Climate change and land:
Some challenges and opportunities

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Former IPCC Vice-Chair (2008 - 2015)

Twitter: @JPvanYpersele

BELFertil 50th anniversary, Antwerp,
13 October 2021

Thanks to the Walloon Government (funding the Walloon Platform for IPCC), and to my team at the Université catholique de Louvain for their support

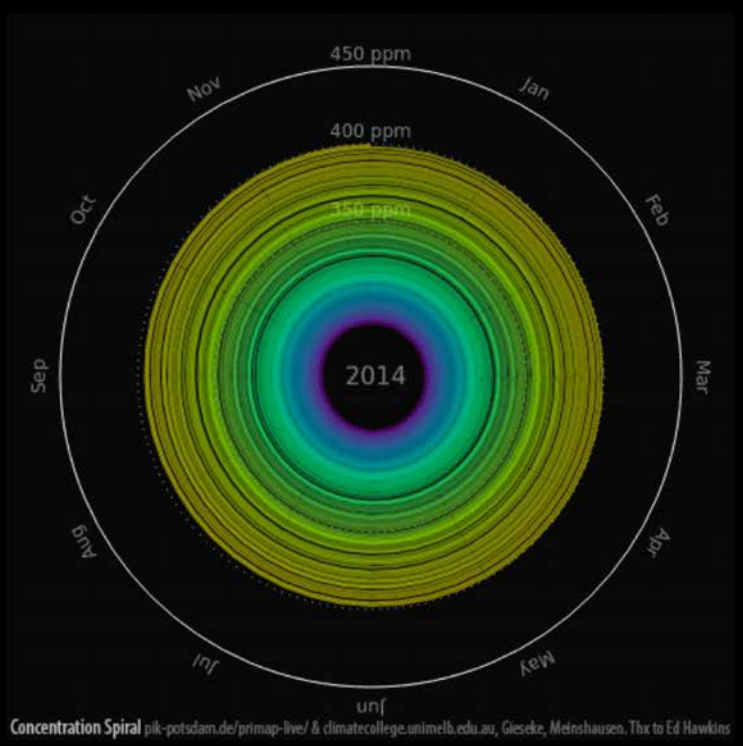
Source: @JohnfoCook

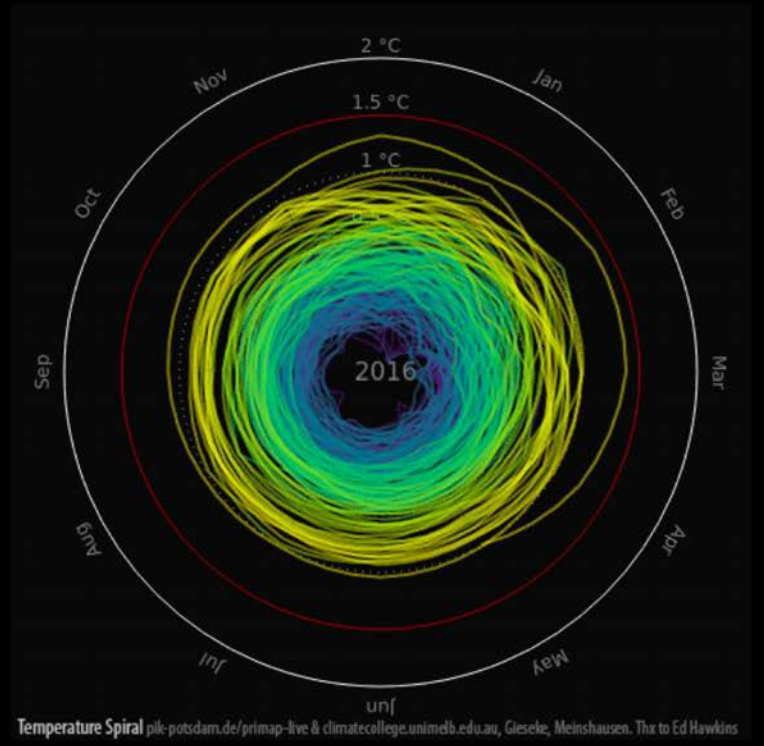
Fact: Because we use the atmosphere as a free dustbin for our greenhouse gases, we thicken the thermal insulation layer around the planet

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

@JPvanYpersele

CO_2 Concentration and Temperature spirals

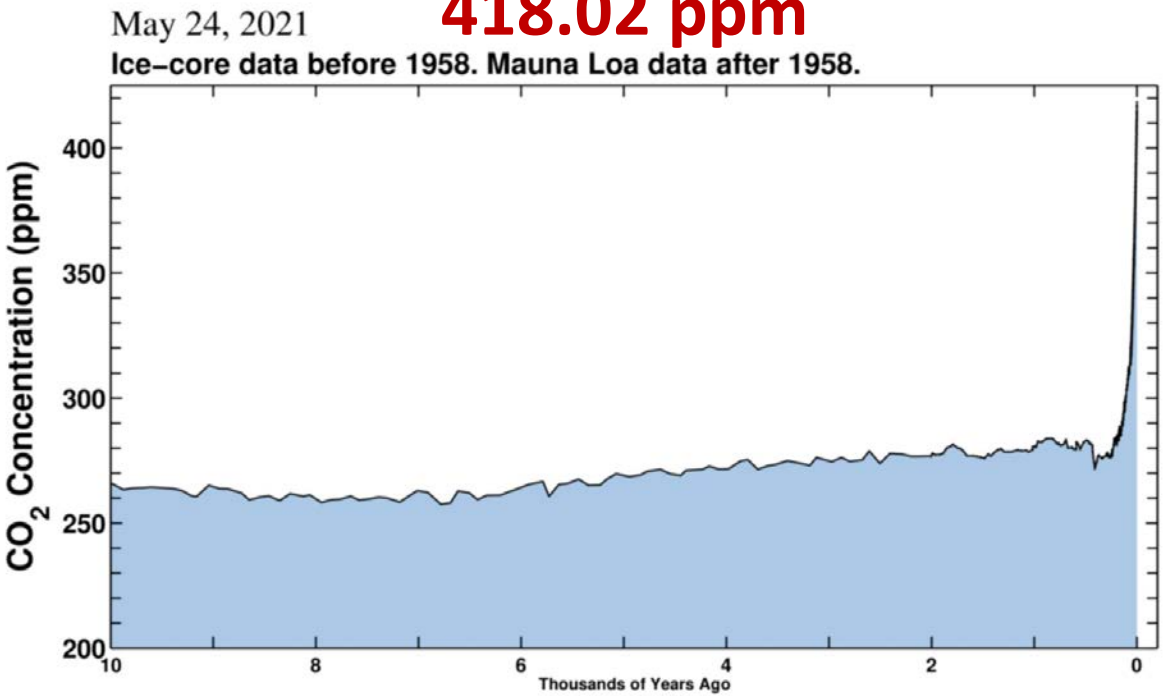




CO_2 Concentration since 1850 and Global Mean Temperature in °C relative to 1850 – 1900
Graph: Ed Hawkins (Climate Lab Book) – Data: HadCRUT4 global temperature dataset
Animation available on http://openclimatedata.net/climate-spirals/concentration-temperature/

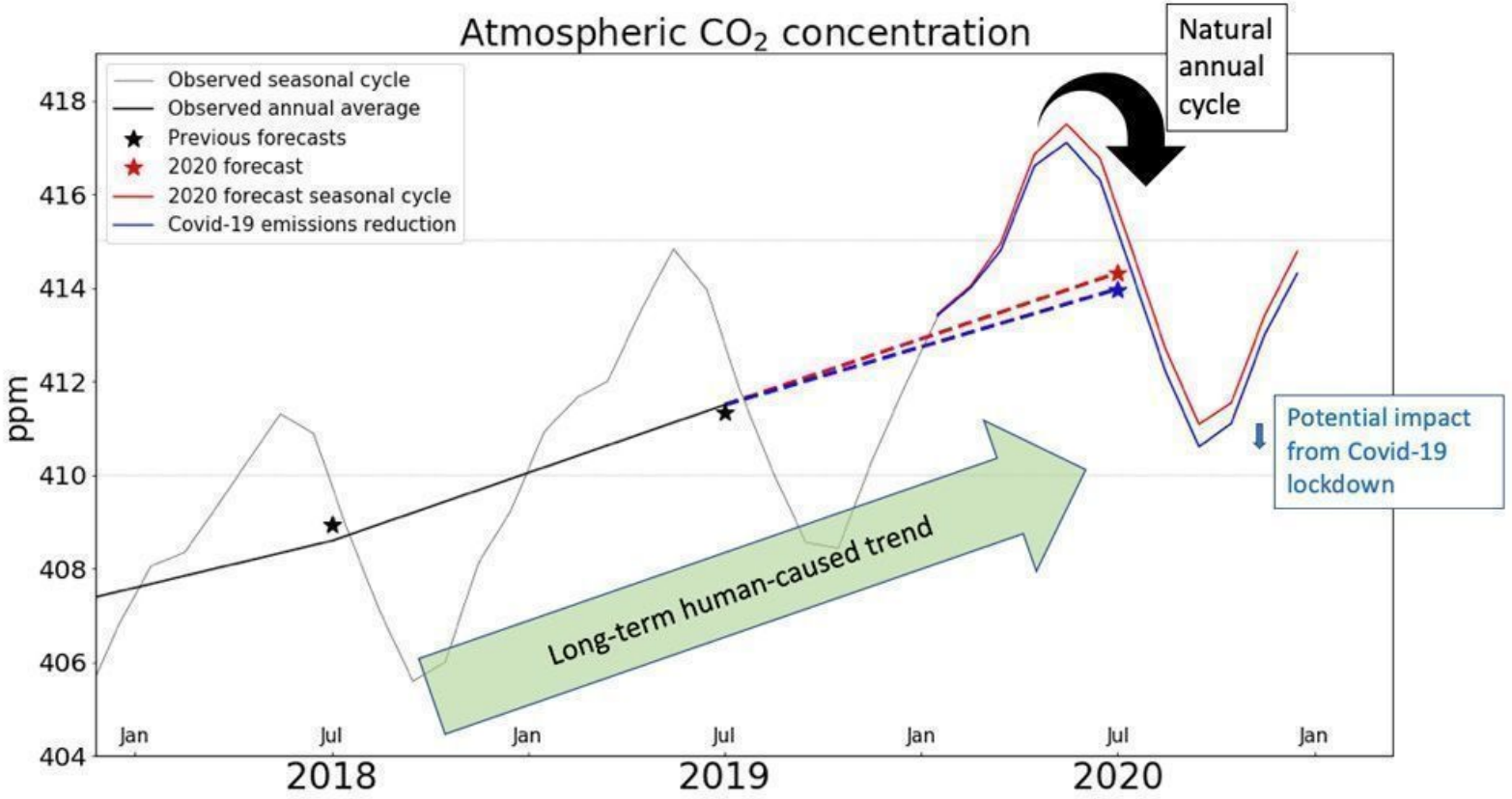
CO_2 Concentration 24 May 2021 (Keeling curve + last 10000 years)

