Climate change:

Renewed urgency after the IPCC WGI report

Jean-Pascal van Ypersele

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Former IPCC Vice-Chair (2008 - 2015)

Twitter: @JPvanYpersele

« What does ambition at COP26 look like? »
UNFCCC COP-26 Pre-briefing, CIEL, Geneva (online), 27 October 2021

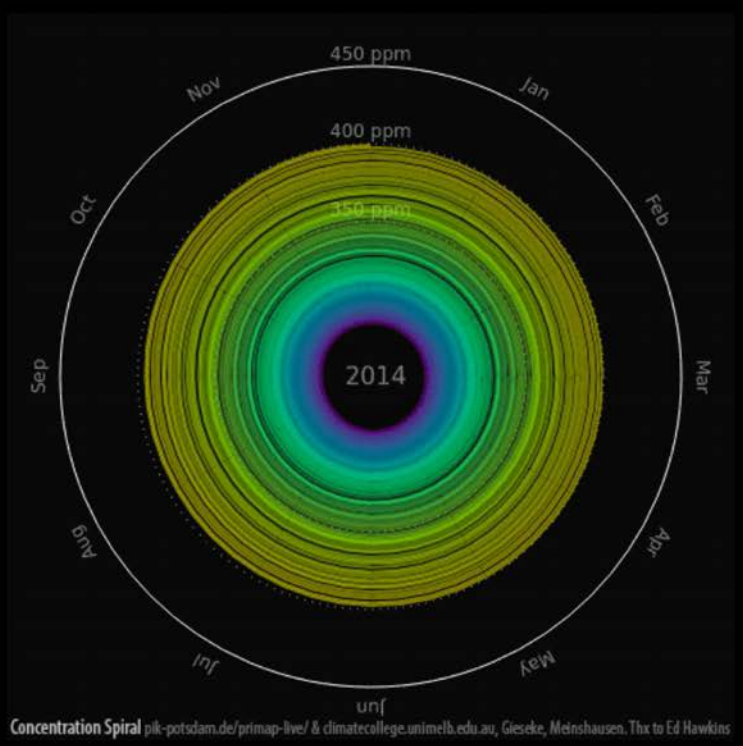
Thanks to the Walloon Government (funding the Walloon Platform for IPCC) to my team at UCLouvain for their support

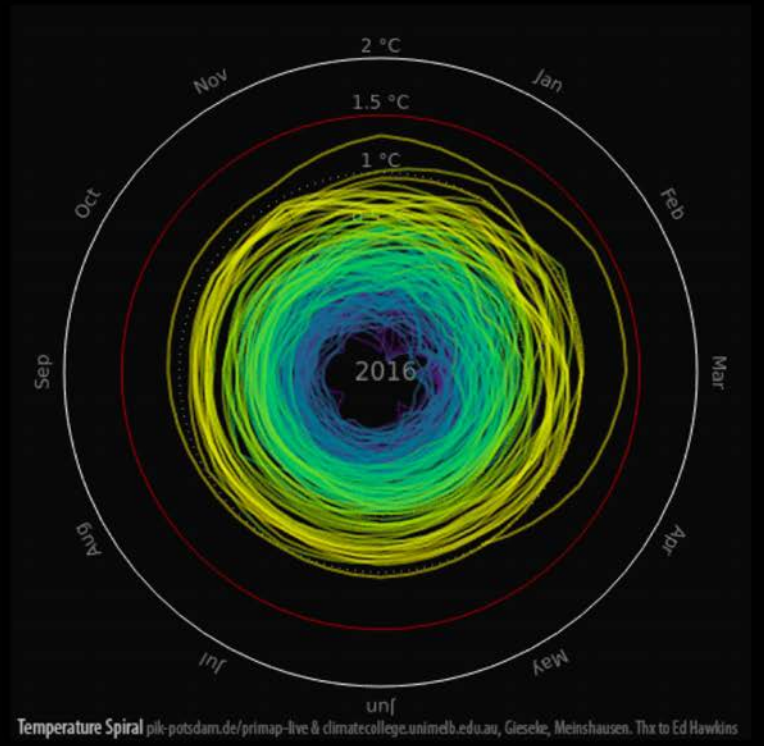
Fact: Because we use the atmosphere as a free dustbin for our greenhouse gases, we thicken the thermal insulation layer around the planet

That is why we must cut emissions to net ZERO as soon as possible

@JPvanYpersele

CO_2 Concentration and Temperature spirals

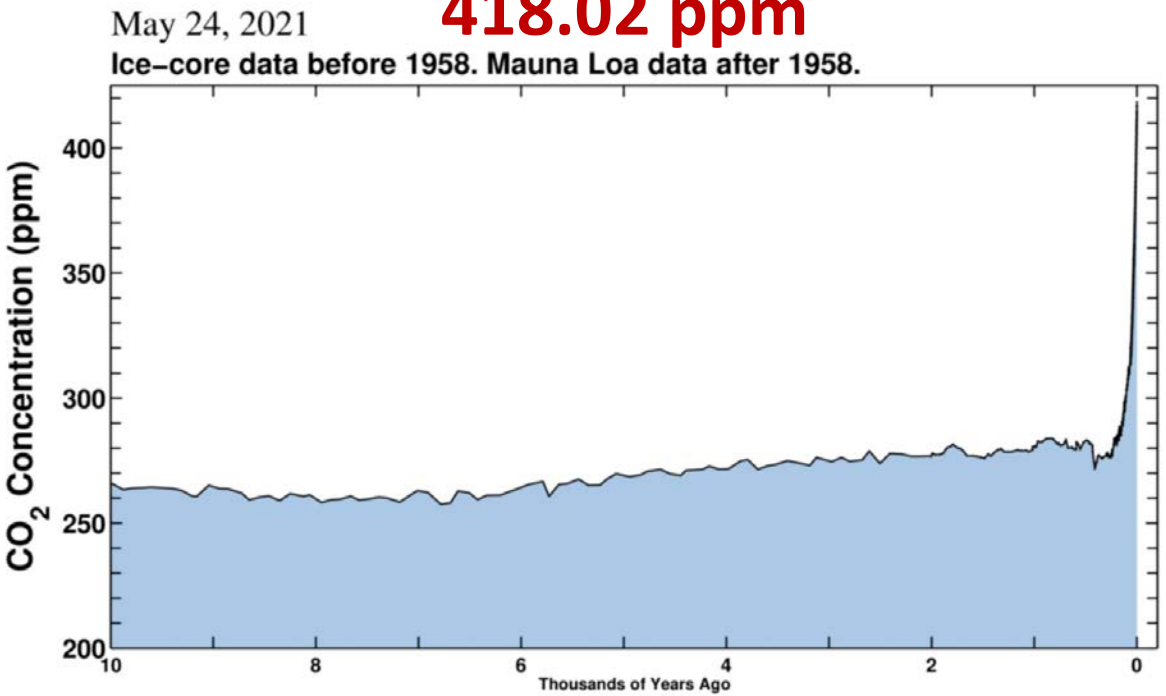




CO_2 Concentration since 1850 and Global Mean Temperature in °C relative to 1850 – 1900
Graph: Ed Hawkins (Climate Lab Book) – Data: HadCRUT4 global temperature dataset
Animation available on http://openclimatedata.net/climate-spirals/concentration-temperature/

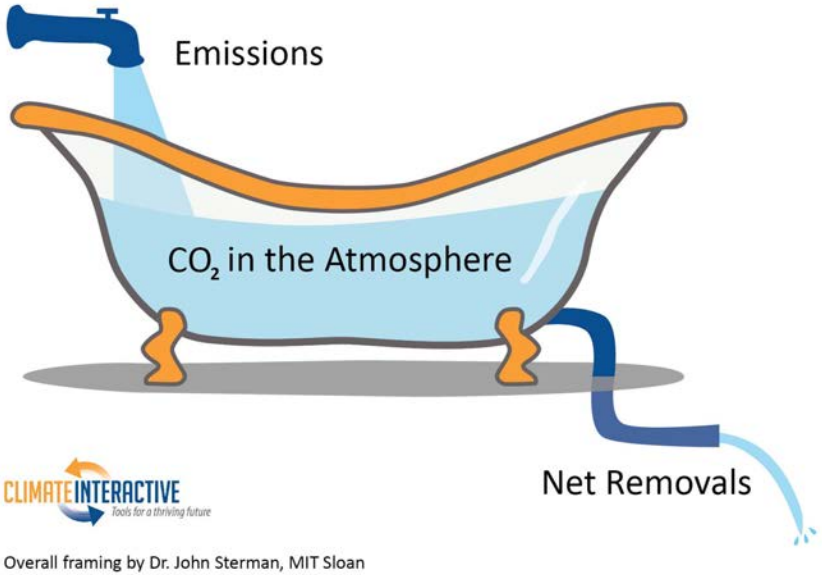
CO_2 Concentration 24 May 2021 (Keeling curve + last 10000 years)

