Where on Earth are we going?

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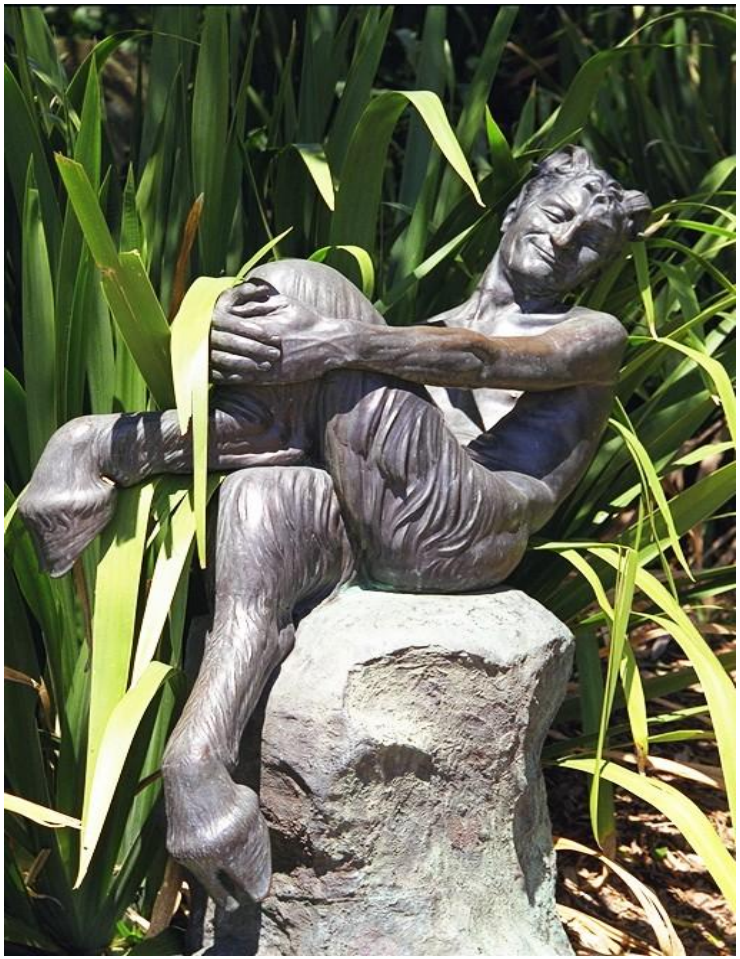
Global Health in the 21st Century
Medical Faculty Heidelberg
14 September 2012


Accidentes, violencia, IRA, ETS
Leptospirosis
Rabia, Cólera, Dengue
ETAs, Cólera, Diarrea, Accidentes Meningitis
Cólera, ETAs, Malaria, Exantemáticas
Cólera, Dengue
Rabia, Cólera, Leptos-pirosis
Cólera, Rabia
Malaria, Cólera, IRA, Dengue
Enero
Febrero
Marzo
Abril
Mayo
Junio
Julio
Agosto
Septiembre
Octubre
Noviembre
Diciembre

Guatemala

$$\text{Impacts} = f\left\{\begin{array}{c}\text{Hazard}\\ \text{Exposure}\\ \text{Vulnerability}\end{array}\right\}$$

Climate: What You Expect



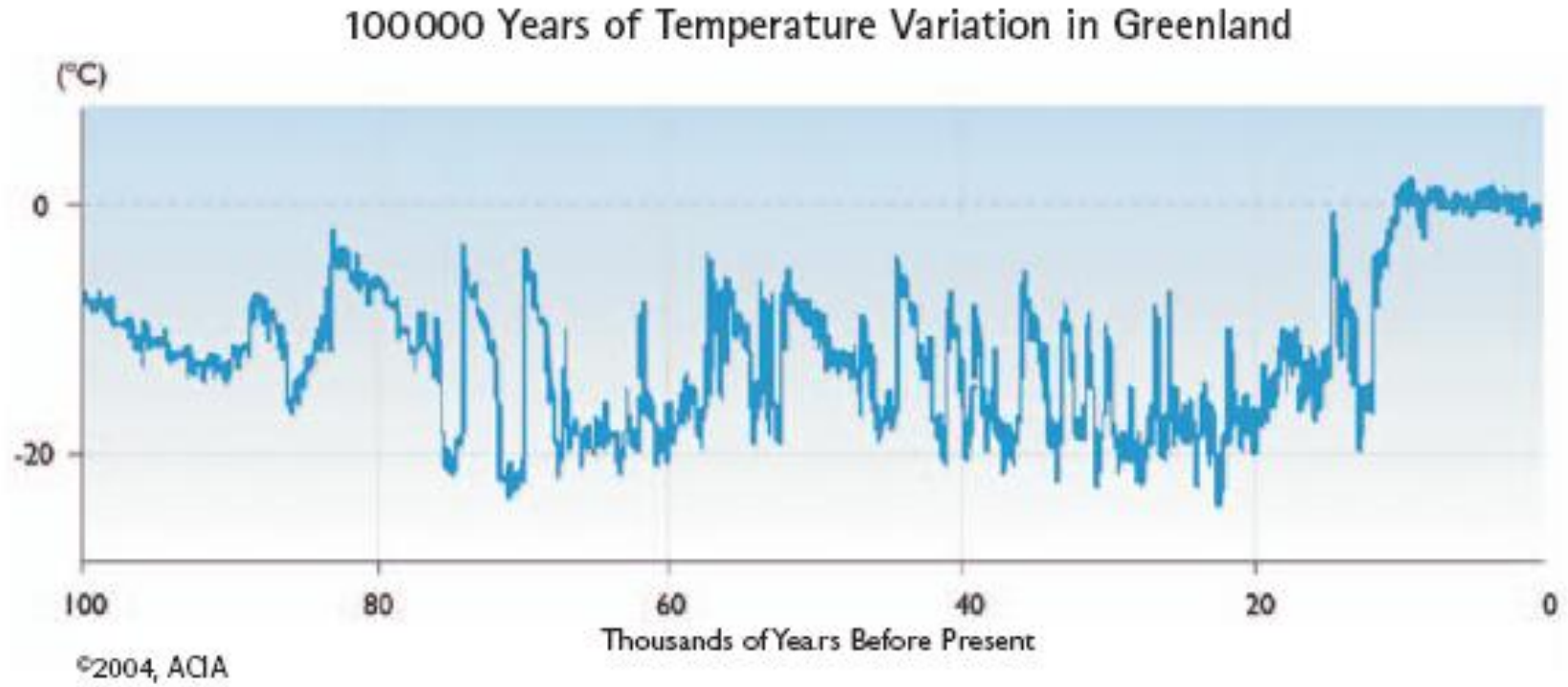
Weather:

What you get

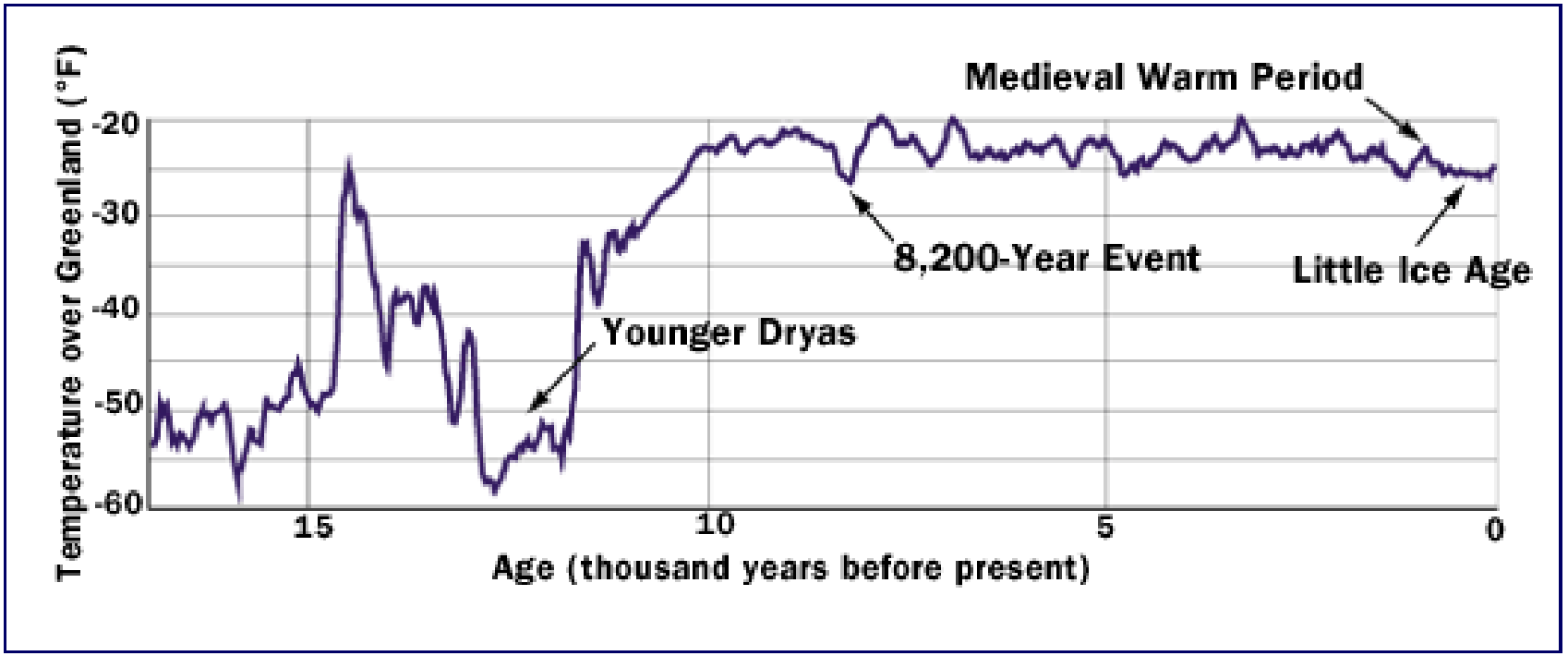
Climate

- Variability
  - Short-term fluctuations around the average weather
  - Includes ENSO (El Nino - Southern Oscillation)
- Change
  - Operates over decades or longer
  - General Circulation Models (GCMs) / Earth System Models (ESMs)
    - Scenarios, NOT predictions
    - Downscaling / spatial issues

