

Climate Change

See

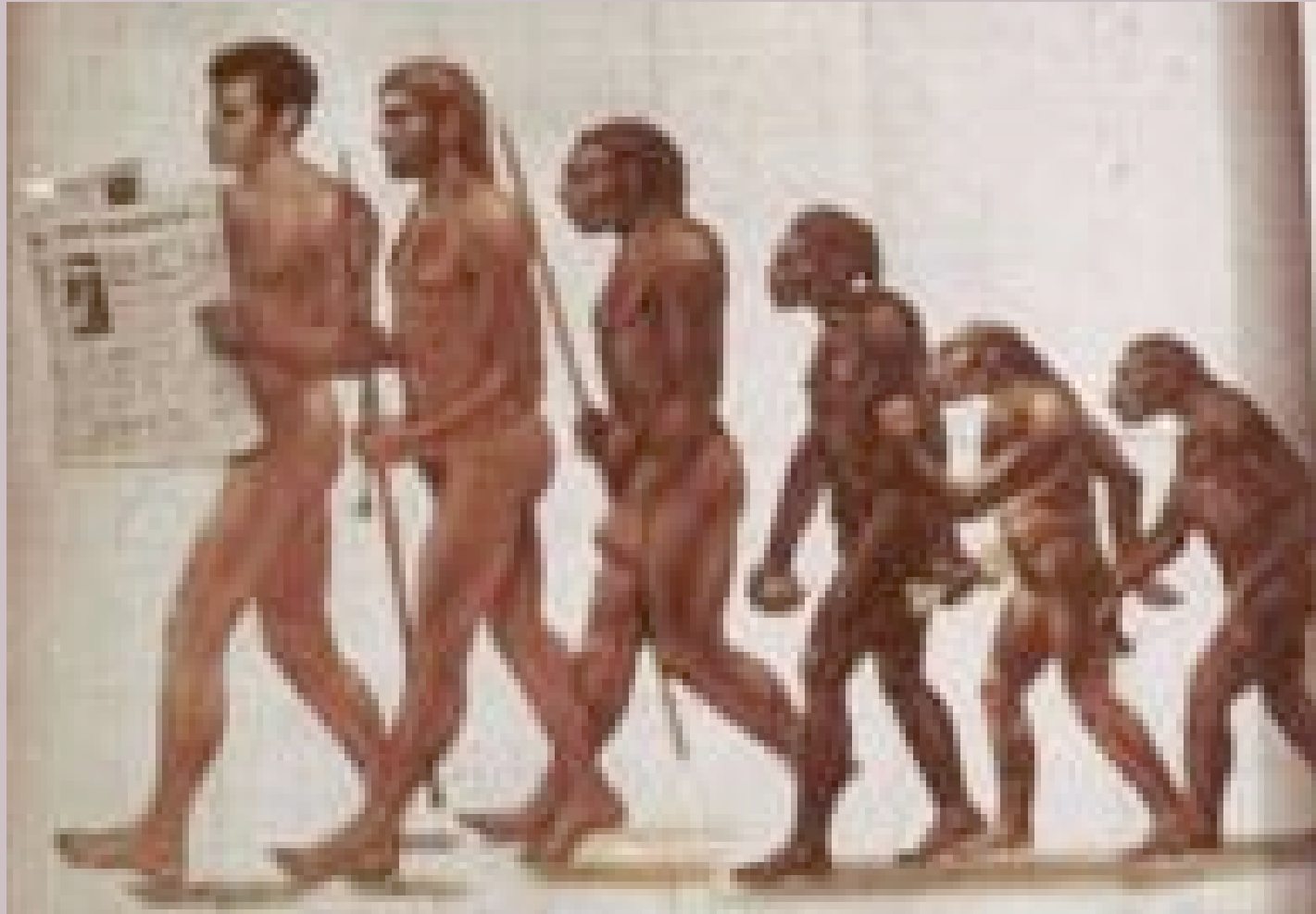
<http://www.quaker.org/fep/BMM307comments.doc> for comments



Karen Street
Berkeley MM

Berkeley Friends Meeting
March 4, 2007

Man Evolves



Creates Agriculture



Writing



And Ways to Put Greenhouse Gases back in the Atmosphere



Carbon dioxide, CO_2 and methane, CH_4 are important greenhouse gases.

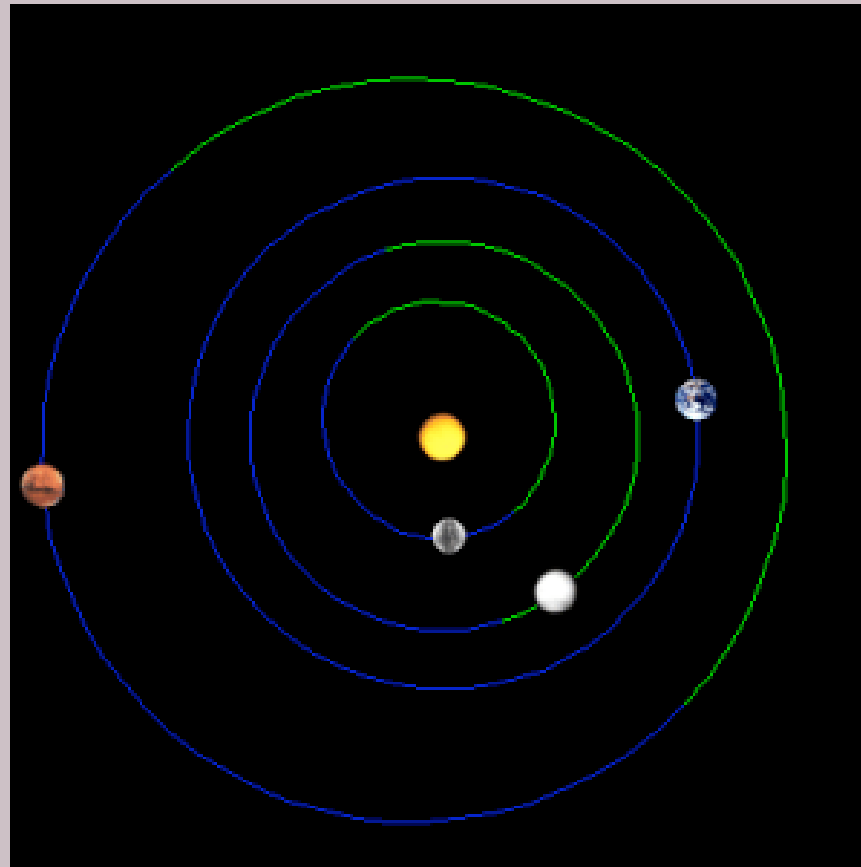
GHG help hold in the heat, and warm the Earth.



Greenhouse Gases and Inner Planets

Mercury no
atmosphere,
 $T = 320\text{F}$

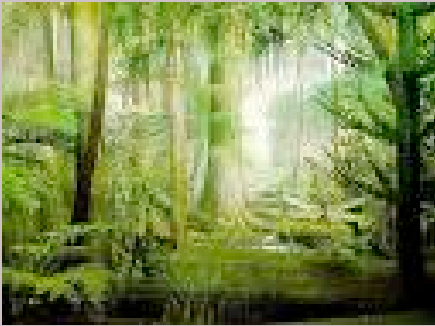
Venus mostly
 CO_2 , $T = 864\text{F}$
instead of
 150F



Earth atmosphere
mostly N_2 and O_2 ,
average $T = 57\text{F}$
instead of 0F , due
to natural GHG

Mars thin
atmosphere, T
 $= -63\text{F}$

Greenhouse Gases on Earth



Dead plants from the time of the dinosaurs and before stored as



natural gas



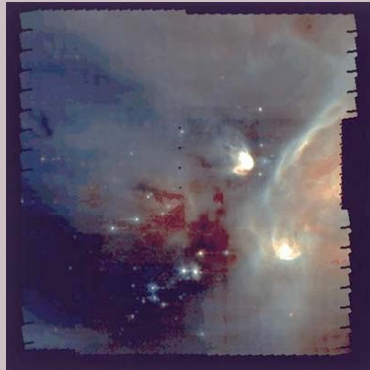
oil



coal

- carbon dioxide CO_2
- methane CH_4

Stars are born, get hotter, and die



This stegasaurus lived when the sun was cooler, but there were more greenhouse gases in the atmosphere.