418.02 ppm

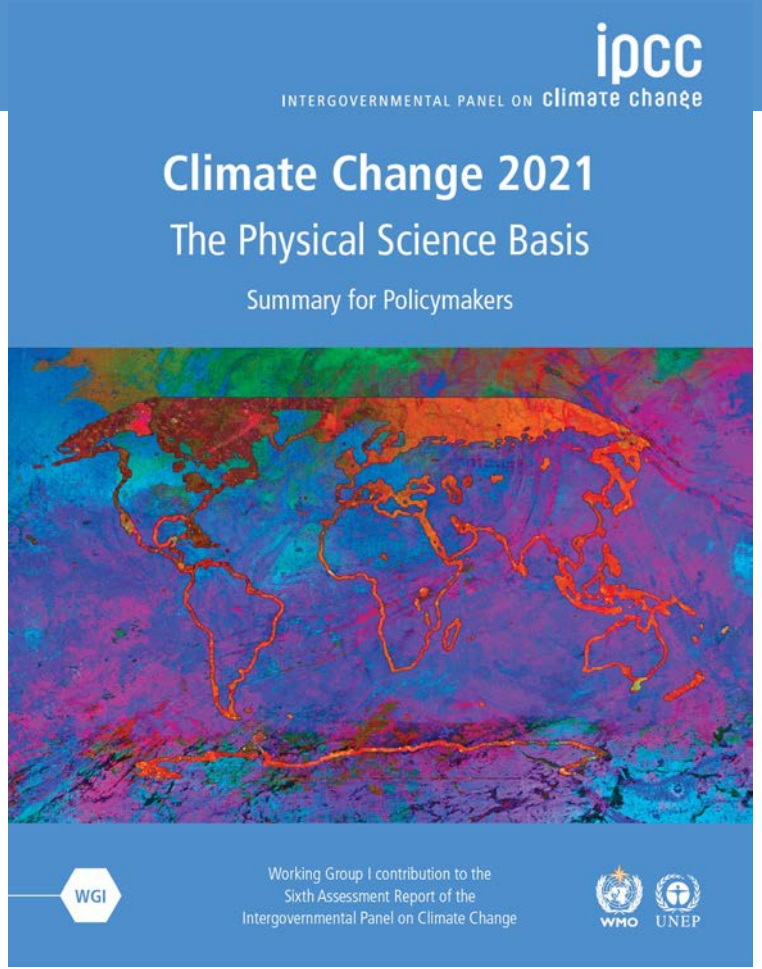


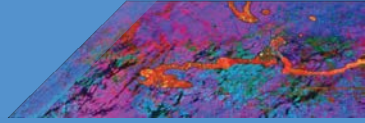
Source: scripps.ucsd.edu/programs/keelingcurve/

The Carbon Bathtub



Source: @CarbonInteractive


ipcc
INTERGOVERNMENTAL PANEL ON climate change
Climate Change 2021
The Physical Science Basis
Summary for Policymakers
WGI
Working Group I contribution to the
Sixth Assessment Report of the
Intergovernmental Panel on Climate Change
WMO
UNEP



BY THE NUMBERS

Author Team

234 authors from **65** countries

28% women, **72%** men

30% new to the **IPCC**

Review Process

14,000 scientific publications assessed

78,000+ review comments

46 countries commented on Final Government Distribution

Key messages from the latest WGI AR6 IPCC Report:

A. The Current State of the Climate

A.1 It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred.

A.2 The scale of recent changes across the climate system as a whole and the present state of many aspects of the climate system are unprecedented over many centuries to many thousands of years.

A.3 Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since the Fifth Assessment Report (AR5).

A.4 Improved knowledge of climate processes, paleoclimate evidence and the response of the climate system to increasing radiative forcing gives a best estimate of equilibrium climate sensitivity of 3°C, with a narrower range compared to AR5.

Progression of Understanding: Greater and Greater Certainty in Attribution

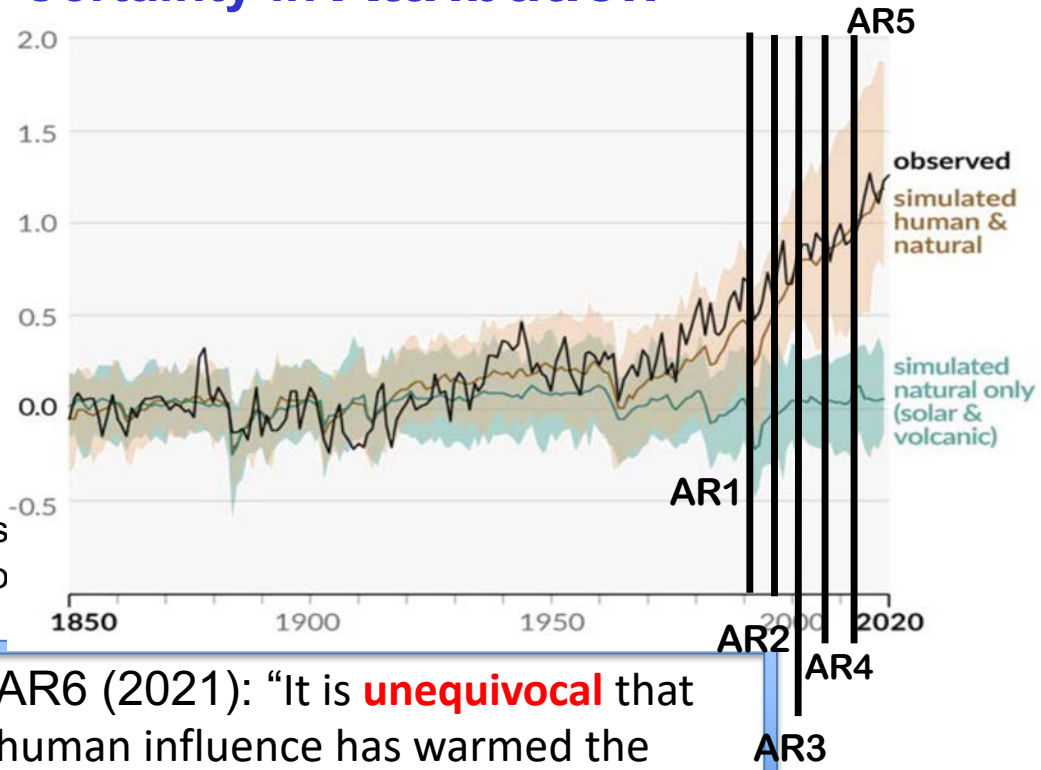
AR1 (1990): “unequivocal detection not likely for a decade”

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”

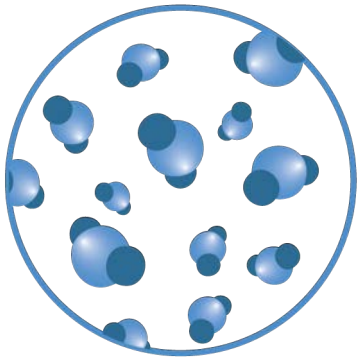
AR4 (2007): “most of the warming is **very likely** (odds 9 out of 10) due to greenhouse gases”

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.”