100,000 Years of Temperature Variation in Greenland

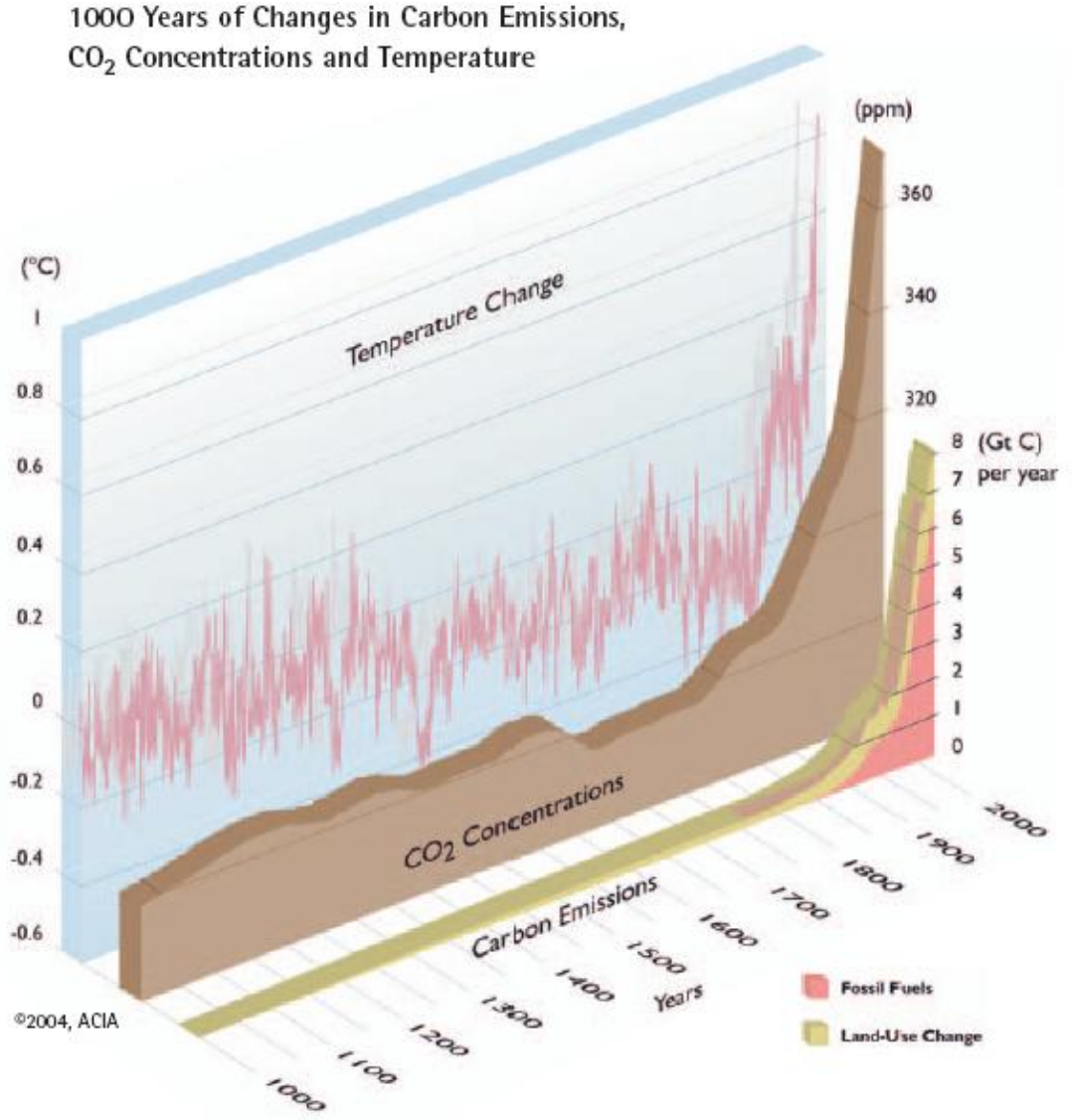


Temperature Over Greenland Over Past 17,000 Years

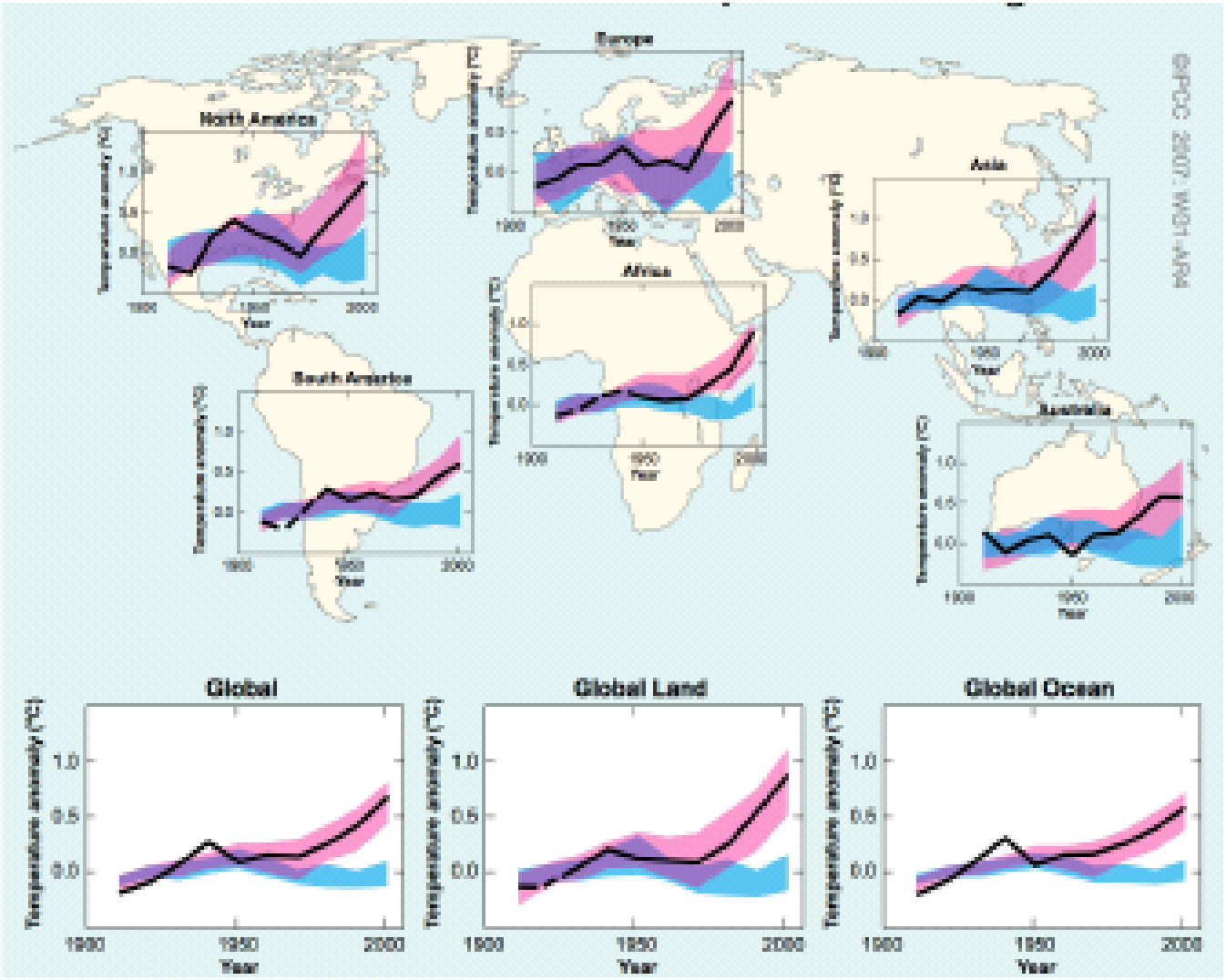


Alley, RB. The Two Mile Time Machine 2000

1000 Years of Changes in Carbon Emissions, CO_2 Concentrations & Temperature

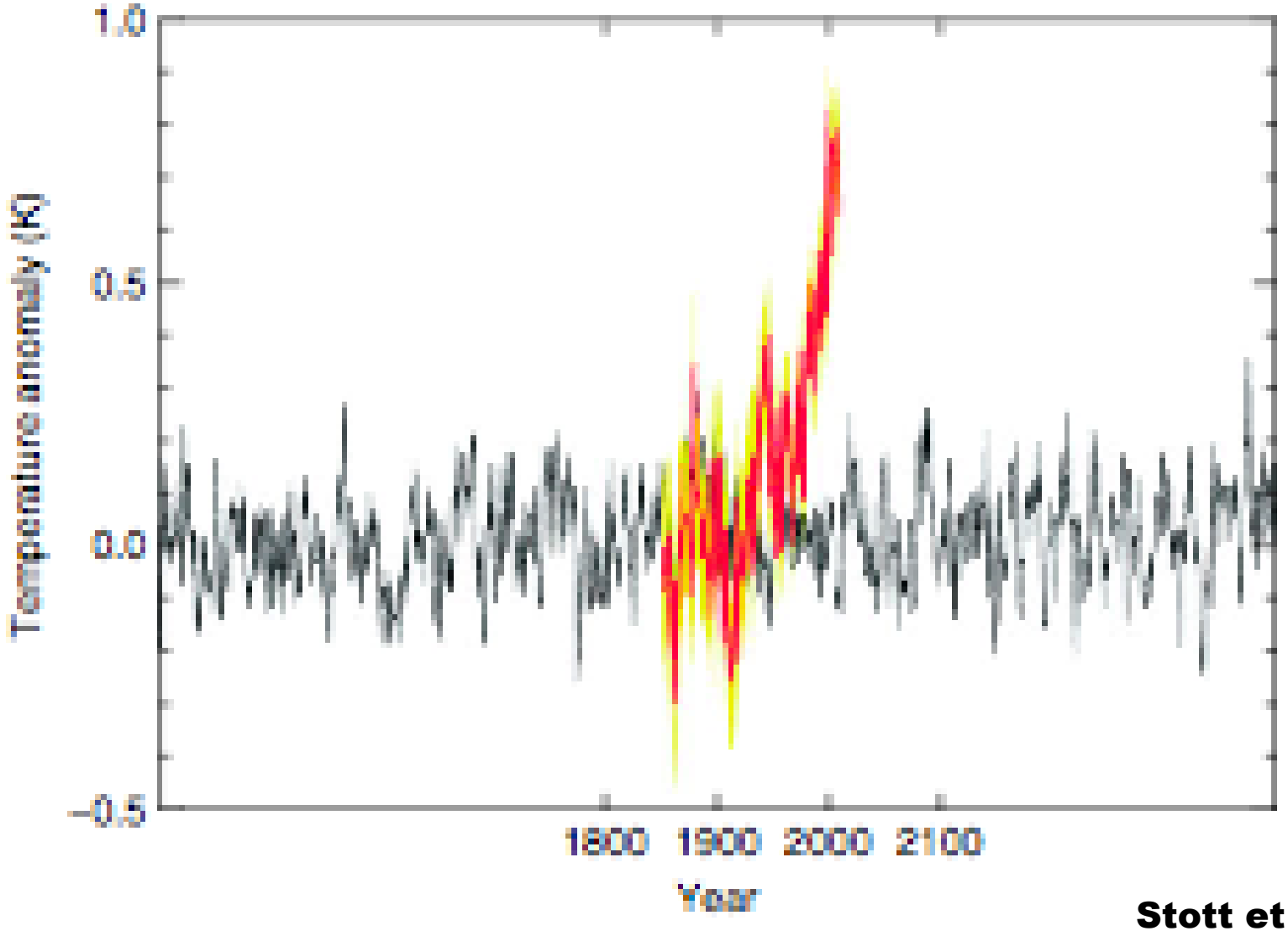


Global and Continental Temperature Change



IPCC 2007

Observed Global Mean Temperature Change 1850-2008

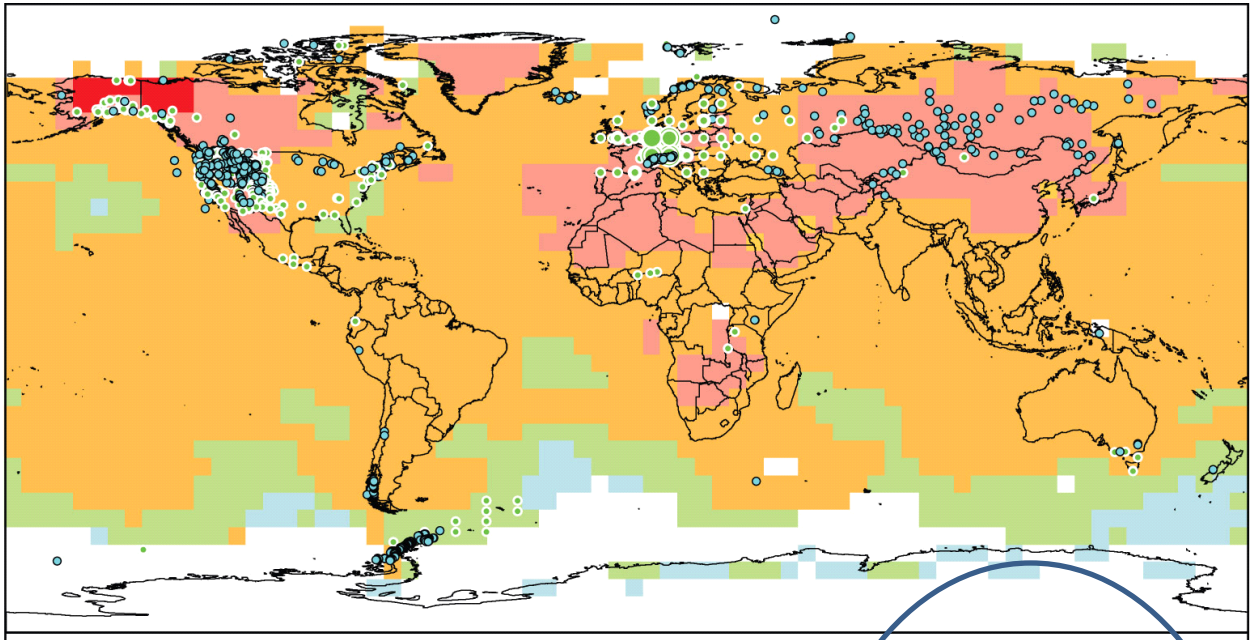


Stott et al. 2010

Evidence (Fingerprints) From:

- Temperature
- Precipitation
- Ocean heat content
- Atmospheric moisture
- Arctic sea ice

Changes in physical and biological systems, 1970-2004: Statistical support for human influence.



NAM		LA		EUR (28,115)		AFR		AS		ANZ		PR*	
355	455	53	5	119		5	2	106	8	6	0	120	24
94%	92%	98%	100%	94%	89%	100%	100%	96%	100%	100%	–	91%	100%

TER (28,586)		MFW**		GLO (28,671)	
764		1	85	765	
94%	90%	100%	99%	94%	90%

Observed data series
- Physical systems (snow, ice and frozen ground; hydrology; coastal processes)
- Biological systems (terrestrial, marine, and freshwater)

Europe ***
- 1-30
- 31-100
- 101-800
- 801-1,200
- 1,201 -7,500

Temperature change °C
1970-2004
-1.0 -0.2 0.2 1.0 2.0 3.5

Physical	Biological
Number of significant observed changes	Number of significant observed changes
Percentage of significant changes consistent with warming	Percentage of significant changes consistent with warming

* Polar regions include also observed changes in marine and freshwater biological systems.
** Marine and freshwater includes observed changes at sites and large areas in oceans, small islands and continents. Locations of large-area marine changes are not shown on the map.
*** Circles in Europe represent 1 to 7,500 data series.

