

Climate Change: Extreme urgency, reasonable hope

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**Light and enlightenment: Perspectives on the next decade, Photonics
Research Group, Ghent University, 29 September 2023**

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The Essential Truth About Climate Change in Ten Words

The basic facts of climate change, established over decades of research, can be summarized in five key points:

IT'S REAL

IT'S US

EXPERTS AGREE

IT'S BAD

THERE'S HOPE

Global warming is happening.

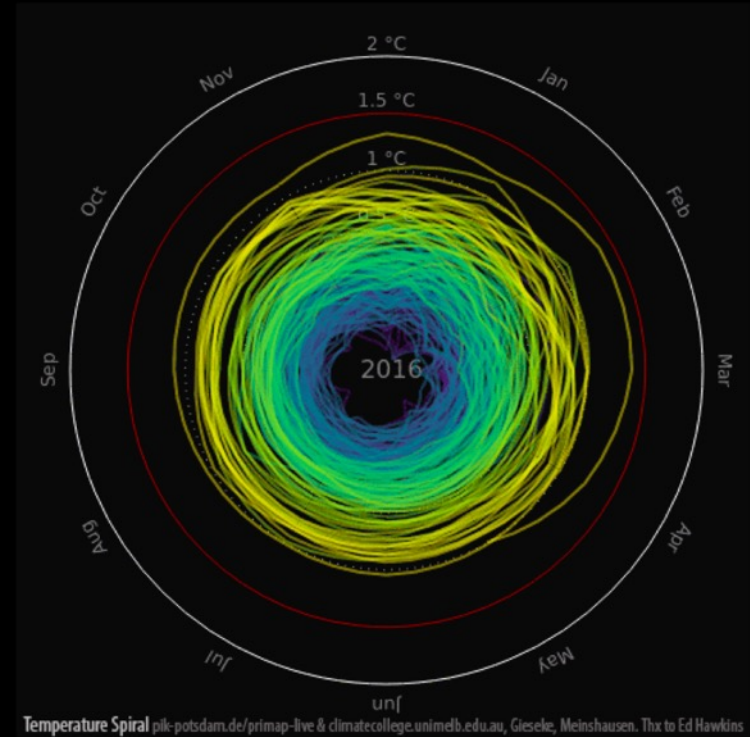
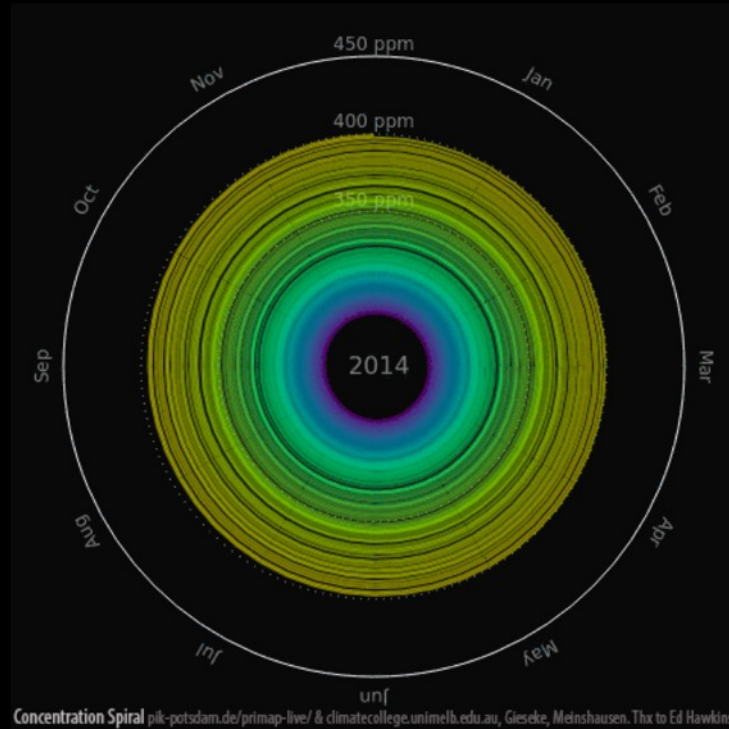
Human activity is the main cause.

There's scientific consensus on human-caused global warming.

The impacts are serious and affect people.

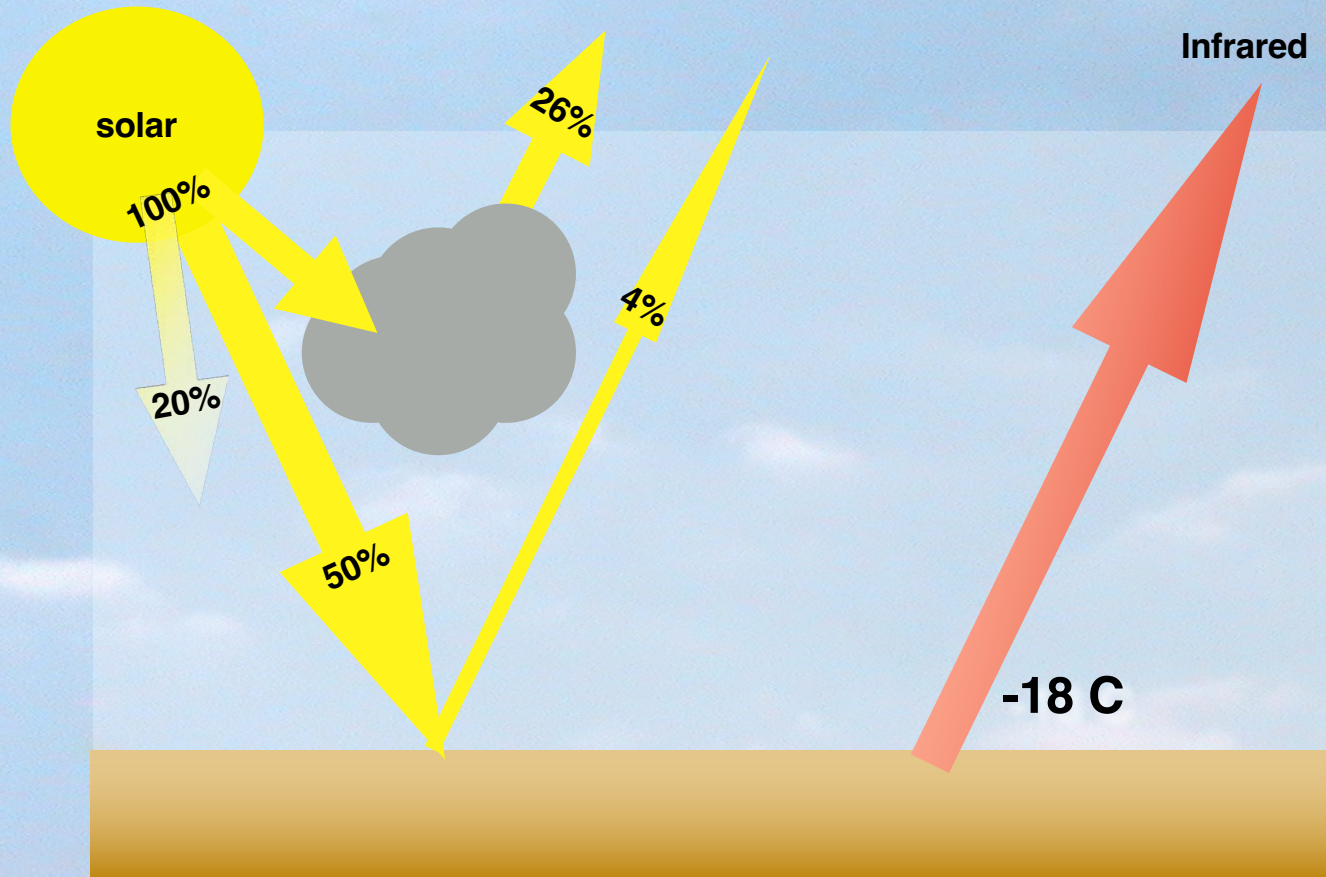
We have the technology needed to avoid the worst climate impacts.

