Addressing the Challenge of Climate Change:
Responsibilities of Tertiary Institutions

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Introduction

Some quotes relating to climate change:

Extinction is forever.

Anon

This is the most serious problem facing humanity in the 21st century … this is the problem that if we don't address it will undermine and perhaps destroy civilization … Don't be under 40 … if we fail to solve this problem, my advice to people is not to be under 40.

Professor Tom Burke, Imperial College London (BBC interview, 2006)

Introduction

1. Climate change is one of the defining issues of our time – with multiple dimensions: ethical, political, environmental, economic, scientific, international relations, food security, etc.
2. While this presentation will focus on climate change, there are many other important environmental issues requiring urgent attention:
   - Destruction of natural habitats
   - Destruction of global fisheries
   - Loss of biodiversity
   - Loss of top soil
   - Depletion of freshwater resources
   - Toxic chemicals
   - Population growth and the total human impact
3. And there are many important non-environmental issues (global inequality and poverty, trade policy issues, security issues, etc.)

Introduction

4. But climate change is particularly pressing because of the long-lags in the climate system and the pressing need to act now if the planet is to avoid very significant temperature increases during the latter part of this century
5. There is a risk of humanity inflicting large-scale, irreversible damage to key biophysical systems, destroying countless species, submerging numerous coastal settlements and making the planet much less agreeable for human life
6. The subject area is highly complex and controversial; there is *deep uncertainty* (many things are unknown and possibly unknowable), but we know enough ...

Introduction

Garnaut Climate Change Review (Draft Report, 2008, pp.1-2):

> "There is strong support for the mainstream science from the leaders of the relevant science academies in all of the major economies. The outsider to climate science has no rational choice but to accept that, on the balance of probabilities, the mainstream science is right ... We will delude ourselves if we think that scientific uncertainties are cause for delay. Delaying now will eliminate attractive lower-cost options ... To delay is to deliberately choose to avoid effective steps to reduce the risks of climate change to acceptable levels."

Outline

1. The scientific evidence
2. The policy challenges – global and domestic
3. The role of tertiary institutions in addressing climate change
4. The current efforts of tertiary institutions
5. The way forward

Scientific theories and evidence

1. We need to take scientific theories and evidence seriously, but also recognize that science deals with testable and falsifiable propositions; new theories, hypotheses and conjectures are often found wanting, and are revised or discarded
2. The proposition that increasing CO_2 concentrations in the atmosphere will increase the global mean surface temperature (other things being equal) is well established, and has been taught in universities for well over 60 years; the initial detailed calculations regarding the impact of doubling CO_2 concentrations were undertaken by the Swedish chemist, Svante Arrehenius, in the 1890s (Nobel prize, 1903)

Scientific theories and evidence

3. In order to assess the scientific evidence on climate change, the UNEP and WMO established the Intergovernmental Panel on Climate Change (IPCC) in 1988. The IPCC has completed 4 major assessments, the most recent in 2007. These assessments involve hundreds of scientists and policy experts from around the world; each report goes through two lengthy and demanding peer review processes involving thousands of scientists and policy experts.
4. The 4AR Synthesis Report, *Summary for Policy Makers*, was approved in November 2007 by virtually every government in the world

Scientific theories and evidence

The major findings of 4AR include:

- "Warming of the climate system is unequivocal, as in 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." (1906-2005 about 0.75°C increase)
- "Most of the observed increase in globally-averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic GHG concentrations." ('very likely' means 90%+ probability)
- "Continued GHG emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would *very likely* be larger than those observed during the 20th century."

Scientific theories and evidence

The major findings of 4AR include:

- "Anthropogenic warming could lead to some impacts that are abrupt or irreversible, depending upon the rate and magnitude of the climate change."
- "Responding to climate change involves an iterative risk management process that includes both adaptation and mitigation and takes into account climate change damages, co-benefits, sustainability, equity and attitudes to risk."

Scientific theories and evidence

Dr Jim Hansen (head of NASA's Goddard Space Centre) et al (2008)

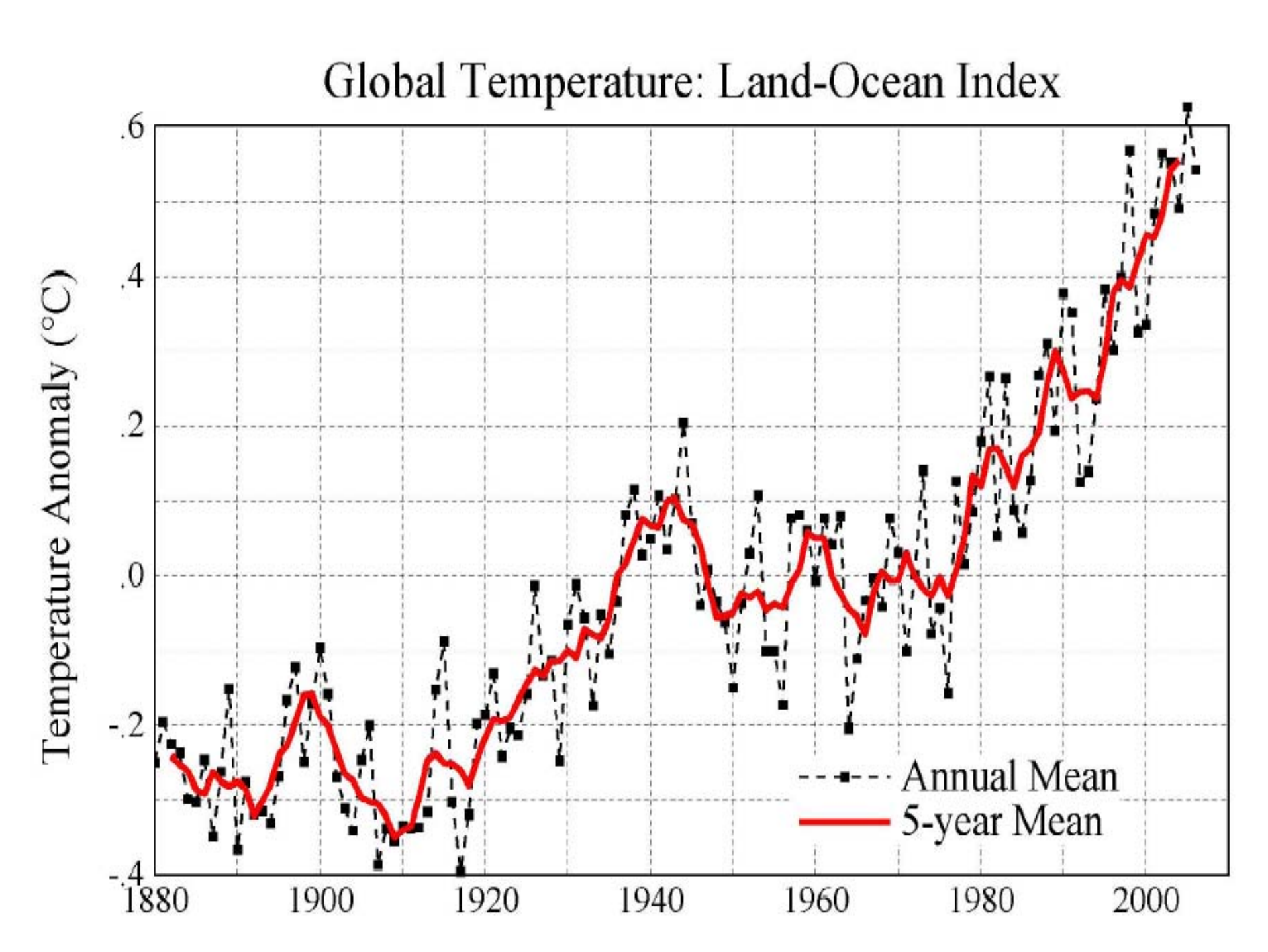
"Humanity today, collectively, must face the uncomfortable fact that industrial civilization itself has become the principal driver of global climate. If we stay our present course, using fossil fuels to feed a growing appetite for energy-intensive life styles, we will soon leave the climate of the Holocene, the world of human history. The eventual response to doubling pre-industrial atmospheric CO2 likely would be a nearly ice-free planet."

