FIVE THINGS

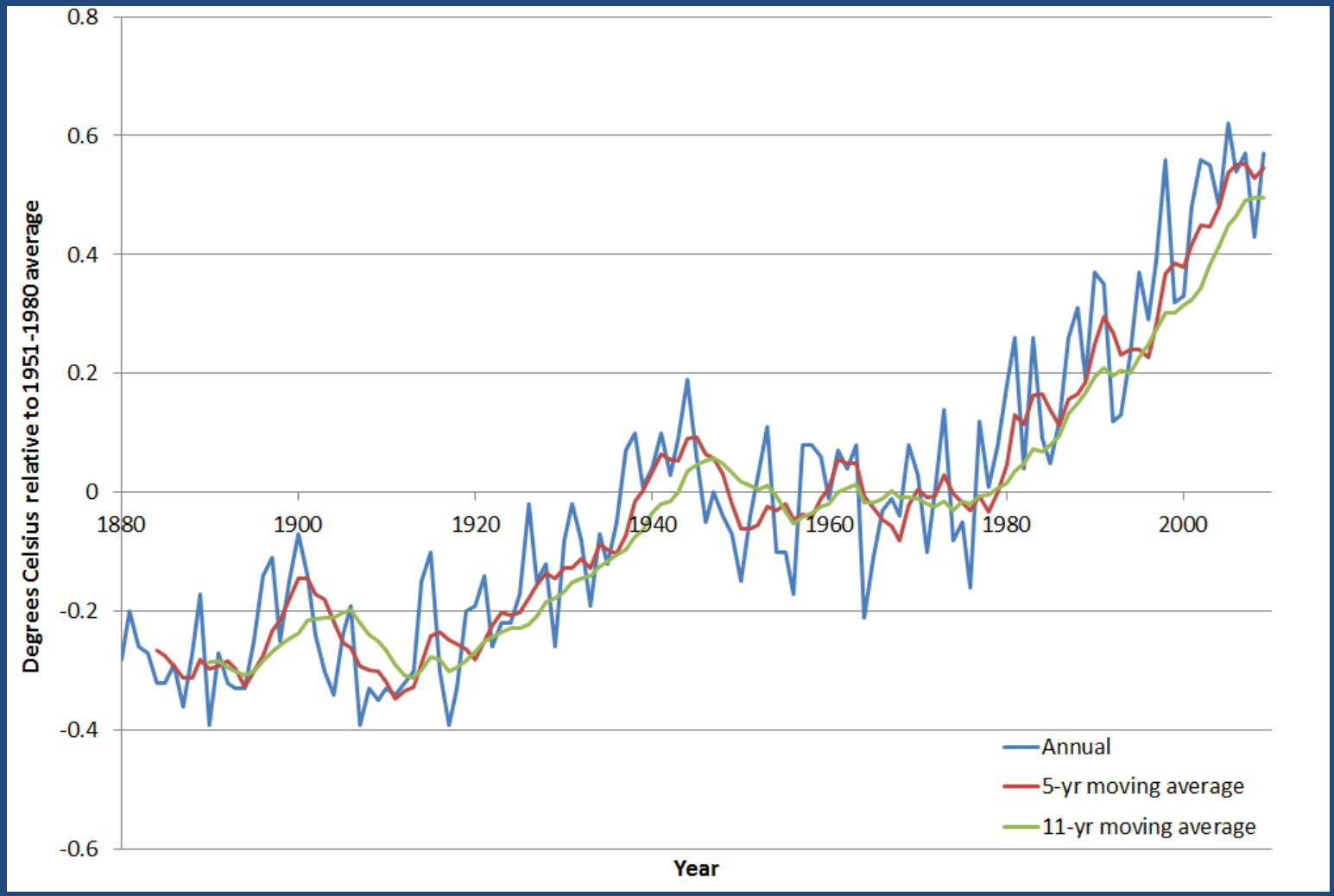
EVERYONE SHOULD KNOW

ABOUT GLOBAL WARMING

SO….
WHAT WERE THOSE FIVE THINGS AGAIN??