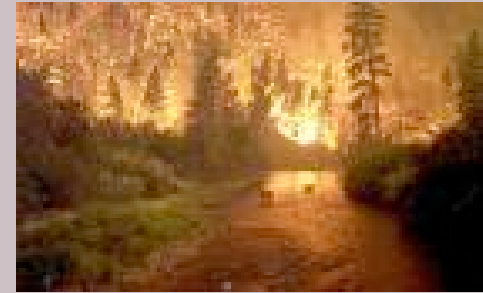
Greenhouse Gases Released

From long-term storage when

- fossil fuels are burned

From short-term storage when

- trees are burned

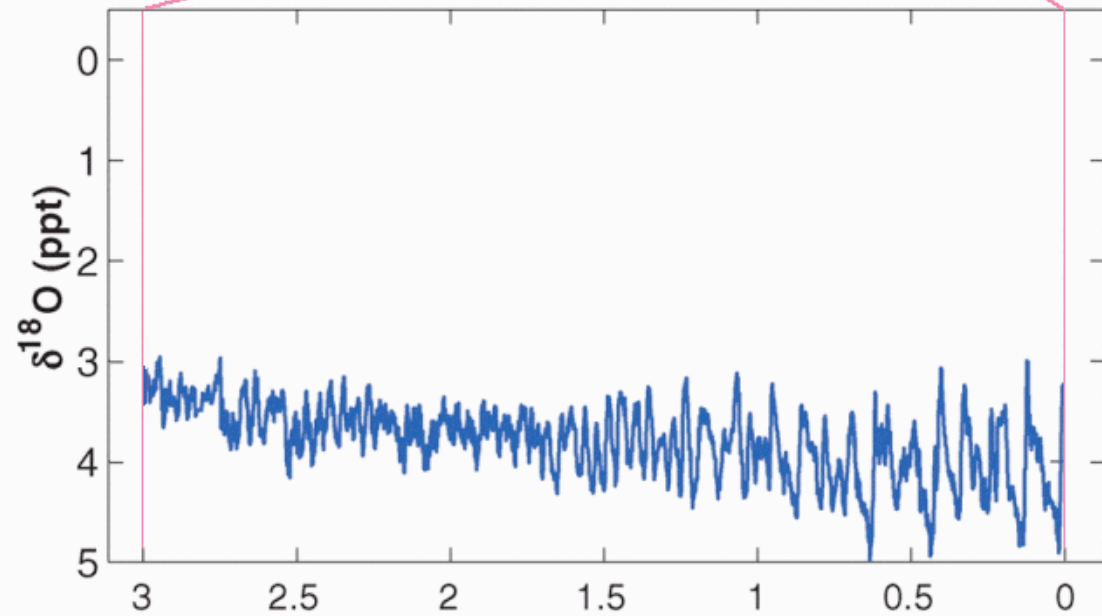
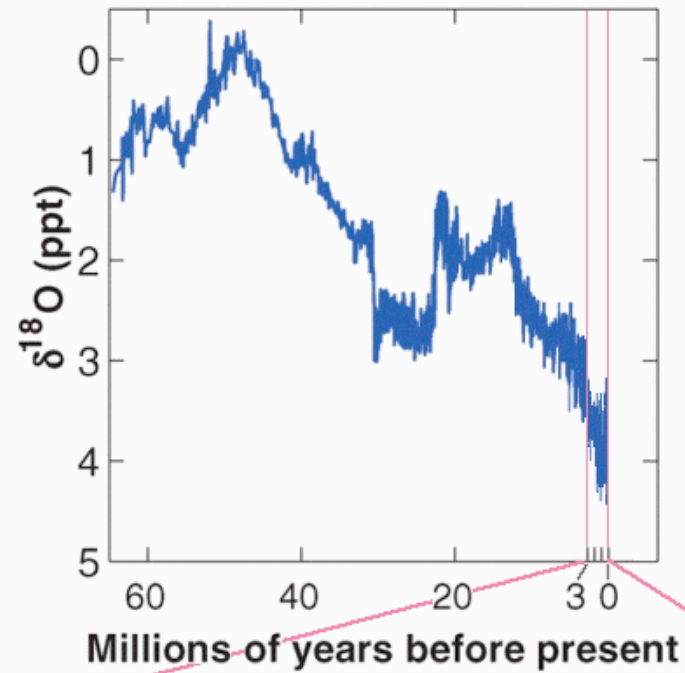


Creating new GHG

- farming
- ranching
- manufacturing cement or aluminum

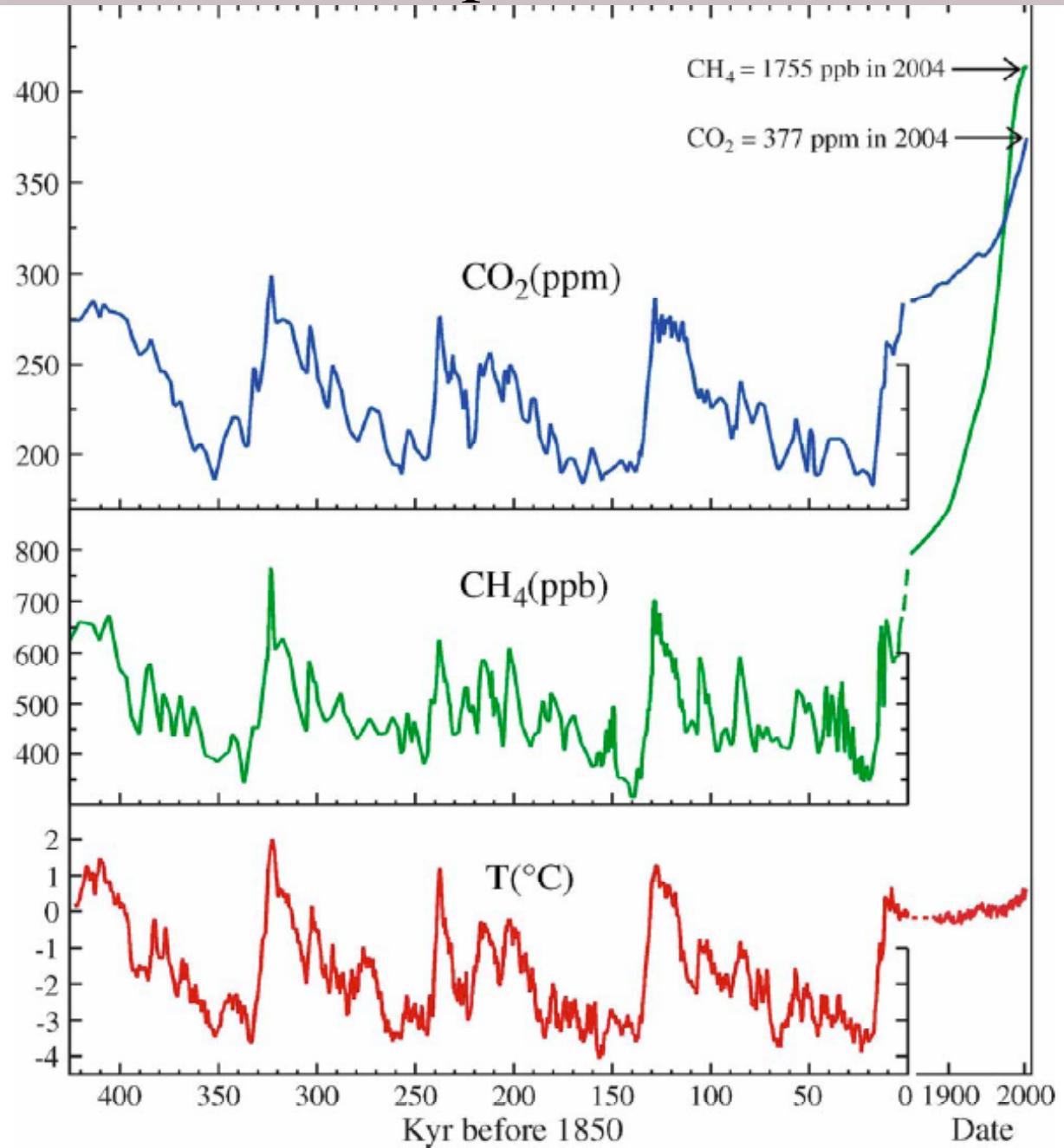


Natural and
Anthropogenic
(Human Caused)
Variation in GHG
and Temperature



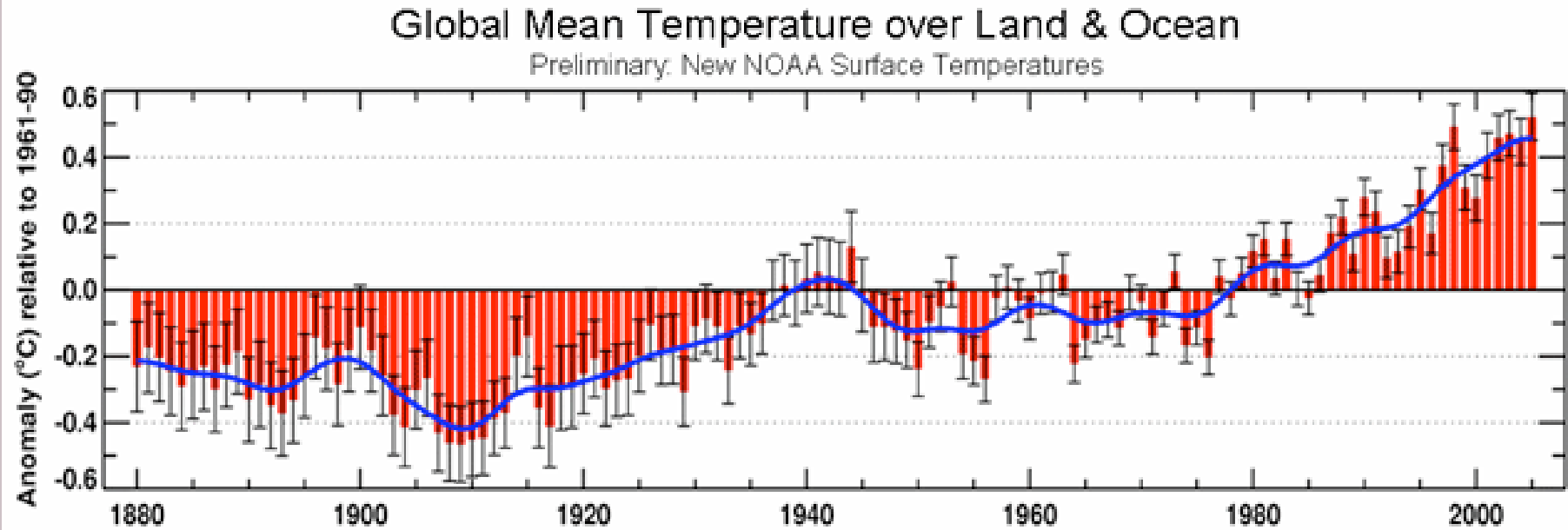
Antarctica (Vostok): Temperature and GHG

CO₂, CH₄ and estimated
global temperature
(Antarctic $\Delta T/2$
in ice core era)
0 = 1880-1899 mean.



