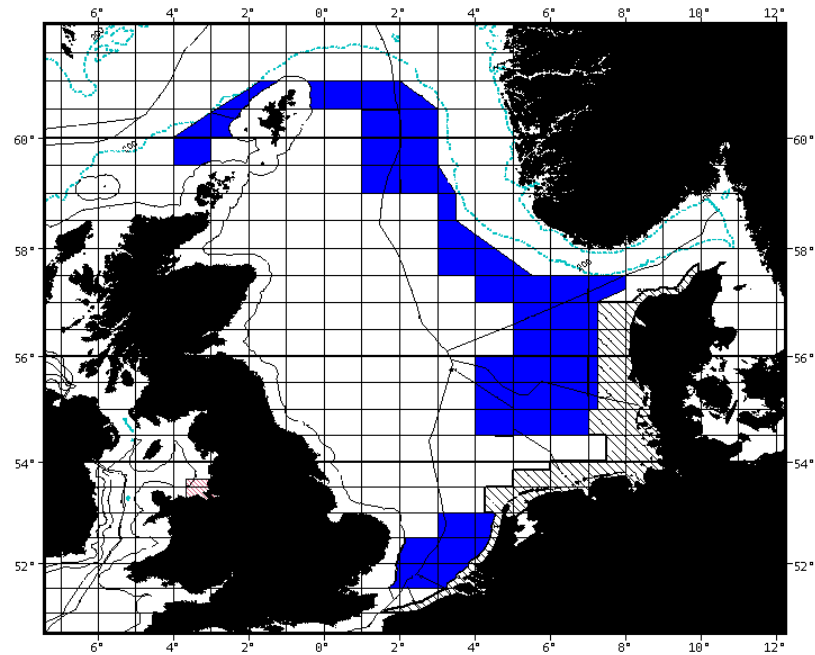


(un) sustainable

What is an environmental problem?

Cod Closure Areas



Karel Mulder

January 8, 2010

<http://ec.europa.eu/fisheries/topics/cod/cod4.gif>

Environmental Problems:

Human cause

Not a natural disaster

Of a more or less permanent character

Airport noise?

Reasonably serious

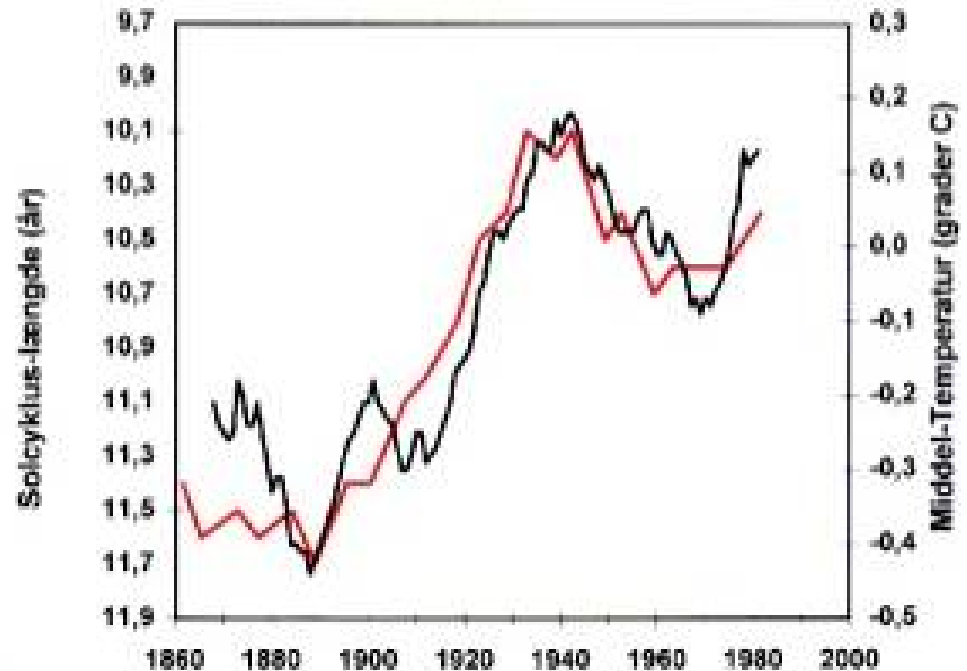
Everything we do causes some environmental effect, but ...

Sustainable Development

What is an Environmental Problem?

Is climate change an environmental problem?

Not if it is a natural phenomenon

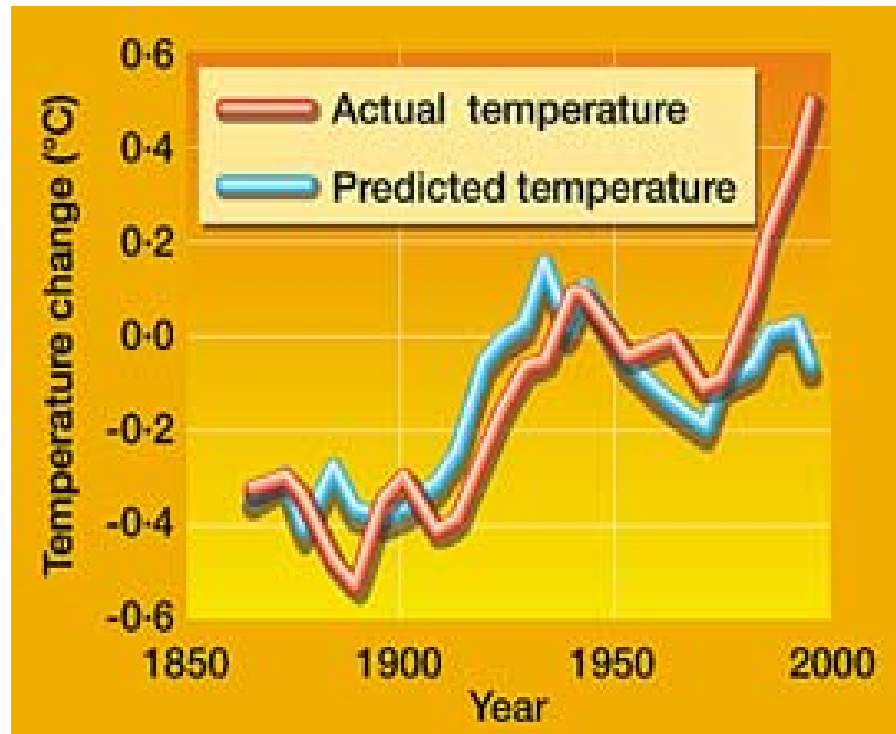


Correlation between solar activity and the Earths' average temperature

Sustainable Development

What is an Environmental Problem?

