

The Intergovernmental Panel
on Climate Change (IPCC)
and the Challenges of Climate
Policy, Equity and Ethics

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UCLA, 16 January 2008

The Intergovernmental Panel on Climate Change (IPCC)

assesses

climate change science
in a policy-relevant but
not policy-prescriptive way.

Disclaimer: I do not speak for IPCC.

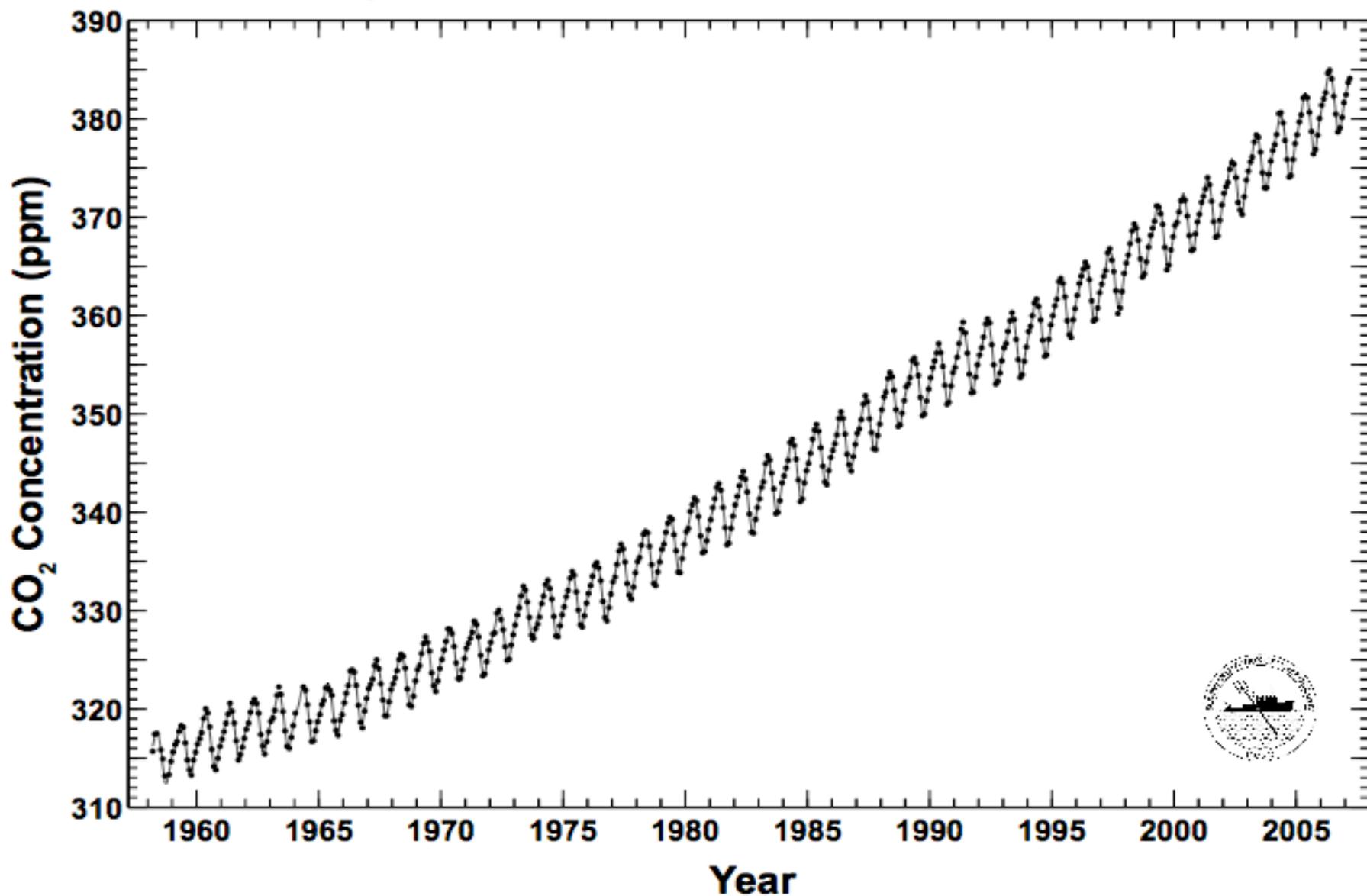
“Human beings are now carrying out a large-scale geophysical experiment of a kind that could not have happened in the past nor be reproduced in the future.”

- Roger Revelle and Hans Suess, 1957

Mauna Loa Observatory, Hawaii Monthly Average Carbon Dioxide Concentration

Data from Scripps CO₂ Program

Last updated March 2007



www.ipcc.ch

Free download of the full 2007 IPCC Fourth Assessment Report [AR4] is available now.

This report is also published in hard copy by Cambridge University Press.

The Working Group One part (1,000 pages) of AR4 deals with the physical climate system.

