Climate Ethics and Climate Justice

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The Imperative of Responsibility

Life and Climate

- Humans are life
- Humans are altering climate in a major way
- A force of more than ”geological” proportions
- We may cause a major catastrophe
- Not just CO_2, but all ”planetary boundaries” (cf. Noone et al.)

This is nothing new

Biosphere recovers from catastrophe

- Oxygenation by cyanobacteria
- Snowball Earth
- Land planet evolution, drawdown of CO_2
- Permo-Triassic mass extinction
- KT ”Dinosaur Killer” impact

Tens of millions of years for recovery, and whoever was king of the hill before usually loses out.

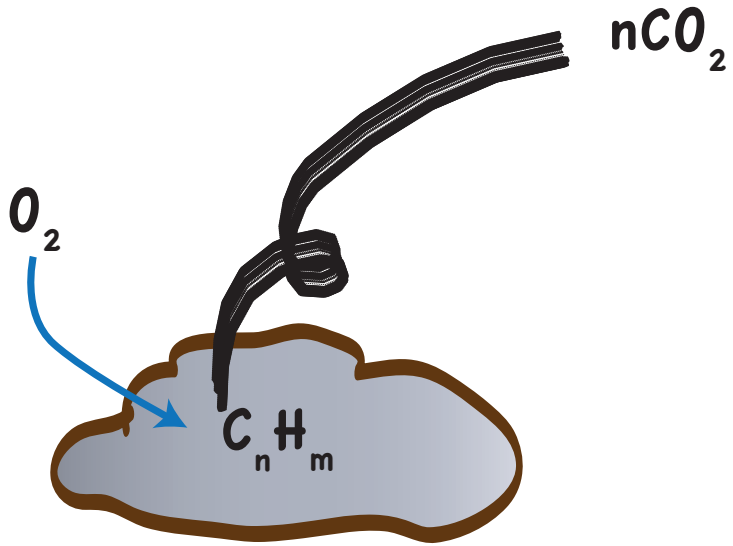
But what *is* new...

- We have foresight, know what we are doing
- We must decide on what kind of climate the planet will have
- What criteria determine the ”right” climate?
- Importance of preserving irreplaceable treasures for future generations, who may have their own ideas of what is the right kind of world.
- Intelligent life may be unique in the universe, and therefor have a special claim on preservation.
- Preserve not just human life, but a world worth living in.

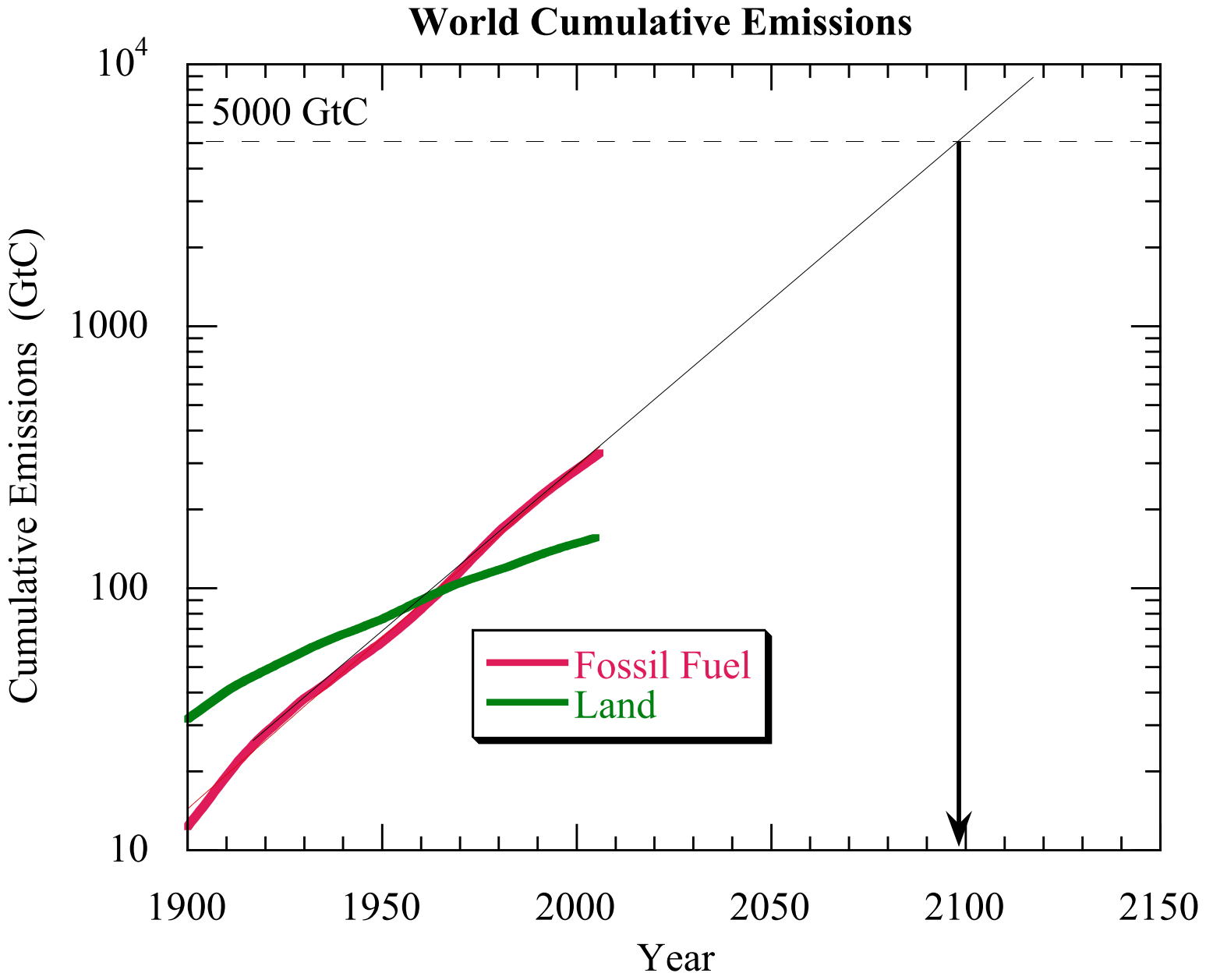
So far, we're not doing any better than cyanobacteria

Consume resources, and reproduce until everything is filled up and used up.

