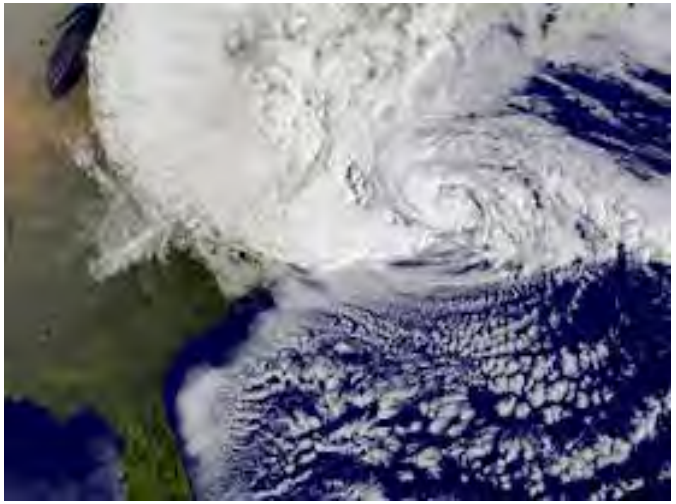
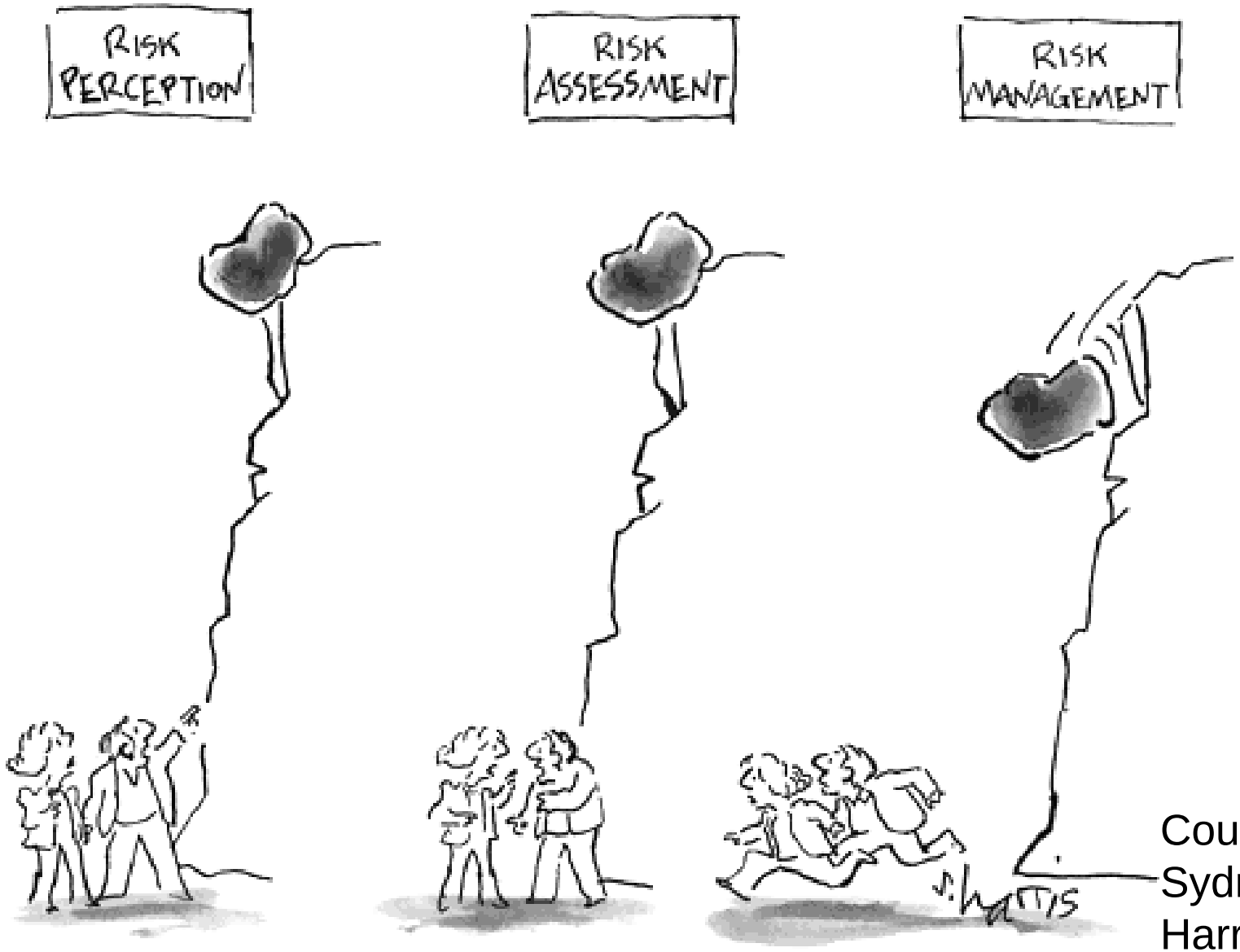
Fifth Assessment Report Intergovernmental Panel on Climate Change:

When Will Global Warming Become Dangerous?



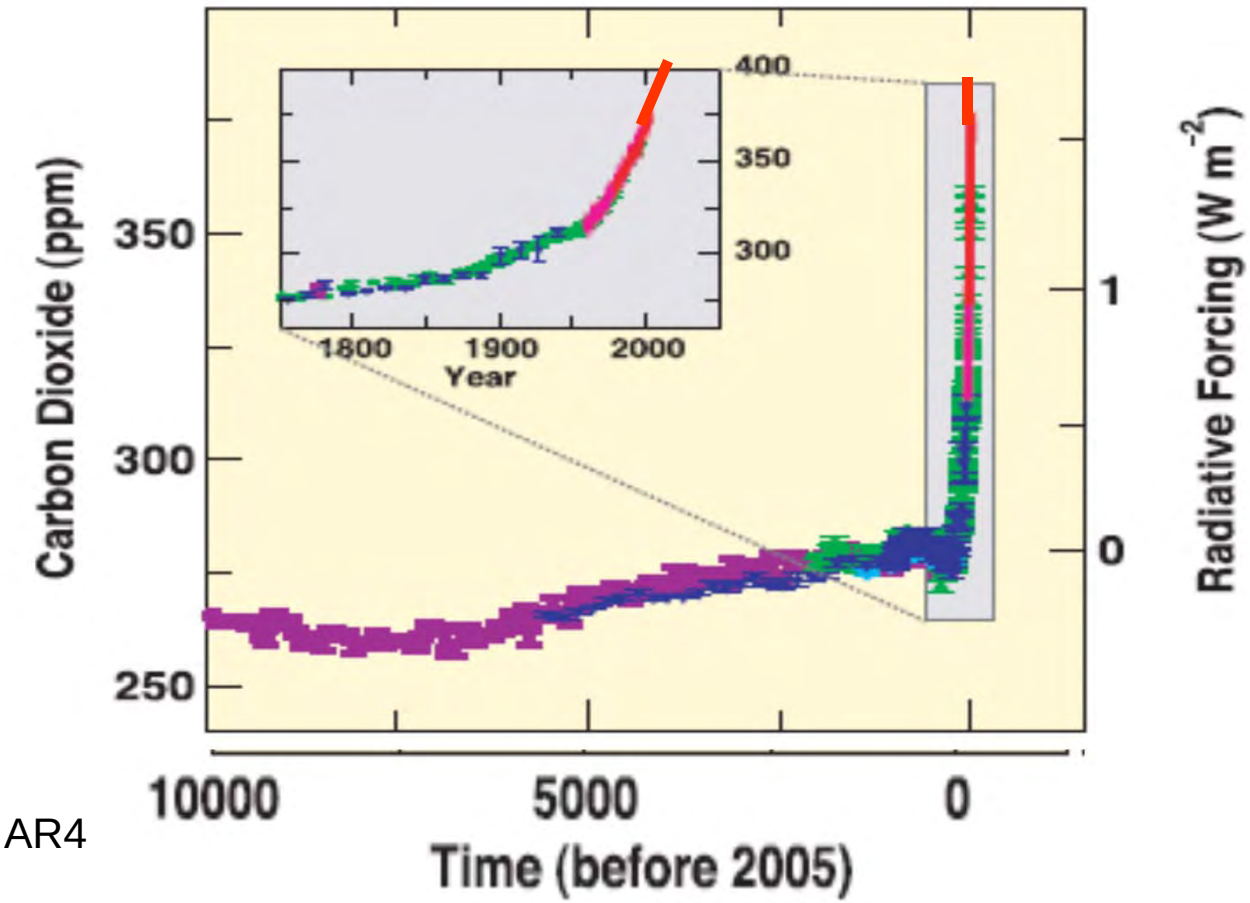
Michael Oppenheimer
Princeton University
At
Pace University
20 November 2014

Can policy makers think ahead?