Scientific theories and evidence

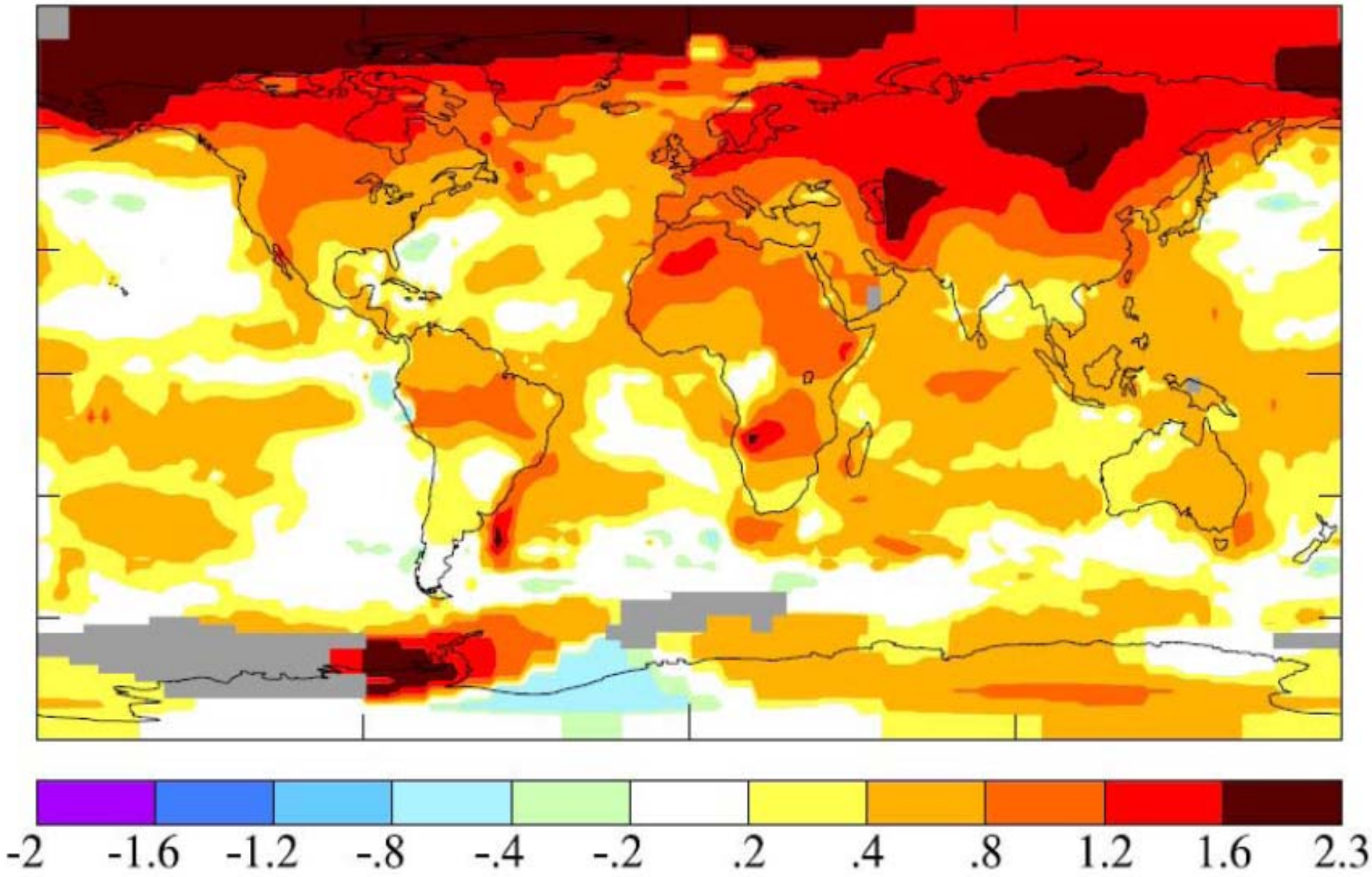
Dr Jim Hansen et al (2008)

“Continued growth of greenhouse gas emissions, for just another decade, practically eliminates the possibility of near-term return of atmospheric composition beneath the tipping level for catastrophic effects.

The most difficult task, phase-out over the next 20-25 years of coal use that does not capture CO2, is herculean, yet feasible when compared with the efforts that went into World War II. The stakes, for all life on the planet, surpass those of any previous crisis. The greatest danger is continued ignorance and denial, which could make tragic consequences unavoidable.”


Global Temperature: Land-Ocean Index
Temperature Anomaly (°C)
.6
.4
.2
.0
-.2
-.4
1880
1900
1920
1940
1960
1980
2000
Annual Mean
5-year Mean

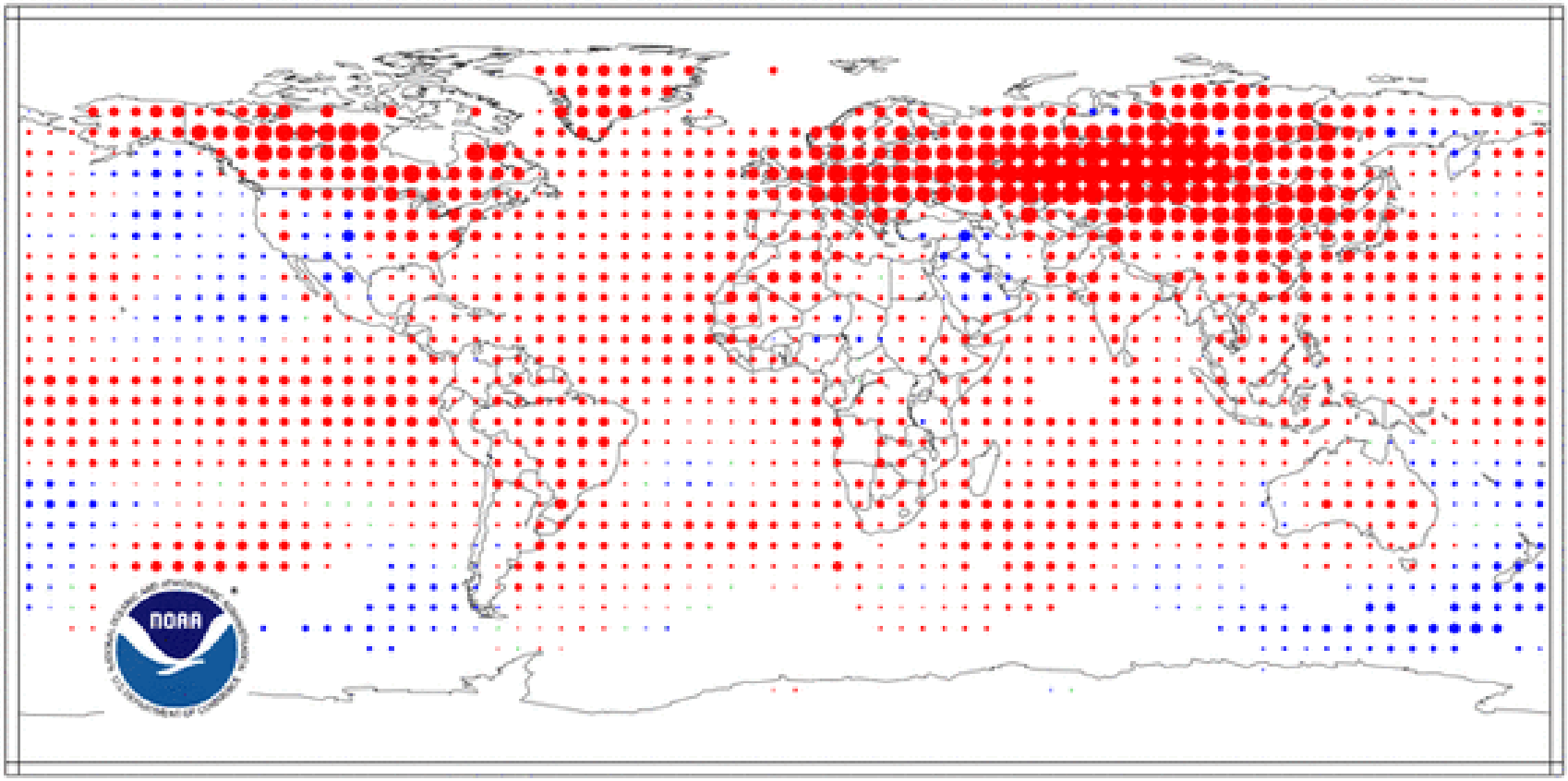
Mean surface temperature increase: Comparison of 2001-07 with 1951-80
Global mean increase: 0.54°C



