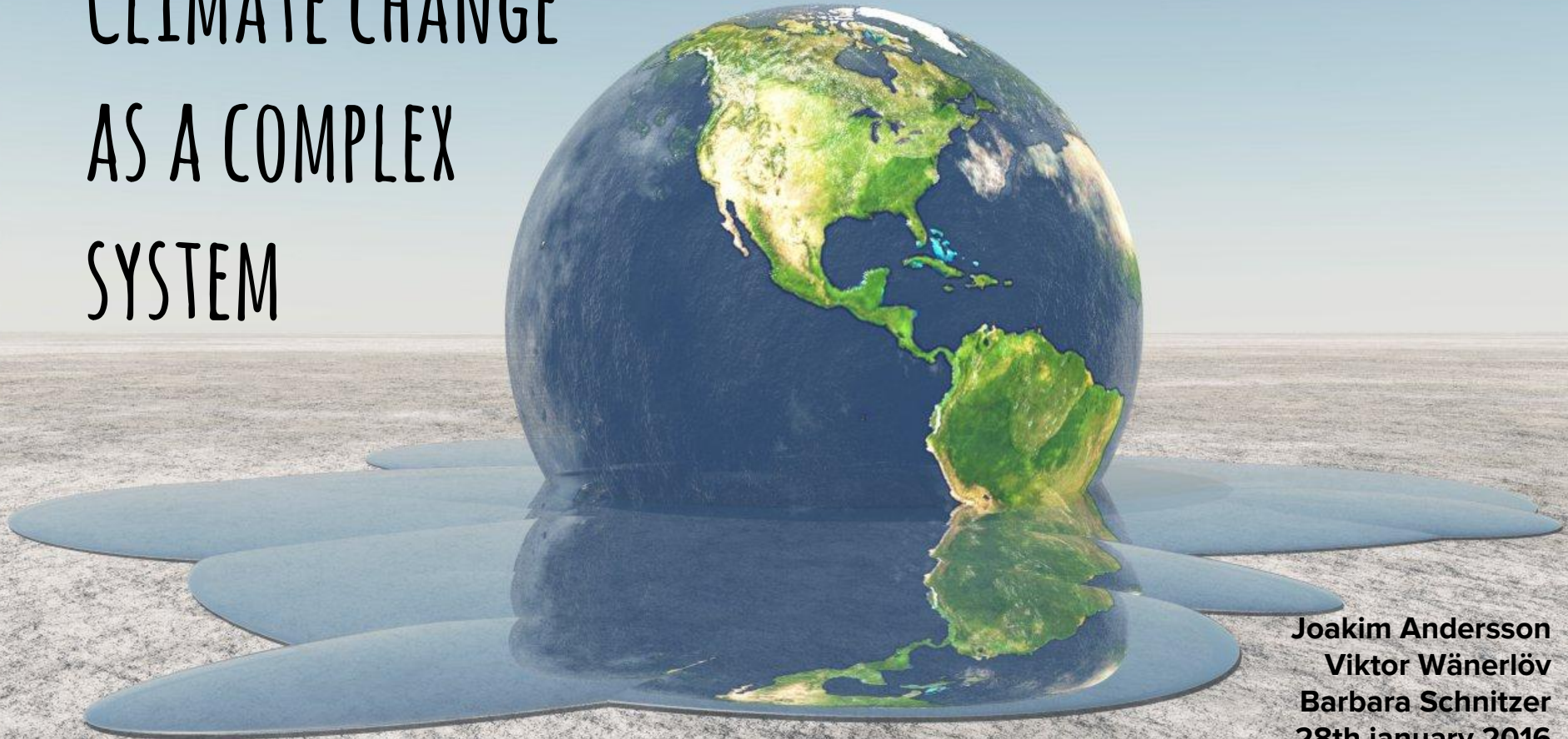


CLIMATE CHANGE AS A COMPLEX SYSTEM



**Joakim Andersson
Viktor Wänerlöf
Barbara Schnitzer
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OUTLINE

What is climate? And what is climate change?

How can we model it?

What about the ethical dilemmas?

