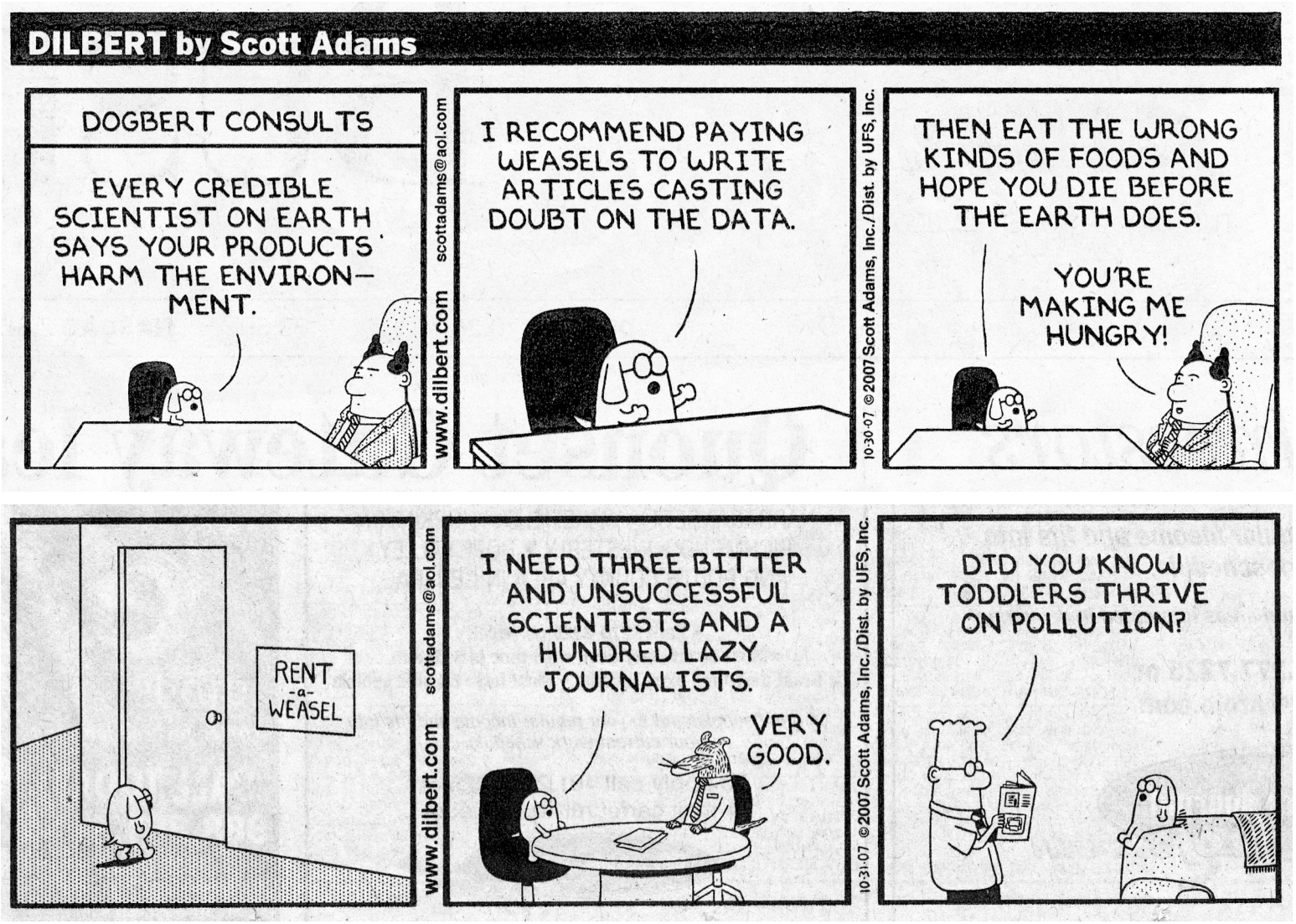
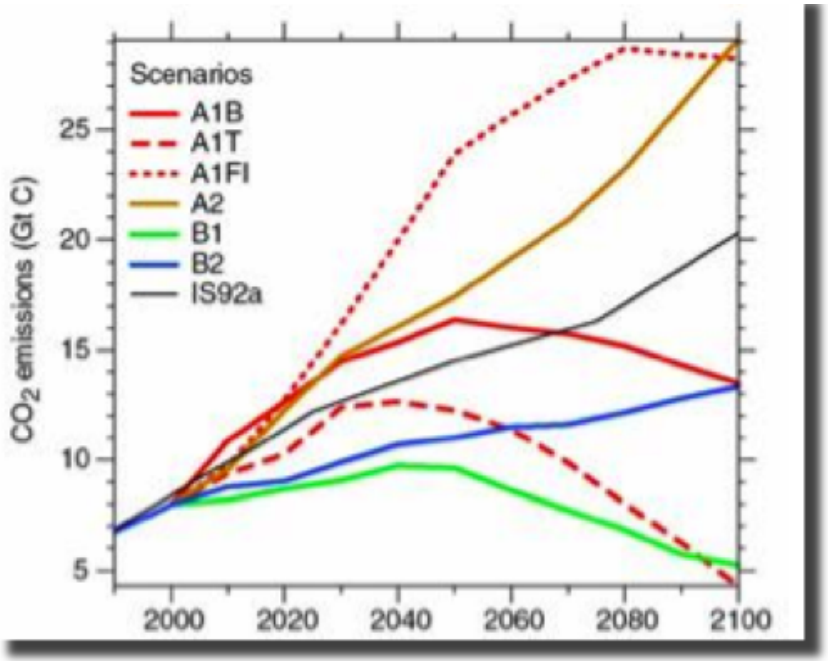
Reason for changes between 2001 & 2007 IPCC climate report?



Increased carbon emissions = climate change



Rising Temperatures

Rising Sea Level

Increased Carbon Emissions

Factors

- Economic growth
  (global vs local)
  (service vs material intensive)

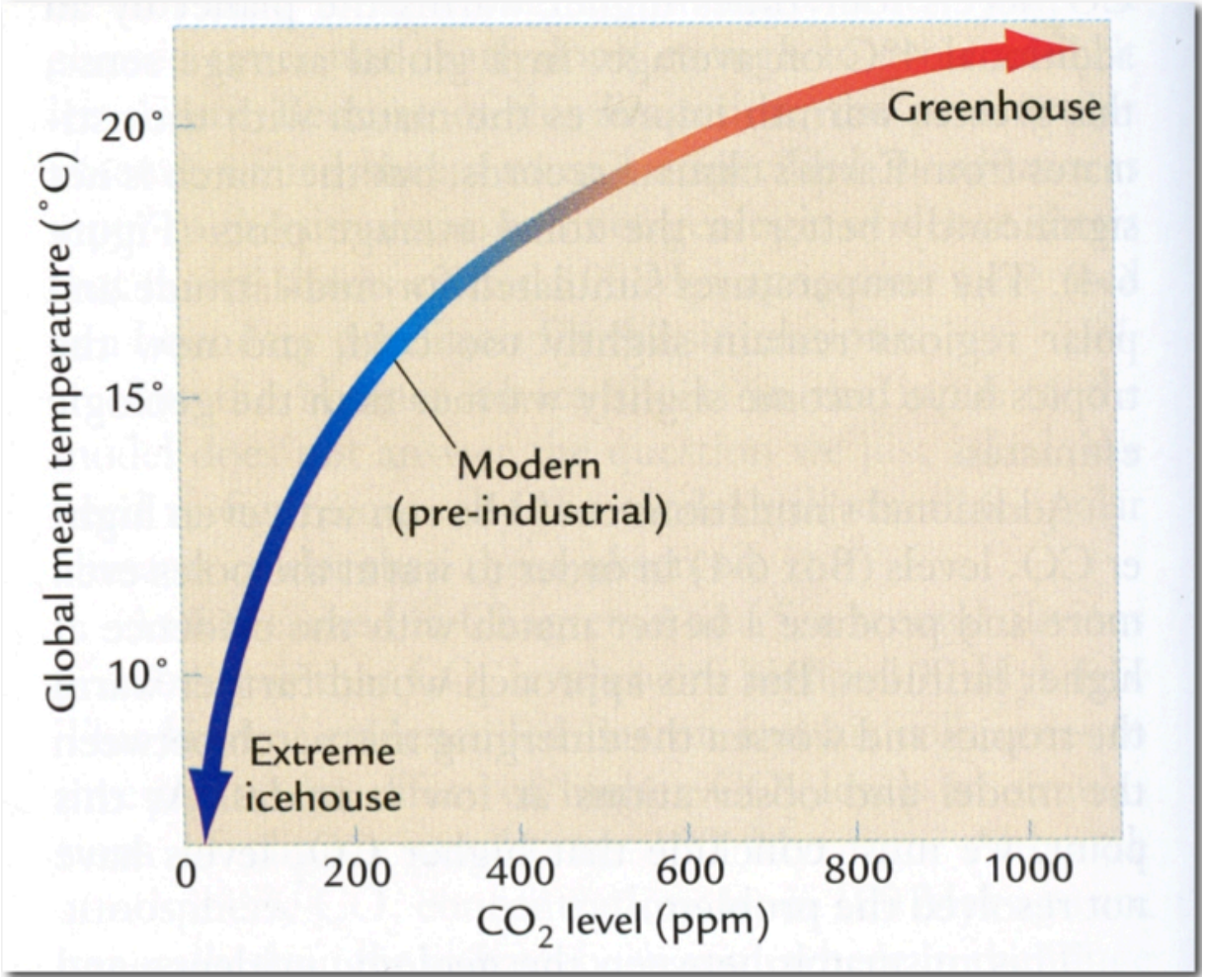
- Global populations
  (mid-century peak vs steady growth)