Temperature Anomalies Dec-Feb 2007

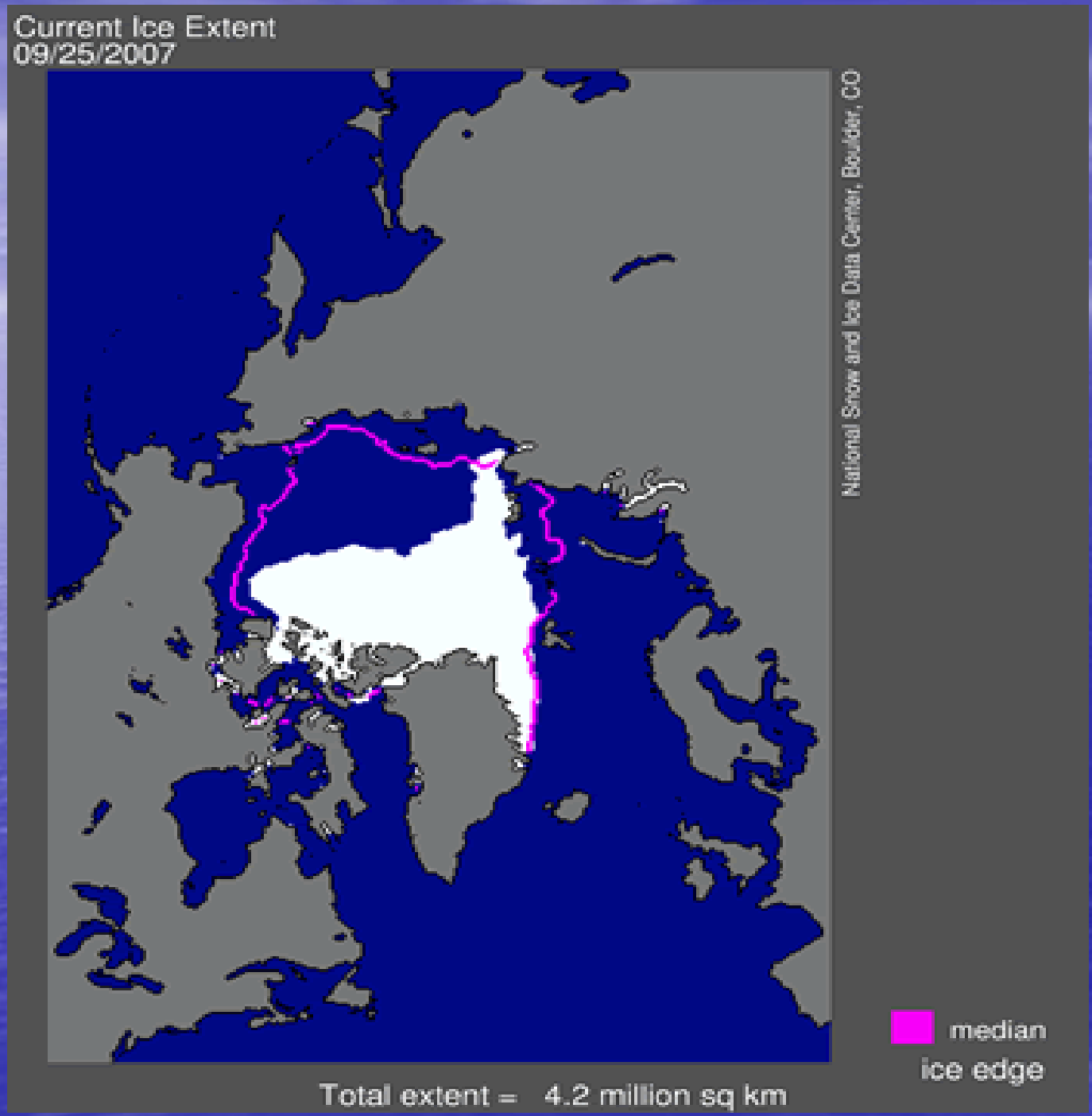
(with respect to a 1961-1990 base period)

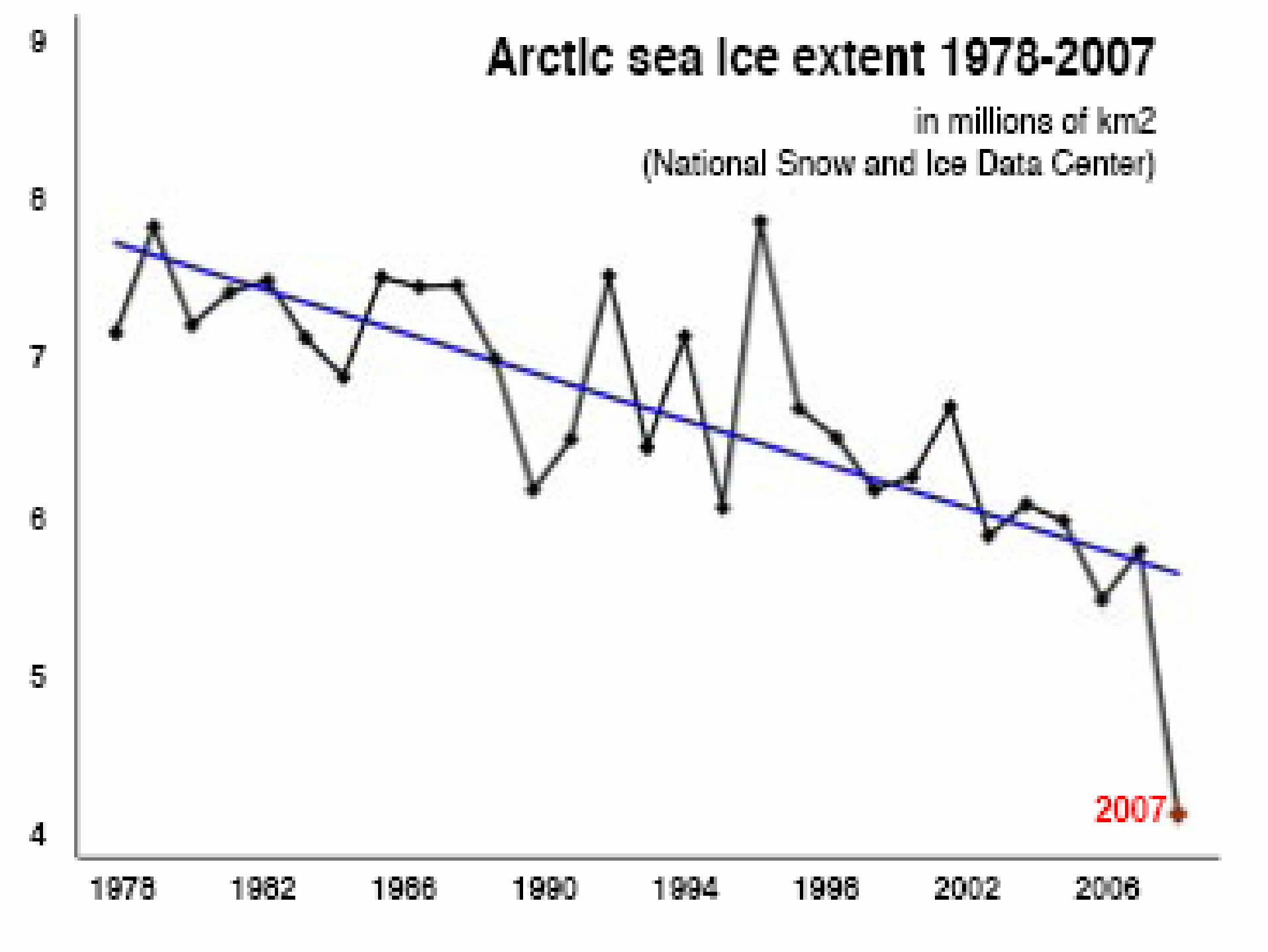
National Climatic Data Center/NESDIS/NOAA