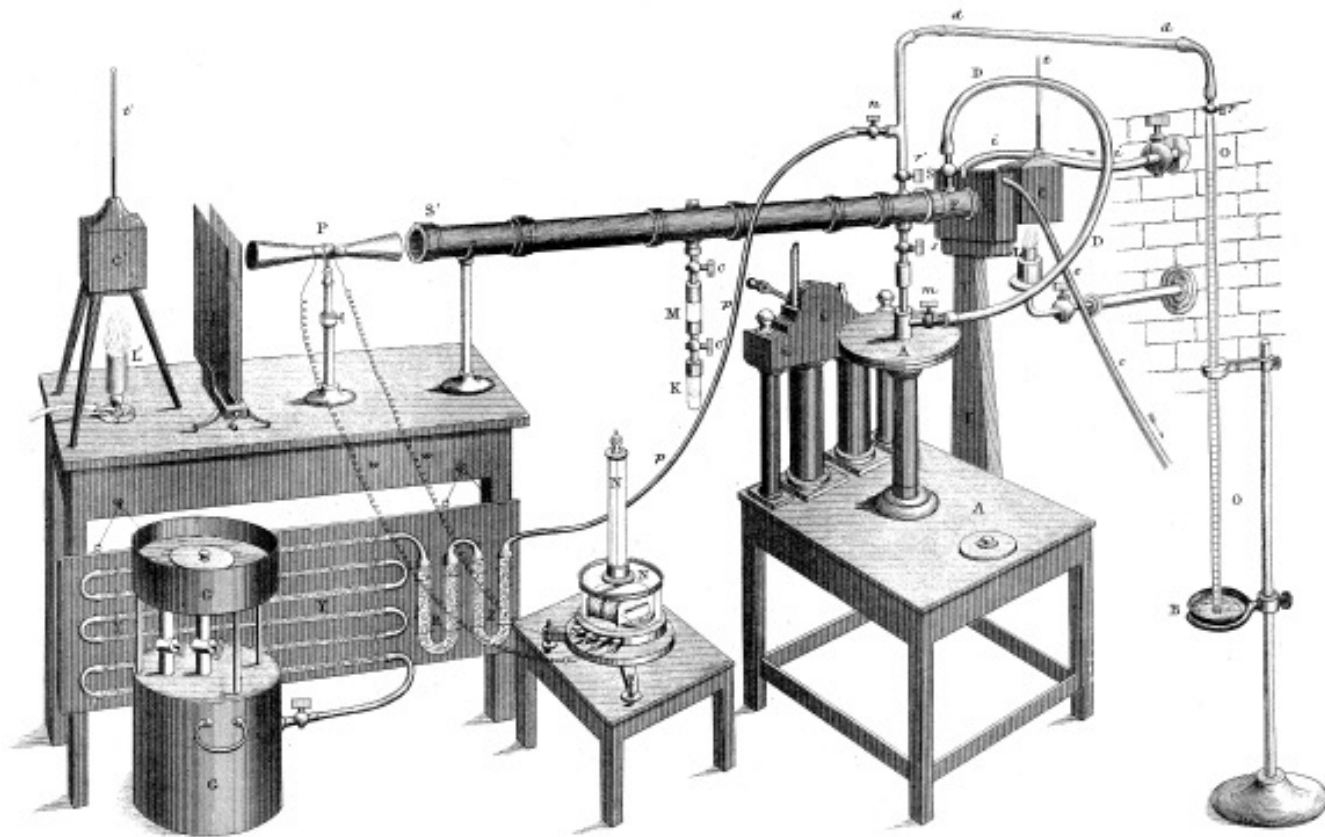
CO₂ Concentration and Temperature spirals



CO₂ Concentration since 1850 and Global Mean Temperature in °C relative to 1850 – 1900
Graph: Ed Hawkins (Climate Lab Book) – Data: HadCRUT4 global temperature dataset
Animation available on <http://openclimatedata.net/climate-spirals/concentration-temperature/>