Source: Hansen, *Clim. Change*, **68**, 269, 2005.

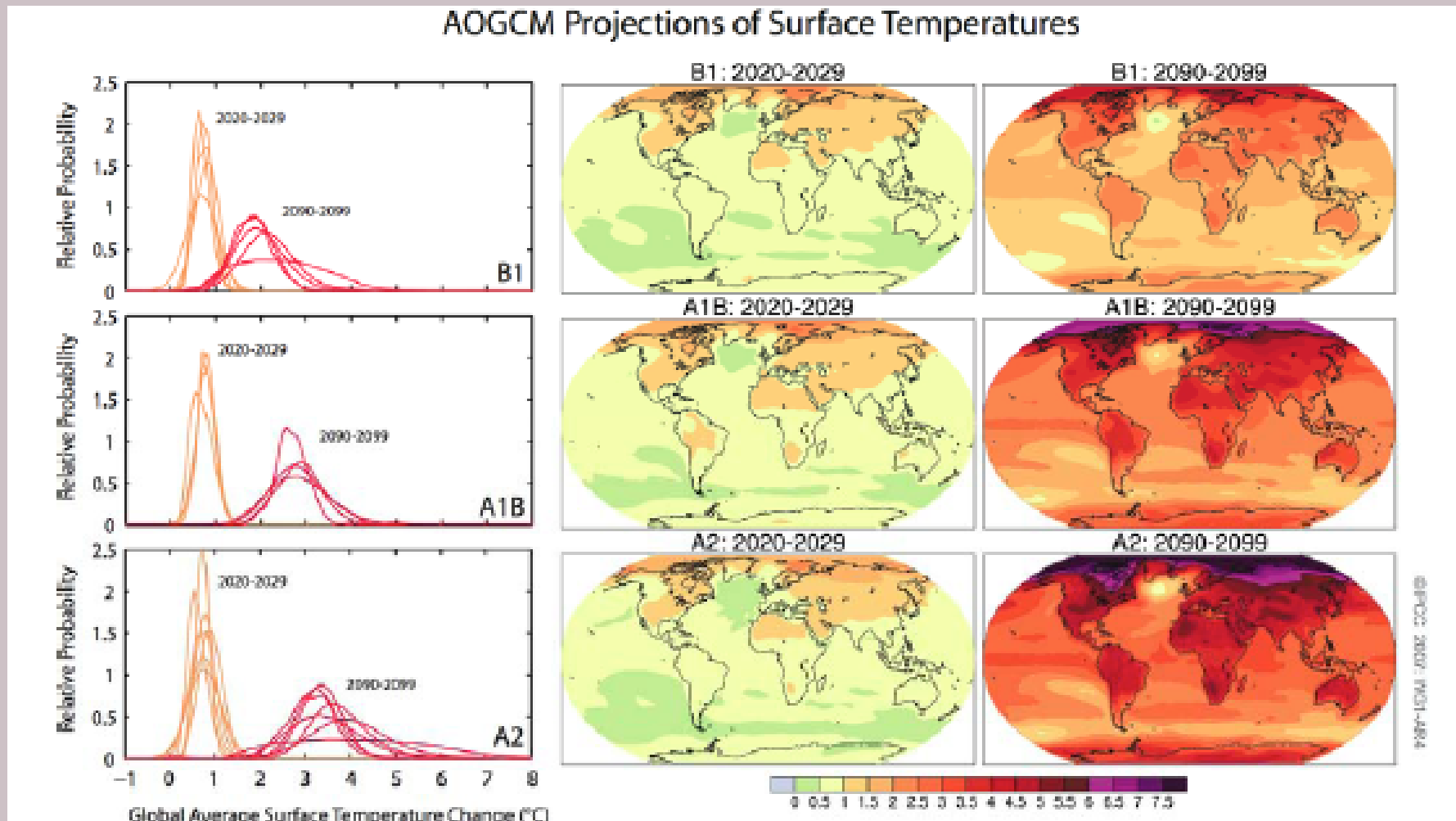
Recent Changes in Temperature



Variations caused by volcanoes (cooler), El Ninos (warmer), and added GHG.

Note: temperature today is the same as 1998, a very warm El Nino year.

Future Changes in Temperature

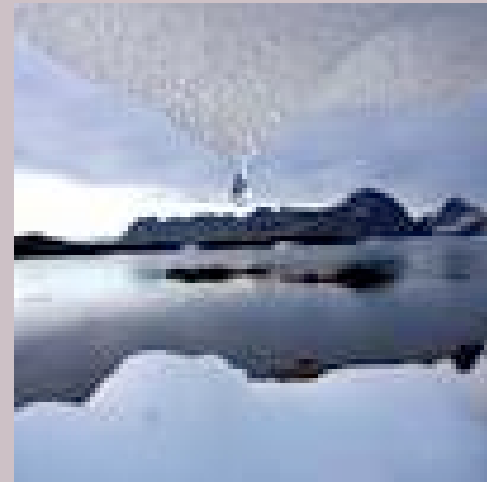


Temperatures are expected to continue increasing this century, more over land than ocean, and most near the Arctic.

As the Earth Warms



Warmer water expands



Glaciers melt

The sea level rises!

Glacier melt is increasing.



Surface water is carried to the base of the glacier, and lubricates flow -- ice is carried out to sea more rapidly.



1992

2002

There is enough ice on Greenland to raise sea level 20 feet.

Glacier melt is increasing.



Antarctica melt could raise sea level 150 feet. West Antarctica alone could raise sea level 20 feet.

Equality

“The produce of the earth is a gift from our gracious Creator to the inhabitants, and to impoverish the earth now to Support outward greatness appears to be an injury to the succeeding age.”

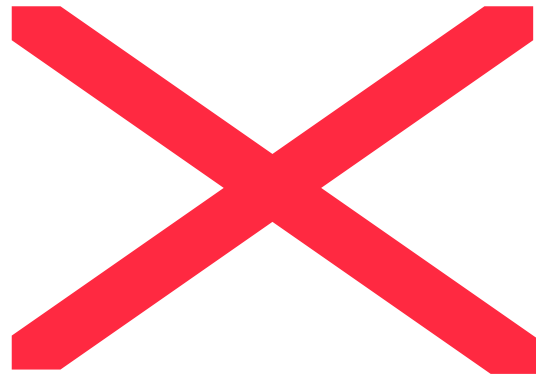
John Woolman, 1772

Worldwide,
hundreds of
millions get their
water from
shrinking glaciers

Peru



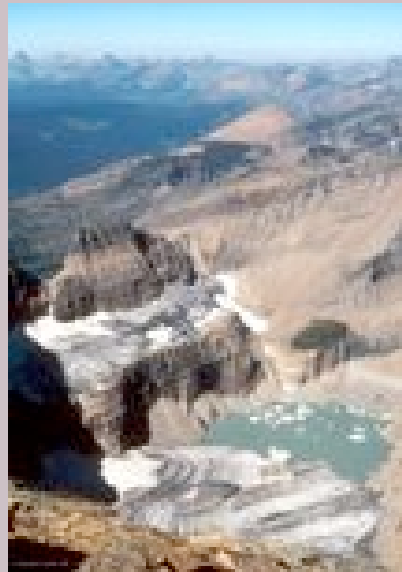
China's Roof of the World
Glacier, half the glacier coverage,
is shrinking 7%/year



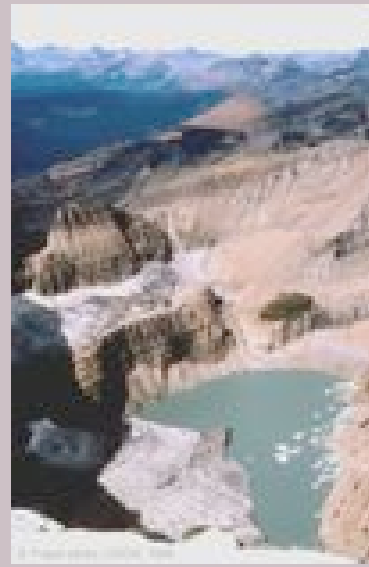
Grinnell Glacier in Glacier Park will disappear in the 2020s