Carbon Accounting



Pre-industrial atmosphere contained 600 Gt carbon


World Cumulative Emissions
10^4
5000 GtC
1000
100
10
Cumulative Emissions (GtC)
Fossil Fuel
Land
1900
1950
2000
2050
2100
2150
Year

Four time scales for CO_2 drawdown

- Uptake by mixed layer. A few decades
- Mixing to deep ocean A few centuries
- Carbonate dissolution A few millennia
- Silicate weathering A few hundred millennia

Key feature is limitation of uptake by carbonate ion supply

- Silicate weathering and *deep* organic carbon burial are the only long term sinks for anthropogenic CO_2.
- Over 20C warming needed to offset 2Gt emissions by silicate weathering
- Therefore any appreciable sustained emissions will lead to continued atmospheric CO_2 buildup for millennia.
- cf. Matthews and Caldeira
  CO_2 *Stabilization requires Near-Zero Emissions*

A common fallacy

(cf. Pacala and Socolow wedge paper)

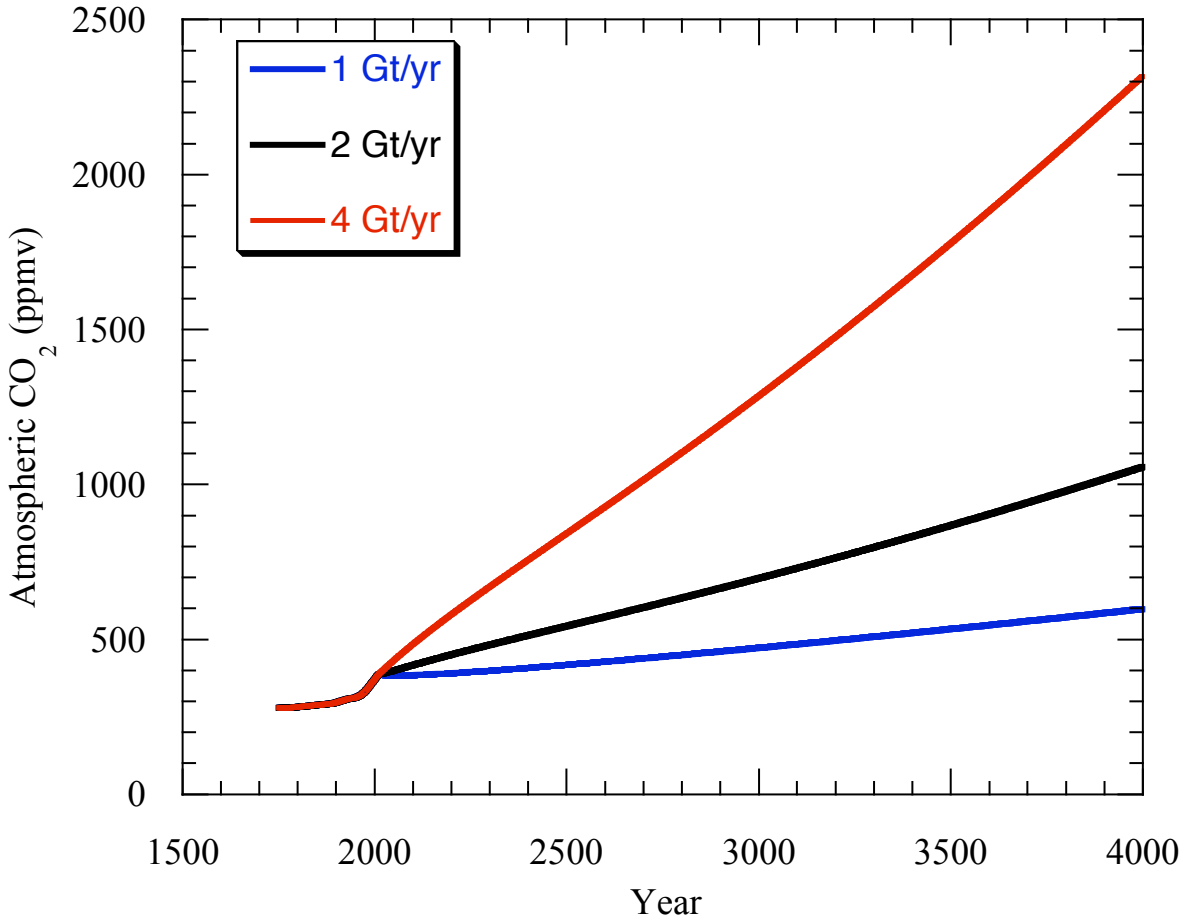
- Oceans take up about 2Gt/yr of CO_2 carbon now
- Therefore if we stabilize emisssions at 2Gt/year, we stabilize atmospheric CO_2

Some simulations

- Hamburg carbon cycle model
- Logistic ramp up to peak emission at 2010
- Followed by dropping emission to 4, 2 or 1 Gt/yr