Without Greenhouse Effect



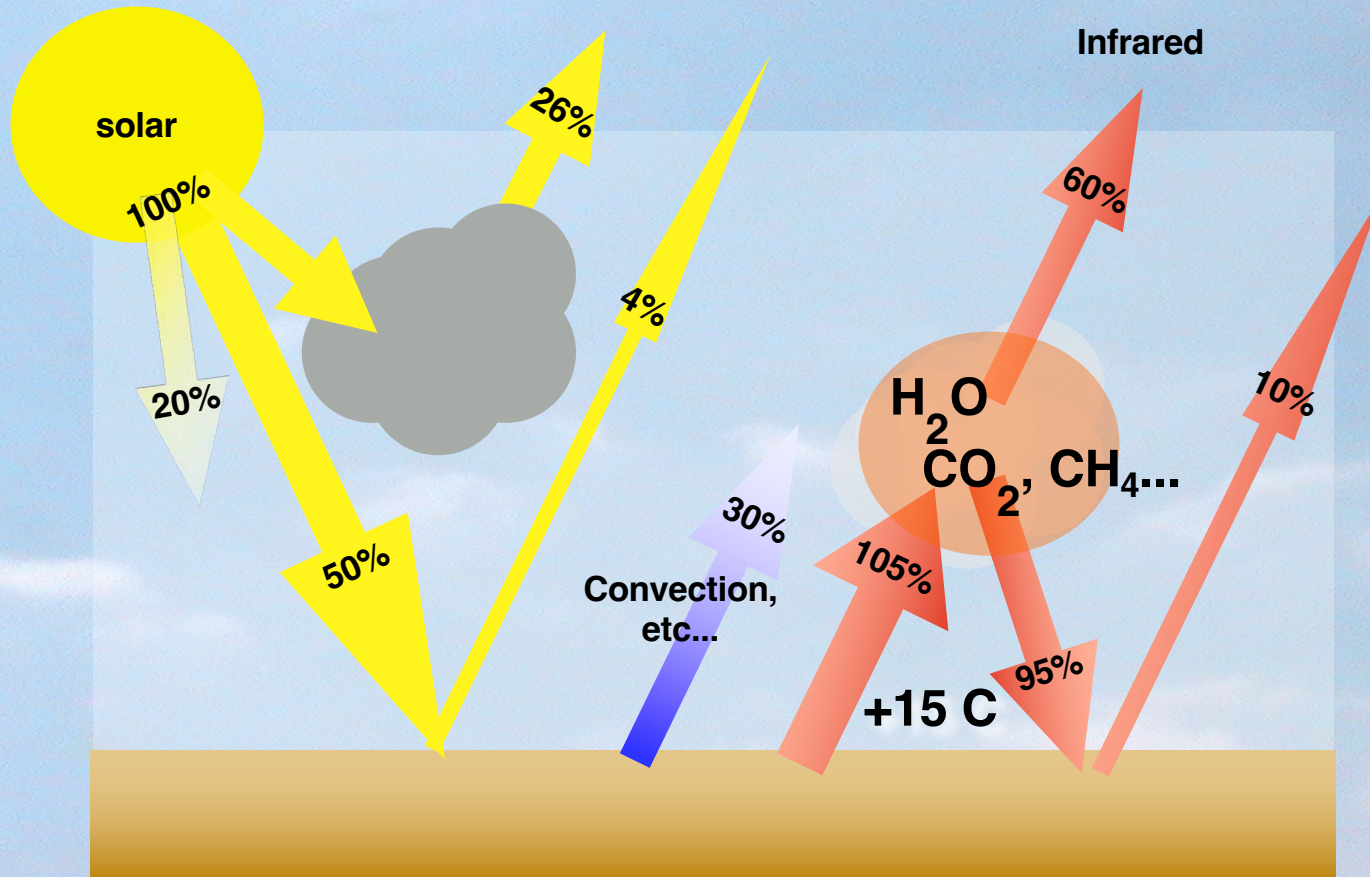


John Tyndall (1861) measures absorption of radiation by different gases

This lady scientist deserves more recognition: Eunice Foote

- **It was Madam Eunice Newton Foote (1819-1888), an American scientist who remained unknown until recently, who first realised (in 1856) that certain gases trap heat. This was three years before John Tyndall**
- **By the way, she was also a campaigner for equal rights for women, a subject that is dear to me as well, particularly as universities are concerned**

With Greenhouse Effect



Progression of Understanding: Greater and Greater Certainty in Attribution

AR1 (1990): “unequivocal detection not likely for a decade”

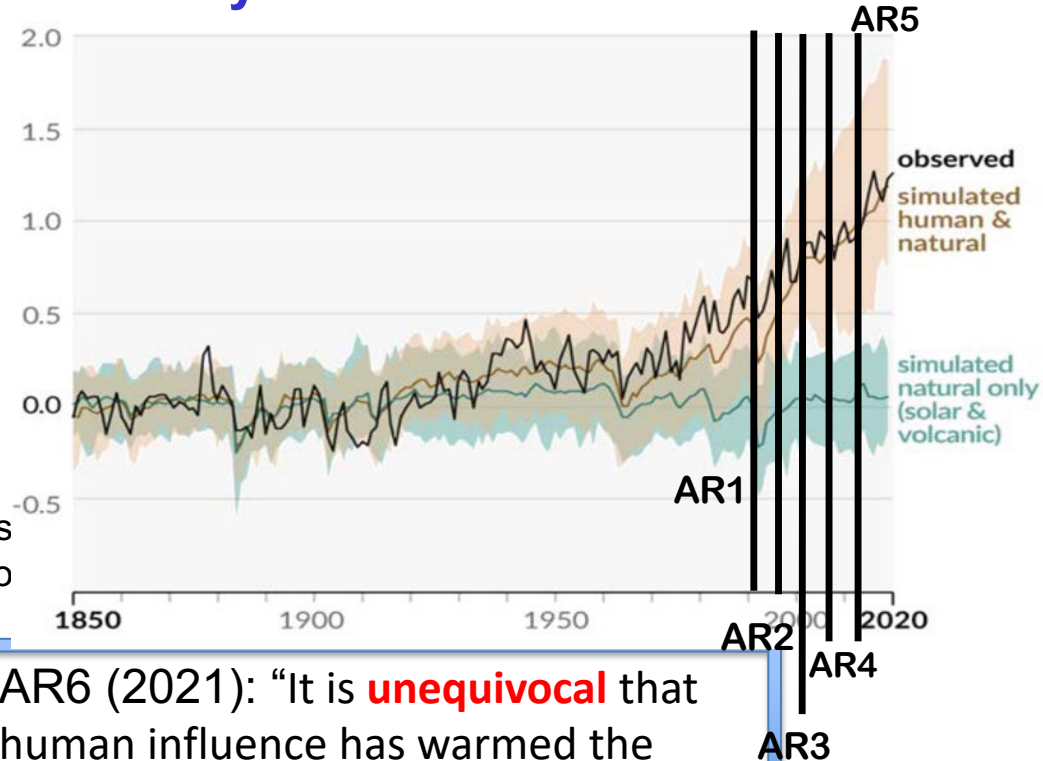
AR2 (1995): “balance of evidence suggests **discernible** human influence”

AR3 (2001): “most of the warming of the past 50 years is **likely** (odds 2 out of 3) due to human activities”

AR4 (2007): “most of the warming is **very likely** (odds 9 out of 10) due to greenhouse gases”

AR5 (2013) «It is **extremely likely** (odds 95 out of 100) that human influence has been the dominant cause... »

AR6 (2021): “It is **unequivocal** that human influence has warmed the atmosphere, ocean, and land.”