Courtesy Sydney Harris

Atmospheric Carbon Dioxide Grew by 43% in Industrial Era



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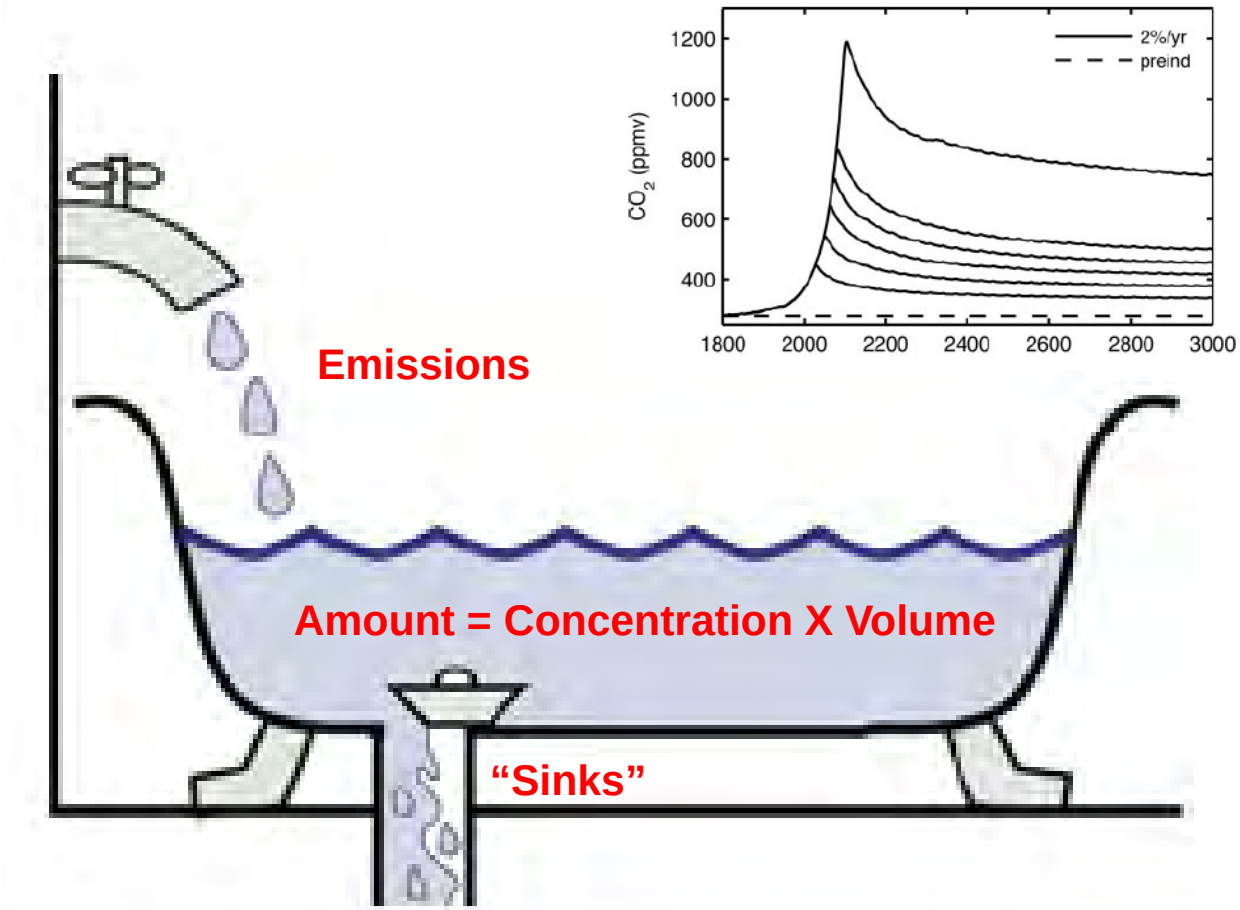
Problem: human-made carbon dioxide in the atmosphere behaves like water in a bathtub with a stuffed drain



Fossil fuels emissions largely responsible

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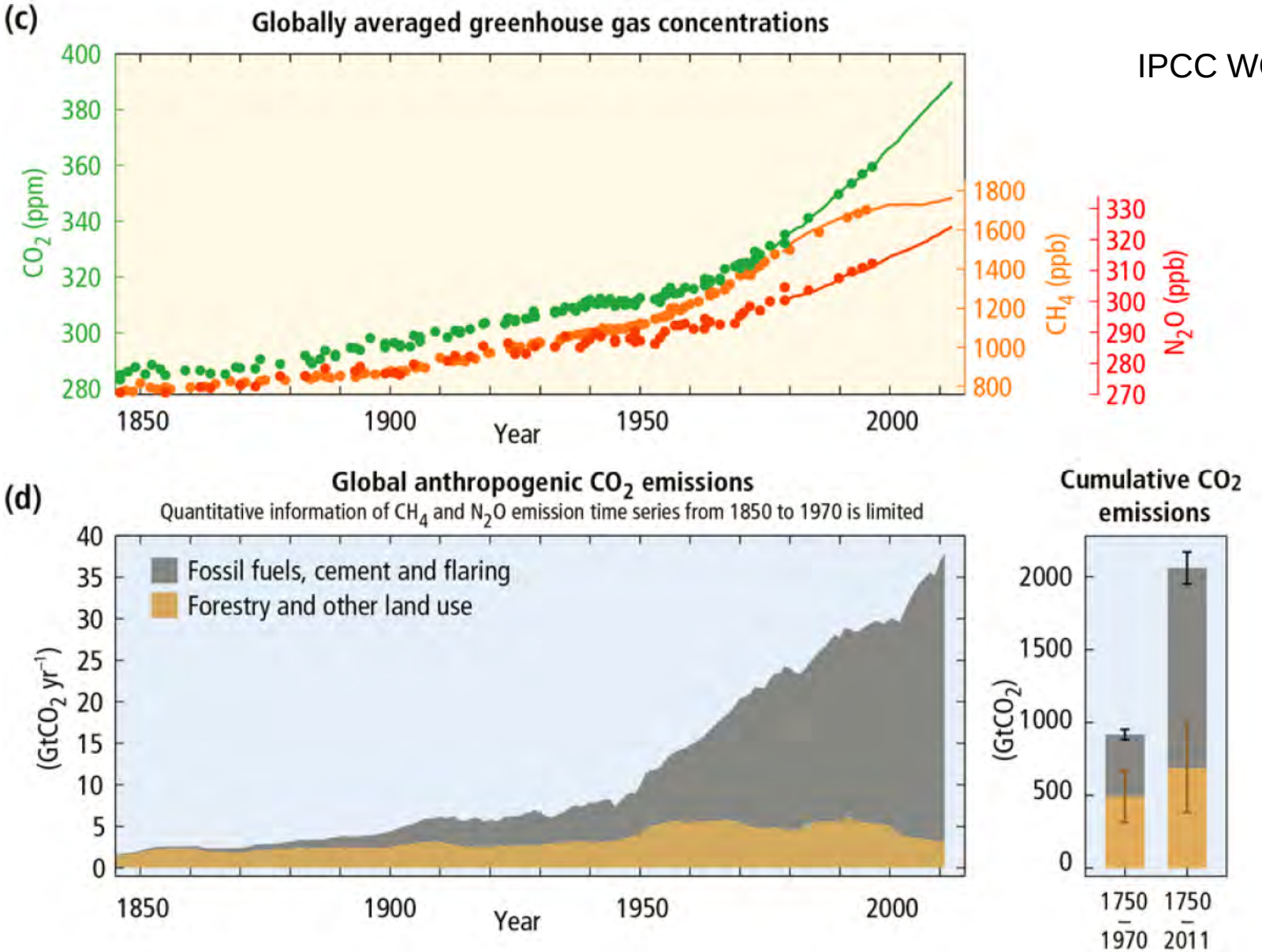

Sources of emissions

Energy production remains the primary driver of GHG emissions

2010 GHG emissions

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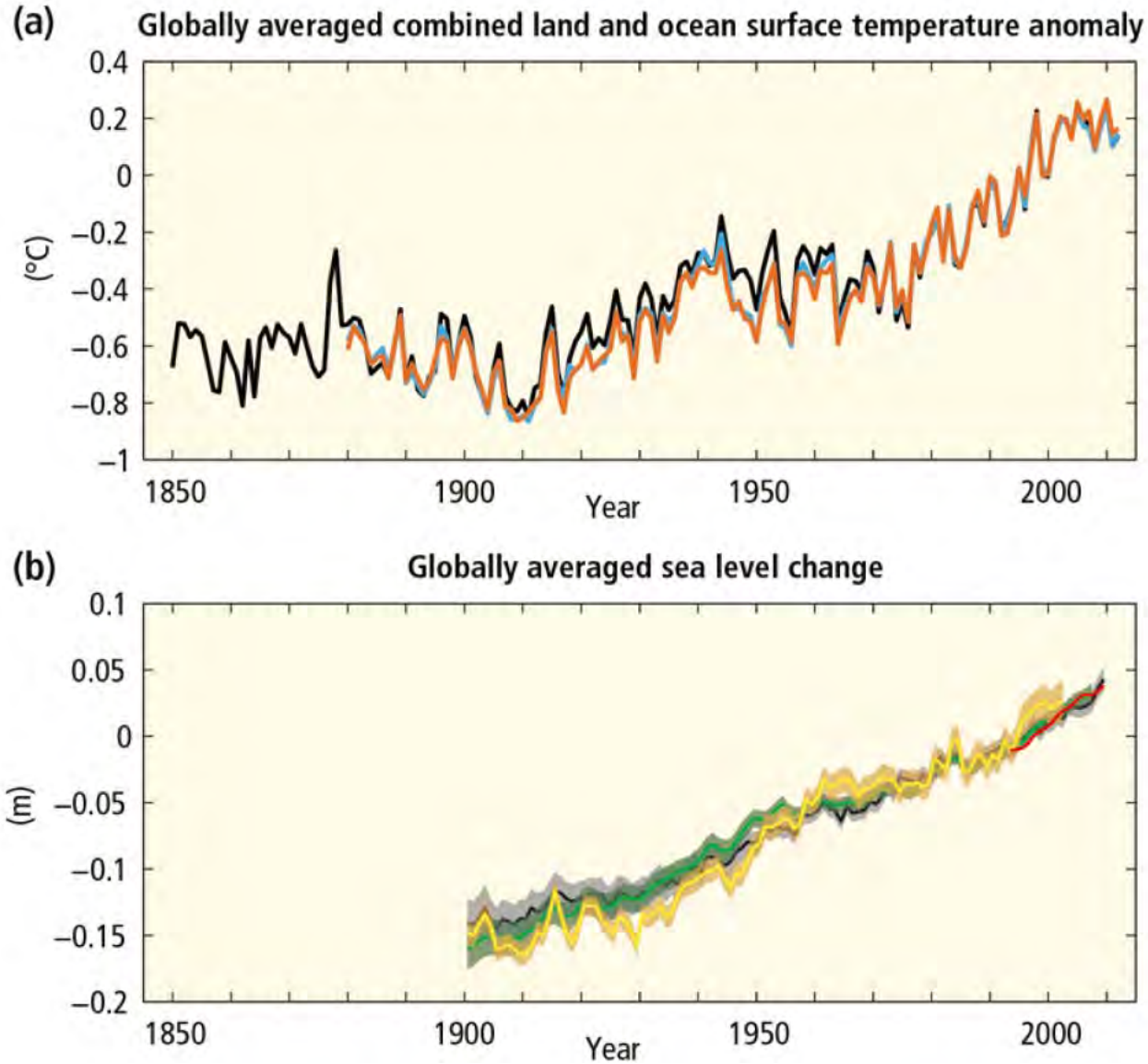
Global Mean Temperature, Sea Level Rising