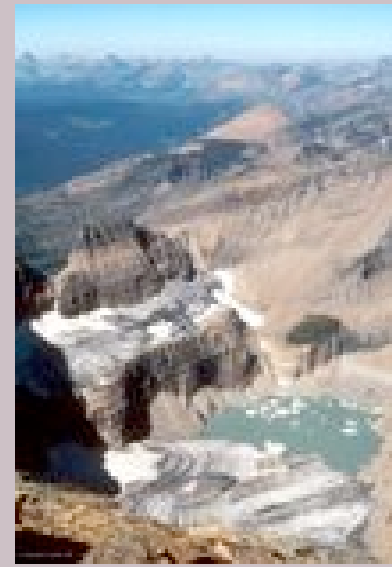
1938



1981



1998



2005



1928



2000

South Cascade Glacier in Washington



1941



2004

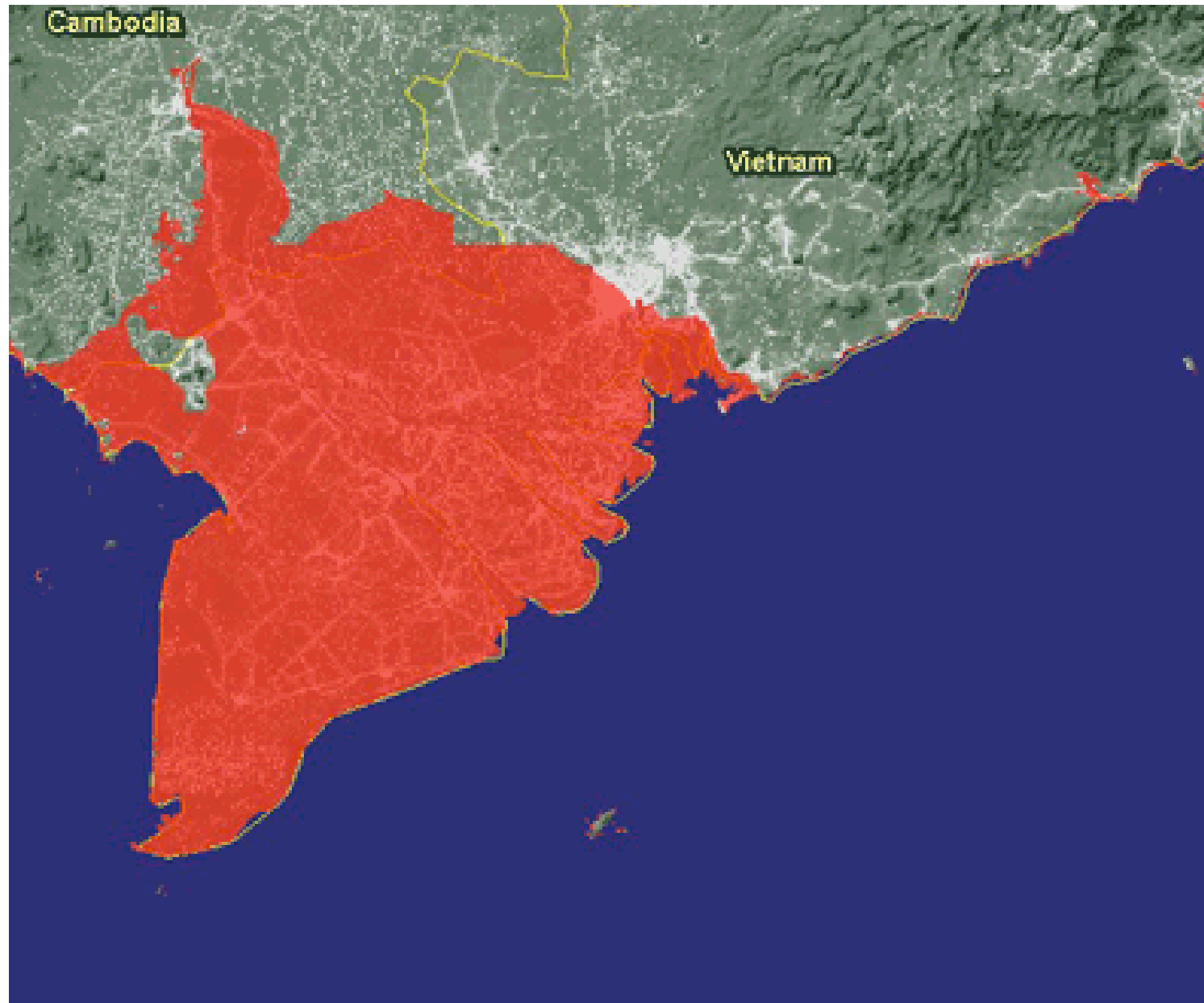
Muir Glacier in Alaska

The effects of climate change, including sea level rise, are expected to fall disproportionately on those who emitted less.

Salt-Farmers in Bangladesh



6 Meter Sea Level Rise and Southeast Asia

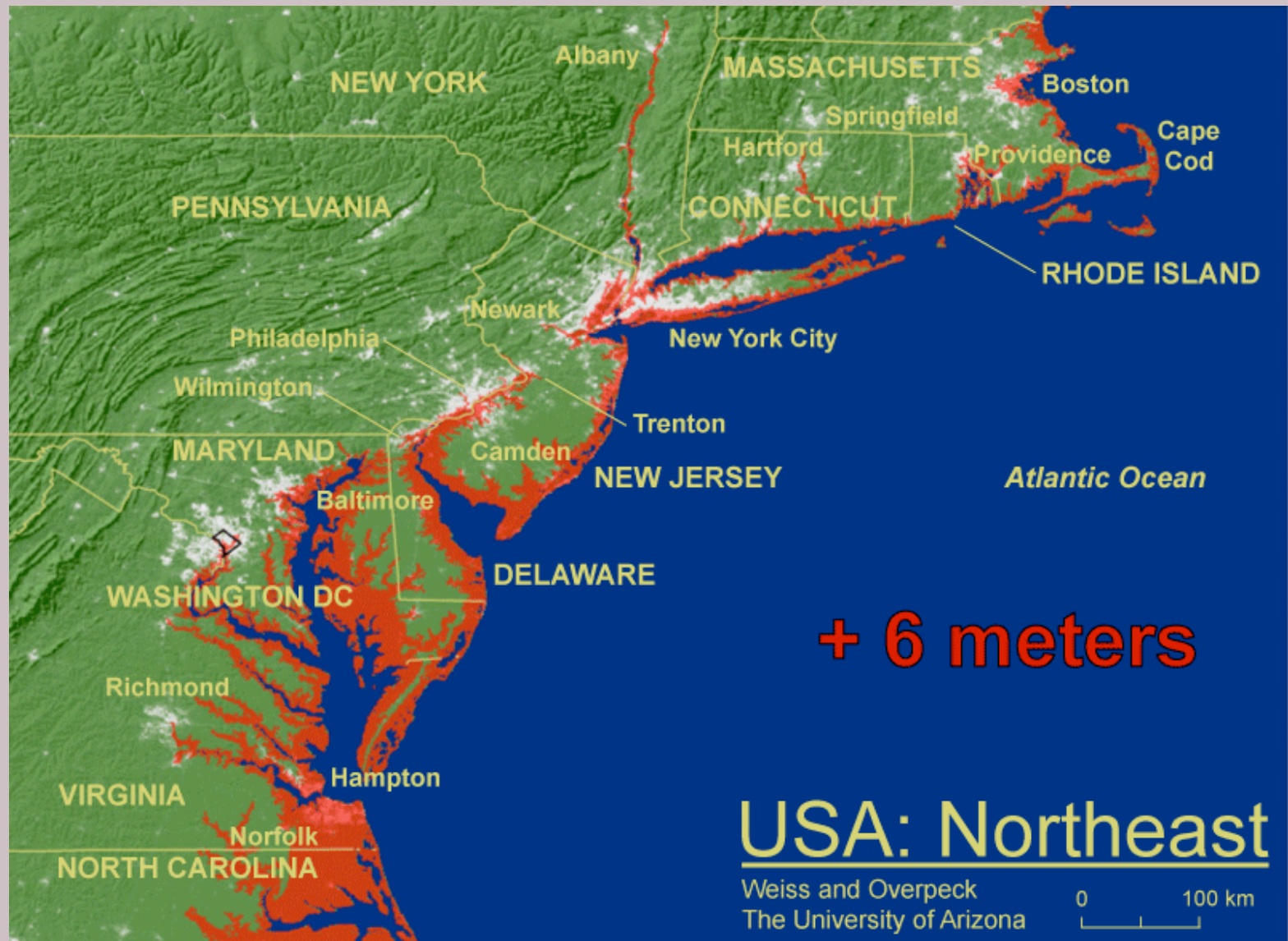


But the rich will pay as well.