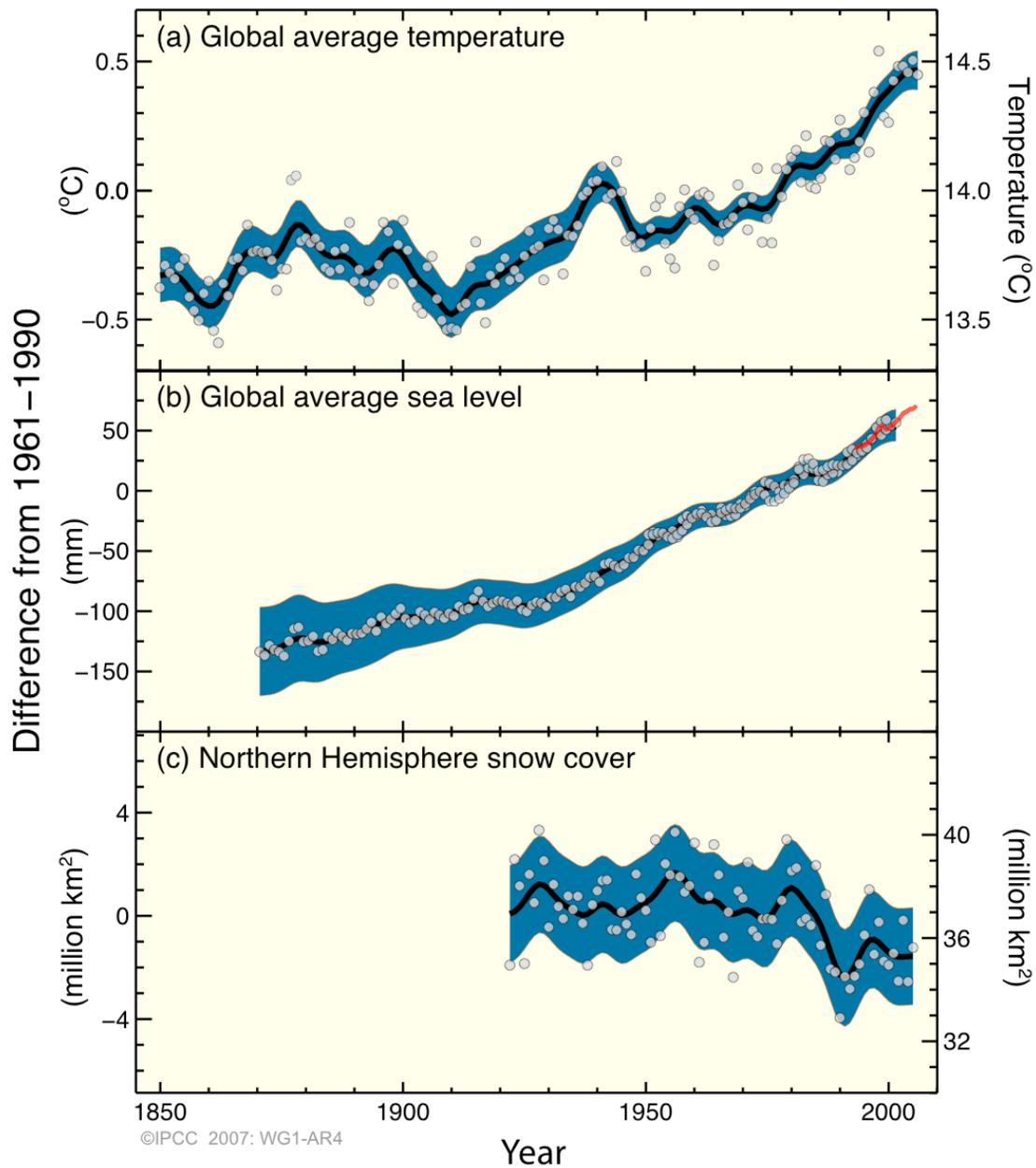


The 20-page Summary for Policymakers was negotiated and approved line-by-line at a plenary in Paris in January-February 2007.

More than 100 governments unanimously approved every word of the Summary. The IPCC Coordinating Lead Authors were present to answer questions and to ensure that the Summary conformed with the report.

The science was never compromised.

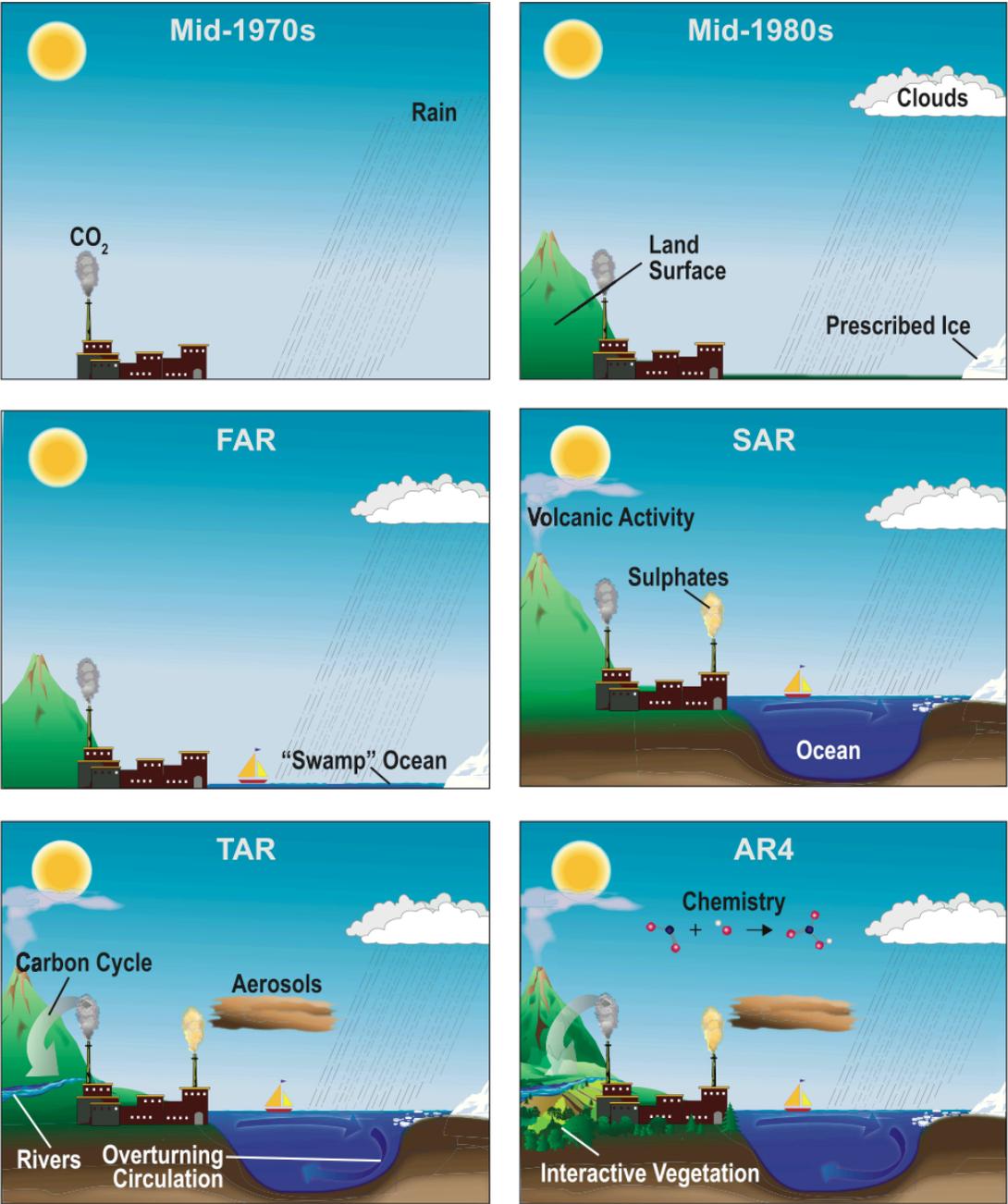
Changes in Temperature, Sea Level and Northern Hemisphere Snow Cover