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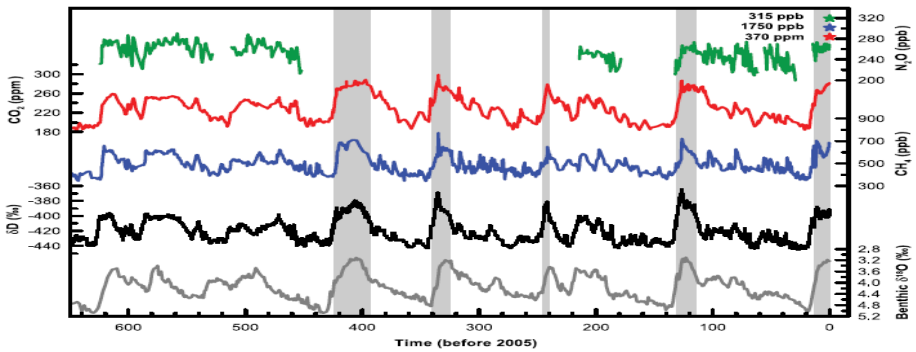
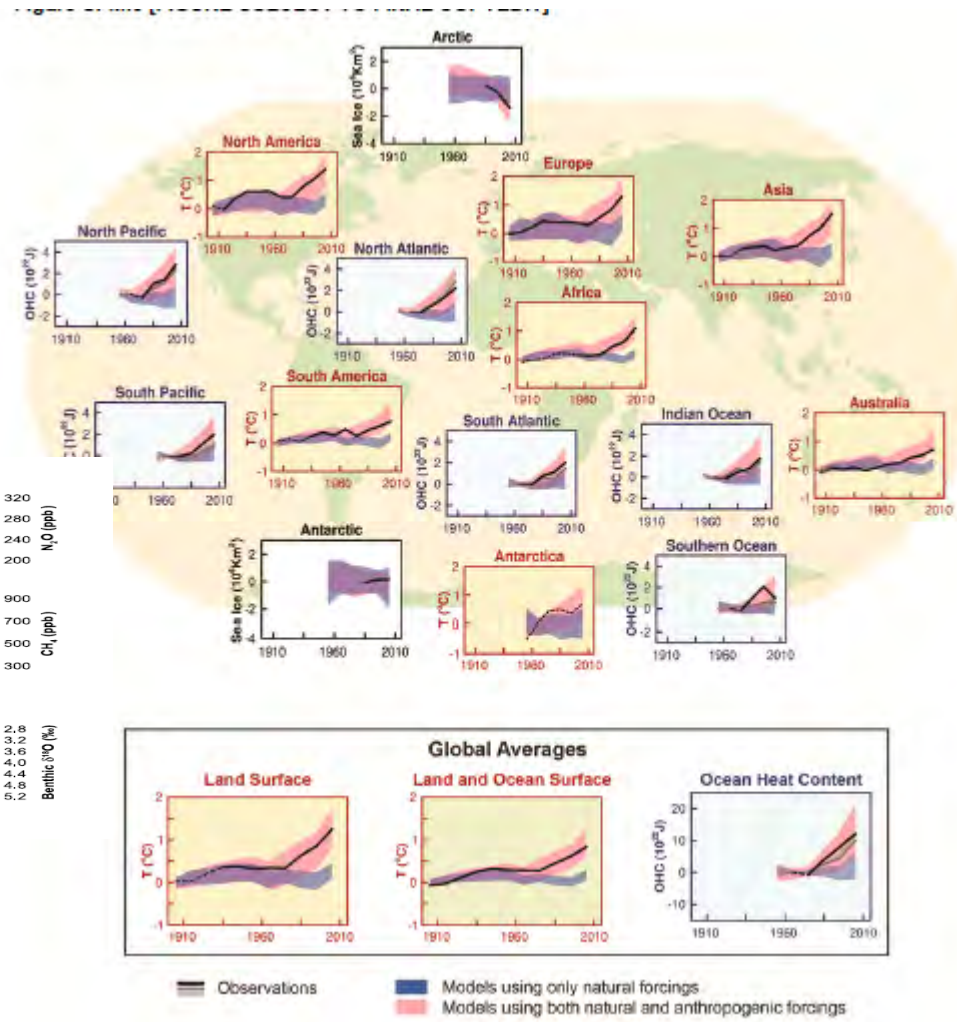
How do we know this warming is human-made?



Nature 453, 291(2008)



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Many Impacts Now Attributable to Climate Change