418.02 ppm

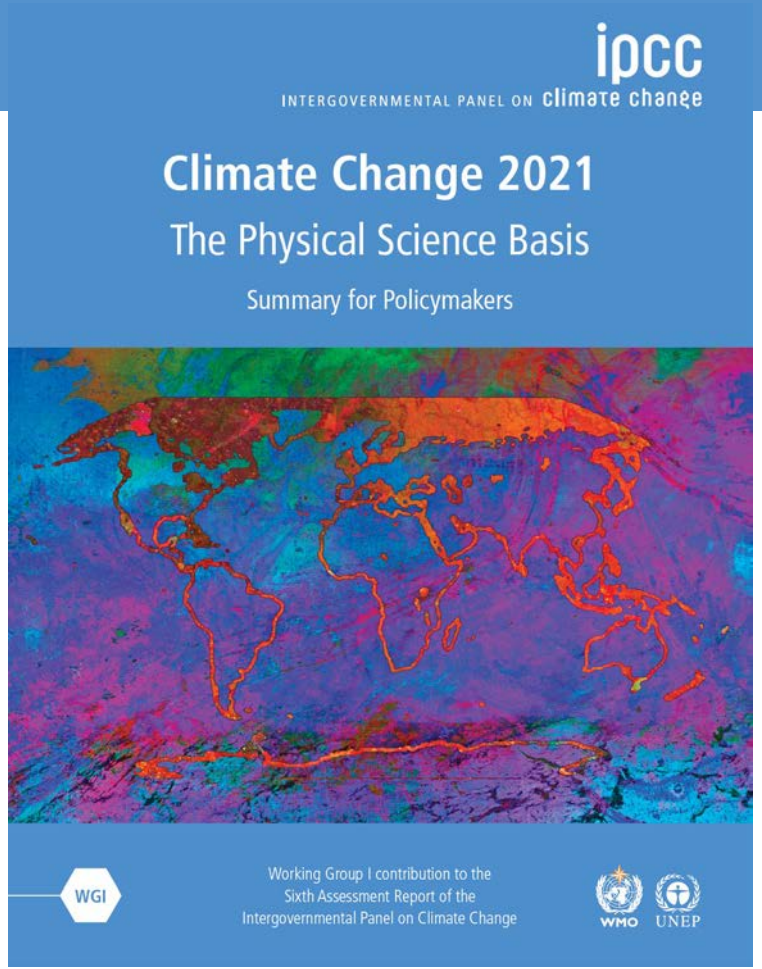


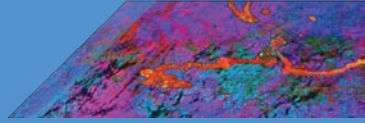
Source: scripps.ucsd.edu/programs/keelingcurve/

« Covid19 »: a very small effect on CO_2 concentration



Source: @CarbonBrief, mai 2020 @JPvanYpersele


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

Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

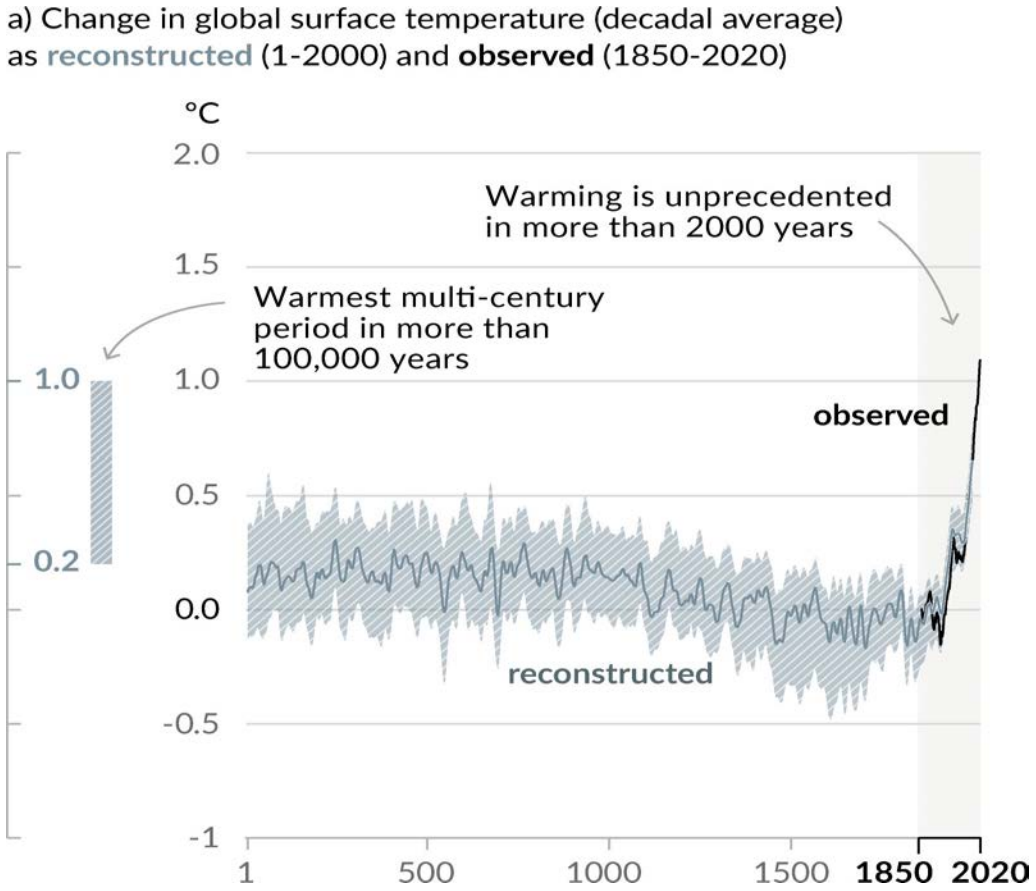


Figure SPM.1

Progression of Understanding: Greater and Greater Certainty in Attribution

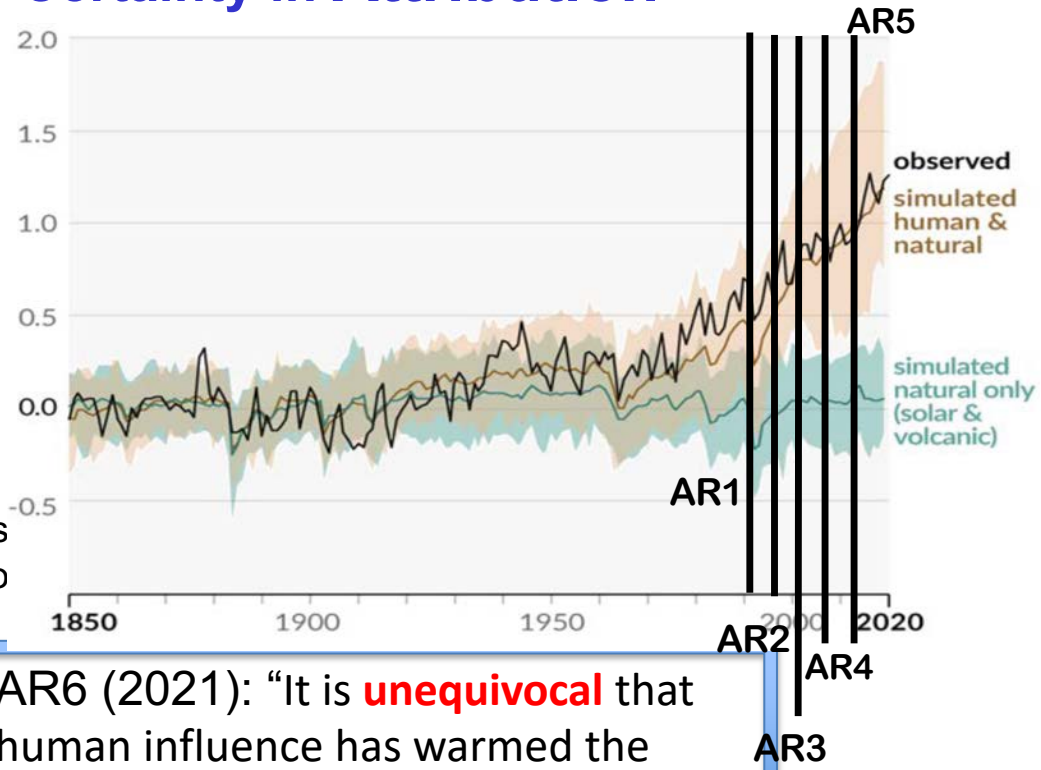
AR1 (1990): “unequivocal detection not likely for a decade”