Conclusion



CLIMATE

The weather conditions prevailing in an area in general or over a long period of time.

CLIMATE

Climate is the **weather conditions** prevailing in an area in general or over a long period of time.

- Temperature
- Catastrophes



CLIMATE

Climate is the weather conditions prevailing in **an area** in general or over a long period of time.

- Earth's climate
- Average

CLIMATE

Climate is the weather conditions prevailing in an area in general or over **a long period of time**.

- Data from the end of the 19th century
- Change

CLIMATE CHANGE

- Energy absorbed and energy emitted.
- Forcing (radiative forcing)[Wm^{-2}]

DRIVERS

- CO_2
- Water vapour
- Other

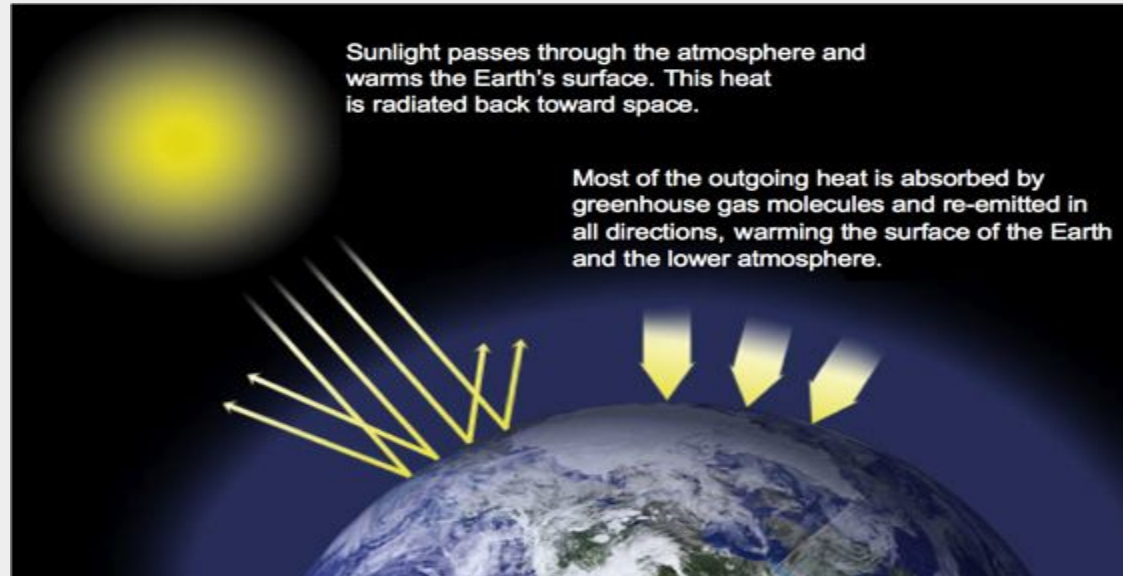


Image from [NASA's Global Climate Change website](#).