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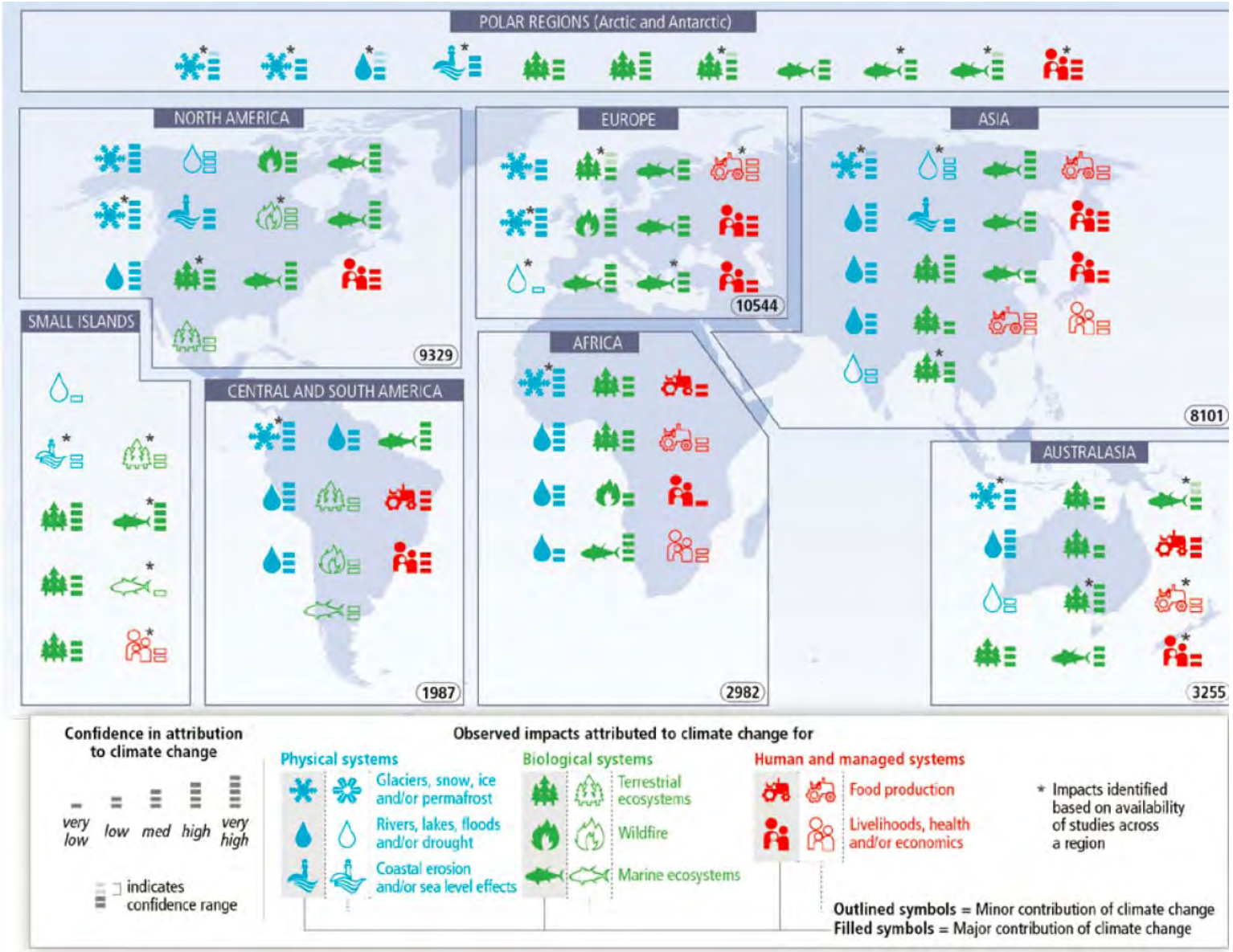
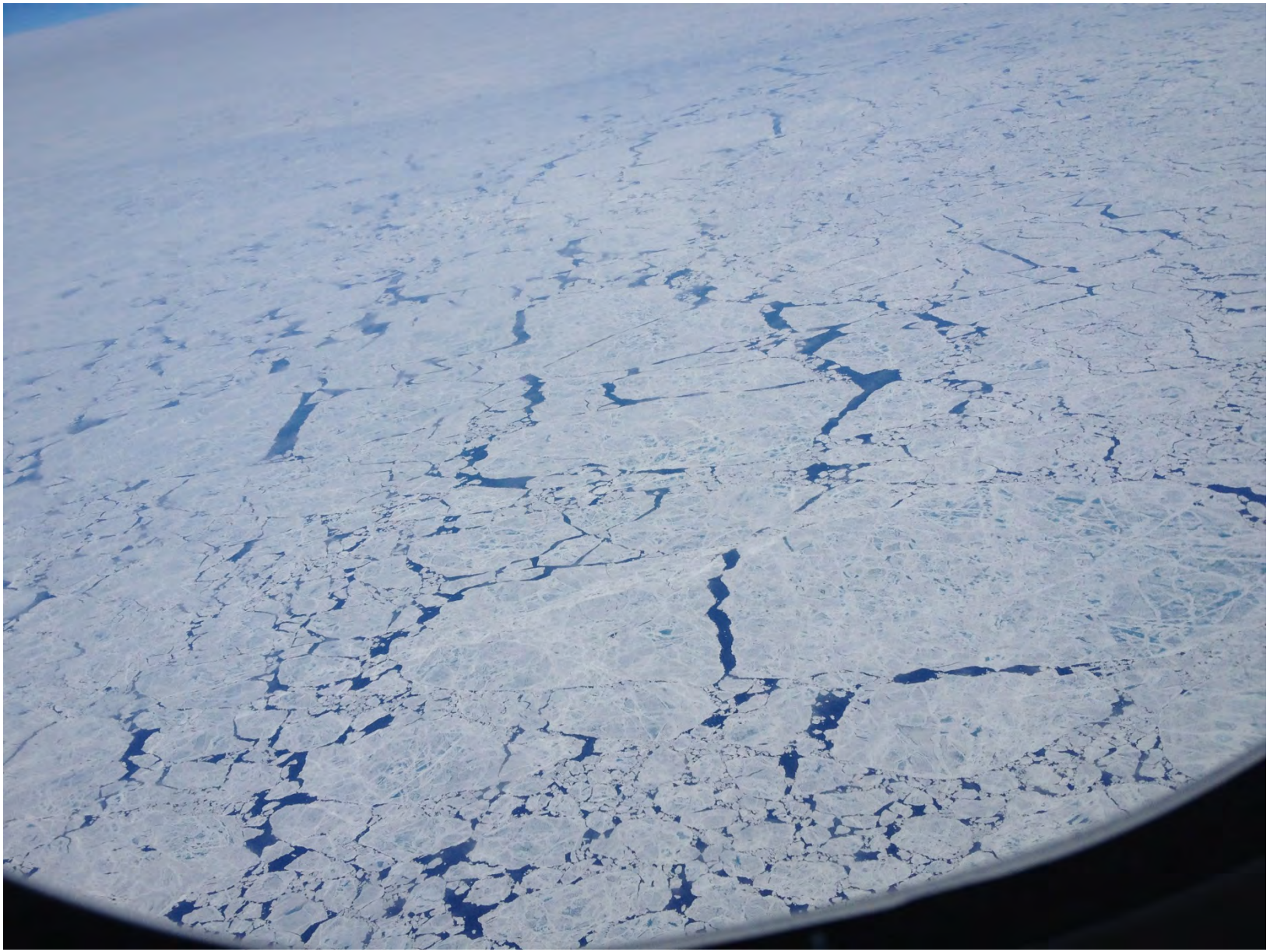
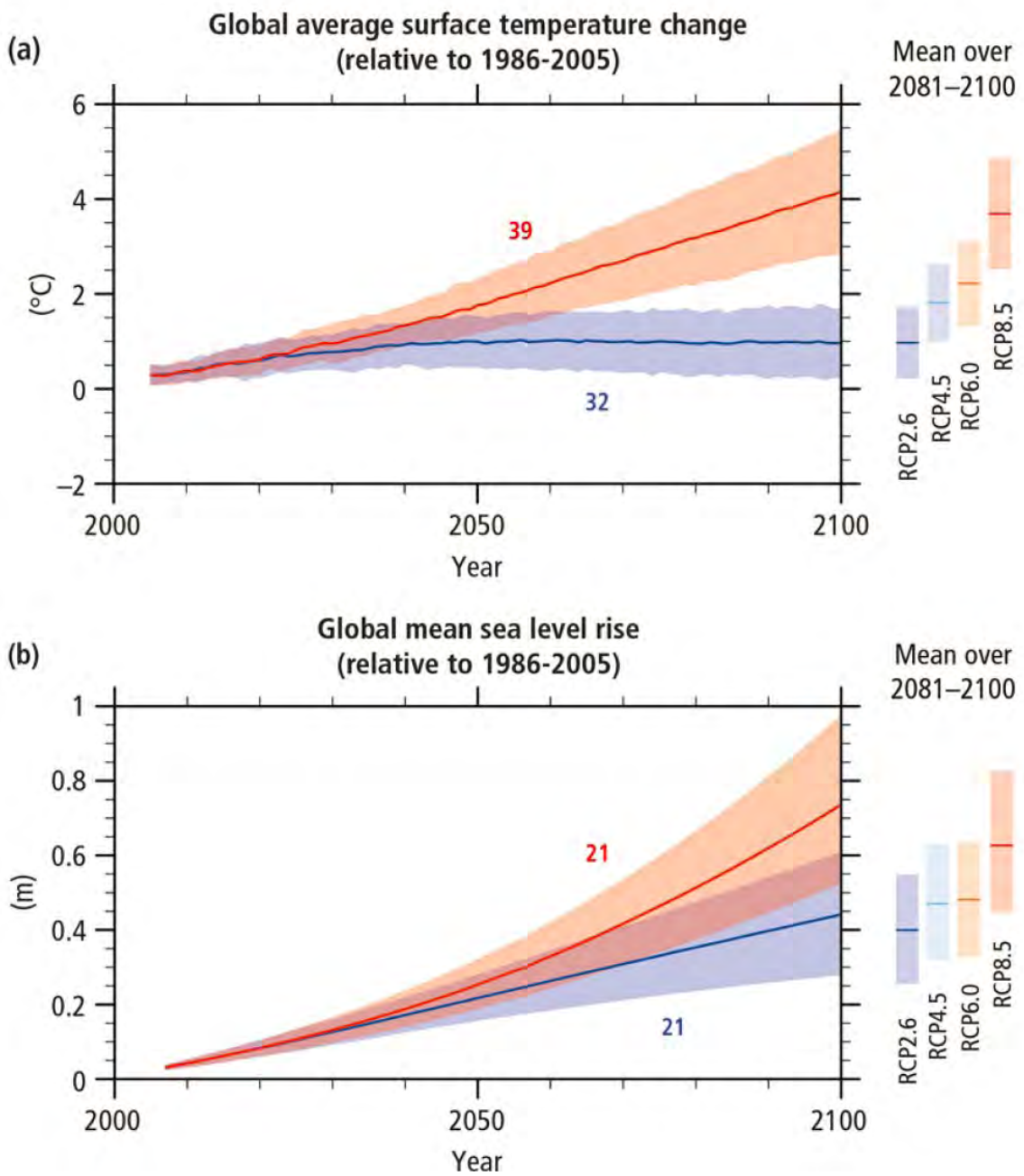


July 3 2014 - Central Arctic

Credit: MO





Projected Warming and Sea Level Rise

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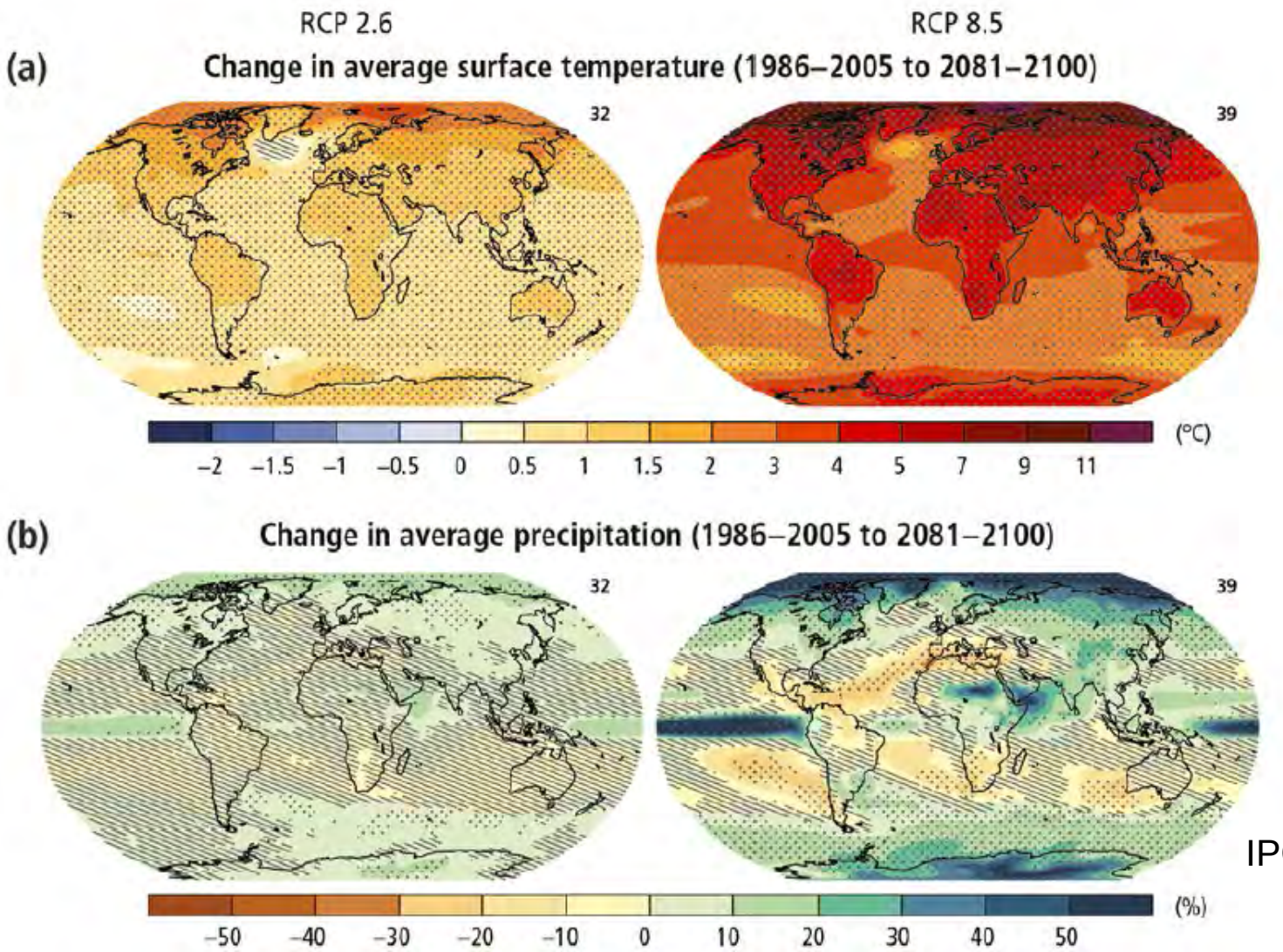
Geographic Picture of Warming