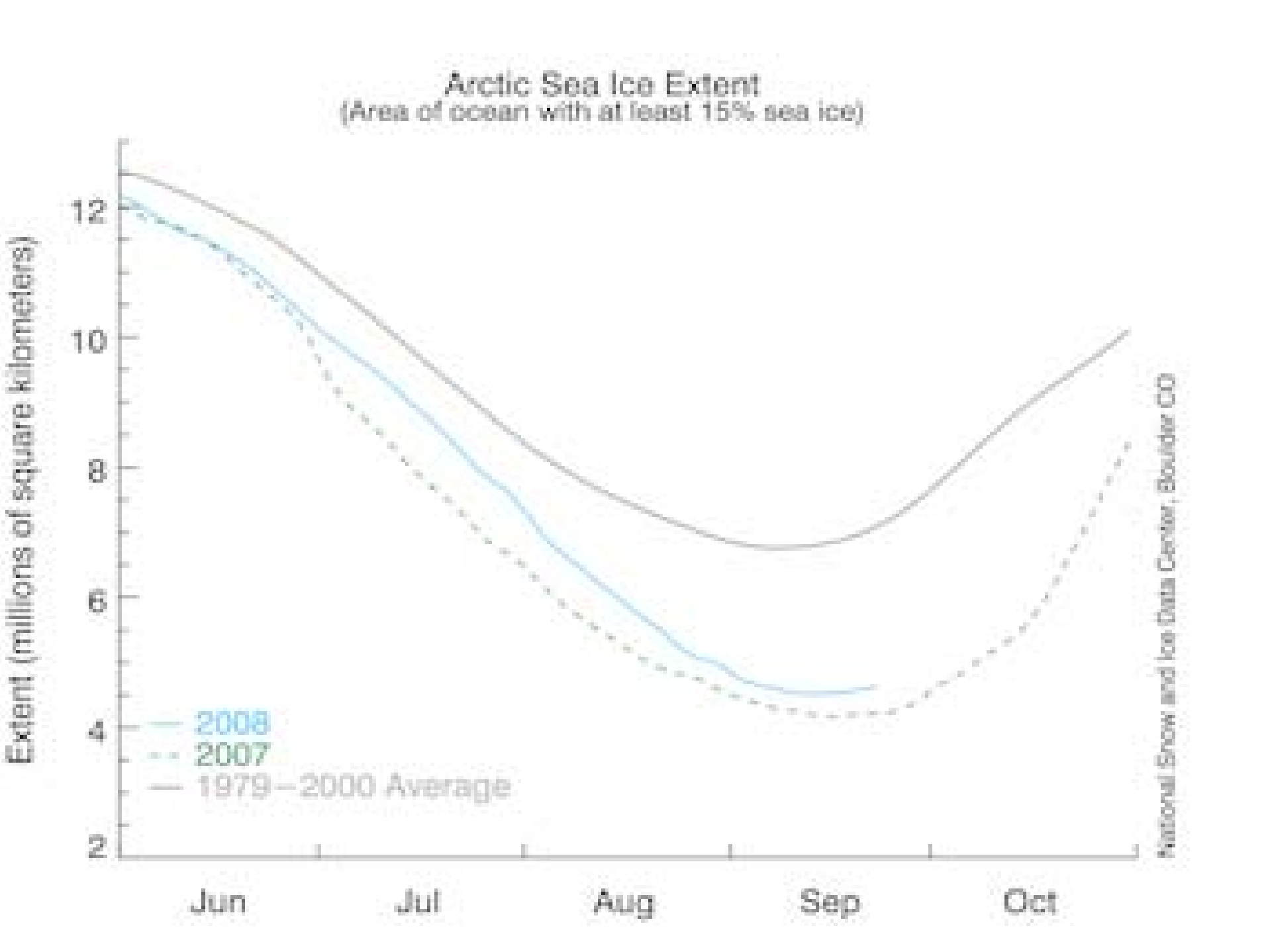


-5C -4C -3C -2C -1C 0C 1C 2C 3C 4C 5C

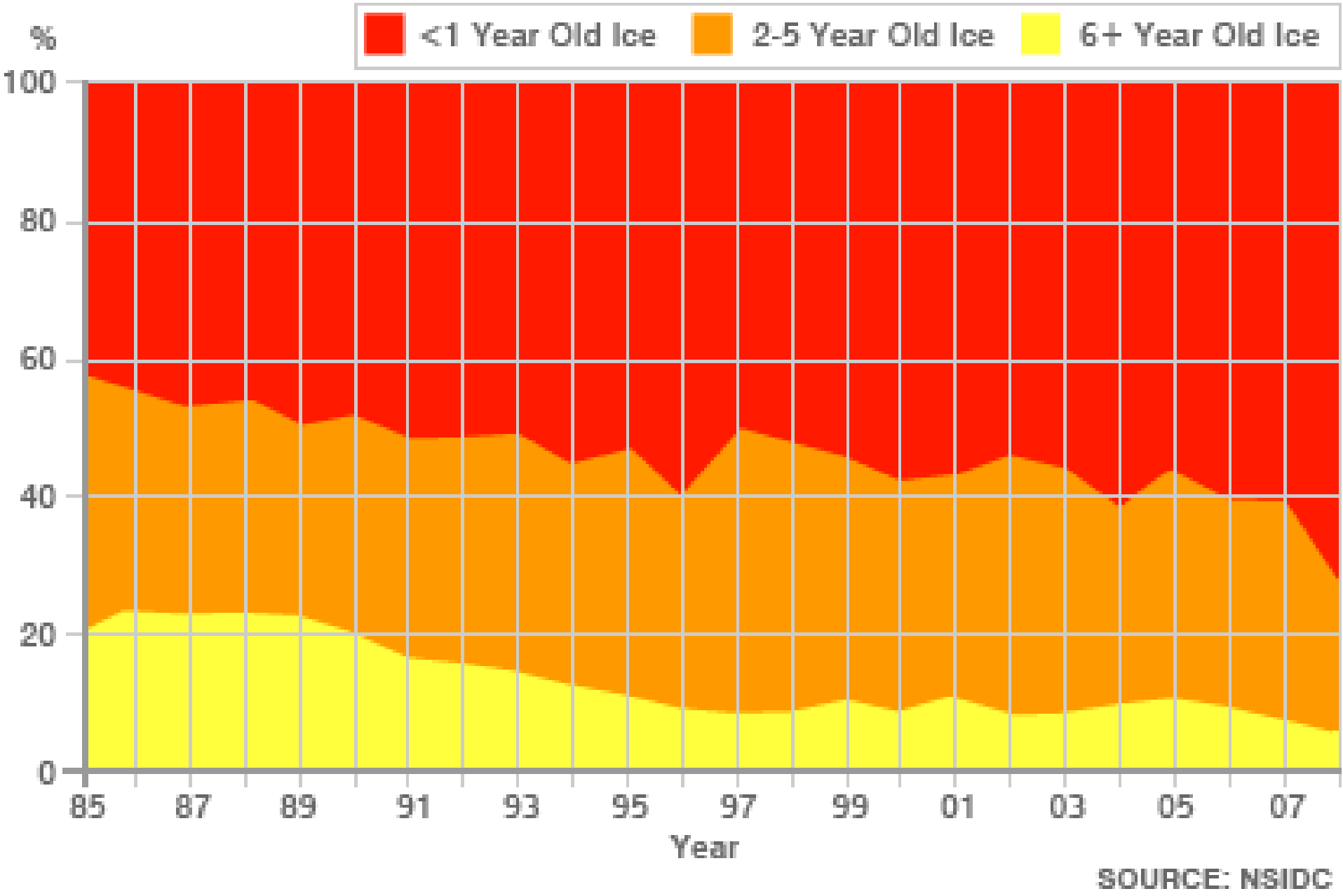
Degrees Celsius


Current Ice Extent
09/25/2007
National Snow and Ice Data Center, Boulder, CO
median
ice edge
Total extent = 4.2 million sq km

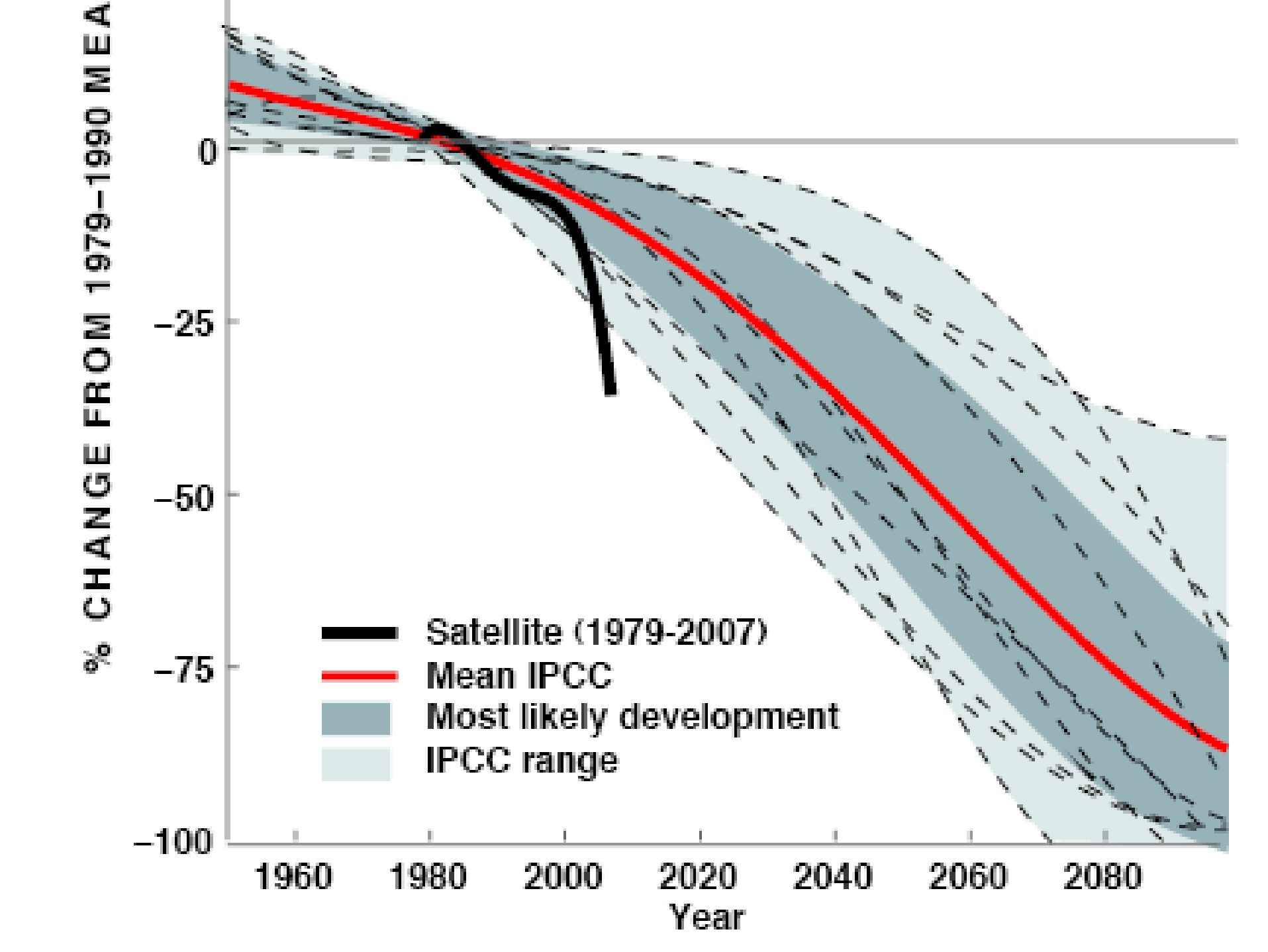

Arctic sea ice extent 1978-2007
in millions of km2
(National Snow and Ice Data Center)
9
8
7
6
5
4
1978
1982
1986
1990
1994
1998
2002
2006
2007