Human-induced climate change is already affecting many weather and climate extremes in every region across the globe



Extreme heat

More frequent

More intense



Heavy rainfall

More frequent

More intense



Drought

Increase in some
regions



Fire weather

More frequent



Ocean

Warming
Acidifying
Losing oxygen

Heat waves kill, particularly if it's humid



A man helps move a heat wave victim to a Karachi hospital on 22 June 2015.

ASIF HASSAN/AFP/Getty Images <https://edition.cnn.com/2015/06/22/asia/gallery/pakistan-heat-wave/index.html>

Wallonia Floods, July 2021

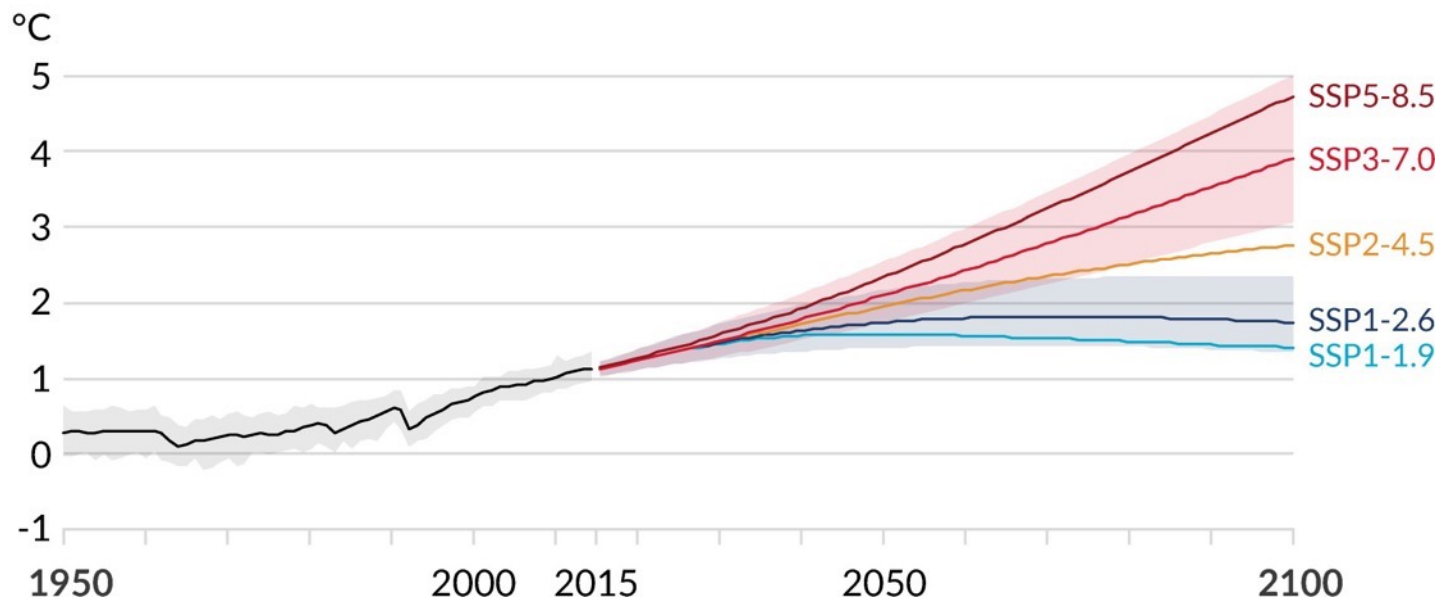


Source:
VRT Nieuws

Human activities affect all the major climate system components, with some responding over decades and others over centuries

Figure SPM.8

a) Global surface temperature change relative to 1850-1900



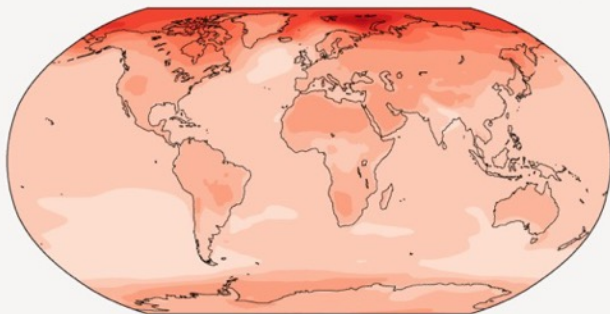
SIXTH ASSESSMENT REPORT

Working Group I – The Physical Science Basis

Across warming levels, land areas warm more than oceans, and the Arctic and Antarctica warm more than the tropics

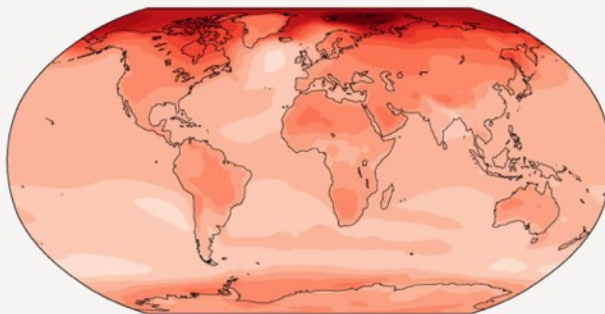
+1.5° C

Simulated change at 1.5 °C global warming



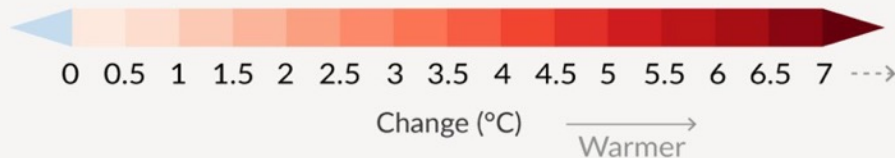
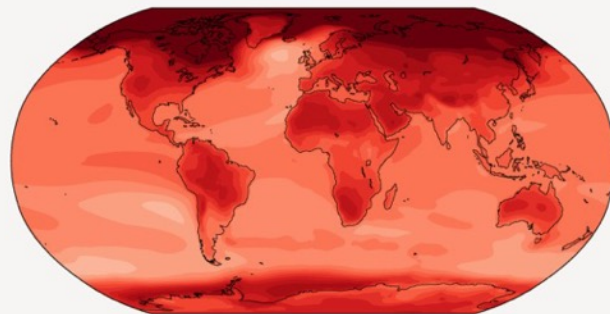
+2° C