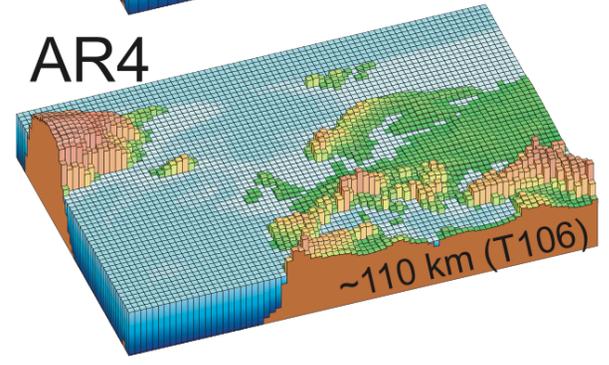
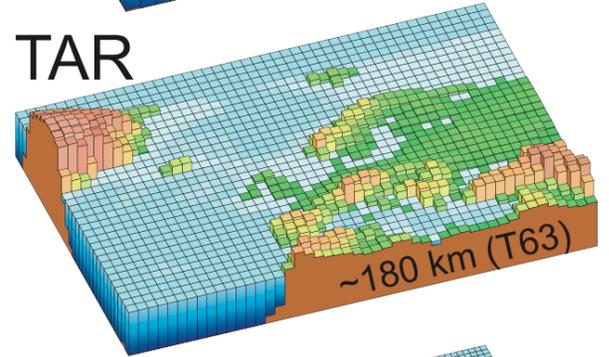
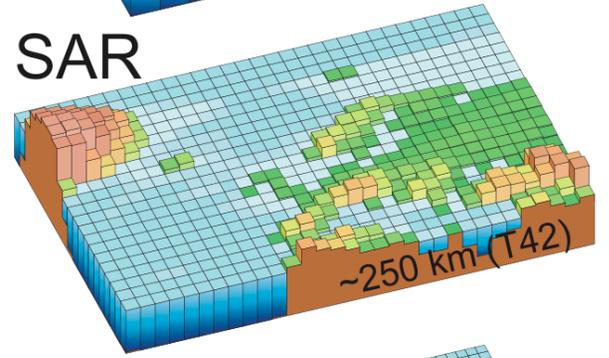
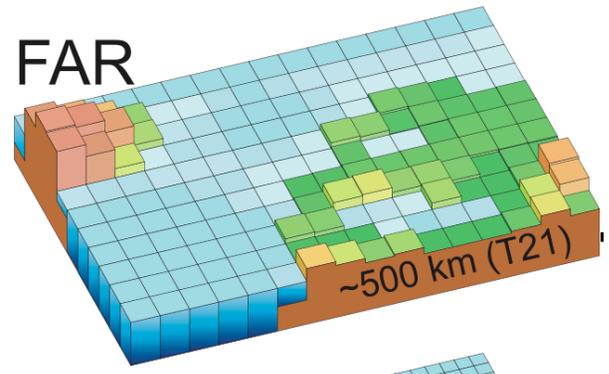


*Updated:
13 Feb 07*

Figure SPM-3

The World in Global Climate Models





Policymakers need an objective source of the most widely accepted scientific information about climate change, its effects, and possible response options.

The IPCC was established in 1988 to meet this need. Both governments and scientists were involved in creating the IPCC and deciding how it would work.

The World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) jointly established the IPCC.

It is important to understand that the IPCC is both governmental and scientific.

This fact has consequences: One is that the governments participate in writing IPCC reports. They are stakeholders.

IPCC does **not** conduct new research
(caveat: IPCC, by its stature, indirectly
influences what types of research are done).

The IPCC mandate is to **assess**, on a
comprehensive, objective, open and
transparent basis, the available scientific
information in peer-reviewed literature.

The 1990 IPCC First Assessment Report [FAR] confirmed the scientific basis for concern about climate change.

It helped persuade governments to adopt the UN Framework Convention on Climate Change, signed at the Earth Summit in Rio de Janeiro (1992).

UNFCCC's objective is to avoid dangerous anthropogenic climate change.

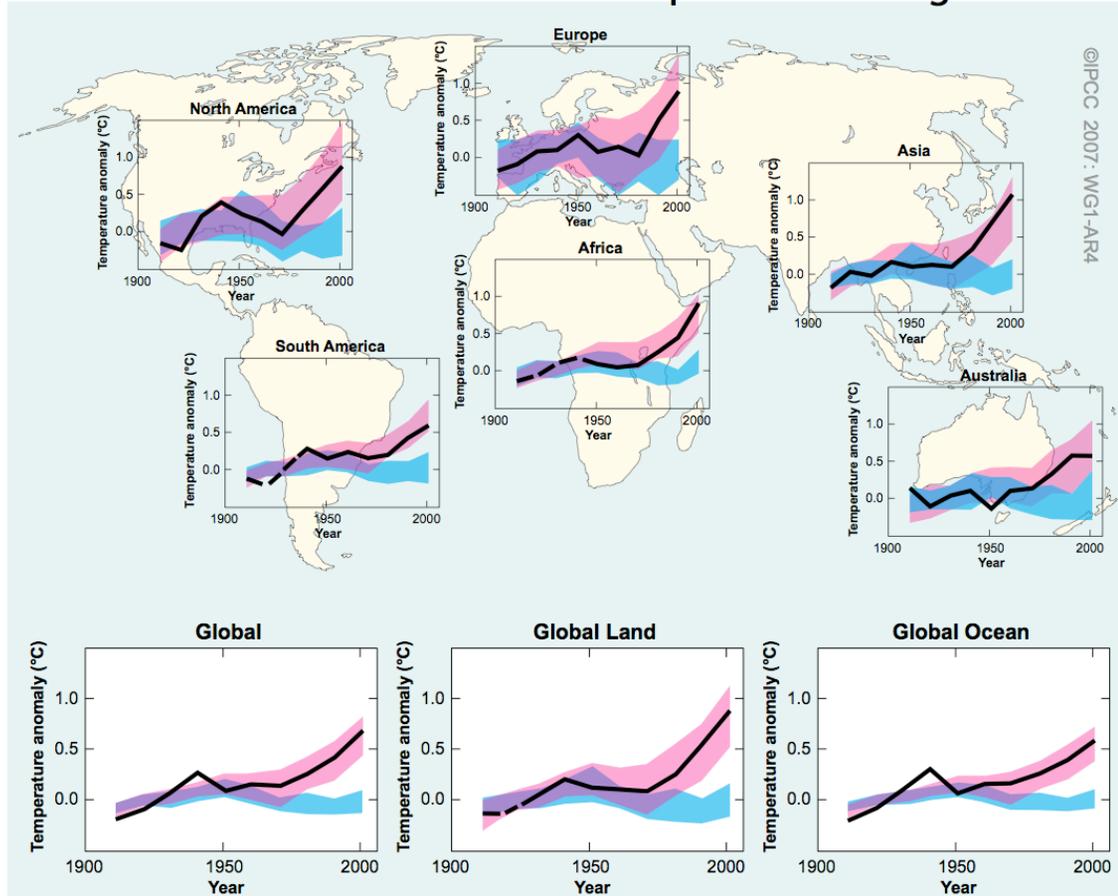
The 1995 IPCC Second Assessment Report [SAR] contributed crucially to the negotiations that led to the adoption of the Kyoto Protocol in 1997.

The Kyoto Protocol, which mandates reduced emissions of greenhouse gases, came into force in February 2005, despite the refusal of the United States to ratify it.

The 2001 IPCC Third Assessment Report [TAR] confirmed the fundamental scientific finding that most of the observed global warming in recent decades is caused by human activities.

Although the mainstream climate research community generally considers this as settled science, many non-scientists and a few experts still remain unconvinced.

Global and Continental Temperature Change



*Updated:
PLENARY*

Figure SPM-4

“The balance of evidence suggests a discernible human influence on global climate.” - IPCC (1995).

“There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.” - IPCC (2001).

“Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.”

- IPCC, Paris, 2 February 2007.

