Mechanisms against Climate Change

Carl Edward Rasmussen

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Outline

- contextual background, goal of the talk
- what do I mean by mechanisms?
- our current process
- what might a better system look like?

Ethical Foundations

Our societies are built on moral and ethical foundations.

Trivial example: I can't just take your possessions.

However, on a environment related global scale, we (humanity) seem to *act* as though such principles do not apply.

For example, vulnerable developing nations, or our children's interests don't carry a lot of weight in decision making.

In this seminar I won't talk about ethics (see eg Singer[1]) but instead ask the question: "What principles would be necessary to address climate change?"

[1] Peter Singer: One World Now: the ethics of globalisation (2016)

Climate Change Key Points

I'll use greenhouse gas and carbon dioxide, CO_2 interchangeably.

When CO_2 is released into the atmosphere

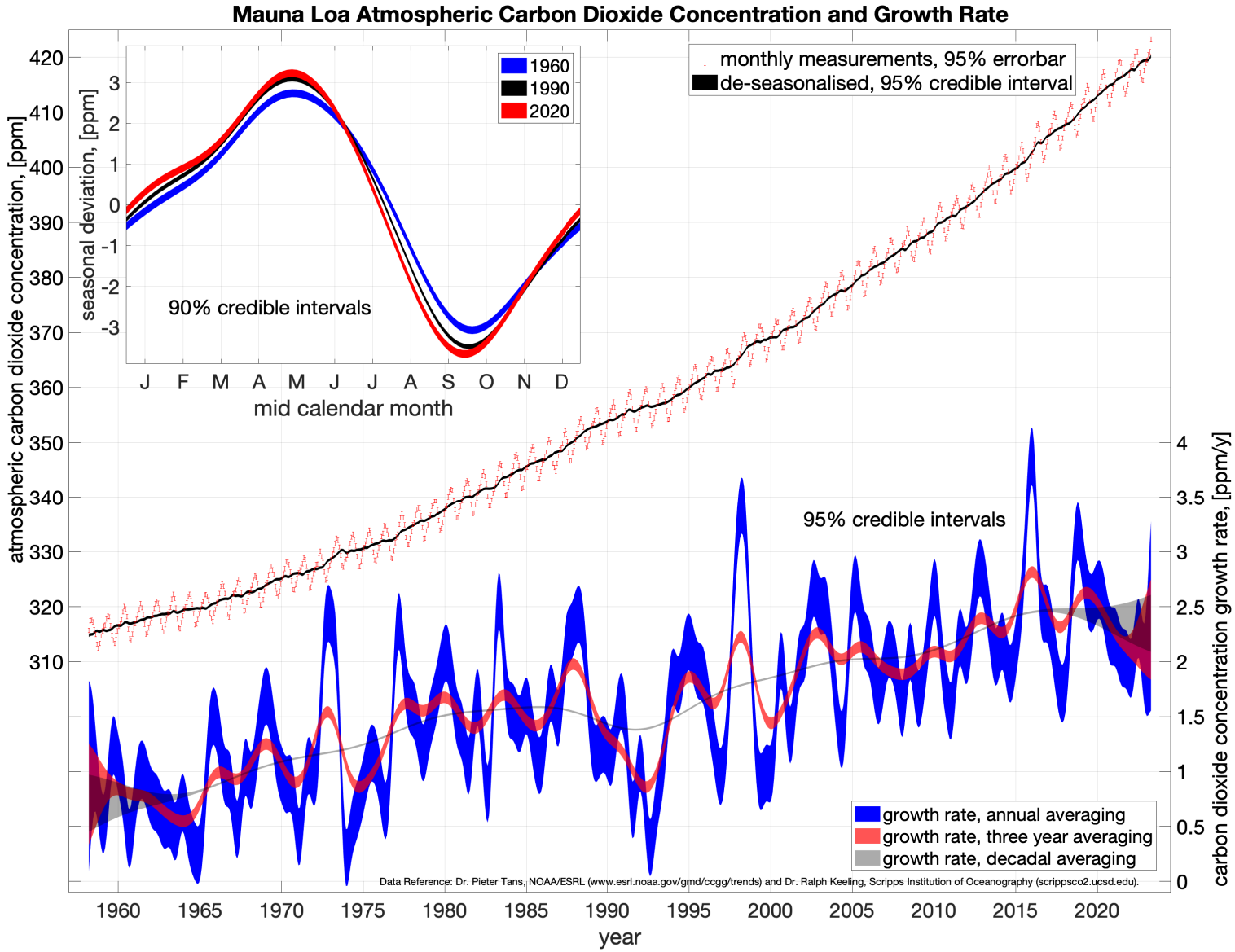
- roughly half gets washed out into surface waters,
- roughly half (the airborne fraction) stays in the atmosphere.