CO_2
concentration



Highest

in at least

2 million years

Sea level
rise

Fastest rates

in at least

3000 years

Arctic sea ice
area

Lowest level

in at least

1000 years

Glaciers
retreat

Unprecedented

in at least

2000 years

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

Photo Credits from left: 1. Luiz Guimaraes 2. Jonathan Ford 3. Peter Burdon 4. Ben Kuo 5. NOAA

Key messages from the latest WGI AR6 IPCC Report:

B. Possible Climate Futures

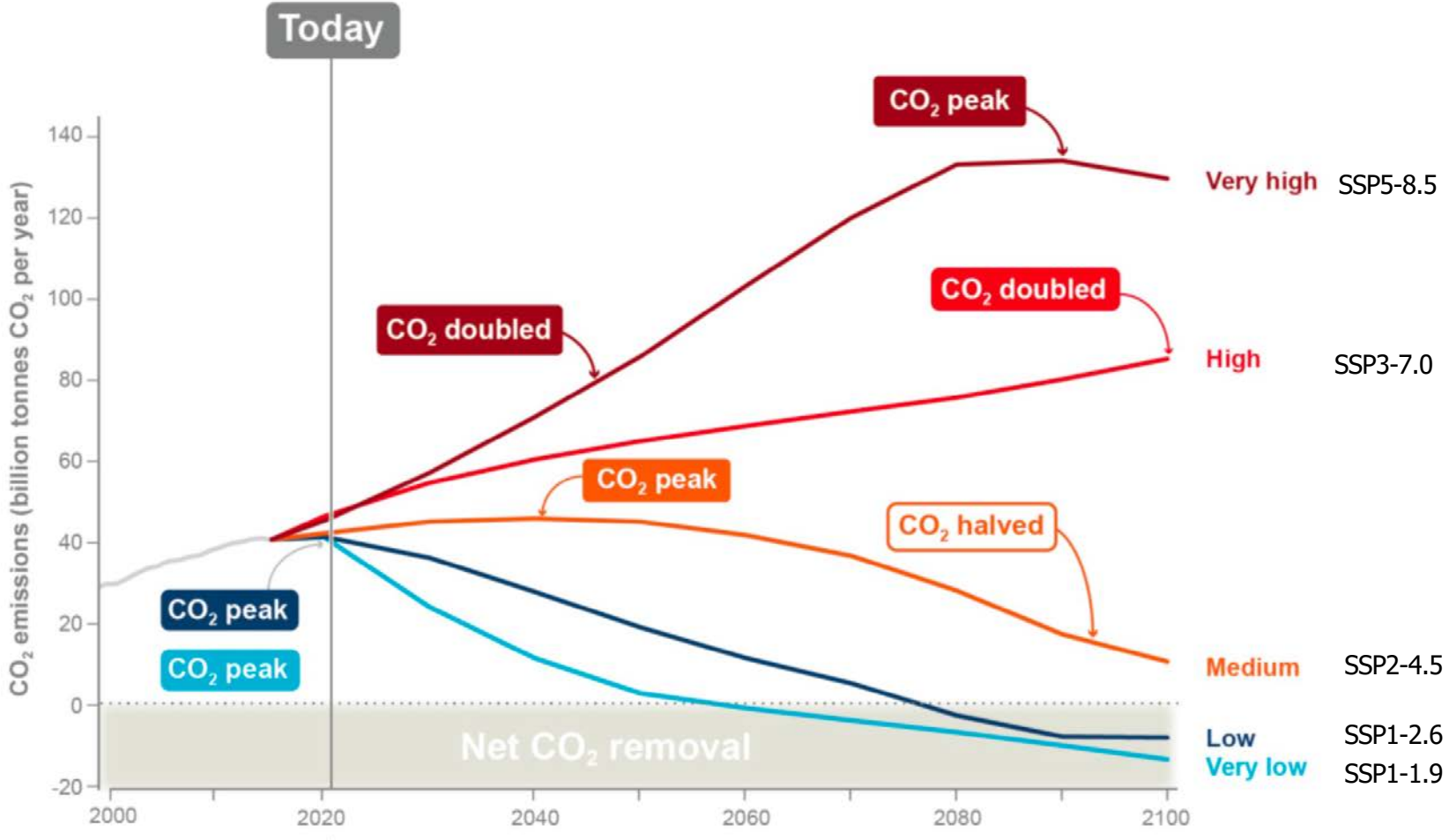
B.1 Global surface temperature will continue to increase until at least the mid-century under all emissions scenarios considered. Global warming of 1.5°C and 2°C will be exceeded during the 21st century unless deep reductions in carbon dioxide (CO_2) and other greenhouse gas emissions occur in the coming decades.

B.2 Many changes in the climate system become larger in direct relation to increasing global warming. They include increases in the frequency and intensity of hot extremes, marine heatwaves, and heavy precipitation, agricultural and ecological droughts in some regions, and proportion of intense tropical cyclones, as well as reductions in Arctic sea ice, snow cover and permafrost.

B.3 Continued global warming is projected to further intensify the global water cycle, including its variability, global monsoon precipitation and the severity of wet and dry events.

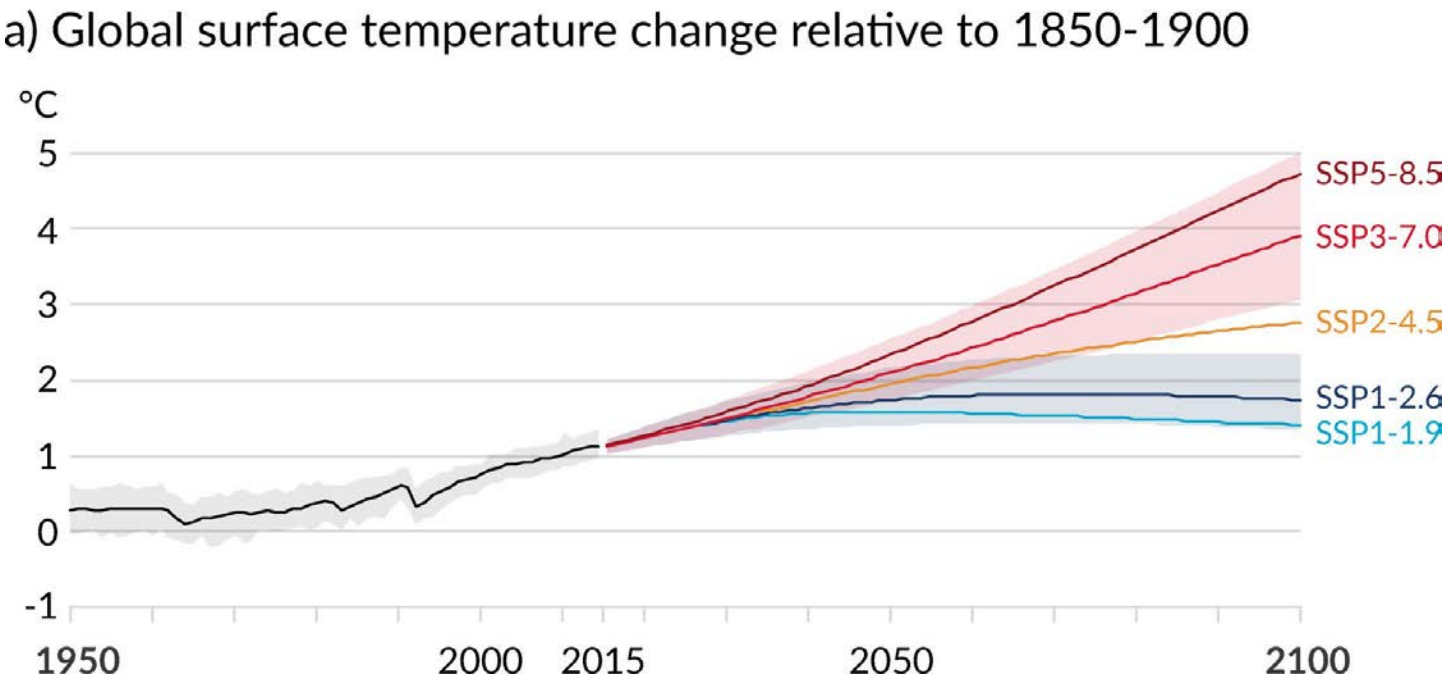
B.4 Under scenarios with increasing CO_2 emissions, the ocean and land carbon sinks are projected to be less effective at slowing the accumulation of CO_2 in the atmosphere.

B.5 Many changes due to past and future greenhouse gas emissions are irreversible for centuries to millennia, especially changes in the ocean, ice sheets and global sea level.