- Introduction of new/efficient technologies

- Energy sources
  (fossil vs clean vs combo)

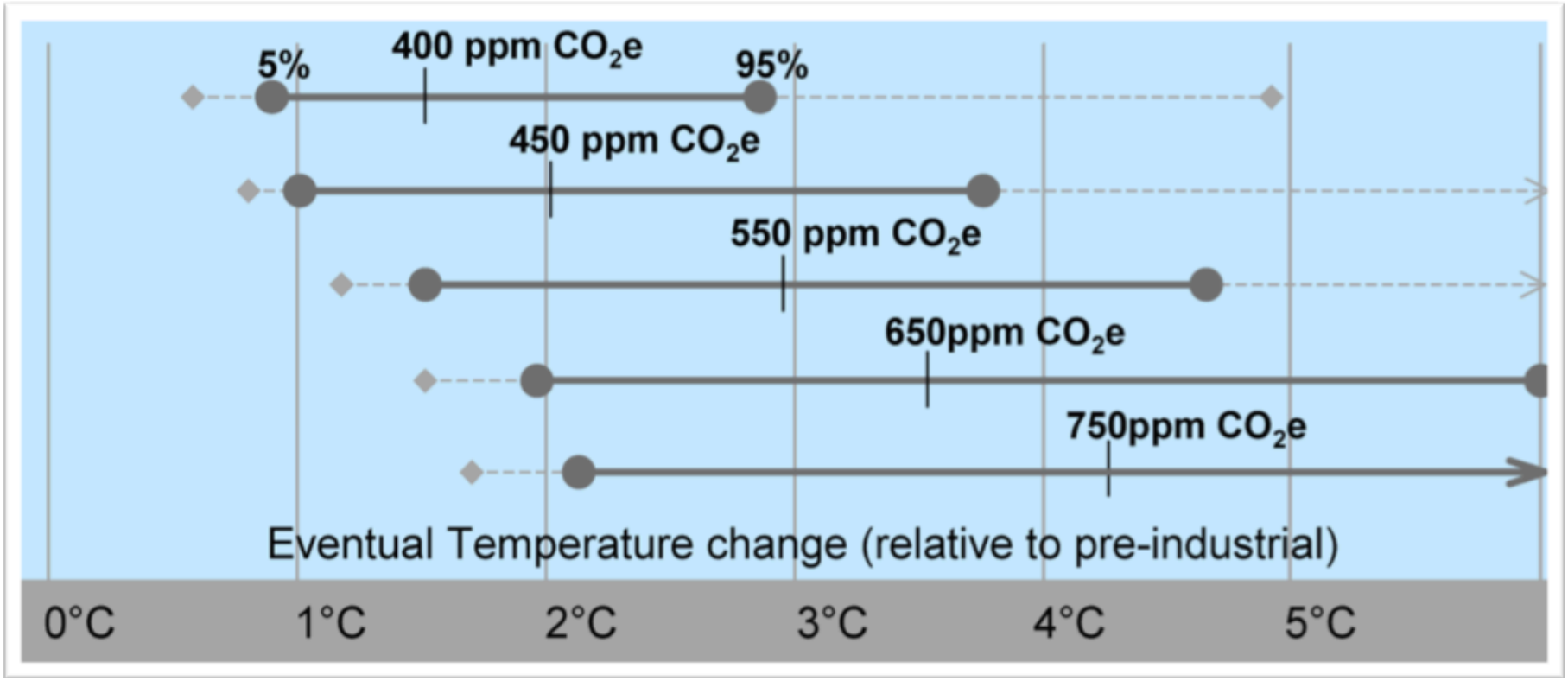
Rising Temperatures

Effect of CO_2 on Climate

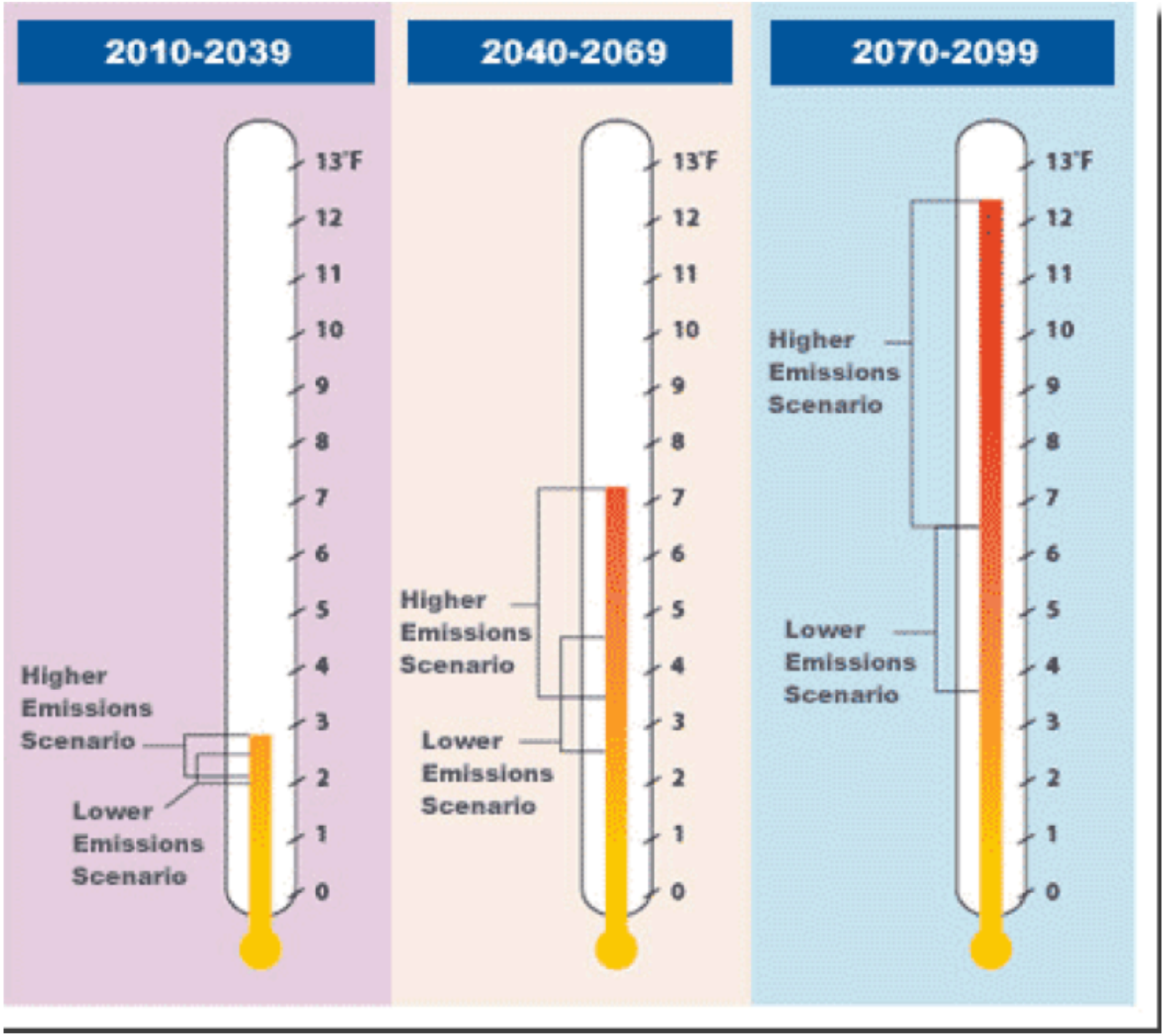


- Higher CO_2 levels leads to higher global temperatures.
- Climate temperature is more sensitive at lower CO_2 concentrations.