Simulations courtesy of David Archer

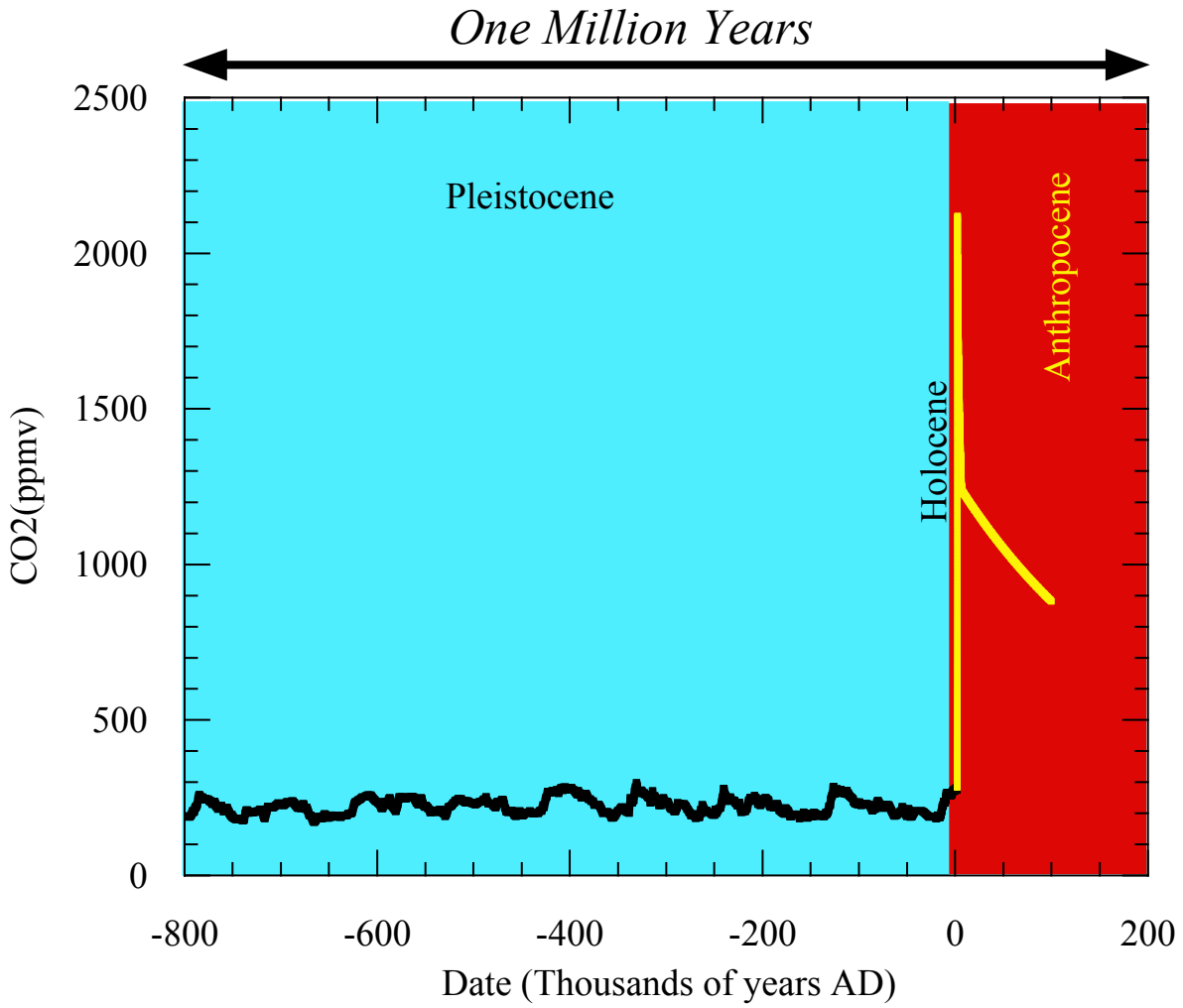
Results


1 Gt/yr
2 Gt/yr
4 Gt/yr
Atmospheric CO_2 (ppmv)
2500
2000
1500
1000
500
0
1500
2000
2500
3000
3500
4000
Year

The general scenario

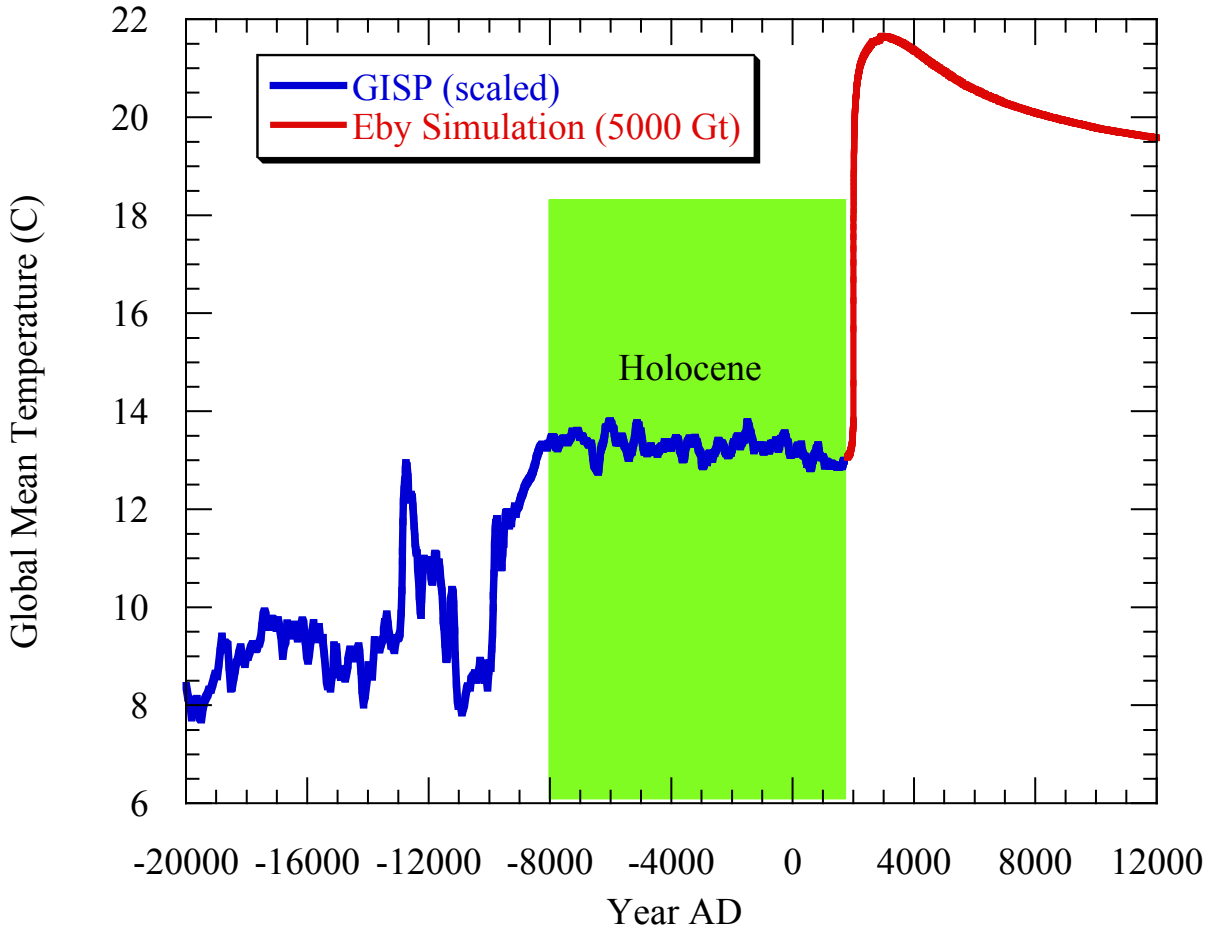
- Fossil fuel era during which a certain cumulative emission of CO_2 is put out
- Followed by zero emissions
- Peak CO_2 occurs at end of fossil fuel era
- Peak value only weakly dependent on emission scenario during fossil fuel era

What does 5000 Gt mean for our future?