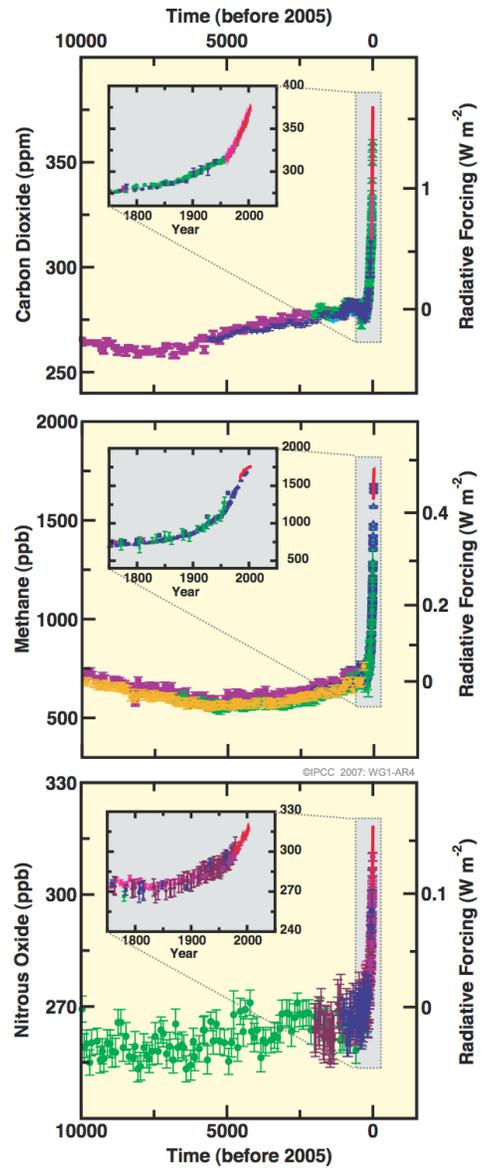
“Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations.”

- IPCC, Paris, 2 February 2007.

(‘*very likely*’ means at least 90% probable)