EFFECTS

- Average temperature increase (1 degree)
- Oceans and ice
- Other

FUTURE

- Complex
- Modelling

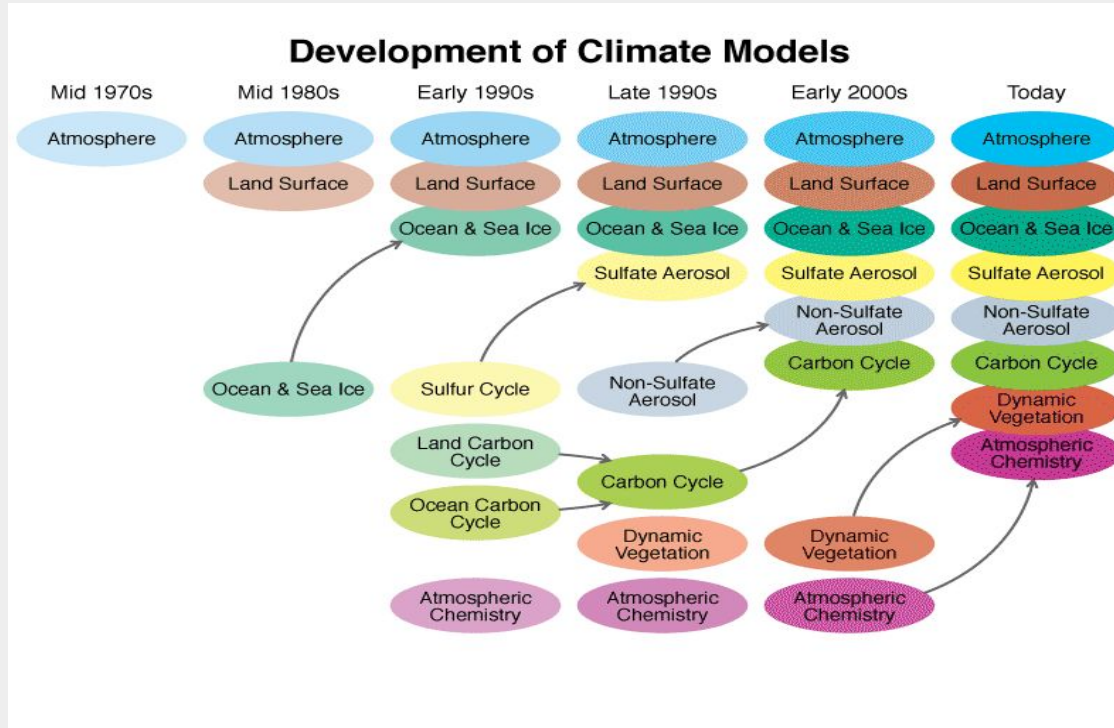


Image from NASA's Global Climate Change website.

FIRST MODEL

- “Only a completely new approach to scientific endeavor that departed from the independent, individual mode of inquiry would produce answers to complex models.”
- General Circulation Model
- Learning rather than predicting
- Used for prediction 1975

