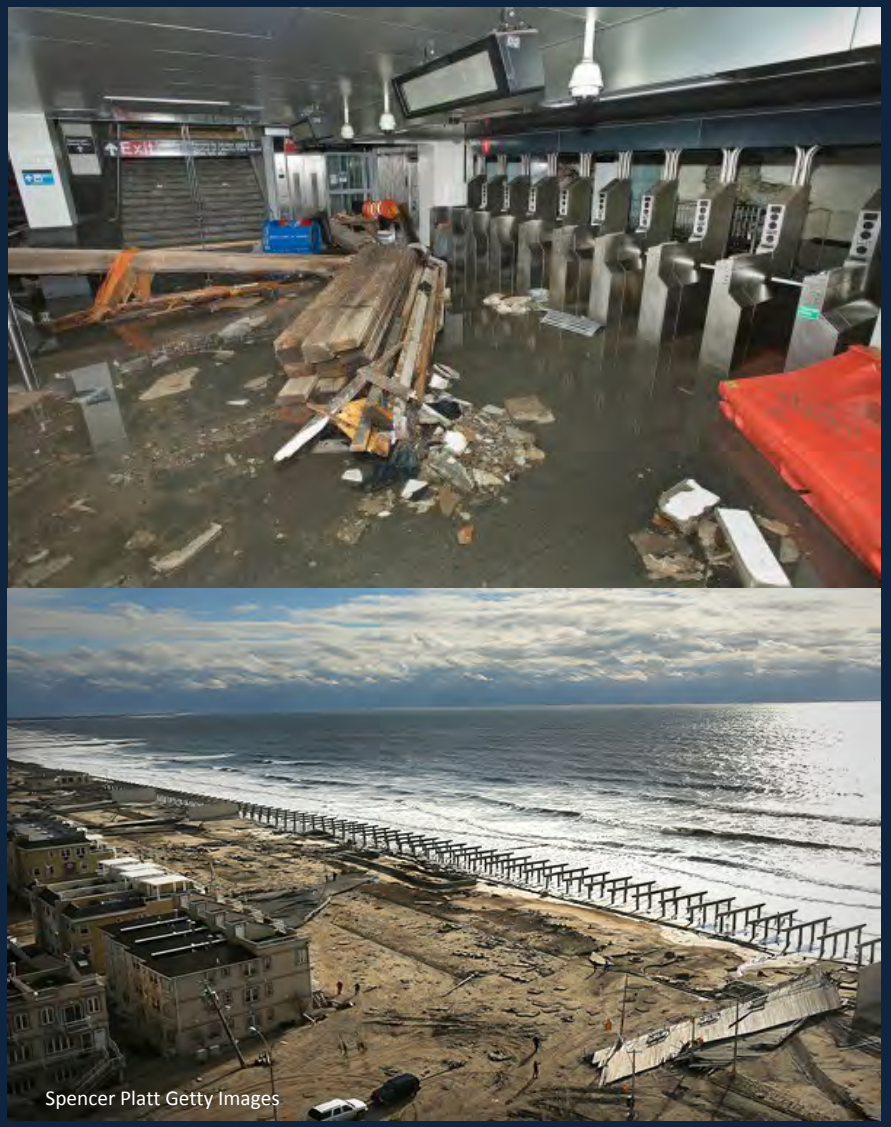
# Hurricane Sandy



Source: NASA

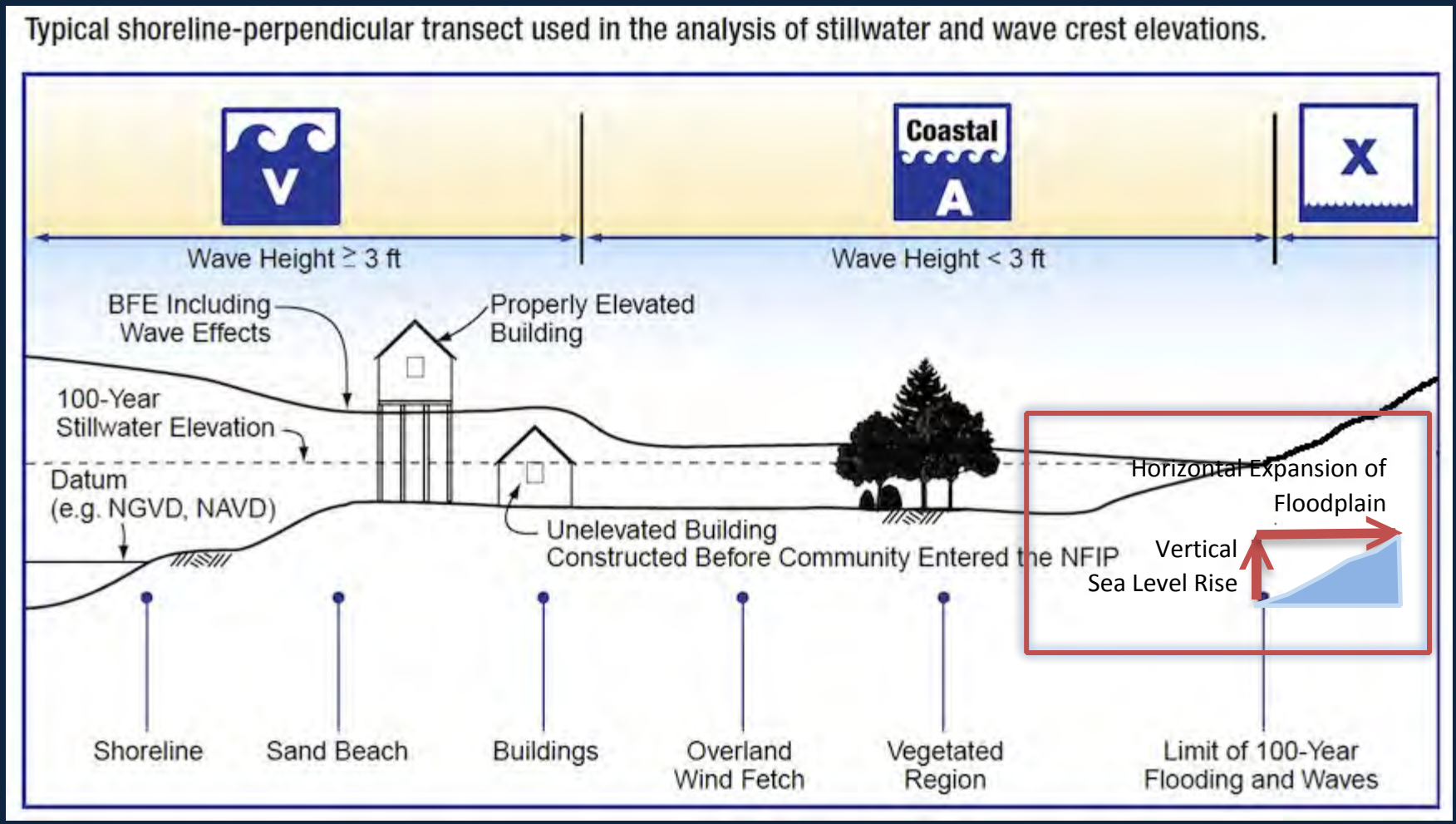
# We knew the impacts were coming




Slide courtesy of Cynthia Rosenzweig (NASA GISS)