On the timescale of a century, to a first approximation CO_2 just stays in the atmosphere.

Once there, it is very, very difficult to get it out of the atmosphere.

The more CO_2 in the atmosphere, the higher the temperature. The CO_2 concentration has risen by 50% since pre-industrial times (280 to 420 ppm). Global warming so far $\sim 1.1°C$, makes a big difference to conditions.

Atmospheric CO_2 concentration and growth rate



The relative absence of atmospheric CO_2 is a Resource

Normally we think of the *presence* of something as a resource. But relative absence of CO_2 share charactistics of resources:

- it is valuable,
- it is limited.

Who owns this resource?

Since it's a shared resource, we need to *cooperate* to manage it.

Managing climate change is equivalent to managing *global cooperation*.

A illustrative game

Ten participants, each having 100 €, play a game:

- in the beginning each player (secretly) pledges a fraction of their money to a common pool
- all players deposit their pledged amount
- the common pool is doubled
- the pool is divided evenly between all players.

How would a rational player behave?

A slightly modified game

Ten participants, each having 100 €, play a game:

- in the beginning each player (secretly) pledges a fraction of their money to a common pool
- all players deposit **the minimum of all** pledged amounts
- the common pool is doubled
- the pool is divided evenly between all players.

How would a rational player behave?

Players won't tend to cooperate if they can get scooped.

How tight is the analogy to the Paris agreement?

In other words, what is the incentive to pledge?

Paris lacks the "I will if you will" property[2] which is crucial.

What are the limitations of the game?

- in reality players are different, eg economically
- and in terms of natural resources
- there is no central referee, or obligation to take part
- the payoffs are delayed in time (by generations)

Fortunately, there is a very strong positive correlation between CO_2 emissions and strength of economy.

[2] MacKay, Cramton, Ockenfels and Stoft: Price Carbon – I will if you will, Nature (2015)

Objectives and Proxies

In the media, climate change is often portrayed as binary: either we succeed in limiting warming to 1.5°C (or 2.0°C) or not. Reality is not binary: the more warming, the more drastic consequences.

Global average temperature is a *proxy* for climate change. What we're really interested in is living conditions.

When working with a proxy, it better be good! But, is it? Unfortunately, no:

- global temperature is fairly difficult to measure
- Atmospheric greenhouse gas concentrations are easy to measure, and easy to relate to behaviour (emmission or mitigation)

Many countries pledge "Net Zero by 2050". **Not** a good target because

- it's the total cumulative emmission not the date you (promise to) reach zero which determines the climate
- it's too far in the future, lets the current decision makers off the hook. No realistic path presented

Carbon trading schemes

Two different mechanisms exist

- Cap and Trade
- Carbon Fee

Cap and Trade seems to be preferred in practise (eg EU ETS and UK ETS). But Carbon Fee has advantages

- the Cap directly sets the limit (advantage of Cap and Trade)
- the price is highly sensitive to the Cap, existing schemes have been difficult to control
- the unknown price makes it very difficult for companies and consumers to *plan*
- Carbon Fee can easily co-exist with other schemes

Short-comings of Paris

- ignores main principle for cooperation: “I will if you will”
- requires unanimous agreement, causes slow, watered down process
- relies on volunteering, no mechanisms of enforcement or sanctions
- it’s currently the only game in town – when failure is clear, decades will have been wasted

Why has such a poor process developed?

Reducing reliance on fossil fuels poses an existential risk to some of the largest and most powerful companies in the world.

Short election cycles for national leaders mean there is very little pressure to address these tough questions. Little political appetite in developed countries to engage in the inconveniences.

Instead, promisses are made for 2030, 2050 and beyond.

Countries are different

Some parts of the world have contributed more to the problem than others. Mitigation efforts should acknowledge these differences.