Temperature predictions based on the activity of the sun: proof for anthropogenic climate change after 1980

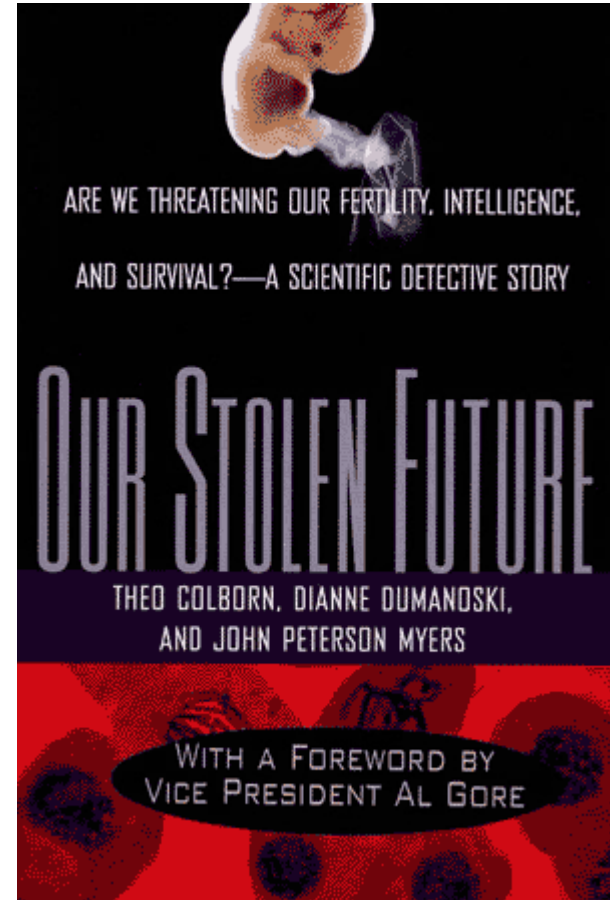


<http://web.dmi.dk/fsweb/solarterrestrial/sunclimate/welcome.shtml>

Environmental Problems

Declining fertility:
environmental problem or
cultural problem?

www.ourstolenfuture.org



Environmental Problems

Human Interference

When is human interference in the environment a problem?

1. When public health is put at risk
2. If nature (ecosystems, species) irreversibly changes
3. If changes affect (economic) benefits from natural processes
4. If nature becomes less useful to us or to others (e.g. to less developed countries or future generations)

Environmental Problems

1 Human Interference and Public Health

Spread of infectious diseases - open sewage systems, manure

Infected food and drinking water - pesticides, heavy metals

Disturbance of hormone levels

Lung conditions – solvents, smog, dust, asbestos

Noise

Radiation – UV (ozone layer), radioactivity (Chernobyl)

Environmental Problems

2 Human Interference and Nature

Nature conservation

Different views regarding nature conservation

Ecosystems

Environmental Problems

2 Human Interference and Nature



http://nl.wikipedia.org/wiki/Afbeelding:American_bison_k5680-1.jpg

Environmental Problems

2 Human Interference and Nature

Human centered position: Anthropocentric

(Problems have negative consequences for humans)

Nature as common heritage: Conservationist

(Conserve nature for later generations)

Nature has its own intrinsic value: Preservationist

(Human needs are unimportant, the destruction of nature itself is the problem)

Humans own nature: Ecocentric

Environmental Problems

2 Chief Seattle's 1854 Oration

How can you buy or sell the sky, the warmth of the land? The idea is strange to us.

If we do not own the freshness of the air and the sparkle of the water, how can you buy them?

Every part of this earth is sacred to my people. Every shining pine needle, every sandy shore, every mist in the dark woods, every clearing and humming insect is holy in the memory and experience of my people. The sap which courses through the trees carries the memories of the red man.



Environmental Problems

2 Chief Seattle's 1854 Oration

The white man's dead forget the country of their birth when they go to walk among the stars. Our dead never forget this beautiful earth, for it is the mother of the red man. We are part of the earth and it is part of us. The perfumed flowers are our sisters; the deer, the horse, the great eagle, these are our brothers. The rocky crests, the juices in the meadows, the body heat of the pony, and man --- all belong to the same family.

<http://www.webcom.com/duane/seattle.html>

Environmental Problems

2 Ecosystems

Tropic levels:

Primary producers – Autotrophs

Consumers – Heterotrophs

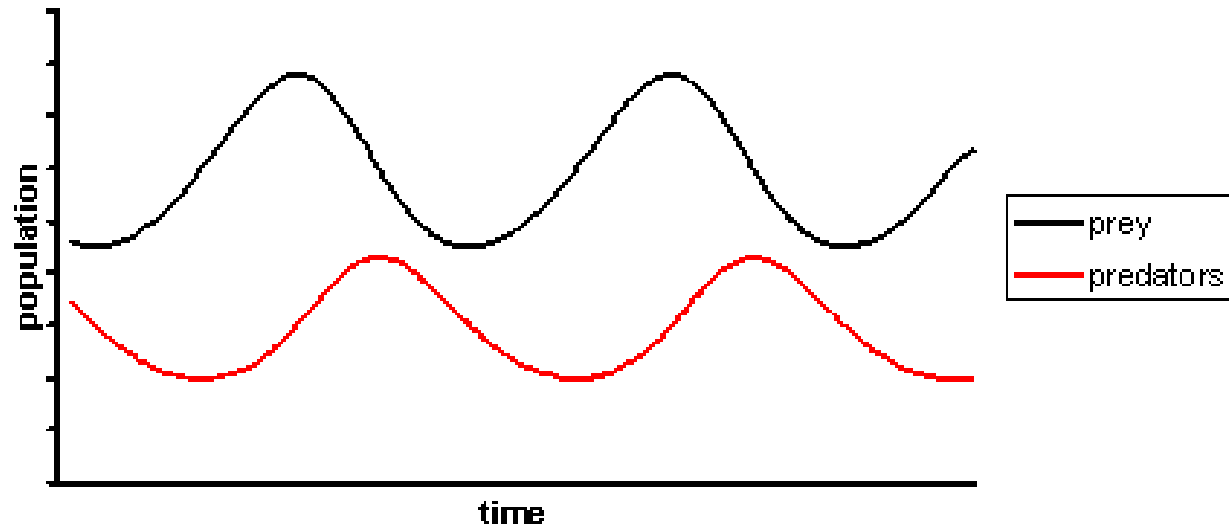
Decomposers

Food chain

Predator and Prey

Environmental Problems

2 Lotka-Volterra Equation



Predator-prey equation showing how two species interact as predator and prey.

http://en.wikipedia.org/wiki/Image:Volterra_lotka_dynamics.PNG

Environmental Problems

2 Ecosystems Threatened by:

Pollution (mercury, lead, cadmium etc)

Extinction of species (whales, fish, tigers)

Overdose of natural substances (pigs manure)

Introduction of new species (alien species such as rabbits and rats)

Environmental Problems

3 Socio-economic Threat

The Earth coming to an end → scarcity of natural resources

Exhausting natural resources

(fossil fuels, ore → solutions through saving energy, limiting waste, recycling)