# The current state of Flood Insurance

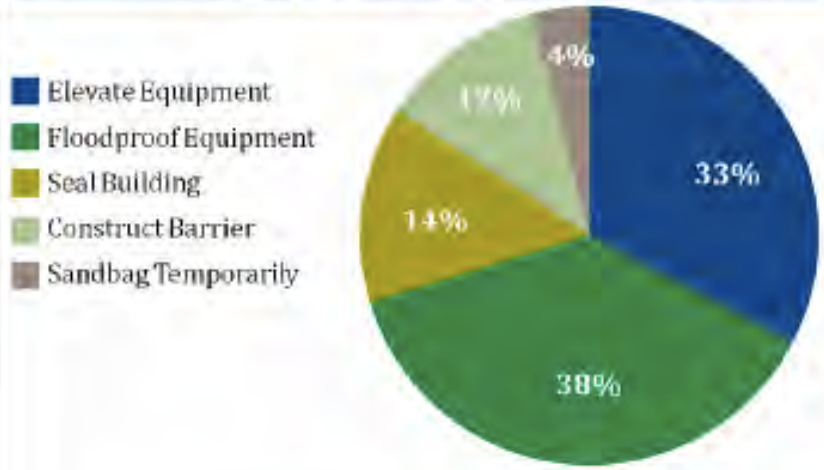



Source: FEMA

# Why consider sea level rise?

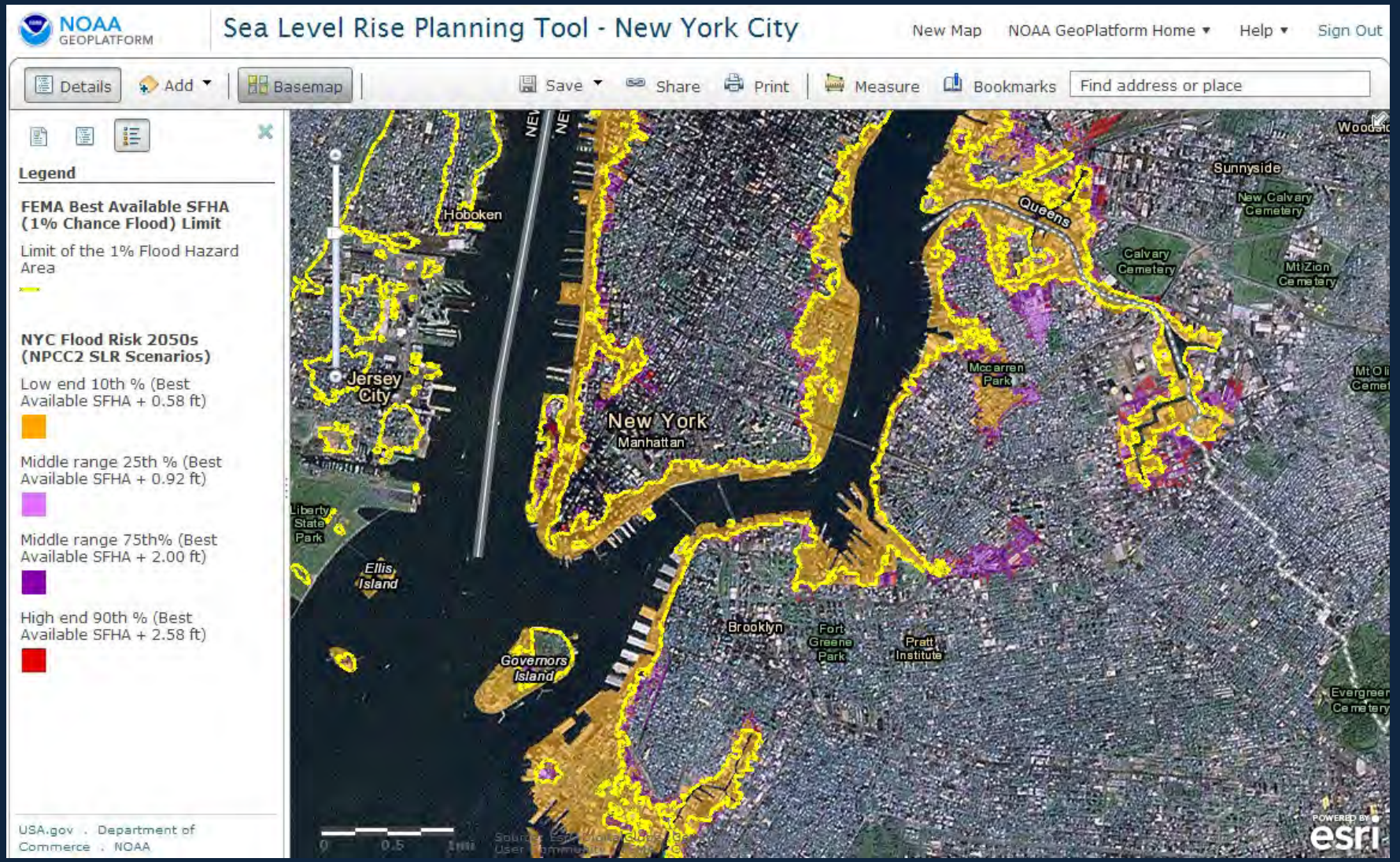
# Cost of Inaction

## Harden Infrastructure- WWTPs




| Facility Type | Adaptation Cost | One-Time No Action Cost | Unmitigated Risk Over 50-Years |
|---|---|---|---|
| WWTP (14) | $189 M | $901 M | $298 M |

# Coordinated Information on Future Risk




In Partnership with CEQ, USGCRP, NOAA, USACE, NYC

# How to rebuild/recover?

**COASTAL ZONE MANAGEMENT ACT OF 1972,**
as amended through Pub. L. No. 109-58,
the Energy Policy Act of 2005

**16 U.S.C. § 1451. Congressional findings (Section 302)**

The Congress finds that--

(a) There is a national interest in the effective management, beneficial use, protection, and development of the coastal zone.
(b) The coastal zone is rich in a variety of natural, commercial, recreational, ecological, industrial, and esthetic resources of immediate and potential value to the present and future well-being of the Nation.