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

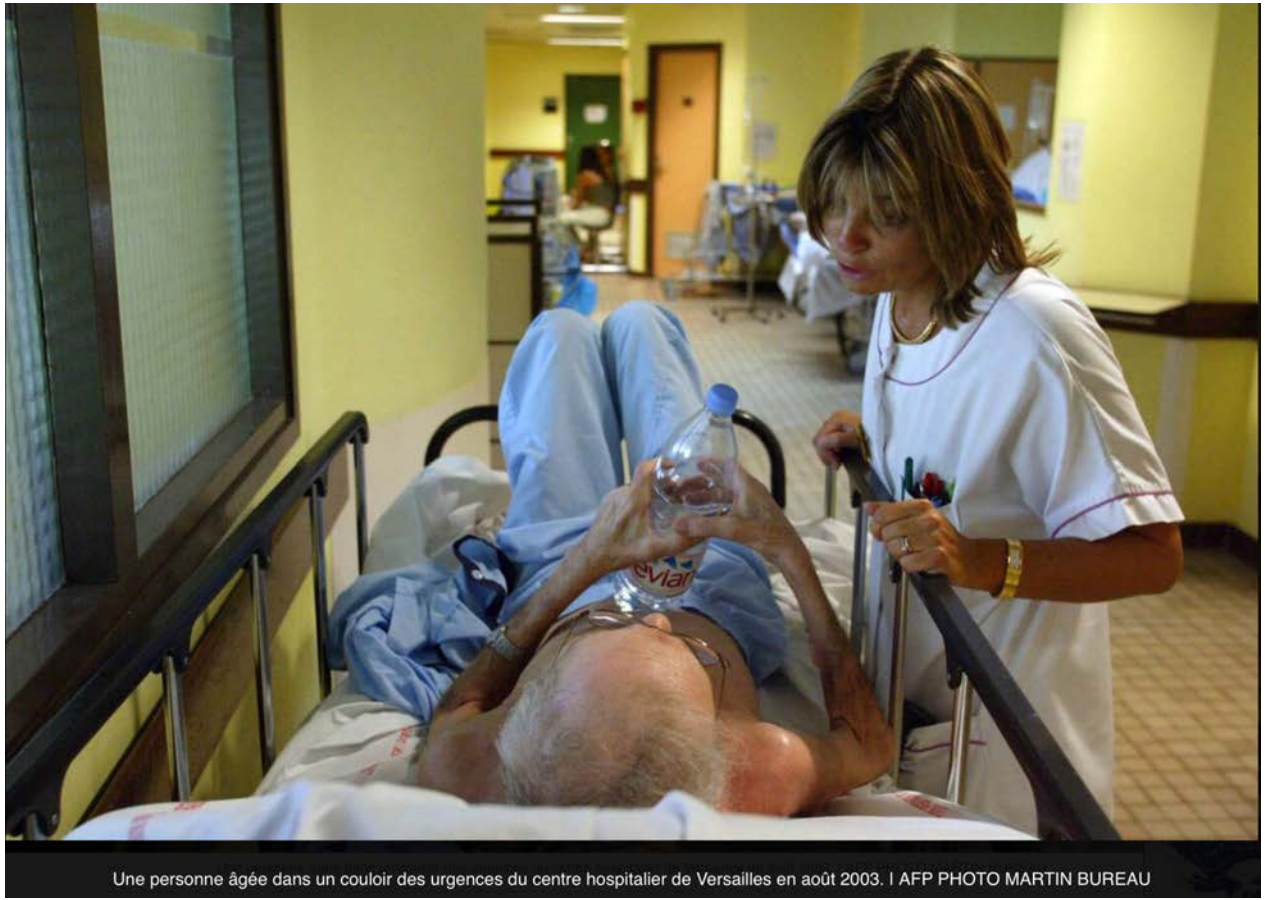
Warming

Acidifying

Losing oxygen

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

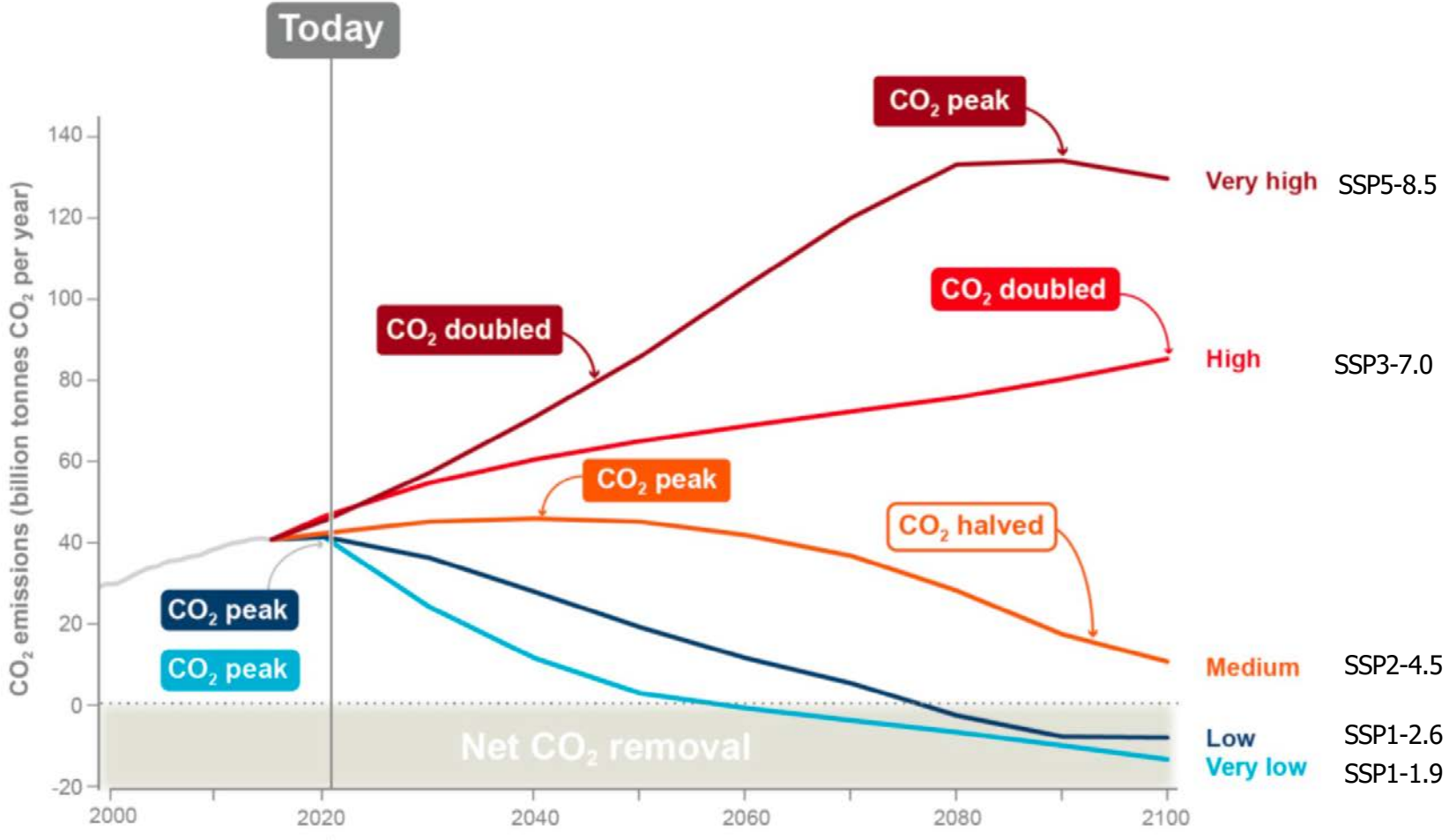
Heat waves kill (Ex: 2003 summer in EU: 70000 deaths)



Une personne âgée dans un couloir des urgences du centre hospitalier de Versailles en août 2003. I AFP PHOTO MARTIN BUREAU