Simulated change at 2 °C global warming



+4° C

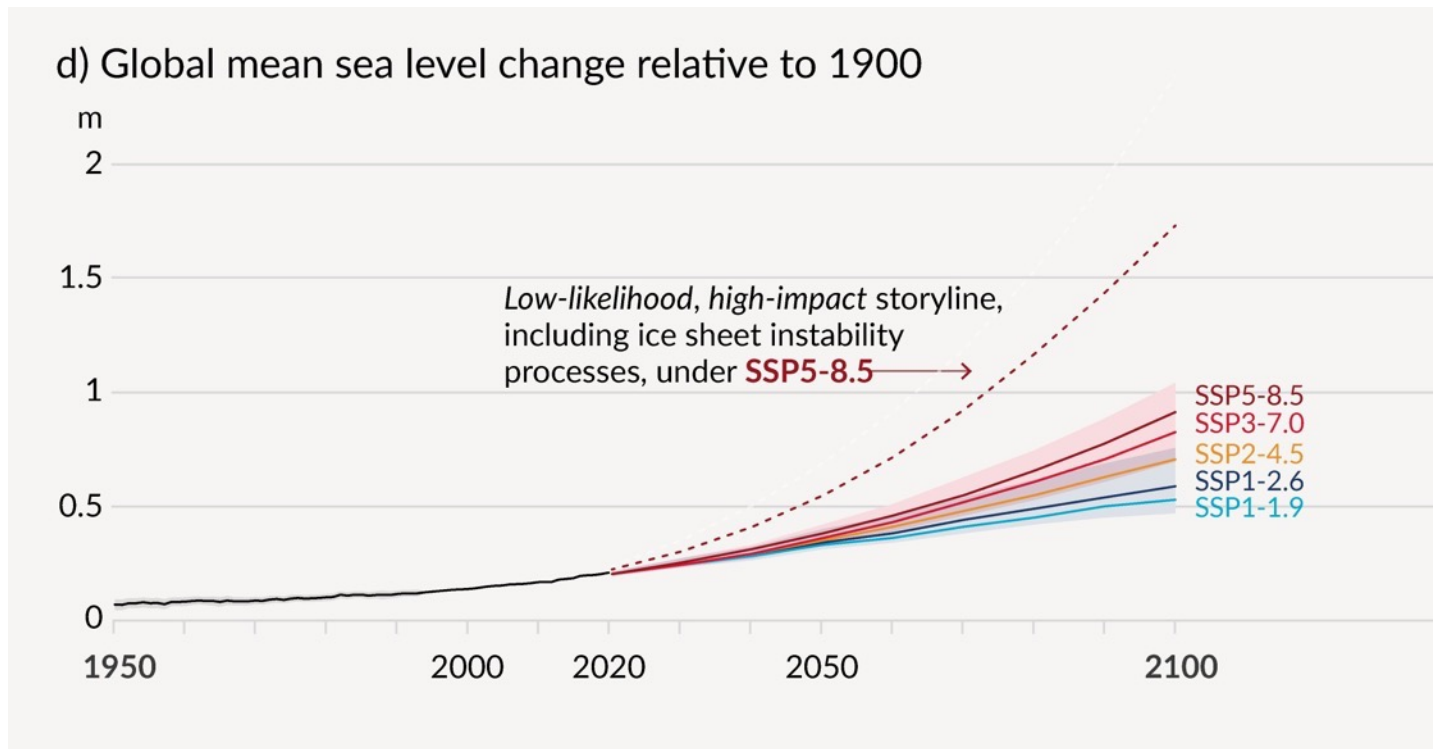
Simulated change at 4 °C global warming



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Working Group I – The Physical Science Basis

Human activities affect all the major climate system components, with some responding over decades and others over centuries *Figure SPM.8*

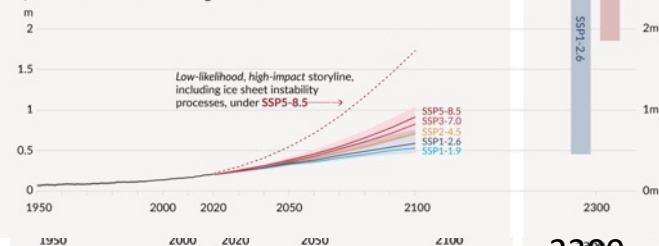


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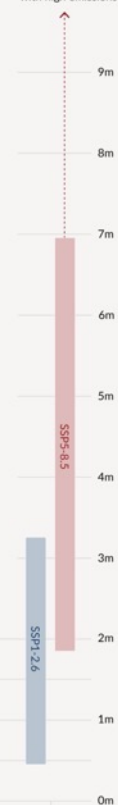
« Sea level rise **greater than 15 m** cannot be ruled out with high emissions »

d) Global mean sea level change relative to 1900



e) Global mean sea level change in 2300 relative to 1900

Sea level rise greater than 15m cannot be ruled out with high emissions



7 m

2 m

Gent koningin der badsteden?

Zonder maatregelen voor milieu is Antwerpen overspoeld in 3000

BRUSSEL - Zonder nieuwe maatregelen zal ons klimaat verder opwarmen. Dan komt tegen 3000 tien procent van België onder water te staan. Daaronder uiteraard alle kuststeden, maar ook Brugge, Antwerpen en zelfs Mechelen. Gent komt aan zee te liggen. Dat blijkt uit een studie van professoren van de UCL in opdracht van Greenpeace.

Gerard Govers, professor geografie aan de Katholieke Universiteit Leuven, tekende gisteren op onze vraag het nieuwe kaartje van Vlaanderen anno 3000 uit. Een land waarin de zeespiegel volgens het rapport van Greenpeace mogelijk 8 meter gestegen is. "In dat geval zou het grootste gedeelte



Govers. "Gent zou nog net boven water blijven, ze mogen daar al appartementjes beginnen bouwen."

Gent als koningin der badsteden? Het is een grapje, volgens professor Govers is het moeilijk om nu al voorspellingen voor het volgende millennium te maken. "Dat lijkt me

meetbaar te worden en er bestaan al voorspellingen voor het jaar 2050, zelfs 2100. Maar verder hangt veel af van wat op Antarctica gaat gebeuren en dat is moeilijk te zeggen. Afwachten dus."