Physical threat to e.g. crops in agriculture or fishing industry

Environmental Problems

3 Destruction of the Nature that Feeds us:

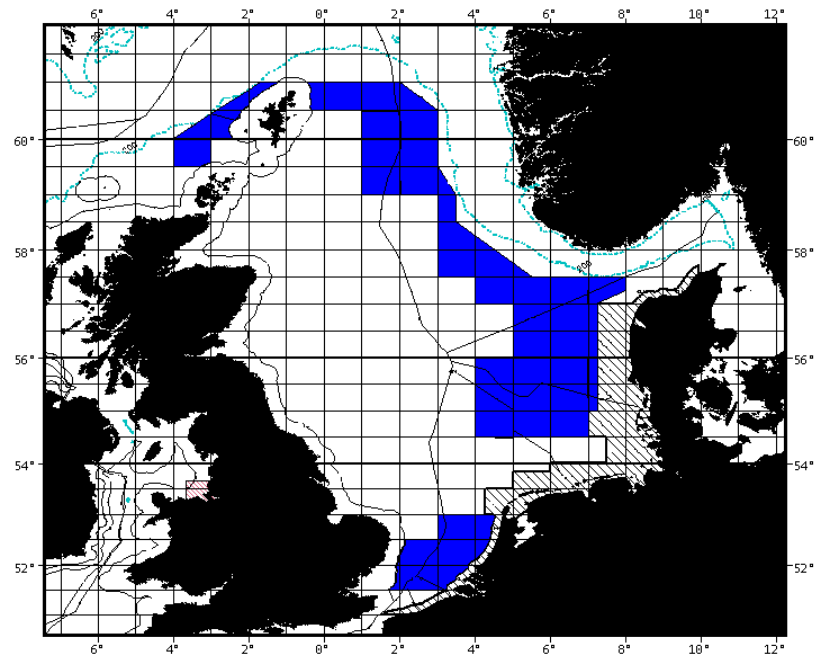
Overfishing:

Fish populations might increase while a collapse is imminent

Overfishing is usually noticed when it is already too late

(e.g. San Francisco's Fisherman's Wharf)

Cod Closure Areas



<http://ec.europa.eu/fisheries/topics/cod/cod4.gif>

Environmental Problems

4 The Problem of Justice

Future generations should not suffer from our misbehavior

Inequity in consumption between rich and poor should be stopped

Who has the right to deplete the world of its limited resources?
(The rich, everybody, future generations) Fair trade is part of Sustainable Development



http://www.fairtrade.org.uk/resources/downloadable_resources.aspx

Environmental Problems & International Conflict

4 The Problem of Justice

International tension by environmental problems:

- Threatened islands by sea level rise
- Environmental refugees

Wars caused by conflicts on scarce resources (oil, water)



http://www.fairtrade.org.uk/resources/downloadable_resources.aspx

Environmental Problems

Spatial Distribution

On an increasing scale:

Indoor e.g. radon gas

Local soil pollution by former gas works

Regional noise caused by an international airport

Continental acid rain

Global climate change, biodiversity

Or alternate more appropriate spatial scales:

River basins

Coastal Seas

Environmental Problems

Dealing with Global Environmental Issues: example ozone



Environmental Problems

4 phases in a problem

Is there a problem?

What causes the problem?

What are the solutions?

Implementation

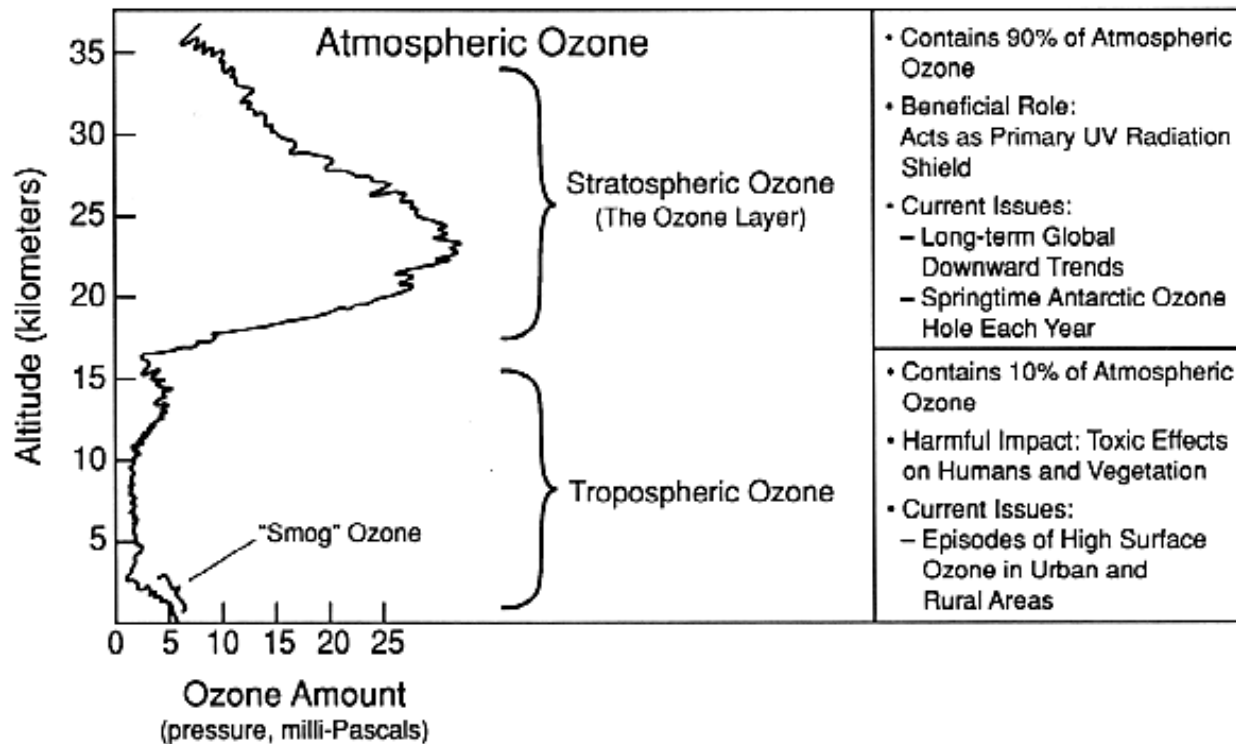
Principle of Precaution:

Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

The United Nations Conference on Environment and Development, Rio de Janeiro, 3 to 14 June 1992,

Environmental Problems

Distribution of Ozone in the Atmosphere



www.ndsc.ncep.noaa.gov/freq_qu?faq.html, 25 October 2005

Environmental Problems

Ozone Layer - UV

Ultraviolet radiation in Sun light

	Wavelength
UV-A	320 - 400 nm
<i>UV-B</i>	<i>280 - 320 nm, especially 310 - 320 nm</i>
UV-C	< 280 nm

UV-C is broken down completely by O₂

UV- A induces vitamin D production,

Too much UV-A: Adverse health effects on the skin, eye, and immune system

Environmental Problems

Ozone Layer - UV

Troublemaker: UV- B

absorbed by DNA

Damage to immune system

Skin cancer

Less vitamin D production

Less Vitamin D synthesis

UV-B is only broken down by ozone

Environmental Problems

UV, Plants and Animals

Other effects UV-B:

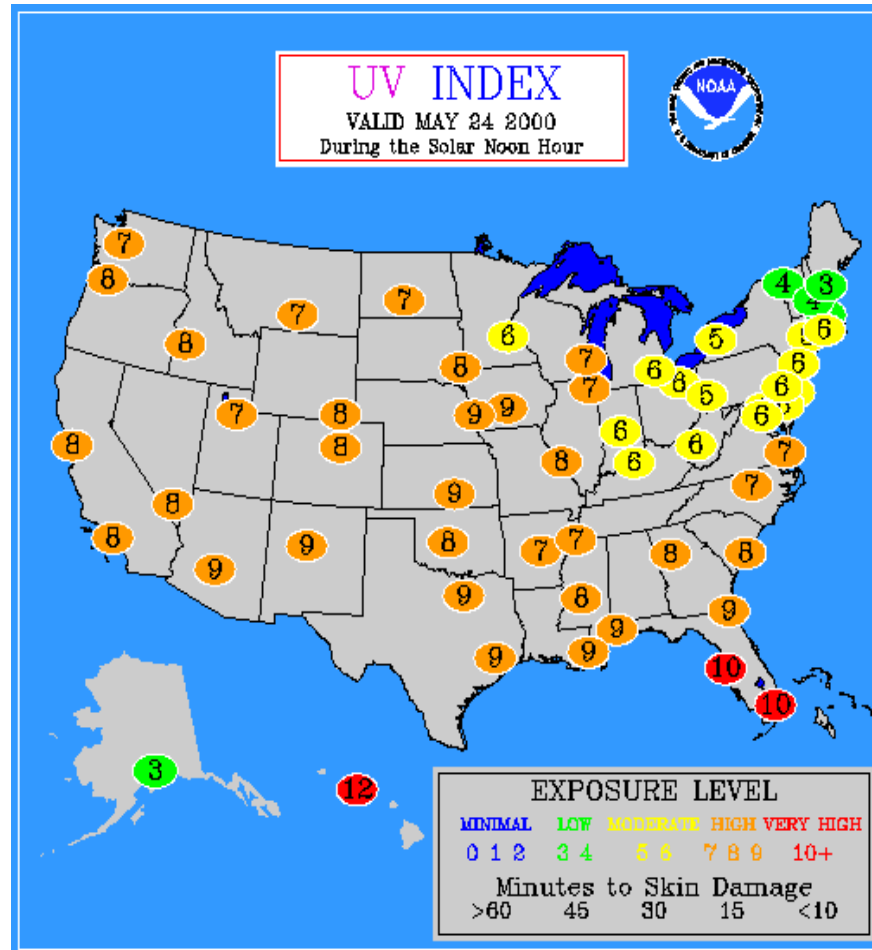
Reduced growth of plants

Threat to fish

Negative effects on phytoplankton (Antarctica)

Environmental Problems

UV Index



<http://www.noaanews.noaa.gov>

Environmental Problems

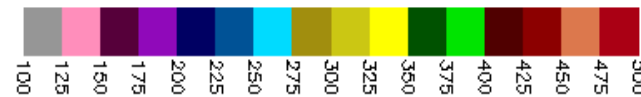
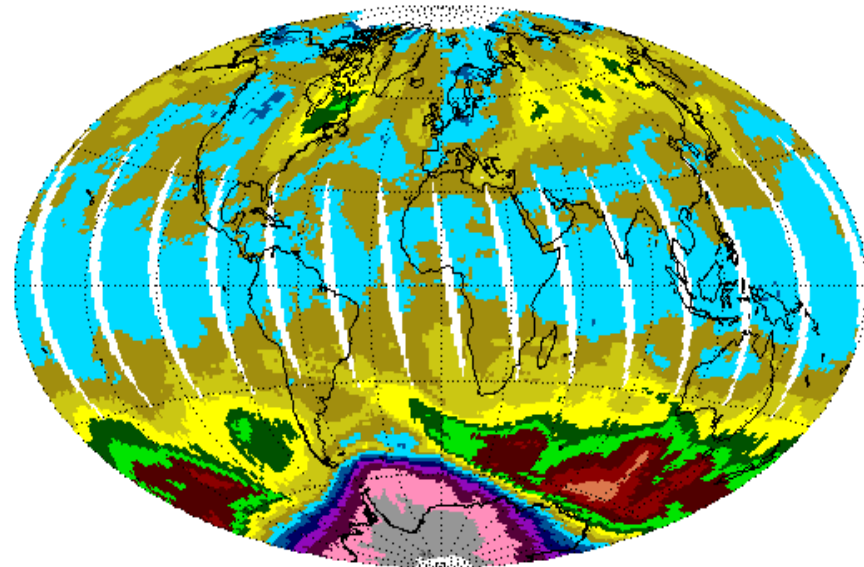
Dobson Unit

Dobson Unit:

0.01 mm ozone at
0°C en 1 atmosphere

Normal: Variation of
260 DU at the
equator to 300 DU at
the poles

EP/TOMS Total Ozone Sep 28, 2000



Dobson Units

Dark Gray < 100, Red > 500 DU

GSFC/916



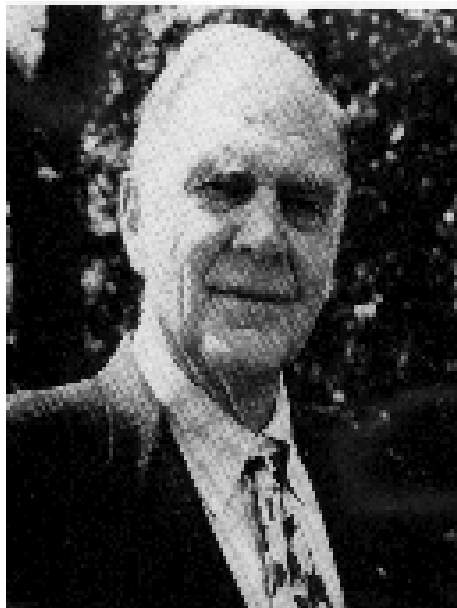
GEN:273/2000

Environmental Problems

CFCs

1970 Lovelock discovers CFCs in the air above Western Ireland

1974 F. Sherwood Rowland (UC-Irvine), Mario Molina



Environmental Problems

CFCs

Are only broken down by UV-B and UV-C radiation

Remain in the atmosphere for a long period of time

Enter the ozone layer

Meet only there high concentrations of UV-B and UV-B and are broken down

Release chlorine

Chlorine radicals catalyze the process of ozone destruction

Environmental Problems

CFCs

1974 Producers: Du Pont, Allied Chemical, Pennwalt, Union Carbide, Kaiser Aluminum, Racon, ICI,

Market: US- 750 million lbs, \$ 500 million

Global production:	1045 million lbs	– spray cans
	343 million lbs	– foam
	380 million lbs	– cooling
	<u>113 million lbs</u>	<u>– other</u>
	1900 million lbs	TOTAL