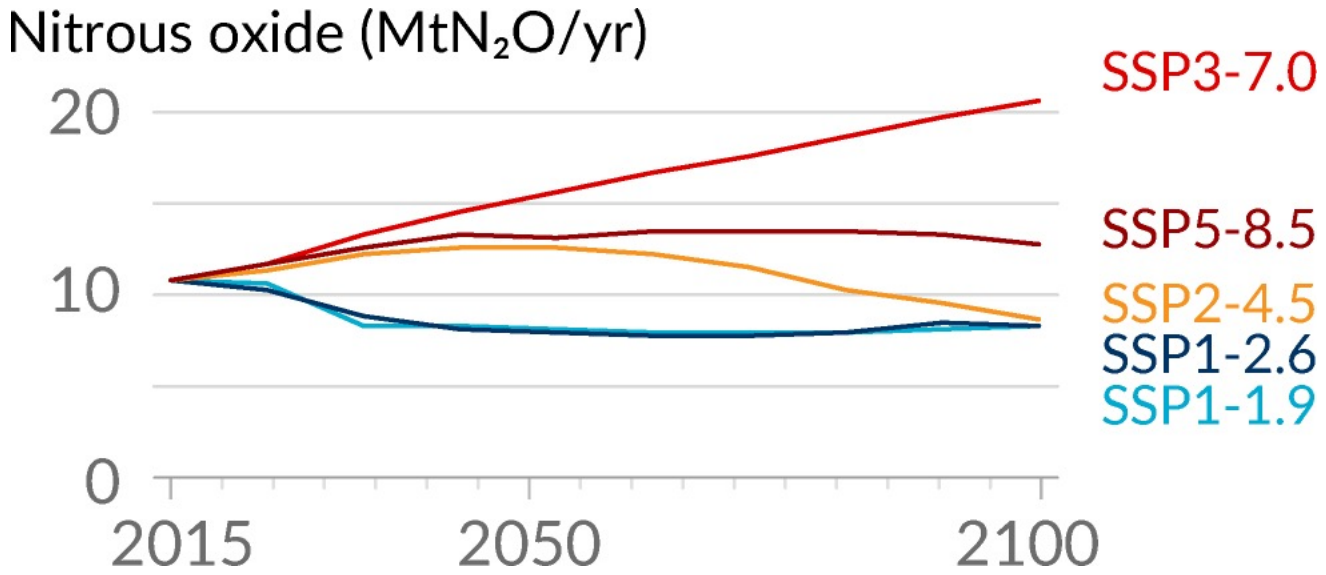
Wallonia Floods, July 2021

Source:
VRT Nieuws


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

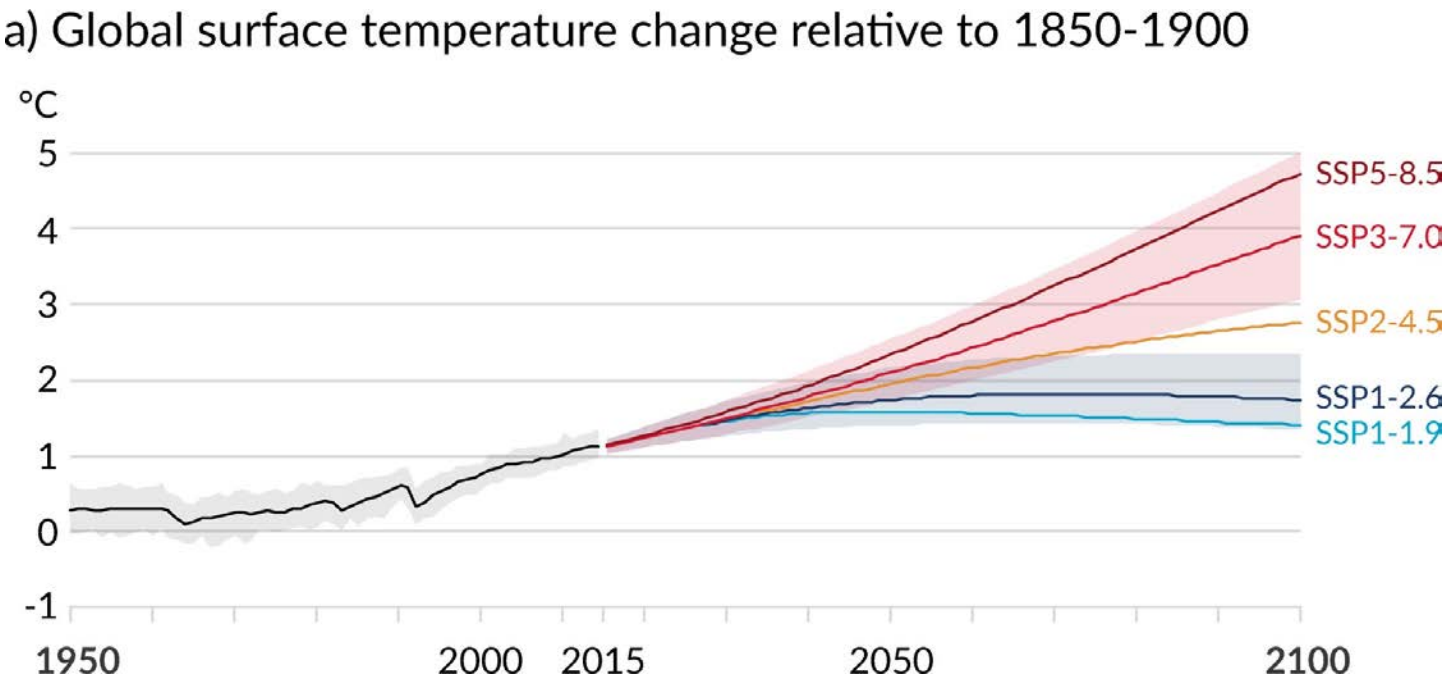
Future emissions cause future additional warming, with total warming dominated by past and future CO_2 emissions

Figure SPM.4



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

Figure SPM.8

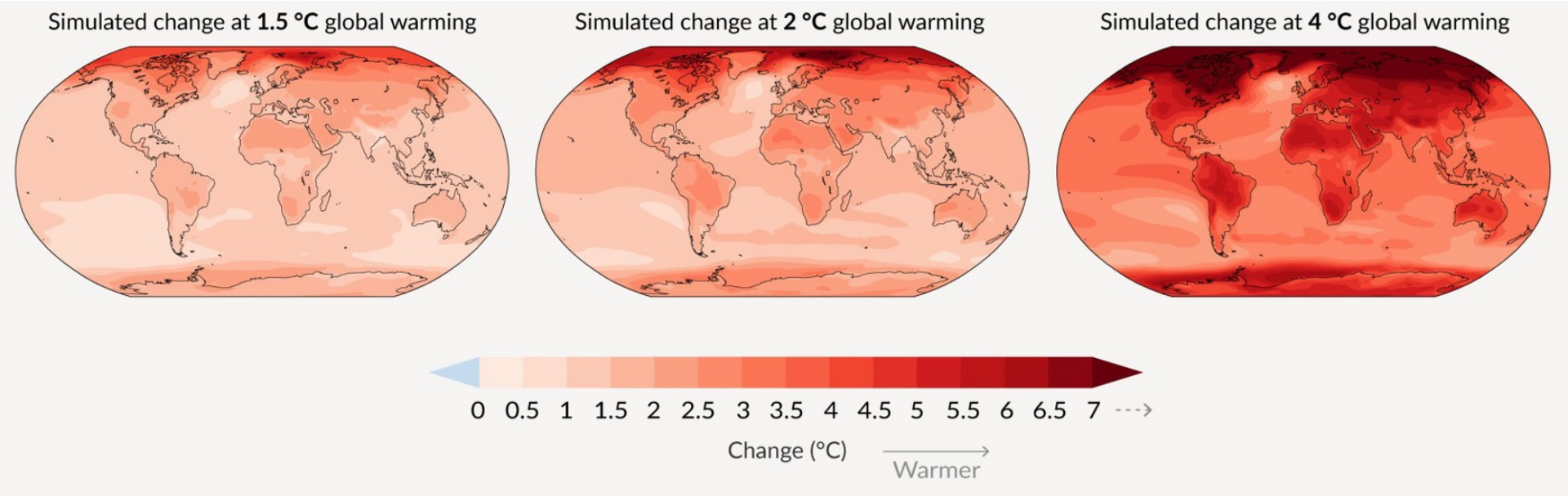


Across warming levels, land areas warm more than oceans, and the Arctic and Antarctica warm more than the tropics