Arctic Sea Ice Extent
(Area of ocean with at least 15% sea ice)
Extent (millions of square kilometers)
12
10
8
6
4
2
2008
2007
1979–2000 Average
Jun
Jul
Aug
Sep
Oct
National Snow and Ice Data Center, Boulder CO

ICE AGE - THE ARCTIC IN FEBRUARY



SOURCE: NSIDC


% CHANGE FROM 1979–1990 MEA
0
−25
−50
−75
−100
1960
1980
2000
2020
2040
2060
2080
Year
Satellite (1979-2007)
Mean IPCC
Most likely development
IPCC range

Jakobshavn Ice Stream in Greenland

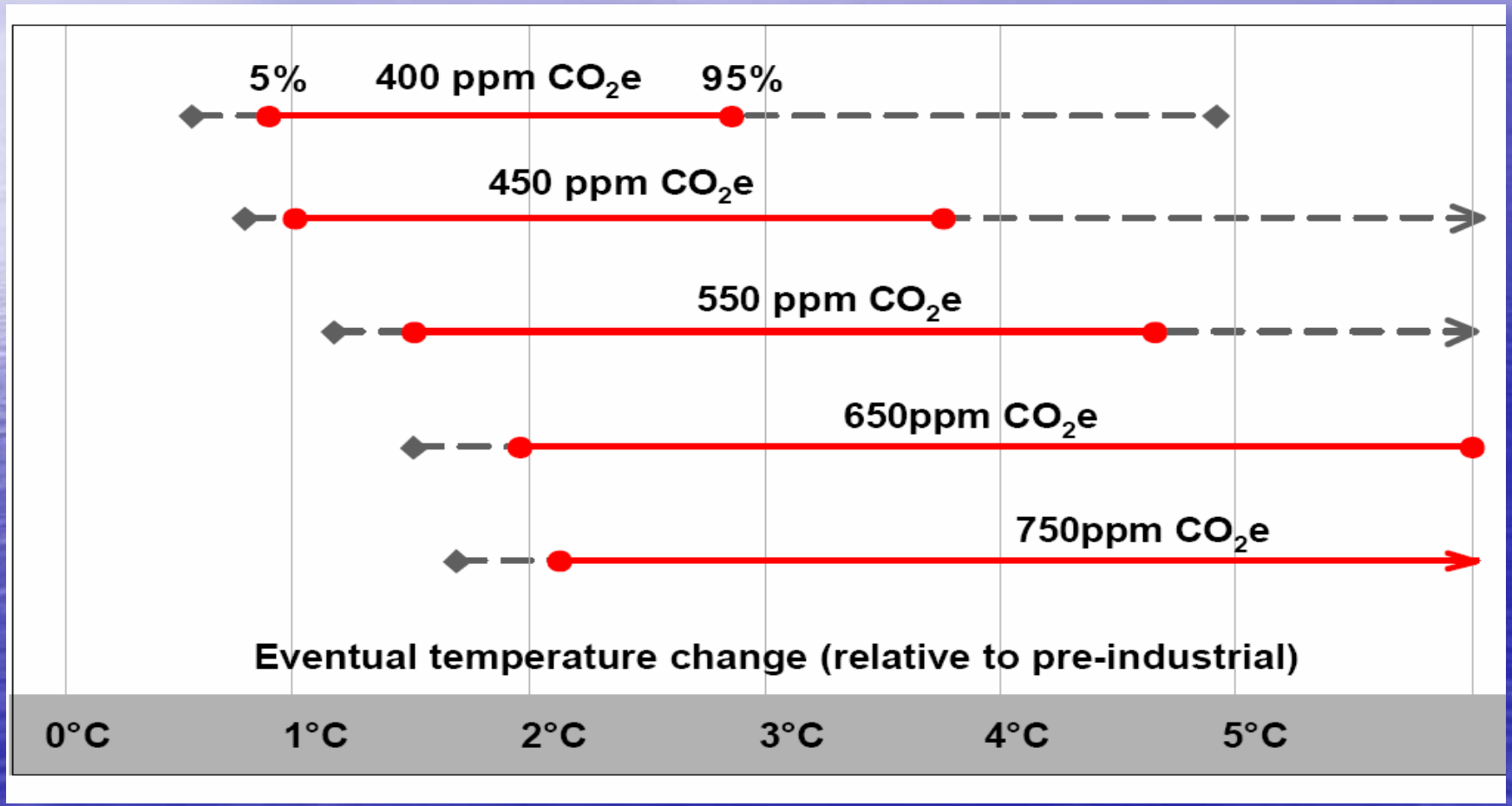
Discharge from major Greenland ice streams is accelerating markedly.

Source: Prof. Konrad Steffen, Univ. of Colorado

What needs to be done?

1. The global mean surface temperature has increased about 0.75°C above pre-industrial levels; another 0.5°C is in the pipeline (lags)
2. To prevent an increase of much over 2°C (above pre-industrial), CO2 equivalent concentrations need to be stabilized at well under 500ppm (currently about 430ppm and rising at 2ppm p.a.)

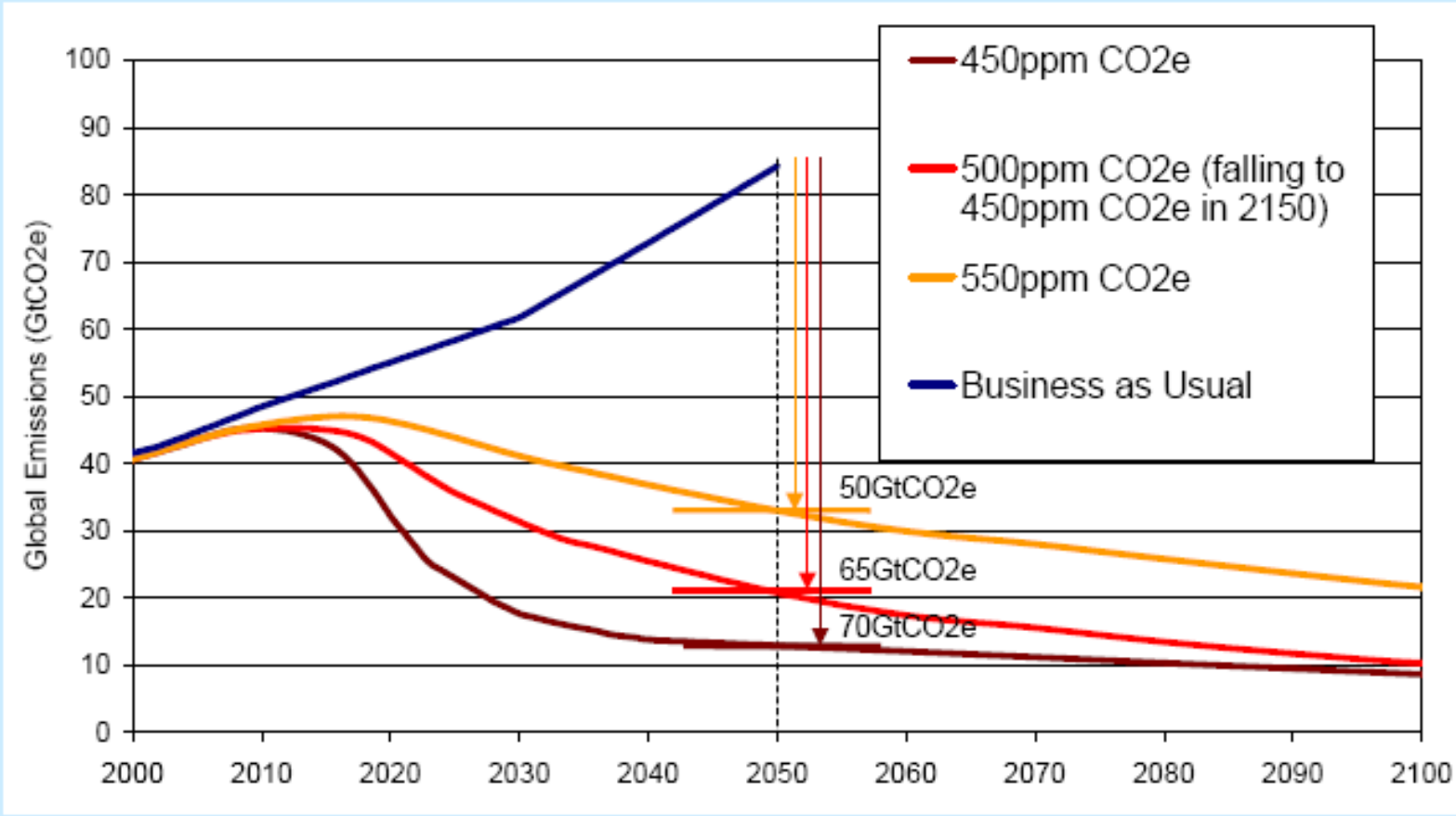
Stabilization targets and temperature implications (from Stern Review)



What needs to be done?