Environmental Problems

CFCs

Reactions to the paper by Rowland/Molina

EPA is authorized to take drastic measures

Netherlands: discussion in the chamber of parliament

Demand for spray cans reduces by 25%

1978: USA, Canada, Norway and Sweden ban the use of spray cans where it is not strictly necessary

Environmental Problems

CFCs

1981- EPA

Effects of CFCs on ozone layer are 'highly controversial'

Models result in lower estimates

No empiric proof

People are less worried

Industry does not react

The market for CFC 113 increases

The market for CFC 11/12 stagnates

Environmental Problems

CFCs

1978:

Nimbus 7 monitors
ozone layer

1984:

Joe Farman: ozone
layer above Antarctica
is very thin

1985:

Publication



Environmental Problems

Ozone Layer - UV

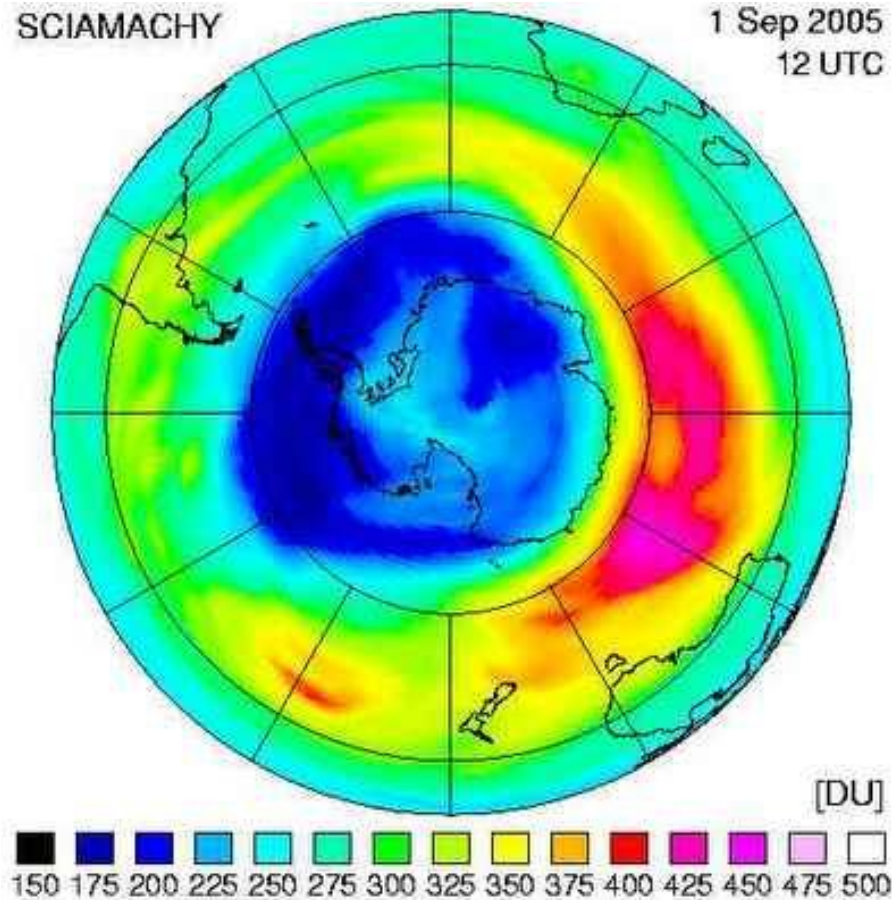
August 1985: Confirmation
from NASA

By reinterpretation of the
Nimbus 7 results



Environmental Problems

Ozone Layer - UV



Environmental Problems

Ozone Layer

Explanation 'ozone hole'

Vortex in polar night of Antarctica --> $T < -80^{\circ}\text{C}$

Polar Stratospheric Clouds ($\text{HNO}_3(\text{H}_2\text{O})_3$)

At surface of crystals, chlorine accumulates

End polar night, light --> chlorine radicals

Environmental Problems

Ozone Layer

International Policy

1974-'85 Precautionary Principle?

1985 Convention of Vienna--monitoring ozone layer

Environmental Problems

Ozone Layer

Discovery 'hole'

- sept '87 Montreal protocol: stabilizing production, halving in 1999
- 1990 London protocol: phase out in 2000, except 3rd w.
- 1992 Copenhagen protocol: phase out in 1995, 3rd w in 2005
- 1997 Montreal: trade forbidden

Environmental Problems

Ozone Layer

Next phase in policy only if there is sufficient consensus on the previous issue

In practice, precautionary principle plays limited role

Environmental Problems

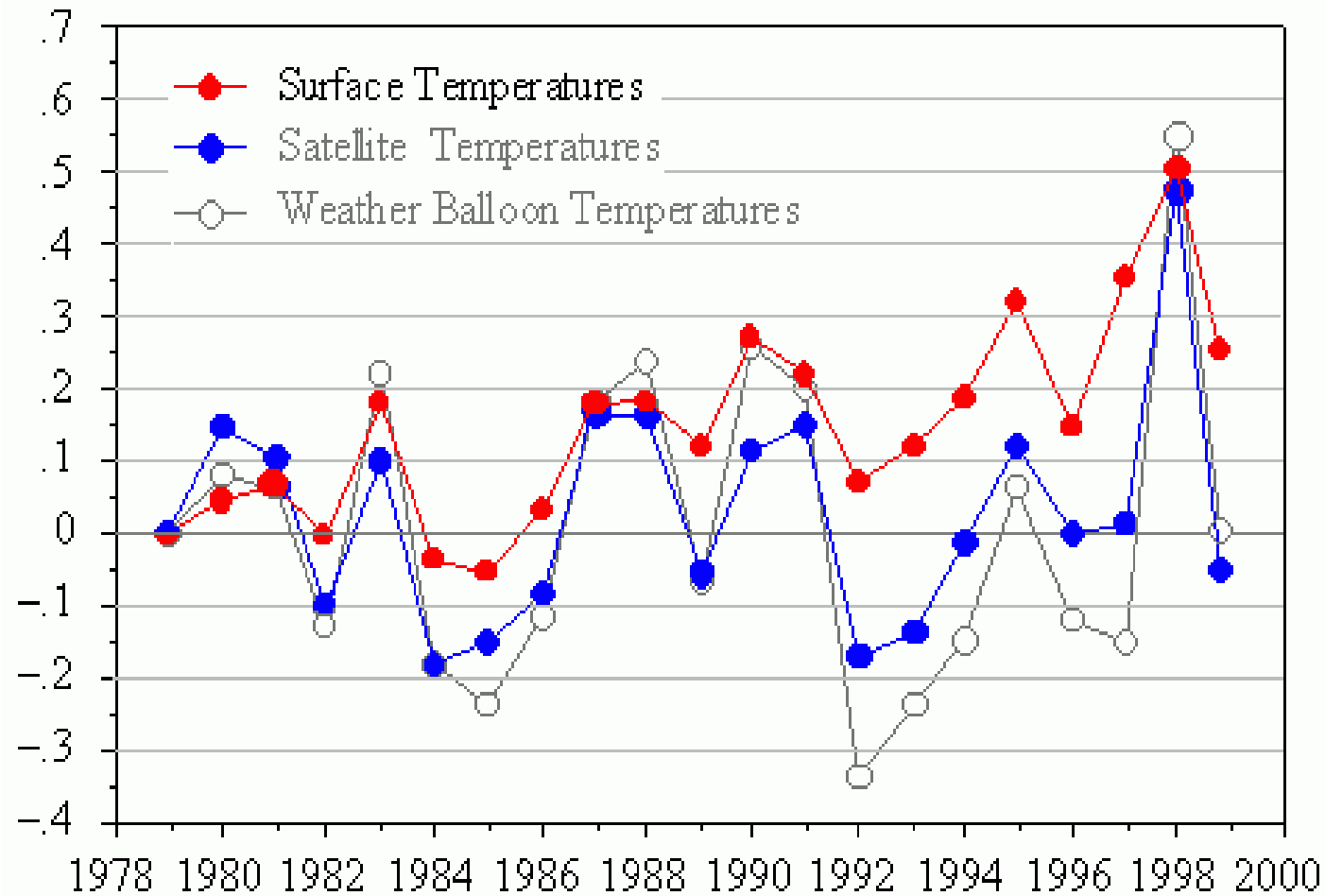
What about Climate Change?