Today
CO_2 peak
CO_2 doubled
CO_2 doubled
CO_2 peak
CO_2 halved
CO_2 peak
CO_2 peak
Net CO_2 removal
CO_2 emissions (billion tonnes CO_2 per year)
140
120
100
80
60
40
20
0
-20
2000
2020
2040
2060
2080
2100
Very high
SSP5-8.5
High
SSP3-7.0
Medium
SSP2-4.5
Low
SSP1-2.6
Very low
SSP1-1.9

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

Figure SPM.8



Changes in global surface temperature for the five illustrative emissions scenarios considered

Table SPM.1

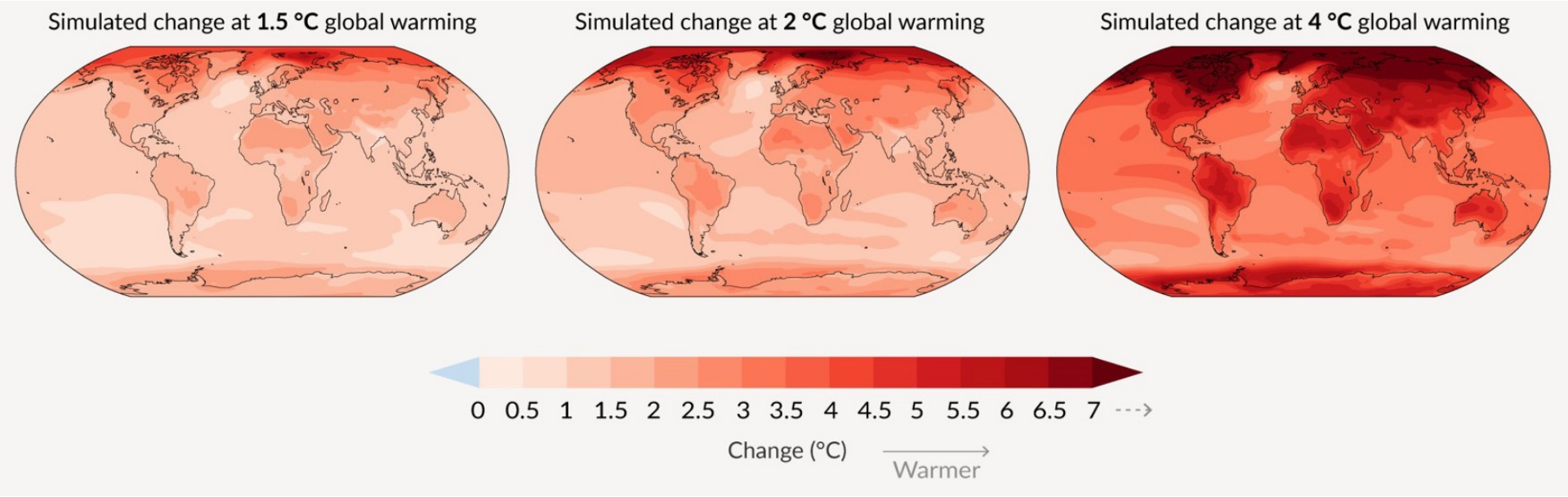
	Near term, 2021–2040		Mid-term, 2041–2060		Long term, 2081–2100	
Scenario	Best estimate (°C)	*Very likely* range (°C)	Best estimate (°C)	*Very likely* range (°C)	Best estimate (°C)	*Very likely* range (°C)
SSP1-1.9	1.5	1.2 to 1.7	1.6	1.2 to 2.0	1.4	1.0 to 1.8
SSP1-2.6	1.5	1.2 to 1.8	1.7	1.3 to 2.2	1.8	1.3 to 2.4
SSP2-4.5	1.5	1.2 to 1.8	2.0	1.6 to 2.5	2.7	2.1 to 3.5
SSP3-7.0	1.5	1.2 to 1.8	2.1	1.7 to 2.6	3.6	2.8 to 4.6
SSP5-8.5	1.6	1.3 to 1.9	2.4	1.9 to 3.0	4.4	3.3 to 5.7