Relationship between CO_2 concentration and global warming

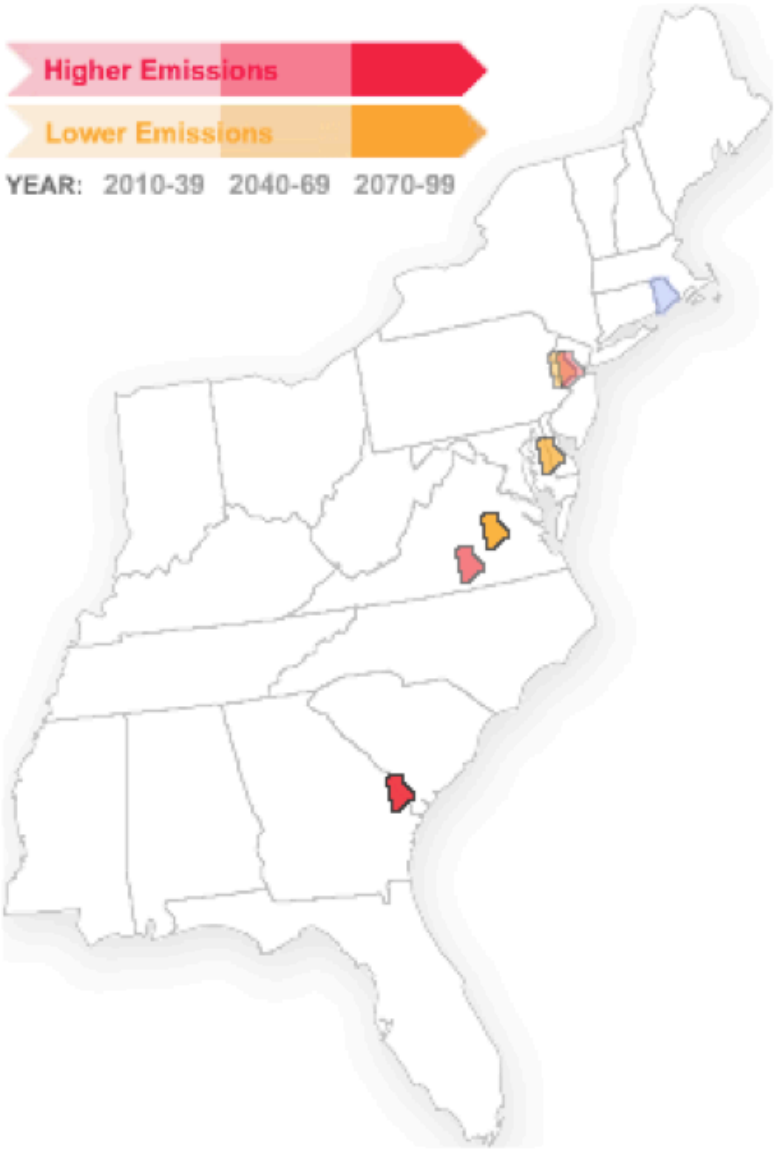


Rising Temperatures



Courtesy of the Union of Concerned Scientists

Rhode Island climate "migration"



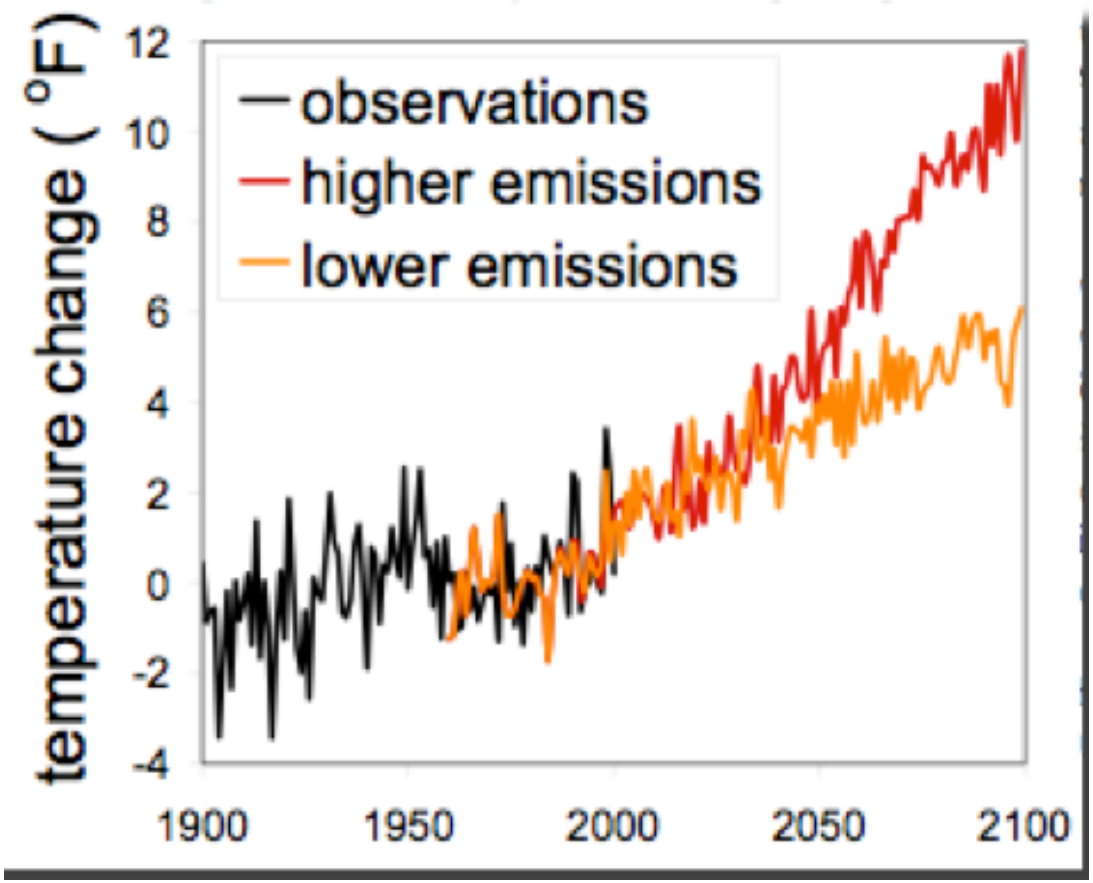
Summer in Rhode Island could feel like the typical summer in coastal South Carolina or Georgia by the end of the century unless we take action to reduce heat-trapping emissions today.

Lower-Emissions Scenarios: *a shift away from fossil fuels in favor of clean energy technologies, causing heat-trapping emissions to decline by mid-century*