1. It's real

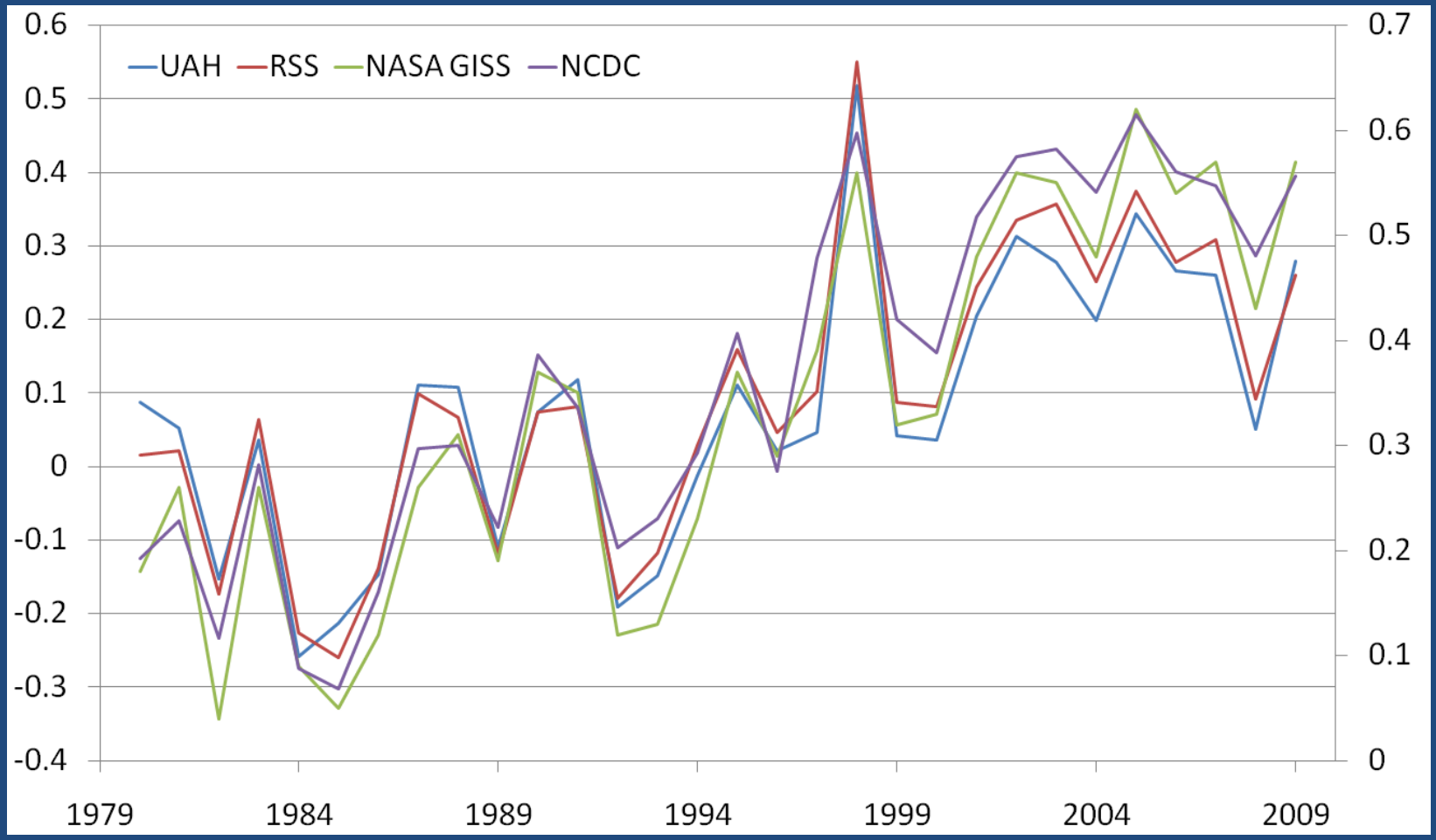
Temperature trend 1880-2009



Source: data from NASA GISS

1. It's real

Multiple data sets all show warming

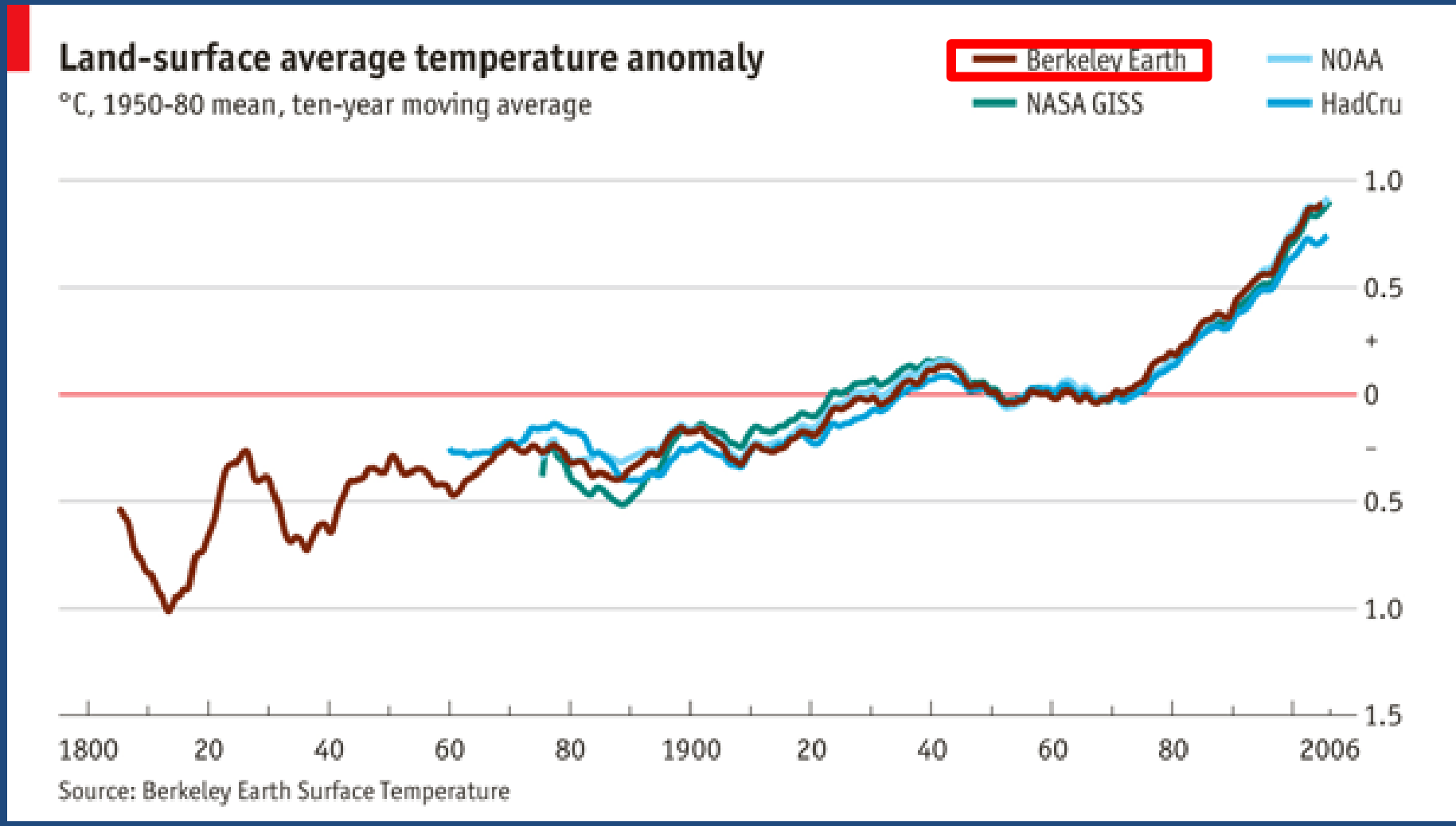


Source: data downloaded from websites of each research organization. Graph shows temperature change in Celsius for middle troposphere (satellite) and surface (surface stations), relative to different standards.

1. It’s real

Global average temperature change over the last 140 years.

Source: The heat is on, *The Economist*, 2011.



1. It’s real

McCall Glacier, Alaska, 1958.

Source: National Snow and Ice Data Center glacier rephotography collection.

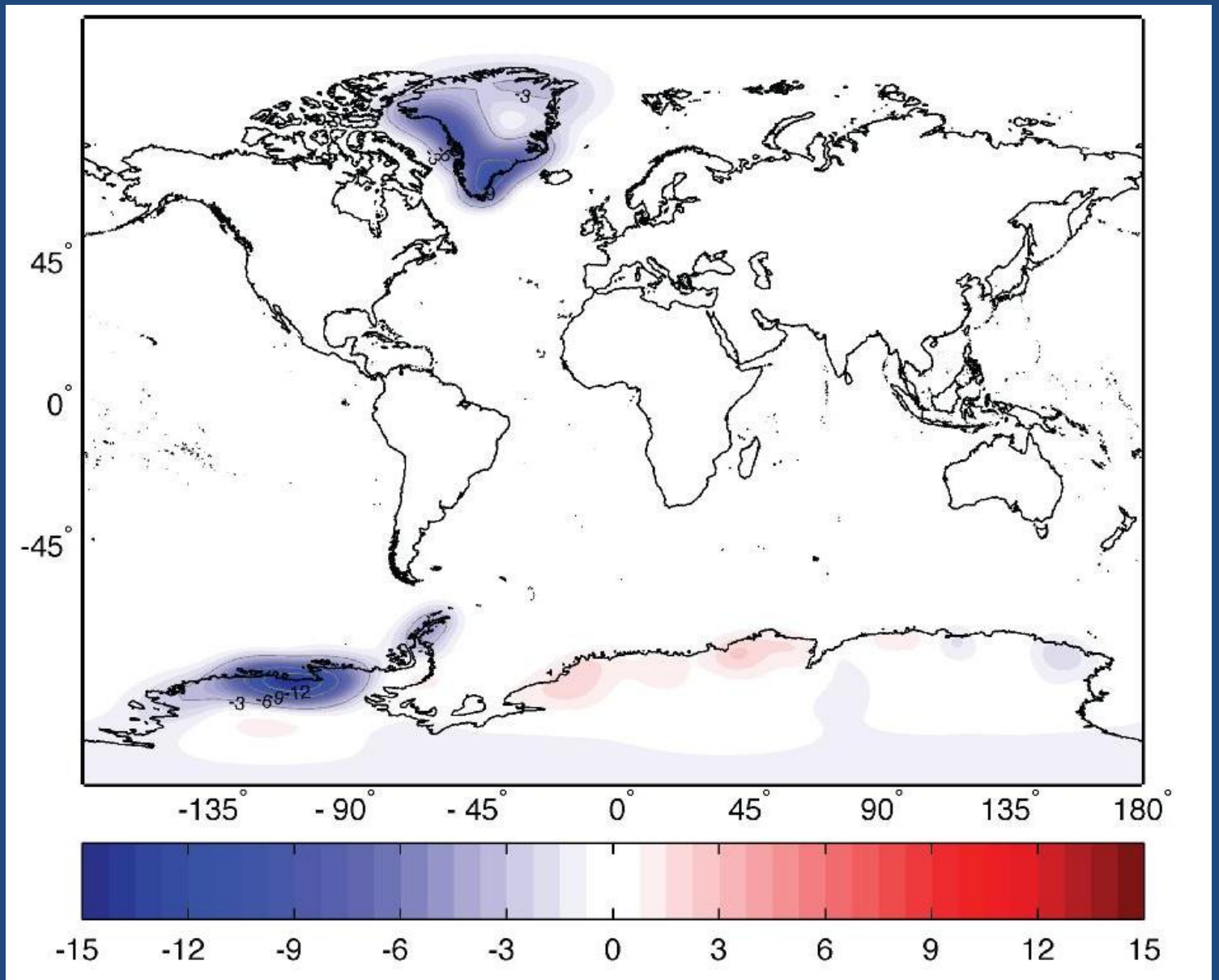
1. It’s real

McCall Glacier, Alaska, 2003.

Source: National Snow and Ice Data Center glacier rephotography collection.

1. It's real

Change in mass, 2003-2010, cm water. Source: NASA



2. It’s us

2. It's us

Carbon dioxide changes over time

Atmospheric CO_2 recorded in the Vostok ice core, Antarctica, and measured at Mauna Loa, HI.

Source: data from WDC Paleoclimatology and NOAA Mauna Loa CO_2 records.

