

TOPIC #16

THE IPCC FINDINGS

About the IPCC,
the Projections,
& Impacts

pp 87-92

“Eden” by Gregory Kitterle

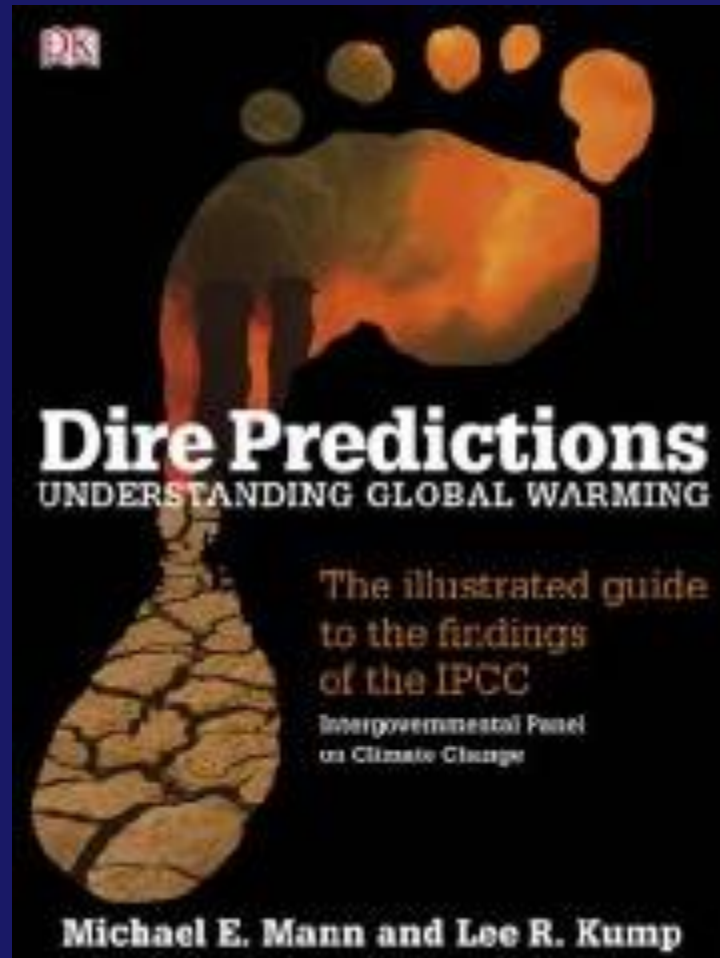


SGC Textbook cover

"A world civilization able to envision God and the afterlife, to embark on the colonization of space,

will surely find the way to save the integrity of this magnificent planet and the life it harbors because quite simply it's the right thing to do, and ennobling to our species.

~ E. O. Wilson
Eminent Scientist &
Radical Naturalist



“The Illustrated Guide to the findings of the IPCC”

The most comprehensive source of information on Global Climate Change -- the IPCC



INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



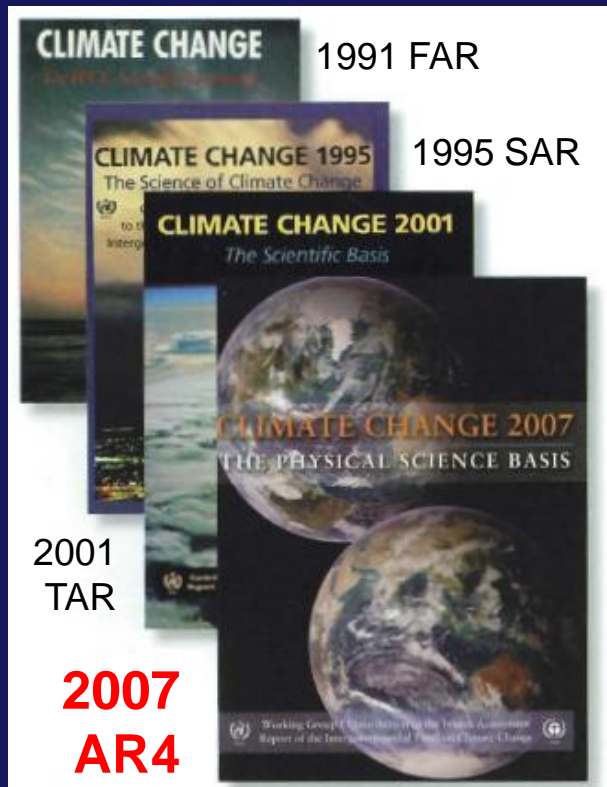
- Established by World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) in 1988 as an objective source of information for decision-makers, etc.

“to provide the world with a clear scientific view on the current state of climate change and its potential environmental and socio-economic consequences” (IPCC 2007)

- The IPCC does not conduct any research nor does it monitor climate related data or parameters.

Began with:

The “First Assessment Report” (FAR) in 1991



Most recent:

“Assessment Report 4” (AR4) in 2007

- Its role is **to assess on a comprehensive, objective, open and transparent basis** the latest **scientific, technical** and **socio-economic** literature produced worldwide relevant to the understanding of:

- the **risk** of human induced climate change

- its **observed and projected impacts** and

- options for **adaptation and mitigation.**

- The **IPCC** is a **scientific body**
- **Thousands of scientists** from all over the world contribute to the work of the IPCC on a voluntary basis.
- **PEER REVIEW** is an essential part of the IPCC process, to ensure an objective and complete assessment of current information.
- **Differing viewpoints** existing within the scientific community are reflected in the IPCC reports.

- The **IPCC** is an **intergovernmental body**, and it is open to all member countries of UN and WMO.
- Because of its scientific and intergovernmental nature, the IPCC embodies a **unique opportunity to provide rigorous and balanced scientific information to decision makers**.
- By endorsing the IPCC reports, **governments acknowledge the authority of their scientific content**.
- The work of the organization is **therefore policy-relevant and yet policy-neutral, never policy-prescriptive**.



**Small, low income, vulnerable people & nations:
They are least responsible,
yet likely to be impacted the most!**

The IPCC has three working groups and a Task Force:

Working Group I (WGI) assesses the scientific aspects of the climate system and climate change.

Working Group II (WGII) addresses the vulnerability of socio-economic and natural systems to climate change, negative and positive consequences of climate change, and options for adapting to it.

Working Group III (WGIII) assesses options for limiting greenhouse gas emissions and otherwise mitigating climate change

The Task Force on National Greenhouse Gas Inventories oversees the National Greenhouse Gas Inventories Program

The **Fourth Assessment Report (AR4)** was released in 2007, and it consists of four volumes: the three IPCC Working Groups (WGs) Reports and a Synthesis Report (SYR)



© The Nobel Foundation

IPCC honoured with the 2007 Nobel Peace Prize

The AR4 Synthesis Report

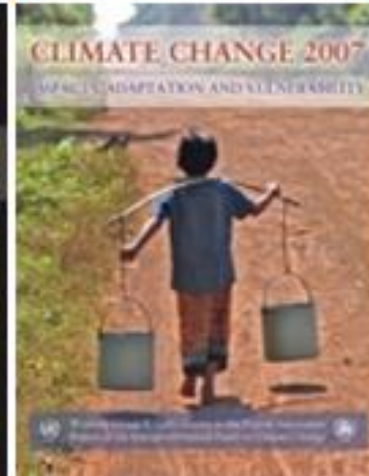
WG I
The Physical Science Basis

WG II
Impacts, Adaptation and Vulnerability

WG III
Mitigation of Climate Change

Climate Change 2007:
Synthesis Report

Summary for Policymakers



An Assessment of the Intergovernmental Panel on Climate Change

This summary approved in detail at IPCC Plenary XXVII (Bali, Indonesia, 12-17 November 2007), represents the formally agreed statement of the IPCC concerning key findings and uncertainties contained in the Working Group contributions to the Fourth Assessment Report.

Based on a draft prepared by:

Larry Birnbaum, Peter Bosch, Osvaldo Canziani, Zhenlin Chan, Renato Christ, Ogunlade Deckson, William Hare, Suleyman Hsu, David Karoly, Vladimir Kattsov, Zbigniew Kundzewicz, Jian Li, Ulrike Lohmann, Martin Manabe, Toshi Matsuno, Barbara Mearns, Bert Metz, Montuul Mirza, Neville Nicholls, Leonard Ntsoa, Rajendra Pachauri, Juan Palisot, Martin Parry, Dasha Qin, Nijavalli Ravindranath, Andy Reisinger, Jitwan Rian, Keywan Riahi, Cynthia Rosenzweig, Marika Rusticucci, Stephen Schneider, Yubei Tokina, Susan Solomon, Peter Stott, Howard Strubbe, Toshi Sugiyama, Rob Swart, Dennis Tzipak, Colleen Vogel, Gary Yeh