Het rapport van Greenpeace werd gisteren overhandigd aan Bruno Tobback en Kri

Future global climate risks



Heat stress

Exposure to heat waves will continue to increase with additional warming.



Water scarcity

At 2° C, regions relying on snowmelt could experience 20% decline in water availability for agriculture after 2050.



Food security

Climate change will increasingly undermine food security.



Flood risk

About a billion people in low-lying cities by the sea and on Small Islands at risk from sea level rise by mid-century.


**We are heading fast towards a situation where our planet is significantly less inhabitable than today,
« a brick wall »**

- **One good news is that we know it**
- **The other good news is that we know how to brake and change course**
- **Technology will help, but will not suffice**
- **Transdisciplinary approaches will help**
- ***Much* more political will is needed**

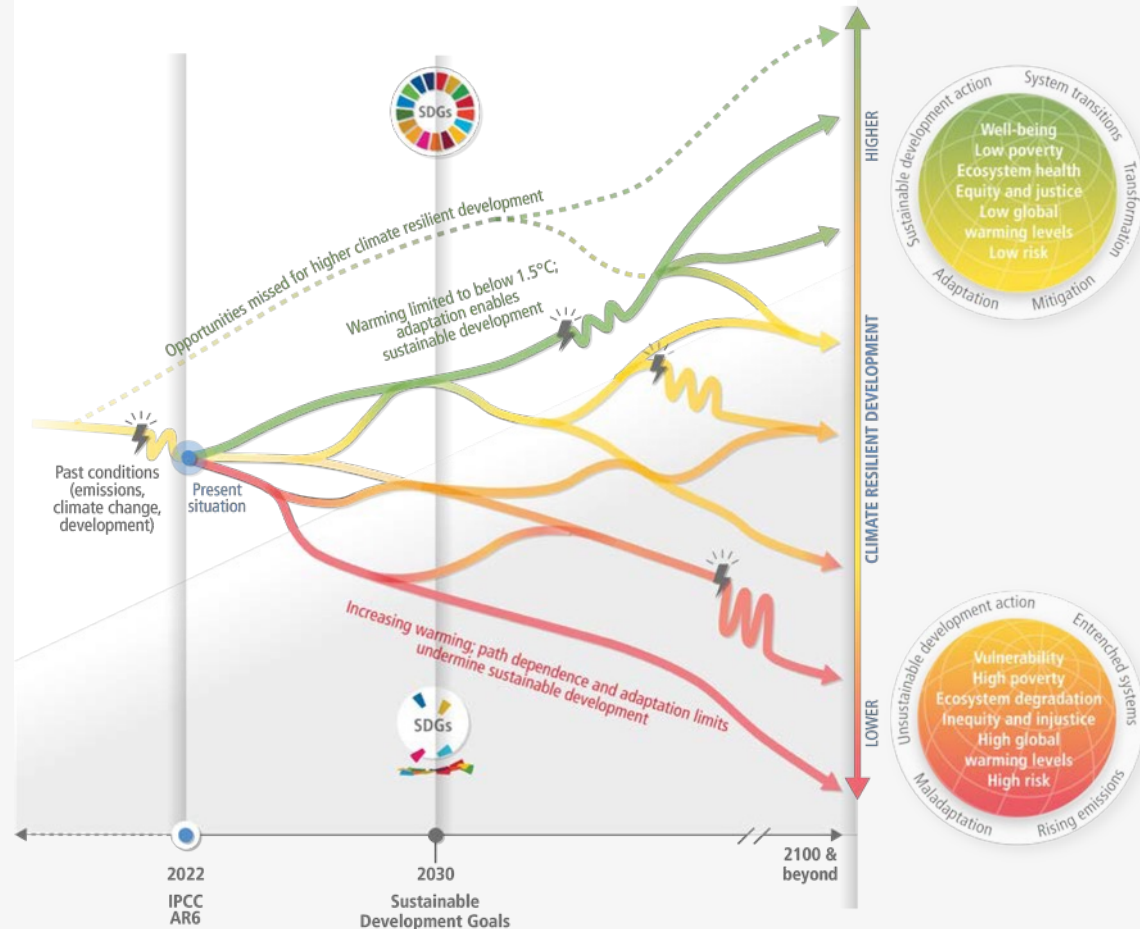
Increasing urgency

Starting today,
every action, every
decision matters.

Worldwide action is more urgent
than previously assessed.

 Illustrative climatic or non-climatic shock,
e.g. COVID-19, drought or floods,
that disrupts the development pathway

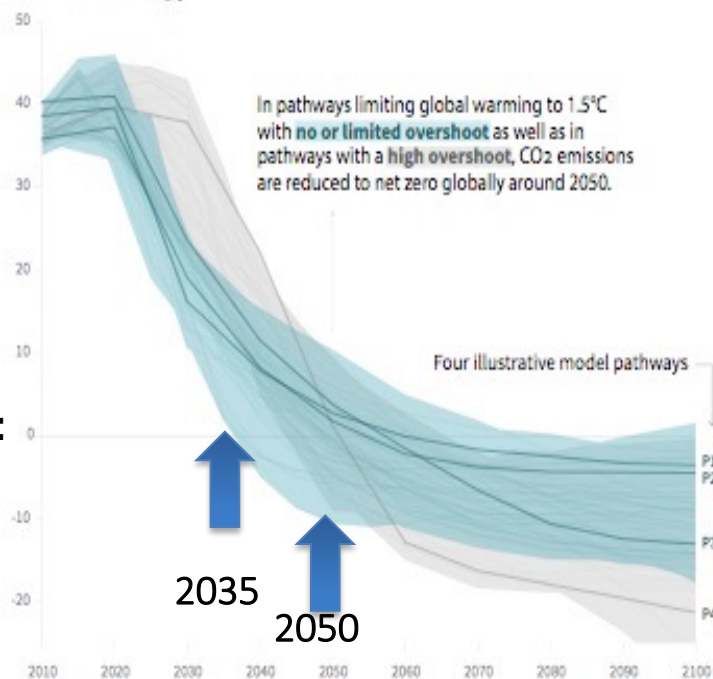
 Narrowing window of
opportunity for higher CRD



Emission pathways compatible with below 1.5° C warming:

Global total net CO₂ emissions

Billion tonnes of CO₂/yr



Net ZERO:

2035

2050

Timing of net zero CO₂

Line widths depict the 5-95th percentile and the 25-75th percentile of scenarios



Pathways limiting global warming to 1.5°C with no or low overshoot

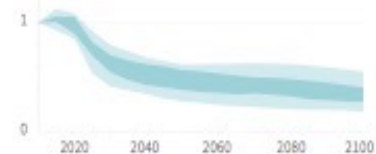
Pathways with high overshoot

Pathways limiting global warming below 2°C (Not shown above)

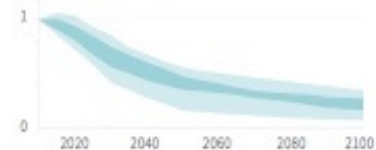
Non-CO₂ emissions relative to 2010

Emissions of non-CO₂ forcers are also reduced or limited in pathways limiting global warming to 1.5°C with **no or limited overshoot**, but they do not reach zero globally.