2. It’s us

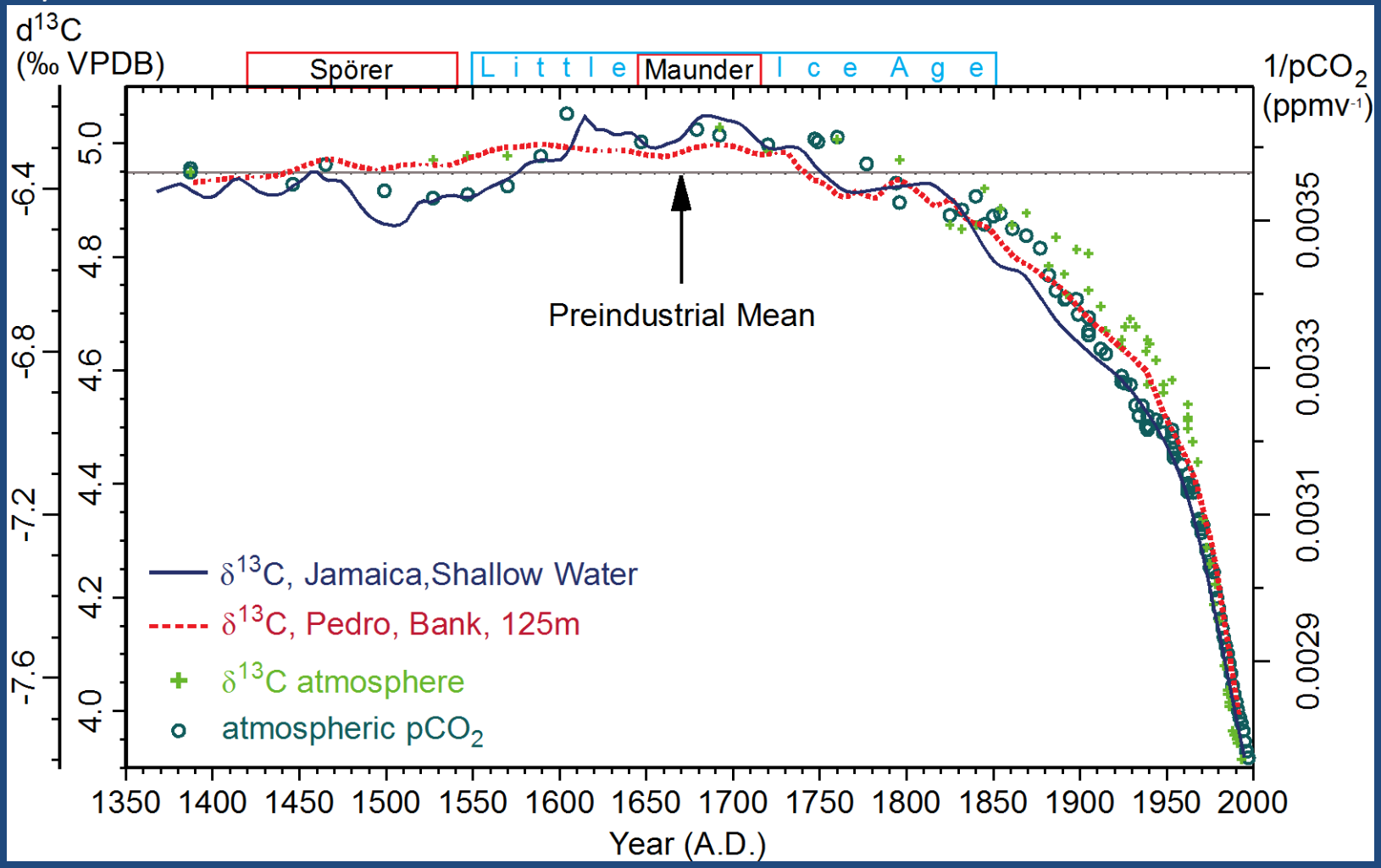
The isotopic composition of atmospheric carbon is changing

2. It's us

Isotopic composition of atmospheric carbon is changing

More ^{13}C/Less ^{12}C

Changes in carbon isotope ratios in Caribbean sponge skeletons



Less ^{13}C/More ^{12}C

Source: Böhm *et al*, 2002

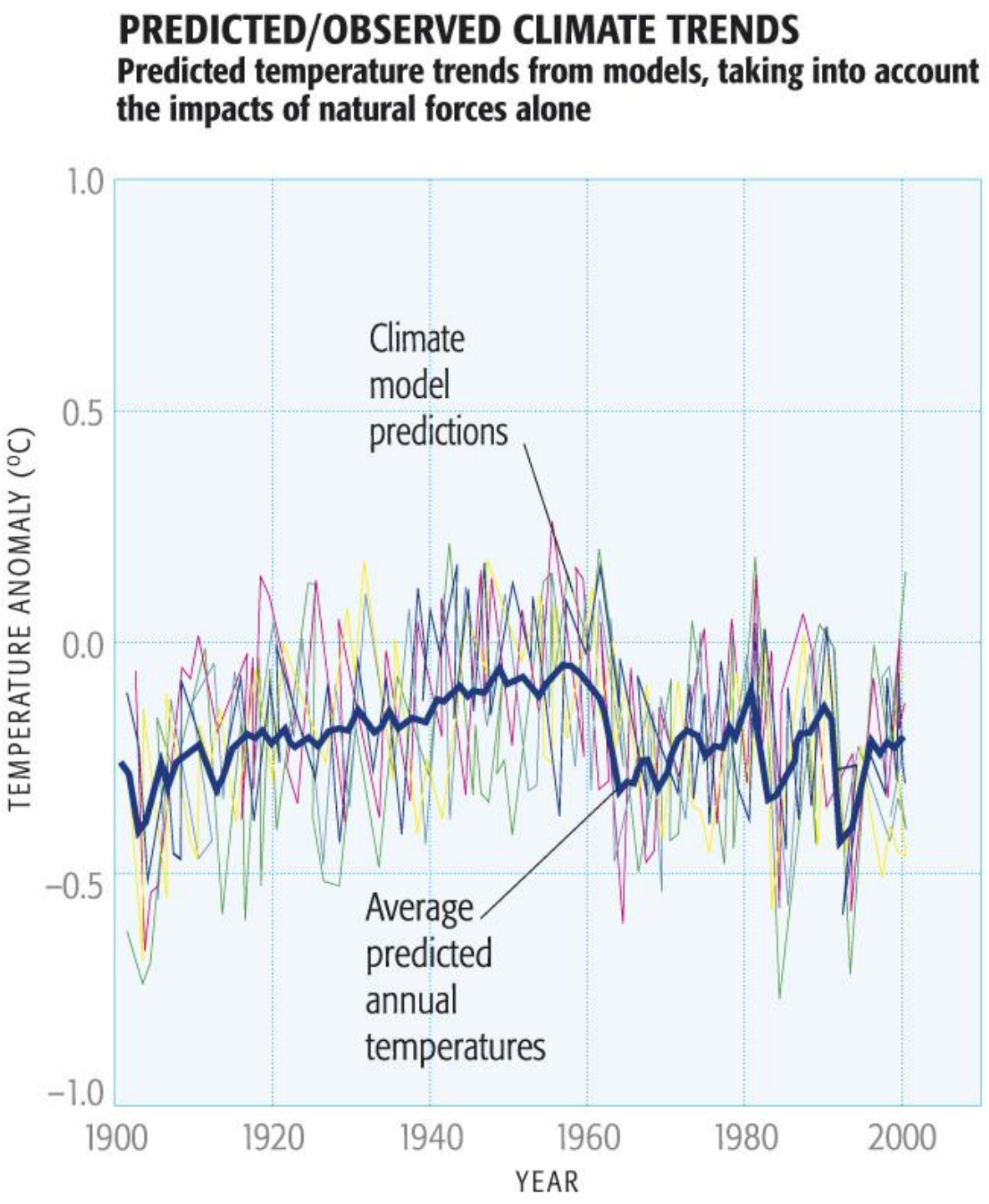
2. It’s us

Climate models cannot reproduce recent temperature changes without including human influences

2. It's us

Model predictions (natural forcings only).