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

+1.5° C

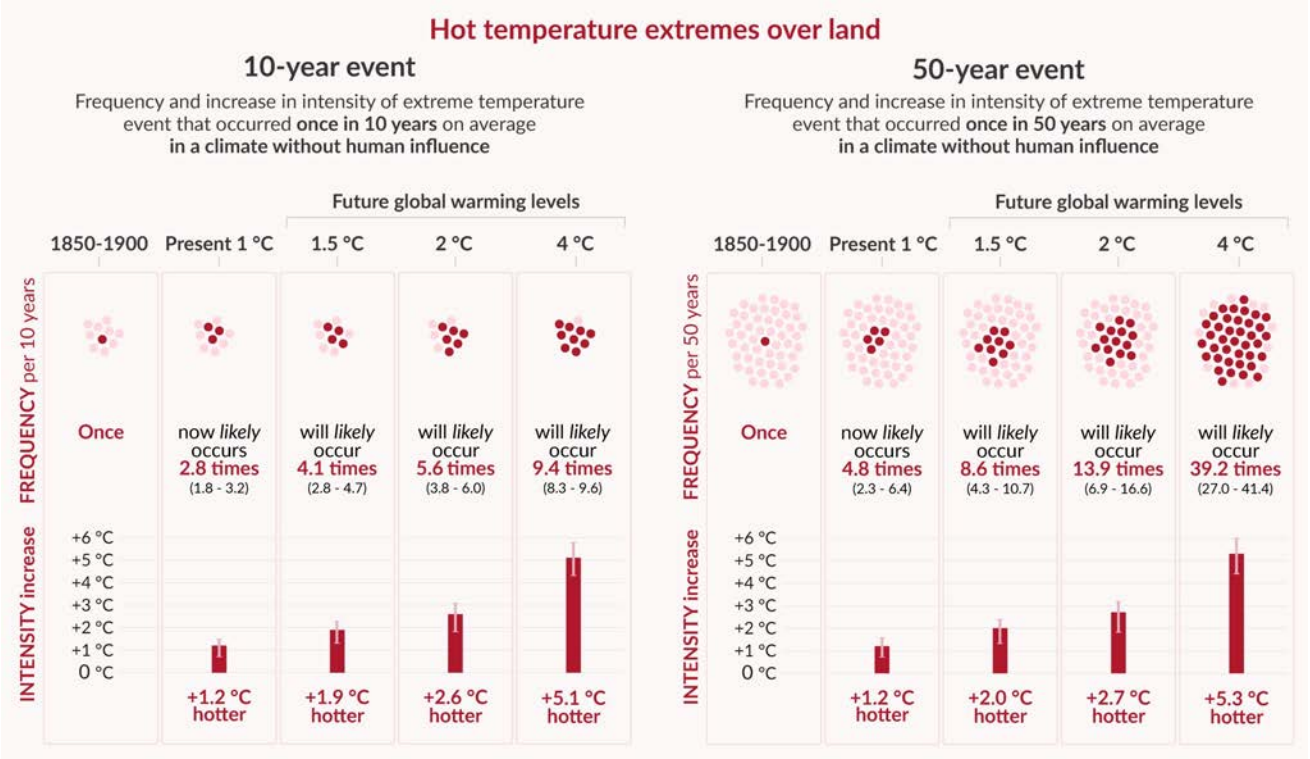
+2° C

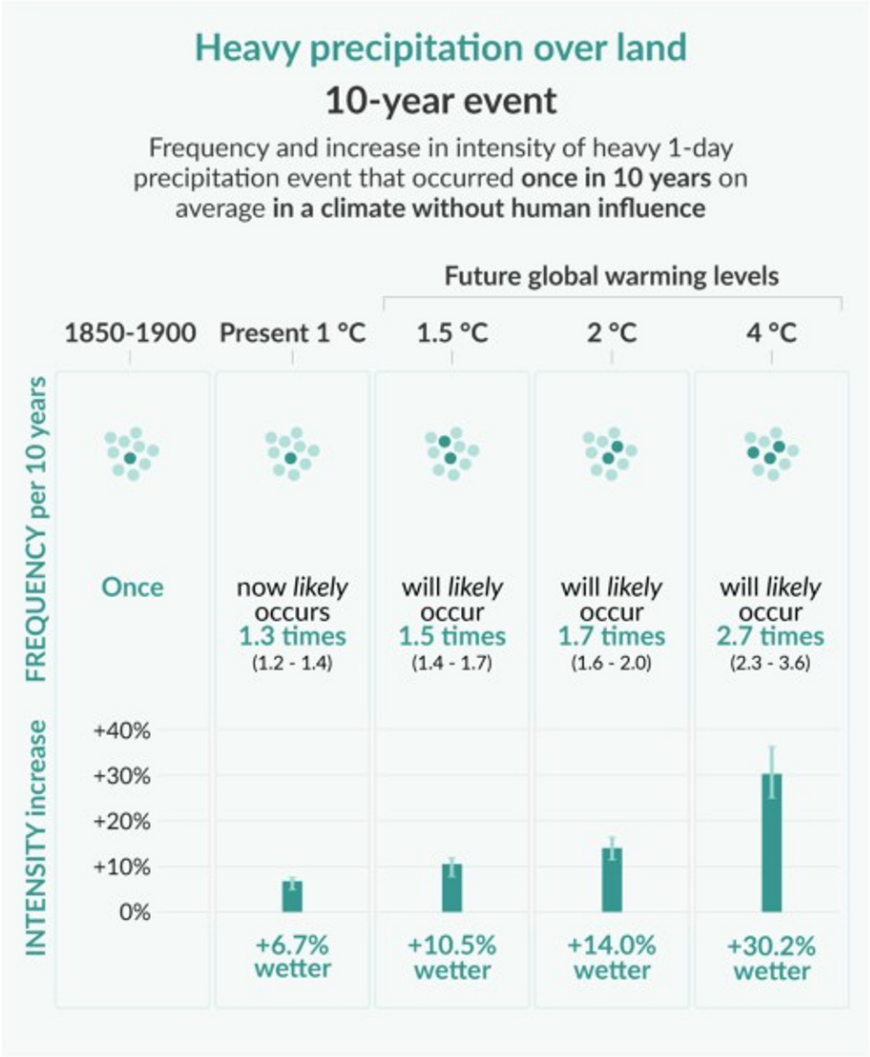
+4° C



Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming

Figure SPM.6

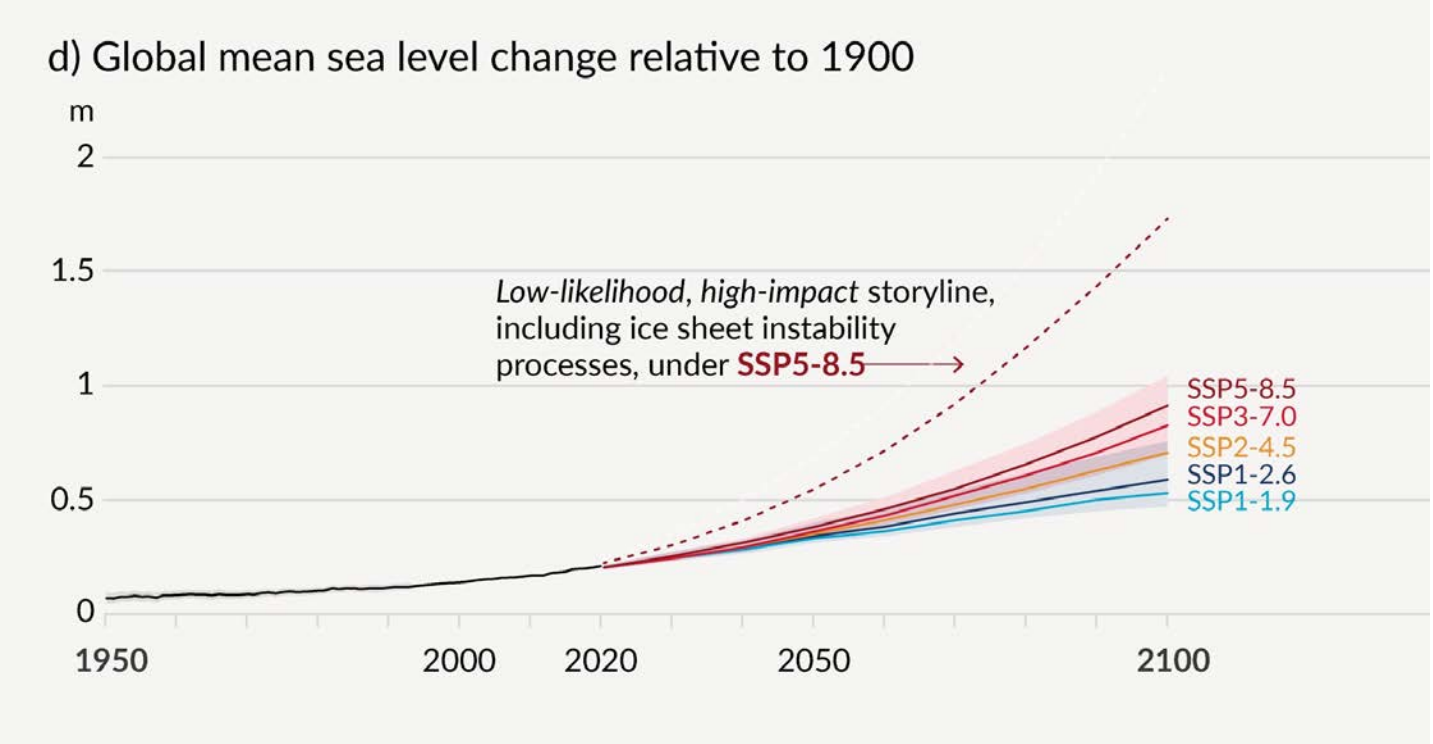




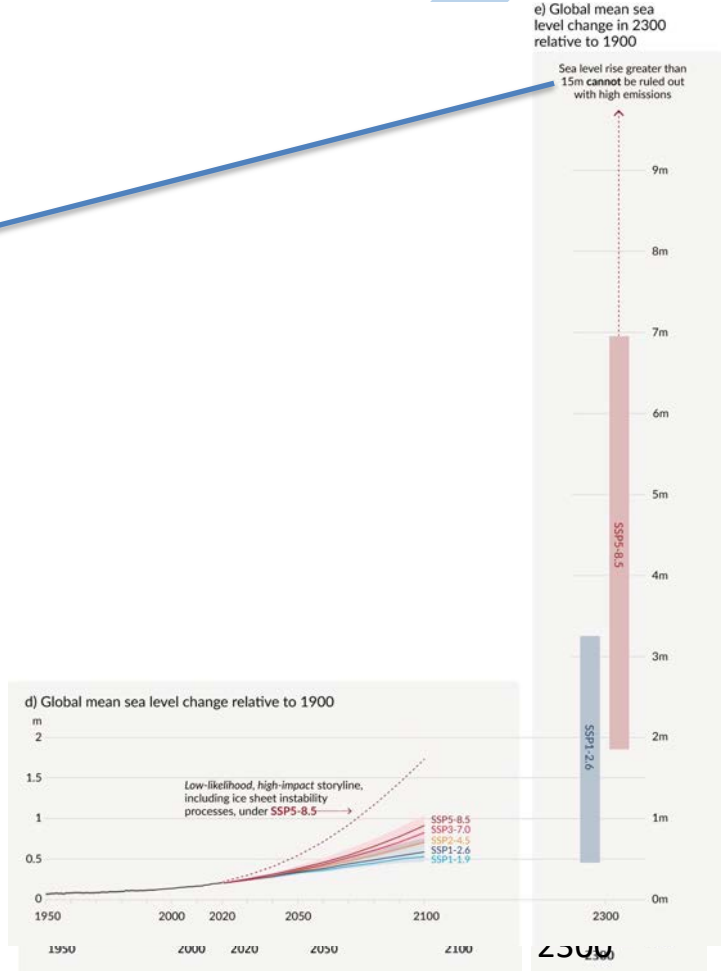
IPCC AR6 WGI SPM
Figure SPM.6

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

Figure SPM.8



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



7 m

2 m

Key messages from the latest WGI AR6 IPCC Report:

C. Climate Information for Risk Assessment and Regional Adaptation

C.1 Natural drivers and internal variability will modulate human-caused changes, especially at regional scales and in the near term, with little effect on centennial global warming. These modulations are important to consider in planning for the full range of possible changes.

C.2 With further global warming, every region is projected to increasingly experience concurrent and multiple changes in climatic impact-drivers. Changes in several climatic impact-drivers would be more widespread at 2°C compared to 1.5°C global warming and even more widespread and/or pronounced for higher warming levels.

C.3 Low-likelihood outcomes, such as ice sheet collapse, abrupt ocean circulation changes, some compound extreme events and warming substantially larger than the assessed *very likely* range of future warming cannot be ruled out and are part of risk assessment.

Key messages from the latest WGI AR6 IPCC Report:

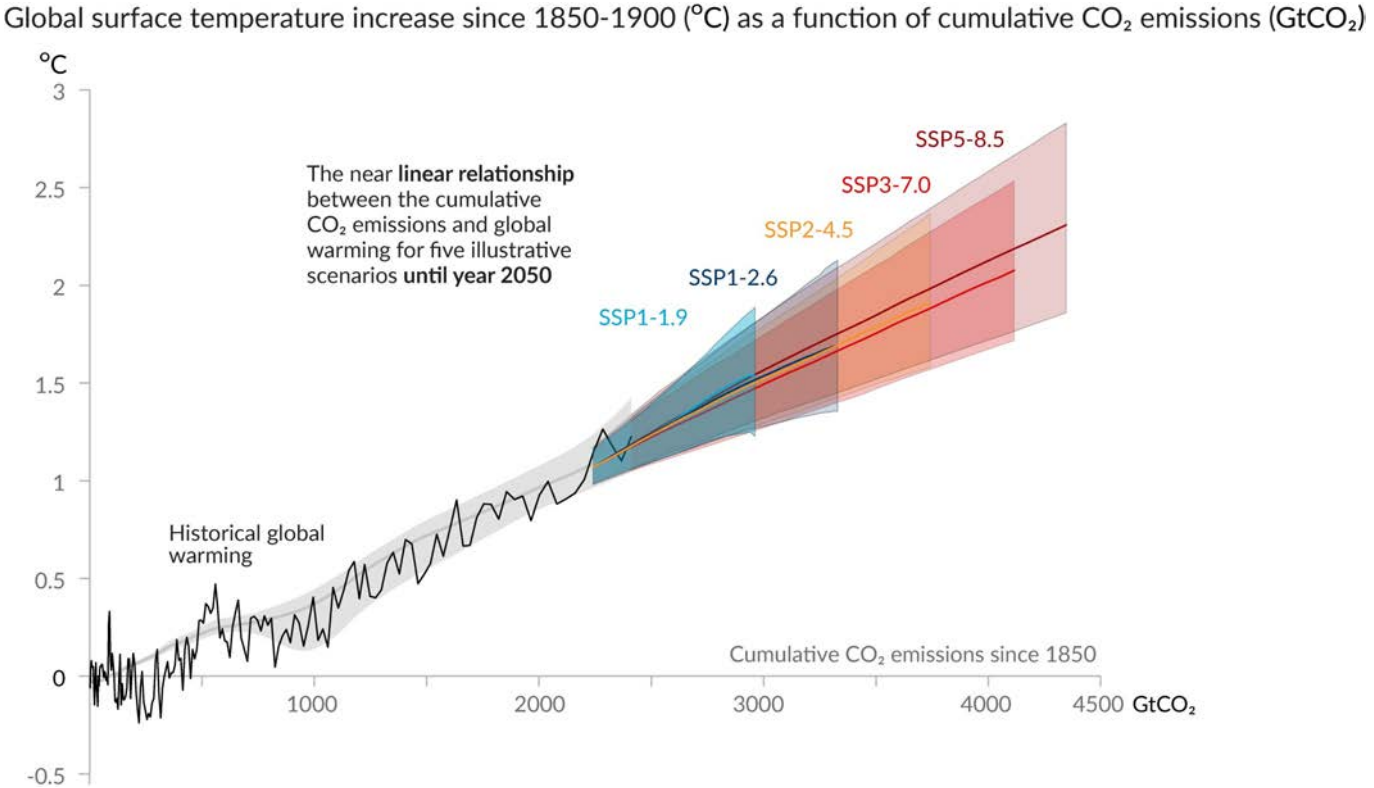
D. Limiting Future Climate Change

D.1 From a physical science perspective, limiting human-induced global warming to a specific level requires limiting cumulative CO_2 emissions, reaching at least net zero CO_2 emissions, along with strong reductions in other greenhouse gas emissions. Strong, rapid and sustained reductions in CH_4 emissions would also limit the warming effect resulting from declining aerosol pollution and would improve air quality.

D.2 Scenarios with low or very low greenhouse gas (GHG) emissions (SSP1-1.9 and SSP1-2.6) lead within years to discernible effects on greenhouse gas and aerosol concentrations, and air quality, relative to high and very high GHG emissions scenarios (SSP3-7.0 or SSP5-8.5). Under these contrasting scenarios, discernible differences in trends of global surface temperature would begin to emerge from natural variability within around 20 years, and over longer time periods for many other climatic impact-drivers (*high confidence*).

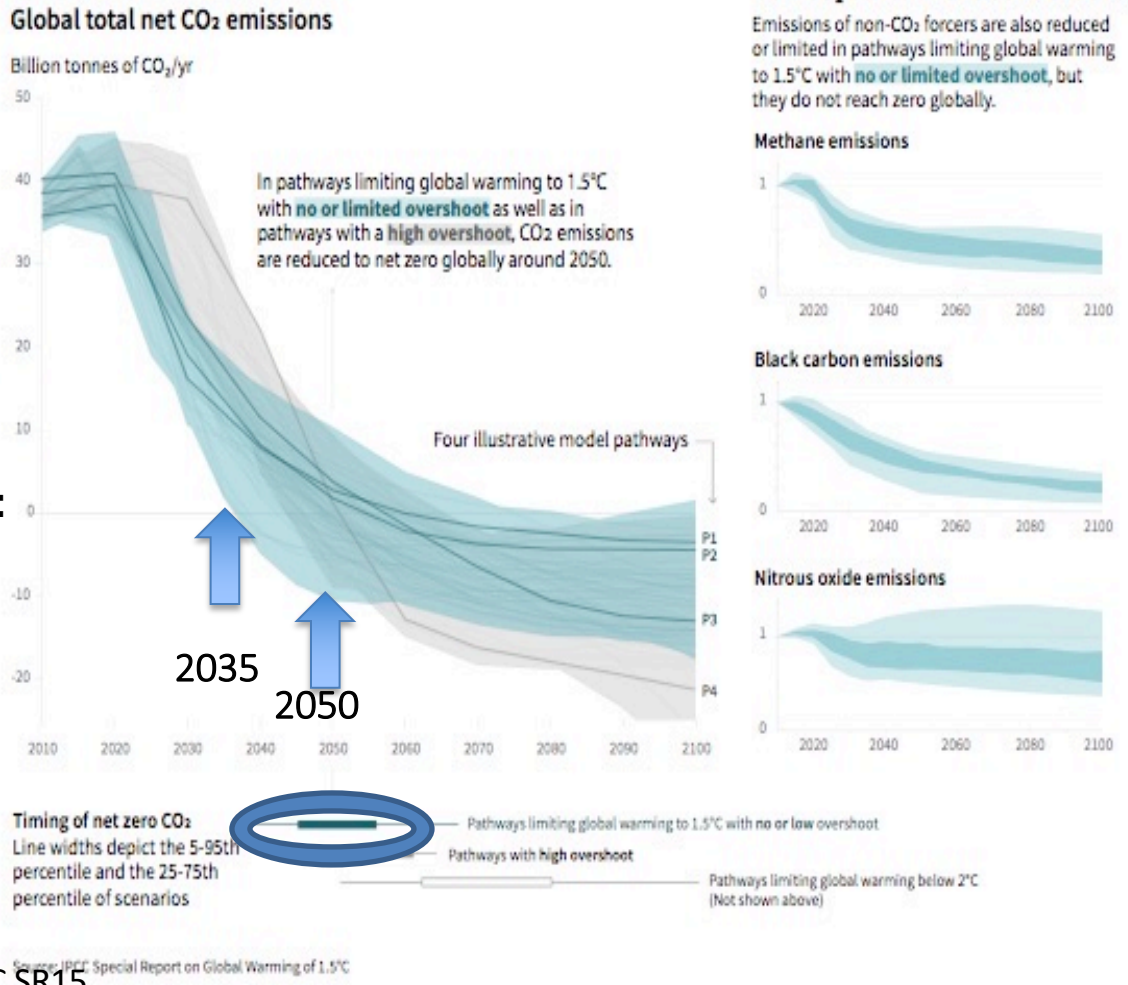
Every tonne of CO_2 emissions adds to global warming