+1.5° C

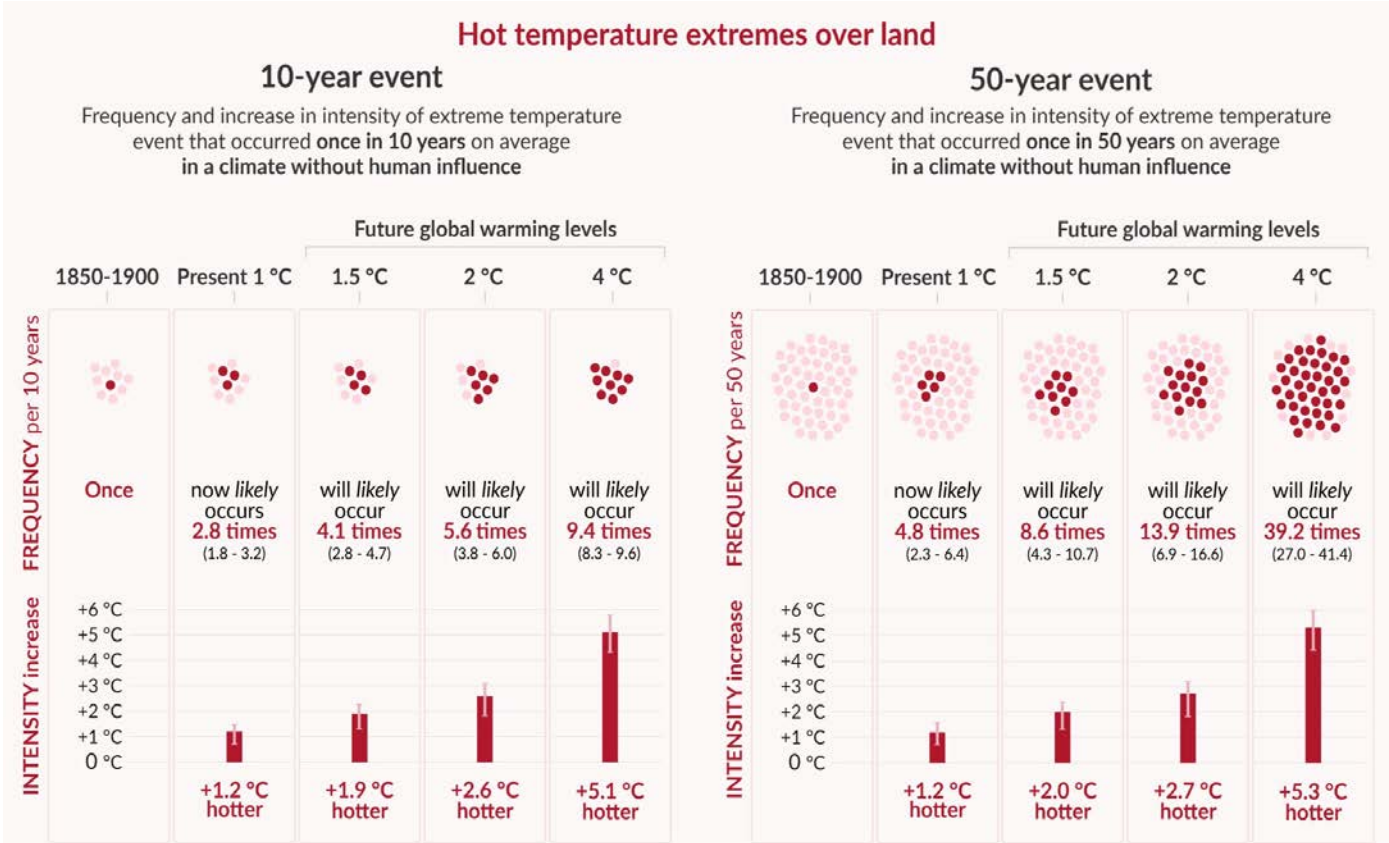
+2° C

+4° C



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

Figure SPM.6

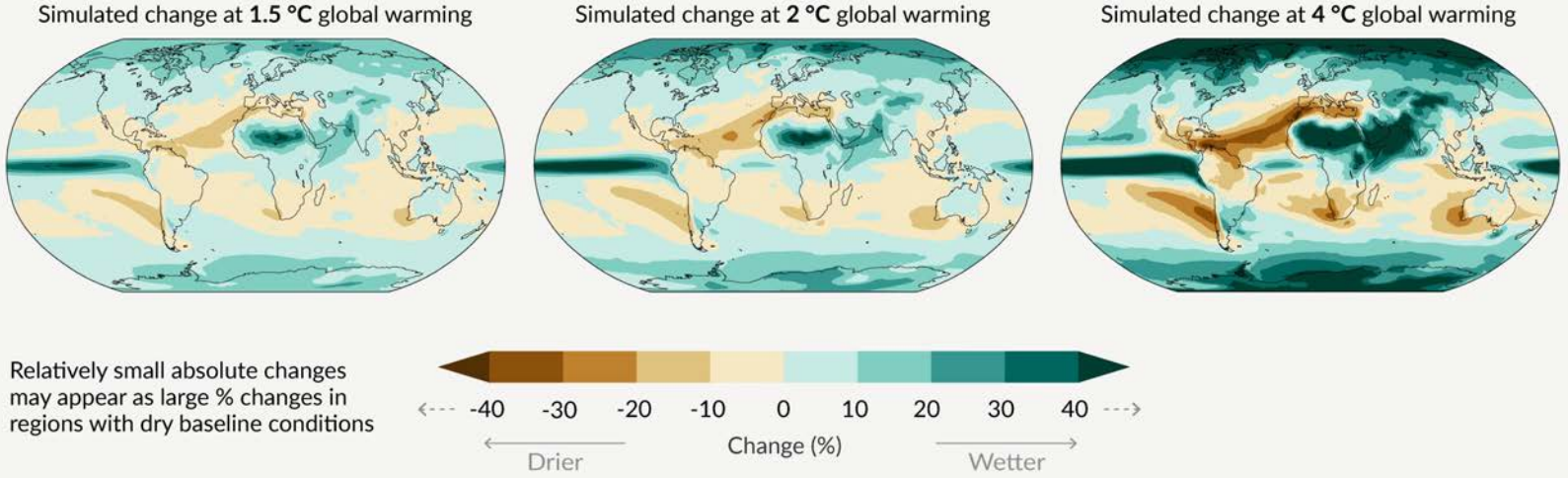


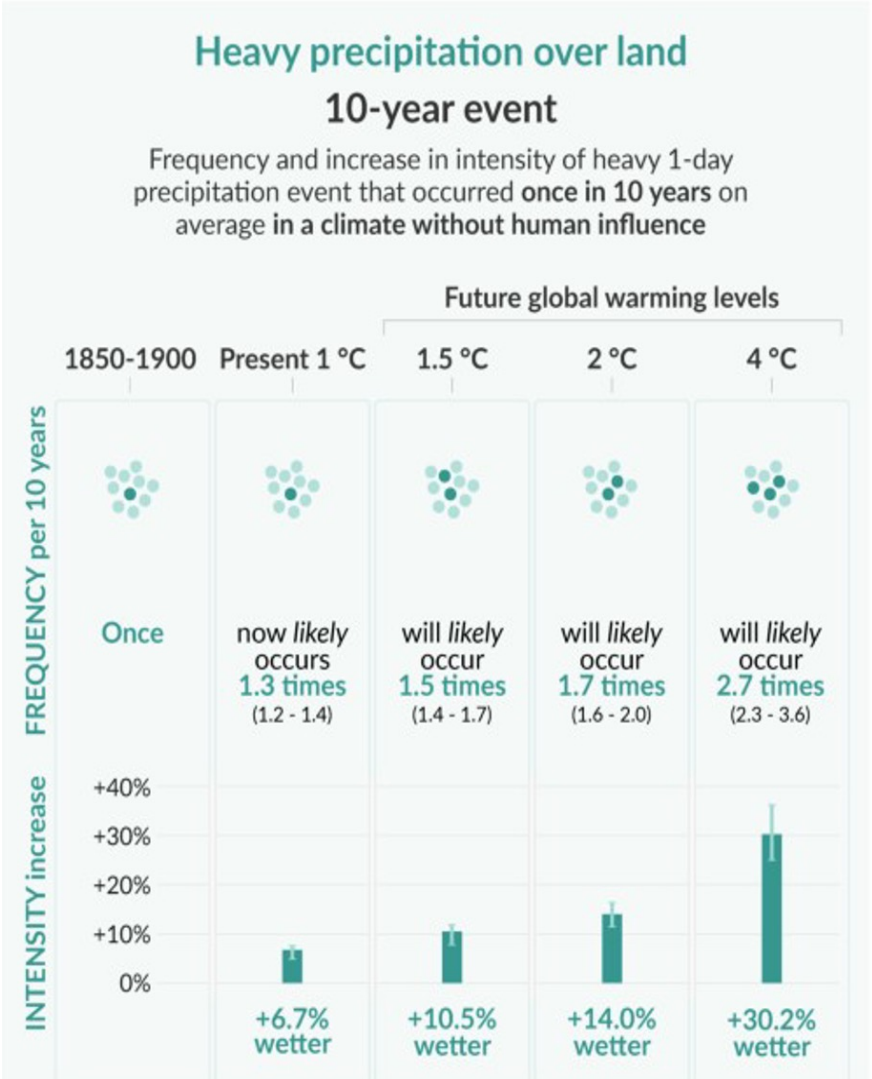
With every increment of global warming, changes get larger in regional mean temperature, precipitation and soil moisture

Figure SPM.5

c) Annual mean precipitation change (%) relative to 1850-1900

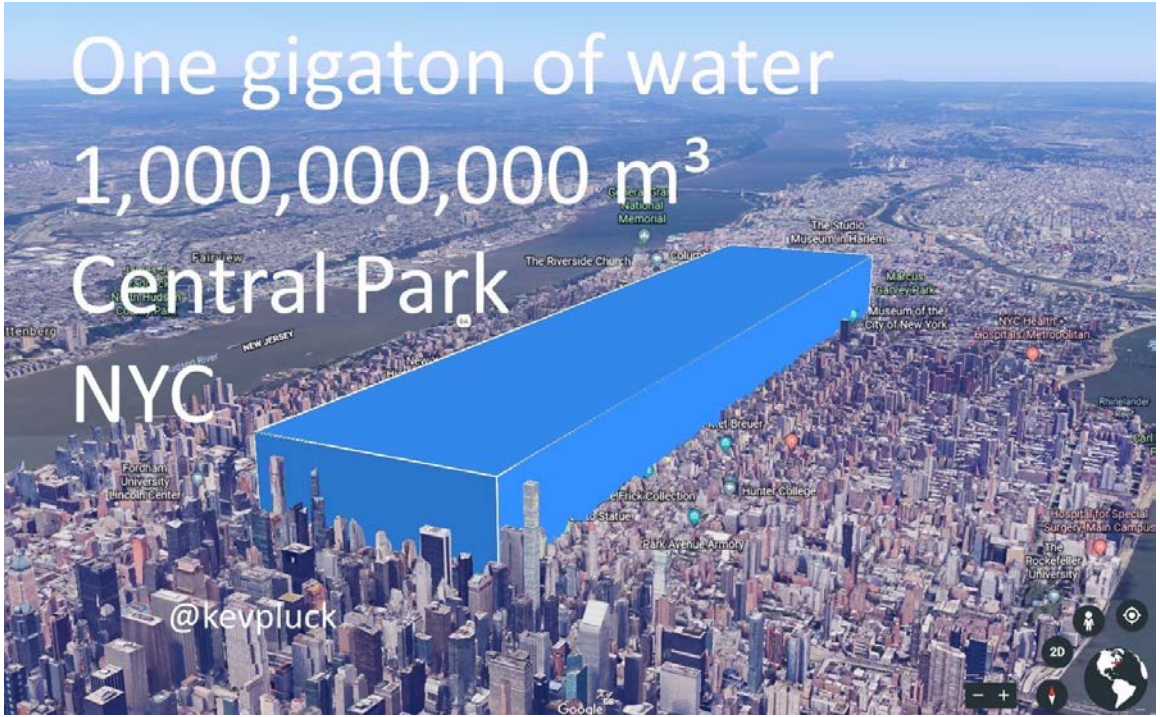
Precipitation is projected to increase over high latitudes, the equatorial Pacific and parts of the monsoon regions, but decrease over parts of the subtropics and in limited areas of the tropics.