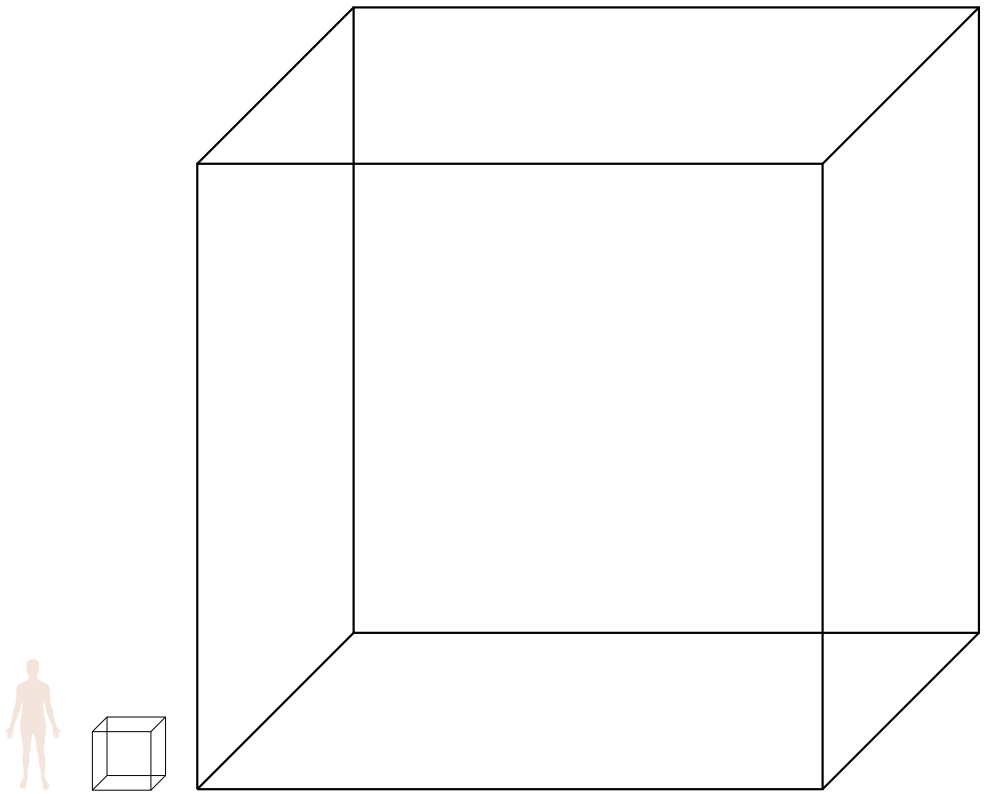
Below, data from 1990, about the time when the threat of climate change became generally known (IPCC established by UNEP in 1988):

	1990	2019
India	0.6	1.8
China	1.9	7.6
UK	9.8	5.2
Germany	12.0	7.9
Australia	15.4	15.3
World	3.9	4.4

Per capita annual CO_2 release[3], tons per person per year. Population grew 46% from 1990-2019.

[3] World bank: https://data.worldbank.org/indicator/EN.ATM.CO2E.PC

What does 1 ton of CO_2 look like?



Grown person (height 1.7 m) with a small cube of 435 litres of petrol/gasoline (side 0.76 m) and large cube of 1 ton = 1000 kg of CO_2 resulting from its combustion (side 8.1 m), drawn to scale.

A constructive way forward

Necessary properties:

- effects need to be near term
- participation voluntary
- has to respect the “I will if you will” principle
- needs mechanism to avoid free riding and temporal free riding
- has to be very flexible, because countries are different
- needs to be able to co-exist with other initiatives
- there must be a strong incentive to participate
- must be legally binding and enforceable

Climate Clubs

Climate clubs have been proposed eg by G7 and EU.

Clubs could be based on "minimum carbon pricing". Flexible as doesn't stipulate method of implementation or what to do with proceeds. Can co-exist with other schemes.

Implementation can be based on "fee and dividend", where all proceeds are returned to citizens. Would make schemes more palatable to voters.

The "minimum carbon pricing" would maintain level playing field within the club.

Non-participants must be penalised by trade barriers (carbon based or flat fee).

Developing nations would need favourable conditions and long term CO_2 polluters stricter club terms.

Conclusions

It is difficult to know whether humanity is able to rise to the climate challenge.

It's important to acknowledge that the Paris agreement is very unlikely to succeed.

In this talk, I've attempted to outline some fo the characteristics that are necessary for a constructive way forward.

It's difficult to co-operate over common resources in a economically divided world.

The stakes are high!