3. To achieve this target, *global* GHG emissions need to be reduced by 50-85% by 2050 and 98% by 2100. The cuts for developed countries like Australia & NZ need to be about 90% by 2050, or 90-95% per capita (see later slides)
4. Put differently, current global GHG emissions need to be reduced from about 6-7 tonnes per capita to less than 2 tonnes per capita by 2050 and eventually to almost zero (Australian emissions are currently about 26 tonnes per capita, NZ 20 tonnes)

Emission paths to stabilization
(from Stern Review)



The Policy Challenges

The fundamental policy problem:

The Earth's atmosphere is a 'natural global commons' or a 'global public good', and thus is subject to the free-rider problem: without clear and enforceable property rights, every country has an incentive to use it as a dumping ground for greenhouse gases and other pollutants. Further, if enough nations refuse to cooperate, or refuse to take sufficient action, any collective endeavours to mitigate the problem by the remainder of the global community will be put at risk and rendered less effective. In these circumstances, there will be an increased likelihood of a 'tragedy of the commons' (i.e. dangerous global warming).

The Policy Challenges

Ross Garnaut: “Climate change is a diabolical policy problem. It is harder than any other issue of high importance ...”

Multiple challenges:

- National self-interest and incentives for each country to free-ride
- Conflicts between the developed and developing world (and within each block) over how the burden of mitigation and adaptation should be shared
- The power of vested interests (especially the fossil fuel industry)
- The sheer complexity of the policy issues
- The short-term economic and political costs of taking action, with the gains not being evident for decades (although the aggregate economic costs of coordinated action are likely to be modest)
- Weak international institutions
- Ignorance, a lack of will and skepticism

The Policy Challenges

Global efforts to address the problem:

1. UNFCCC
2. Kyoto Protocol and first commitment period (2008-12)
3. Quest for a second commitment period post 2012 (Bali, Copenhagen and beyond)
4. National actions – conditional and unconditional
5. Global burden sharing/effort sharing issues

Burden Sharing – Effort Sharing

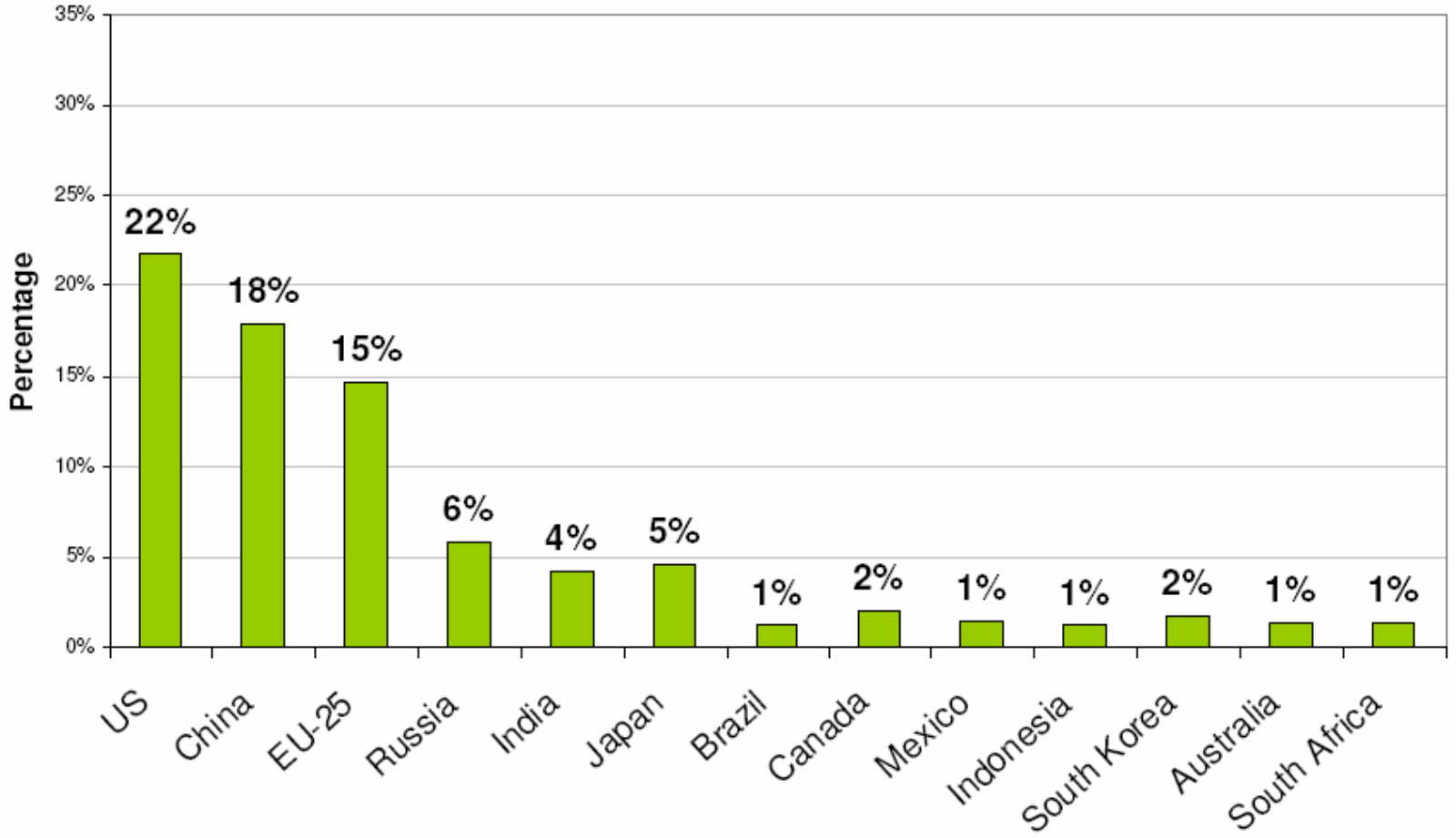
1. UNFCCC embraces the principle of "common but differentiated responsibilities and respective capabilities"; but on what basis should we differentiate between countries? Is there a case for equal per capita emission allowances and, if not now, then when?

2. Possible principles for post-2012:

   - Equal sharing of the burden (objections)
   - Historical contribution/responsibility (based on total accumulated emissions – but from when?)
   - Current contribution/responsibility (e.g. as measured by emissions per capita)
   - Capability (e.g. as measured by per capita income)
   - Mitigation potential
   - Need (note distinction between 'survival' and 'luxury' emissions)
   - Comparable effort (but what is comparable? equal?)

3. Long run – equal per capita emission allocation, irrespective of country (contraction and convergence)

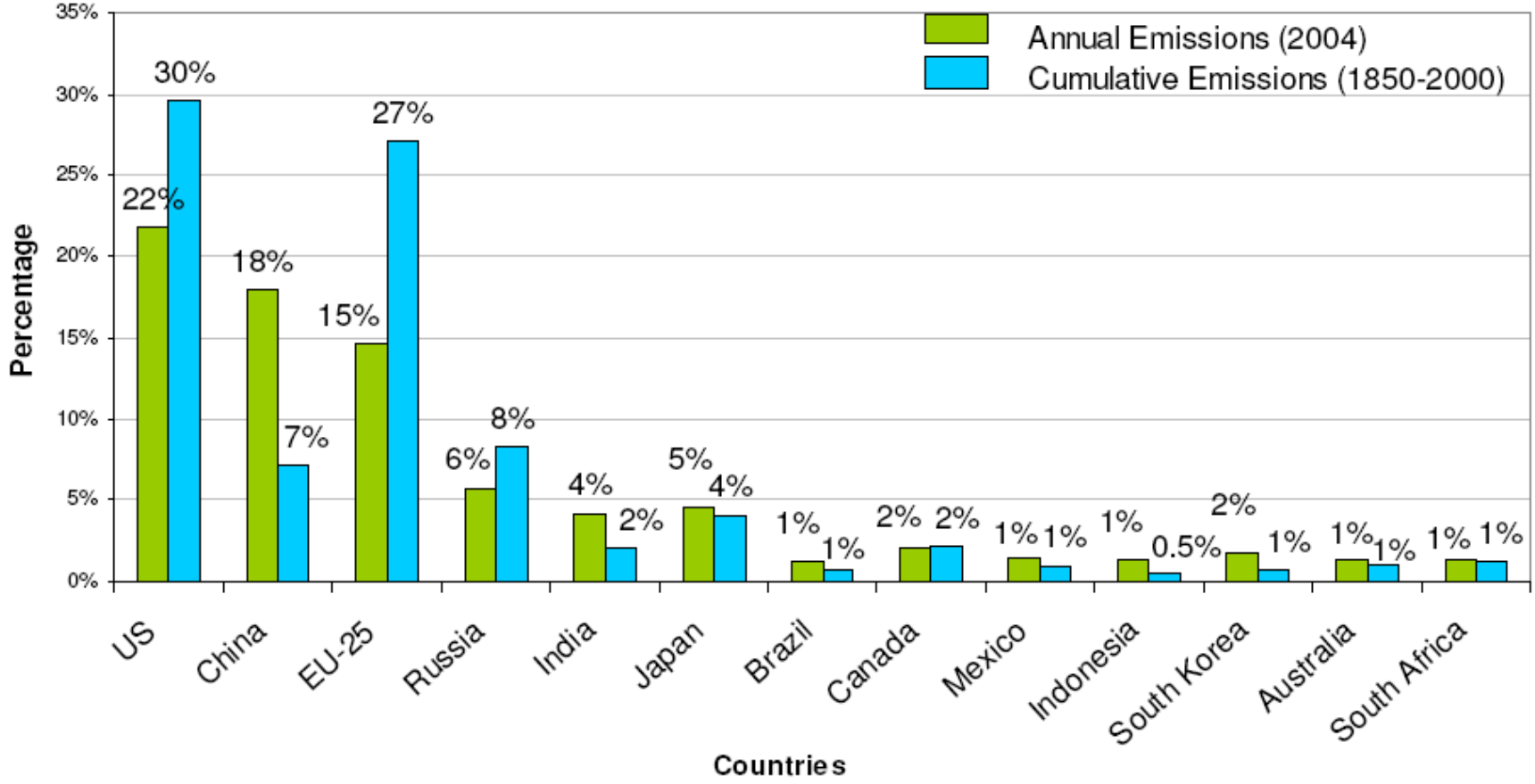
Annual CO_2 Emissions* (2004)