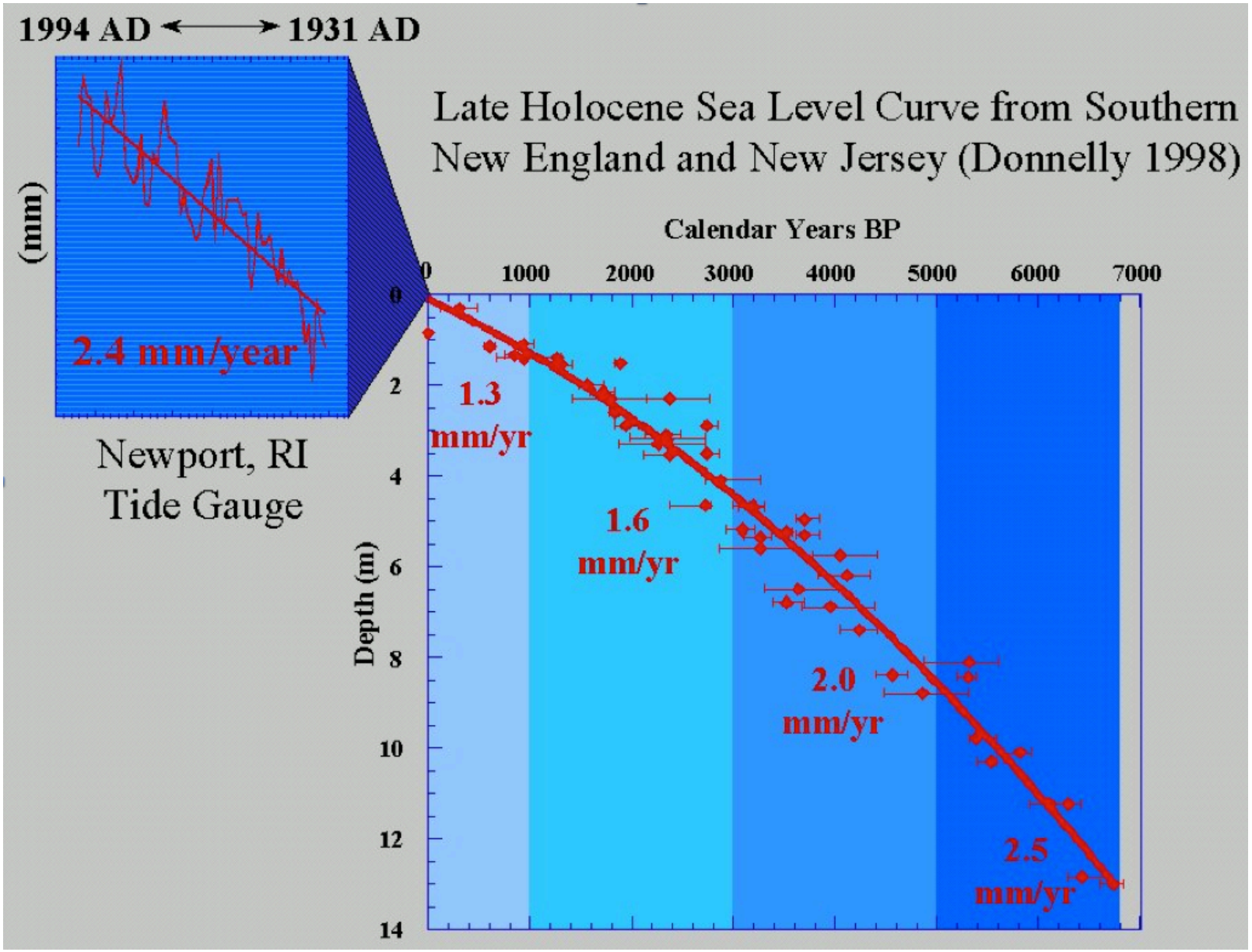
Higher-Emissions Scenarios: *continued heavy reliance on fossils fuels, causing heat-trapping emissions to rise rapidly over the century*

Courtesy of the Union of Concerned Scientists

Changes in annual average temperature - Northeast US



Rising Sea Level


1994 AD ⟷ 1931 AD
(mm)
2.4 mm/year
Newport, RI
Tide Gauge
Late Holocene Sea Level Curve from Southern New England and New Jersey (Donnelly 1998)
Calendar Years BP
0
1000
2000
3000
4000
5000
6000
7000
Depth (m)
0
2
4
6
8
10
12
14
1.3 mm/yr
1.6 mm/yr
2.0 mm/yr
2.5 mm/yr

Four contributions to sea level rise

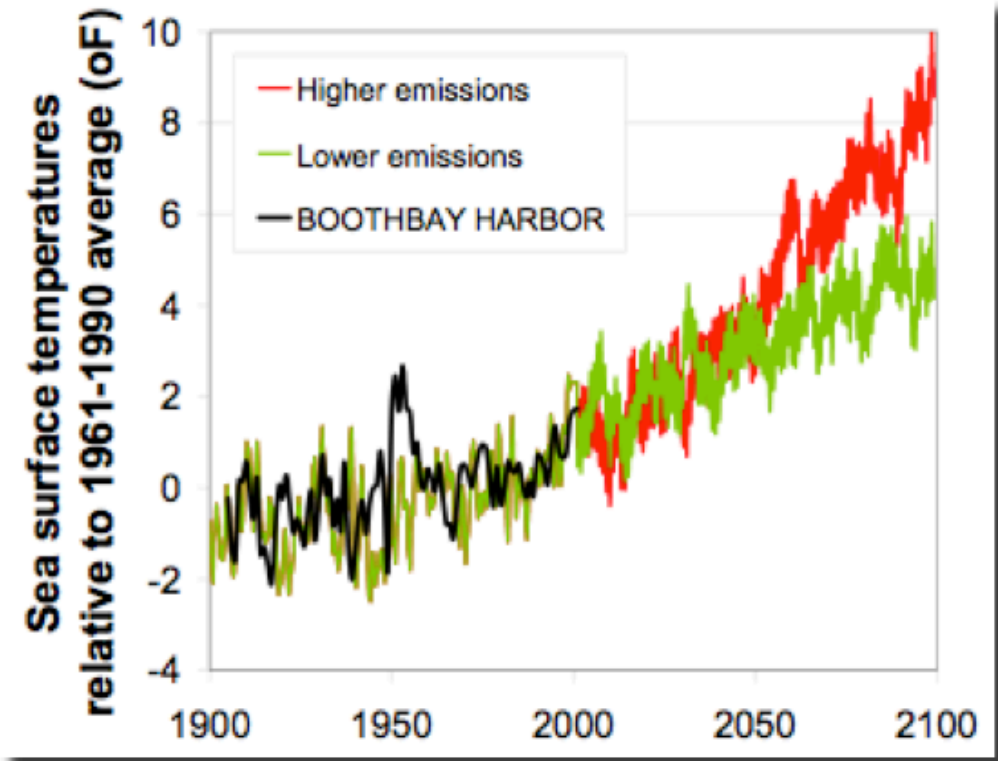
1. Thermal expansion of seawater

2. Melting of glaciers and ice caps

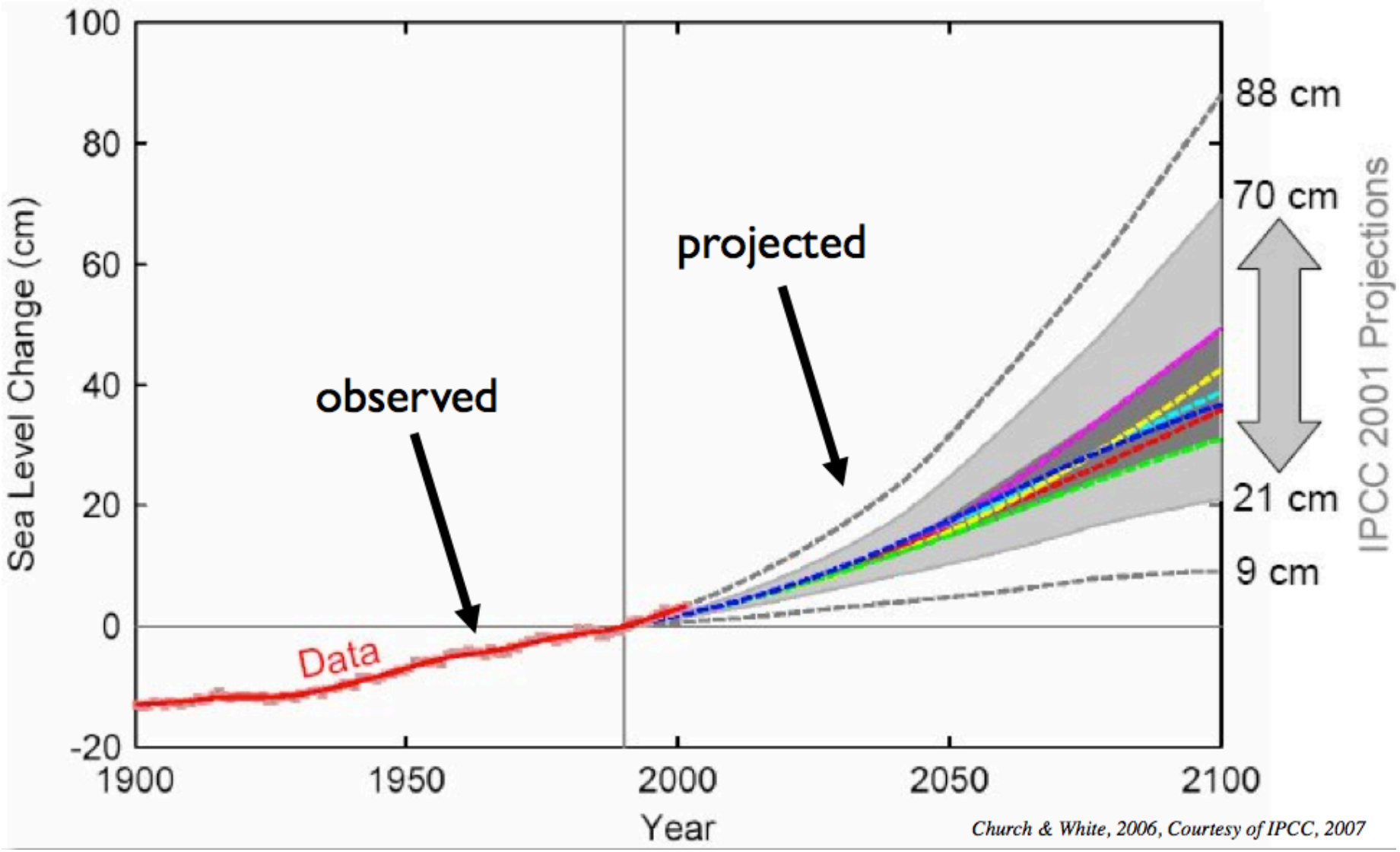
3. Ice sheet surface mass balance
   - snowfall - melting