Low **High**



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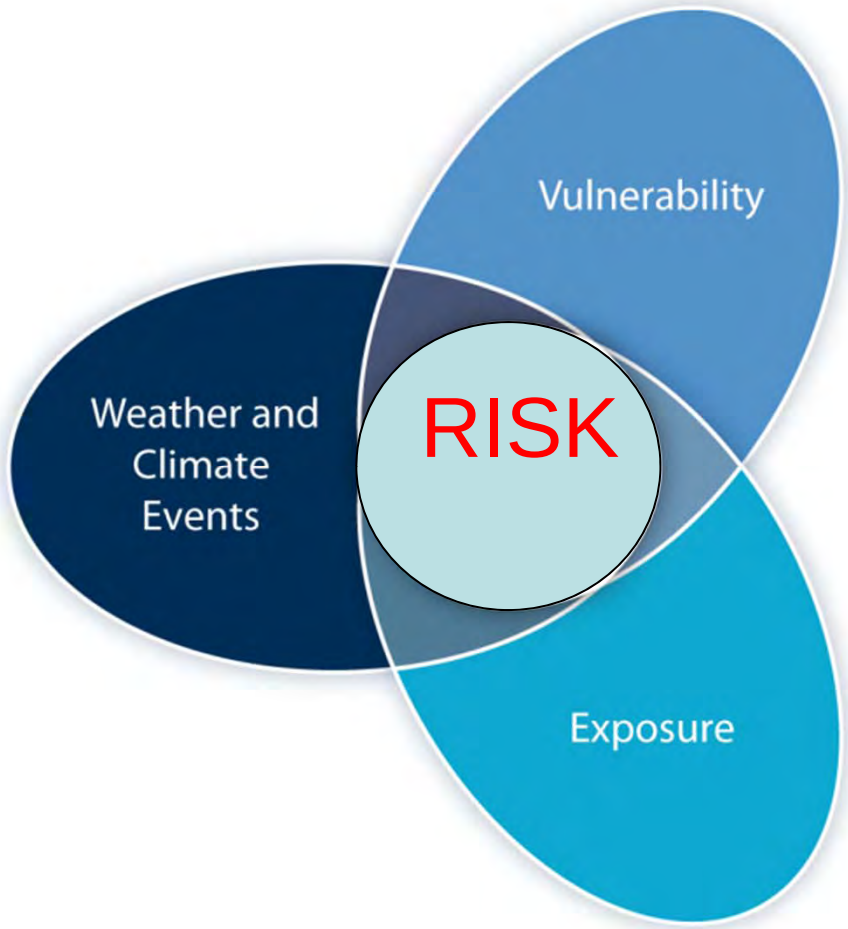
When Considering Dangerous Impacts:

Adaptation (reducing vulnerability and exposure) is Critical but Usually Suboptimal



Vulnerability:

The predisposition of a person or group to be adversely affected

Exposure:

Being in the wrong place at the wrong time

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A Key Risk: Heat Index

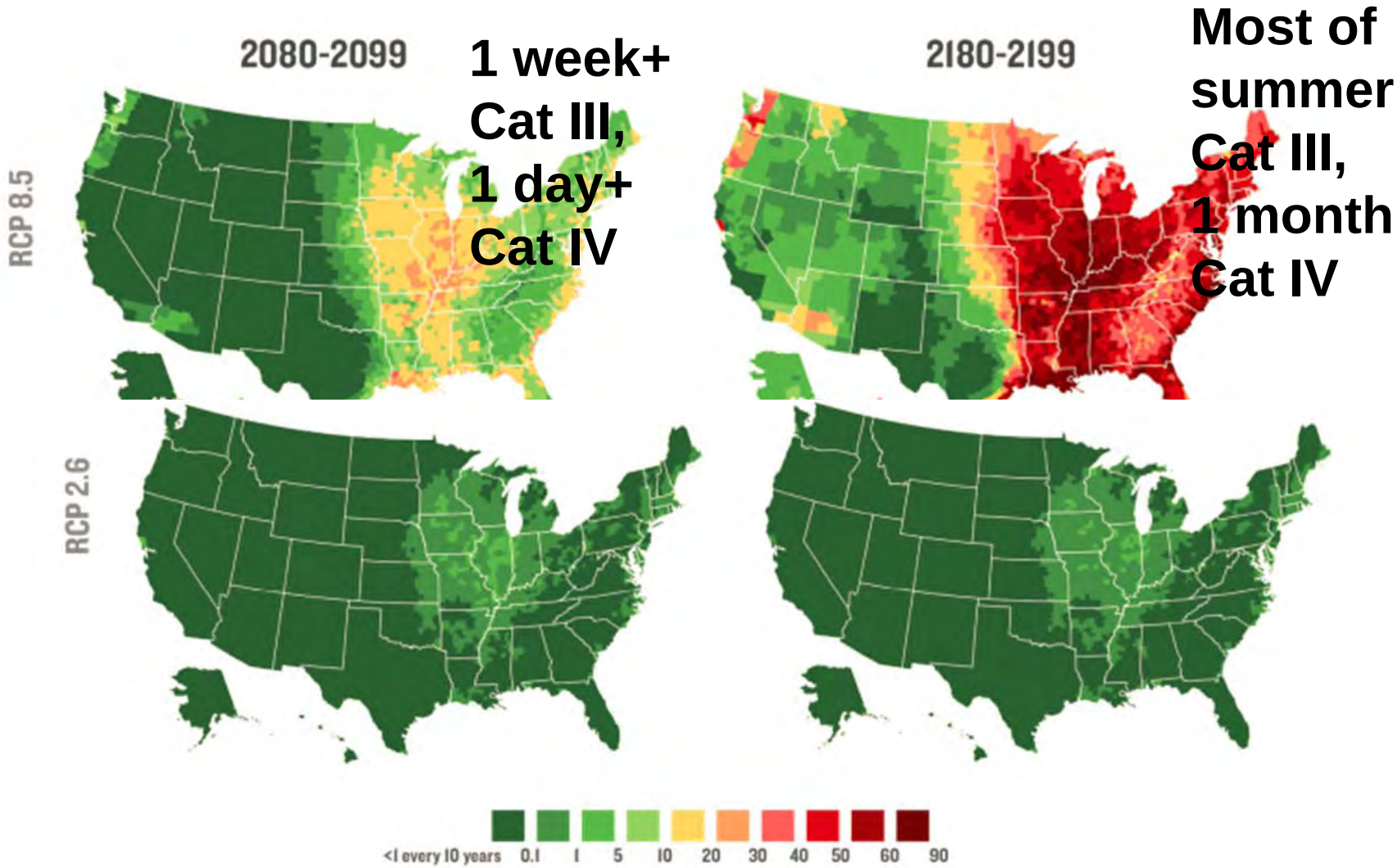
(From "Risky Business")

Table 4.1 The ACP Humid Heat Stroke Index

ACP Humid Heat Stroke Index	Peak Wet-Bulb Temperature	Characteristics of the hottest part of day
I	74°F to 80°F	Uncomfortable. Typical of much of summer in the Southeast.
II	80°F to 86°F	Dangerous. Typical of the most humid parts of Texas and Louisiana in hottest summer month, and the most humid summer days in Washington and Chicago.
III	86°F to 92°F	Extremely dangerous. Comparable to Midwest during peak days of 1995 heat wave.
IV	>92°F	Extraordinarily dangerous. Exceeds all US historical records. Heat stroke likely for fit individuals undertaking less than one hour of moderate activity in the shade.

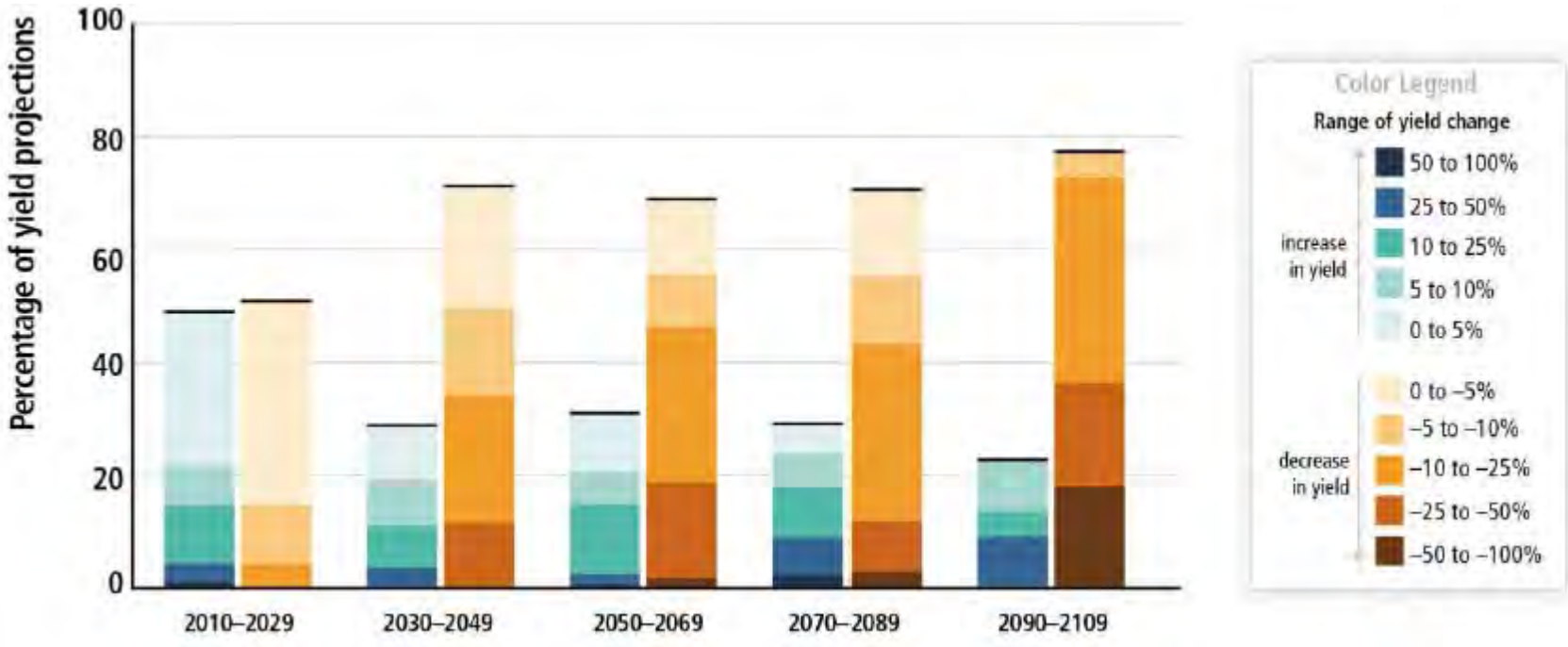
US Extreme Heat Risk

(from "Risky Business")