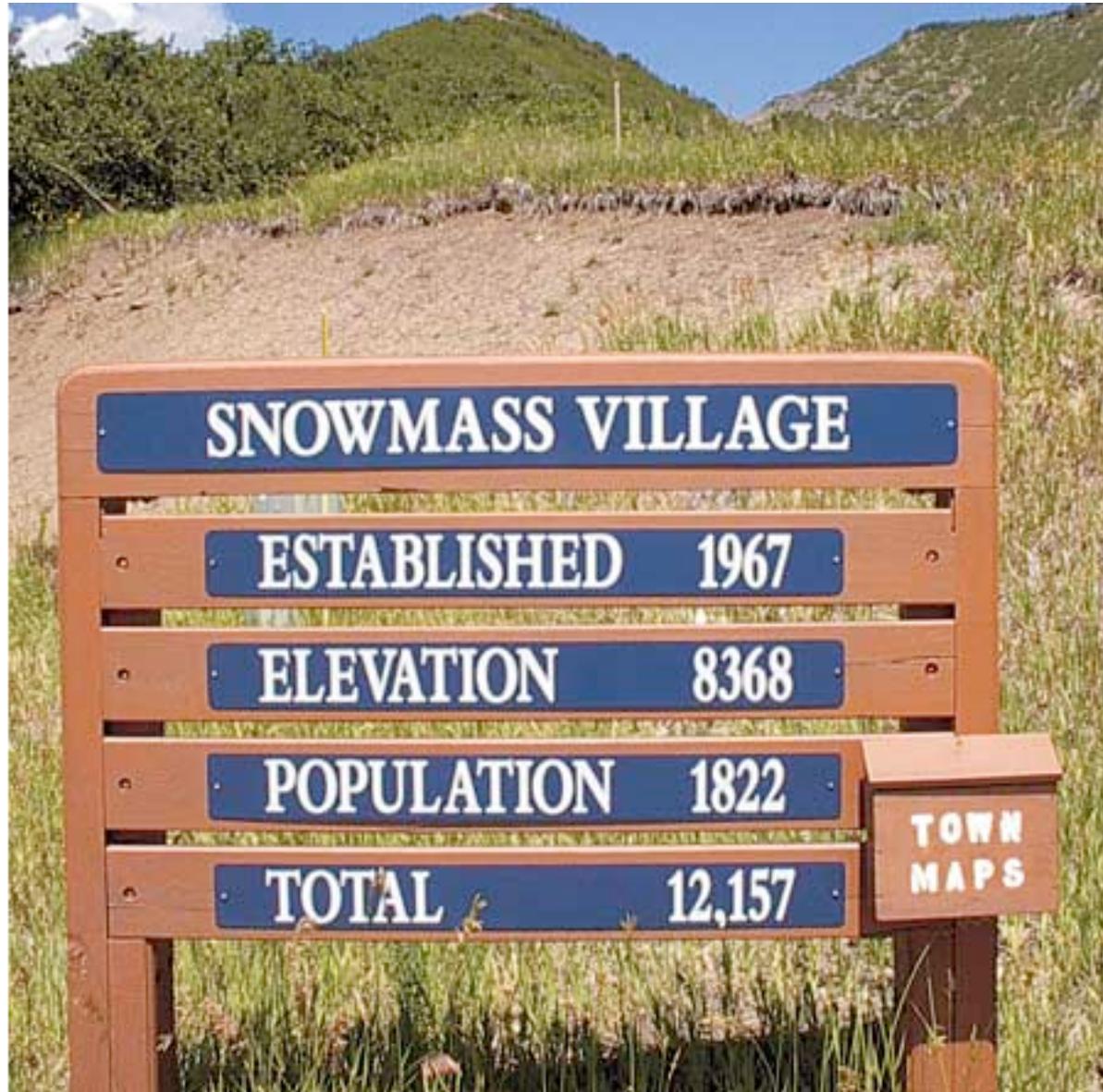
IPCC reports are at www.ipcc.ch

Changes in Greenhouse Gases from ice-Core and Modern Data



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Figure SPM-1



SNOWMASS VILLAGE

ESTABLISHED 1967

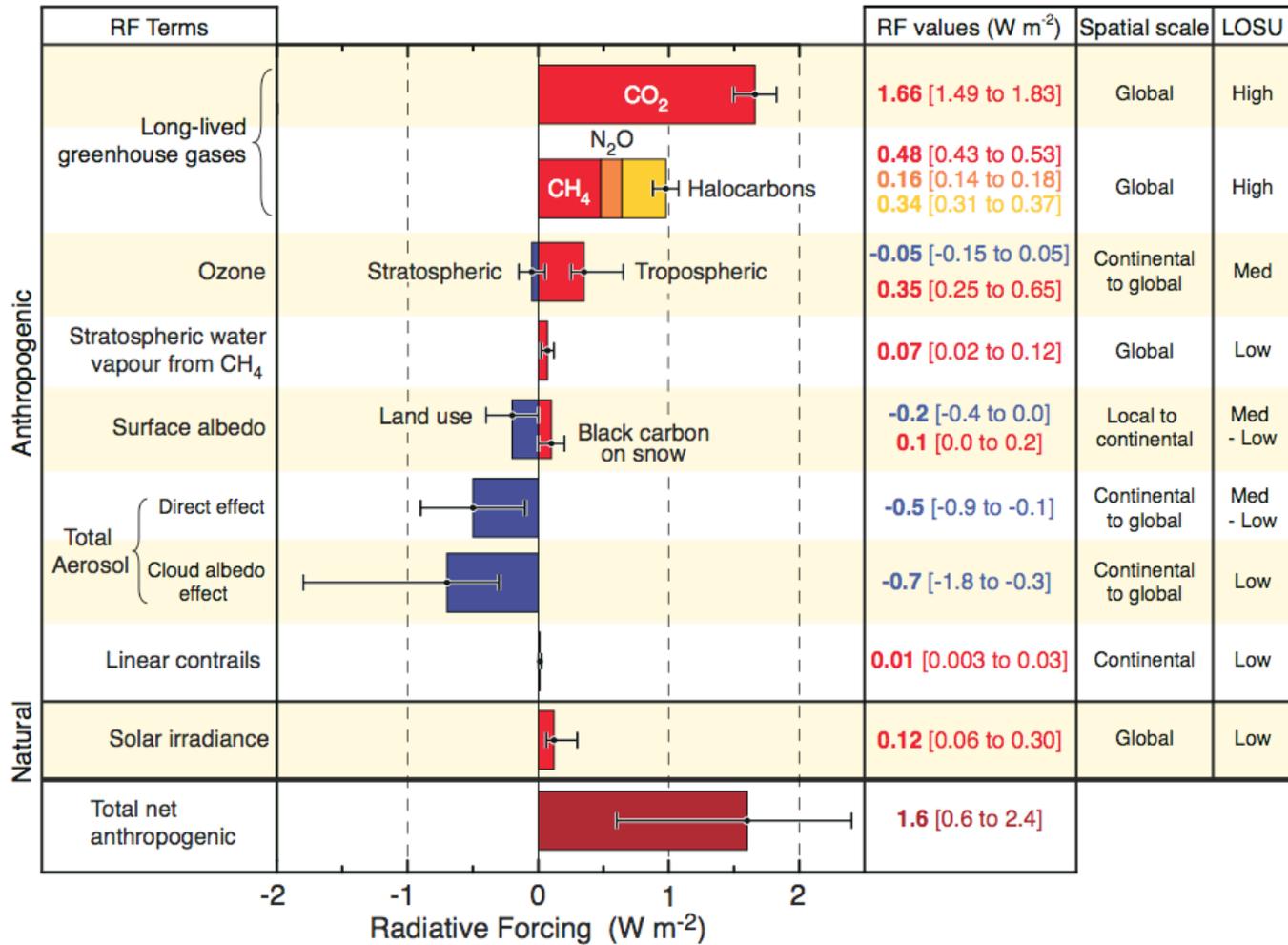
ELEVATION 8368

POPULATION 1822

TOTAL 12,157

**TOWN
MAPS**

Radiative Forcing Components



©IPCC 2007: WG1-AR4

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Figure SPM-2

Some observational evidence of climate change

The largest CO₂ growth rate is in the most recent decade.

Earth is now 0.76 degrees Celsius warmer than in 1860.

North Atlantic hurricanes have intensified since 1970.

Arctic temperatures increased at twice the global rate.

Arctic sea ice has shrunk by 2.7% per decade.

11 of the last 12 years are in the 12 warmest since 1850.

The ocean is warming to depths of at least 3,000 meters.

Some projections of future climate change

Sea level will rise 0.2 to 0.6 meters in the 21st century (with caveats: we cannot yet assess ice sheet dynamics).

Larger values cannot be excluded (125,000 years ago, sea level was 4 to 6 meters higher than at present, but high temperatures then were sustained for a long time).

Over the next 20 years, expect 0.2 degrees C per decade further warming. This continues the observed recent trend, which is consistent with earlier IPCC projections.

More projections of future climate change

Ocean acidity will increase 0.14 to 0.35 pH units by 2100.

Snow cover and sea ice will contract.

Heat waves and heavy precipitation will be more frequent.

Future tropical cyclones will become more intense.

Warming and sea level rise will continue for centuries.

Atlantic meridional overturning circulation will slow.

Precipitation will increase in high latitudes, decrease in low.

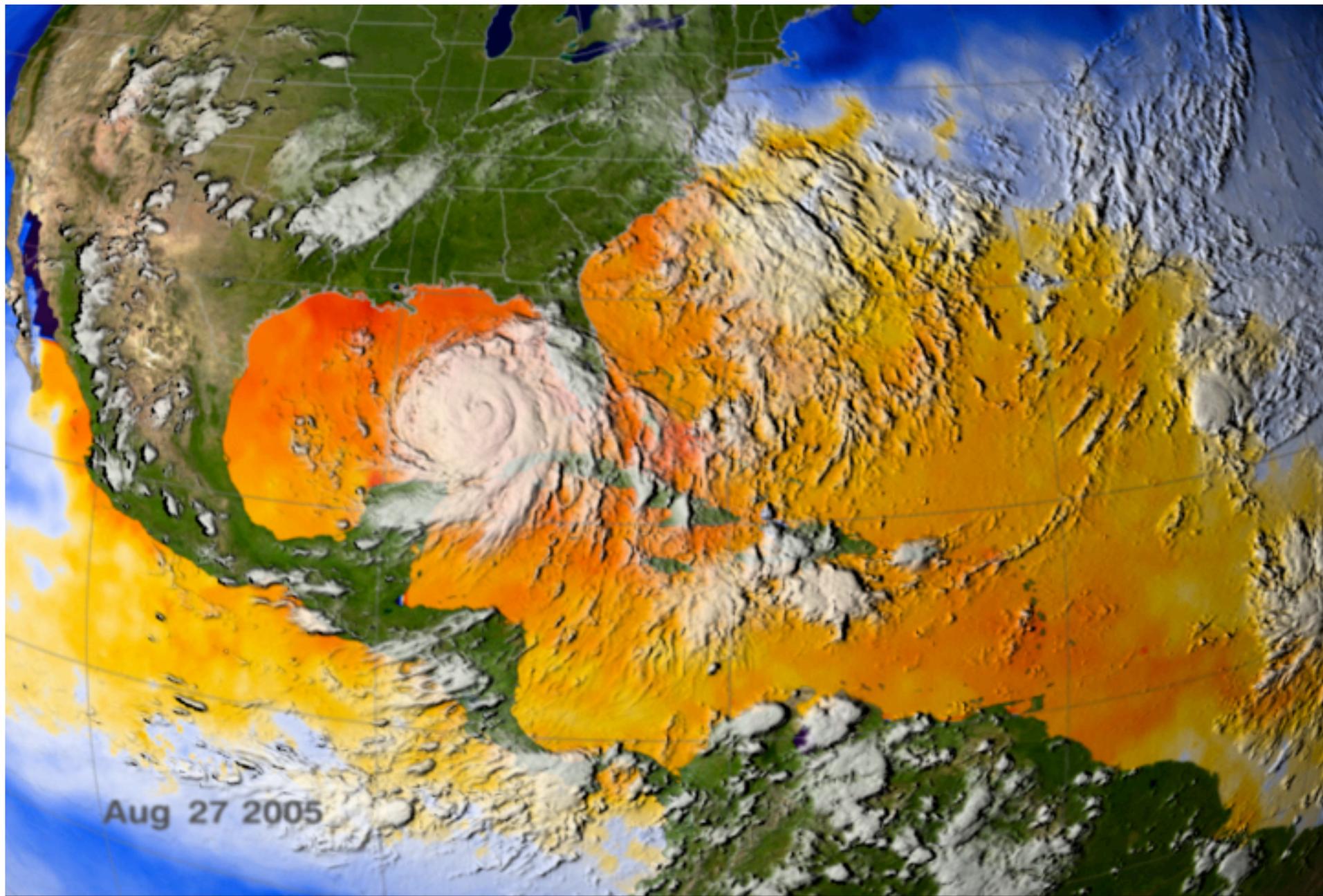
Greenland: up to 7 meters of sea level



From J. Hansen, 2003.
Photo: Roger Braithwaite & Jay Zwally

“Ice sheets have contributed meters above modern sea level in response to modest warming [$\sim 3^{\circ}\text{C}$, or 5°F]...a threshold triggering many meters of sea-level rise could be crossed well before the end of the century.”