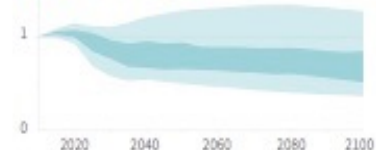
Methane emissions



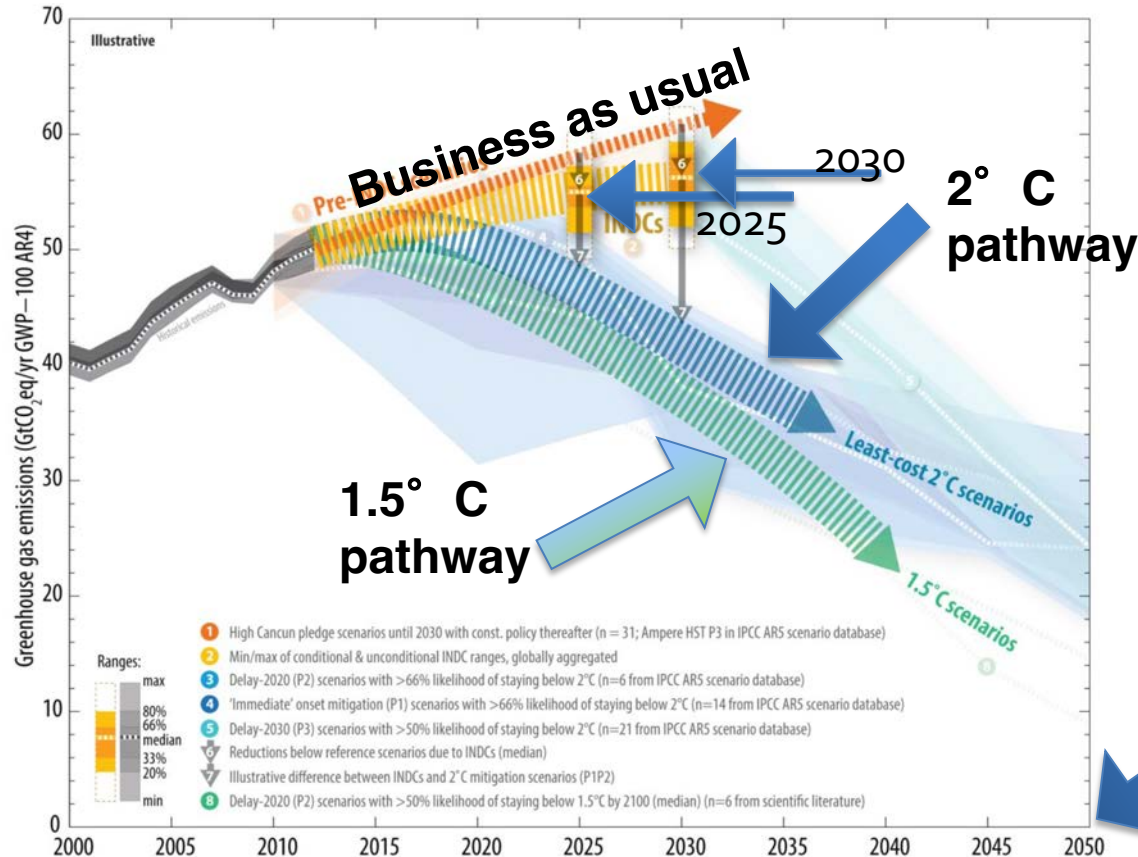
Black carbon emissions



Nitrous oxide emissions



Paris Agreement: plans not sufficient yet!



UNFCCC, Aggregate effect of the intended nationally determined contributions: an update

<http://unfccc.int/resource/docs/2016/cop22/eng/02.pdf>

Reasonable hope? How?

My 5 priority solutions

1: **N**egawatts to replace Megawatts

**IPCC: it can reduce global
emissions in several sectors
by 40-70% by 2050**

Sources: IPCC (2022), Bosch, @JPvanYpersele,
Adam Bataszewicz, Victor Hernandez



2: Prioritize reductions from the highest CO₂ emitters: 50% come from the richest 10% 10% come from the poorest 50%

Germany, food for one week



Peter Menzel / Barcroft Media

Sudan, food for one week



3: Make polluters pay



Shutterstock Photo © Hung Chung Chih

Warning:

Use the collected money well (help the poor & the transition)

4: Use nuclear fusion

4:

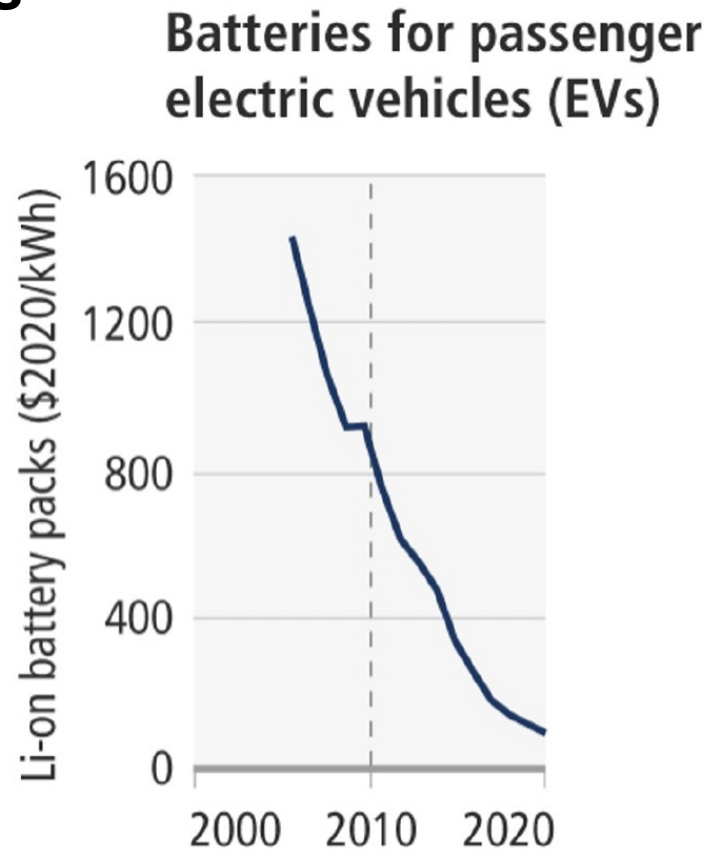
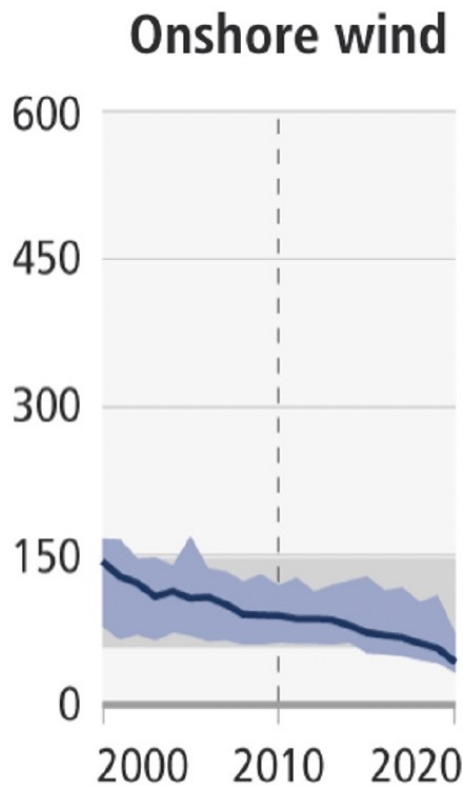
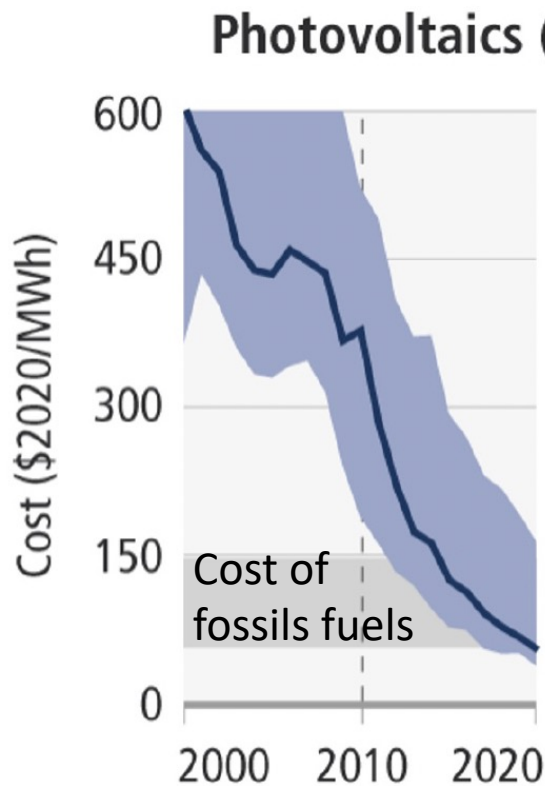
**Use nuclear
fusion now:
the Sun!**

2 hours = 1 year



@AJamesMcCarthy

Good news: solar & wind energy become cheaper than fossil fuels



5: Work with nature

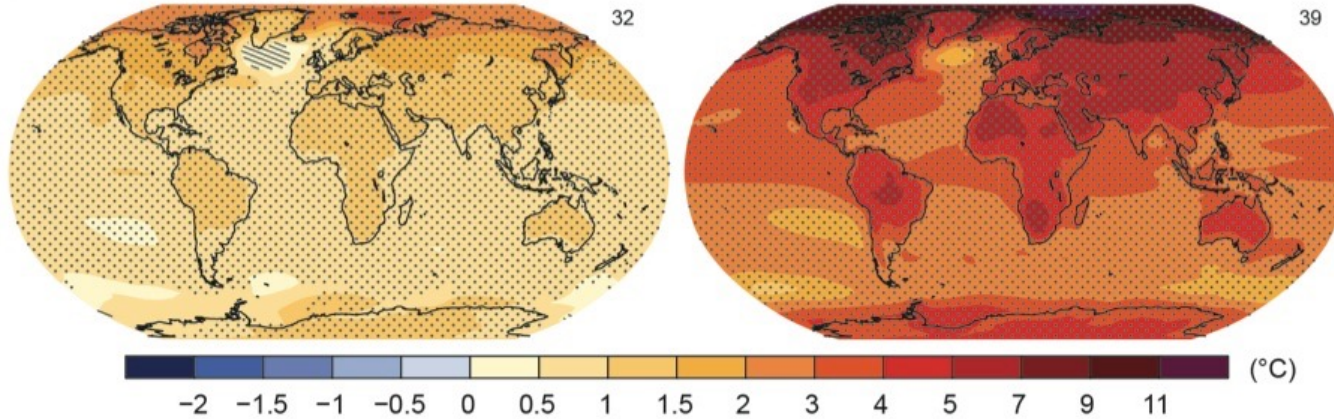


Low emission scenario

High emission scenario

Change in average surface temperature (1986–2005 to 2081–2100)

Fig. SPM.8



Humanity has the choice

Remember (and remind candidates to elections):

- **It's real**
- **It's us**
- **Experts agree**
- **It's bad**
- **There's hope**
- **More **N**egawatts**
- **Prioritize big polluters**
- **Make polluters pay**
- **Use the Sun**
- **Work with nature**

**TIME TO WAKE UP
... and talk to others
about what you can
do, together...**



...to leave a better world
behind us

HELP ME
I CANT BREATHE

To go further :

- www.climate.be/vanyp : my slides (under « conferences »)
- www.ipcc.ch : IPCC
- www.skepticalscience.com : answers to the merchants of doubt arguments
- www.plateforme-wallonne-giec.be : IPCC-related in French, free Newsletter!

Twitter: @JPvanYpersele & @IPCC_CH