Category III+ Wet-bulb Temperature

Crop Yield Declines Outpace Increases



All emission scenarios and adaptation levels relative to late 20th C

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Coastal Flooding:

In warmer world, East Coast US, current hundred-year storm recurs ~annually

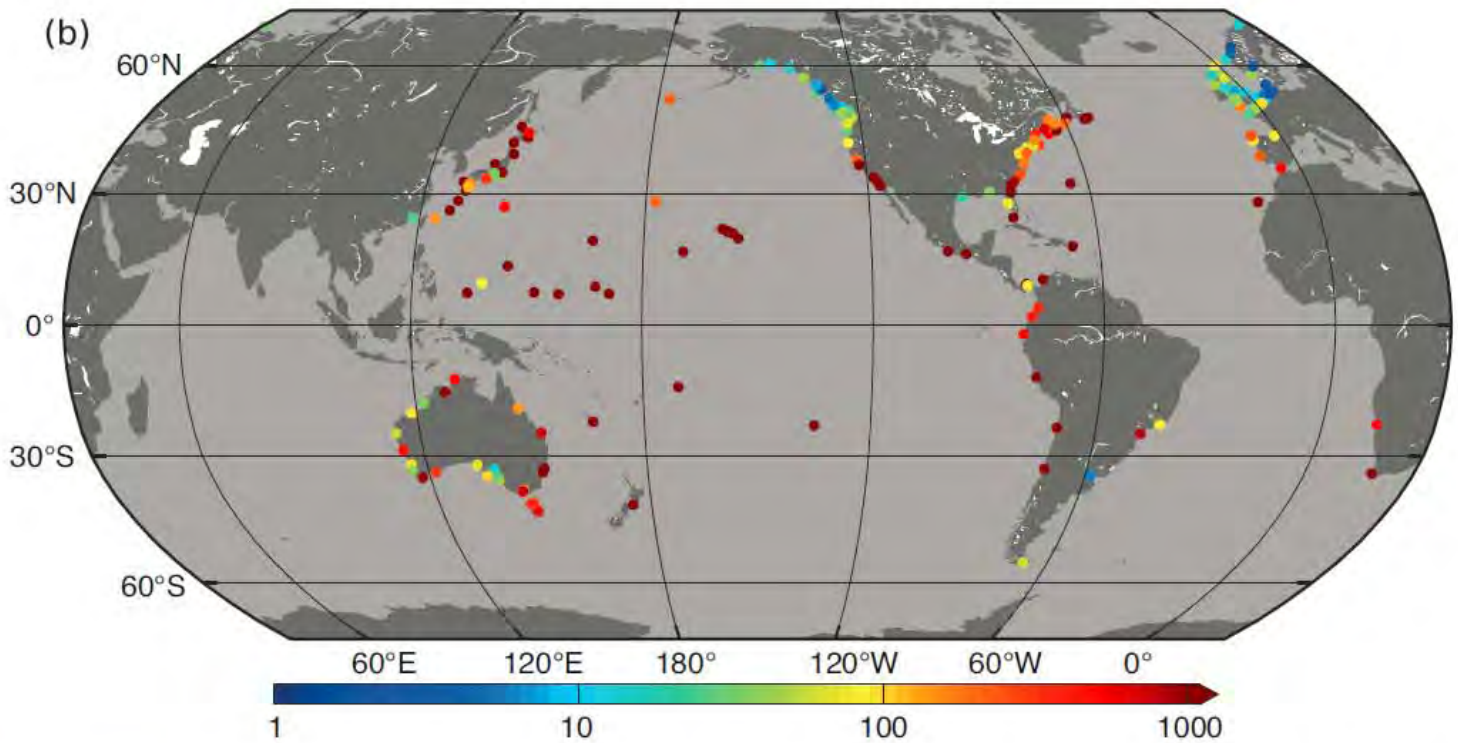

Figure 13.25 | The estimated multiplication factor (shown at tide gauge locations by colored dots), by which the frequency of flooding events of a given height increase for (a) a mean sea level (MSL) rise of 0.5 m (b) using regional projections of MSL for the RCP4.5 scenario, shown in Figure13.19a.

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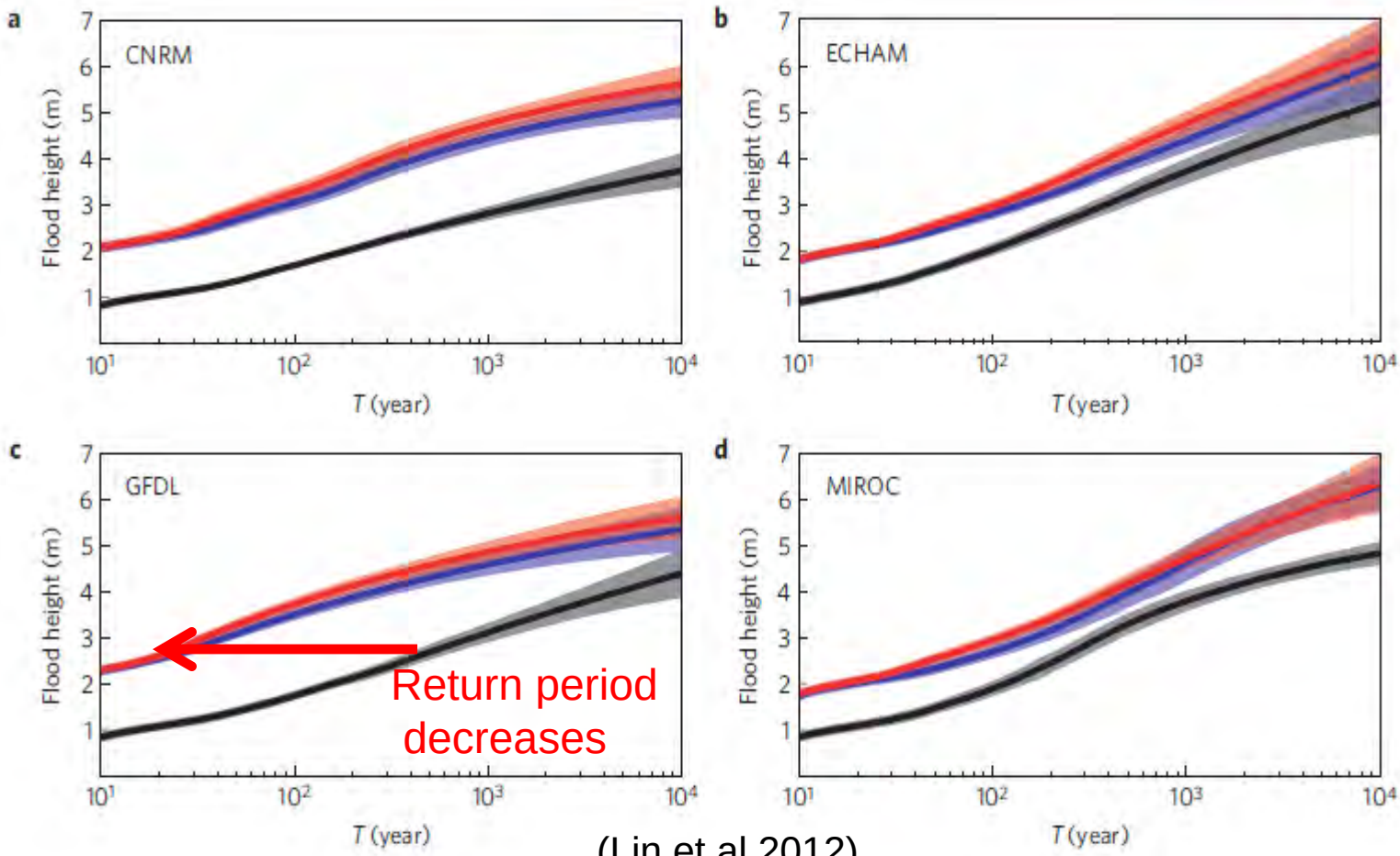
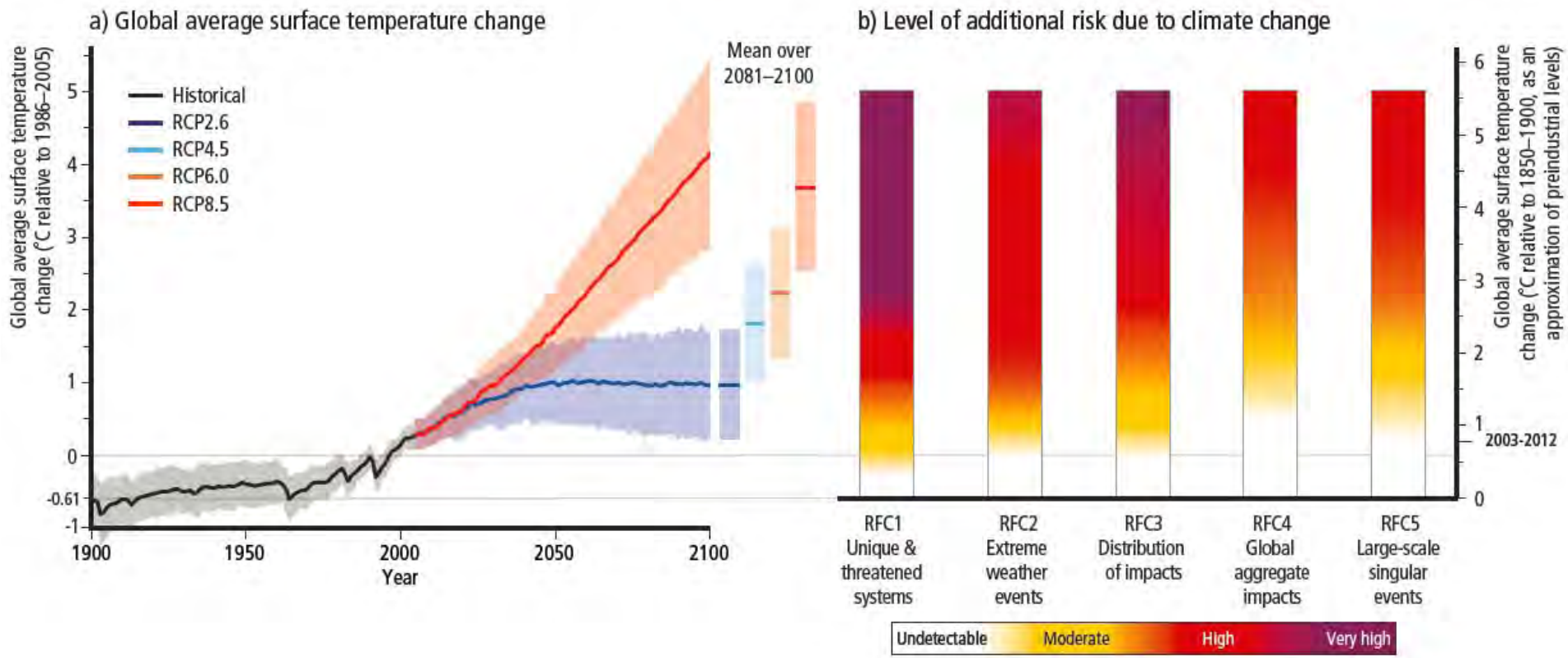
Example: Hurricane Sandy