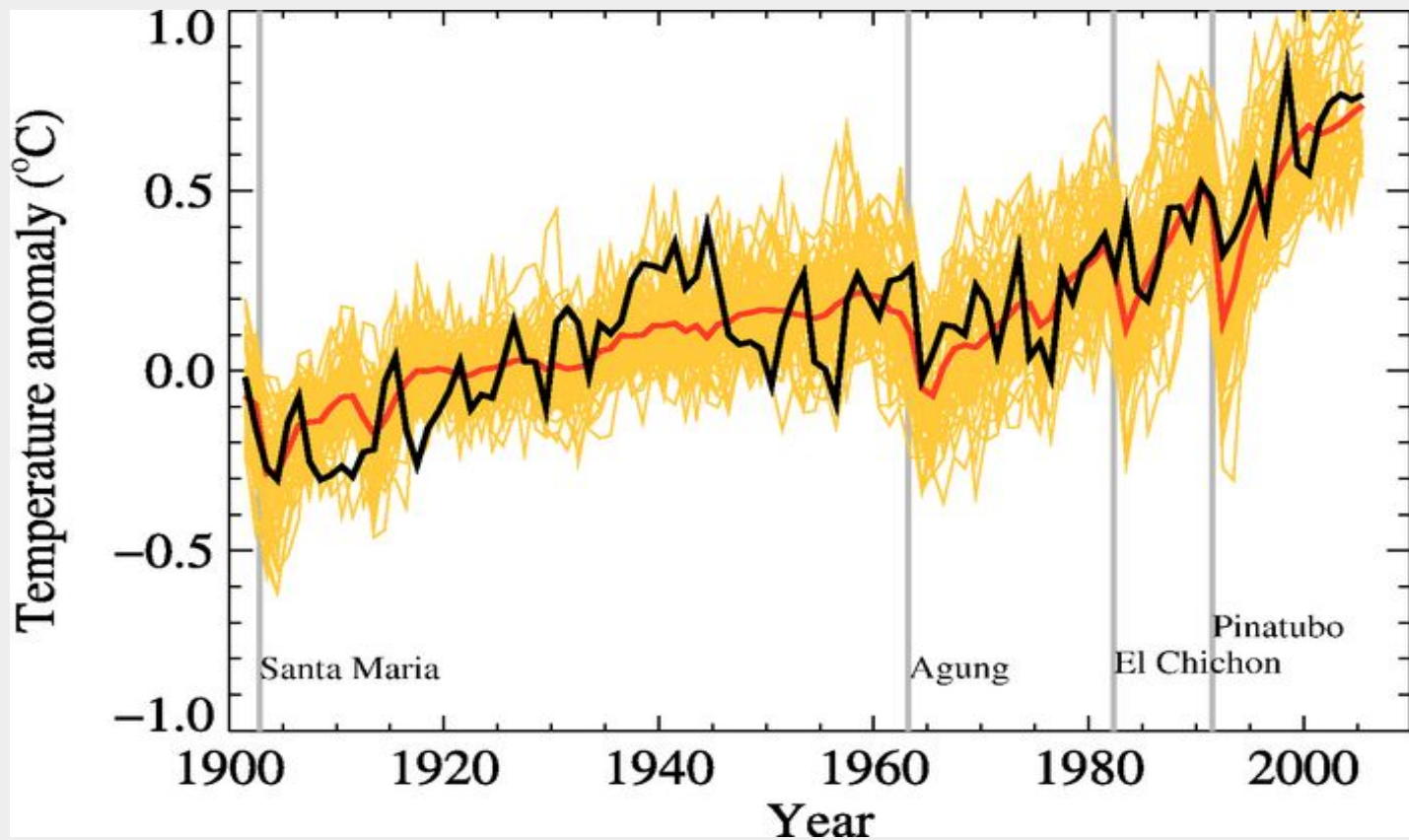
MAJOR CHANGES



RELIABILITY

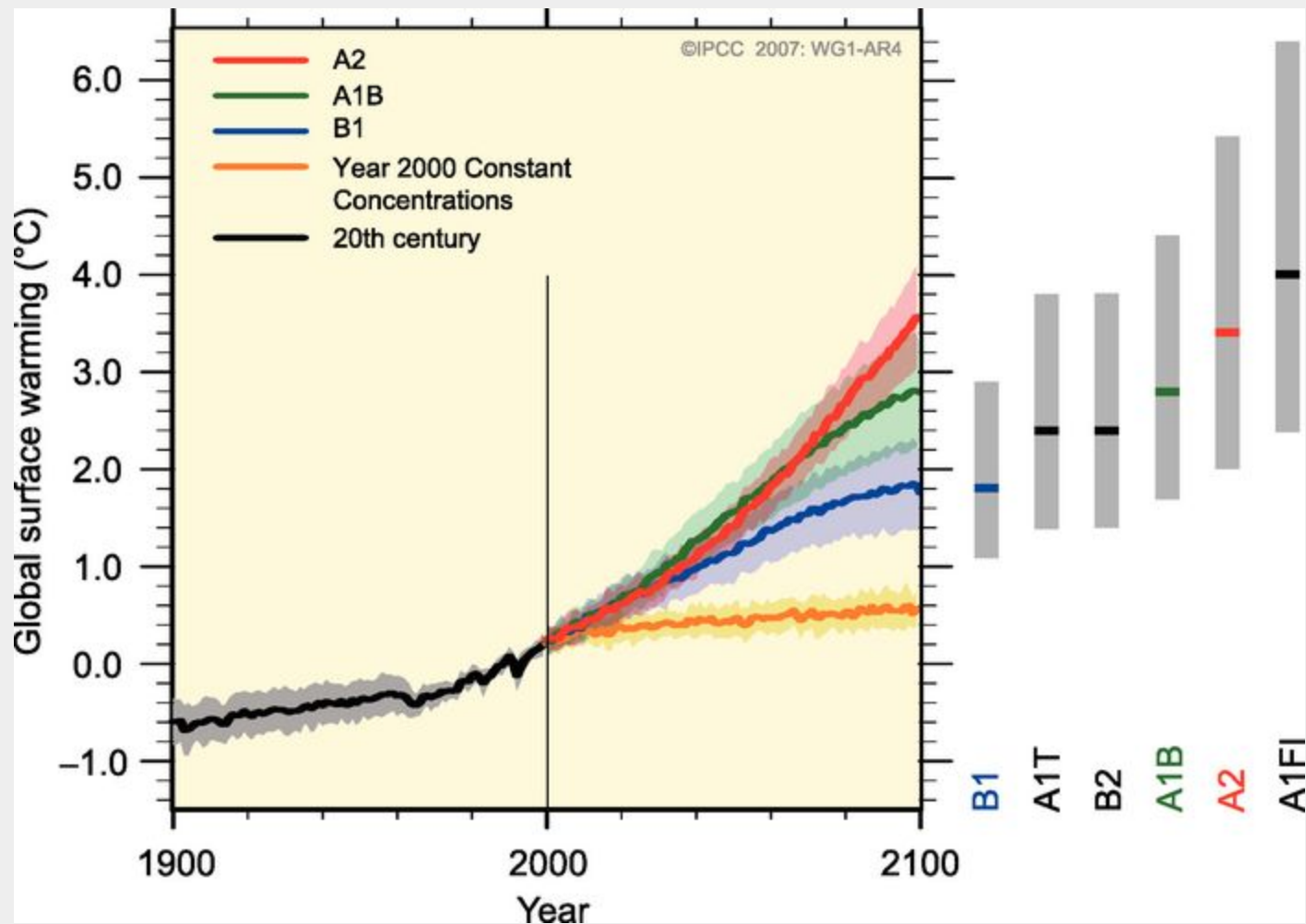
- Based on established physical laws
 - Navier-Stokes equations