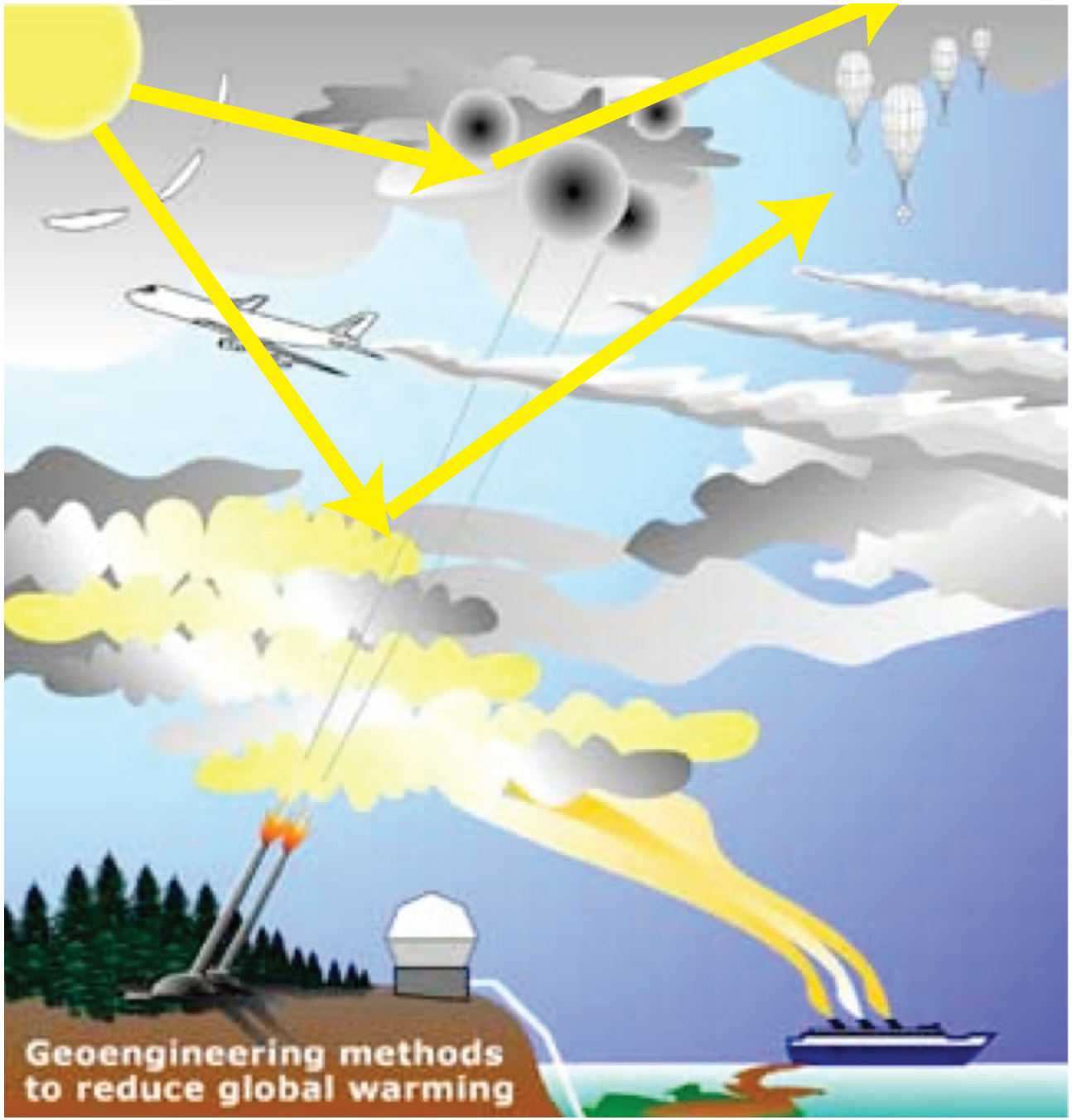


CO_2 simulations by Eby *et al.* 2009

10,000 years of climate disruption, and more



Albedo Geoengineering is a moral abomination


Geoengineering methods
to reduce global warming


CO2, > 10,000 years
SO2, 2 years

But we will need some kind of air capture of CO_2 ("Longwave Geoengineering") to deal with last Gigatonne or so of emissions

Risks in the long tail

- Land, polar regions warm about 2X global mean
- Climate sensitivity may be high
- Deglaciation of Greenland, WAIS. East Antarctica?
- Release of up to 3000 Gt land and marine carbon (cf. PETM)
- *Low-probability catastrophes dominate expected damages!*

The Language of costs and benefits

The questions

- What is the ”right” amount to spend to reduce emissions?
- How should costs be divided up? (US, Europe, China,India,Africa...)
- How top figure the costs of inaction?
- When should it be spent?

Confusion between fairness and expedience

(esp, Cass Sunstein, an Obama regulatory advisor)

- A carbon tax that falls primarily on the first world is a wealth transfer to the developing world
- It is a form of foreign aid
- As foreign aid, it is much larger than any amount of foreign aid Americans (or even Europeans) have ever found acceptable
- Therefore it won't sell to Americans
- Therefore such a tax is unfair
- ?????????

Analysis of costs vs. benefits is OK as long as we realize...

- Not all costs or benefits can be measured by money.
  - e.g. loss of human life, loss of civil liberties
  - Think about effect of capital punishment on crime reduction vs. injustice of executing the innocent
  - ”Contingent valuation” of non-market costs/benefits is hopelessly broken
  - Does it make sense to trade off polar bear extinction against Arctic oil revenue by assigning a money value to polar bears?

- Costs and benefits are not additive
- Cost/benefit analysis is not a substitute for deliberative democracy

GDP vs Gross National Happiness

- Economic models maximize GDP as a proxy for maximizing ”welfare”
- Bastiat and the ”broken window fallacy”
- (Applied often to green jobs)
- But these days, developed world economy is all ”broken windows,” so we at least might as well do something useful with our efforts.

Discounting

What is discounting

- A standard economics methodology for comparing future with present
- Exponentially downweight future harms according to how far in the future they are
- Rationale is that you could put the money in the bank and collect interest to pay for future harms ("Richer future")
- Usually applied to monetized costs
- Need to distinguish this from discounting as a means of modelling human behavior. (Economic models rarely make this distinction)

Discounting assumes

- All harms can be rectified by spending money
- The economy will grow exponentially forever, regardless of how bad things might get because of climate change

Why you might want to discount

- Otherwise a trivial harm that goes on forever yields infinite cost
- If you are richer in the future, you can pay more to rectify a harm
- A means of expressing trade-off between present costs and future benefits
- Need to distinguish discounting as a way of optimizing ”utility” from discounting as a way of modelling human behavior