Sandy-like flood (11 ft.) returns more often due to higher sea level (here 3ft) and stronger hurricanes



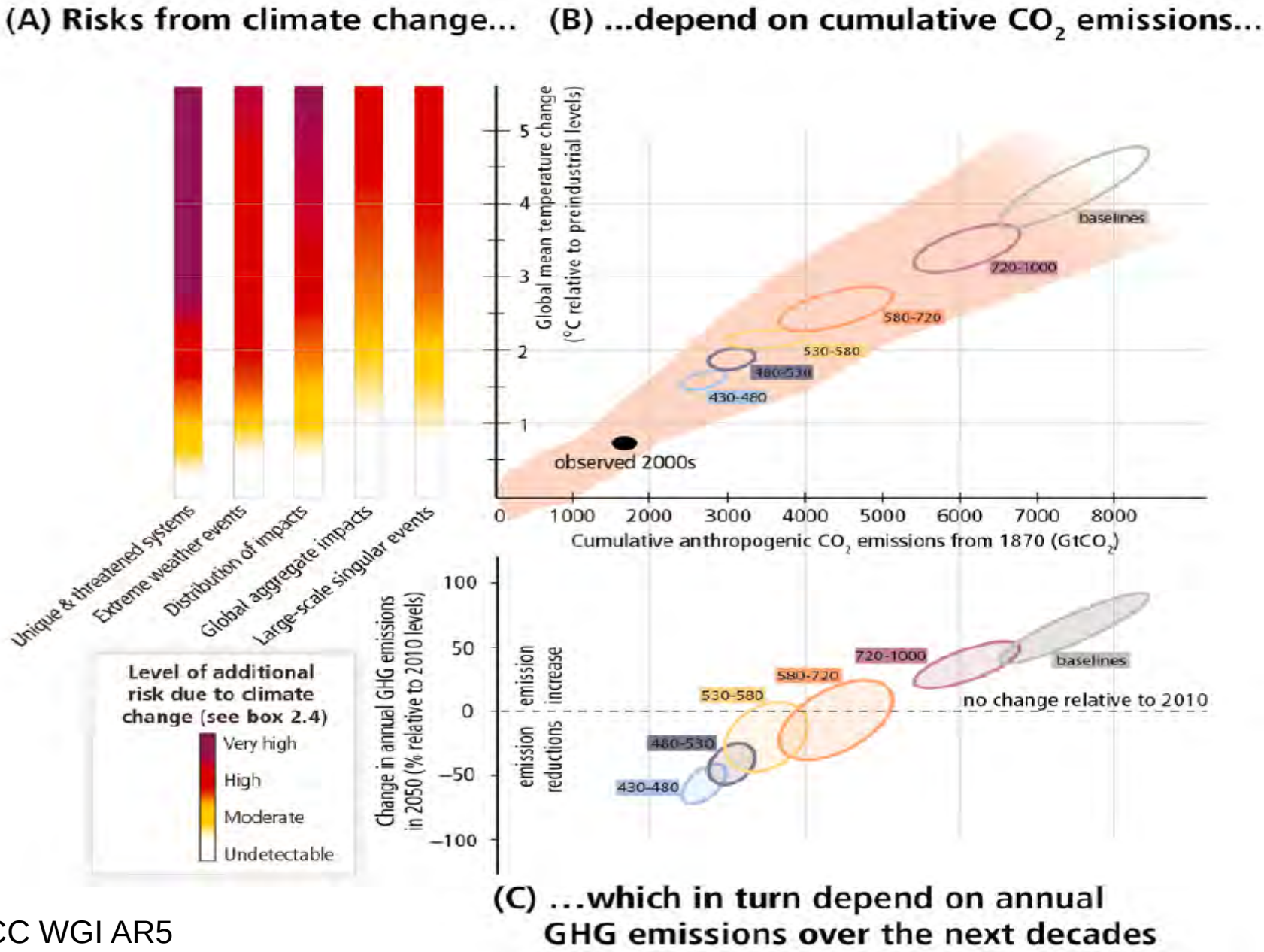
(Lin et al 2012)

Bundling the risks, rationale for 2^{0}C (or lower) danger point is clear



IPCC WGI AR5, Stocker

Implied Emissions Reductions



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Limiting Temperature Increase to 2°C

Global GHG emissions reduction of 40-70 % in 2050 compared to 2010 (to have a 2/3 chance)!

Net zero or negative GHG emissions in 2100

Global emissions to curb within next 5-15 years

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Risk in NOT Acting Aggressively