IPCC AR6 WGI SPM
Figure SPM.6

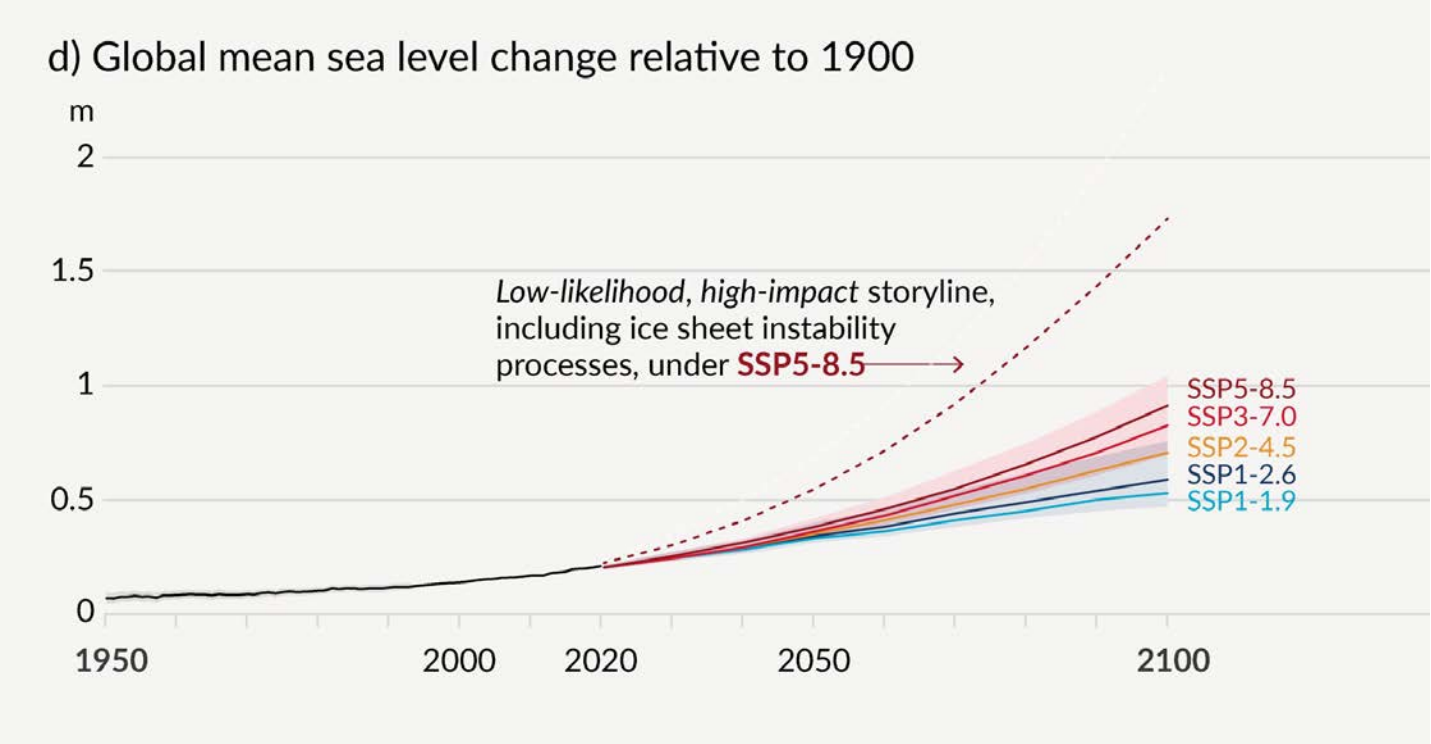
The Antarctic Ice Sheet presently loses 1 Gt of ice every 1.5 day



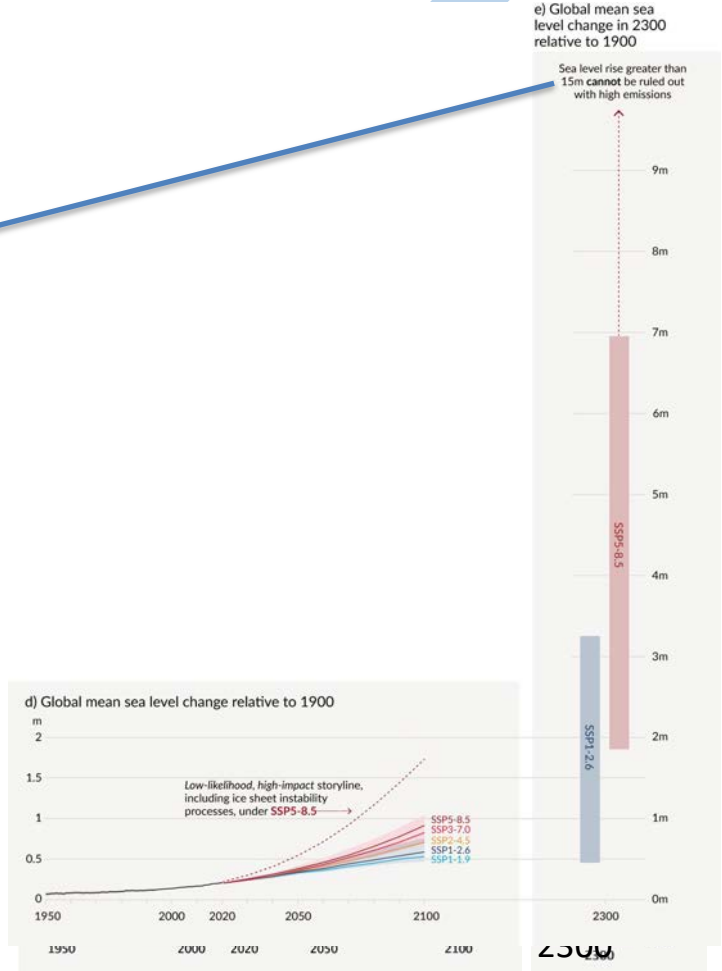
Source: @Kevpluck, June 2018

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:

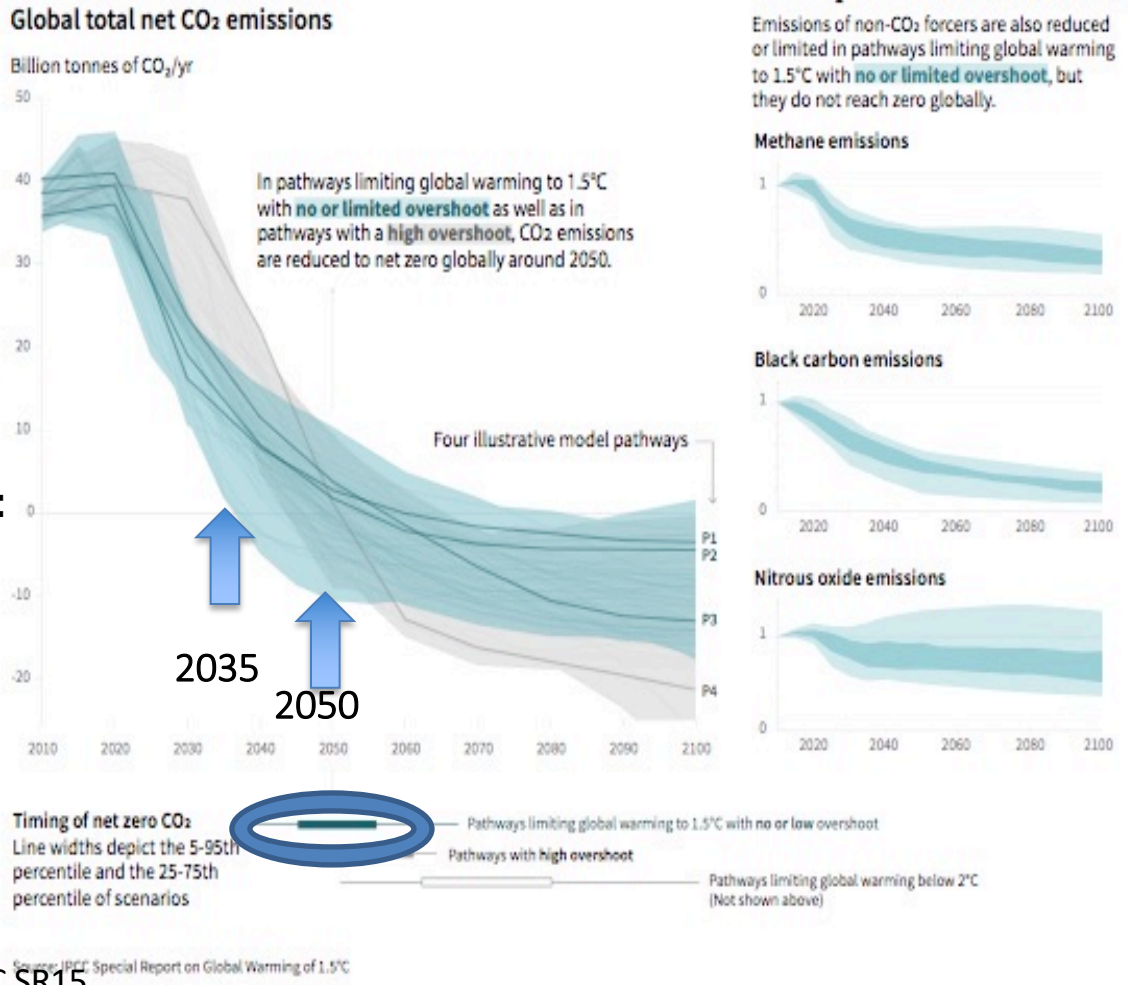
D. Limiting Future Climate Change

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.