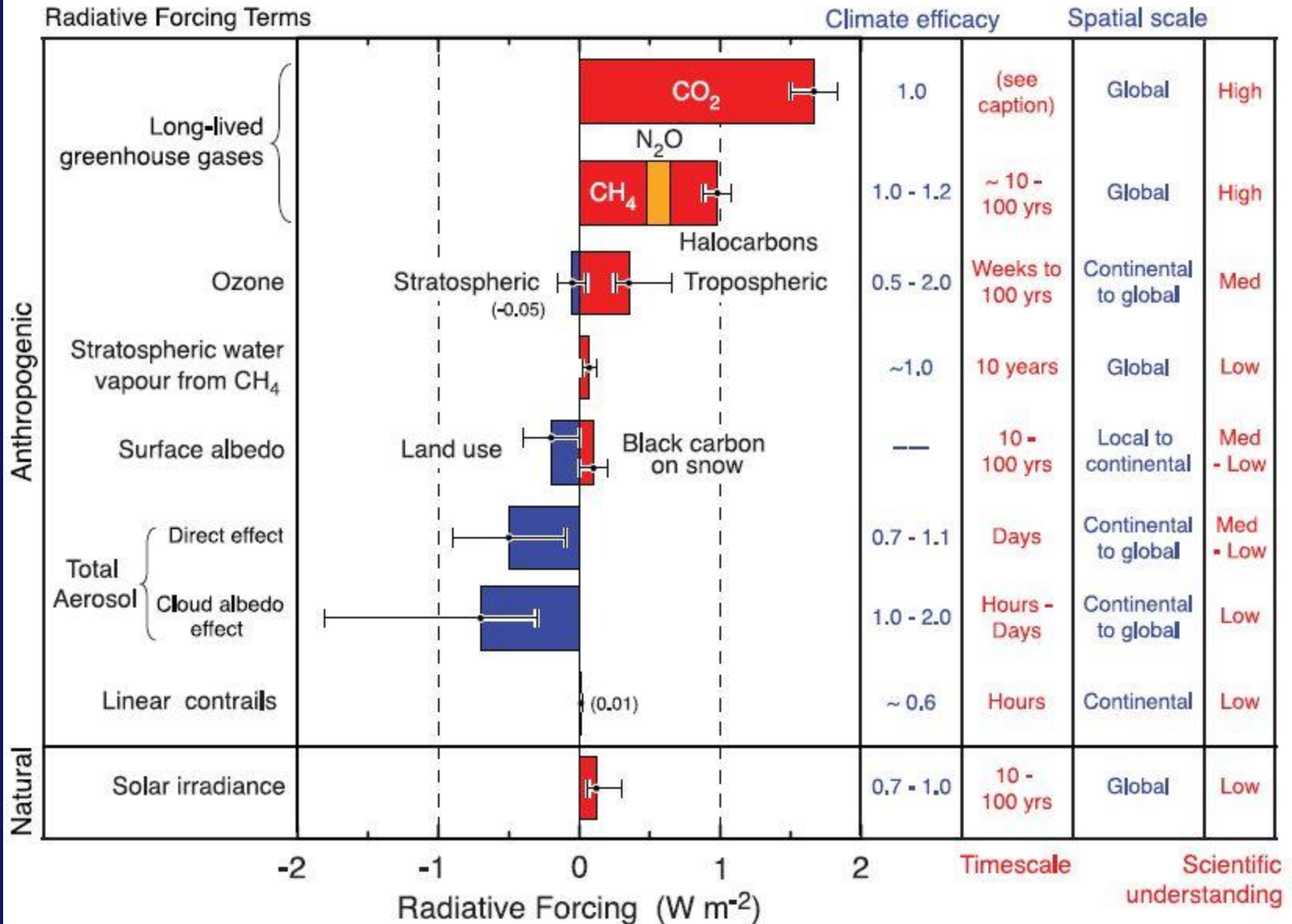
<http://www.ipcc.ch/>

Estimates of confidence in the report's results / conclusions:

- **virtually certain** (greater than 99% chance that a result is true)
- **very likely** (90-99% chance);
- **likely** (66-90% chance);
- **medium likelihood** (33-66% chance);
- **unlikely** (10-33% chance);
- **very unlikely** (1-10% chance);
- **exceptionally unlikely** (less than 1% chance).



Radiative forcing of climate between 1750 and 2005

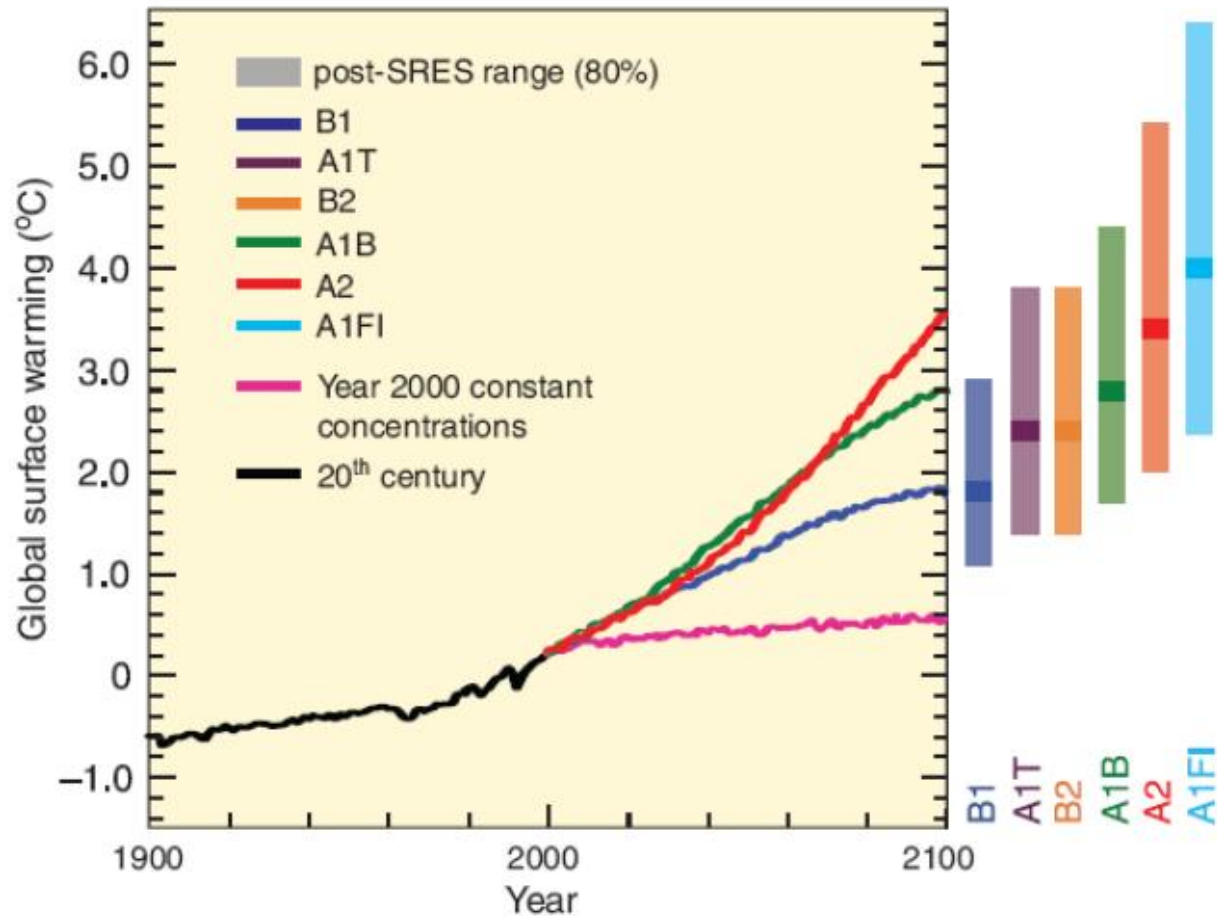
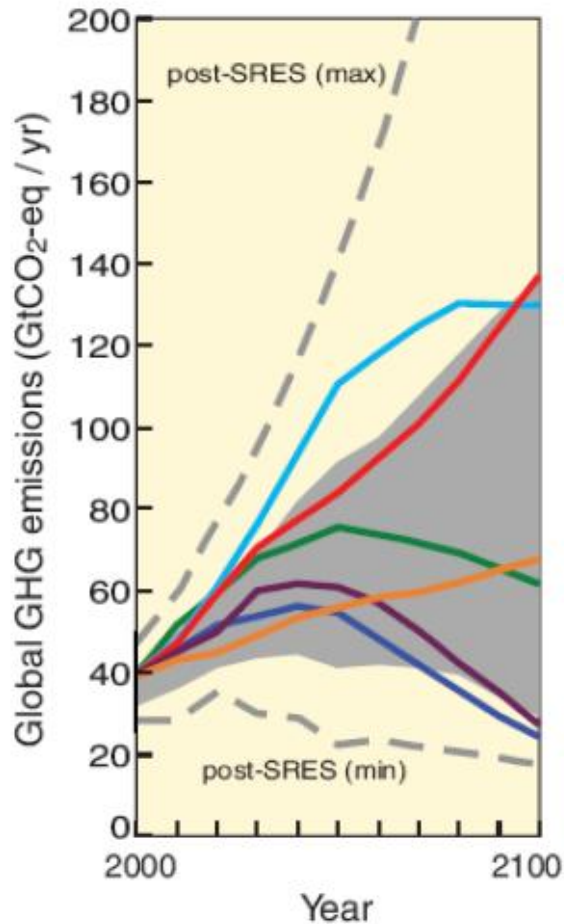


SOURCE: IPCC 2007 WG-1 Synthesis Report Summary for Policymakers

IPCC 2007:

Projected Climate Change for Different Scenarios of GHG Emissions

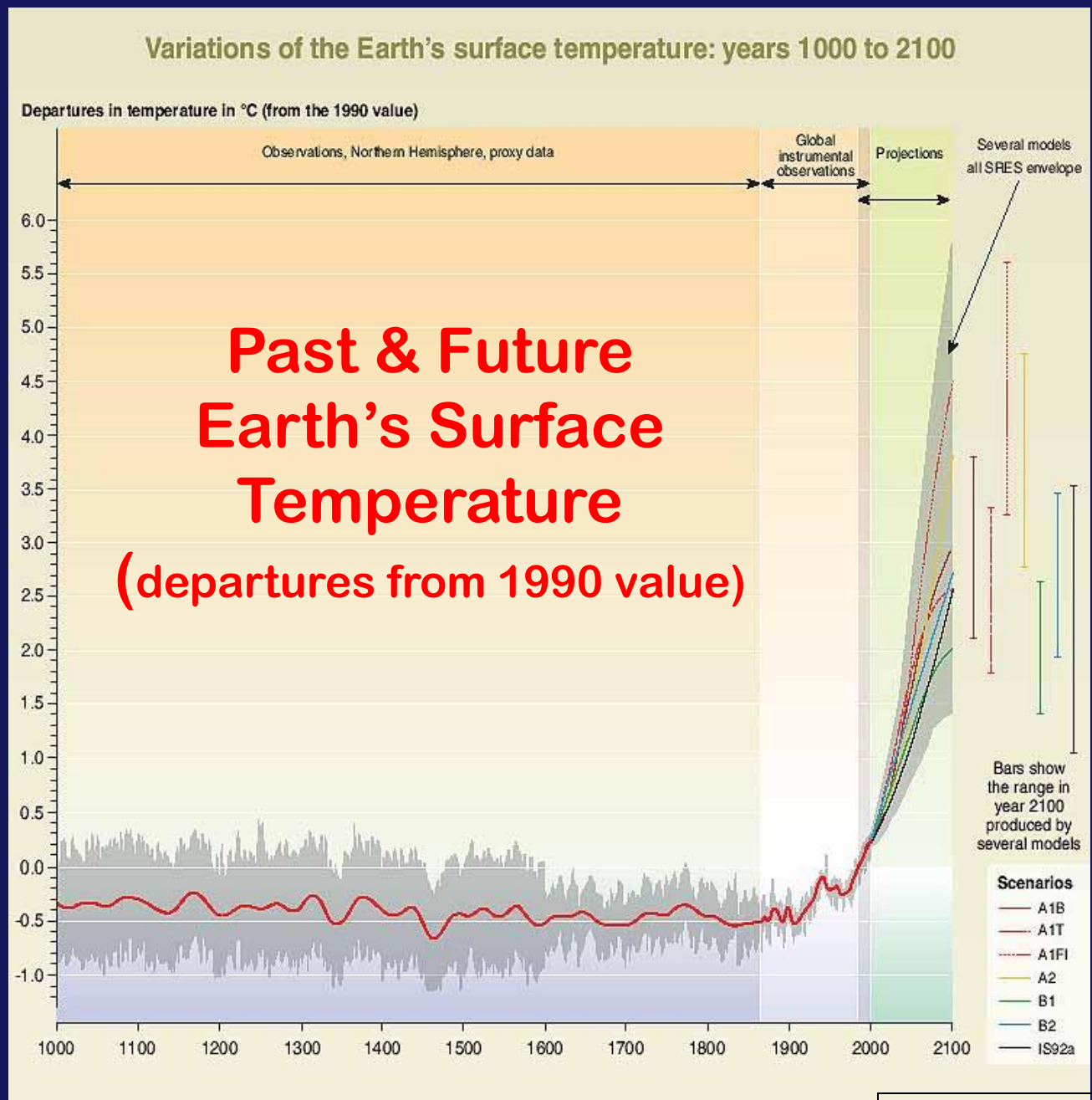
Scenarios for GHG emissions from 2000 to 2100 (in the absence of additional climate policies) and projections of surface temperatures



“Hockey Stick”
approach
introduced in:

2001 IPCC
THIRD
ASSESSMENT
REPORT

GLOBAL
SURFACE
TEMPERA-
TURE
CHANGE
(° C)
(compared
to 1990
value)



Self test 7

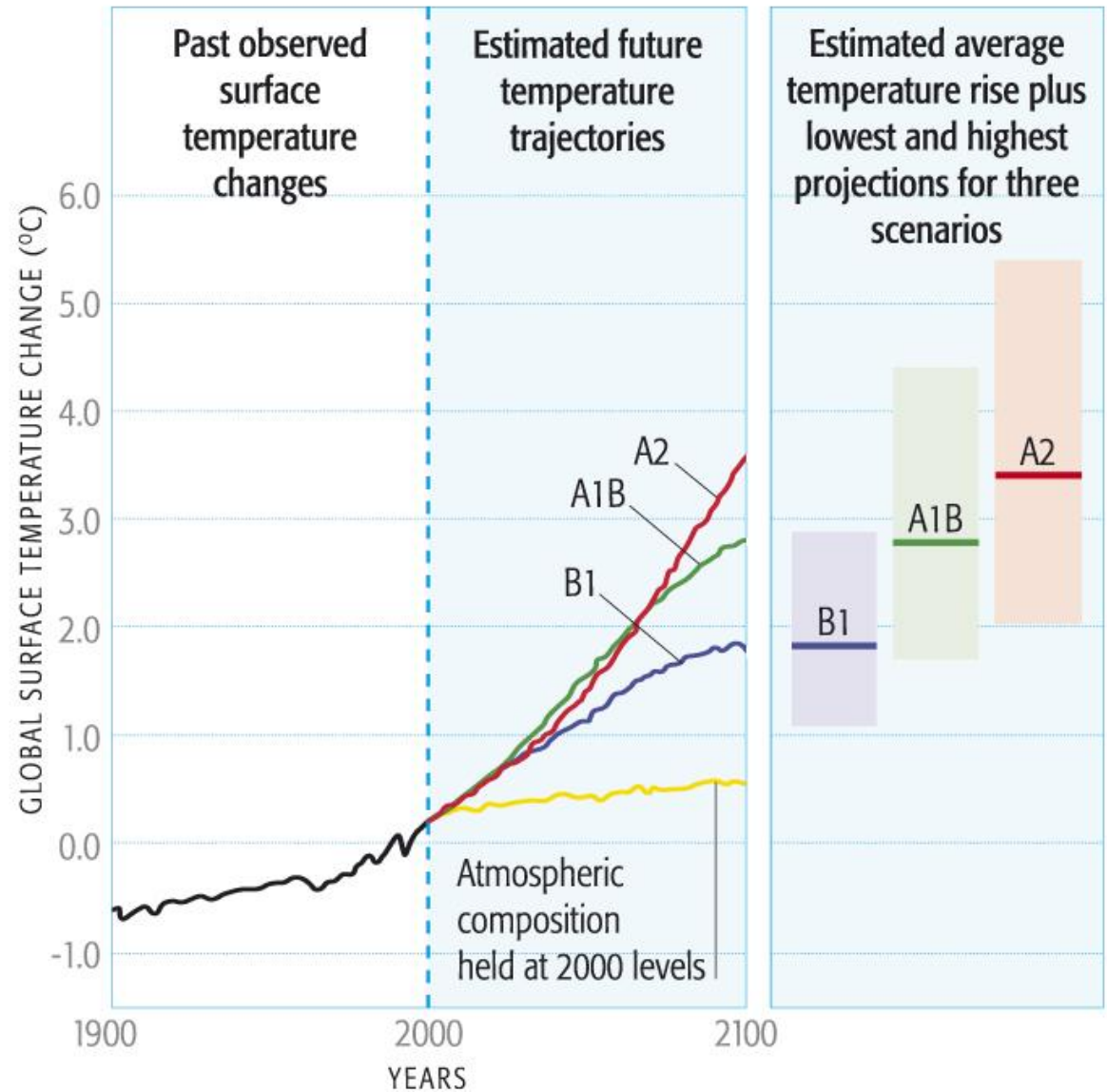
Updated
version in AR4:

2007 IPCC
FOURTH
ASSESSMENT
REPORT

**GLOBAL
SURFACE
TEMPERA-
TURE
CHANGE
(° C)**

Compared
to 1980-
1999
period

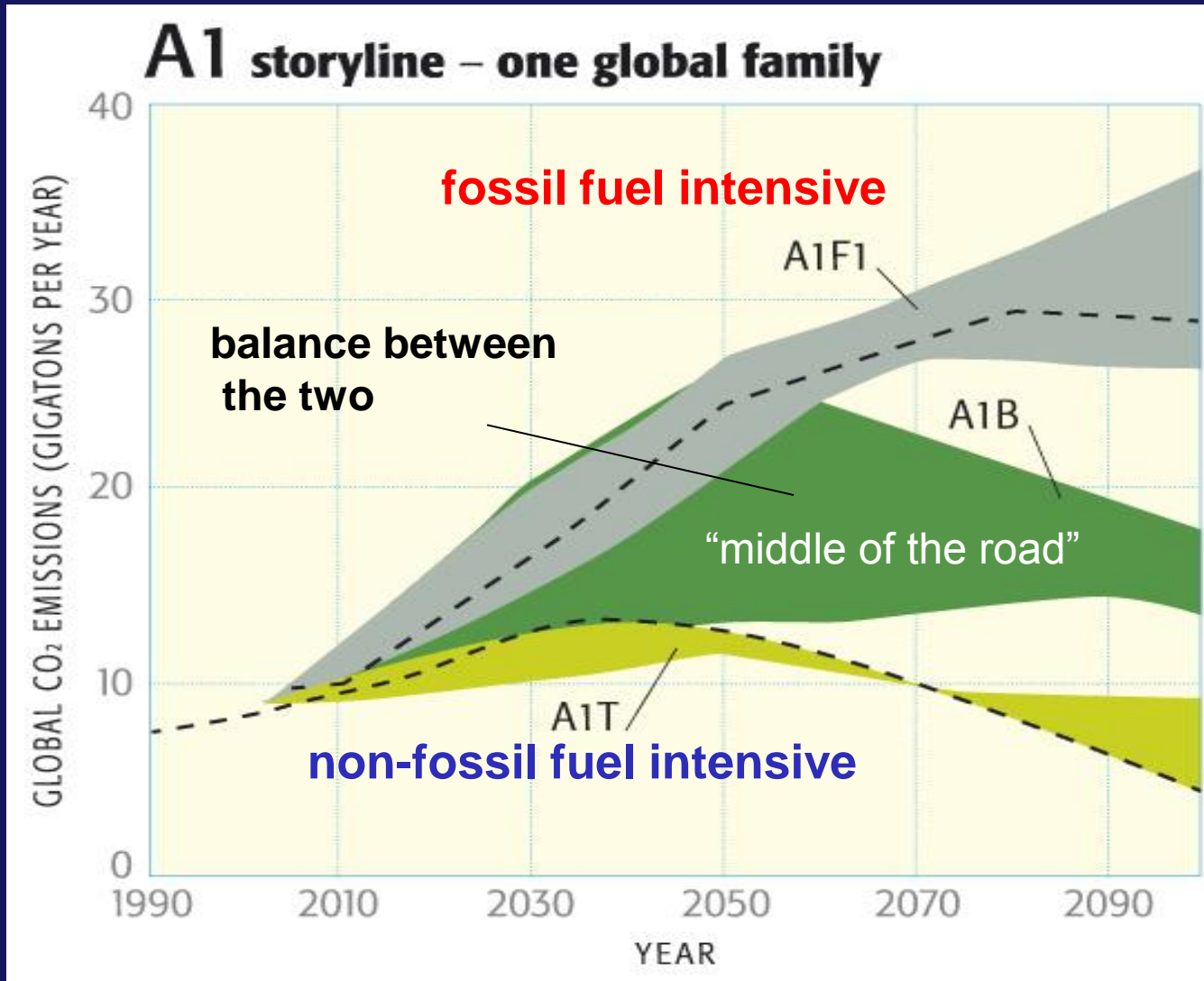
POSSIBLE PATHS OF FUTURE GLOBAL WARMING



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From *Dire Predictions* (p 20)

Possible CO₂ emissions scenarios, or “storylines”



If these things happened . . .

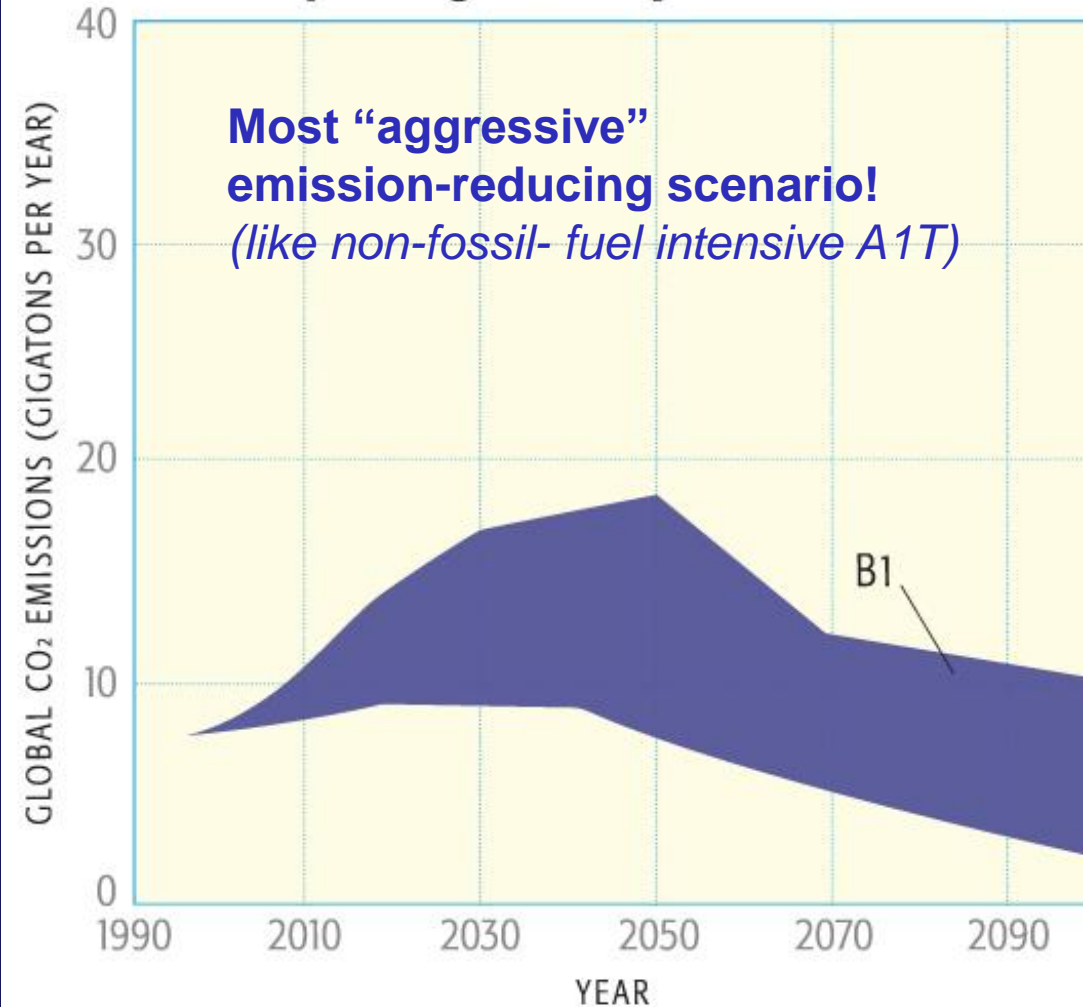
- Regional income differences reduced
- Rapid economic growth
- Peak population in mid 21st century, then declining
- Rapid intro of new more efficient technology

If these things happened . . .

- Emphasis on GLOBAL solutions to sustainability & environmental protection
- Rapid change to information & service economy
- Peak population in mid-21st century, then declining
- Less intense demand for materials
- Intro of clean and efficient energy technologies