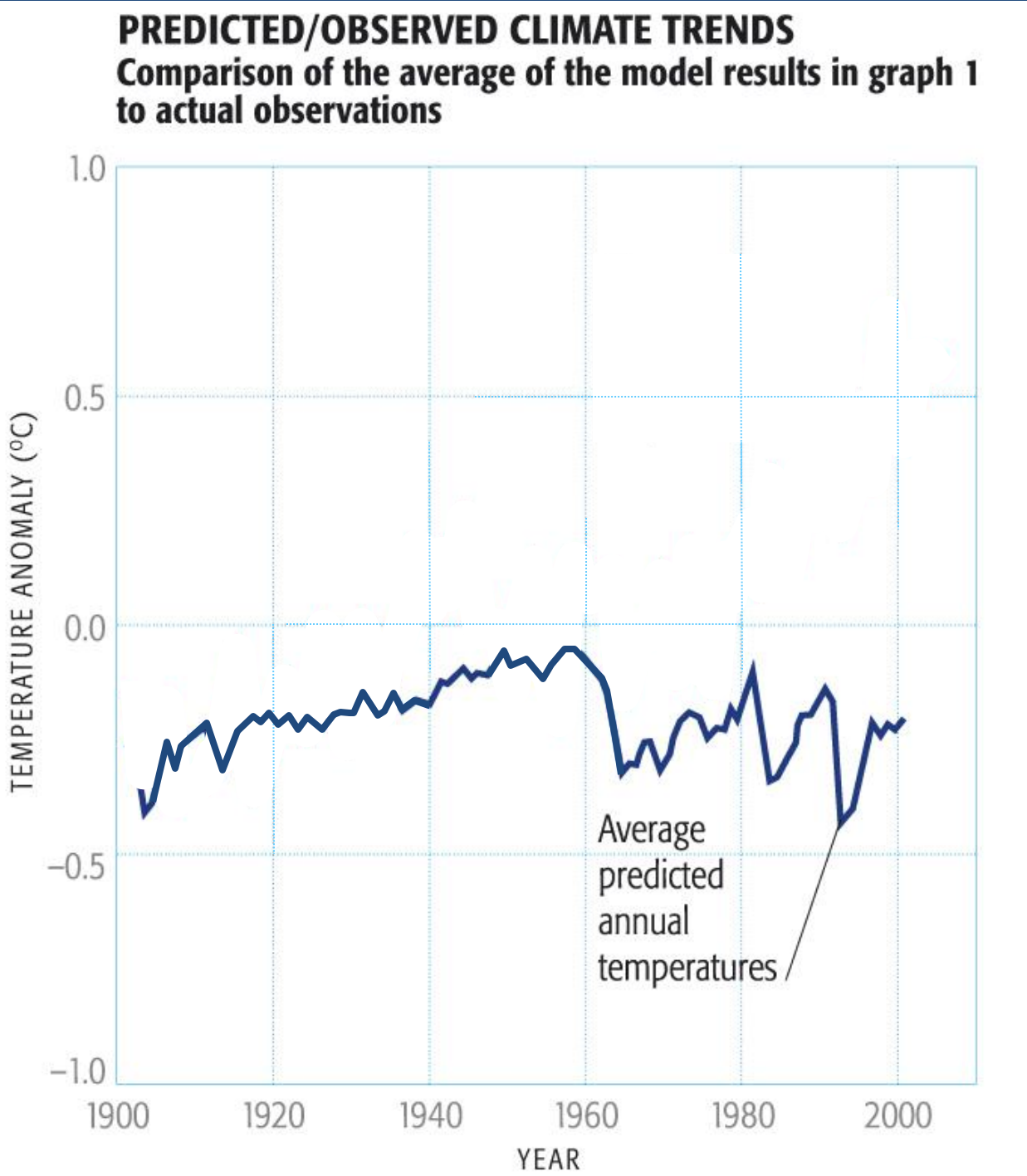
Source: Mann and Kump, 2009, p. 68.



2. It's us

Model predictions (natural forcings only), and observed temperatures.

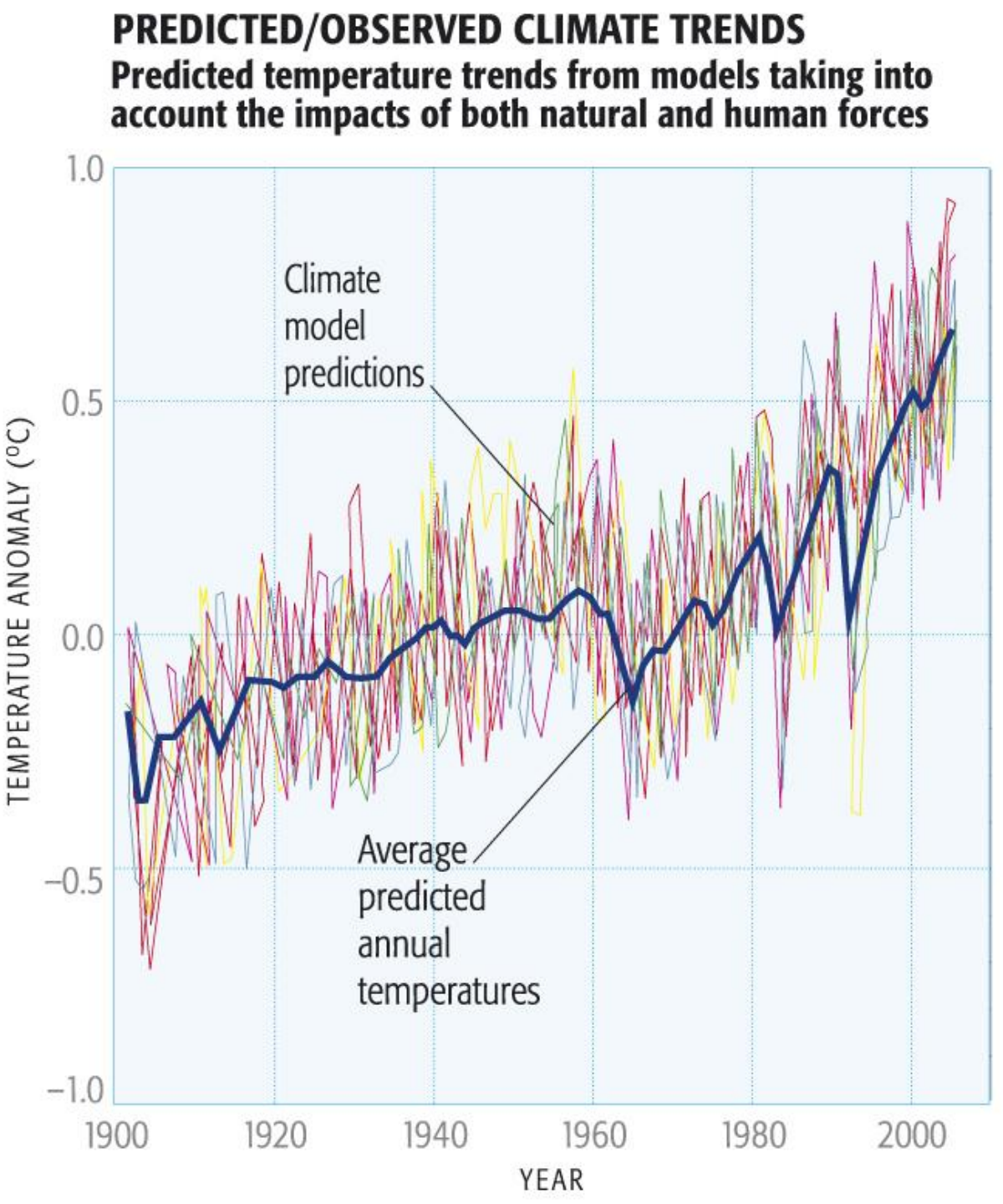
Source: Mann and Kump, 2009, p. 68.



2. It's us

Model predictions (natural and anthropogenic forcings).