Physical	Biological
Number of significant observed changes	Number of significant observed changes
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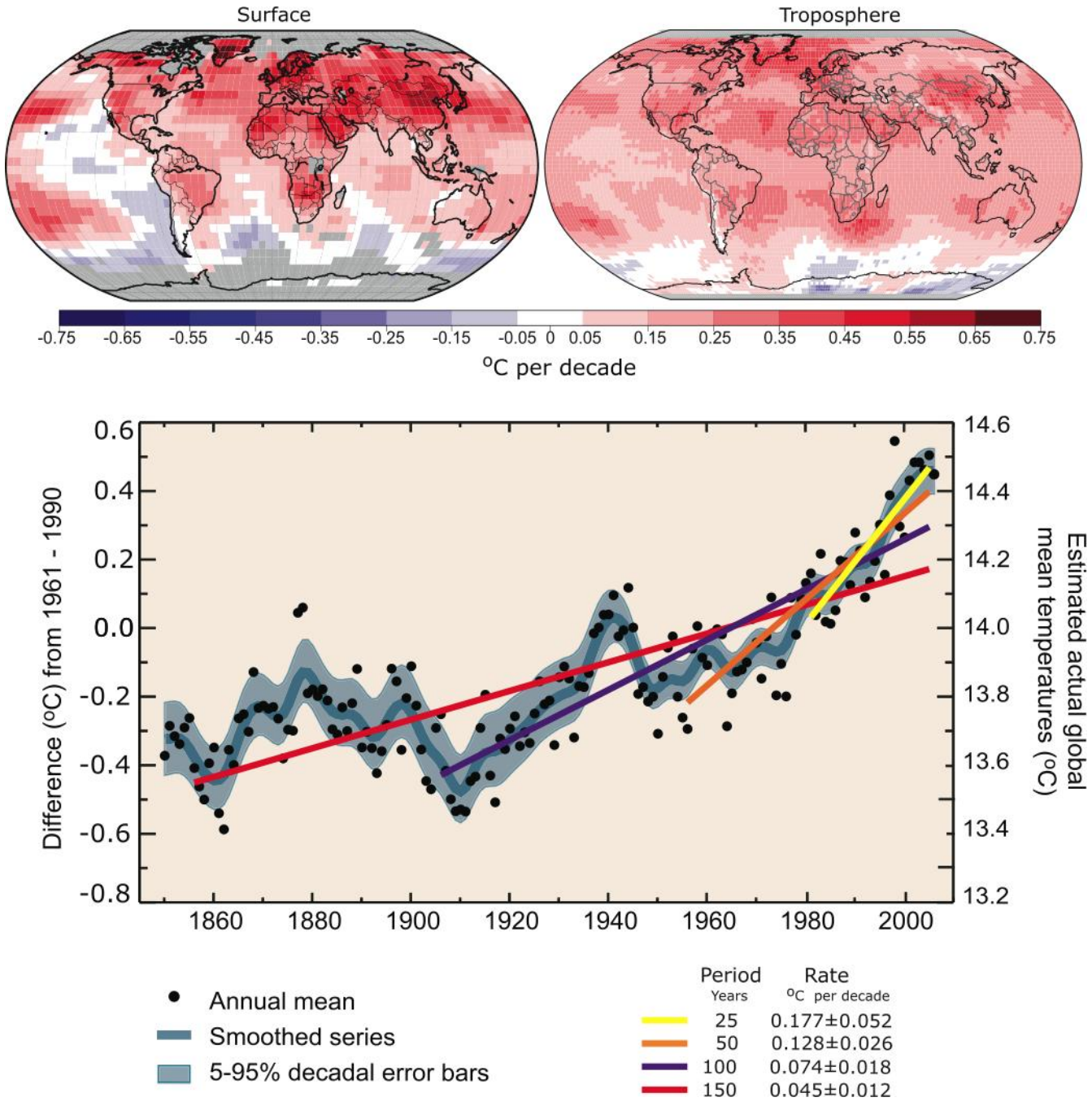
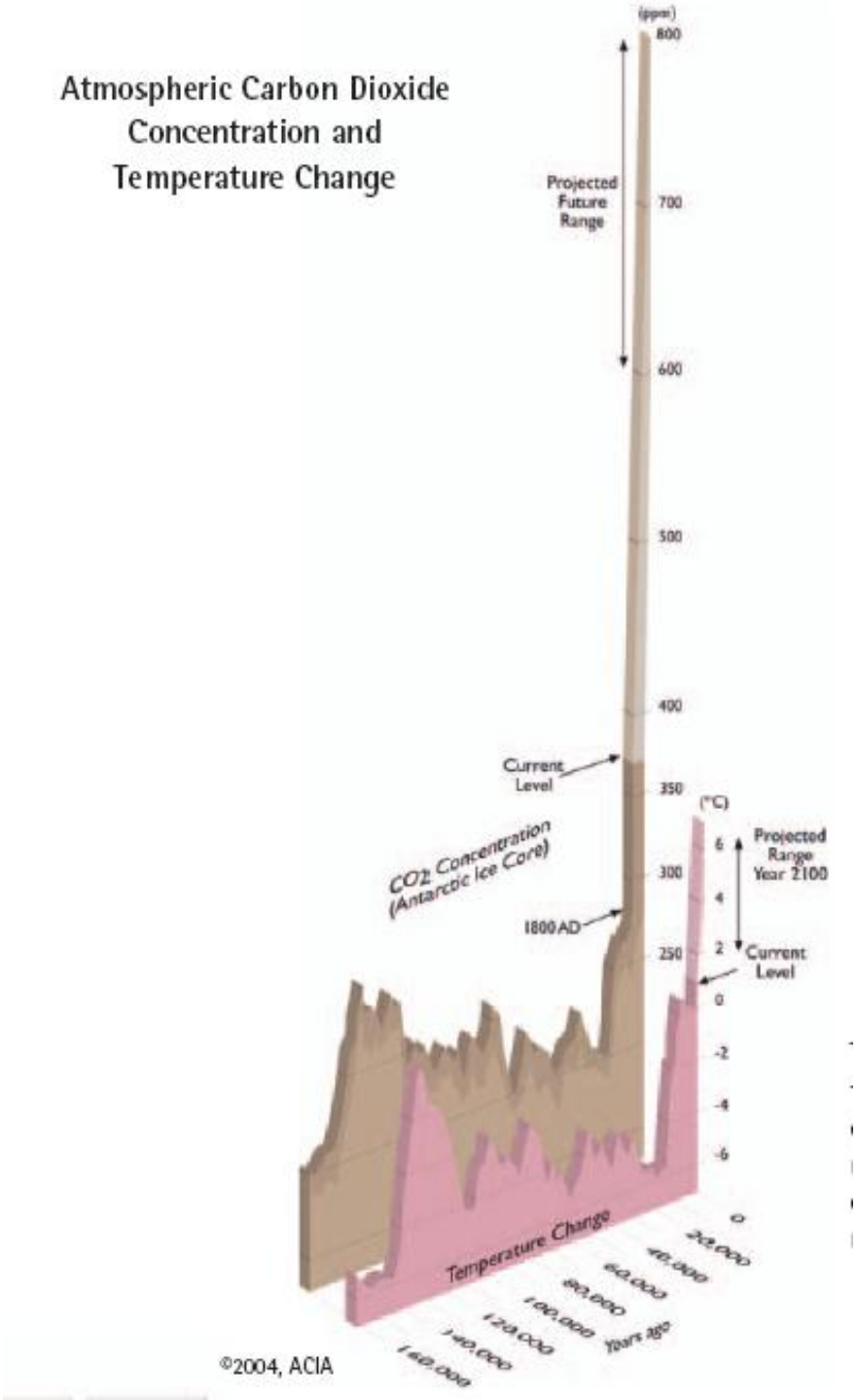
AR4, WG2, Fig TS 1