LONDON TELEGRAPH Jan. 14, 2001
Global warming claims 'based on false data'
By Robert Matthews

FRESH doubt has been cast on evidence for global warming following the discovery that a key method of measuring temperature change has exaggerated the warming rate by almost 40 per cent.

How to
measure the
average
temperature
on Earth?

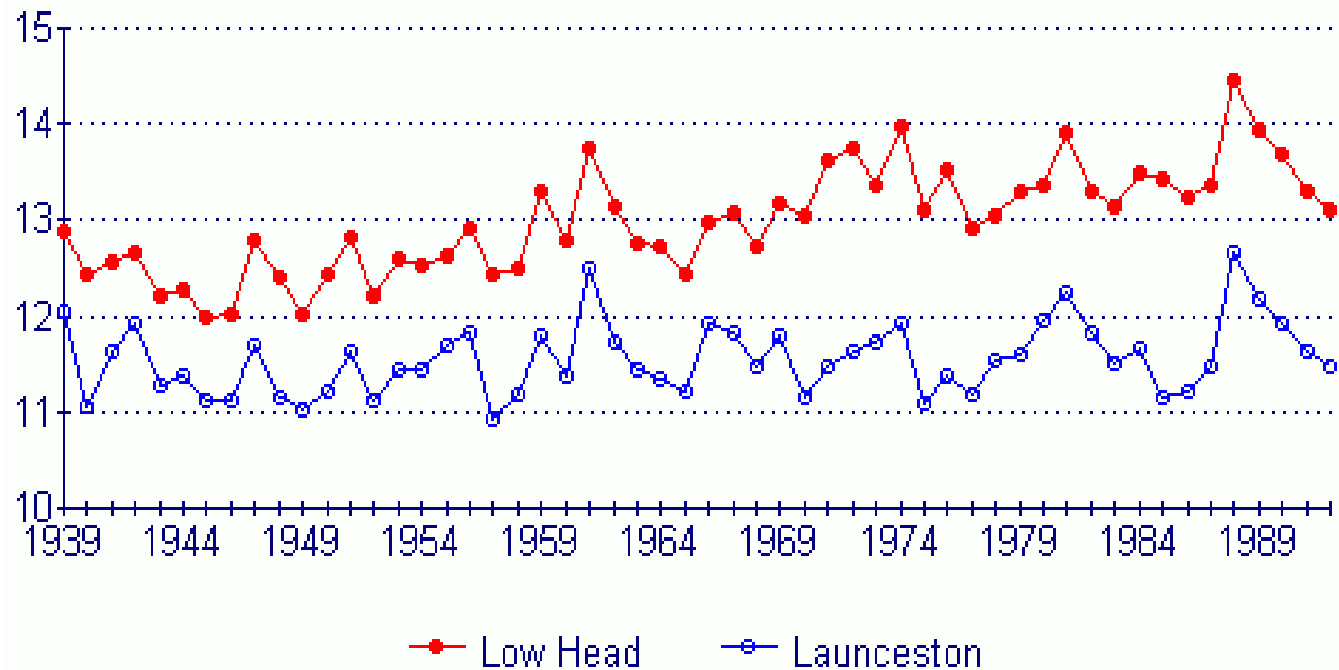
Annual Global Temperature Departures (1999 value based on 8 month mean)



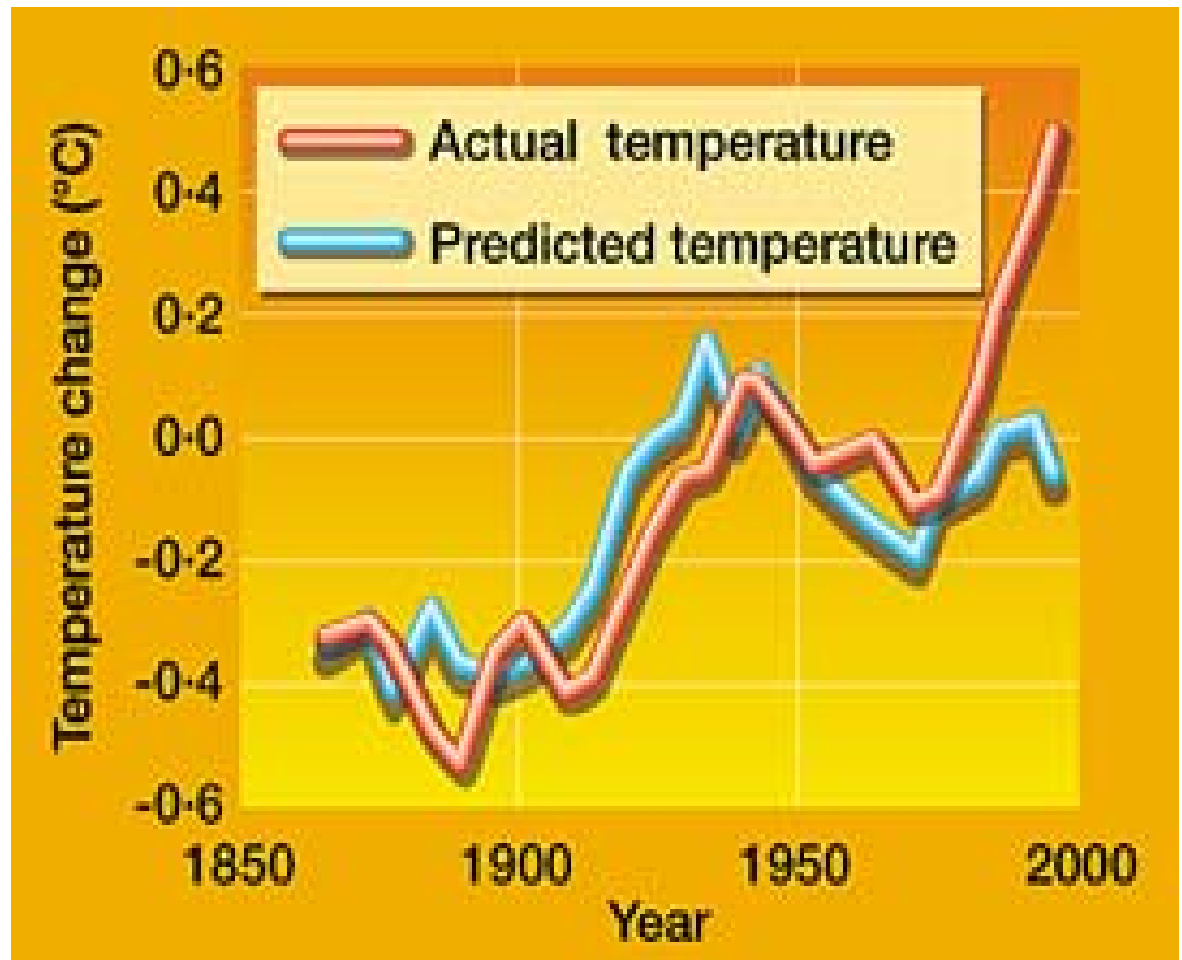
Urbanization
causing local
climate
change?