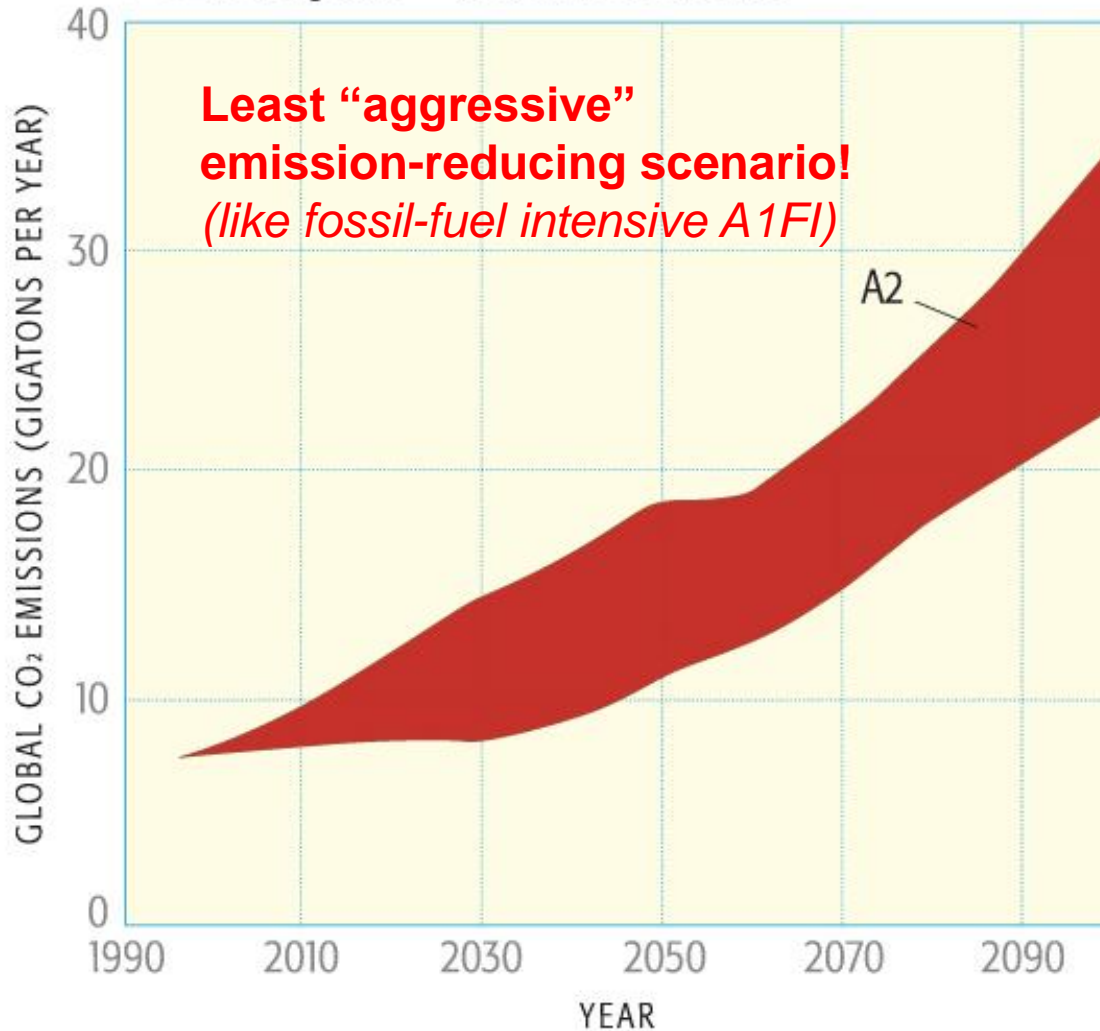
B1 storyline – global utopia

**Most “aggressive”
emission-reducing scenario!**
(like non-fossil-fuel intensive A1T)



A2 storyline – a divided world

**Least “aggressive”
emission-reducing scenario!**
(like fossil-fuel intensive A1FI)



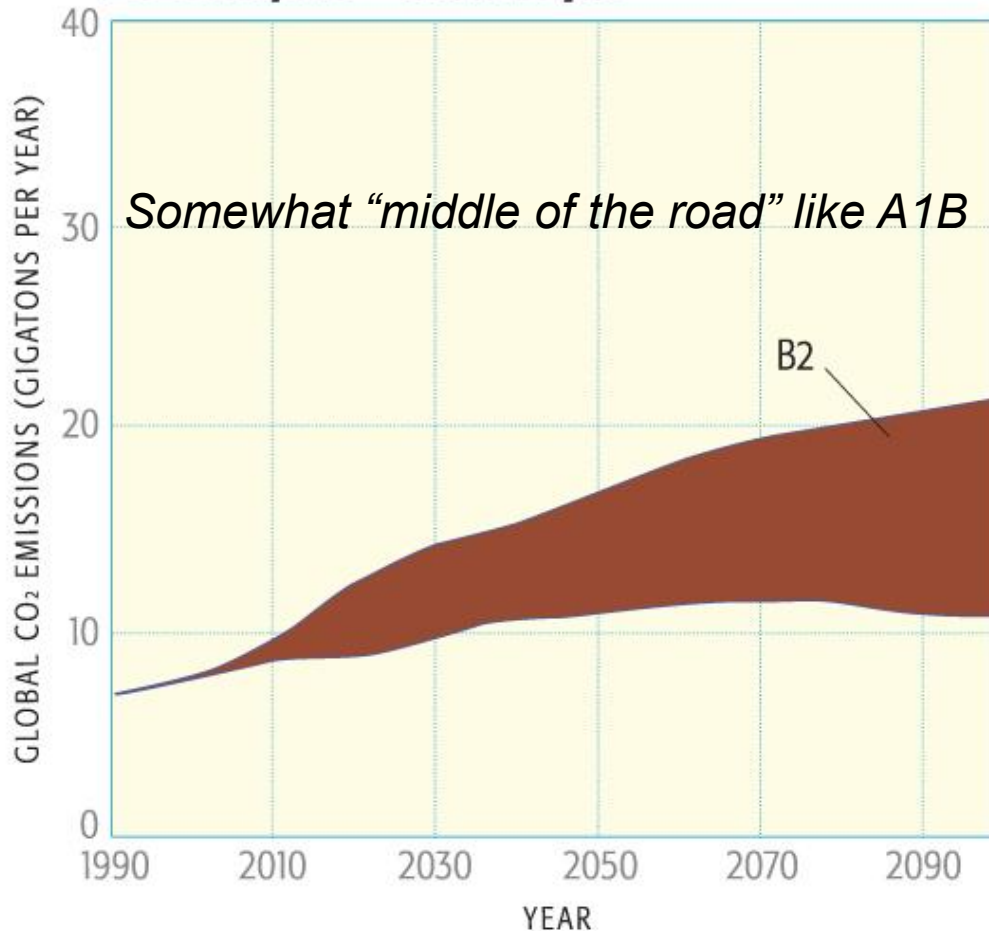
***If these things
happened . . .***

- Emphasis on national identities and local/regional (not global) solutions to environmental protection and social equity
- Slow economic growth
- Continuously increasing world population
- Slow technological advancement

POSSIBLE CO₂ EMISSIONS SENARIOS FOR THE FUTURE

If these things happened . . .

B2 storyline – local utopia



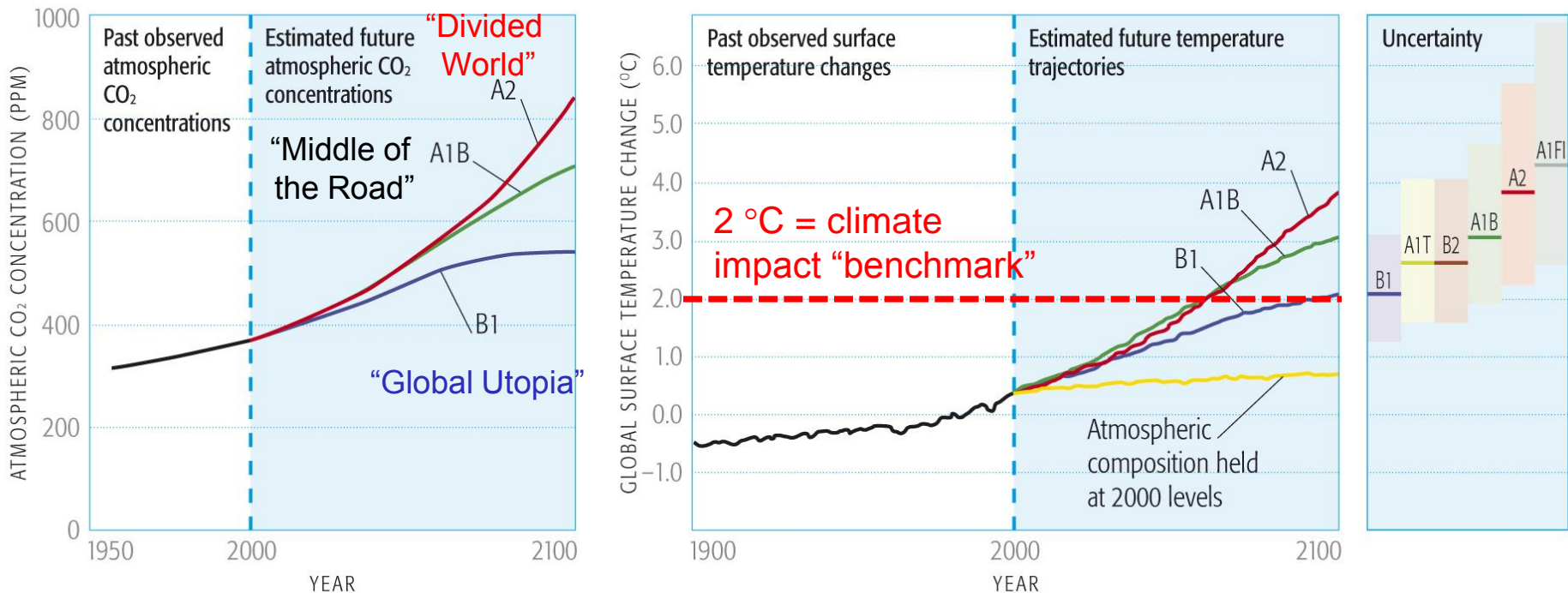
- Emphasis on local and regional (not global) solutions to environmental protection & social equity
- Intermediate economic development
- Continuously increasing world population (but slower than A2)
- Slower development of new energy technologies than B1 and A1

RANGE OF POSSIBLE TRAJECTORIES FOR FUTURE CLIMATE CHANGE

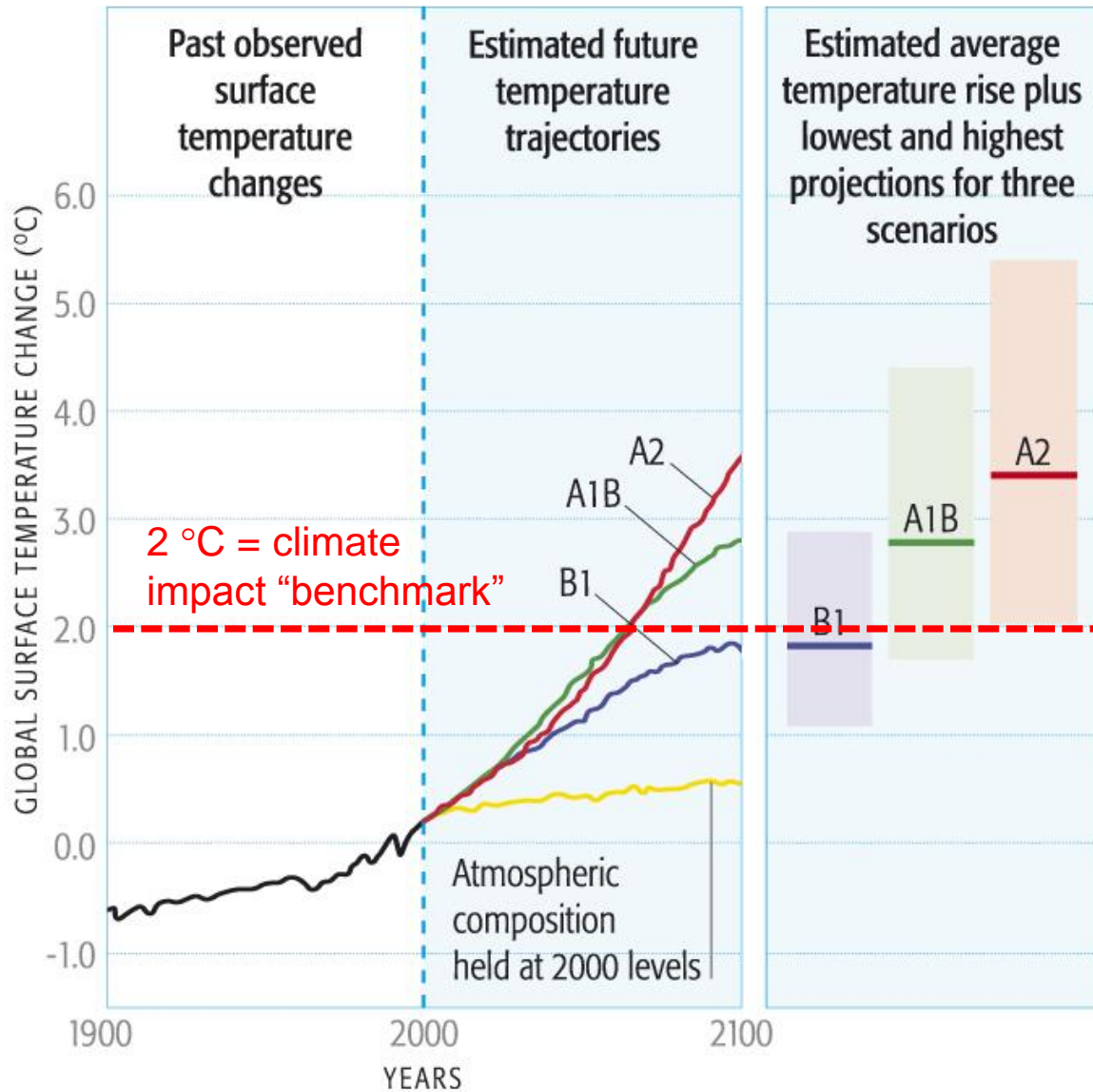
Spread of results due to:

- (a) which future emission scenario used
- (b) variations among different climate models

ESTIMATED CO₂ AND TEMPERATURE TRAJECTORIES FOR VARIOUS EMISSIONS SCENARIOS



POSSIBLE PATHS OF FUTURE GLOBAL WARMING



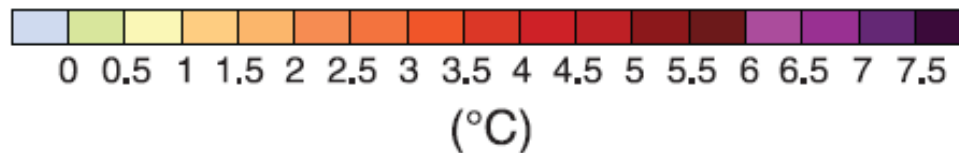
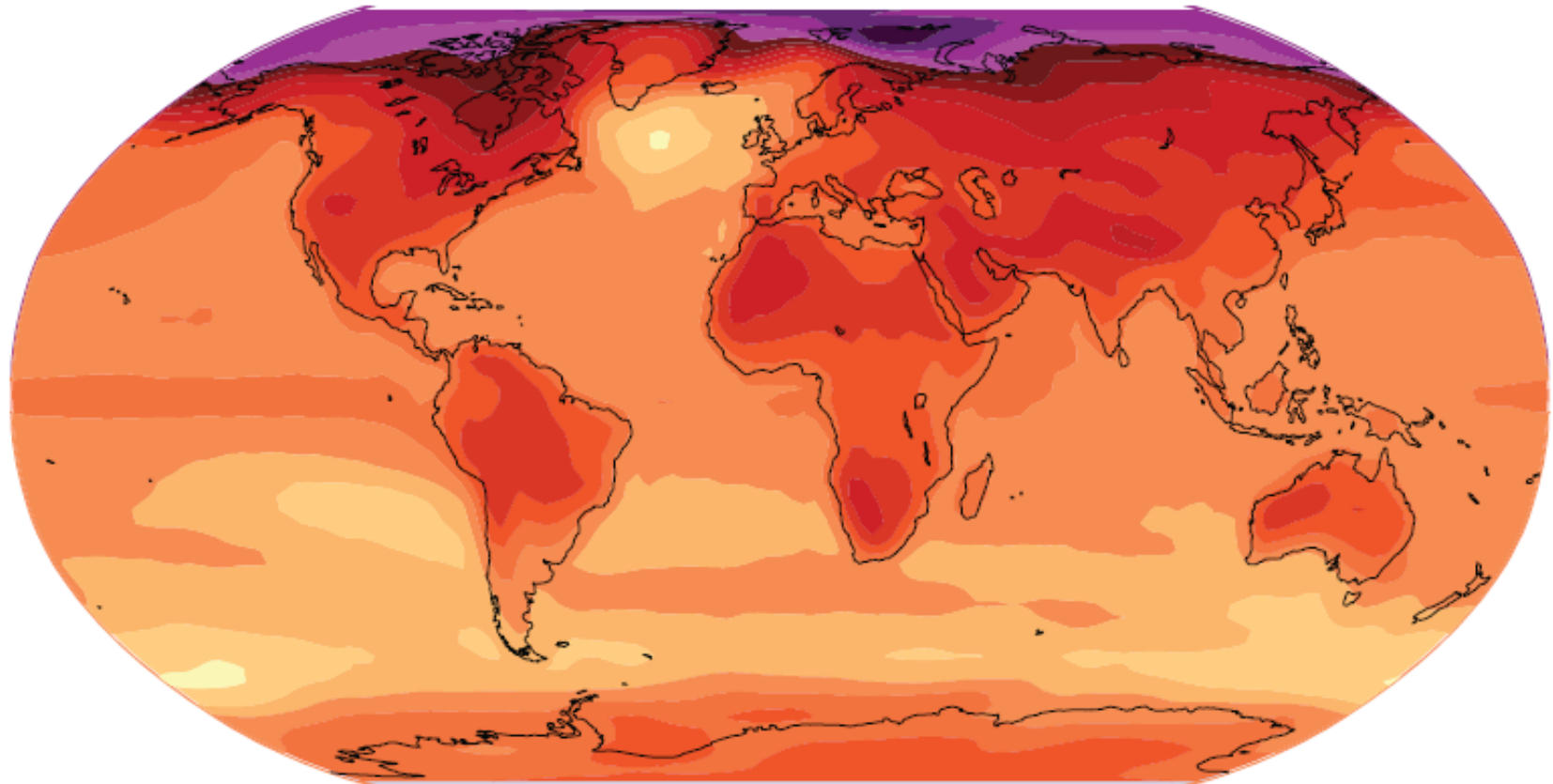
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GLOBAL
SURFACE
TEMPERA-
TURE
CHANGE
(° C)

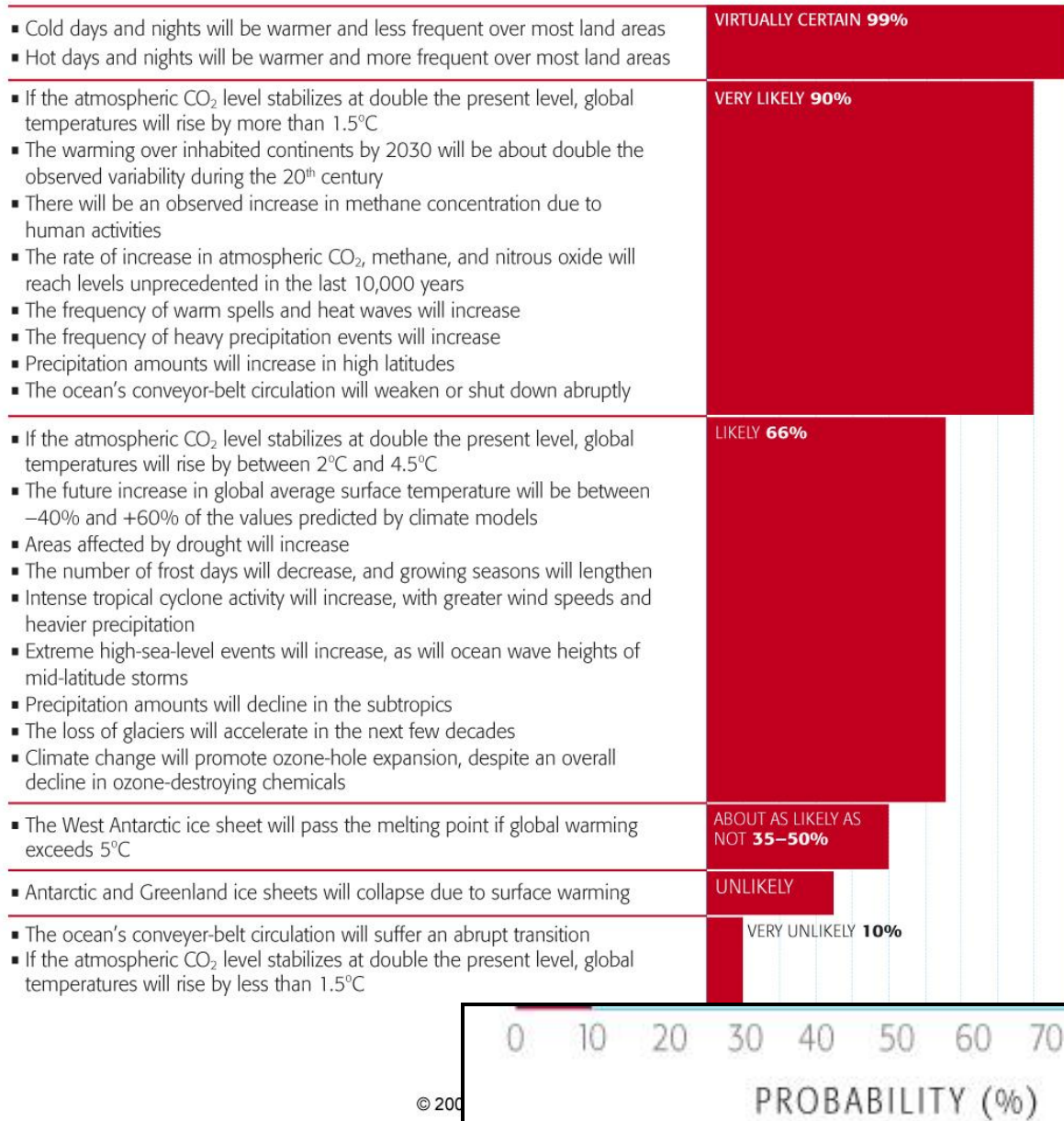
From *Dire Predictions* (p 20)

Projected Warming by Late 21st Century (2090-2099) based on the A1B “Middle of the Road” Scenario

Geographical pattern of surface warming



IPCC PROJECTIONS FOR THE 21ST CENTURY



© 200

From *Dire Predictions* (p 21)