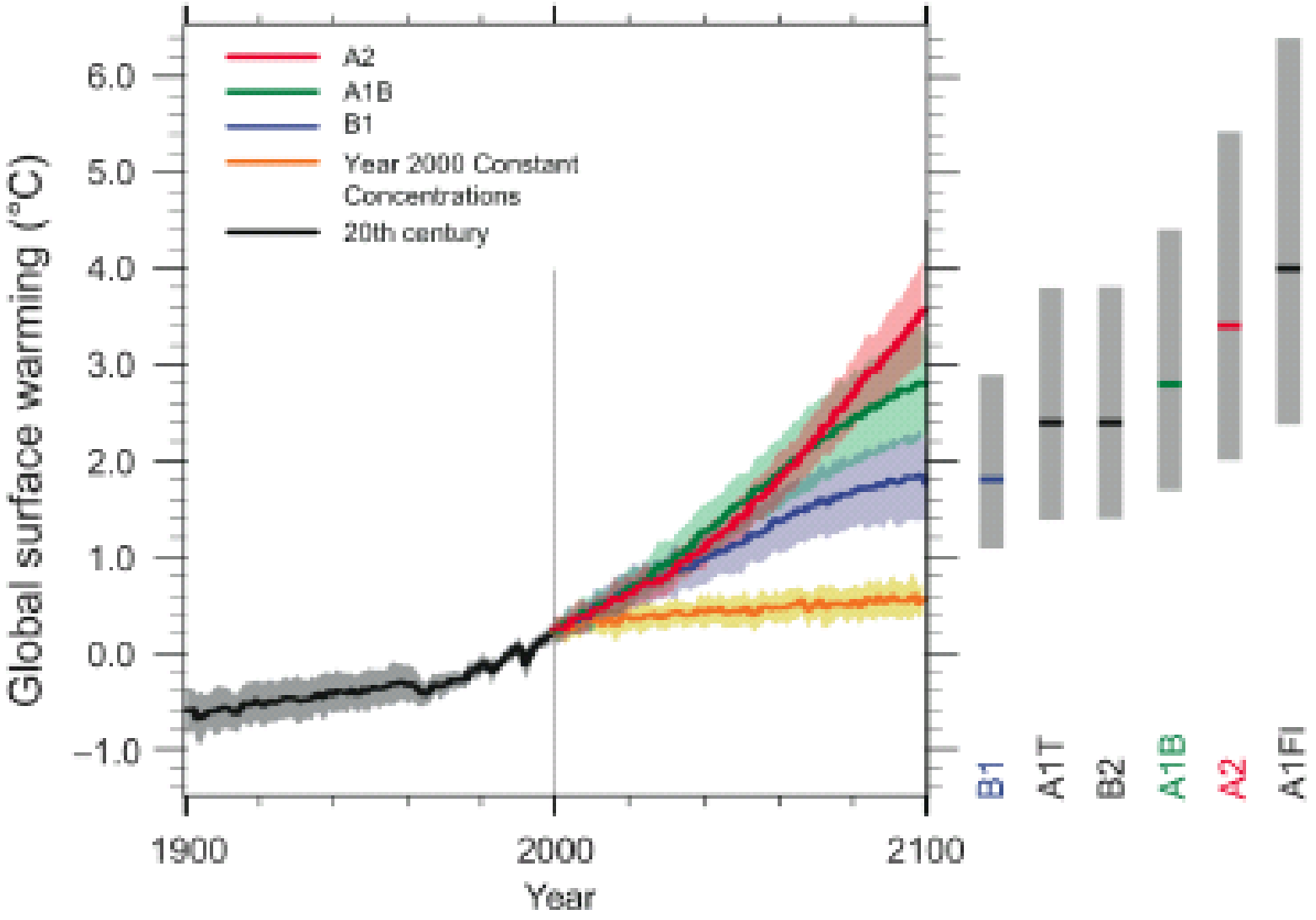

Surface
Troposphere
-0.75 -0.65 -0.55 -0.45 -0.35 -0.25 -0.15 -0.05 0 0.05 0.15 0.25 0.35 0.45 0.55 0.65 0.75
°C per decade
Difference (°C) from 1961 - 1990
Estimated actual global mean temperatures (°C)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
14.6
14.4
14.2
14.0
13.8
13.6
13.4
13.2
1860 1880 1900 1920 1940 1960 1980 2000
Annual mean
Smoothed series
5-95% decadal error bars
Period Years
Rate °C per decade
25 0.177±0.052
50 0.128±0.026
100 0.074±0.018
150 0.045±0.012

Atmospheric CO_2 Concentration and Temperature Change:

Projected Concentrations of CO_2 During the 21st Century Are 2-4 Times Pre-Industrial Levels

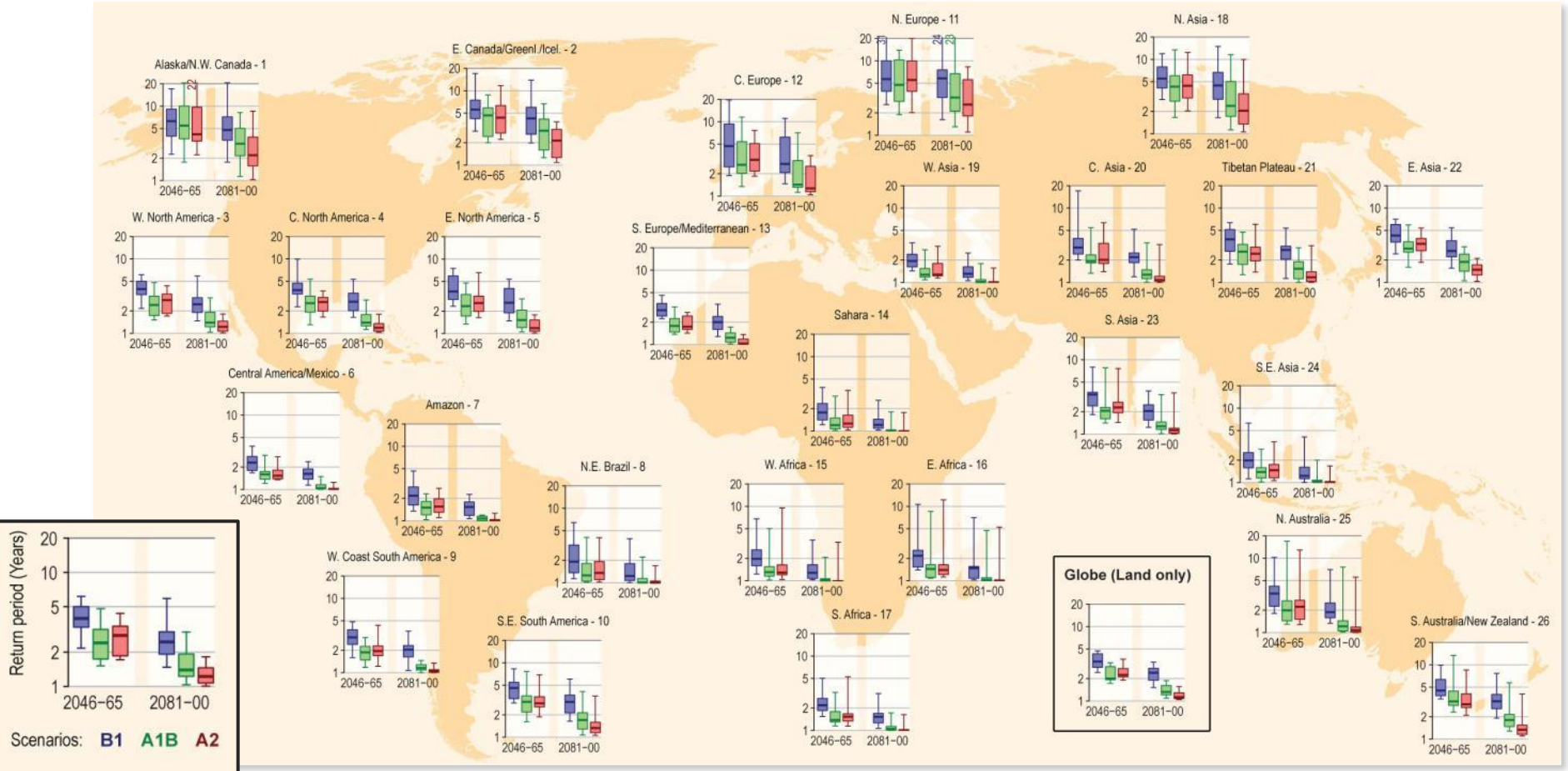


Global Average Surface Temperature



IPCC 2007

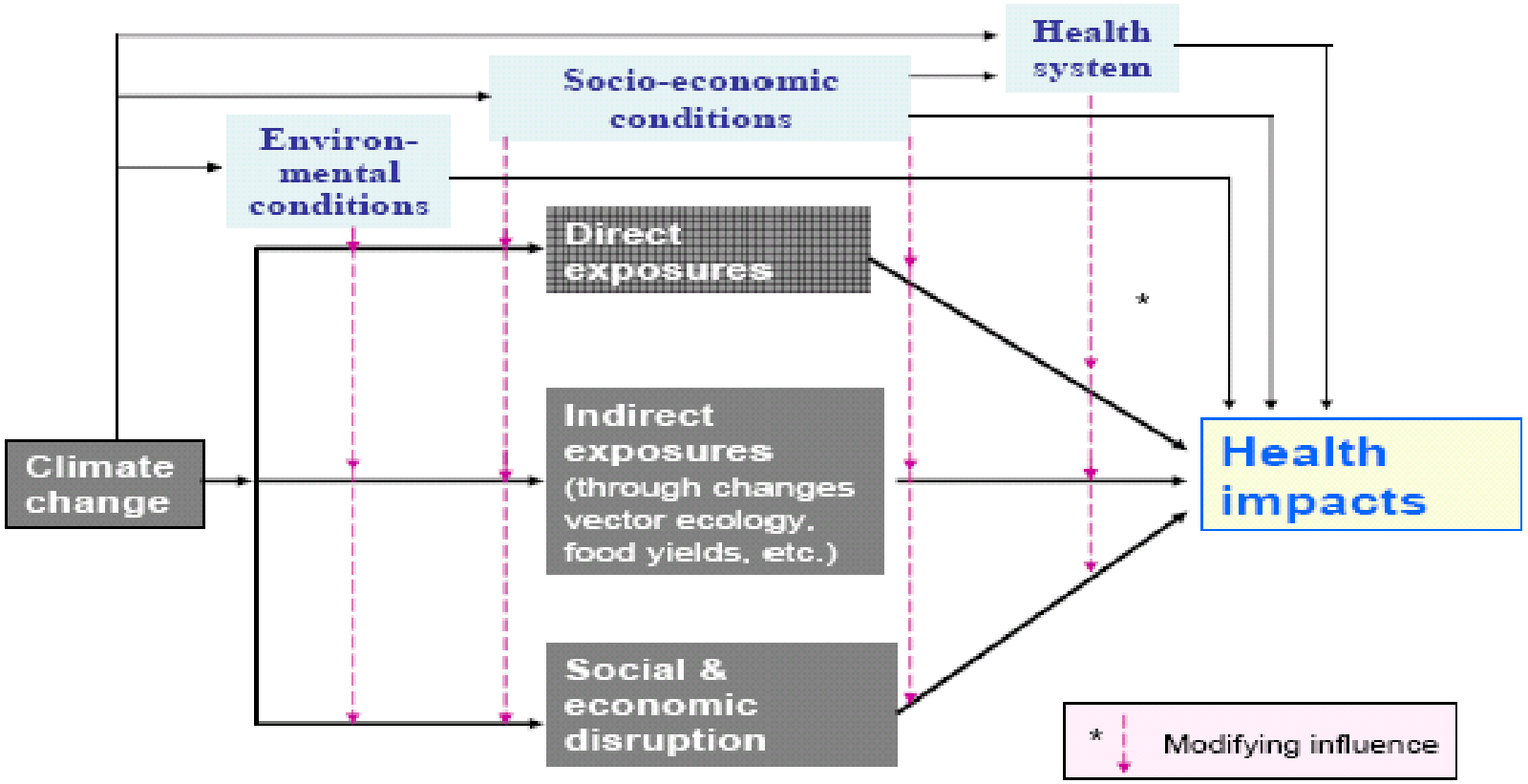
Climate models project more frequent hot days throughout the 21st century