The fatal problem with discounting

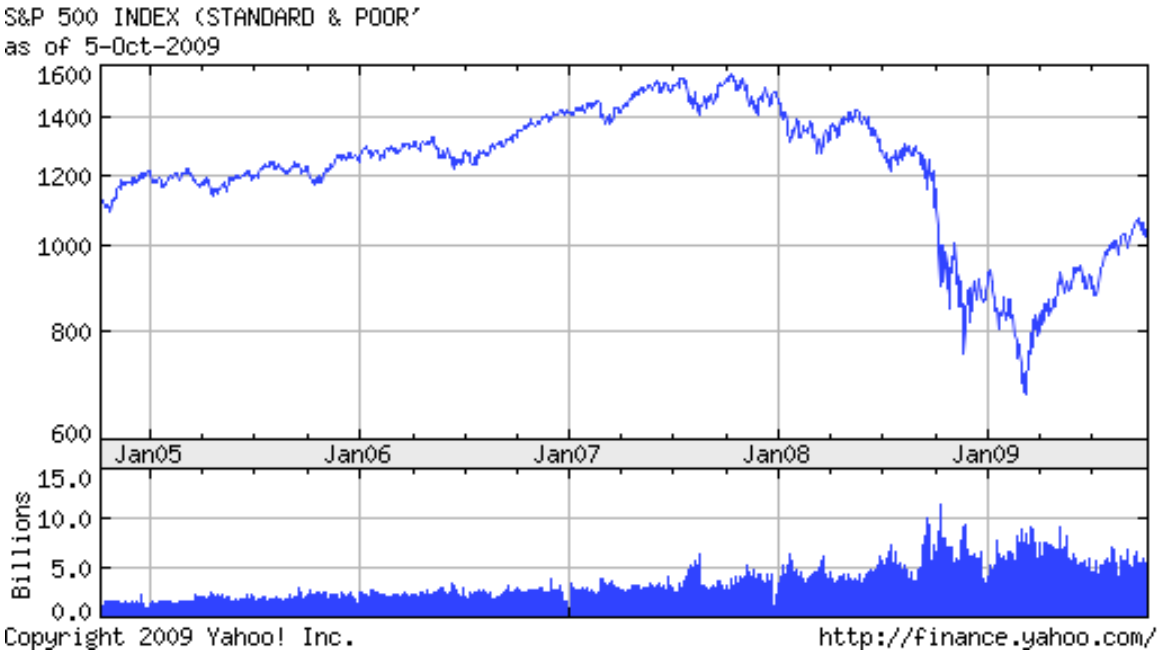
- Some harms cannot be rectified by expenditure of money
  (Think extinction of polar bears in 10 years vs 100 years)
- Future generations may value certain things (e.g. biodiversity) more highly than we can possibly imagine.
- Discounting makes catastrophes 10000 years away disappear

A worked example:

- Suppose this century's CO2 emissions would cause extinction of human race in 10000 years
- How much is it worth spending to prevent this?
- (10 billion people) X ($1 billion per life), discounted to present at 2% per year
- Worth spending $6 \cdot 10^{-23}$ cents to prevent this
  (about a tenth of one atom's worth of a penny)

If the world comes to an end...

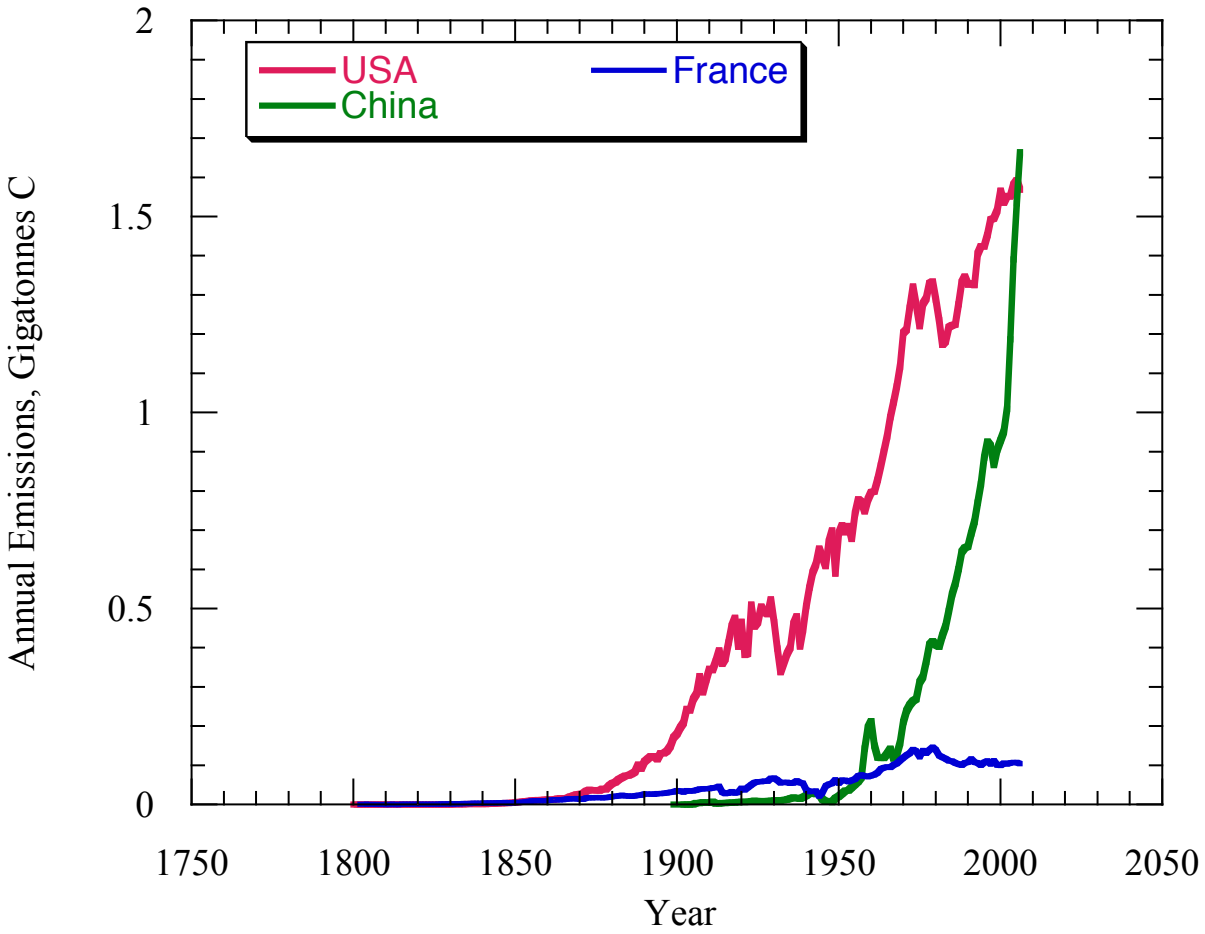
...There are no markets left to pay you interest!