Figure SPM.10

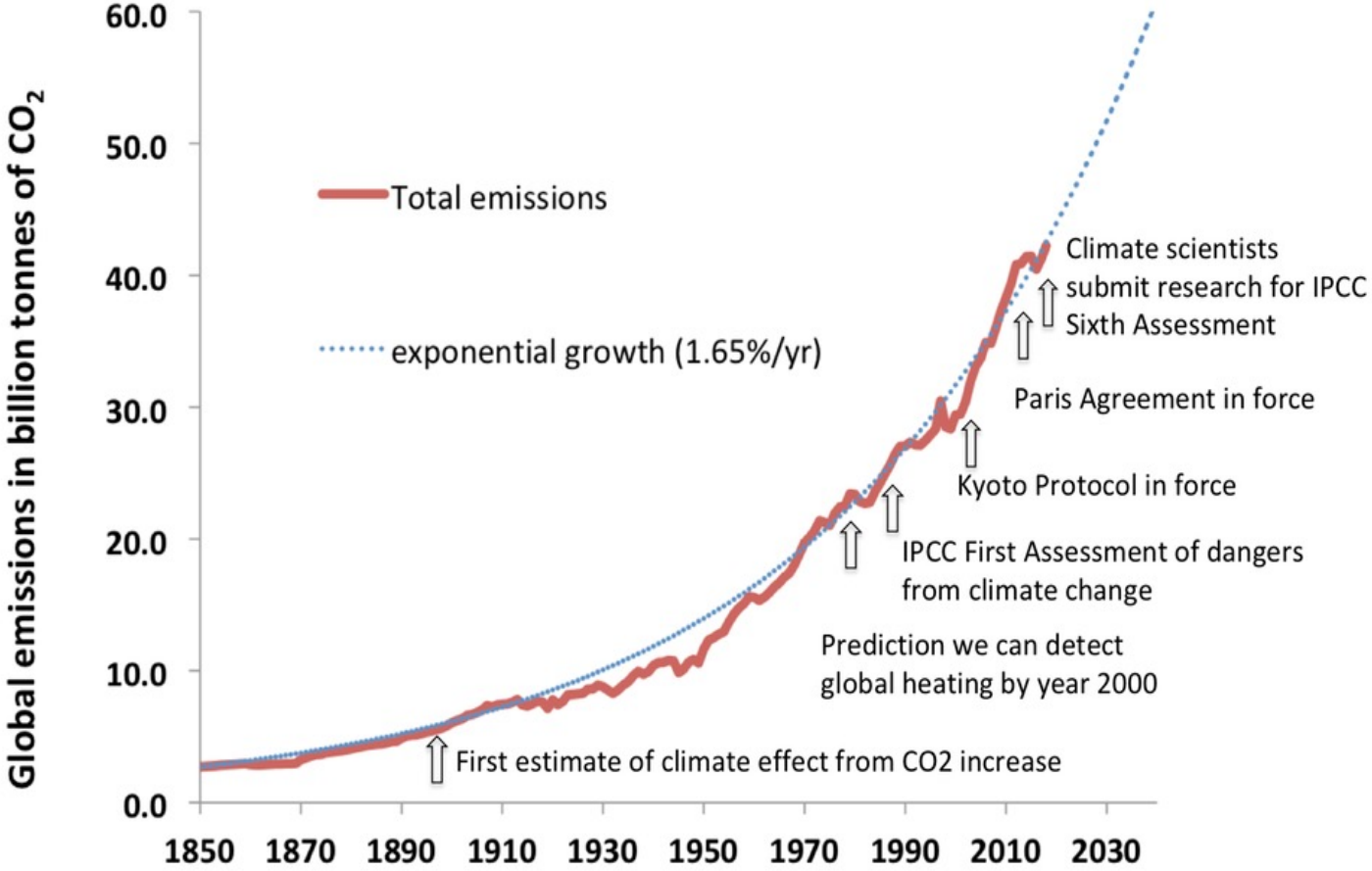


Emission pathways compatible with below 1.5° C warming:

Net ZERO:

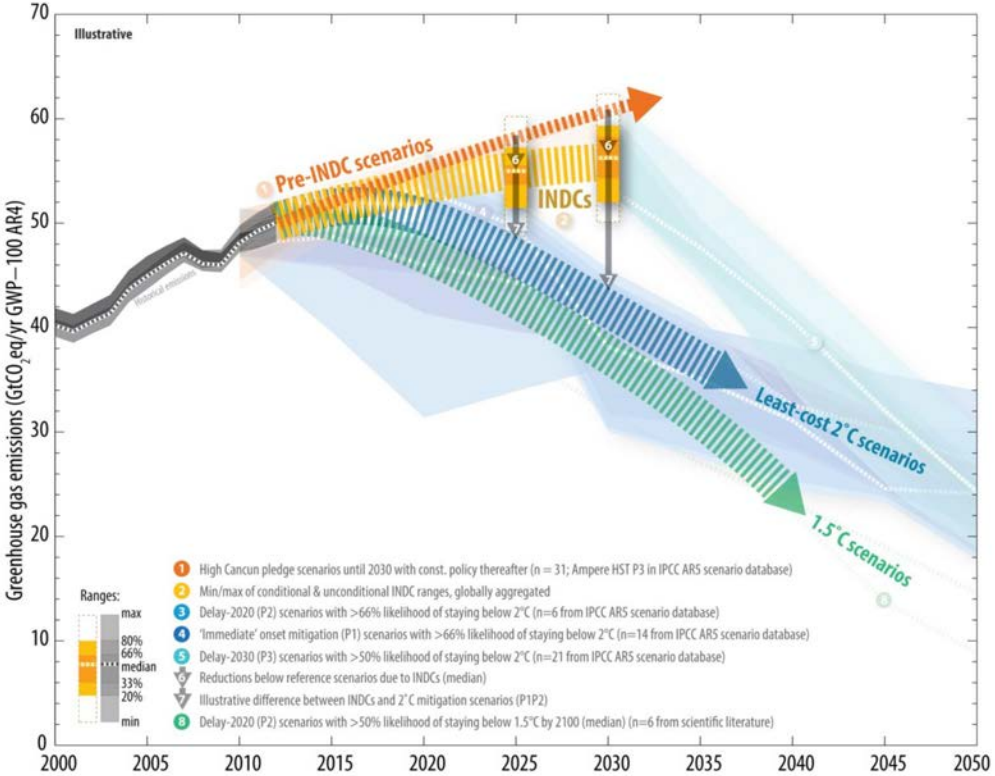


Source: IPCC SR15



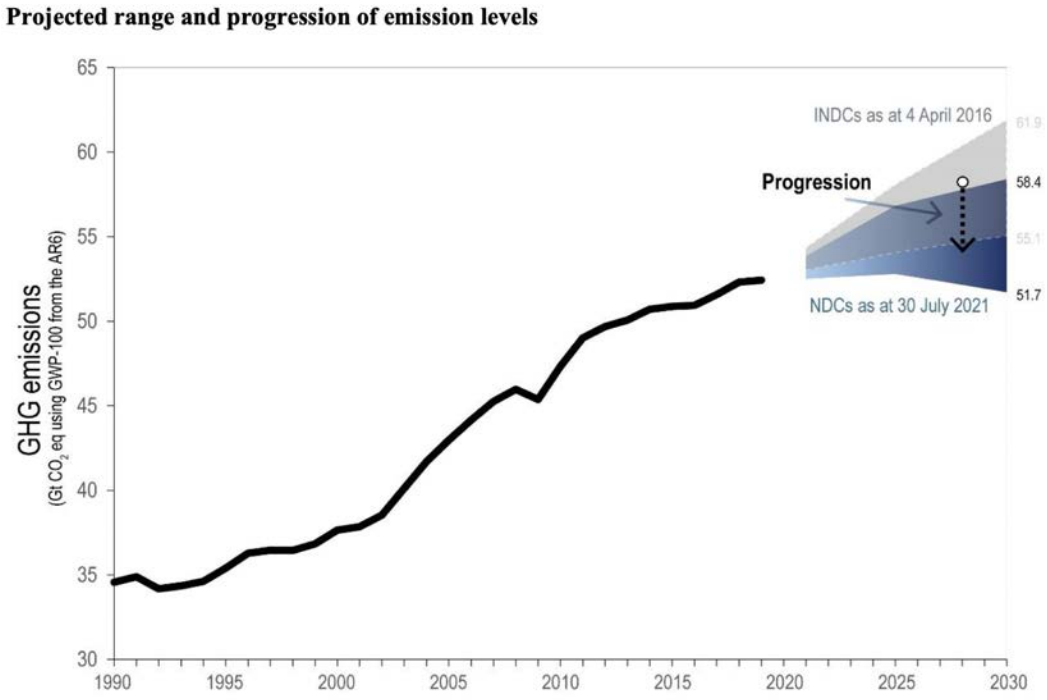
Source: Wolfgang Knorr, in The Conversation (2019)

2016 Comparison of global emission levels in 2025 and 2030 resulting from the implementation of the intended nationally determined contributions



UNFCCC, Aggregate effect of the intended nationally determined contributions: an update
http://unfccc.int/resource/docs/2016/cop22/eng/02.pdf

Update (July 2021) :Comparison of global emission levels in 2025 and 2030 resulting from the implementation of the nationally determined contributions (NDCs)



UNFCCC, Aggregate effect of the nationally determined contributions: an update (2021)
https://unfccc.int/sites/default/files/resource/cma2021_08_adv_1.pdf