In many regions, the time between "20-year" (unusually) warm days will decrease

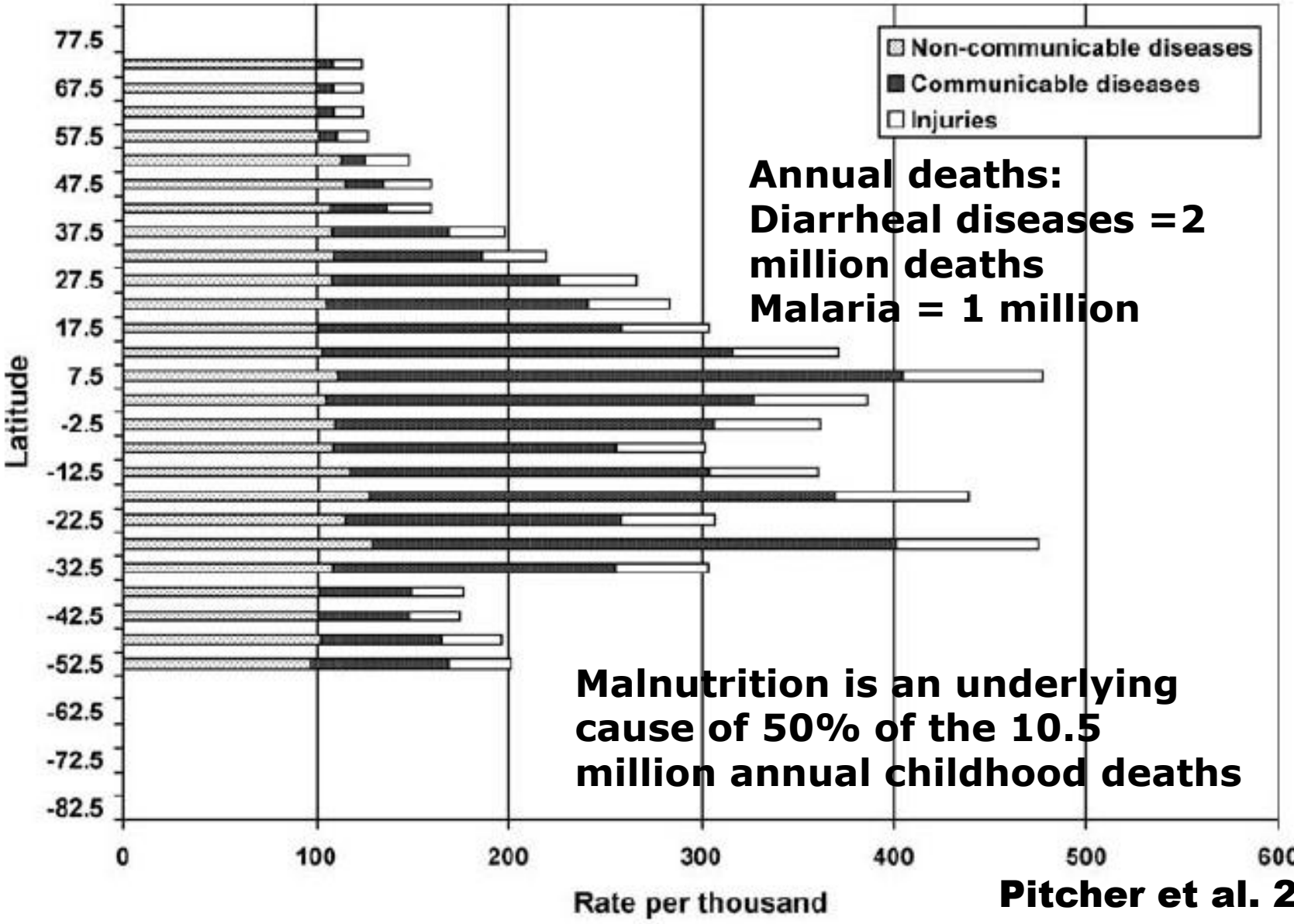
IPCC 2012

Pathways by Which Climate Change May Affect Human Health



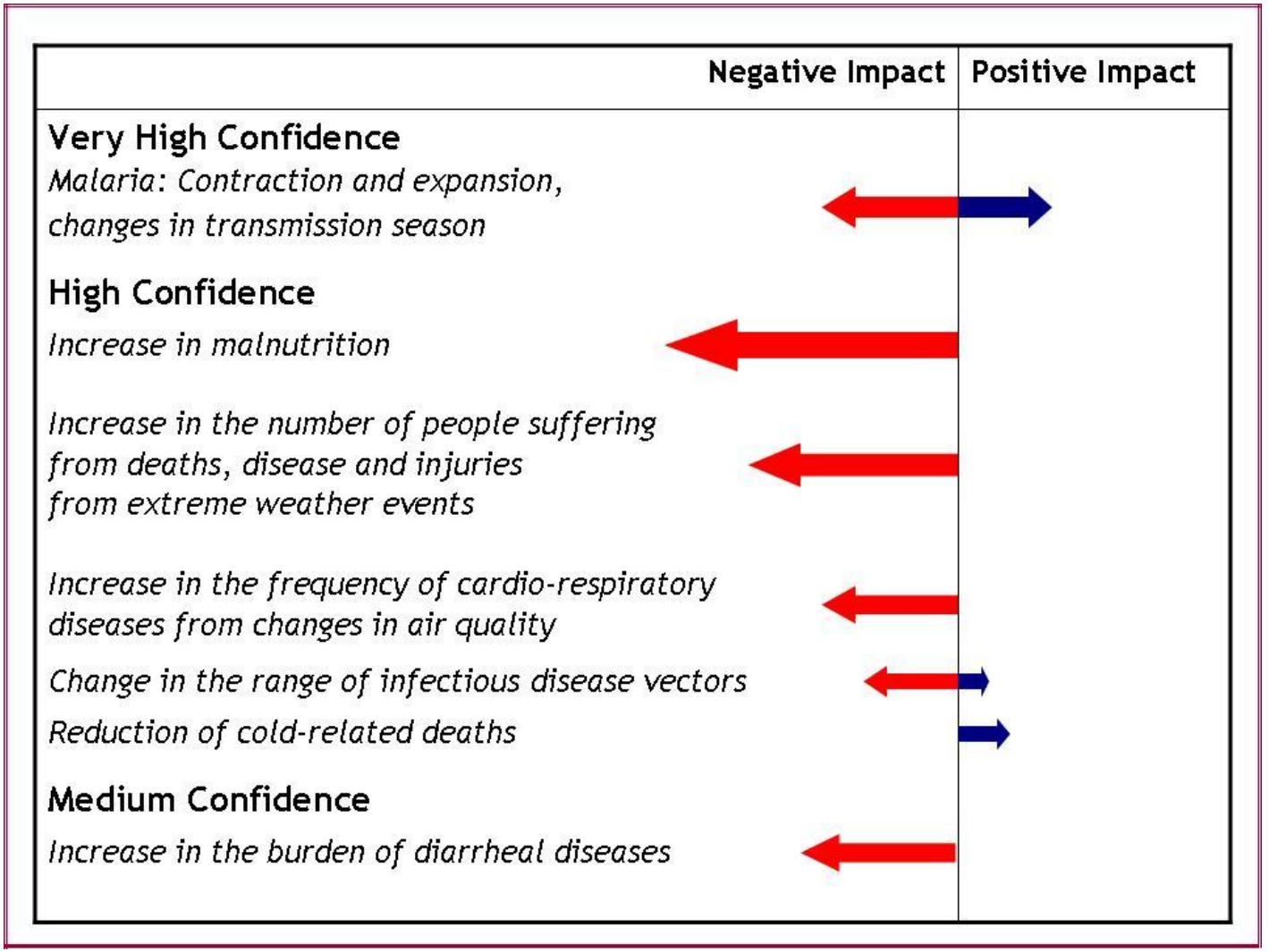
IPCC 2007

Sum of Years of Life Lost and Years of Life Lived with Disability



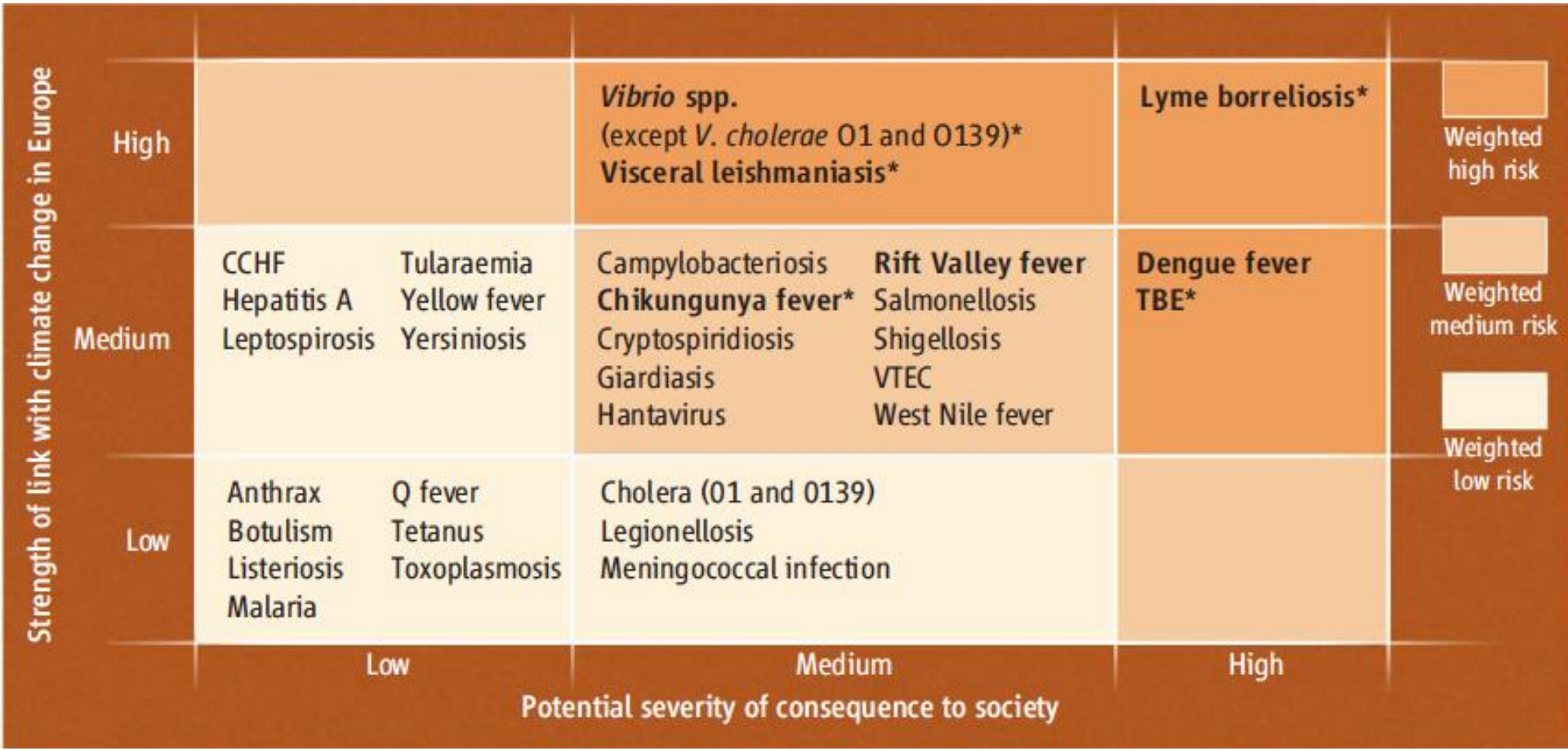