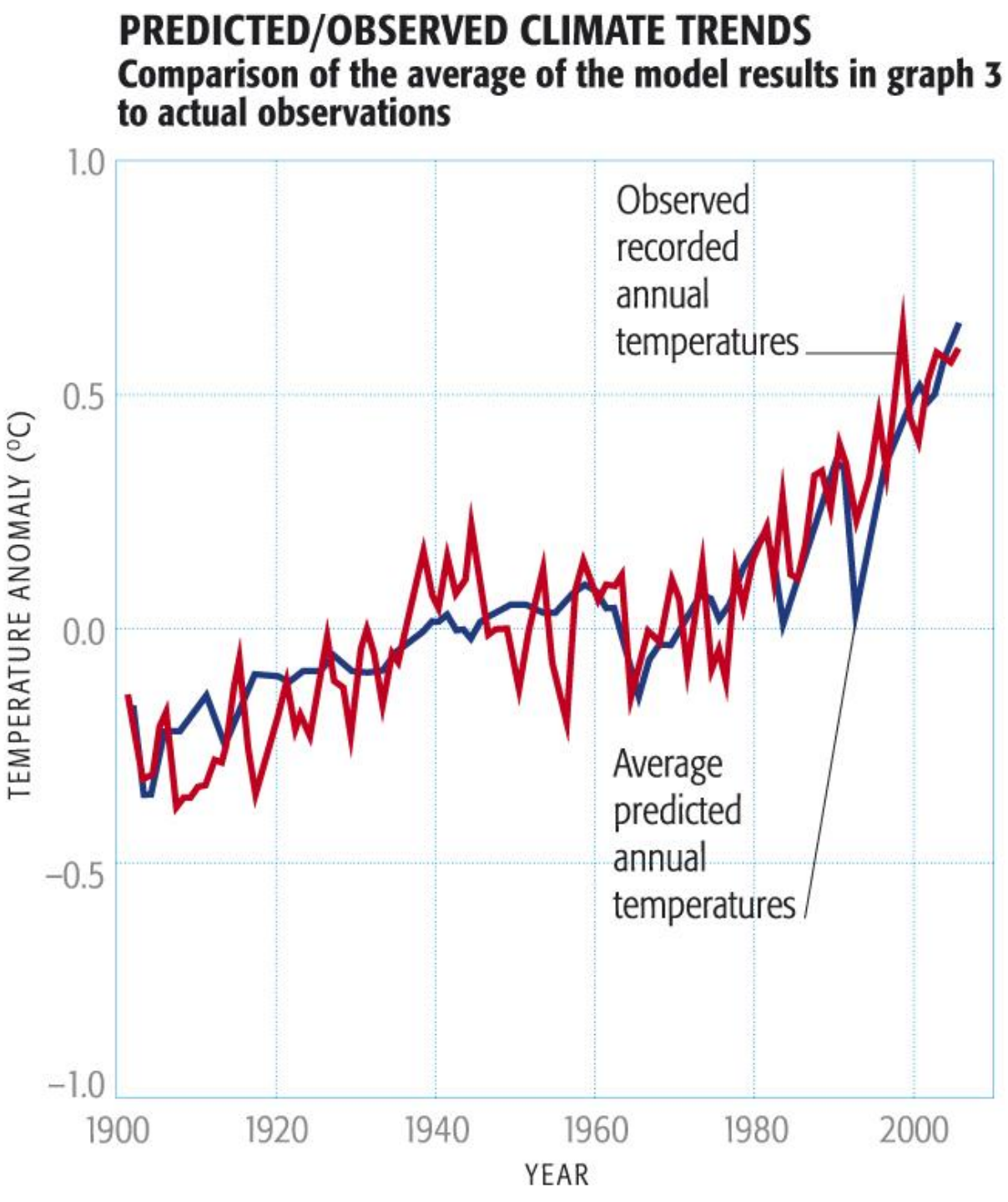
Source: Mann and Kump, 2009, p. 69.



2. It's us

Model predictions (natural and anthropogenic forcings), and observed temperatures.

Source: Mann and Kump, 2009, p. 69.



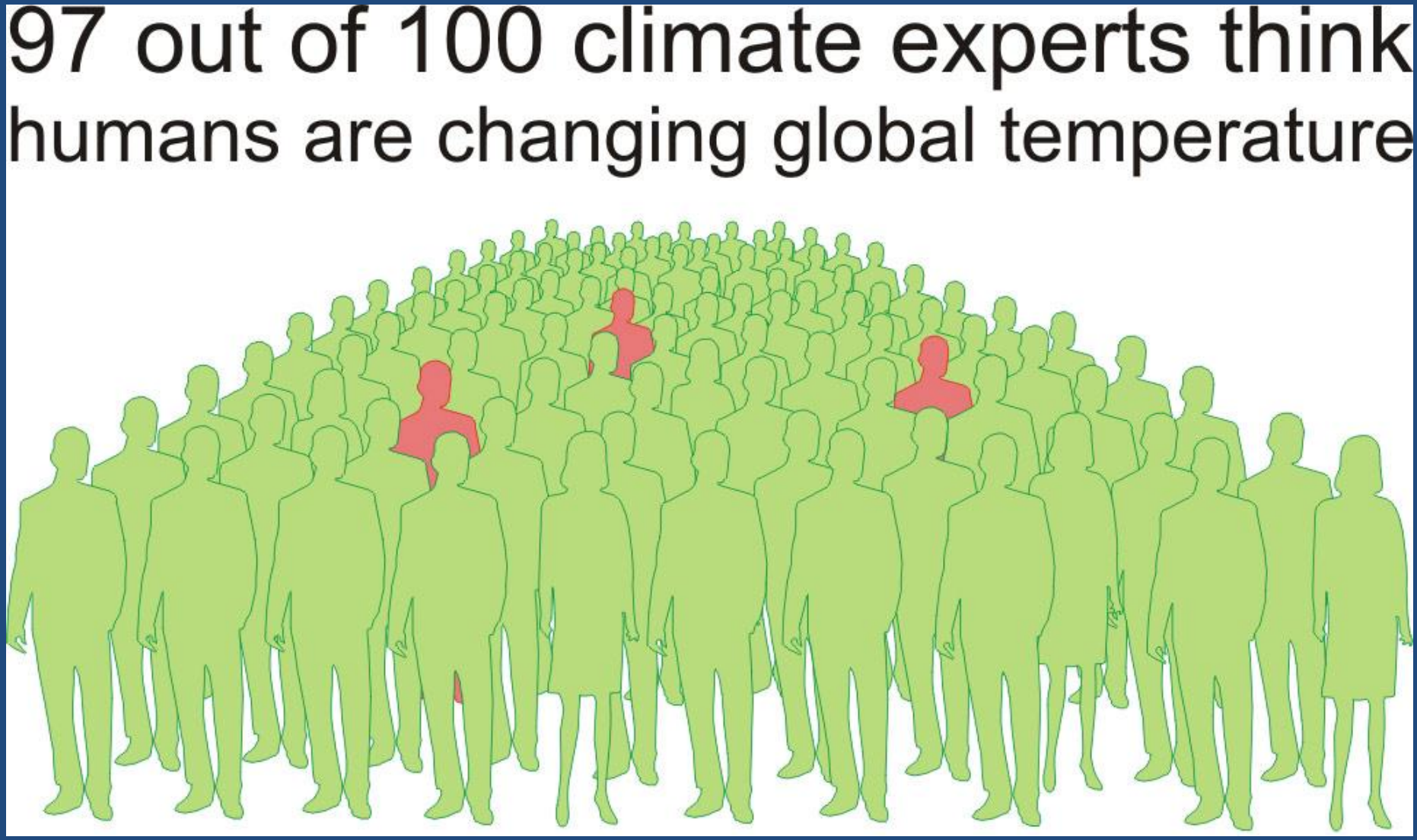
3. Scientists agree

3. Scientists agree

IPCC 2007 Report (AR 4)

It is *very likely* that anthropogenic greenhouse gas increases caused most of the observed increase in globally averaged temperatures since the mid-20th century.