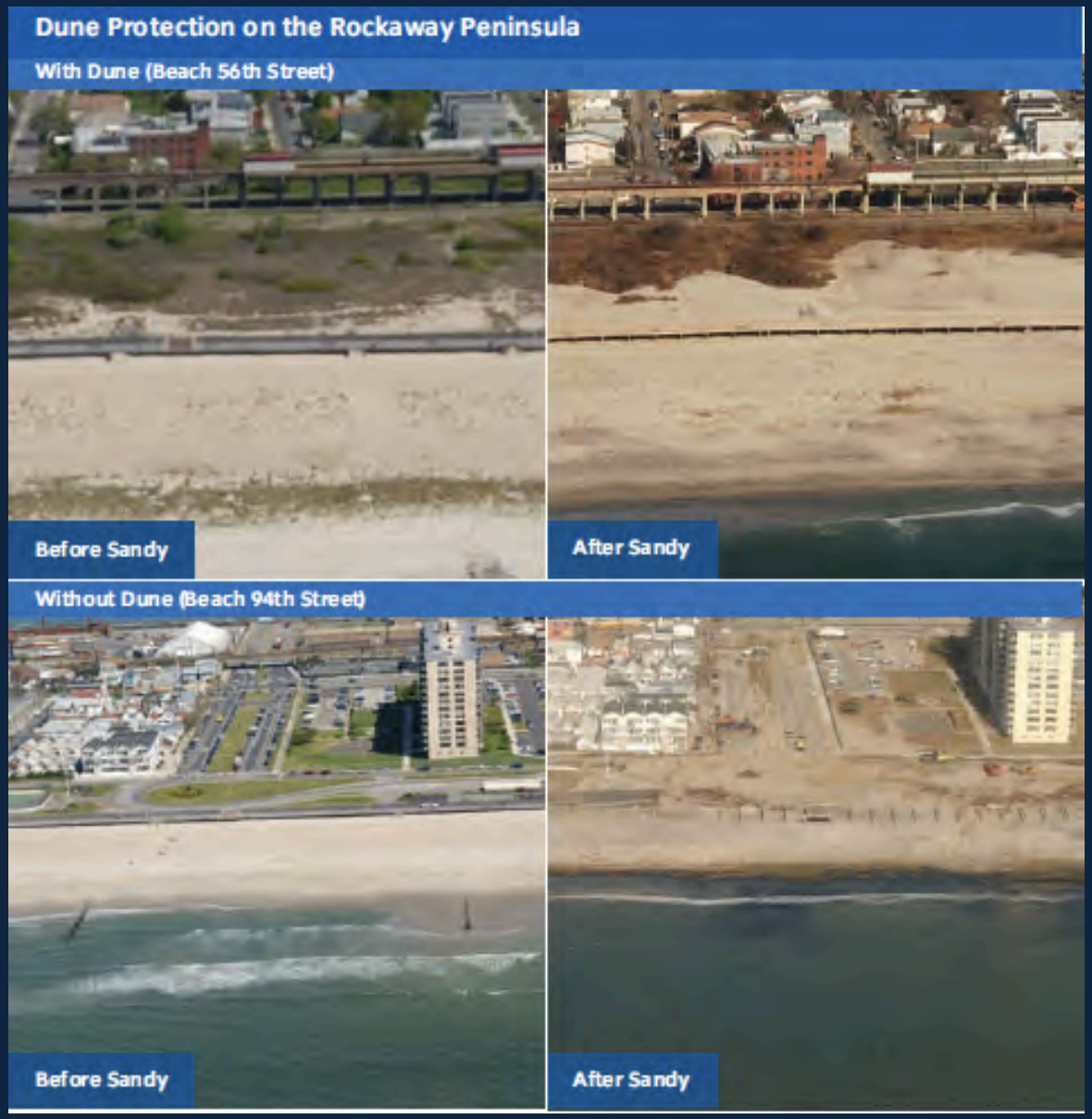
# PROTECTION

# DEFENSE

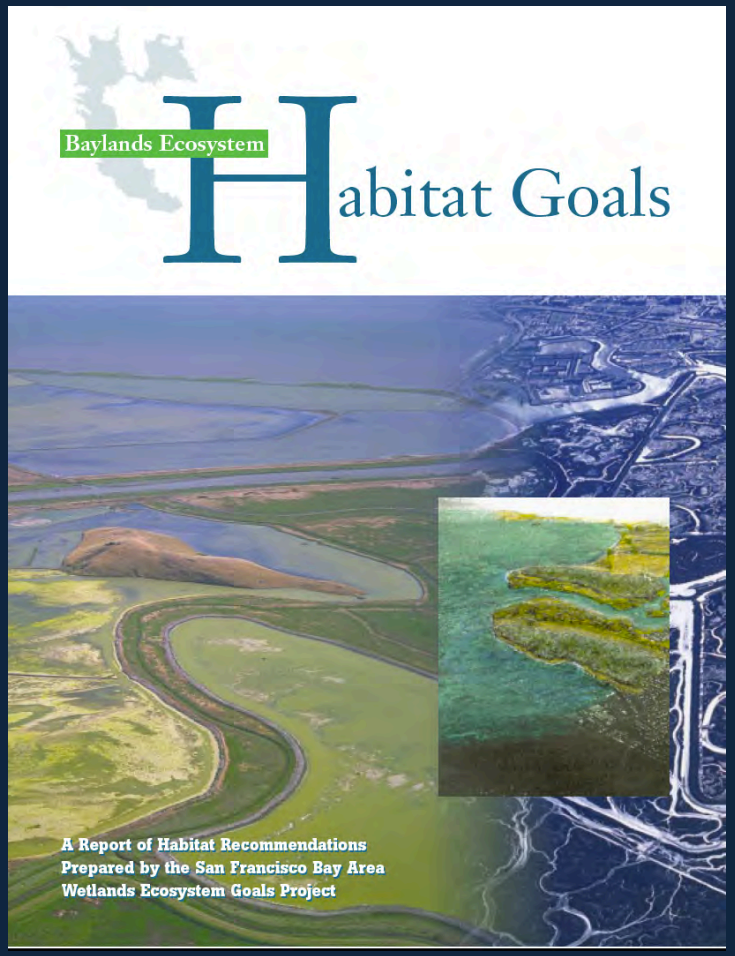
# RETREAT

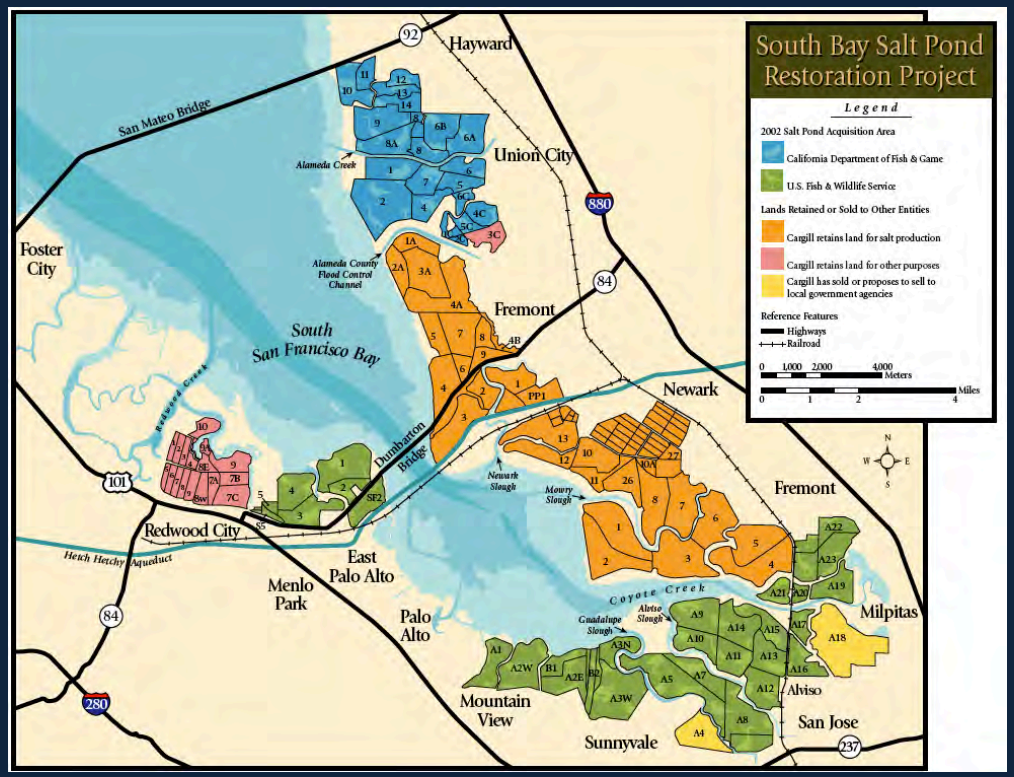

PUBLIC FOOTPATH
DIVERTED
FOR FURTHER DETAILS
TEL IPSWICH 01473 727710
DANGER
SEA-WALL UNSAFE
FOOTPATH CLOSED

# Natural protection



# Getting the goals straight



# Discussion Questions

1. Is the science of sea level rise uncertain? How?
2. How would you decide which number to use?
3. What triggers action to prepare for sea level rise? Are those action driven by community goals?

For Questions, please contact:

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