Pitcher et al. 2008

Direction and Magnitude of Climate Change Health Impacts



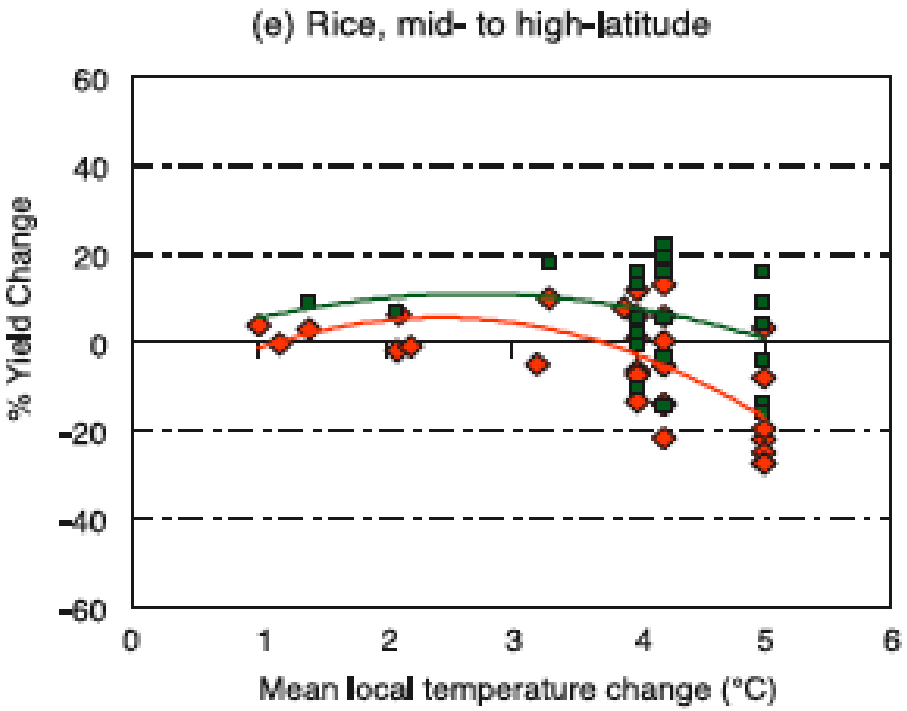
IPCC 2007

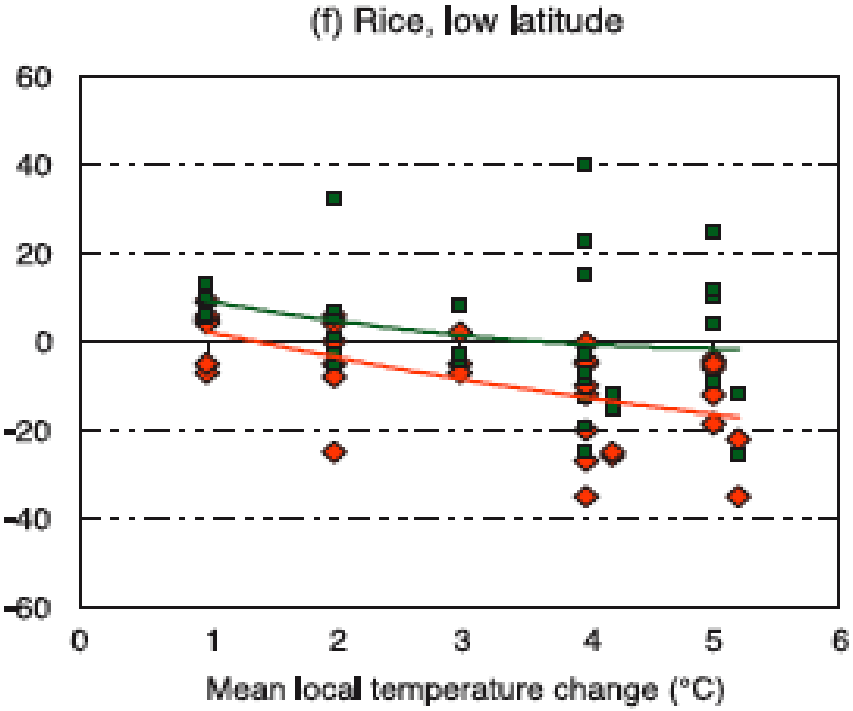
Weighted Risk Analysis of Climate Change Impacts on Infectious Diseases in Europe



Lindgren et al. 2012

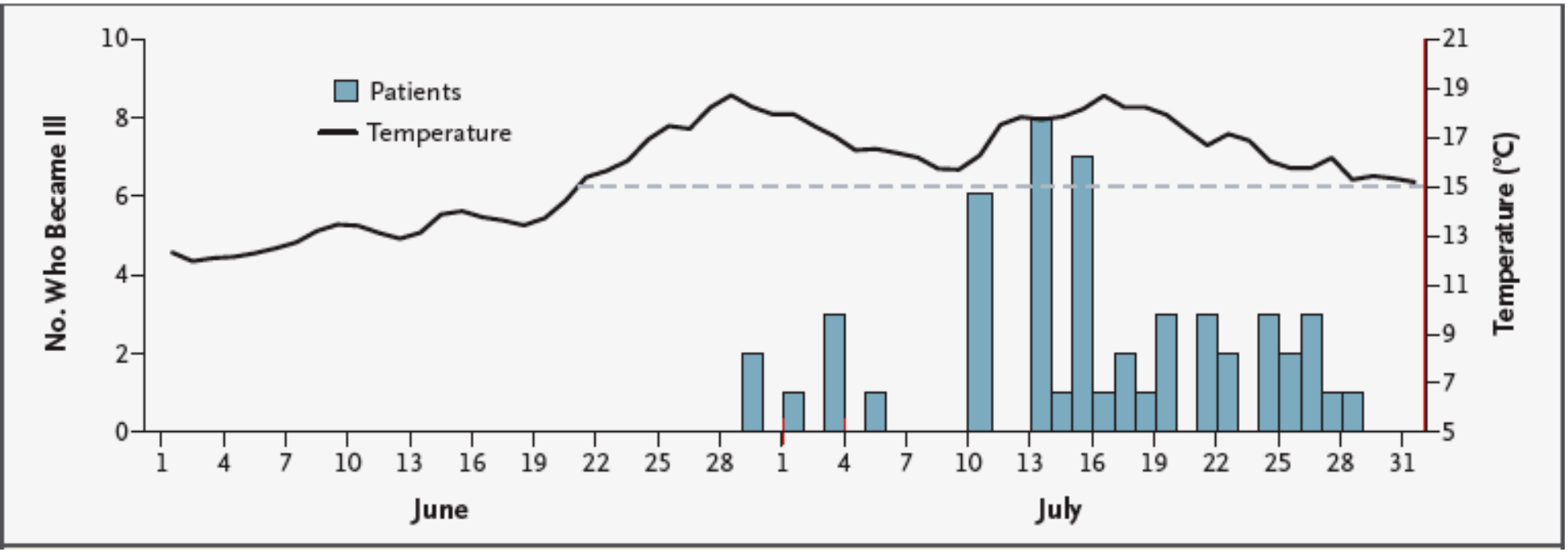
Sensitivity of Rice Yields to Temperature Change