- Ability to simulate important aspects of the current climate.



PREDICTION

- Predict society
 - Economic growth
 - Population growth
 - Technological advancement



MORAL COMPLEXITY - CLIMATE ETHICS

Three major dilemmas (according to Richard C.J. Somerville)

1. How to balance rights and responsibilities of the developed and developing world?
2. How to meet our responsibility to the future generations who must live with a climate that we are shaping today?
3. How to evaluate geo-engineering schemes designed to reverse or slow down climate change?



HOW TO BALANCE RIGHTS AND RESPONSIBILITIES OF THE DEVELOPED AND DEVELOPING WORLD?

Who is responsible so far? - clear answer: the developed world

And now?

~~'PPP' - polluter pays principle?~~

'BPP' - beneficiary pays principle?



HOW TO BALANCE RIGHTS AND RESPONSIBILITIES OF THE DEVELOPED AND DEVELOPING WORLD?

But still ...

... the developed nations have the room for reduction, the money
and the technologies

Deprive their right to emit?

... the developing nations are the big losers so far

Allow them to catch up?

... the developing nations should however avoid to make the
same mistake again

Are we in the position to ask for that?

HOW TO MEET OUR RESPONSIBILITY TO THE FUTURE GENERATIONS WHO MUST LIVE WITH A CLIMATE THAT WE ARE SHAPING TODAY?

How about ...

... introducing an equal per capita emission with/without trading?

= everybody has the right to emit the same amount
disregarding the past additionally you can/cannot
buy allocations from others



HOW TO MEET OUR RESPONSIBILITY TO THE FUTURE GENERATIONS WHO MUST LIVE WITH A CLIMATE THAT WE ARE SHAPING TODAY?

How about ...

... distinguishing between luxury and subsistence emissions?

“Suppose that 50% of the emissions of the US Virgins Islands are luxury and all of the emissions of Rwanda are subsistence emissions. It’s clear who has room for reduction and who doesn’t. Arguing the point is as good as saying some Rwandans should die so that some Virgin Islanders can recharge their phones.”

James Garvey: The Ethics of Climate Change, Continuum, 2008

... deciding the trajectory and our ethical values?

HOW TO EVALUATE GEO-ENGINEERING SCHEMES DESIGNED TO REVERSE OR SLOW DOWN CLIMATE CHANGE?

What is geo-engineering?

= intervention in the earth's natural system to counteract climate change

Examples:

Solar Radiation Management (SRM)

Carbon Dioxide Removal (CDR)

But does that really solve the problem?