6 Meter Sea Level Rise and Florida



6-Meter Sea Level Rise and Northeast



6 Meter Sea Level Rise and Europe



6 Meter Sea Level Rise and Europe



**A too-rapid sea level rise may make rebuilding levees in
the California Delta too expensive**



Under the best scenario, the snow reservoir, which releases water for agriculture and ecosystems in late spring and early summer, will be gone or almost gone by the end of this century.



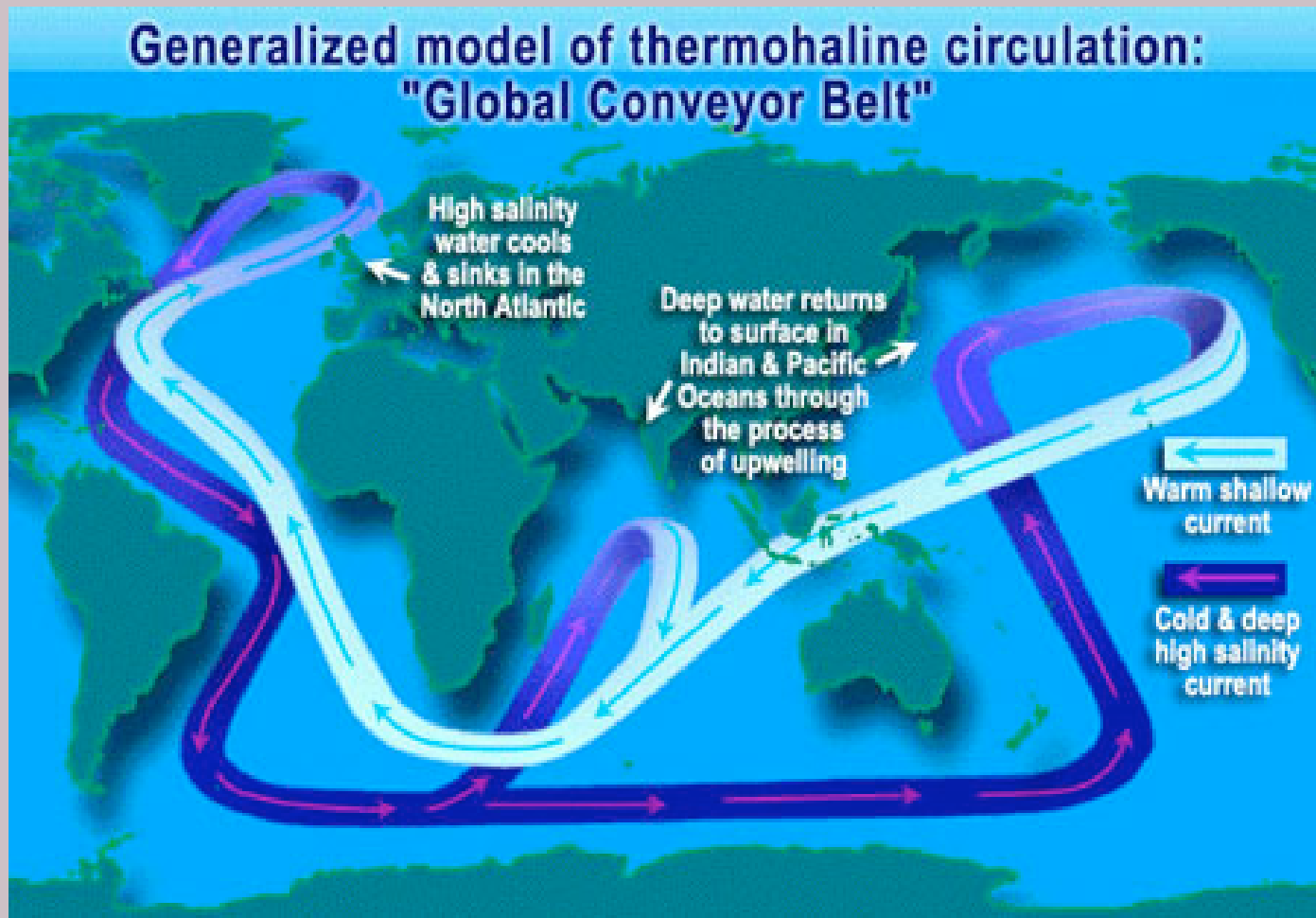
Snow stores water, melts



and some of it makes its way to reservoirs.

But not for much longer.

Changing currents and winds alter temperatures, and where the rain falls.



The ocean currents transfer heat from the tropics toward the poles.

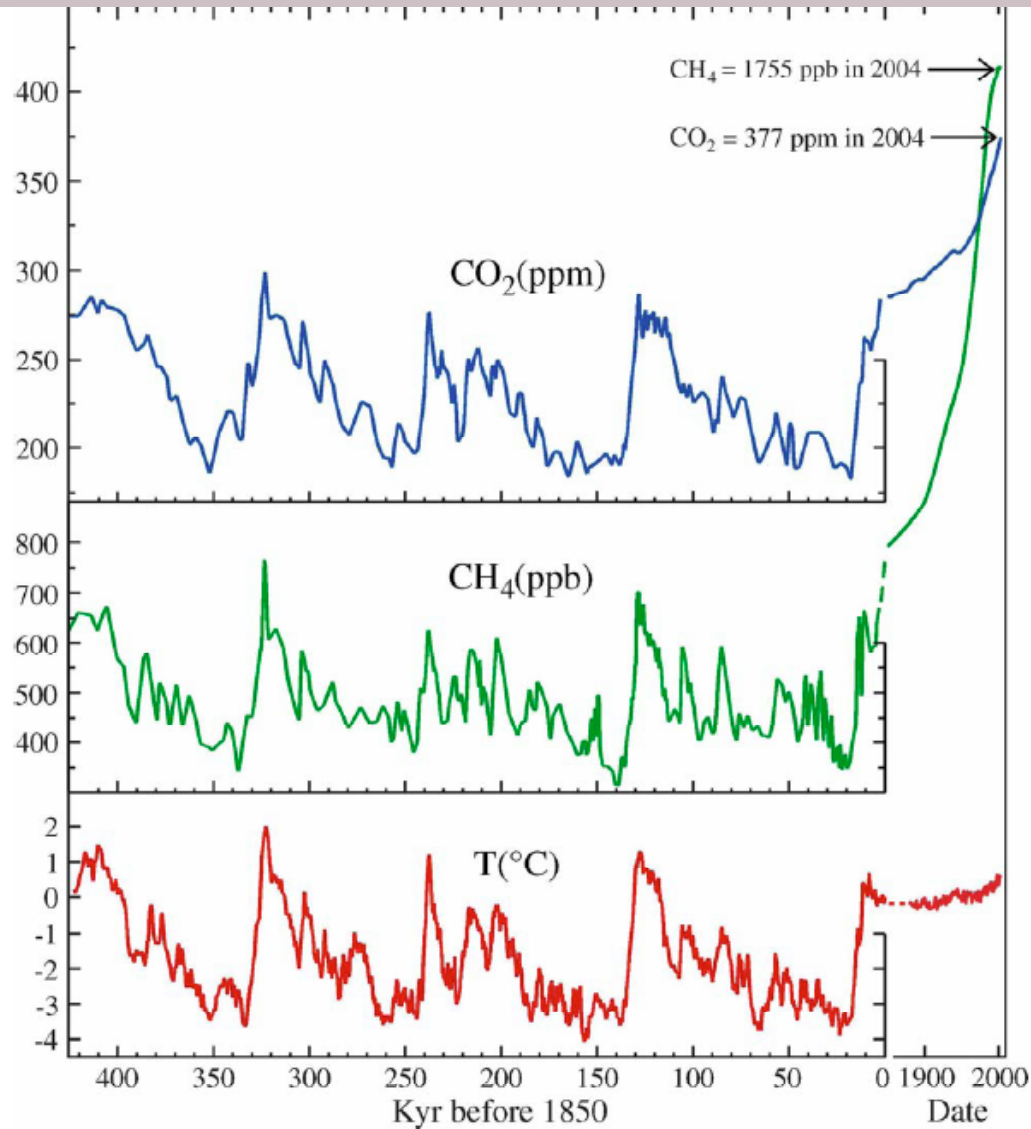
Changing currents and changes in land/ocean temperatures alter monsoon patterns.



Causing drought in China and elsewhere, where food doesn't come from the store.

No more ice ages while people live, because GHG level will stay above glacial levels.