Overpeck et al., *Science*, 2006

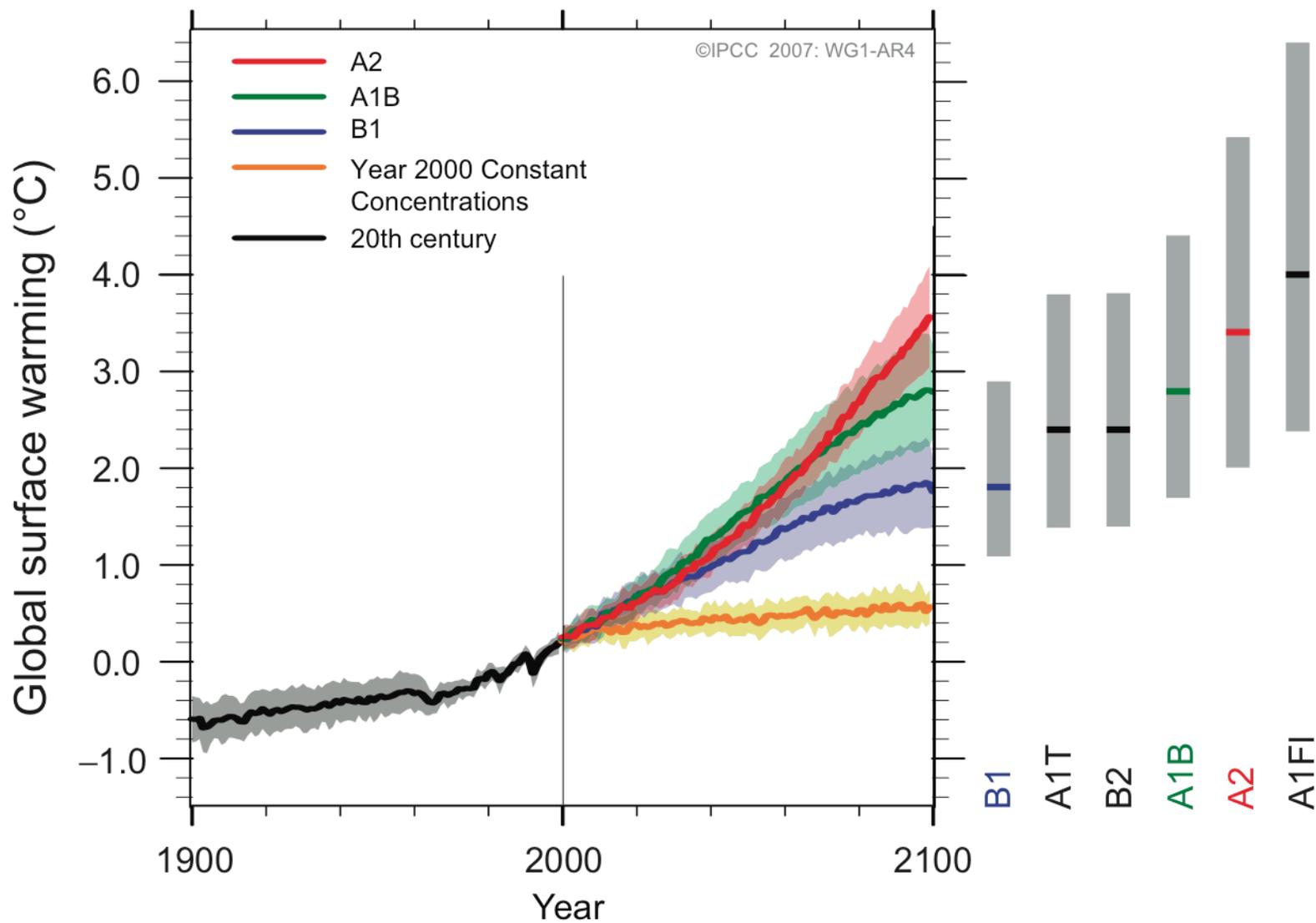


Aug 27 2005

Sea Surface Temperature



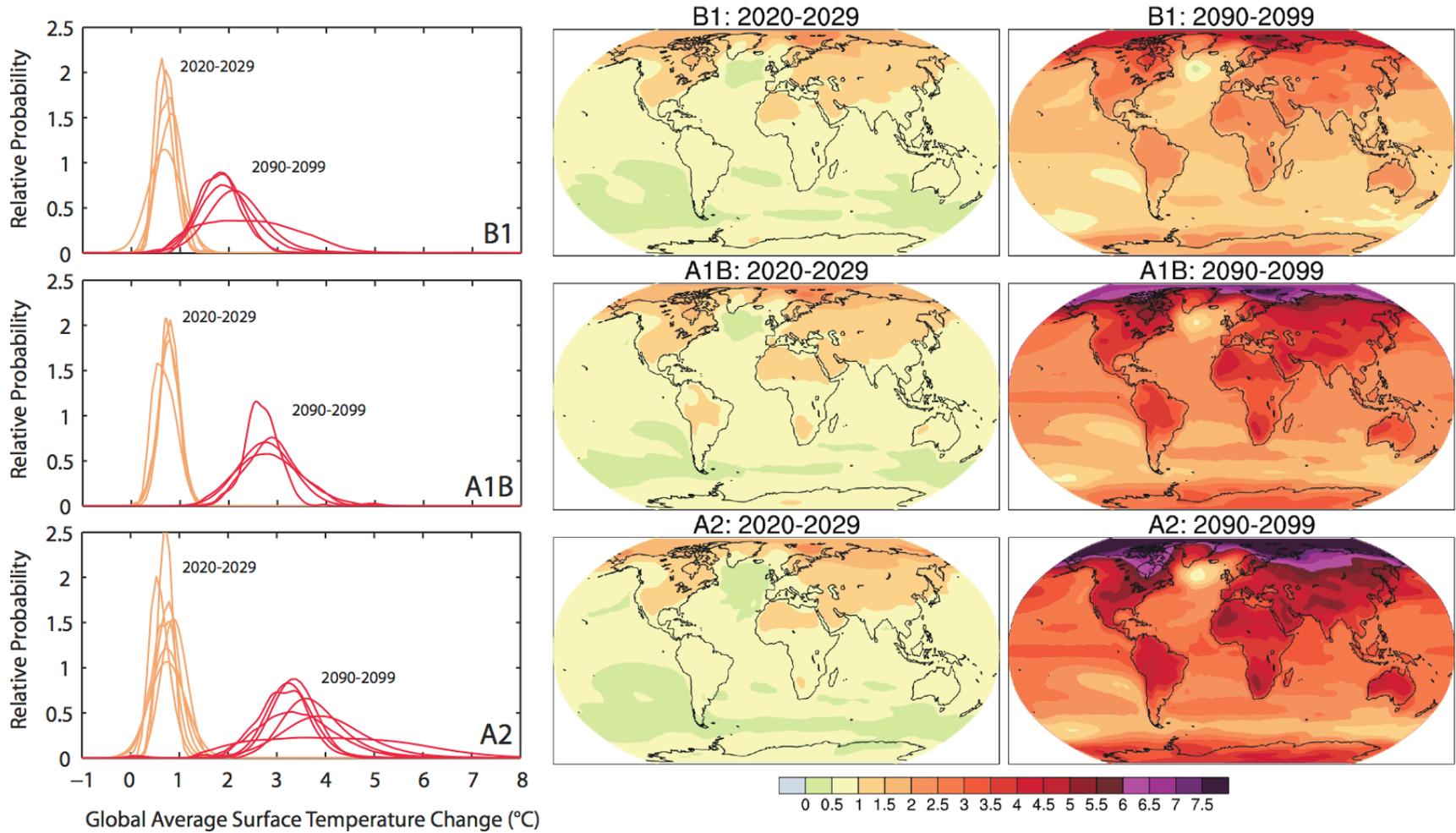
Multi-model Averages and Assessed Ranges for Surface Warming