Launceston and Low Head Compared

Heat Islands are not the only problem

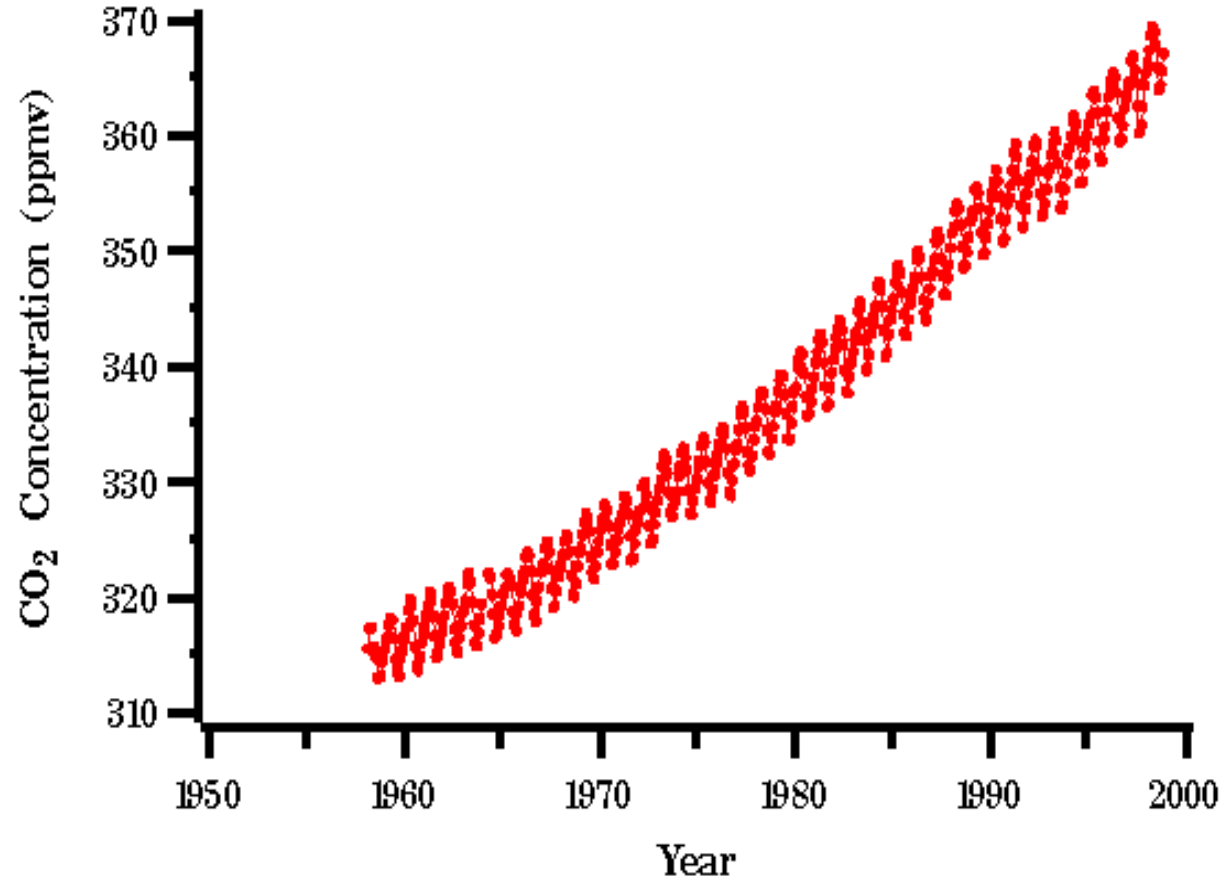


What about the solar cycle?