IPCC PROJECTIONS FOR THE 21ST CENTURY

VIRTUALLY CERTAIN 99%

- Cold days and nights will be warmer and less frequent over most land areas
- Hot days and nights will be warmer and more frequent over most land areas

VIRTUALLY CERTAIN 99%

0 10 20 30 40 50 60 70 80 90

PROBABILITY (%)

- Over most land areas: **COLD DAYS & NIGHTS** will be **WARMER**;
cold days & nights will be **LESS FREQUENT**
- Over most land areas: **HOT DAYS & NIGHTS** will be **WARMER**;
hot days & nights will be **MORE FREQUENT**

IPCC PROJECTIONS FOR THE 21ST CENTURY

VERY LIKELY 90%

- **GLOBAL TEMPERATURES WILL RISE** by **> 1.5 °C** (if CO₂ stabilizes at 2x)
- **WARMING by 2030** will be **DOUBLE** the observed variability during 20th century
- **RATE of increase** of GHG's will be **UNPRECEDENTED** in 10,000 yrs
- Frequency of **WARM SPELLS & HEAT WAVES** will **INCREASE**
- Frequency of **HEAVY PRECIPITATION EVENTS** will **INCREASE**
- **Ocean's conveyor-belt circulation** will **WEAKEN OR SHUT DOWN** abruptly

- If the atmospheric CO₂ level stabilizes at double the present level, global temperatures will rise by more than 1.5°C
- The warming over inhabited continents by 2030 will be about double the observed variability during the 20th century
- There will be an observed increase in methane concentration due to human activities
- The rate of increase in atmospheric CO₂, methane, and nitrous oxide will reach levels unprecedented in the last 10,000 years
- The frequency of warm spells and heat waves will increase
- The frequency of heavy precipitation events will increase
- Precipitation amounts will increase in high latitudes
- The ocean's conveyor-belt circulation will weaken or shut down abruptly

VERY LIKELY 90%

IPCC PROJECTIONS FOR THE 21ST CENTURY

LIKELY 66%

- **GLOBAL TEMPERATURES WILL RISE : 2 - 4.5 °C** (if CO₂ stabilizes at 2x)
- Areas affected by **DROUGHT** will increase
- **# of FROST DAYS** will DECREASE; **GROWING SEASON LENGTHEN**
- **INTENSE Tropical Cyclone Activity** will INCREASE – wind, heavy rain
- Extreme **HIGH SEA LEVEL** events will increase, wave heights
- **SUBTROPICS** (that's us!): **PRECIPITATION DECLINE**
- **GLACIER LOSS** accelerates
- Stratospheric cooling → **ozone hole persistence**; even WITH ban of CFC's

- If the atmospheric CO₂ level stabilizes at double the present level, global temperatures will rise by between 2°C and 4.5°C
- The future increase in global average surface temperature will be between –40% and +60% of the values predicted by climate models
- Areas affected by drought will increase
- The number of frost days will decrease, and growing seasons will lengthen
- Intense tropical cyclone activity will increase, with greater wind speeds and heavier precipitation
- Extreme high-sea-level events will increase, as will ocean wave heights of mid-latitude storms
- Precipitation amounts will decline in the subtropics
- The loss of glaciers will accelerate in the next few decades
- Climate change will promote ozone-hole expansion, despite an overall decline in ozone-destroying chemicals

LIKELY 66%

IPCC PROJECTIONS FOR THE 21ST CENTURY

AS LIKELY AS NOT 35 - 50%

- **W. ANTARCTIC ICE SHEET MELTING (if Temp > 5° C)**

- The West Antarctic ice sheet will pass the melting point if global warming exceeds 5°C

ABOUT AS LIKELY AS
NOT **35-50%**

UNLIKELY 35%

- **ANTARCTIC & GREENLAND ICE SHEETS COLLAPSE**

- Antarctic and Greenland ice sheets will collapse due to surface warming

UNLIKELY

VERY UNLIKELY 10%

- Ocean's **CONVEYOR BELT CIRCULATION** – abrupt transition

- **GLOBAL TEMPERATURES** will rise by LESS than **1.5° C** (if CO₂ stabilizes at 2x)

- The ocean's conveyer-belt circulation will suffer an abrupt transition
- If the atmospheric CO₂ level stabilizes at double the present level, global temperatures will rise by less than 1.5°C

VERY UNLIKELY **10%**

SEA LEVEL RISE

Table SPM.1. Projected global average surface warming and sea level rise at the end of the 21st century. {Table 3.1}

Case	Temperature change (°C at 2090-2099 relative to 1980-1999) ^{a, d}		Sea level rise (m at 2090-2099 relative to 1980-1999)
	Best estimate	Likely range	Model-based range excluding future rapid dynamical changes in ice flow
Constant year 2000 concentrations ^b	0.6	0.3 – 0.9	Not available
B1 scenario	1.8	1.1 – 2.9	0.18 – 0.38
A1T scenario	2.4	1.4 – 3.8	0.20 – 0.45
B2 scenario	2.4	1.4 – 3.8	0.20 – 0.43
A1B scenario	2.8	1.7 – 4.4	0.21 – 0.48
A2 scenario	3.4	2.0 – 5.4	0.23 – 0.51
A1FI scenario	4.0	2.4 – 6.4	0.26 – 0.59



Department of Geosciences
Environmental Studies Laboratory

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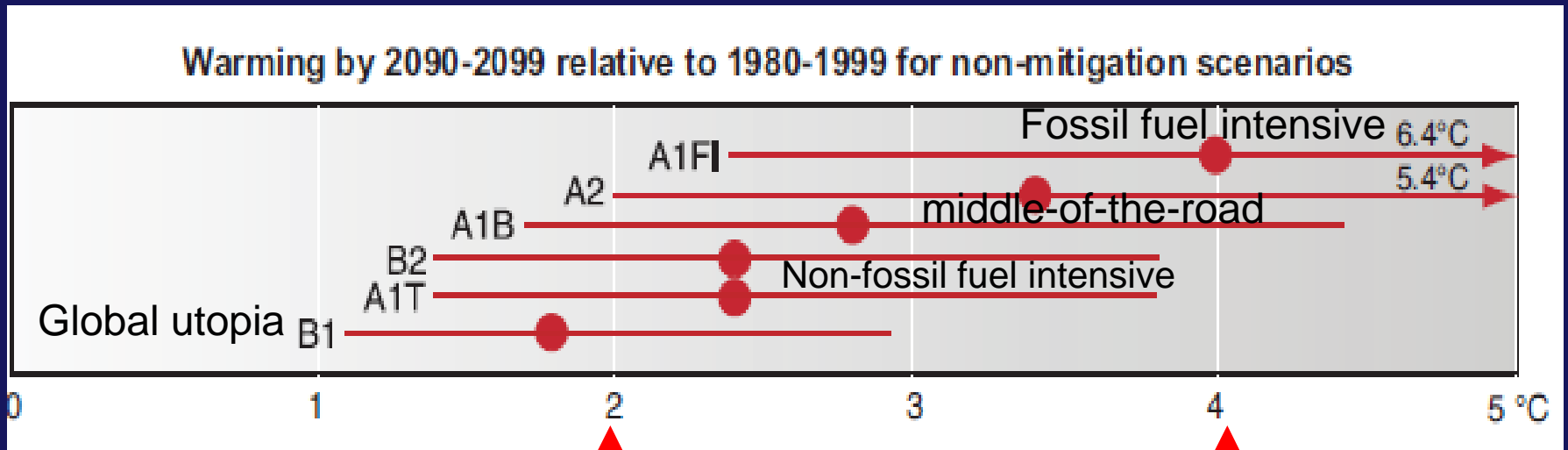
Climate Change and Sea Level



http://www.geo.arizona.edu/dgesl/research/other/climate_change_and_sea_level/sea_level_rise/sea_level_rise_old.htm#images