RCP2.6 RCP8.5

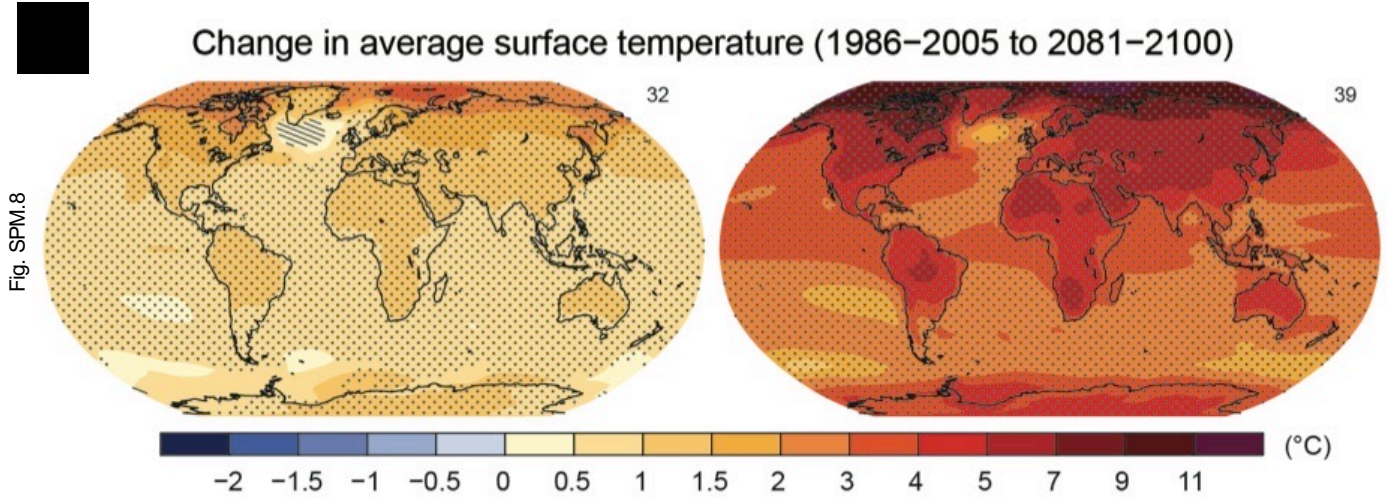


Fig. SPM.8

Humanity has the choice

SUSTAINABLE DEVELOPMENT GOALS

Ecrit pour les jeunes (et moins jeunes), avec des liens vers des ressources utiles

Disponible gratuitement, 6X/an: www.plateforme-wallonne-giec.be

Plateforme wallonne pour le GIEC
Lettre n°21 - Édition spéciale - Août 2021

6e rapport d'évaluation du GIEC

Changements climatiques 2021 : Les éléments scientifiques

[Aspects physiques du climat : en anglais *The Physical Science Basis*]

Aperçu du Résumé pour les décideurs

Après les terribles inondations qui ont frappé la Wallonie et l'Allemagne, et alors que des incendies détruisent des milliers d'hectares de forêt dans le Sud de l'Europe, en Sibérie et en Amérique du Nord, il nous a semblé utile de publier cette édition spéciale dès la parution du nouveau rapport du GIEC. Elle donne un aperçu du Résumé pour les décideurs du rapport, sous la forme de ses 14 messages clés. Cet automne, une Lettre plus substantielle sera consacrée à ce nouveau rapport de près de 4000 pages, mais vous disposez ainsi déjà de l'essentiel, en français (la traduction officielle paraîtra dans plusieurs mois).

Le texte intégral est bien entendu disponible sur le site du GIEC : ipcc.ch/ar6. Vous pourrez aussi y expérimenter un des éléments les plus novateurs de ce rapport: l'Atlas interactif, qui permet d'obtenir pour chaque région du monde des informations sur l'évolution de nombreux paramètres climatiques au cours du 21e siècle, et ce pour différents scénarios d'émission de gaz à effet de serre.

Les autres parties du 6e rapport d'évaluation seront toutes publiées en 2022. En février, le GIEC adoptera la deuxième partie du rapport, qui sera consacrée aux impacts des changements climatiques, à la vulnérabilité et aux mesures d'adaptation. En mars, ce sera la troisième, consacrée aux mesures d'atténuation (réductions d'émissions de gaz à effet de serre). Le rapport de synthèse, transversal, sera publié en septembre[*].

Bonne lecture !

Jean-Pascal van Ypersele, Philippe Marbaix, Pénélope Lamarque et Elisabeth Rondiat.

[*] La 17e Lettre donne un aperçu de l'ensemble du rapport, et le plan du rapport de synthèse est disponible sur plateforme-wallonne-giec.be.

> Le rapport et son approbation

Le 6 août 2021, l'assemblée Plénière du GIEC a adopté la première partie du 6e rapport d'évaluation du GIEC (RE6). Cette partie du rapport concerne principalement l'observation du climat, la compréhension des processus qui influencent le climat, l'évaluation des modèles, et les projections pour le futur.

Les délégués des 195 États membres du GIEC ont également approuvé le Résumé pour les décideurs de ce rapport, après l'avoir discuté phrase par phrase pendant une réunion qui s'est tenue du 26 juillet au 6 août. La délégation belge était placée sous la responsabilité du Pr Jean-Pascal van Ypersele. Ce processus permet aux représentants des gouvernements de demander de reformuler des phrases pour les rendre plus claires et pertinentes selon leurs critères, mais une phrase n'est approuvée que moyennant la confirmation de sa validité scientifique par les auteurs du rapport. Les chapitres du rapport détaillé sont entièrement sous la responsabilité des auteurs scientifiques, supervisés par les co-présidents et vice-présidents du groupe de travail concerné (ici le GT1) et du GIEC.

Trois scientifiques de nationalité belge ont participé à la rédaction de ce rapport du GIEC en tant qu'auteurs principaux d'un chapitre : le Dr Rafiq Hamdi (IRM), le Pr Philippe Huybrechts (VUB), et le Dr. Joeri Rogelj (Imperial College London).

PwG
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Wallonie environnement Awac

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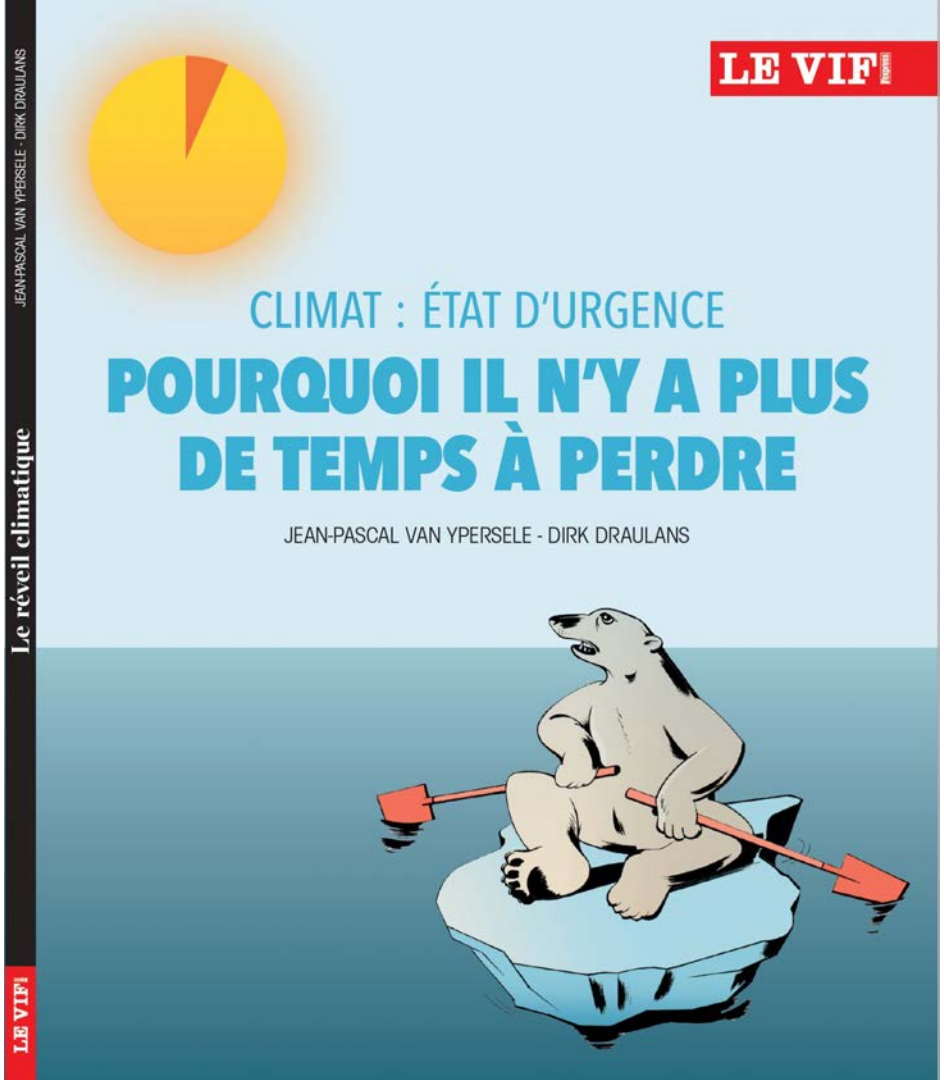
Gratuit sur
www.levif.be/reveil-climatique



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, Newsletter, latest on climate, basic climate science
- **Twitter: @JPvanYpersele & @IPCC_CH**

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