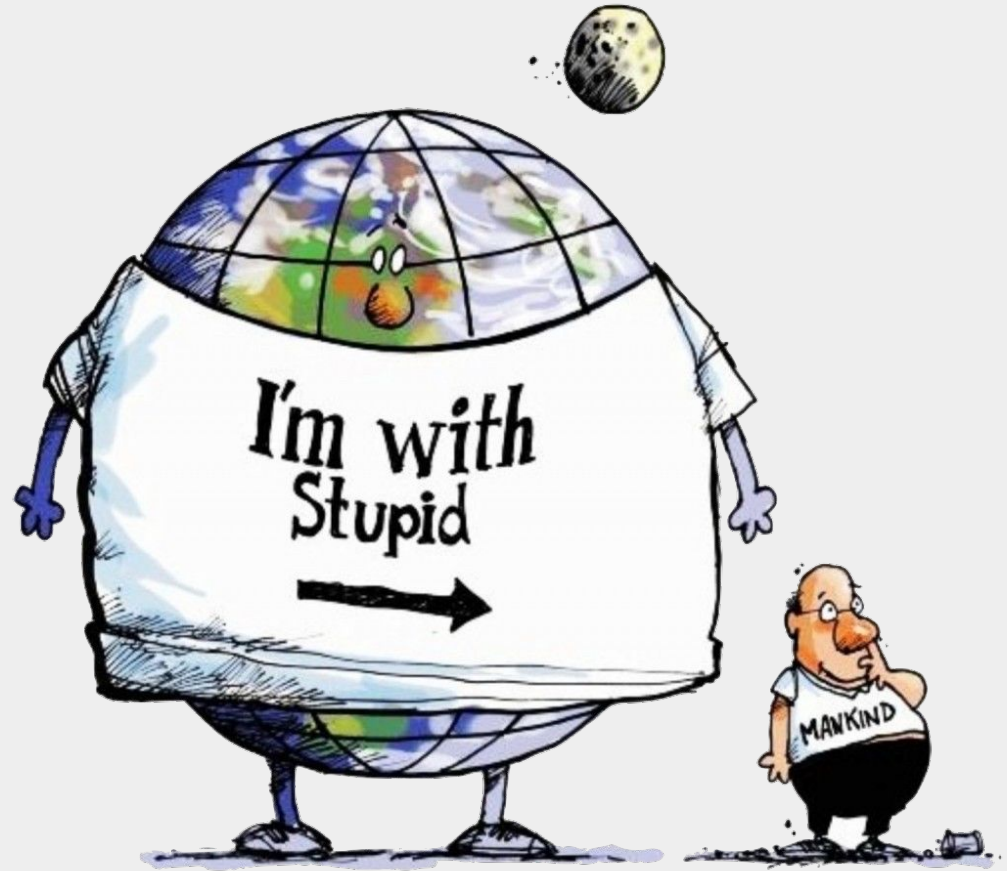
CONCLUSIONS

There are a lot of different factors that cause and still influence climate change.

Models are needed to handle the complexity.

Adding moral aspects makes it even harder to deal with.

THANK YOU FOR
YOUR ATTENTION!
QUESTIONS?



DISCUSSION QUESTIONS

Given that scientists in the future have knowledge of geo-engineering and its effects on the climate, should it be permitted to intervene in the natural system of the earth (using e.g. SRM, CDR)? If so, what restrictions for this would be appropriate?

"I feel about geoengineering exactly as I do about nuclear war: Study it, by all means, but never try it."
- Richard C.J. Somerville

Should developing countries be granted greater allowed emission quota than developed countries since the current developed countries historically stand for the vast majority of pollution/emission? What other solutions could there be regarding this issue? Discuss (dis)advantages for the "Polluter pays", "Beneficiary pays", and "Equal part per capita" methods.

Assuming Equal part per capita, should it be allowed to trade emission quota? What would this incentivise? Would it be easily exploitable by richer nations or would the world market self adjust to compensate for this?

What qualifies as a luxury resp. subsistence emission? Examples?