IMPACTS

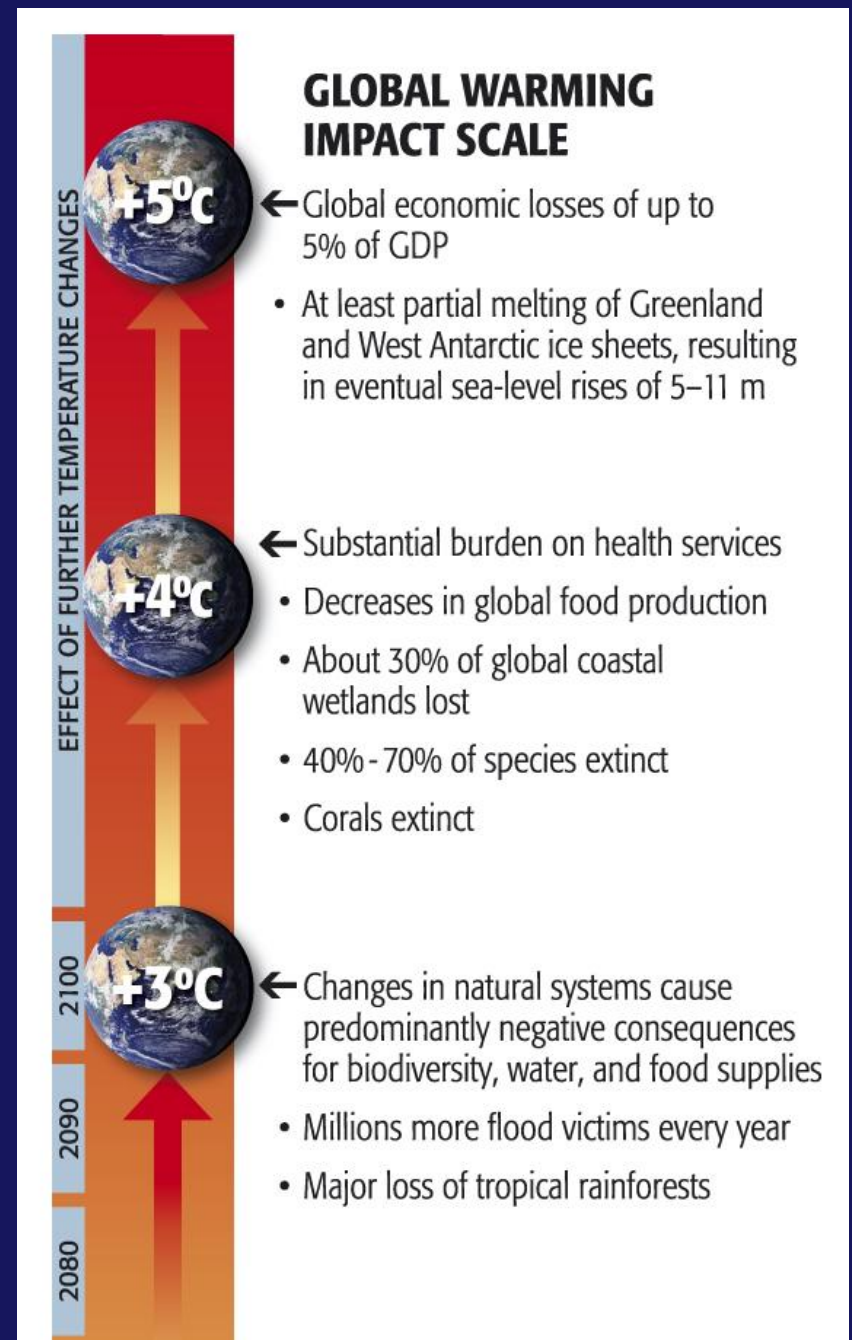
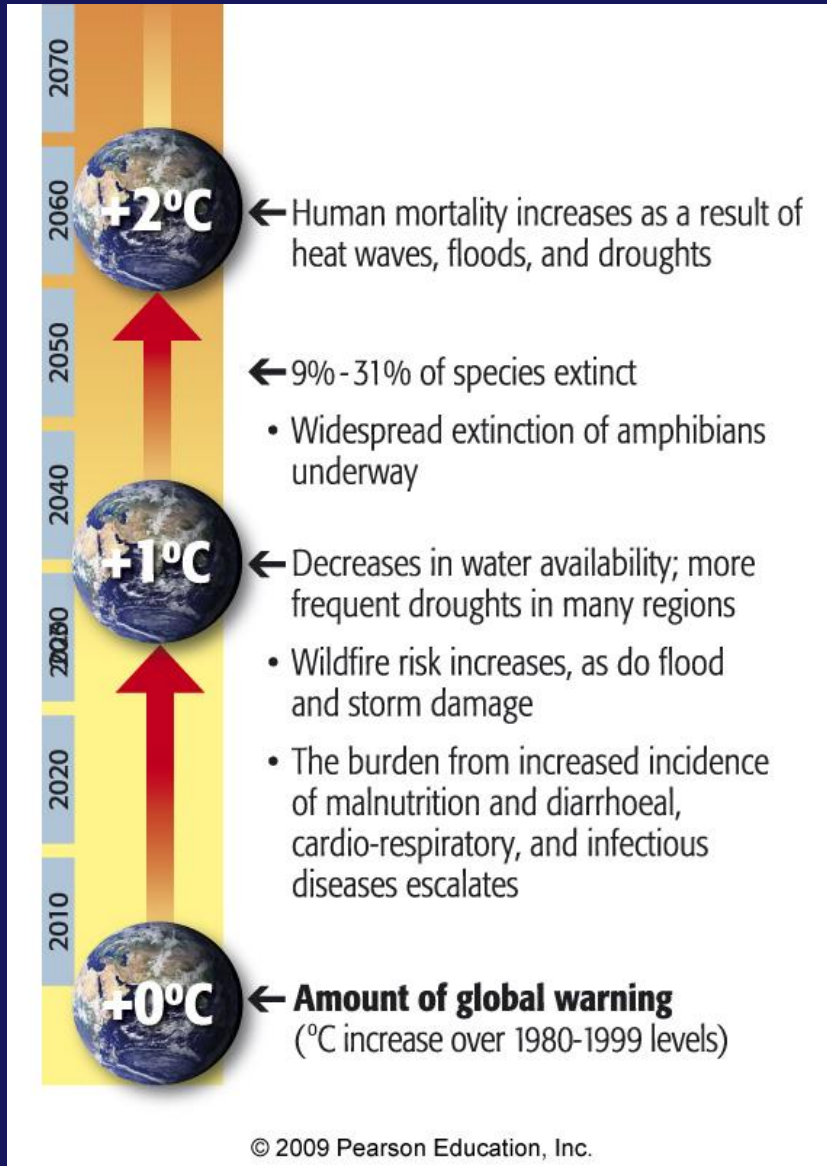
an introduction . . .



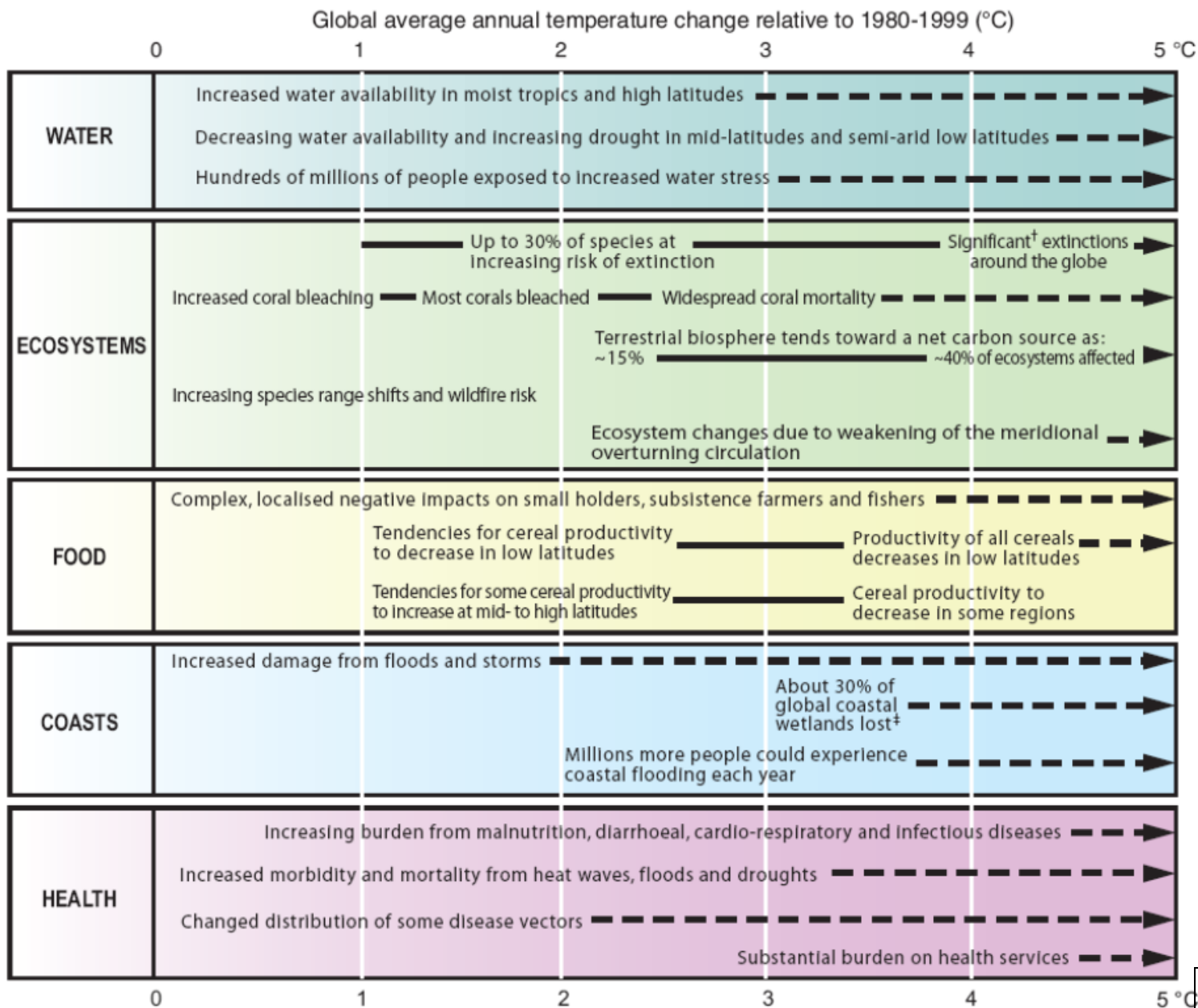
CO₂ increasing so fast that it may be difficult to stay BELOW 450 ppm (2° C warming)

Latest science suggests that hitting 4° C warming is far more likely than originally thought !

GLOBAL WARMING IMPACT SCALE



Examples of impacts associated with global average temperature change
 (Impacts will vary by extent of adaptation, rate of temperature change and socio-economic pathway)



† Significant is defined here as more than 40%. ‡ Based on average rate of sea level rise of 4.2mm/year from 2000 to 2080.

GETTING READY FOR OUR LAST CLASS:

**I-4 Global Warming Debate Preparation
(last assignment)**

THE QUESTION:

**Should the United States
take aggressive and
immediate action to slow
global warming?**

**(e.g. sign the International
Climate Treaty, reduce or tax
GHG emissions, etc. etc.)**

So what do we do about it???

**NEXT: SOLUTIONS &
CHOICES**

**POLICIES & POSSIBLE
ACTIONS TO SLOW
GLOBAL WARMING . . .**





**Happy
Thanksgiving**