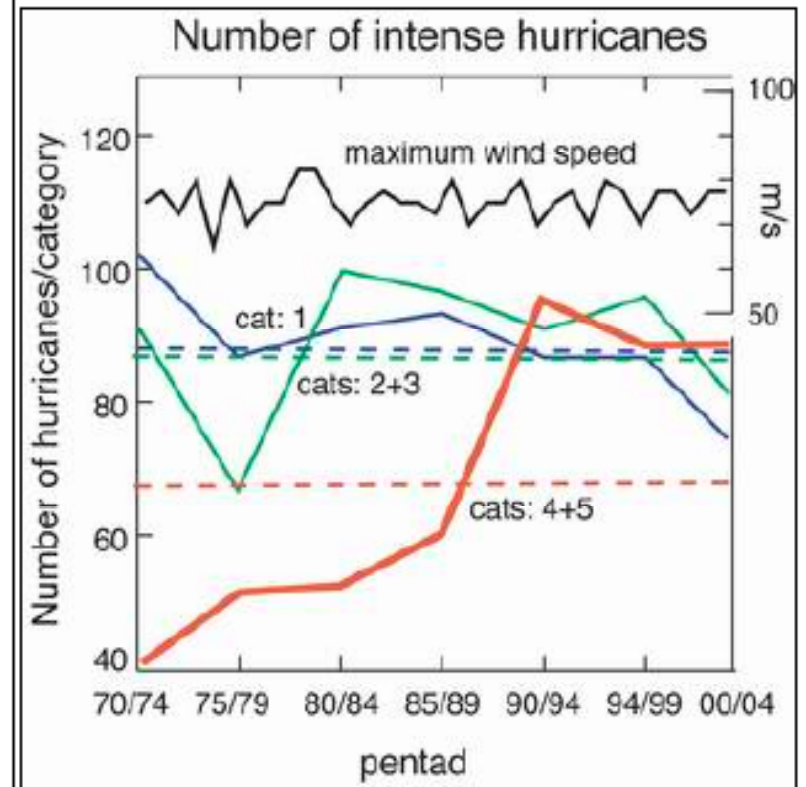
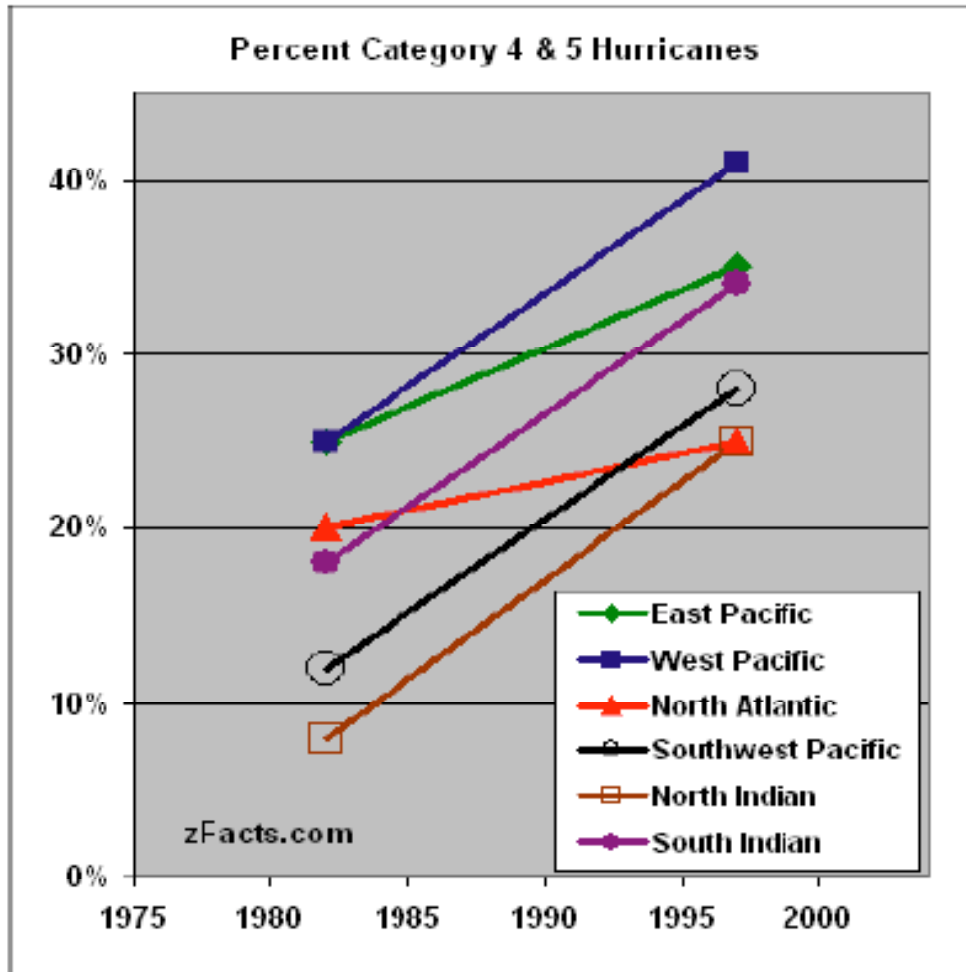
CO₂, CH₄ and estimated global temperature (Antarctic $\Delta T/2$ in ice core era) 0 = 1880-1899 mean.



Source: Hansen, *Clim. Change*, **68**, 269, 2005.

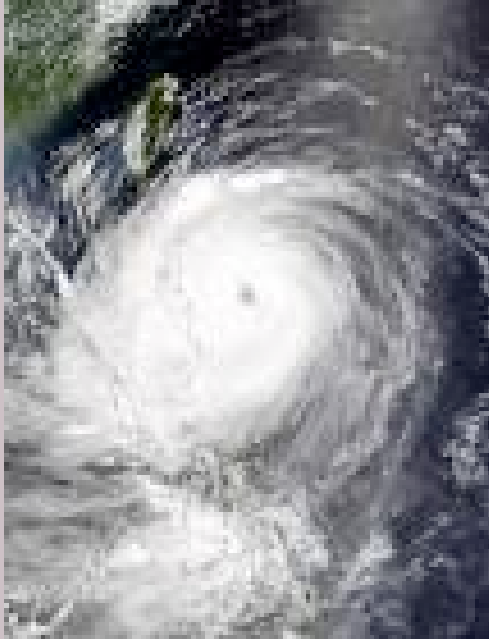
Hurricane intensity (?)

- Hurricanes require warm sea surface water ($>26^{\circ}$)
- Hurricanes require higher water vapor content in the atmosphere



Sources: K. Emanuel, MIT; and
G. Holland, J. Curry, and H.
Chang, GATech

Hurricanes Becoming Stronger?



NOAA

Typhoon Mindulle
500 dead
Millions displaced
July 2005



Hurricane Mitch
11,000 dead
8,000 missing
Oct/Nov 1998



Hurricane Katrina
>1,800 dead
? Displaced
August 2005

We aren't prepared for the ones we see today.

Ethiopian Famine



Stewardship

“Our gracious Creator cares and provides for all his creatures.”

John Woolman, 1763

Forest Fires are Already Increasing



Drought and the spread of bark beetles with climate change make forests more susceptible to fire. CA, Canada, and Alaska are among regions already affected.

Where to Plant?



Tree and grape habitats are shifting, but where?

Plants, animals, and insects are migrating towards the poles 4 miles every 10 years since 1950.

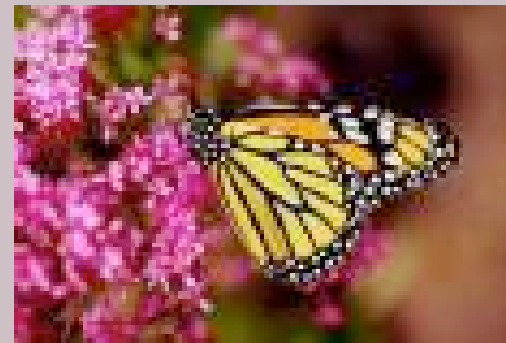
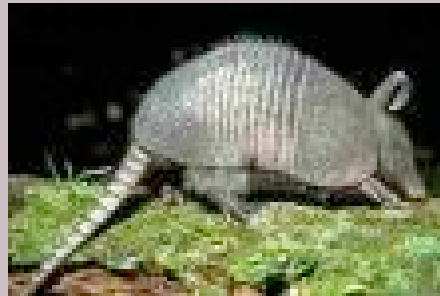
Plants, animals, and insects are migrating towards the poles 4 miles every 10 years since 1950.

They will soon need to migrate faster -- 70 miles every 10 years.

Some can't migrate far.



Others migrate at different speeds from the rest of the ecosystem.



Many birds are arriving before the food.

Some will run into obstacles.



Migration rates this century may need to be faster than at any time during the glacial-interglacial shifts.

Some are already gone.



Golden Toad

Protea is unique to South Africa due to its Mediterranean climate.



Insects and bats are in rapid decline; climate change is one cause, an important cause in the immediate future.



We are in the midst of the sixth mass extinction since complex life began.



Meteorites striking Earth throw up dust -- plants can't get light, animals can't get plants.



Continental drift moves plants and animals away from friendly climates.

We are in the midst of the sixth mass extinction since complex life began.



One sixth to one third of species will be committed to extinction by 2050.



Peace

living in the "virtue of that life and power that takes away the occasion of all wars."

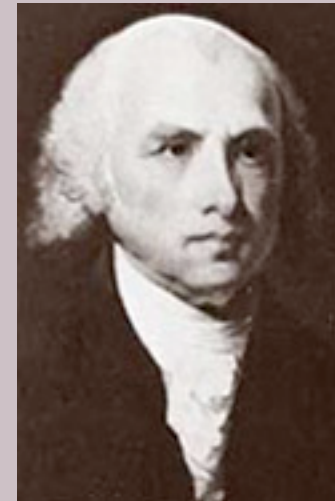
George Fox, 1647

Sometimes people send their
best minds.