4. Ice sheet surface dynamical imbalance
   - increased flow rate

Changes in sea surface temperature - Maine



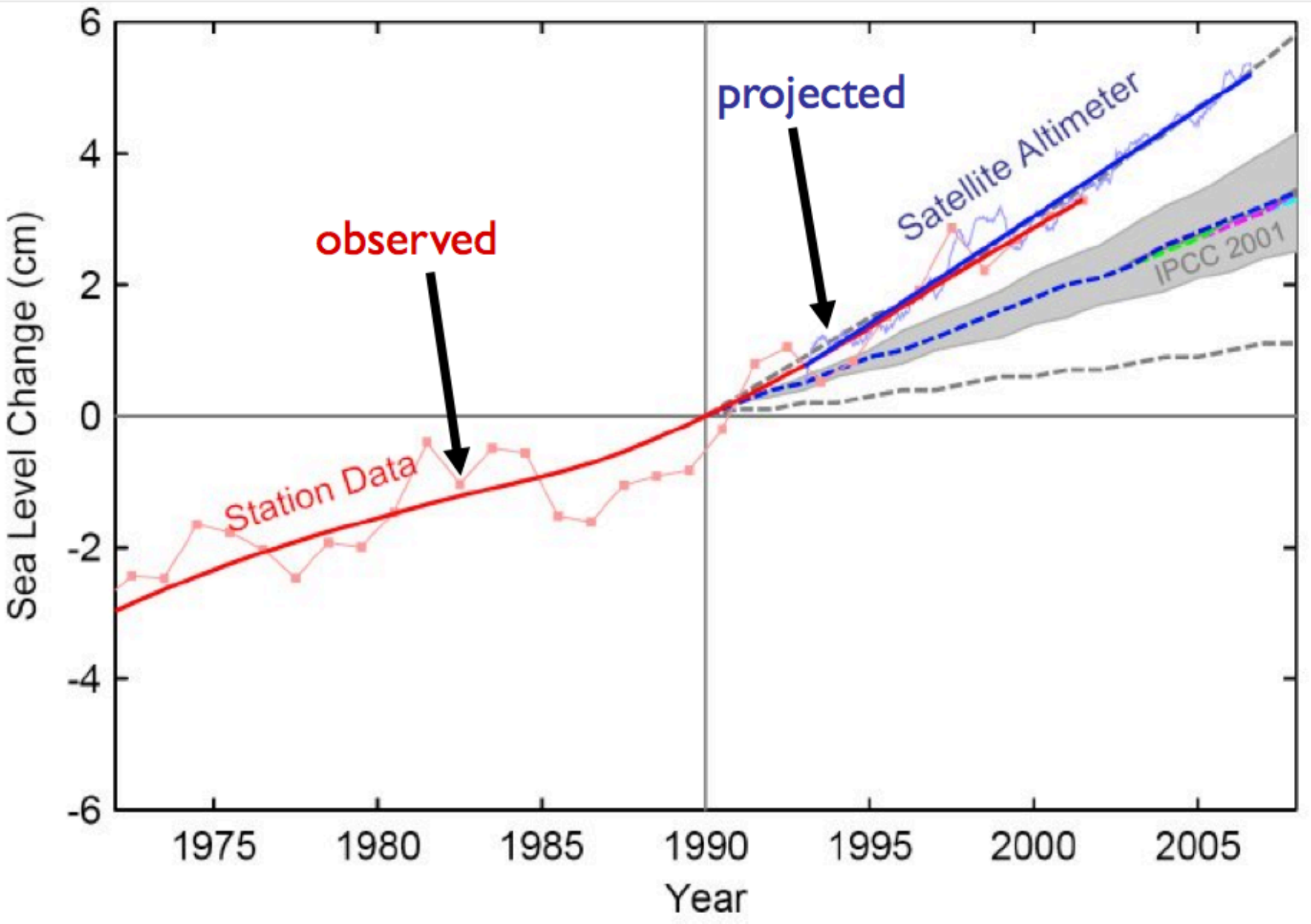
Observed and Projected Sea Level Rise by 2100



Sea Level Rise: Observed vs. Projected

Interval	Model Prediction mm/year	Observed mm/year
1993 - 2003	2.6	3.1
1961 - 2003	1.2	1.8

Sea Level Rise: Observed = Projected



Sea Level Rise: New Estimates

Reference	By 2100 (feet)	Total Rise (feet)
Overpeck, *et al.*, 2006	> 3	13 - 20
Rahmsorf, 2007	1.6 - 4.6	- - -
Pfeffer, *et al.*, 2008	2.6 - 6.6	- - -

Increased sea level rise estimates for New England

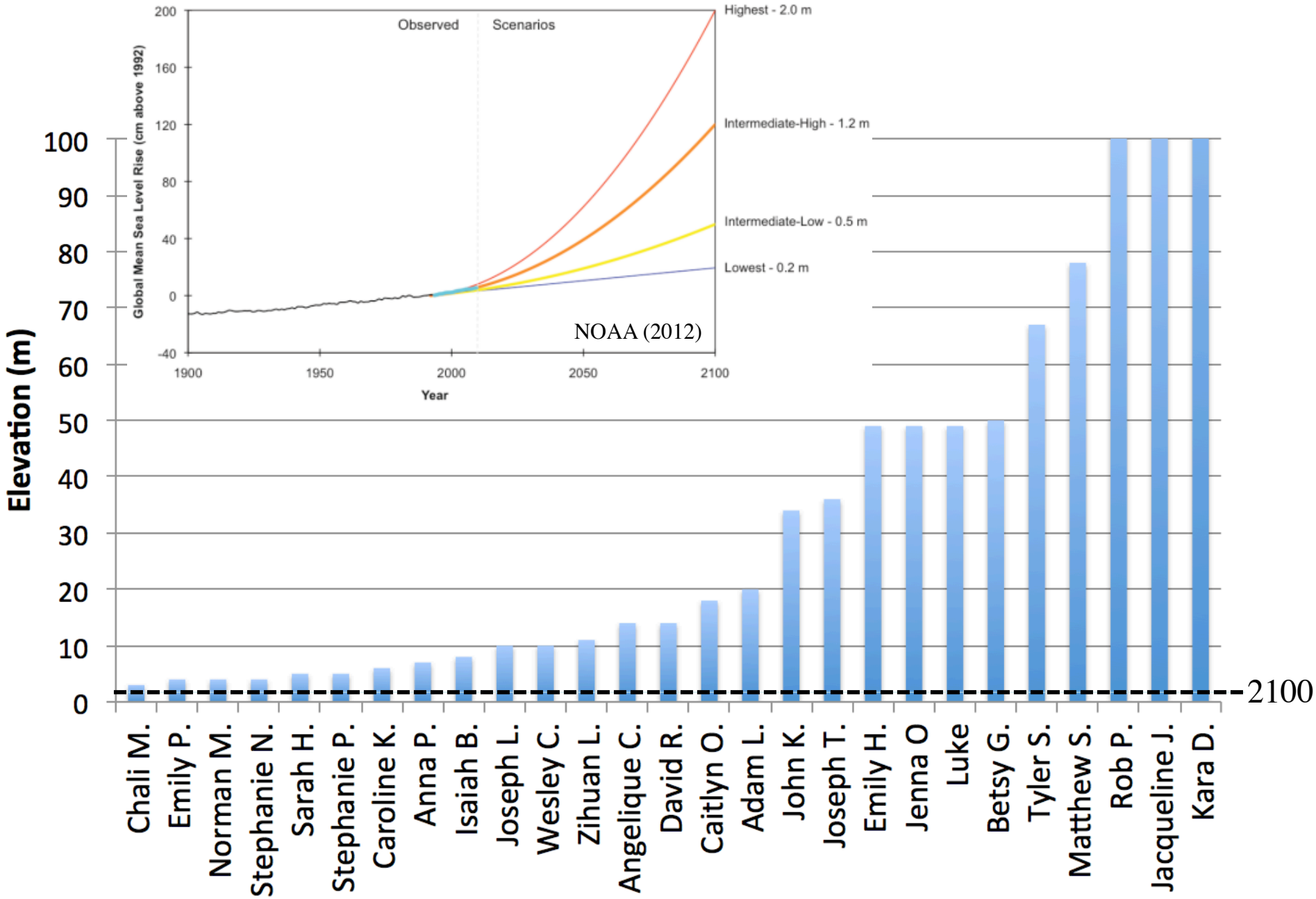
Reference	Additions to global rise predictions
Yin, *et al.*, 2009	+ 8 inches
Hu, *et al.*, 2009	+ 12 - 20 inches
Total global + regional	2.3 - 8.3 feet