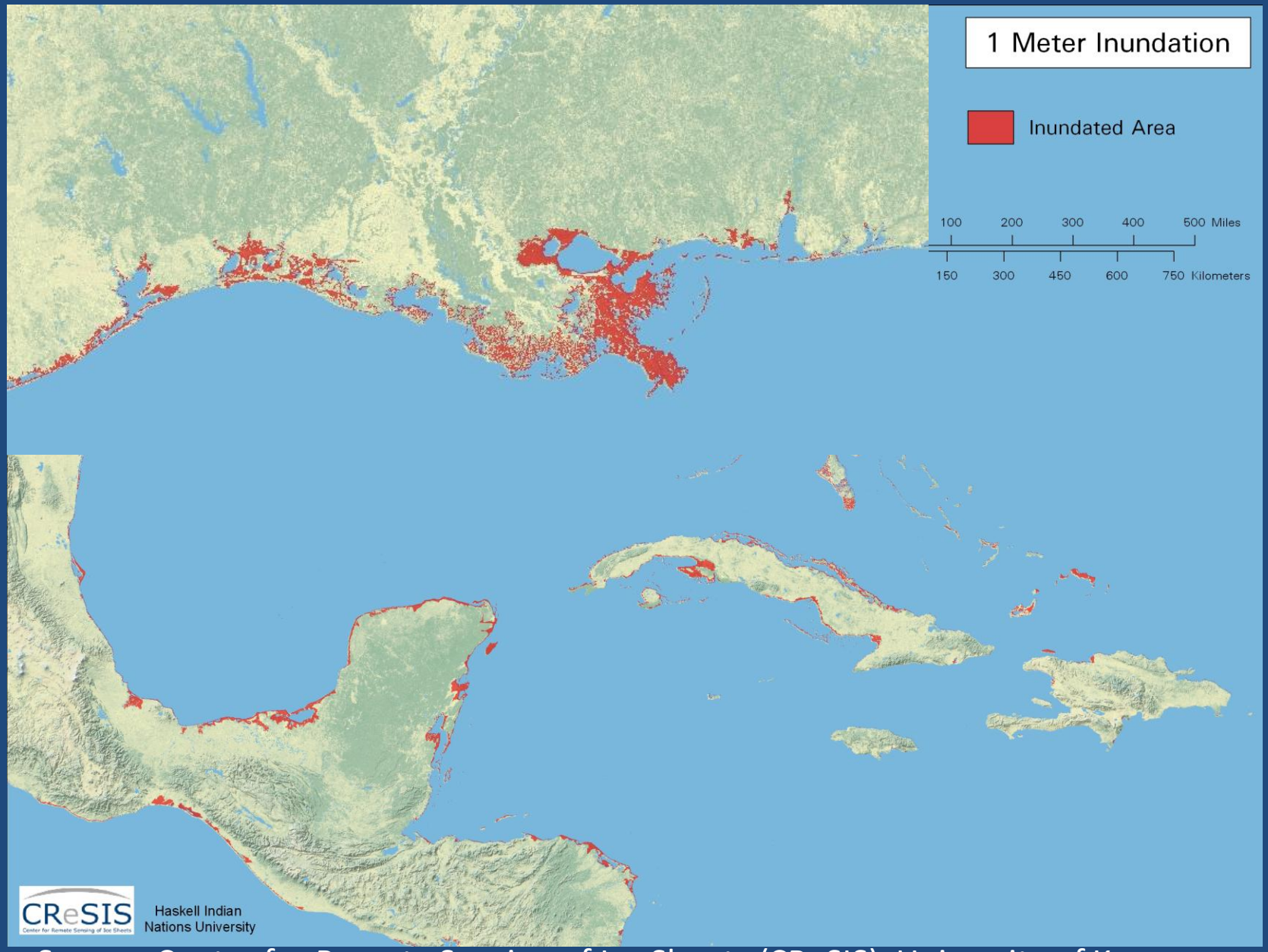
3. Scientists agree



Source: SkepticalScience.com, after Doran and Zimmerman, *Eos*, 2009.

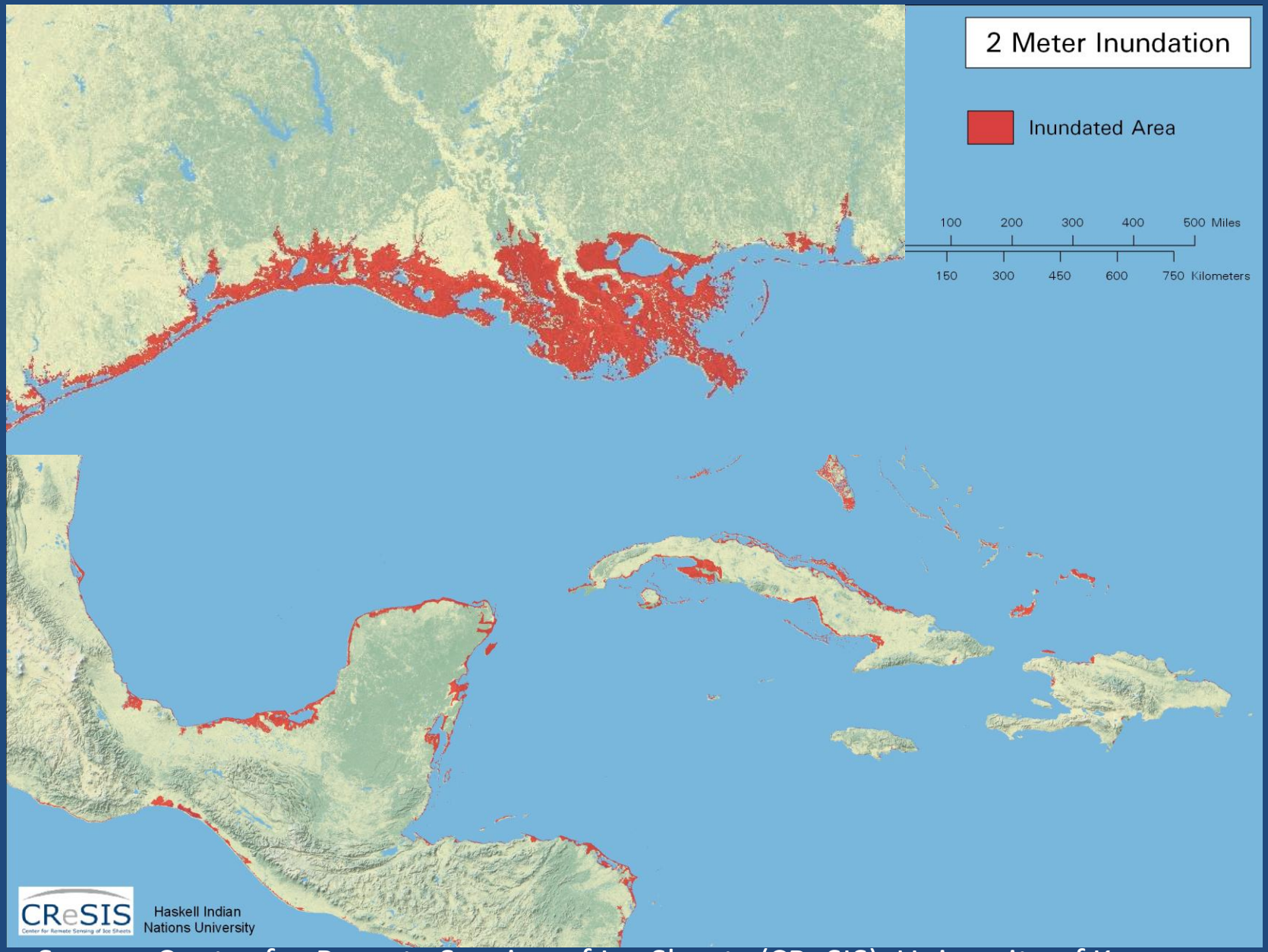
4. It could be bad

4. It could be bad



Source: Center for Remote Sensing of Ice Sheets (CReSIS), University of Kansas.

4. It could be bad

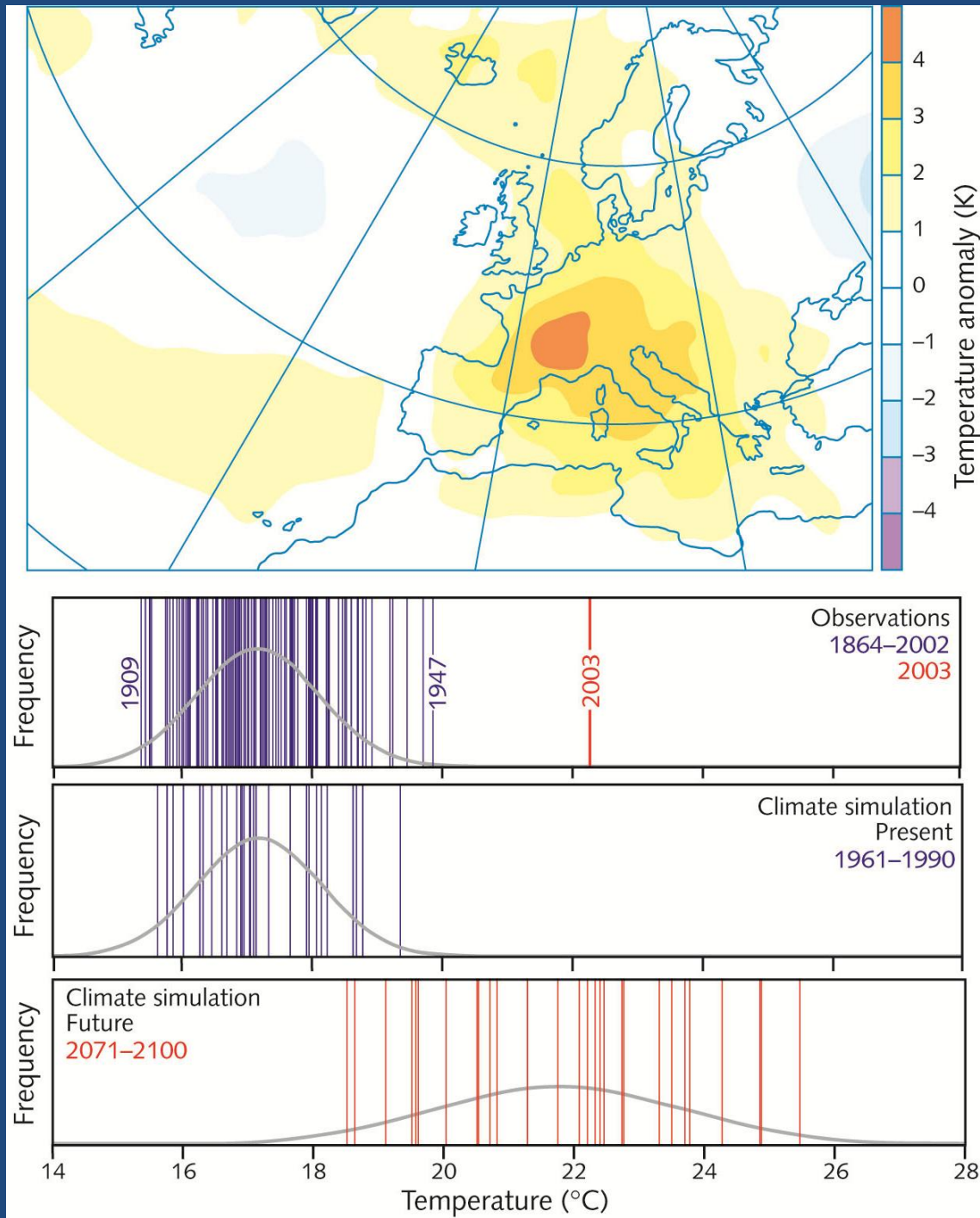


Source: Center for Remote Sensing of Ice Sheets (CReSIS), University of Kansas.