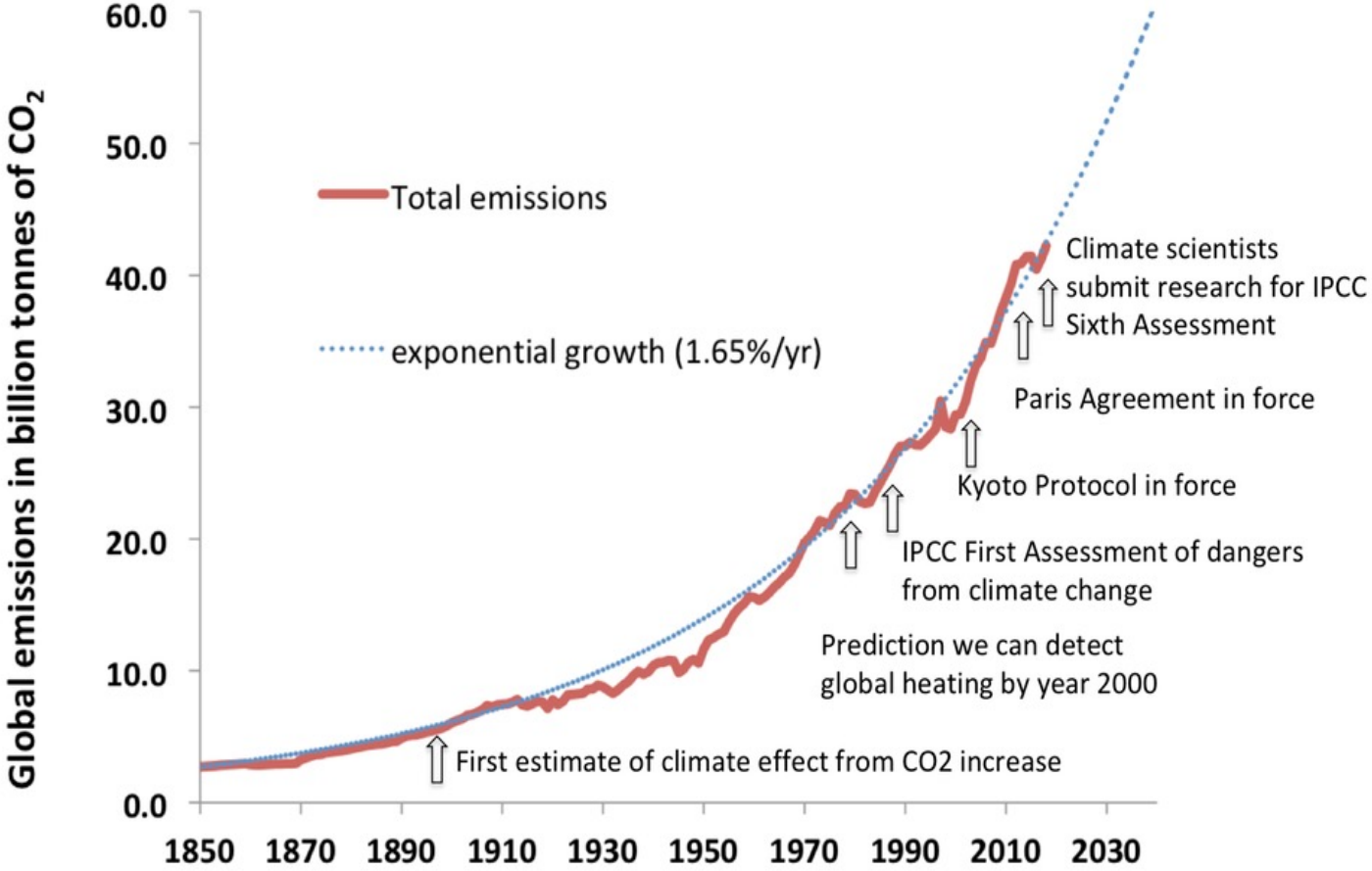
D.2 Scenarios with low or very low greenhouse gas (GHG) emissions (SSP1-1.9 and SSP1-2.6) lead within years to discernible effects on greenhouse gas and aerosol concentrations, and air quality, relative to high and very high GHG emissions scenarios (SSP3-7.0 or SSP5-8.5). Under these contrasting scenarios, 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*).

Emission pathways compatible with below 1.5° C warming:

Net ZERO:

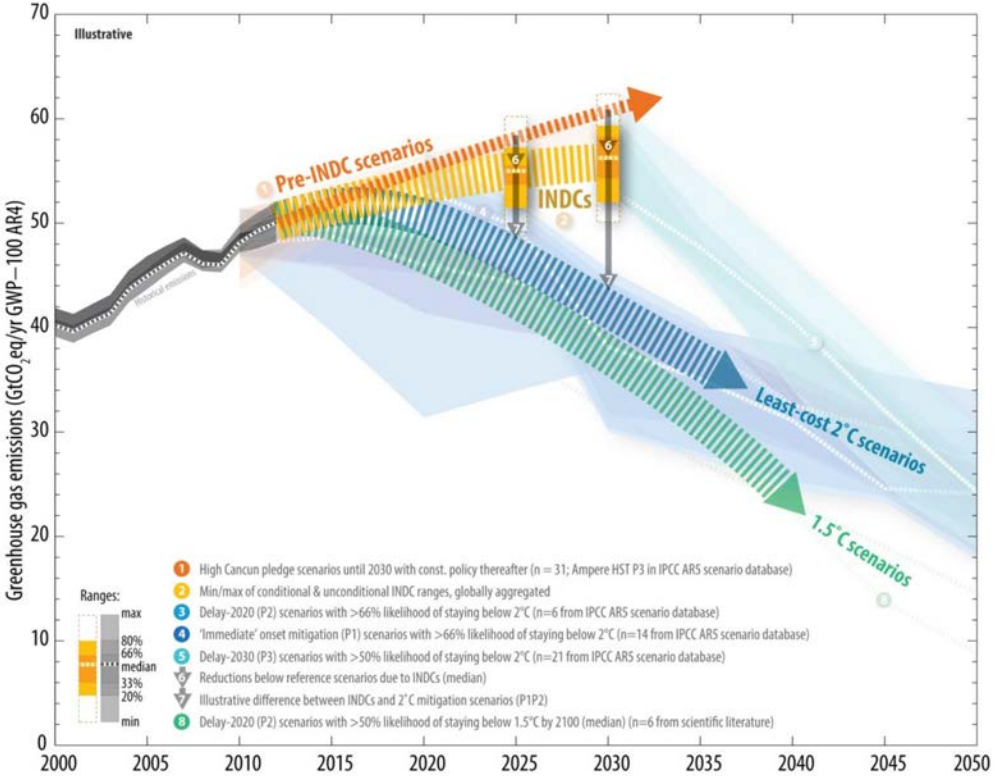


Source: IPCC SR15



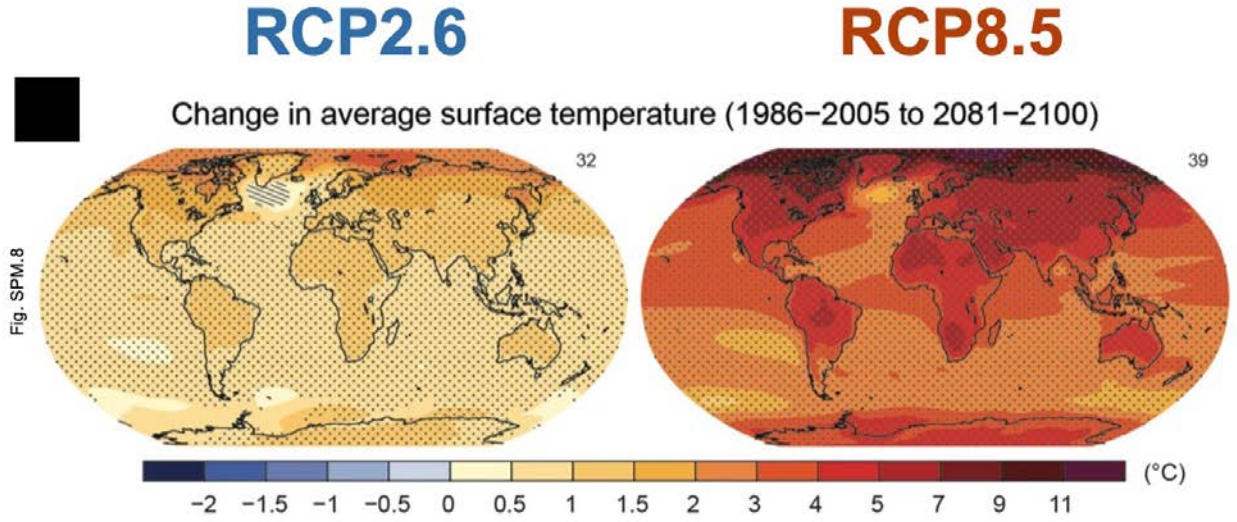
Source: Wolfgang Knorr, in The Conversation (2019)

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



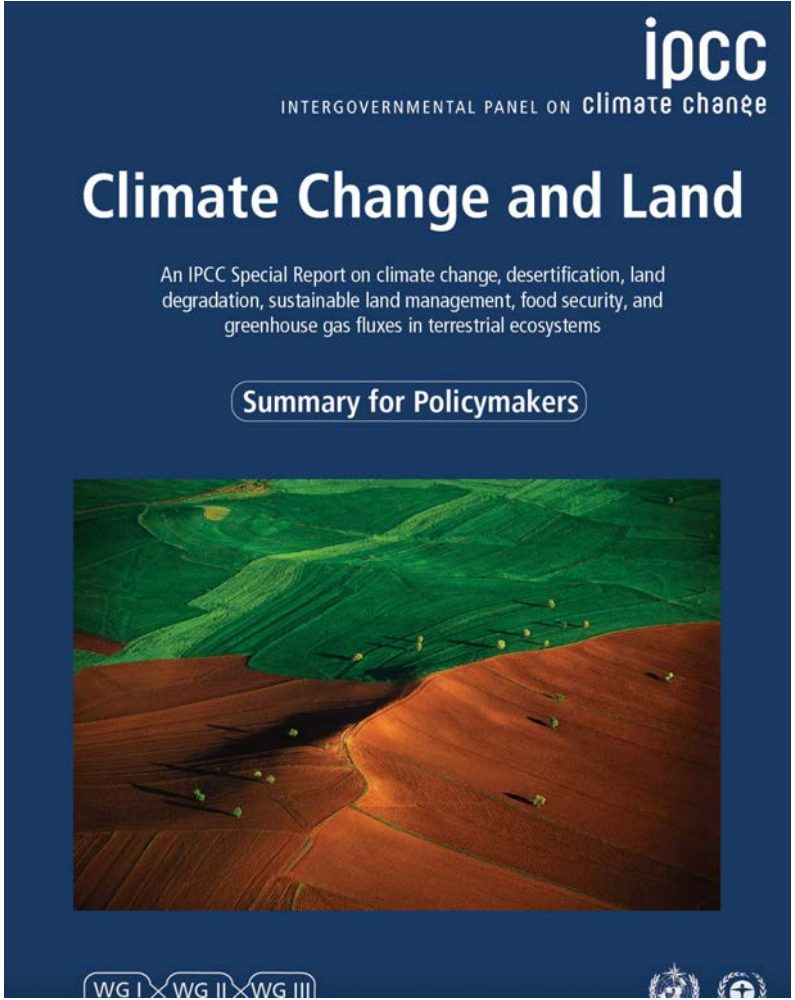
UNFCCC, Aggregate effect of the intended nationally determined contributions: an update
http://unfccc.int/resource/docs/2016/cop22/eng/02.pdf

Fact: It might become much worse, but the future climate is in our hands



Humanity has the choice

IPCC « SRLand »:



Special IPCC Report, 2019, available on www.ipcc.ch

IPCC SRLand:

Gas	Units	Direct Anthropogenic					
		Net anthropogenic emissions due to Agriculture, Forestry, and Other Land Use (AFOLU)			Non-AFOLU anthropogenic GHG emissions[6]	Total net anthropogenic emissions (AFOLU + non-AFOLU) by gas	AFOLU as a % of total net anthropogenic emissions, by gas
Panel 1: Contribution of AFOLU							
		FOLU	Agriculture	Total			
		A	B	C = A + B	D	**E = C + D**	F = (C/E) ×100
CO_2[2]							
	$GtCO_2\ yr^{-1}$	5.2 ± 2.6	No data[11]	5.2 ± 2.6	33.9 ± 1.8	**39.1 ± 3.2**	13%
CH_4[3,8]	$MtCH_4\ yr^{-1}$	19.2 ± 5.8	142 ± 42	161 ± 43	201 ± 101	**362 ± 109**	
	$GtCO_2eq\ yr^{-1}$	0.5 ± 0.2	4.0 ± 1.2	4.5 ± 1.2	5.6 ± 2.8	**10.1 ± 3.1**	44%
N_2O[3,8]	$MtN_2O\ yr^{-1}$	0.3 ± 0.1	8.3 ± 2.5	8.7 ± 2.5	2.0 ± 1.0	**10.6 ± 2.7**	
	$GtCO_2eq\ yr^{-1}$	0.09 ± 0.03	2.2 ± 0.7	2.3 ± 0.7	0.5 ± 0.3	**2.8 ± 0.7**	81%
Total (GHG)	**$GtCO_2eq\ yr^{-1}$**	**5.8 ± 2.6**	**6.2 ± 1.4**	**12.0 ± 2.9**	**40.0 ± 3.4**	**52.0 ± 4.5**	**23%**

IPCC SRLand:

Panel 2: Contribution of global food system

		Land-use change	Agriculture		Non-AFOLU[5] other sectors pre- to post-production	Total global food system emissions
CO_2 Land-use change[4]	$GtCO_2\ yr^{-1}$	4.9 ± 2.5				
CH_4 Agriculture[3,8,9]	$GtCO_2eq\ yr^{-1}$		4.0 ± 1.2			
N_2O Agriculture[3,8,9]	$GtCO_2eq\ yr^{-1}$		2.2 ± 0.7			
CO_2 other sectors[5]	$GtCO_2yr^{-1}$				2.6 – 5.2	
Total[10]	**$GtCO_2eq\ yr^{-1}$**	**4.9 ± 2.5**	**6.2 ± 1.4**		**2.6 – 5.2**	**10.8 – 19.1**

IPCC SRLand:

- Anthropogenic AFOLU N_2O emissions are rising, and were 8.7 ± 2.5 Mt N_2O /year (2.3 ± 0.7 $GtCO_{2eq}$ /year) during the period 2007-2016.
- Anthropogenic N_2O emissions from soils are primarily due to ***nitrogen application including inefficiencies*** (over-application or poorly synchronised with crop demand timings) (high confidence).
- Cropland soils emitted around 3 Mt N_2O /year (around 795 $MtCO_{2eq}$ /year) during the period 2007–2016 (medium confidence).

SUSTAINABLE DEVELOPMENT GOALS

Conclusions (1/2)

The IPCC AR6 WGI report confirmed that the inhabitability of the Earth is at stake due to climate change

Stabilizing the temperature as close as possible to no more than 1.5°C above the pre-industrial is essential, and requires to move away quickly from fossil fuels, to stop deforestation, and to store more carbon in soils and biomass (while protecting biodiversity)

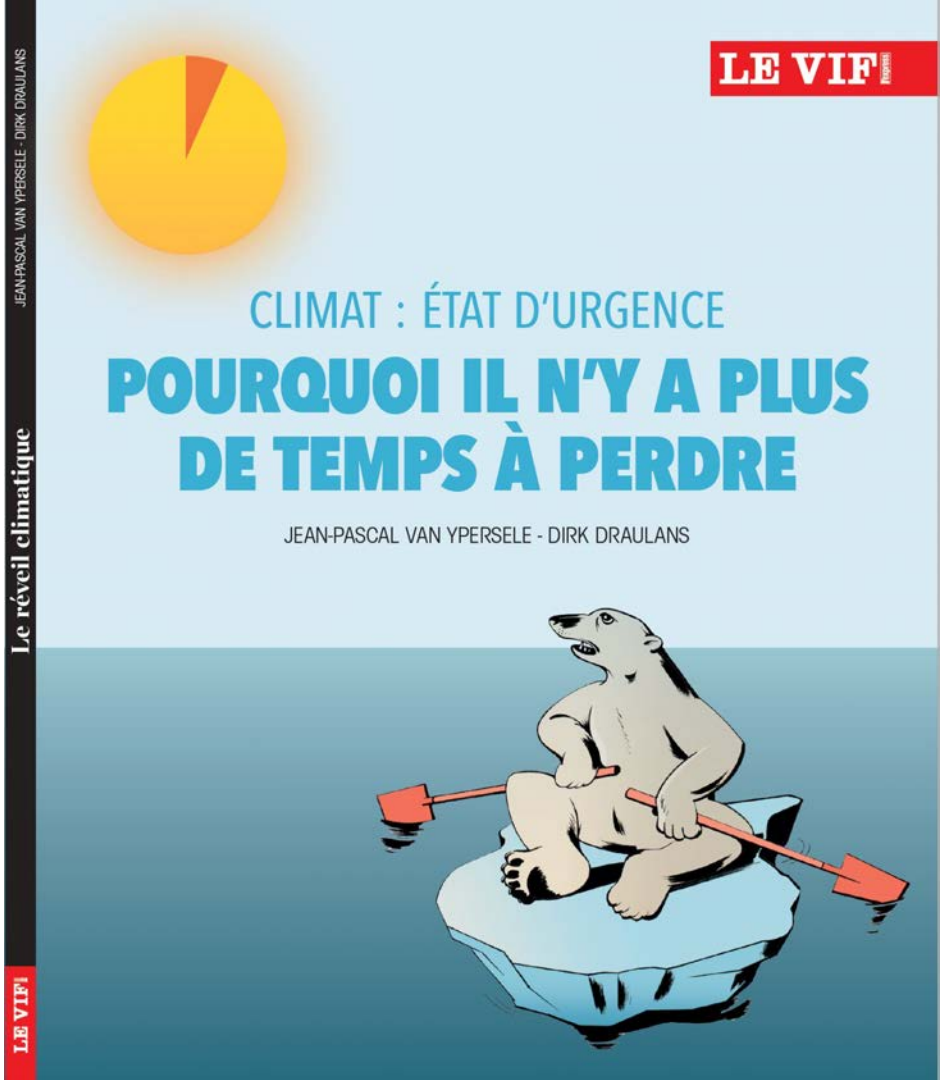
Conclusions (2/2)

The challenge is huge: transform the world in a few decades so that the whole world activities are decarbonized, while the other Sustainable Development Goals are achieved (eliminating poverty and hunger, providing decent jobs, protecting nature, …)

Addressing this challenge offers many opportunities, especially if it is made in a synergistic manner

The agricultural sector is both a potential victim of climate change and a potential positive actor

Gratuit sur
www.levif.be/reveil-climatique



Gratis op
www.knack.be/klimaatalarm

DAT POLITICI OVER TWINTIG JAAR NIET KOMEN JANKEN DAT ZE HET NIET WISTEN.

DIRK DRAULANS (1956) is bioloog, doctor in de wetenschappen en was gastonderzoeker aan de University of Oxford. Sinds 1987 is hij journalist bij Knack.

JEAN-PASCAL VAN YPERSELE (1957) is fysicus en klimatoloog. Hij is hoogleraar klimatologie en milieuwetenschappen aan de UCLouvain en was ondervoorzitter van het Intergovernmental Panel on Climate Change (IPCC).

BIJLAGE BIJ KNACK VAN 16 SEPTEMBER 2020. MAG NIET LOS VERKOCHT WORDEN.

HET KLIMAATALARM

HET KLIMAAT ALARM

Dirk Draulans en
Jean-Pascal van Ypersele

Knack

Exemple de Lettre de la Plateforme wallonne pour le GIEC

Plateforme Wallonne pour le GIEC

Lettre N°14 - juillet 2019

Changements climatiques et terres

Le GIEC termine la préparation de son rapport spécial « Changements climatiques et terres », dont l'adoption est prévue au début du mois d'août. Le texte n'est pas encore public et le résumé doit encore être discuté en séance plénière, mais nous présentons ici une introduction au sujet.

Cette Lettre contient principalement deux parties :

- *une brève présentation du contenu du rapport à paraître*
- *trois articles qui donnent un éclairage sur des aspects spécifiques traités dans le rapport, selon le point de vue de scientifiques belges.*

L'information contenue dans ce numéro est donc relativement « spécialisée », mais nous avons ajouté de courtes synthèses pour en faciliter l'accès.

Un aspect du rapport, qui apparaît concrètement dans les trois articles présentés, est que l'utilisation des terres est un enjeu très important. Les terres sont sollicitées pour de multiples usages : amélioration de la sécurité alimentaire pour une population mondiale encore en croissance - en dépit des impacts négatifs des changements climatiques sur les cultures -, préservation de la biodiversité, maintien ou accroissement du stock de carbone que constituent les sols et la végétation… Une priorité est bien entendu l'arrêt du déboisement.

Nous présenterons un aperçu du Résumé pour les décideurs lorsque le GIEC l'aura finalisé.

Nous vous souhaitons une agréable lecture de cette Lettre !

Philippe Marbaix, Bruna Gaino et Jean-Pascal van Ypersele

Sommaire

Wallonie environnement Awac

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

To go further :

- www.climate.be/vanyp : my slides (under « conferences »)
- www.ipcc.ch : IPCC
- www.realclimate.org : answers to the merchants of doubt arguments
- www.skepticalscience.com : same
- www.plateforme-wallonne-giec.be : IPCC-related in French, Newsletter, latest on climate, basic climate science
- **Twitter: @JPvanYpersele & @IPCC_CH**