Rising Sea Level:

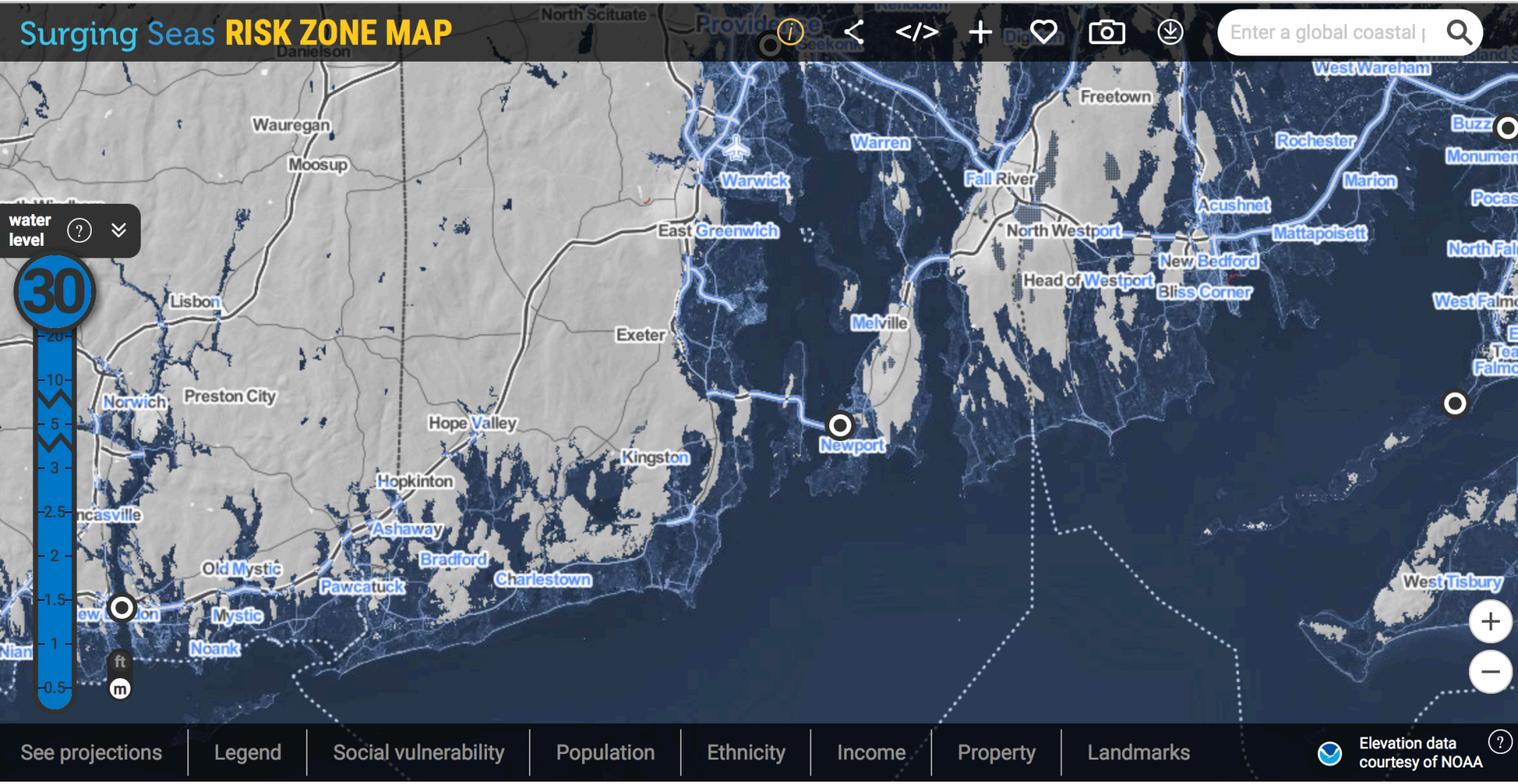
Rhode Island

Rising Sea Level:

Northeast


Elevation (m)
100
90
80
70
60
50
40
30
20
10
0
2100
Chali M.
Emily P.
Norman M.
Stephanie N.
Sarah H.
Stephanie P.
Caroline K.
Anna P.
Isaiah B.
Joseph L.
Wesley C.
Zihuan L.
Angelique C.
David R.
Caitlyn O.
Adam L.
John K.
Joseph T.
Emily H.
Jenna O
Luke
Betsy G.
Tyler S.
Matthew S.
Rob P.
Jacqueline J.
Kara D.
Observed
Scenarios
Global Mean Sea Level Rise (cm above 1992)
200
160
120
80
40
0
-40
1900
1950
2000
2050
2100
Year
Highest - 2.0 m
Intermediate-High - 1.2 m
Intermediate-Low - 0.5 m
Lowest - 0.2 m
NOAA (2012)

http://sealevel.climatecentral.org/ssrf/rhode-island



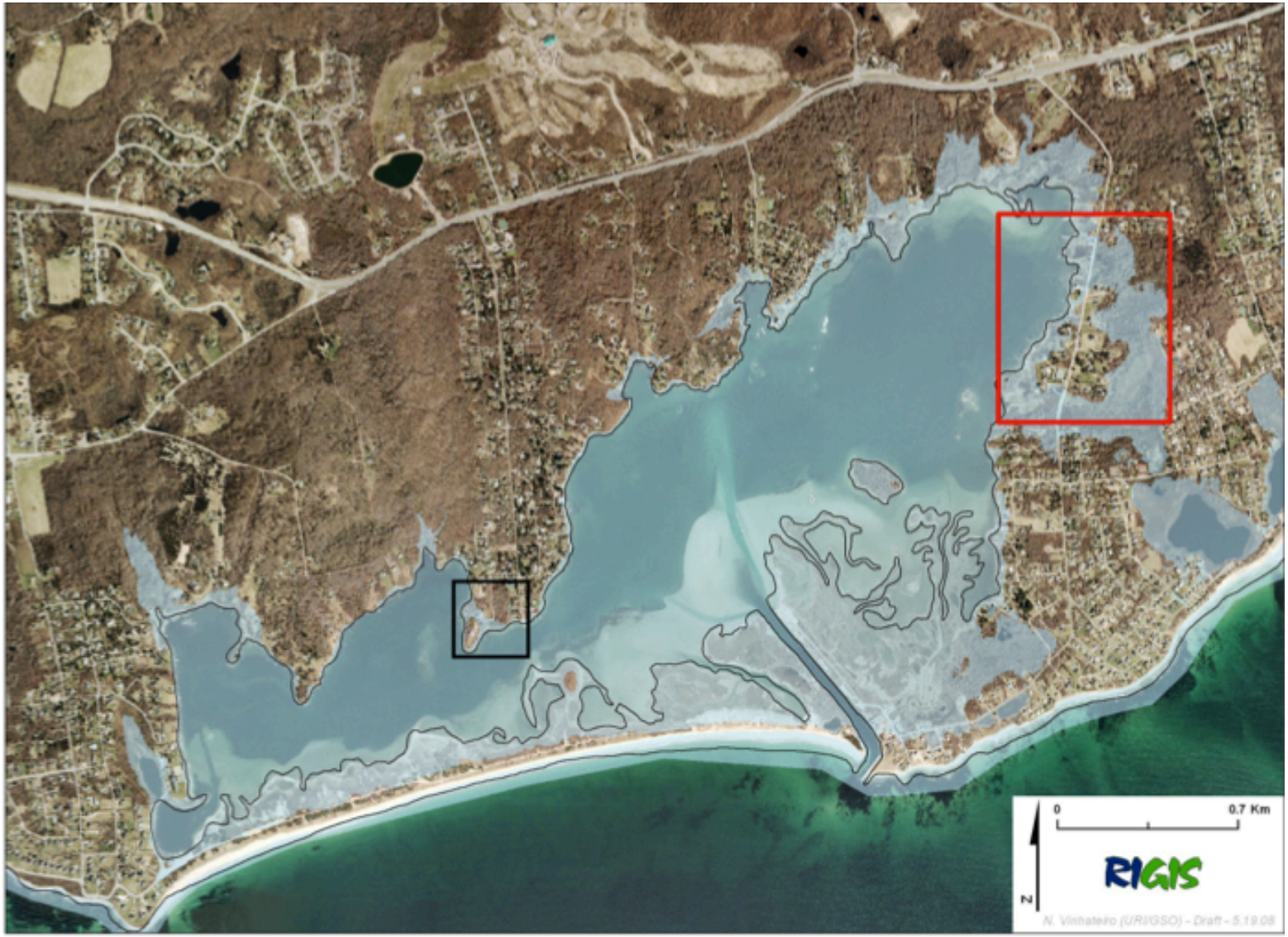
Hong Kong
http://ss2.climatecentral.org/#10/22.2929/114.2331?show=satellite&projections=0-RCP85-SLR&level=0.5&unit=meters&pois=hide