4. It could be bad

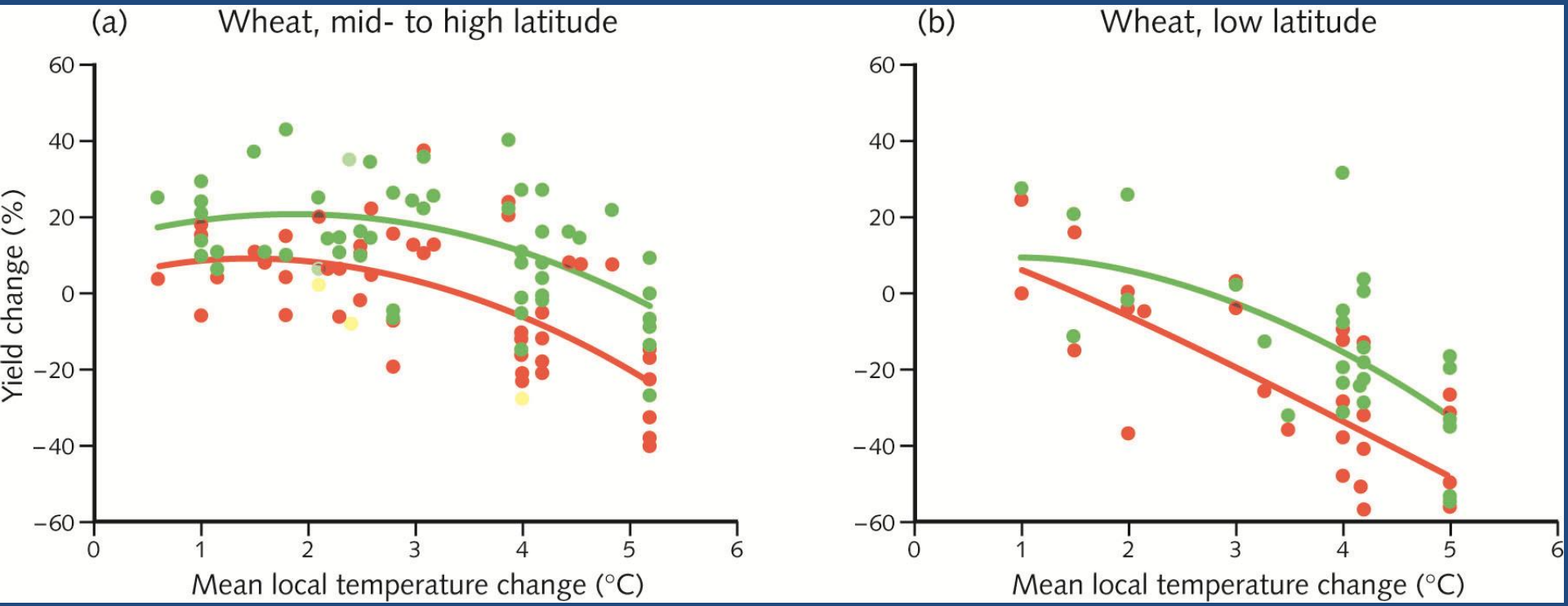
The 2003 European heat wave in context: 15,000 deaths in France, 35,000 total deaths in Europe.

Source: Houghton, 2009, p. 215.



4. It could be bad

Effects on wheat yields of increased average temperature.

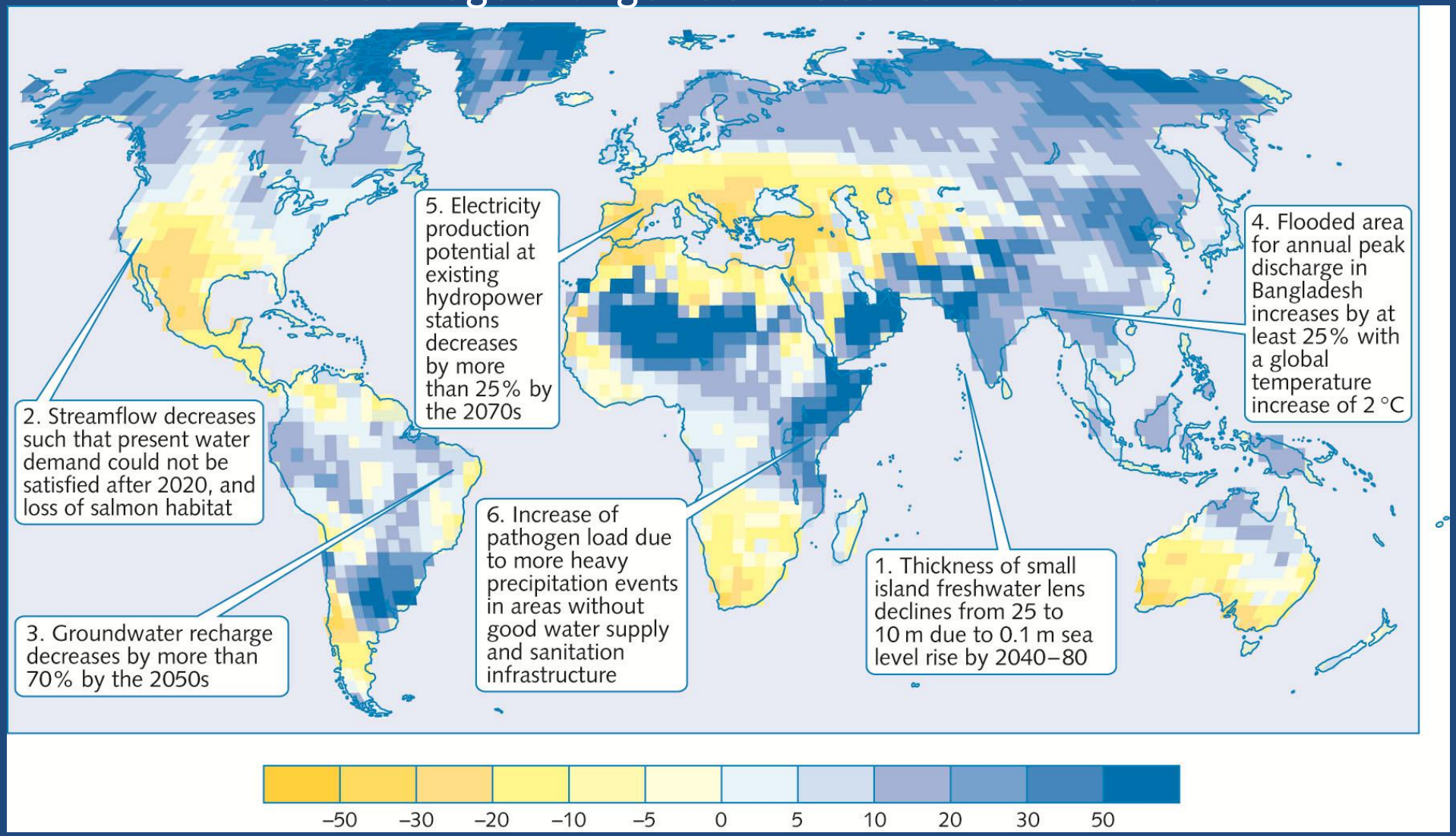


Source: Houghton, 2009, p. 202.

4. It could be bad

Ensemble mean change in annual runoff, SRES A1B

Percentage change 1981-2000 vs. 2081-2100



Source: Houghton, 2009, p. 193.