Jefferson

Franklin



Madison

But bad times can lead to bad leaders.



- Population increased during good times,
- conditions changed,
- hundreds of thousands were massacred.

Bad times can lead to bad leaders.

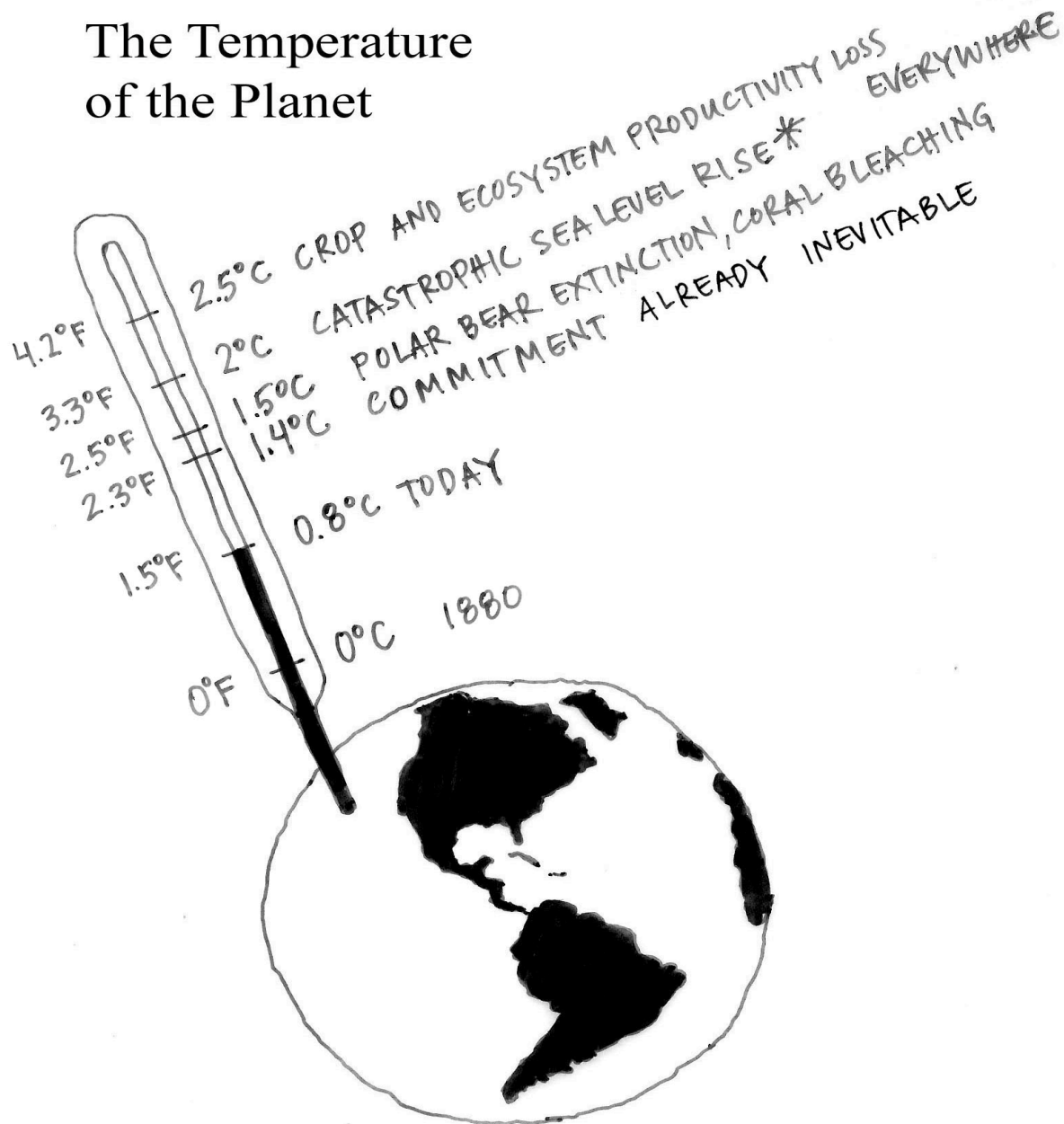


Adolf Hitler was elected during a depression, when Germans were feeling humiliated.

More than 60 million died.

Summing it all up

The Temperature of the Planet



* 3-4 METERS PER CENTURY
(10-13 FEET)

Stremiska '06

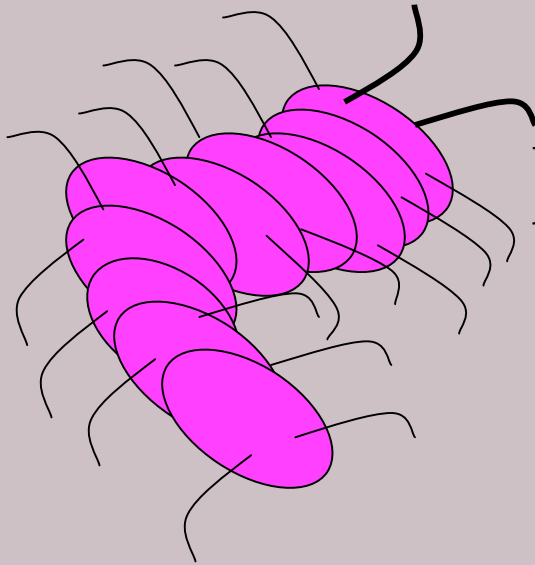
To Keep Temperature Increase Below 2°C

- Step 1: GHG emissions must level off or drop 10% by 2015 from 2005 levels. This means:
 - Carbon cap and trade
 - Carbon capture and storage
 - Double fuel economy of light duty vehicles
 - Who will pay for third world reductions?
 - Etc. Does this include voluntarily living with less?

To Keep Temperature Increase Below 2°C

If step one is not successful, there is no step 2 that will work.

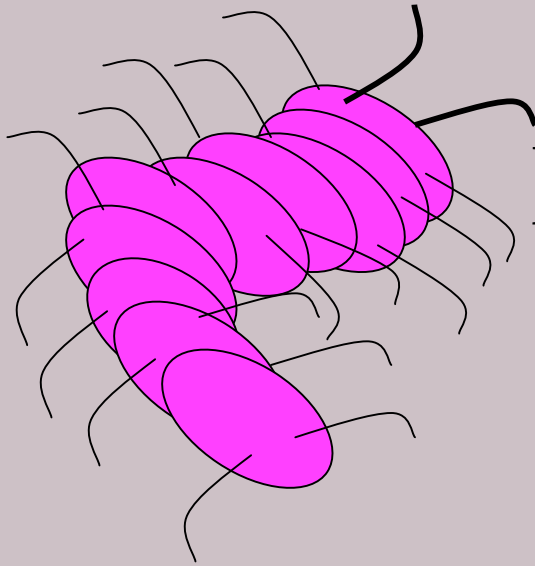
- Step 2: Reduce GHG emissions another 60% or 60%+ or 60%++ by 2050
- Step 3: Zero out carbon emissions.



Move Like a Centipede

If we can get 20 legs moving more or less in the same direction, we can get the centipede moving.

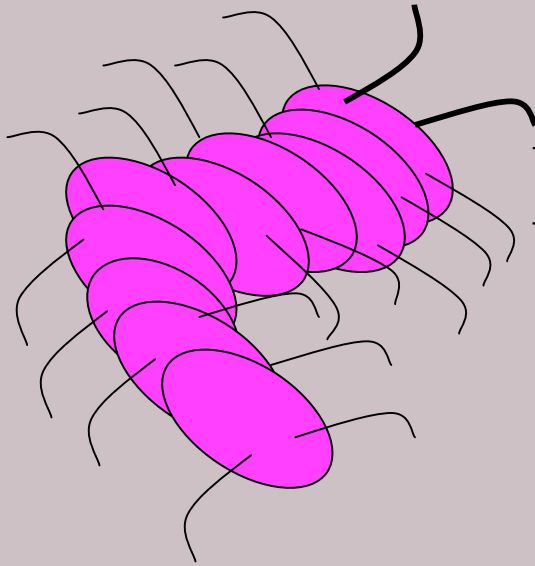
So what constitutes motion?



Move Like a Centipede

Reduce my own GHG emissions 10% this year.

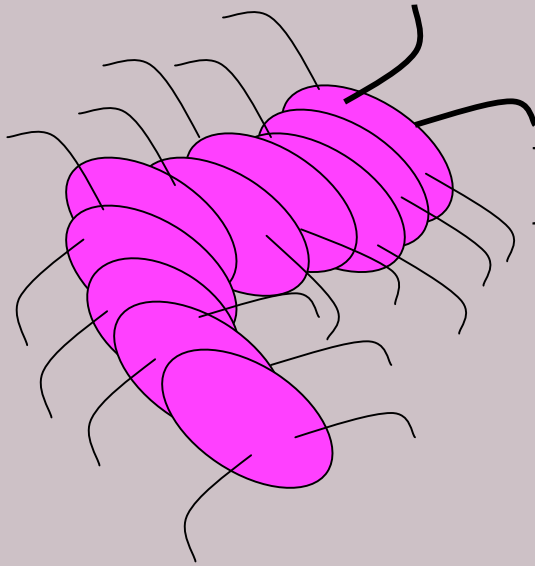
- Drive and fly less, use more fuel efficient cars, drive more efficiently.
- Switch to more efficient light bulbs and appliances, insulate, stop heating and cooling and lighting unused rooms.
- Work with others to reduce their emissions.