Beijing
http://ss2.climatecentral.org/#9/39.4892/117.3120?show=satellite&projections=0-RCP85-SLR&level=0.5&unit=meters&pois=hide

Rising Sea Level in Rhode Island ~

Southern Coastal Ponds

Quonochontaug Pond 5’ sea level rise: Model by Nathan Vinhateiro, GSO-URI



The 1938 Hurricane: Napatree Point

The 1938 Hurricane: Misquamicut Beach

The 1938 Hurricane: Narragansett Sea Wall

The 1938 Hurricane: Pawtuxet Village

Assessing the Impact of Climate Change:

An Alternative Approach to IPCC

The Stern Review

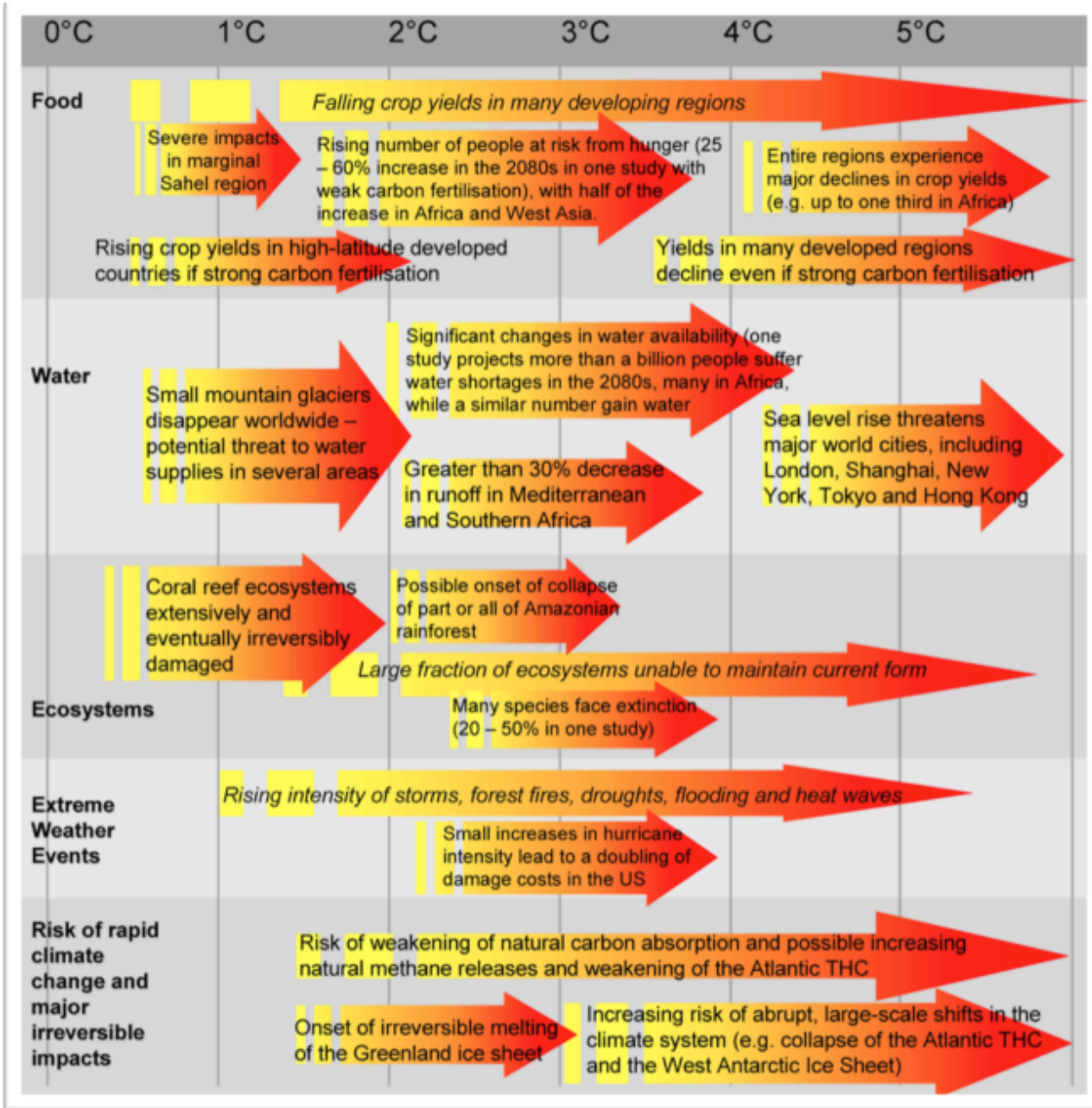
Sir Nicholas Stern

- Ph.D. Economics, Oxford University
- Academic, 1970-1999
- Chief economist, World Bank, 2000 - 2003
- Knighted, 2004
- Member, House of Lords, 2007

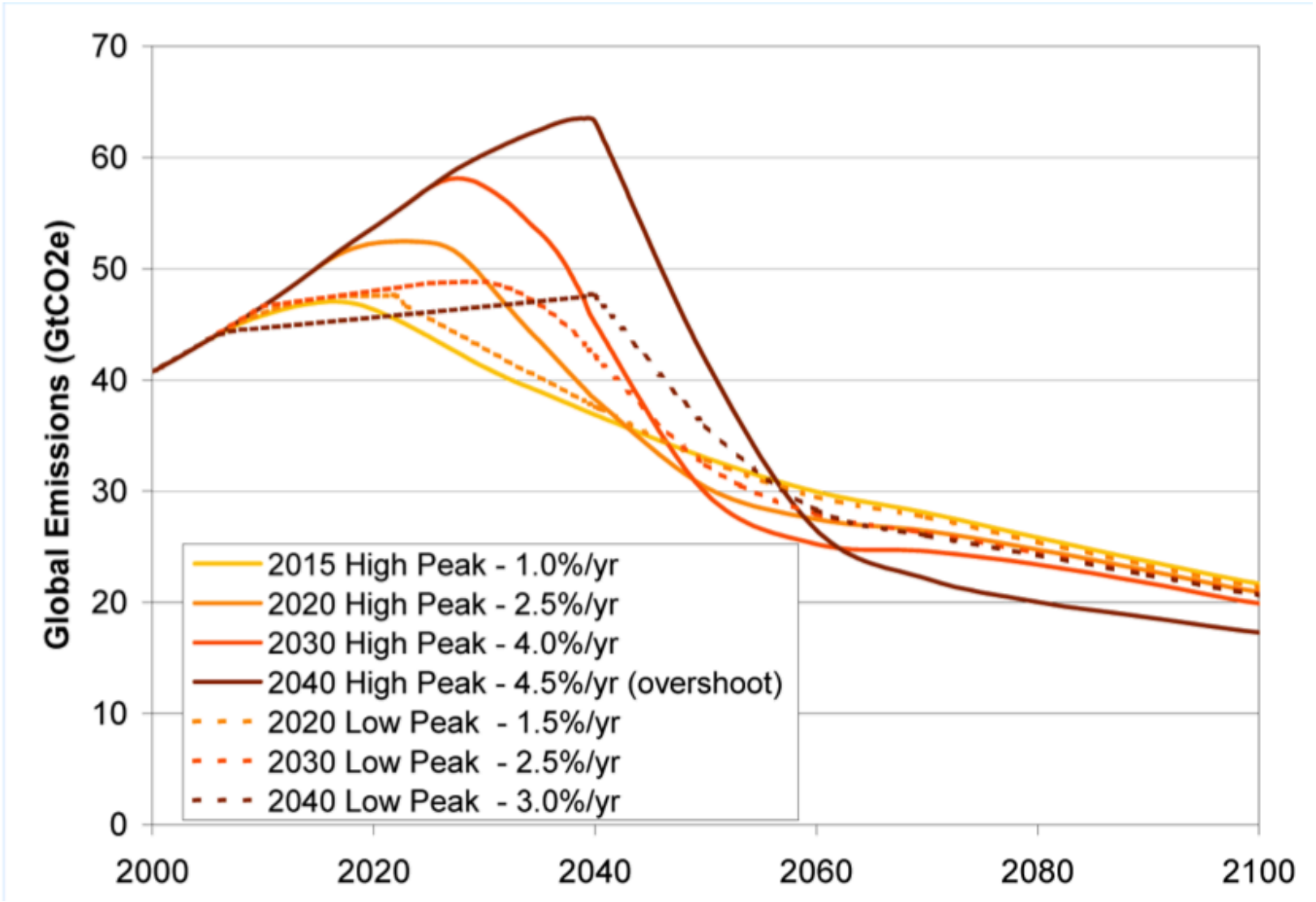
The Stern Review: The Economics of Climate Change