5. It’s not too late

5. It's not too late

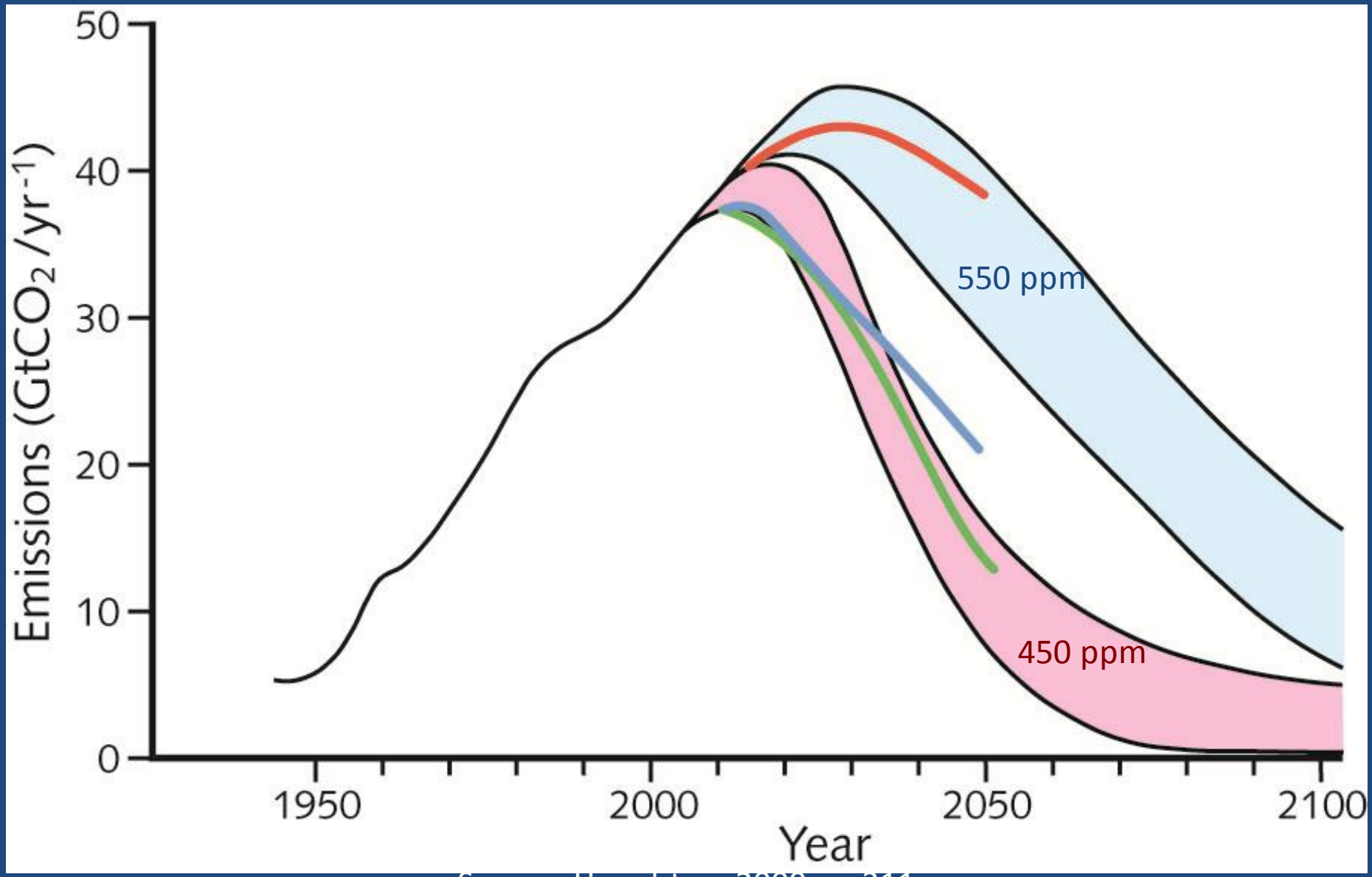
CO_2 stabilisation scenarios.

Source: Houghton, 2009, p. 310.

Category	Radiative forcing ($W.m^{-2}$)	Stabilisation concentration (ppm CO_2e)	Peaking year for CO_2 emissions	CO_2 emissions change in 2050 (% 2000)	Temp. increase vs. pre-industrial (°C)
I	2.5-3.0	445-490	2000-2015	-85 to -50	2.0-2.4
II	3.0-3.5	490-535	2000-2020	-60 to -30	2.4-2.8
III	3.5-4.0	535-590	2010-2030	-30 to +5	2.8-3.2
IV	4.0-5.0	590-710	2020-2060	+10 to +60	3.2-4.0
V	5.0-6.0	710-855	2050-2080	+25 to +85	4.0-4.9
VI	6.0-7.5	855-1130	2060-2090	+90 to +140	4.9-6.1

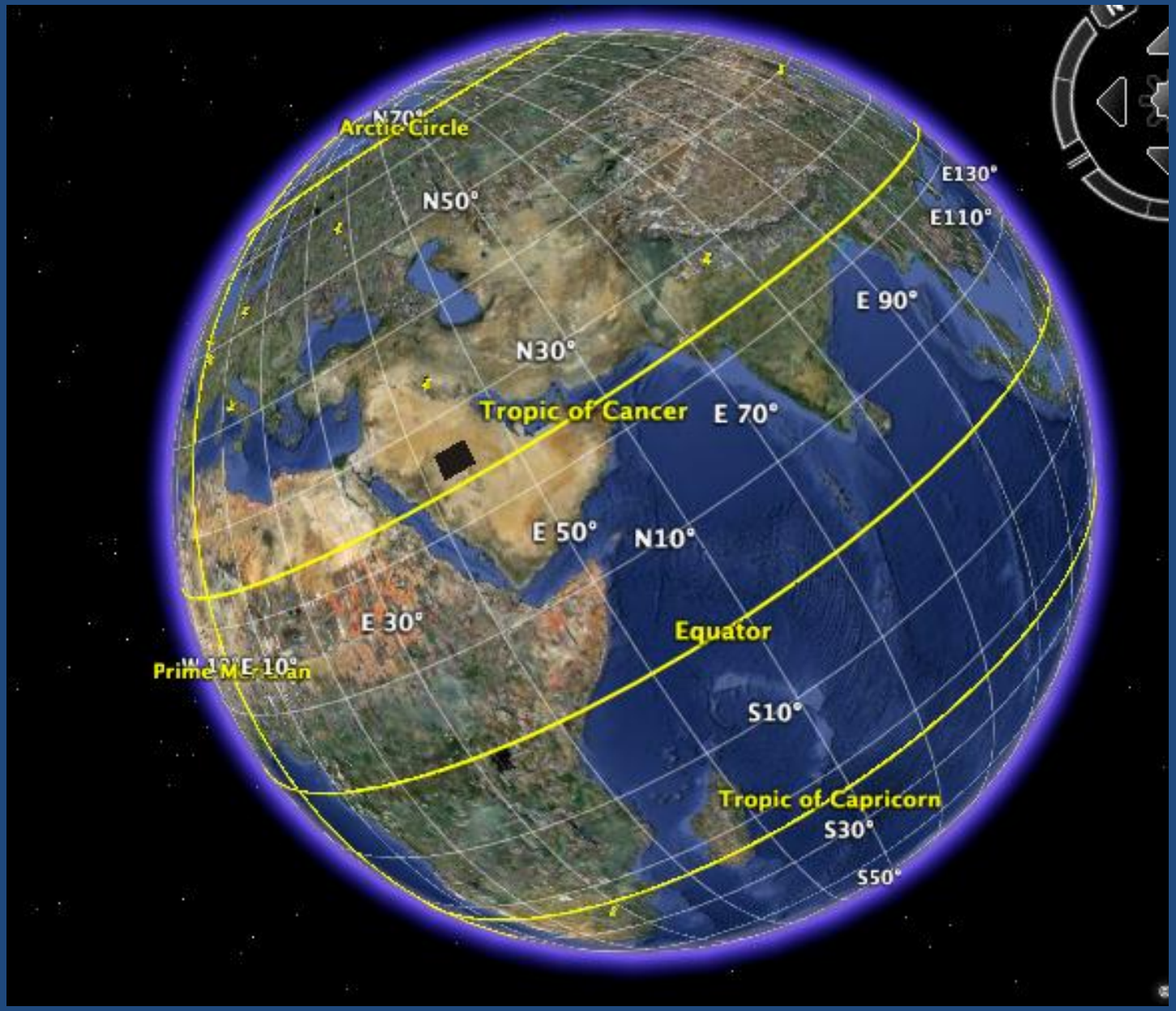
5. It's not too late

Global CO_2 emissions for stabilisation at 450 and 550 ppm CO_2



Source: Houghton, 2009, p. 311.

5. It's not too late



Source: Pierrehumbert, R., 2009, RealClimate.org blog post.

SO….
WHAT WERE THOSE FIVE THINGS AGAIN??

QUESTIONS??