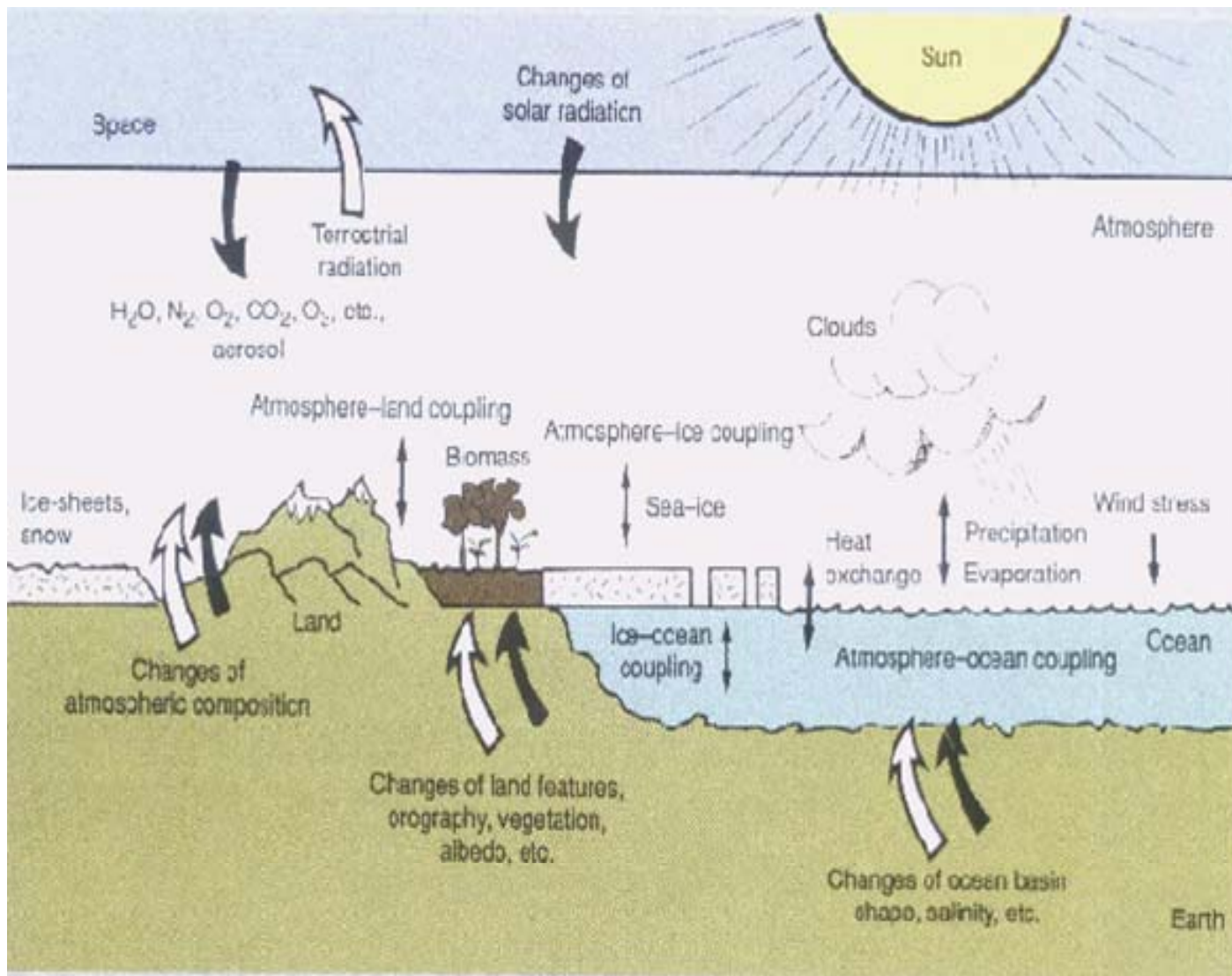


<http://web.dmi.dk/fsweb/solarterrestrial/sunclimate/welcome.shtml>

The Influence of plants on CO₂ levels



Source: Dave Keeling and Tim Whorf (Scripps Institution of Oceanography)



Environmental Problems

Uncertainties

Different ways of measuring temperature

Sea/land/satellites

Role of the oceans in absorbing CO₂

Increased growth of plants

Aerosols (caused by combustion) have a cooling effect

Clouds have a cooling effect

Unstable sea currents?

Heavier El Nino, affected gulf stream, salinity of the Mediterranean by decreased inflow from the Nile?

Environmental Problems

Consequences

Changing Climate zones

Agriculture

Ecosystems

Tourism (snow)

Parasites (disease)

Rise in Sea level

Flooding

Coral reefs

Revision of dikes

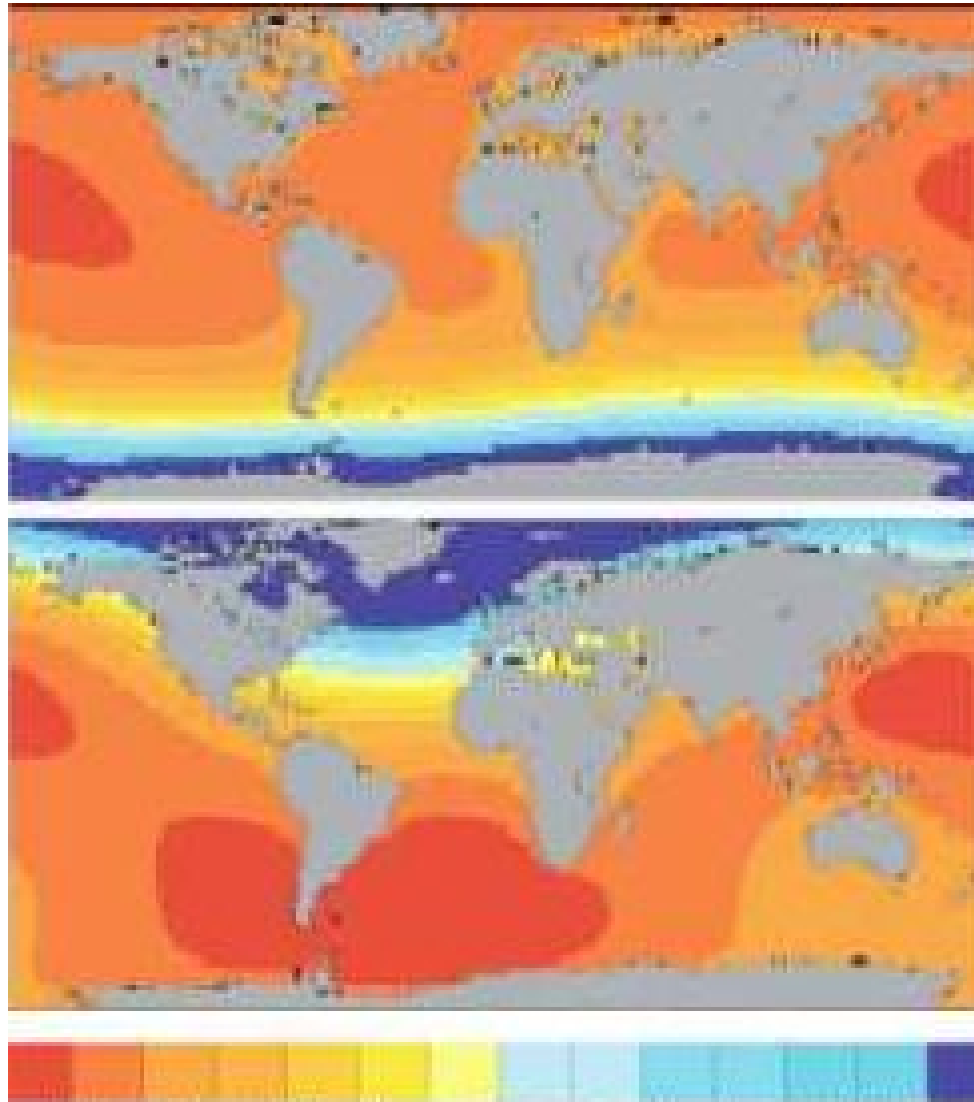
Disappearing wetlands

Damage from the weather

Storms

Flooding

Extra plant growth



Changing gravity fields cause unequal distribution of sea level rise:

Highest levels at equator

Environmental Problems

Interests

Fossil fuel industry

OPEC

Rich vs. poor countries

Environmental Activists

E5 (Industries in favor of Kyoto)

Fossil fuel industry

Trade in emission rights

Different types of agriculture

Environmental Problems

International Action

After Al Gore, action?

Prisoners Dilemma: who takes the lead?

How to enforce measures?