*Energy-related CO2 gases only

Source: IEA (2006) CO_2 Emissions from Fossil Fuel Combustion .

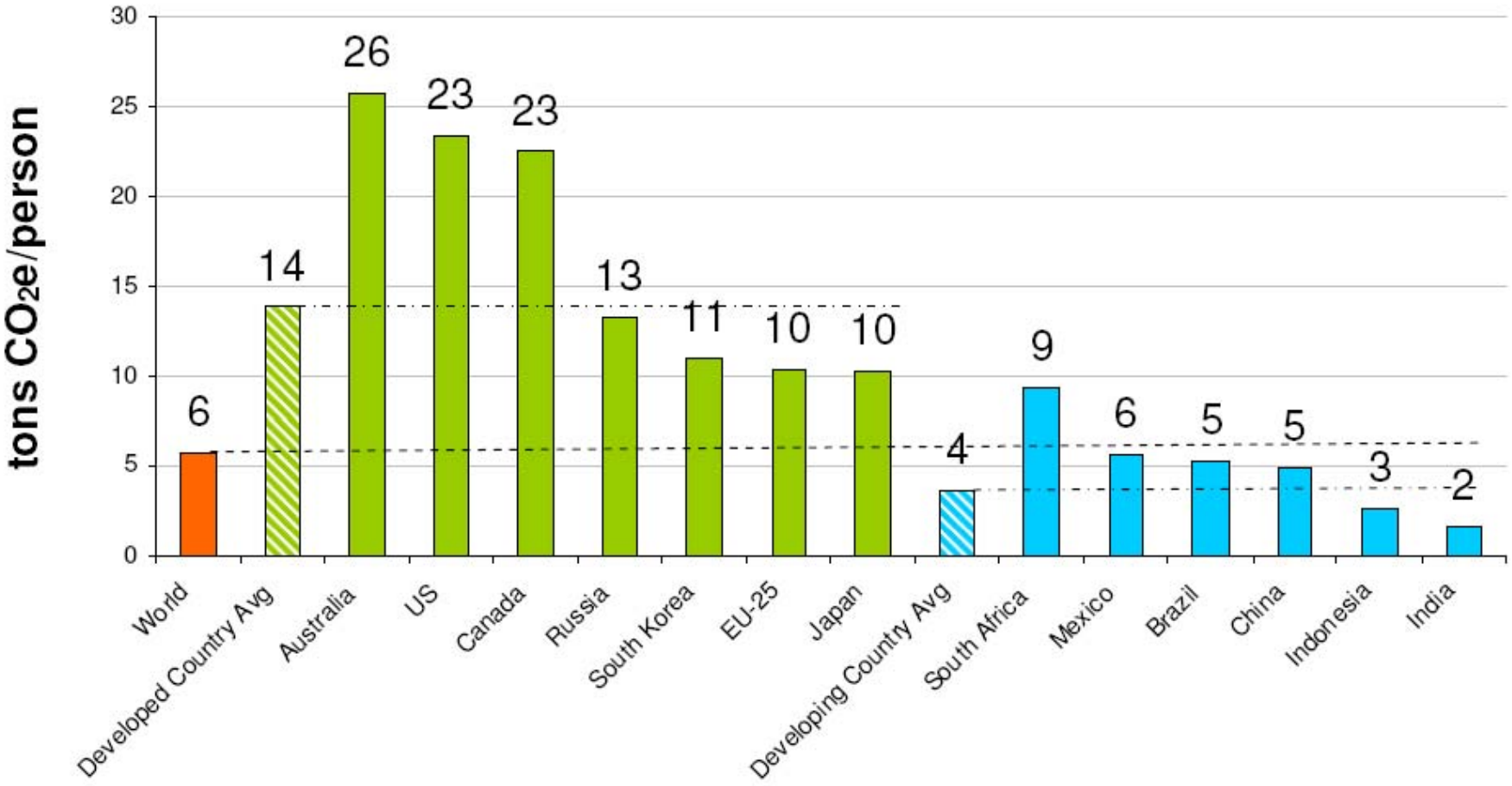
Comparison: Annual* & Cumulative** CO_2 Emissions



Source: * Annual Emissions for the year 2004 from IEA (2006) CO_2 Emissions from Fossil Fuel Combustion

** Cumulative Emissions from 1850-2000, CAIT WRI

Per Capita GHG Emissions (2004)

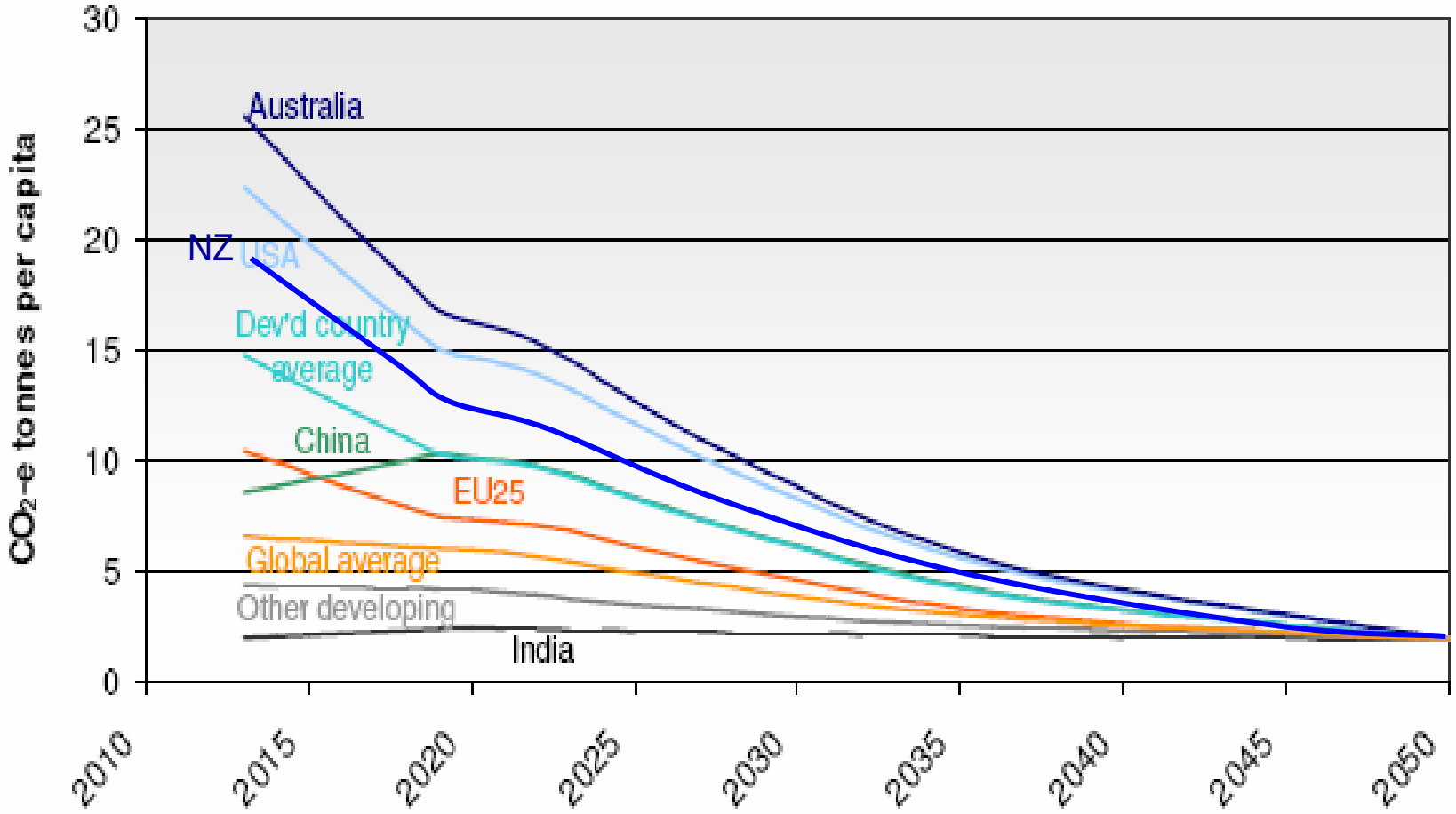


Source: IEA (2006) CO2 Emissions from Fossil Fuel Combustion and EPA (2006) Global Anthropogenic Non-CO2; Greenhouse Gas Emissions: 1990 – 2020