Easterling et al. 2007

Vibrio parahaemolyticus Infections by Harvest Date and Mean Daily Water Temperature



McLaughlin et al. 2005

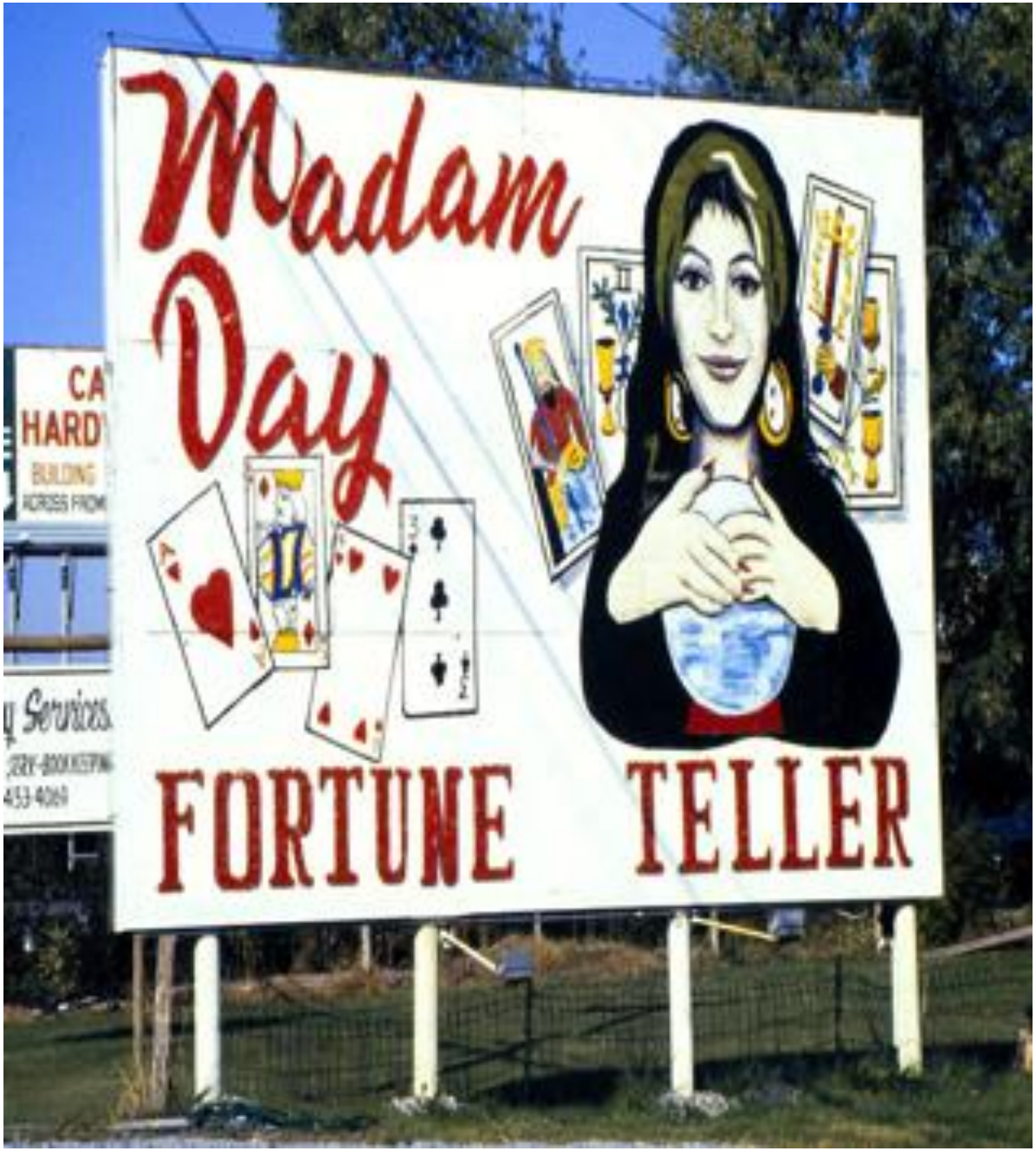
Climate Change Impacts in 2030 under 750 ppm CO_2 Scenario (thousands of cases)

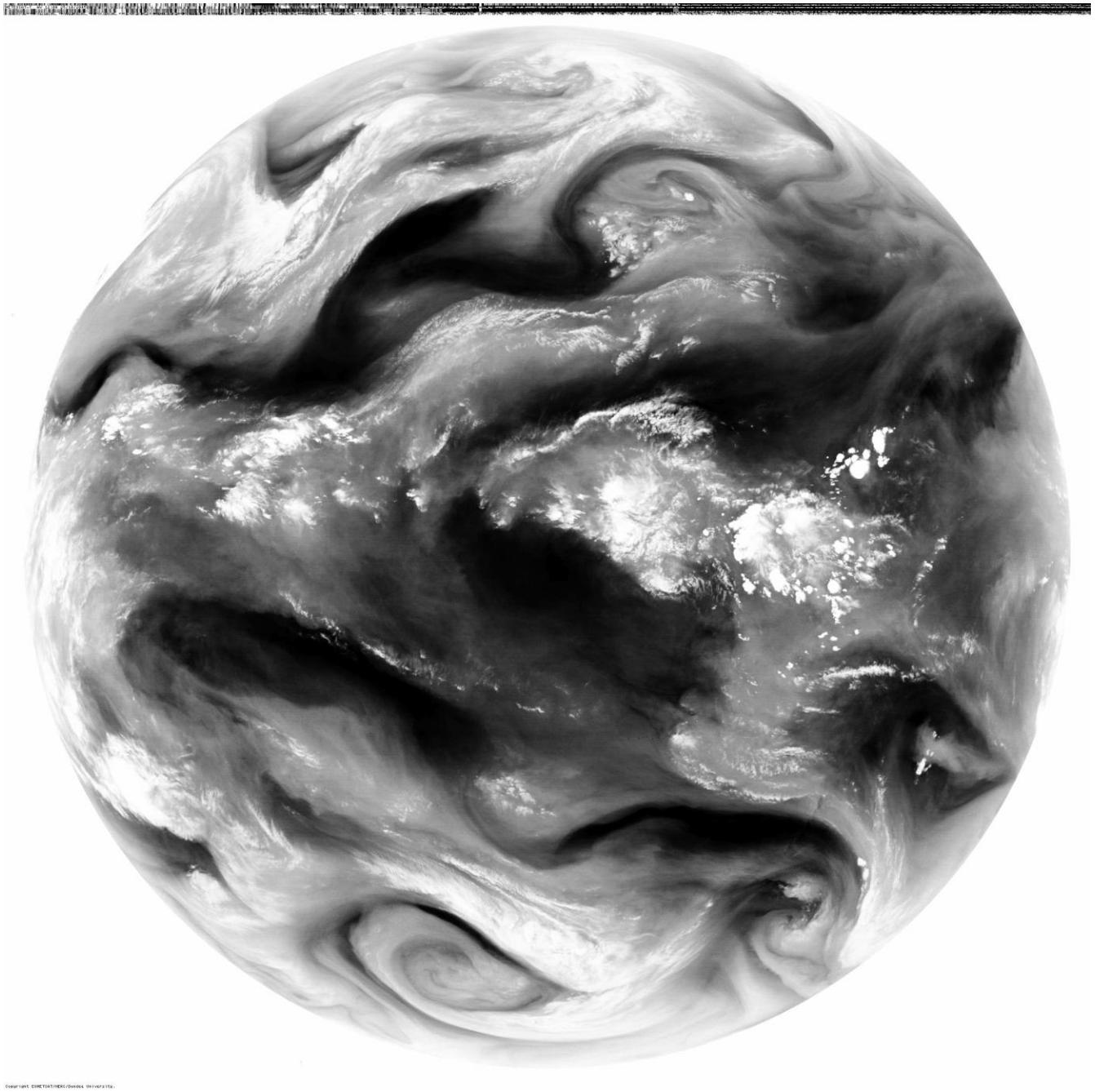
Estimated costs to treat the climate change-related cases = $3,992 to $12,603 million

	Diarrhea	Malnutrition	Malaria
Total	4,513,981	46,352	408,227
Climate change impacts	131,980	4,673	21,787
% increase	3%	10%	5%

Ebi 2008

Philip Wijmans, LWF/ACT Mozambique, March 2000


Madam
Day
FORTUNE
TELLER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