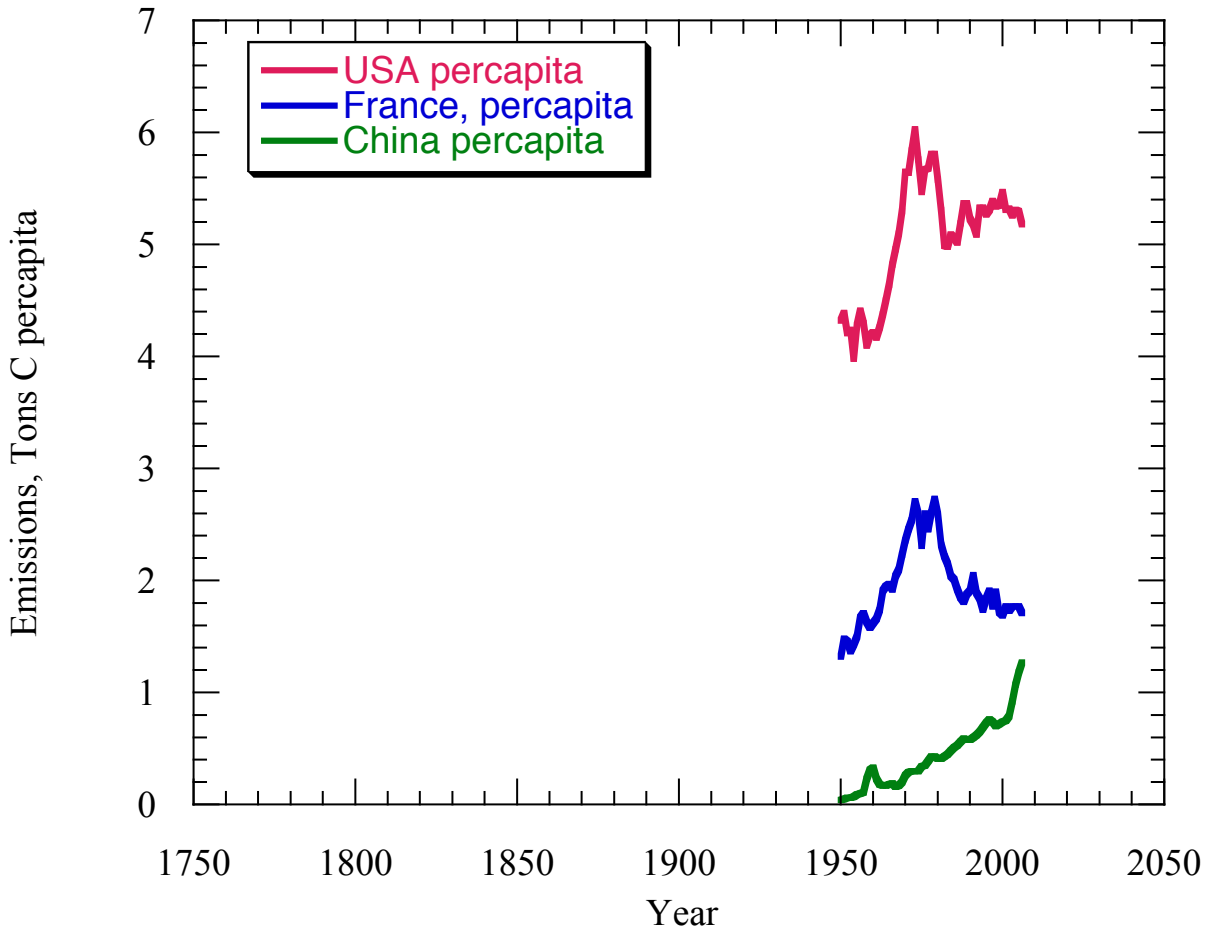


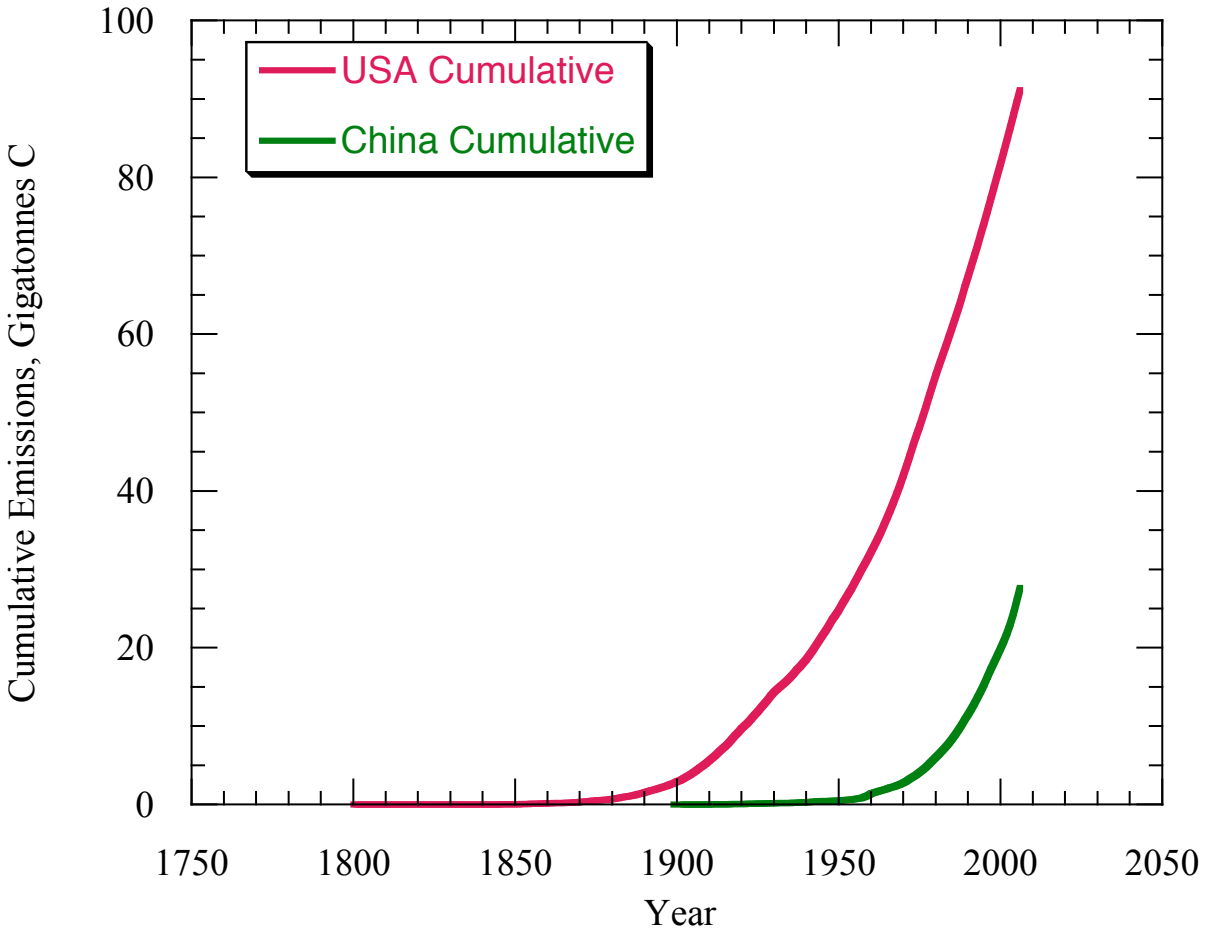
Carbon emission allocations – what is ”fair”?