Updated: 13 Feb 2007

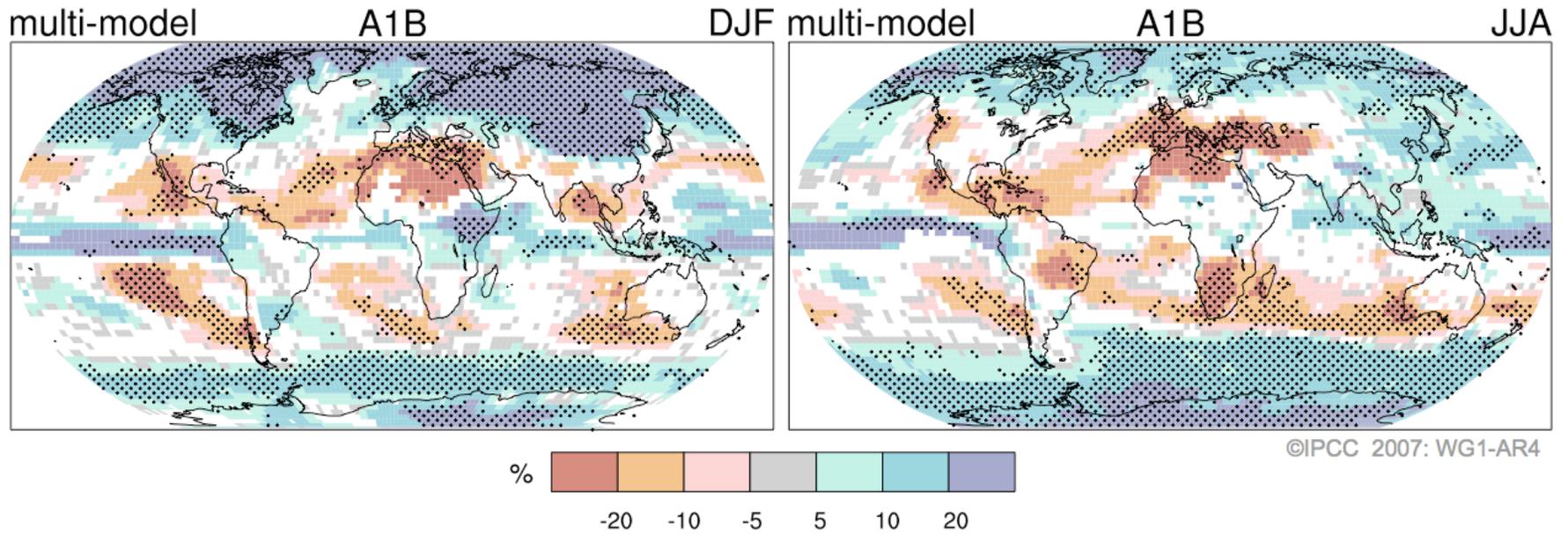
Figure SPM-5

AOGCM Projections of Surface Temperatures



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Figure SPM-6

Projected Patterns of Precipitation Changes



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Figure SPM-7

<http://www.ipcc.ch>

Fourth Assessment Report: 152 lead authors
(including 22 coordinating lead authors).

700 author nominations from governments.

25% earned highest degree in last 10 years.

75% were not previous IPCC authors.

35% from developing countries and countries
with economies in transition.

The most recent WGI IPCC report took three years to write, and more than 30,000 review comments were received on the various drafts. The authors' responses to every comment are in the public record.

The open and transparent attributes of the IPCC process, the multiple stages of peer review, and the credentials of the authors, all contribute to the stature of the report.

To the extent that the state of the science permits, the IPCC reports allow informed policymakers to see the consequences of alternative decisions.

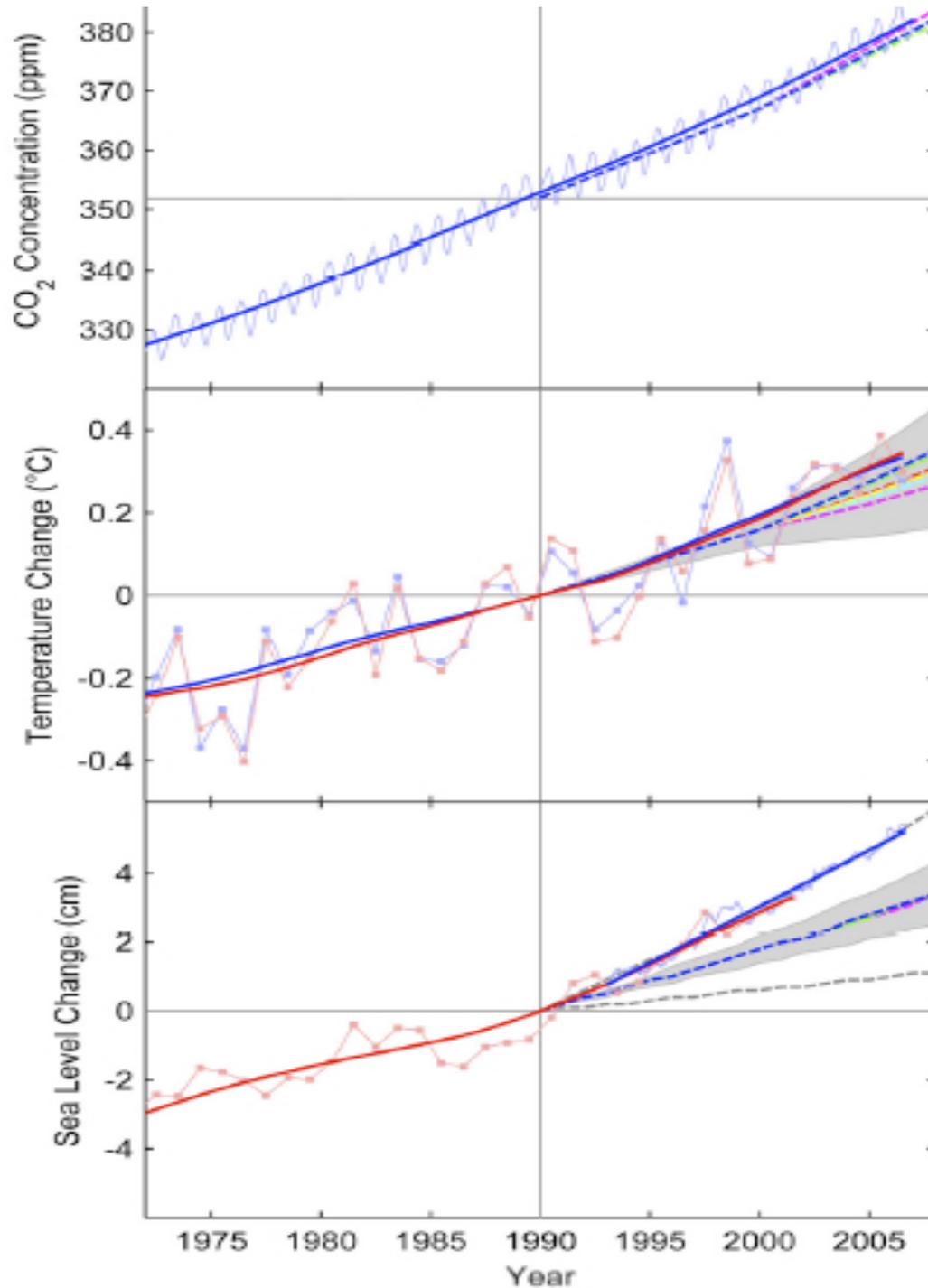
In this sense, the IPCC can help provide sound scientific input to the making of wise policy.