- 670 page independent review commissioned by the British government to better understand the economics of climate change
- Uses risk-management approach to assess the impact of climate change
- The risk- management approach focuses on worst case scenarios and how to prevent them
- Stern Review tends to be more definitive than the IPCC report

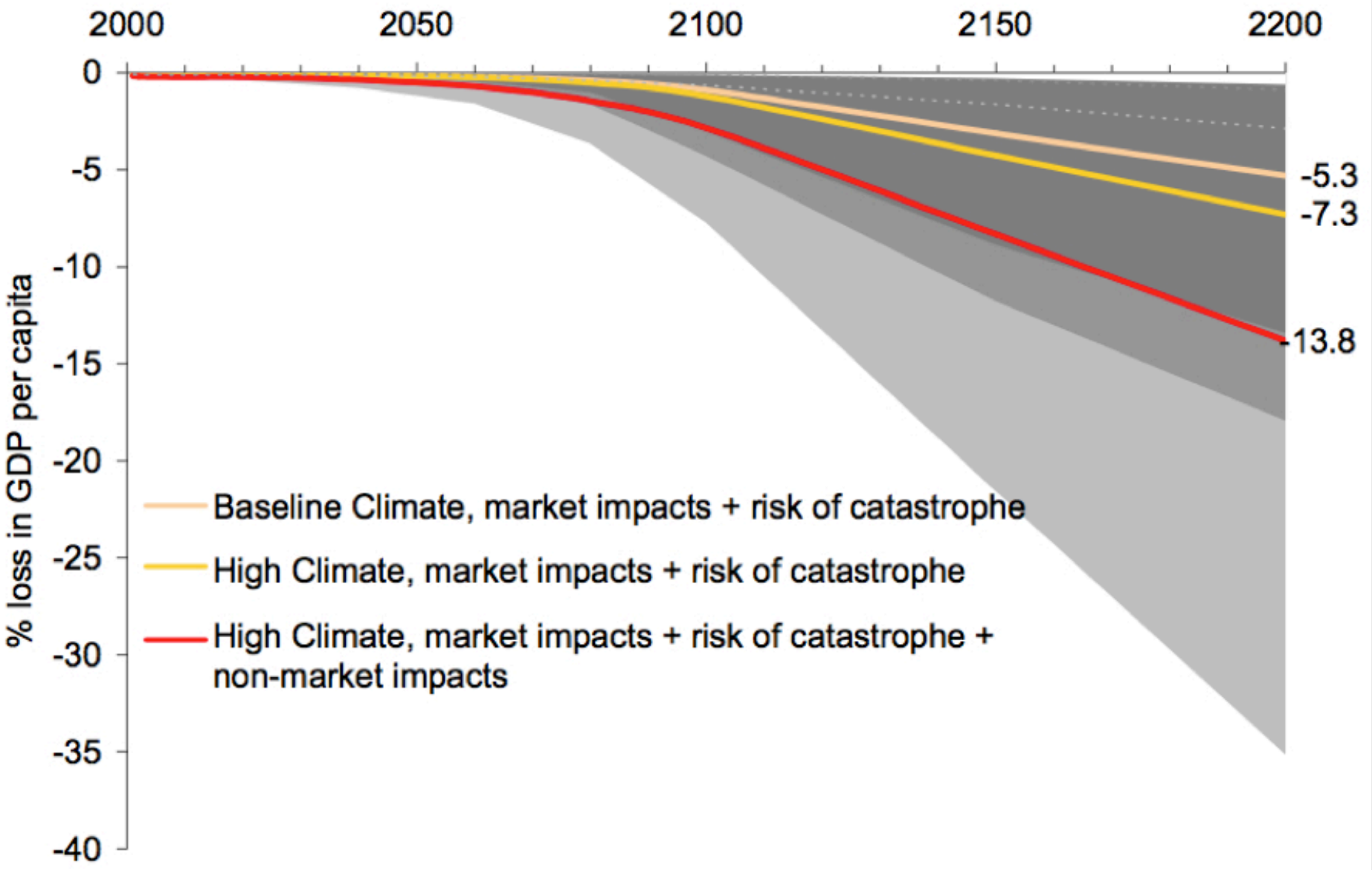
Impacts of increased greenhouse gases



Scenarios to stabilize at 550 ppm CO_2



Losses in per capita income due to climate change

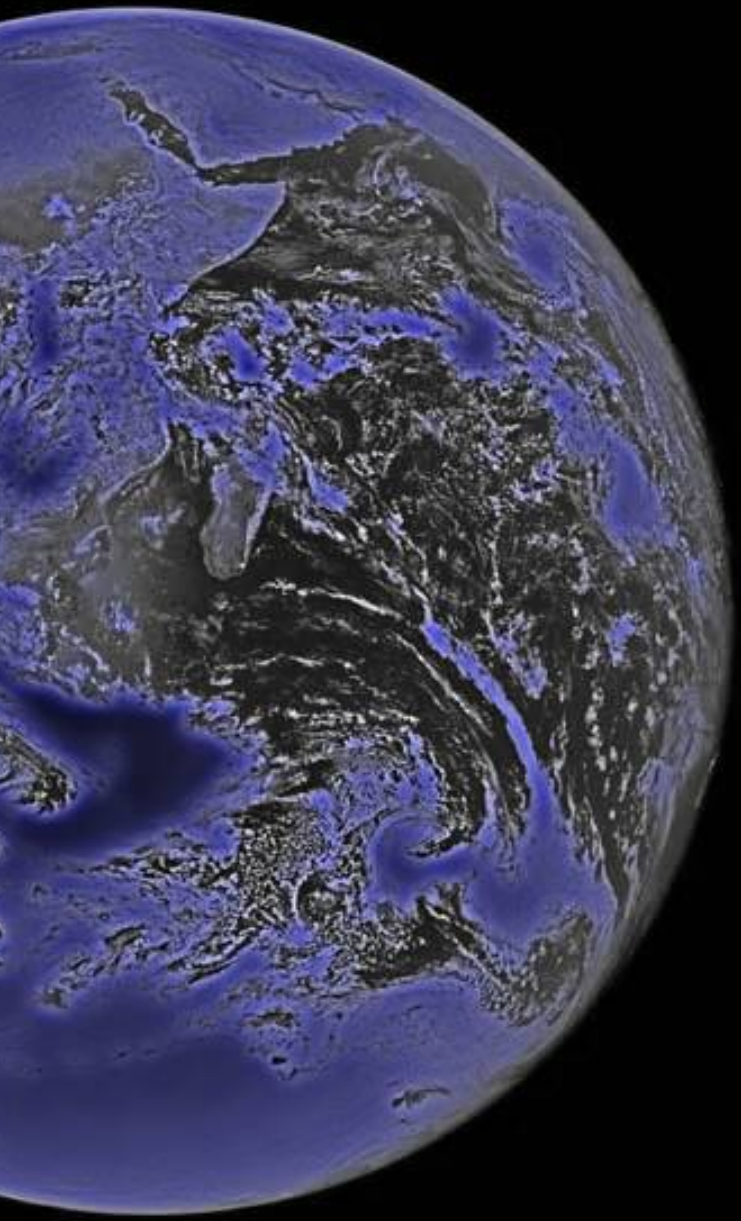


Conclusions:

The scientific community has reached a consensus that current climate change is human-induced, and will produce devastating environmental and societal impacts during the next century.

The benefits of strong early action to mitigate climate change clearly outweigh the costs.

The US should aim for moral, scientific and industrial leadership to mitigate climate change, rather than vying to be the head weasel.



"Perhaps our epitaph will be:

The good Earth. We could have saved it, but we were too damn cheap and lazy."

~ Kurt Vonnegut