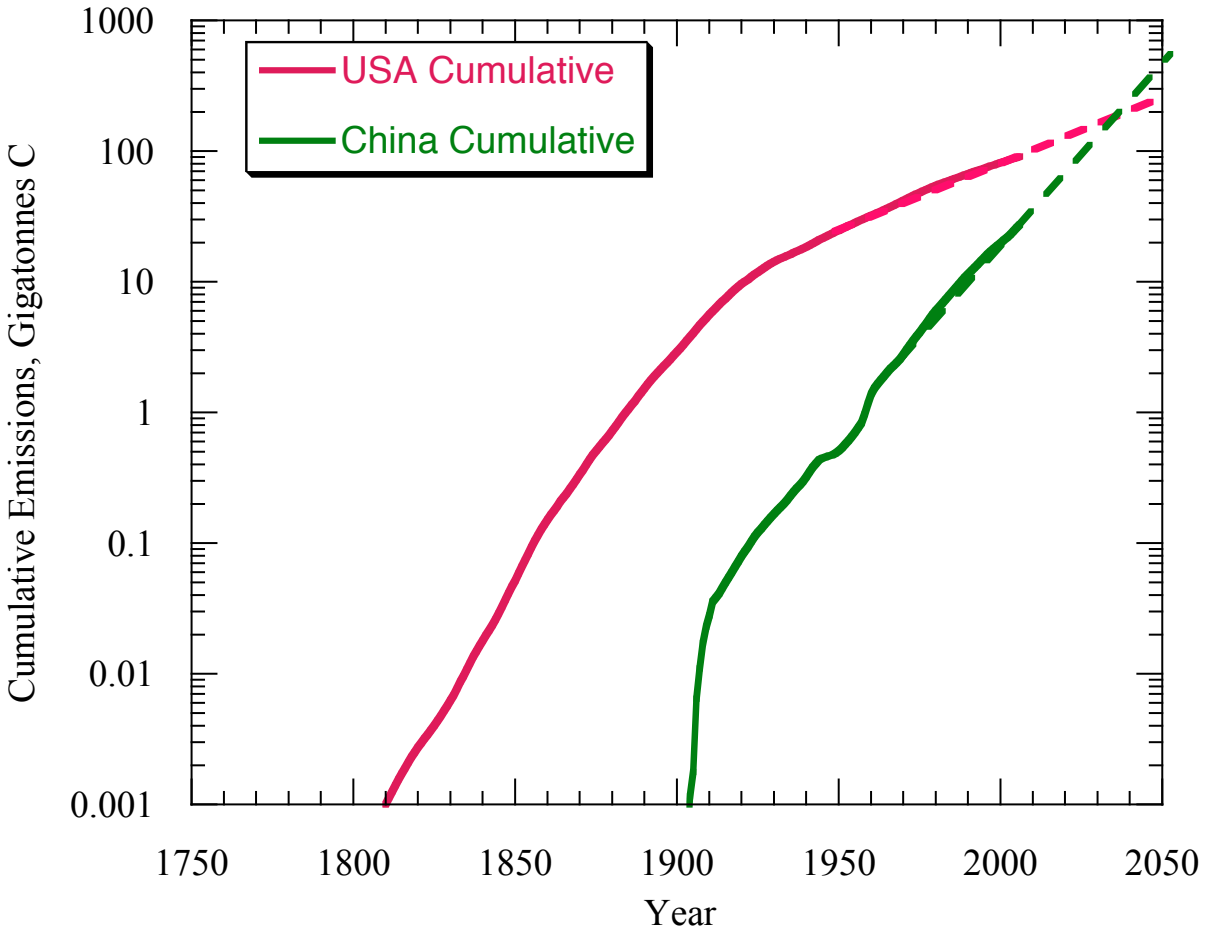
Ideas about fairness

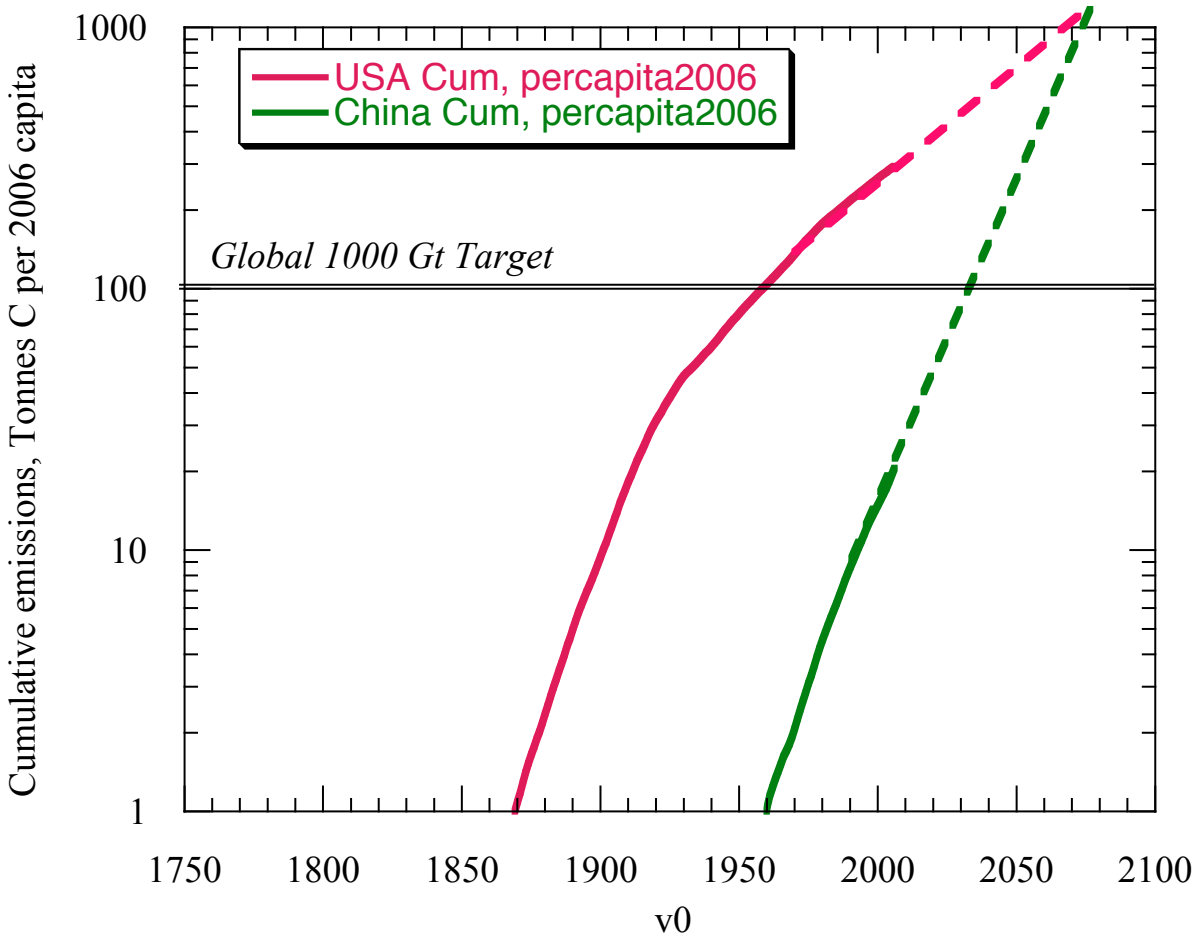
- Retributive justice (punish the bad guys)
- You broke it, you fix it
- Whoever suffers the least from fixing it moves first
- All people are created equal