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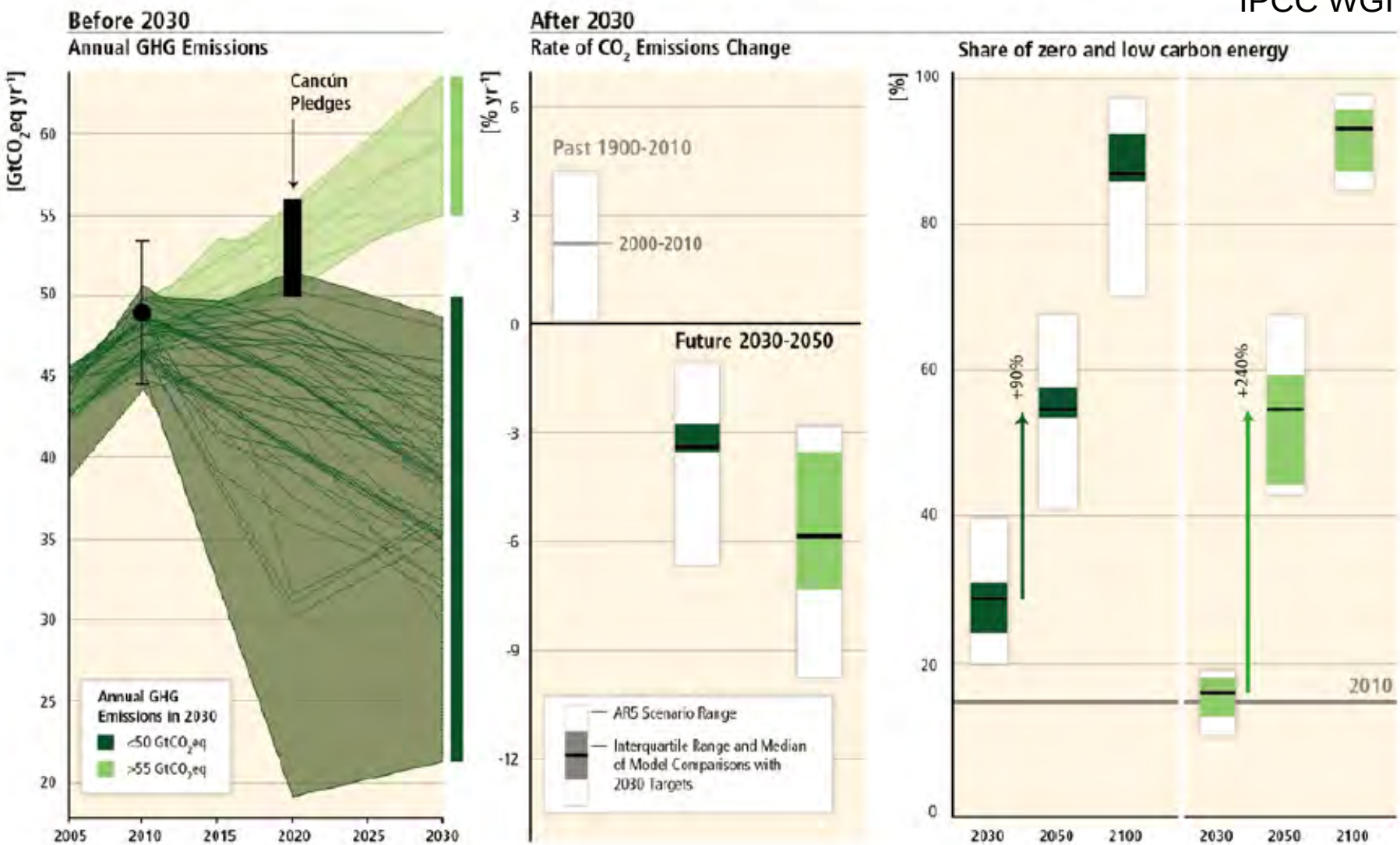
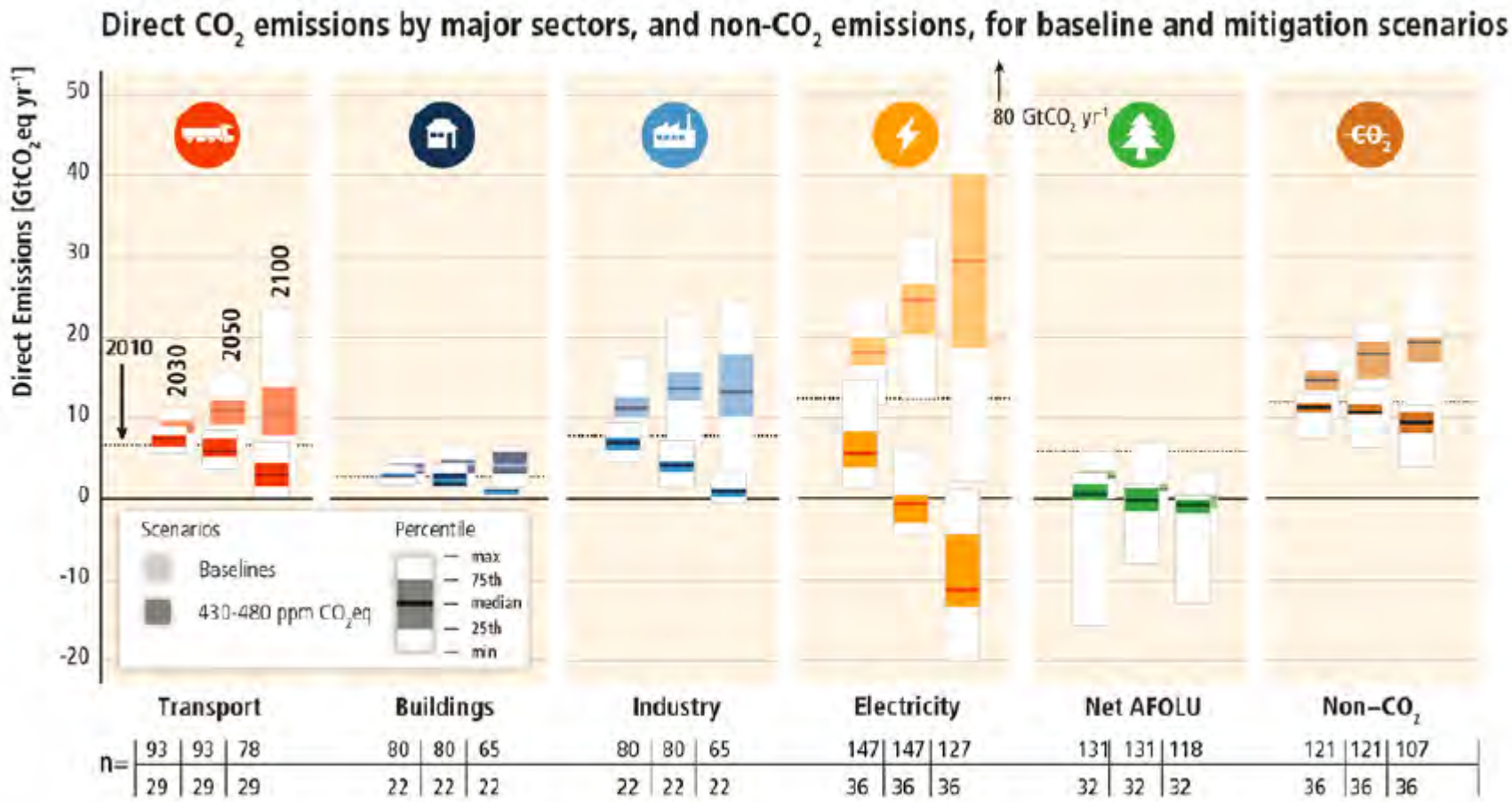


Where Reductions Fall, by Sector



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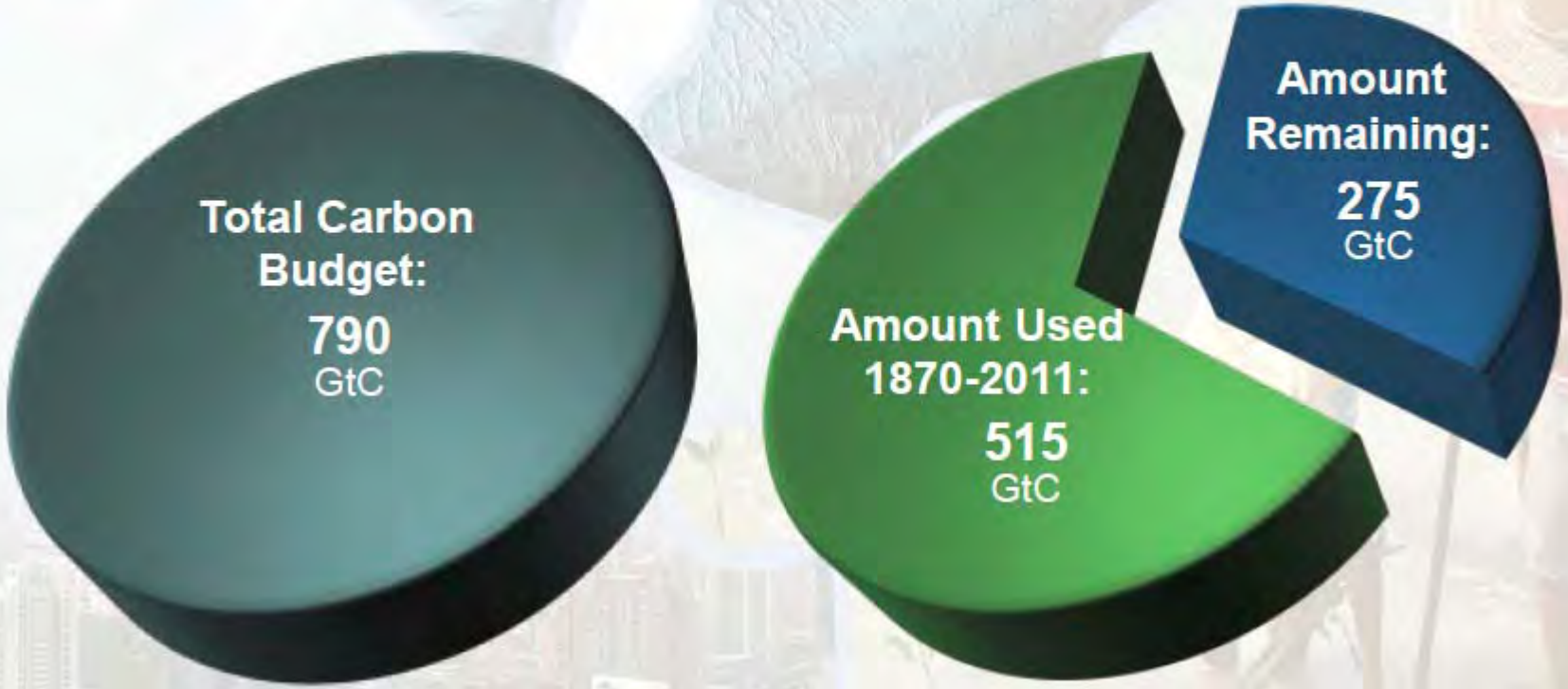
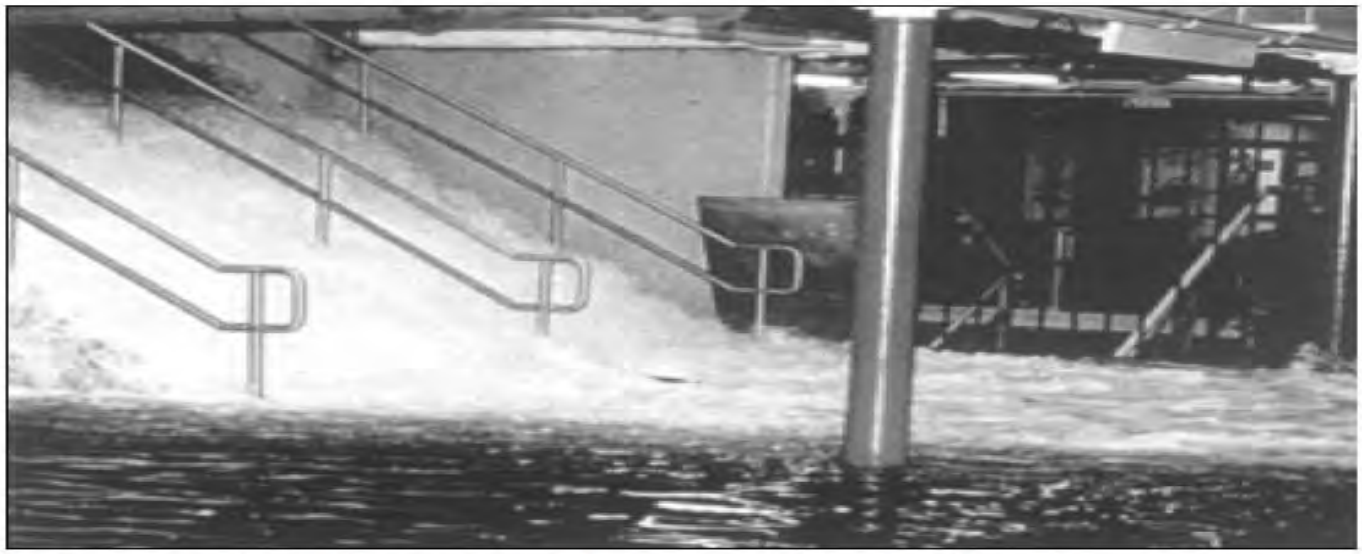
The window for action is rapidly closing

65% of our carbon budget compatible with a 2° C goal already used



AR5 WGI SPM

A Reminder That We Forget



Hoboken subway station 2012 - - - and 1992