However, this input is strictly science-based and is always policy-neutral.

Relating greenhouse gases to global warming

CO ₂ concentration at stabilization (2005 = 379 ppm) ^(b)	CO ₂ -equivalent Concentration at stabilization including GHGs and aerosols (2005 = 375 ppm) ^(b)	Peaking year for CO ₂ emissions ^(a, c)	Change in global CO ₂ emissions in 2050 (% of 2000 emissions) ^(a, c)	Global average temperature increase above pre-industrial at equilibrium, using "best estimate" climate sensitivity ^{(d), (e)}	Global average sea level rise above pre-industrial at equilibrium from thermal expansion only ^(f)
ppm	ppm	Year	Percent	°C	metres
350 – 400	445 – 490	2000 – 2015	-85 to -50	2.0 – 2.4	0.4 – 1.4
400 – 440	490 – 535	2000 – 2020	-60 to -30	2.4 – 2.8	0.5 – 1.7
440 – 485	535 – 590	2010 – 2030	-30 to +5	2.8 – 3.2	0.6 – 1.9
485 – 570	590 – 710	2020 – 2060	+10 to +60	3.2 – 4.0	0.6 – 2.4
570 – 660	710 – 855	2050 – 2080	+25 to +85	4.0 – 4.9	0.8 – 2.9
660 – 790	855 – 1130	2060 – 2090	+90 to +140	4.9 – 6.1	1.0 – 3.7

Policymakers must decide what actions to take. Science can predict how climate will respond.



Recent Climate Observations Compared to Projections

Stefan Rahmstorf, Anny Cazenave, John A. Church, James E. Hansen, Ralph F. Keeling, David E. Parker, Richard C. J. Somerville

Science, 4 May 2007

Assessing earlier IPCC projections

This research article, published in 2007, concludes:

“Overall, these observational data underscore the concerns about global climate change.

Previous projections, as summarized by IPCC, have not exaggerated but may in some respects even have underestimated the change, in particular for sea level.”

Bali Climate Declaration by Scientists

IPCC is policy-neutral. Individual scientists are free to advocate policy. Over 200 scientists recently declared:

The next round of focused negotiations for a new global climate treaty begins in December 2007 in Bali.

The goal should be to limit warming to 2 °C (or 3.6 °F) above the pre-industrial temperature.

This limit has already been formally adopted by the European Union.

Bali Climate Declaration by Scientists

This 2 °C goal requires reducing global greenhouse gas emissions by at least 50% below their 1990 levels by the year 2050.

Greenhouse gas concentrations must be stabilized well below 450 parts per million, in CO₂-equivalent units.

To stay below 2 °C, global emissions must peak and then start to decline in the next 10 to 15 years.

Thus, this is urgent.

Should scientists be policy advocates?

I think some of them should, some of the time.

"What's the use of having developed a science well enough to make predictions, if in the end, all we're willing to do is stand around and wait for them to come true!"

- F. Sherwood Rowland, concerning ozone, 1984

(quoted by Paul Brodeur, *The New Yorker*, June 9, 1986, p. 81)

Guidelines and principles for climate policy.

1. Scientific uncertainty should not be used as an excuse to prevent all action. An analogy: Medical science is imperfect but still useful.
2. Win-win policies, or policies that have collateral benefits, are preferable. An example: Energy efficiency and energy conservation.
3. Scientists should not make policy, but wise policy should be informed by sound science. An example: halting stratospheric ozone depletion.
4. Do no harm (beware unintended consequences).

Climate ethics. What constitutes “fairness”?

North-south equity. What should the “differentiated rights and responsibilities” of developed and developing countries be? Disagreement on these issues dominated the Bali negotiations.

Intergenerational equity. What are the obligations of people alive today to their descendants?

Ethics of geoengineering. Who has the moral (or legal) right to decide to intentionally modify the planet? Who pays for unintended consequences?

Solutions to climate change are best founded on ethical and equitable grounds.

Incorporating such ideals is not just a moral concern.

The fact is, doing so leads to practical, effective solutions.

The scientific and ethical worlds must work together to motivate people to act.

Just solutions require considering both ethical and scientific input.

The climate system is a global commons.

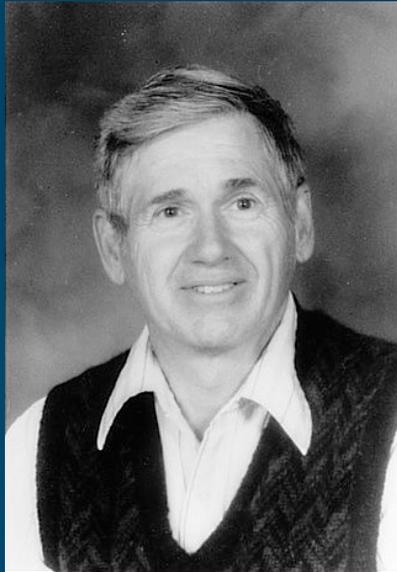
Nobody owns it.

Nobody has the right to damage it.

Advocates of geoengineering (increasing Earth's albedo, fertilizing the sea with iron, etc.) should reflect soberly on the concept of hubris.

Hubris (“any outrageous act or exhibition of pride or disregard for basic moral law”) was the greatest sin known to the ancient Greeks.

Offending the gods often led to fatal retribution.



Charles D. Keeling (1928-2005)



*Image credit: Publication of the National Oceanic & Atmospheric Administration (NOAA), NOAA Central Library;
Photo Date: 1982 February; Photographer: Commander John Bortniak, NOAA Corps (ret.)*