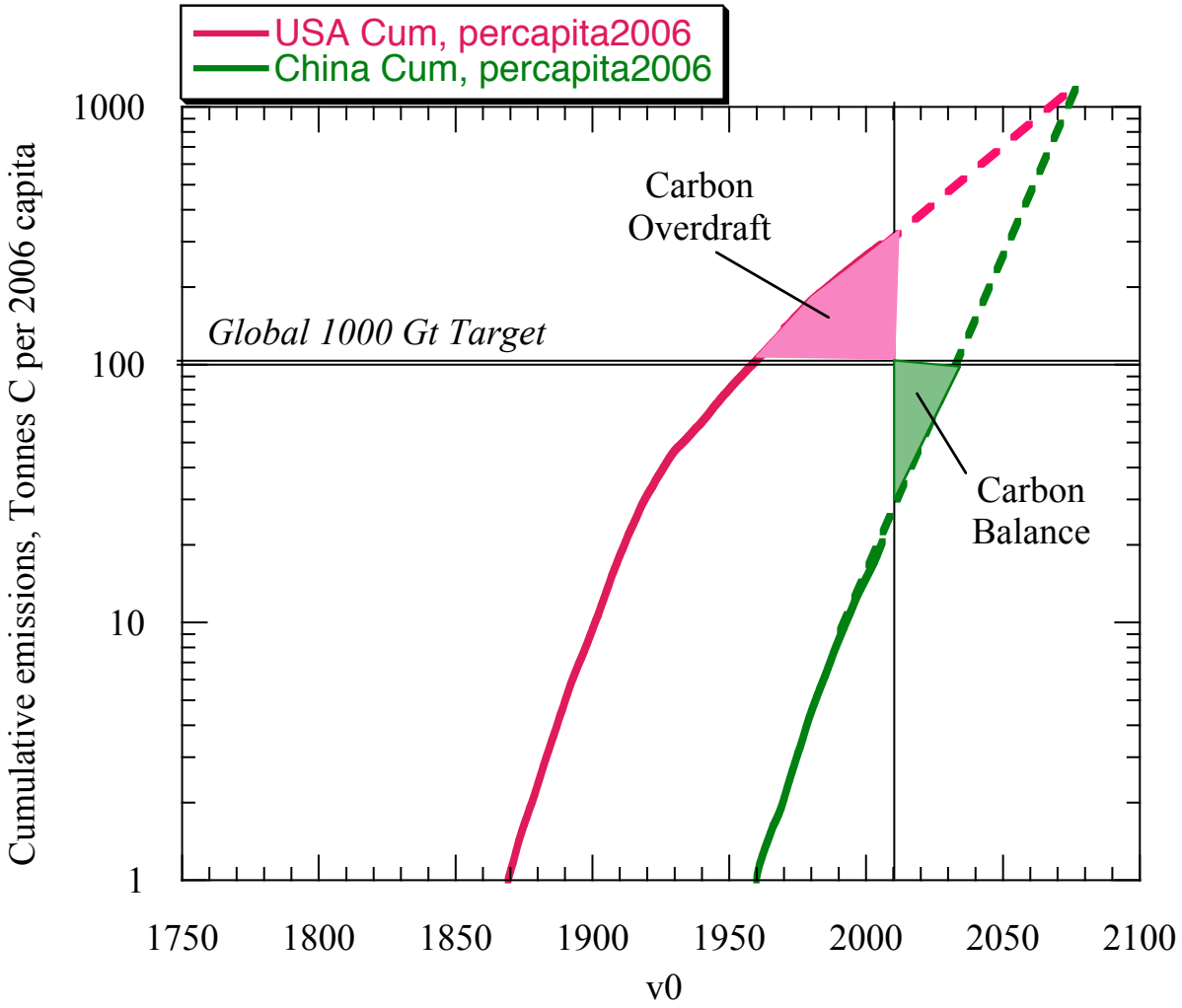

USA
France
China
Annual Emissions, Gigatonnes C
2
1.5
1
0.5
0
1750
1800
1850
1900
1950
2000
2050
Year


USA percapita
France, percapita
China percapita
Emissions, Tons C percapita
Year
0
1
2
3
4
5
6
7
1750
1800
1850
1900
1950
2000
2050


USA Cumulative
China Cumulative
Cumulative Emissions, Gigatonnes C
100
80
60
40
20
0
1750
1800
1850
1900
1950
2000
2050
Year


USA Cumulative
China Cumulative
Cumulative Emissions, Gigatonnes C
1000
100
10
1
0.1
0.01
0.001
1750
1800
1850
1900
1950
2000
2050
Year


1000
100
10
1
Cumulative emissions, Tonnes C per 2006 capita
USA Cum, percapita2006
China Cum, percapita2006
Global 1000 Gt Target
1750
1800
1850
1900
1950
2000
2050
2100
v0


USA Cum, percapita2006
China Cum, percapita2006
Cumulative emissions, Tonnes C per 2006 capita
1000
100
10
1
Carbon
Overdraft
Global 1000 Gt Target
Carbon
Balance
1750
1800
1850
1900
1950
2000
2050
2100
v0

Fairness and Justice

- Because of ”carbon debt” of the developed nations, even reducing our emissions to *zero* would not make it fair or just to expect China to commit to halting emissions at the 100 tonne percapita point
- On top of halting our own emissons, justice would argue that we owe the developing nations (and unborn future) payback (reparations) for the atmospheric carbon dump we have already ”used up.”
- But theres’s also the issue of how to account for ”your father’s carbon”

Unfortunately...

- The climate doesn't care about "fairness"
- The climate cares about net CO2 emissions
- If China/India do only what is "fair" large climate changes will result

Also ...

- What is ”fair” for China/India to do may not be what is in their best interests
- Even if USA does not behave honorably, it may be in the best interests of China/India to make ”unfair” emissions reductions, just for the sake of protecting their climate, if that is what is necessary to get the US congress to go along with US emissions reductions.