Garnaut Climate Change Review:
Targets and Trajectories (Sept 2008)

1. Explores several stabilization options
2. Argues for contraction and convergence (starting in 2012 and completed by 2050)
3. Pessimistic about the prospects for a global agreement over the next few years on a low (i.e. 450ppm) target
4. Proposes an unconditional commitment by Australia to a 5% cut in emissions by 2020 on 2000 levels (25% per capita, cf EU 17%)
5. Proposes a commitment by Australia to a 10% cut in emissions by 2020 (30% per capita) if there is a global agreement with a 550ppm stabilization target
6. Proposes a commitment by Australia to a 25% cut in emissions by 2020 (40% per capita) if there is a global agreement with a 450ppm stabilization target

Figure 5.3 Per capita emissions entitlements for the 450 scenario



Note: The graph starts in 2012. Australia's 2012 starting value assumes Kyoto compliance, as do those for the EU25. Other countries start at their emissions level given by the no mitigation scenario in 2012.

Table 5.2 Emissions entitlement allocations for 2020 and 2050 relative to 2000–01

Total emissions	550		450	
	2020 over 2001	2050 over 2001	2020 over 2001	2050 over 2001
World	40%	-13%	29%	-50%
Developed	-15%	-76%	-31%	-86%
Australia	-10%	-80%	-25%	-90%
Canada	-33%	-80%	-45%	-89%
EU25	-14%	-69%	-30%	-82%
Japan	-27%	-75%	-41%	-86%
USA	-12%	-81%	-28%	-89%
Developing	91%	50%	85%	-14%
China	210%	-4%	195%	-45%
India	98%	230%	97%	90%

Note: Australia's allocations are relative to 2000 actuals, and are rounded. Actual numbers (also relative to 2000) are 10%, -80%, -27%, and -89%. All other countries are relative to 2001 no-mitigation scenario.

The Role of Tertiary Institutions

1. There is a moral responsibility to address climate change; it applies at multiple levels (global, national, institutional, individual, etc.)
2. The responsibility falls particularly on those with the knowledge and means to make a difference
3. Tertiary institutions (of all kinds) have a unique set of roles and capabilities and a significant responsibility to respond to the climate change challenge

The Roles of Tertiary Institutions

1. Research
2. Teaching and capability building
3. Critic and conscience
4. Internal policies, practices and processes – leadership by example

The Role of Tertiary Institutions:
Leadership in research on climate change

1. Discovery, integration and application of knowledge
2. Most, if not all, disciplines have something to contribute (holistic approach needed)
3. Key areas:
   - Better knowledge of the climate system, future scenarios and impacts, etc.
   - Mitigation – technical solutions and policy analysis
   - Adaptation – technical solutions and policy analysis
   - Importance of the overall innovation system
4. Need for new staff and refocusing of current research interests, better coordination & partnerships with business, government agencies
5. Research funding sources

The Role of Tertiary Institutions:
Leadership in teaching on climate change

1. Incorporate issues relating to climate change into existing programmes & courses, and develop new programmes & courses – at all levels, and across many subject areas
2. Wider public education role
3. Resources for wider education system

The Role of Tertiary Institutions:
Critic and conscience role

1. Facilitating public debate
2. Contribution to public inquiries and reviews
3. Media commentary
4. Critical analysis of government policies
5. Protecting academic freedom (in a context of powerful vested interests)

The Role of Tertiary Institutions:
Leadership by example

1. Development of comprehensive environmental strategies and policies – aim for sustainability
2. Commitment to reducing GHG emissions – energy efficiency & sources, travel, modes of communication & learning
3. Pursuit of 'carbon neutrality' (zero net GHG emissions) – measure, minimize, offset
4. Issues:
   - What to measure: how comprehensive?
   - Costs/benefits of action (planning, co-benefits, branding/reputation, offsets, phasing-in)
   - Cost of inaction
   - Integrity of offsets (impact of Kyoto rules, etc)
   - Generating in-house carbon credits
   - Implications for academic air travel, conferences, etc.

The Current Efforts of Tertiary Institutions: Performance to date

1. New research initiatives
2. New teaching programmes
3. Critic and conscience role
4. Leadership by example

A few examples ...

The Current Efforts of Tertiary Institutions: Research Initiatives

1. Australian Universities Climate Consortium (2007)

   - 4 universities: ANU, Monash, Melbourne and NSW
   - Links with CSIRO, Bureau of Meteorology, etc.
   - Represents about 80% of university-based research on climate change, including mitigation and adaptation
   - Covers a very wide range of disciplinary research
   - Aims to provide a world-class, strategic, team-based climate science capability for Australia & build an outstanding UG and PG education programme on climate change

The Current Efforts of Tertiary Institutions: Examples of Internal Policies

1. Many institutions have developed energy efficiency/energy saving objectives and strategies (e.g. motion detectors fro lights and air-conditioning, push-button timers to control heating, more efficient building design, more efficient lighting, etc.)
2. Many have waste reduction programmes (including recycling, food compositing, etc.)
3. Some are seeking to purchase more of their electricity from renewable sources (e.g. ANU, Monash, etc.)
4. Some have carbon-reduction targets (e.g. Melbourne Uni: 50% reduction by 2010 and 100% by 2030)
5. Some have tree-planting programmes (e.g. NSW)
6. ANU has created a large corporate bicycle fleet

Current Efforts – Victoria University of Wellington

1. Several proposals by VUW Environment Committee to senior management for the University to become ‘carbon neutral’; both rejected
2. But Faculty of Architecture and Design has achieved ‘carbon neutral’ status, and VUW has made a strategic investment by establishing a new Climate Change Research Institute and supporting the climate policy work of the Institute of Policy Studies, etc.
3. Case for carbon neutrality:
   - Commitment to environmental responsibility
   - Attracting students
   - Positioning VUW as a leader
   - Strengthening research activities

Current Efforts – Victoria University of Wellington

	Tonnes CO2 e	
Source of emissions	**2006**	**2007**
Air travel	3,752	1,720
Natural gas	3,355	3,063
Fuel for land transport	305	186
Total carbon offsets required	7,422	4,969

Current Efforts – Victoria University of Wellington

Notes:

1. Excluded are 4,095 tonnes CO2e of electricity emissions in 2007 (because VUW's electricity contract is with Meridian – which is accredited as carbon neutral ... But ...)
2. Also excluded are emissions from commuter travel (for staff & students), estimated at 3,463 tonnes CO2e in 2007
3. Cost of offsets: via CarboNZero (Landcare) at $25/tonne (+ costs of measurement, certification, right to use logo, etc.), approx. NZ$260,000/year; v purchase of credits independently – this depends on the quality of the credits, but approx. NZ$135,000/year at current prices
4. Total budget – approx. NZ$270m/year (offsets would represent about 0.05-0.1 of current expenditure)

Conclusions

1. The most recent, reliable scientific evidence suggests that the risks of inaction to mitigate climate change are potentially huge in scope, scale and duration
2. There is a strong ethical case for taking a precautionary approach – especially given the potential for catastrophic and irreversible impacts on major planetary systems (insurance principle)
3. Global GHG emissions need to be cut by well over 50% by 2050; for developed countries as much as 90% (and more per capita)
4. Overall, the costs of mitigation are likely to be modest relative to the costs of inaction
5. We need concerted and effective action at multiple levels of government – international, national and sub-national – and by businesses, community organizations, educational institutions and individuals
6. Tertiary education institutions have a particularly important role to address the technical, behavioural and policy challenges posed by climate change, given their multiple and distinctive roles

Concluding thought:

"No one made a greater mistake than the person who did nothing because he could do so little"

Edmund Burke

Acknowledgements

1. National Climatic Data Centre (NOAA)
2. National Snow and Ice Data Center
3. The Garnaut Climate Change Review
4. Dr Jim Hansen's blog
5. The Pew Center

Some references:

1. Intergovernmental Panel on Climate Change (2007) *Fourth Assessment Report* (Summaries for Policy Makers from WG1, WG2 and WG3)
2. www.climateark.org
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5. Jonathan Boston (ed) *Towards a New Global Climate Treaty: Looking Beyond 2012* (Wellington, Institute of Policy Studies, 2007)