Move Like a Centipede

Educate ourselves and others:

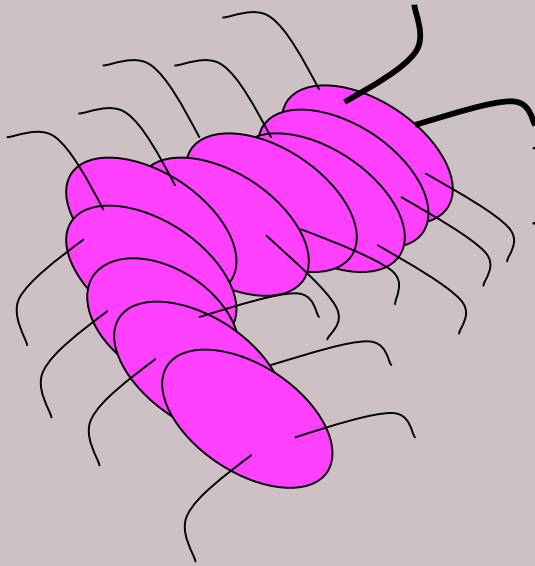
- What is the science, what are the impacts, what are the solutions?
- How do we communicate the urgency?
- What comes up for us emotionally, morally, and spiritually when we consider what is happening? When we consider changing the way we live?



Move Like a Centipede

Work with our legislators.

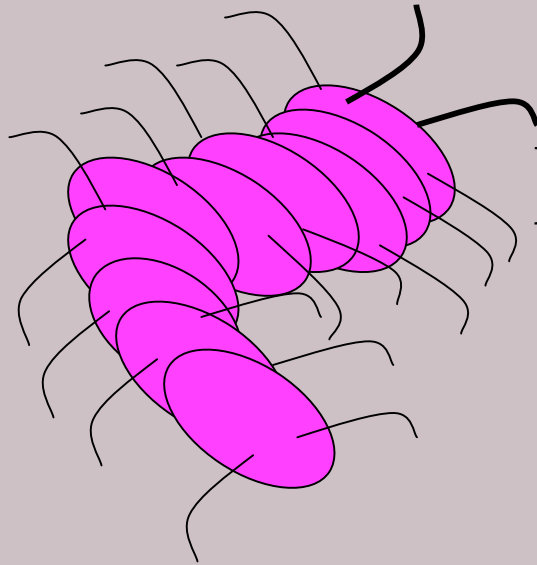
- Carbon cap and trade
- Higher fuel economy on higher fuel prices.
- Tax our energy use to pay the developing world's cost.
- Require planning for adapting to climate change.



Move Like a Centipede

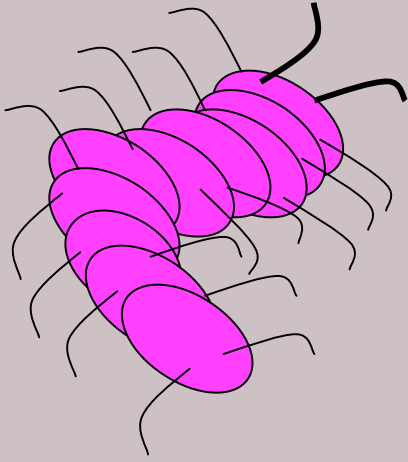
Work with our legislators.

As Al Gore says, labor with them, and if that doesn't work, replace them.



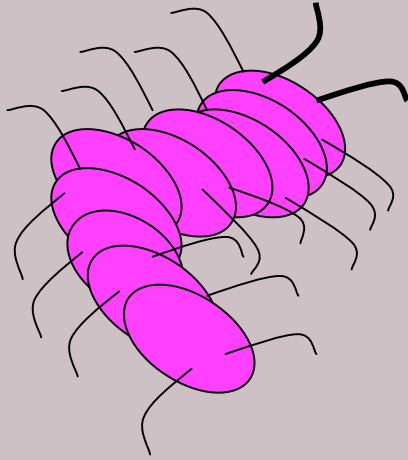
Move Like a Centipede

Now if we can just get 20 legs moving....



Meetings and Climate Change

If you want your “centipede” to survive, each leg must not only be in motion, but must also move in the same direction as the other legs. We don’t all have to be doing the same thing, but we need to keep from tripping up our neighbors.



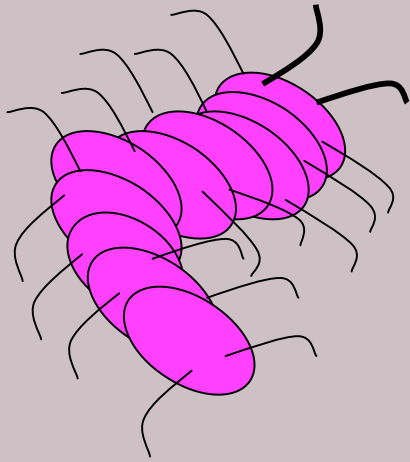
Meetings and Climate Change

Look at our own behavior

in order to consider changing how I live and/or better understand policy issues.

Queries:

- What are my big ticket items and where can I make changes?
- What are the advantages and disadvantages of living without a car, or finding alternatives to flying?
- When I consider changing, what are my emotional and spiritual responses?
- Which behaviors must new policies address because we find them hard to change?

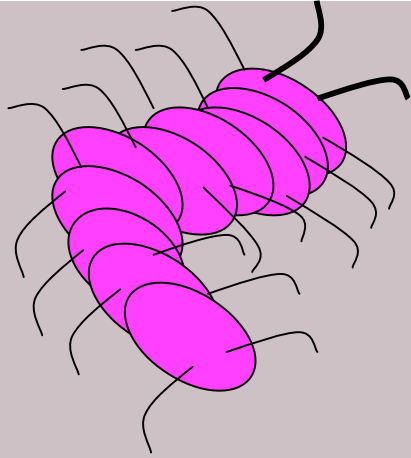


Meetings and Climate Change

Policy:

There is no silver bullet -- we need a portfolio of solutions.

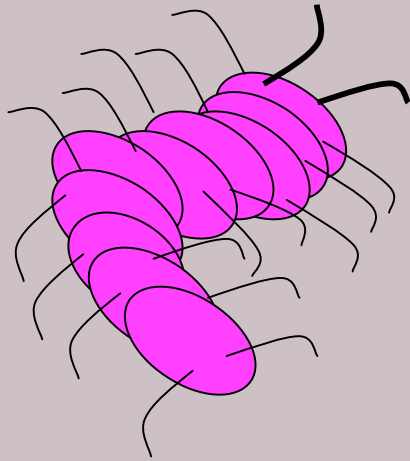
Resources for educating yourselves about these complex topics include *A Musing Environment* (<http://pathsoflight.us/musing>) and *Relative Dangers of Energy Sources* (<http://www.quaker.org/fep/reldangersquestions.html>) and the writings of John Holdren, outgoing president of AAAS, e.g., *The Energy Innovation Imperative*.



Meetings and Climate Change

Some major public discussions in the US and elsewhere (early resolution would benefit policy makers):

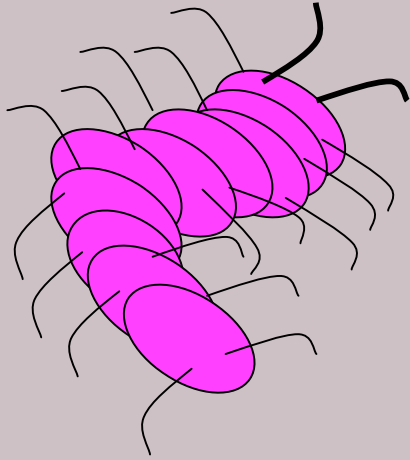
- Can I, will I change my consumption patterns to reduce GHG emissions? Should we stop subsidizing air flights -- and price tickets high enough to discourage flying (for all but the rich)?
- Should we allow/encourage governments to pass strong laws affecting public behavior: mandating high efficiency bulbs, cars, and appliances, or mandating lighting or temperature limits in public buildings?



Meetings and Climate Change

Some major public discussions in the US and elsewhere (early resolution would benefit policy makers) cont.:

- Should people in the industrialized world, particularly the US, pay several hundred dollars/family/year for reducing GHG emissions and funding research?
- Should we pay the same amount again for economic competitors such as China, where per capita GDP is about 1/30th that in the US, when their cumulative emissions are so much less than ours (28% since 1850)?
- Should we reconsider nuclear power?



Meetings and Climate Change

Major public discussions in the US and elsewhere (early resolution would benefit policy makers) cont.:

How can we facilitate public discussions of the knotty issues?

Blog and Web Sites

A Musing Environment

<http://pathsoflight.us/musing>

Friends Energy Project

<http://www.quaker.org/fep/>

Talks on Berkeley campus

<http://cbc.berkeley.edu/thisweek.html>