Climate Change: Insights from the latest IPCC Report (AR6)

Prof. Jean-Pascal van Ypersele

Université catholique de Louvain (UCLouvain)
Former IPCC Vice-Chair (2008-2015)

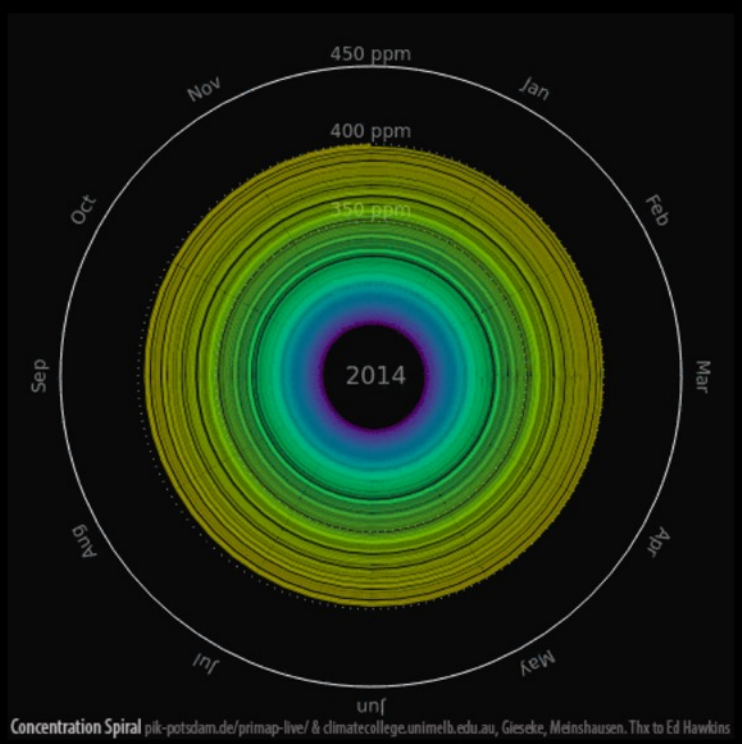
Twitter: @JPvanYpersele

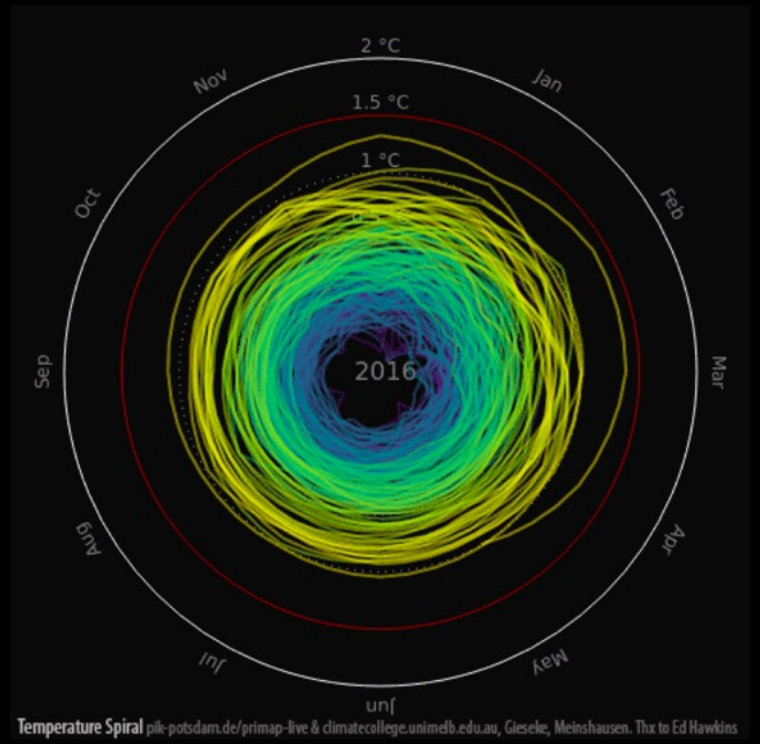
ClimMigHealth event, Seasonal School on the climate, migration, and health nexus, Ghent University, 20 September 2023

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

Source: @JohnfoCook

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/

Progression of Understanding: Greater and Greater Certainty in Attribution

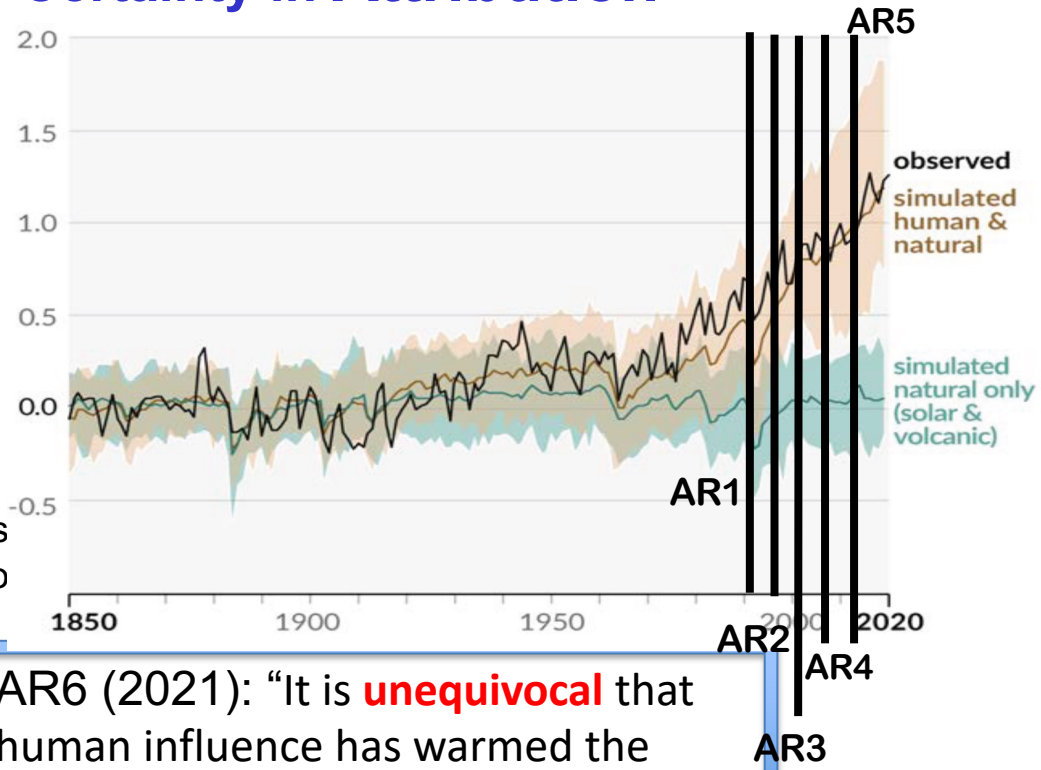
AR1 (1990): “unequivocal detection not likely for a decade”

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, particularly if it's humid

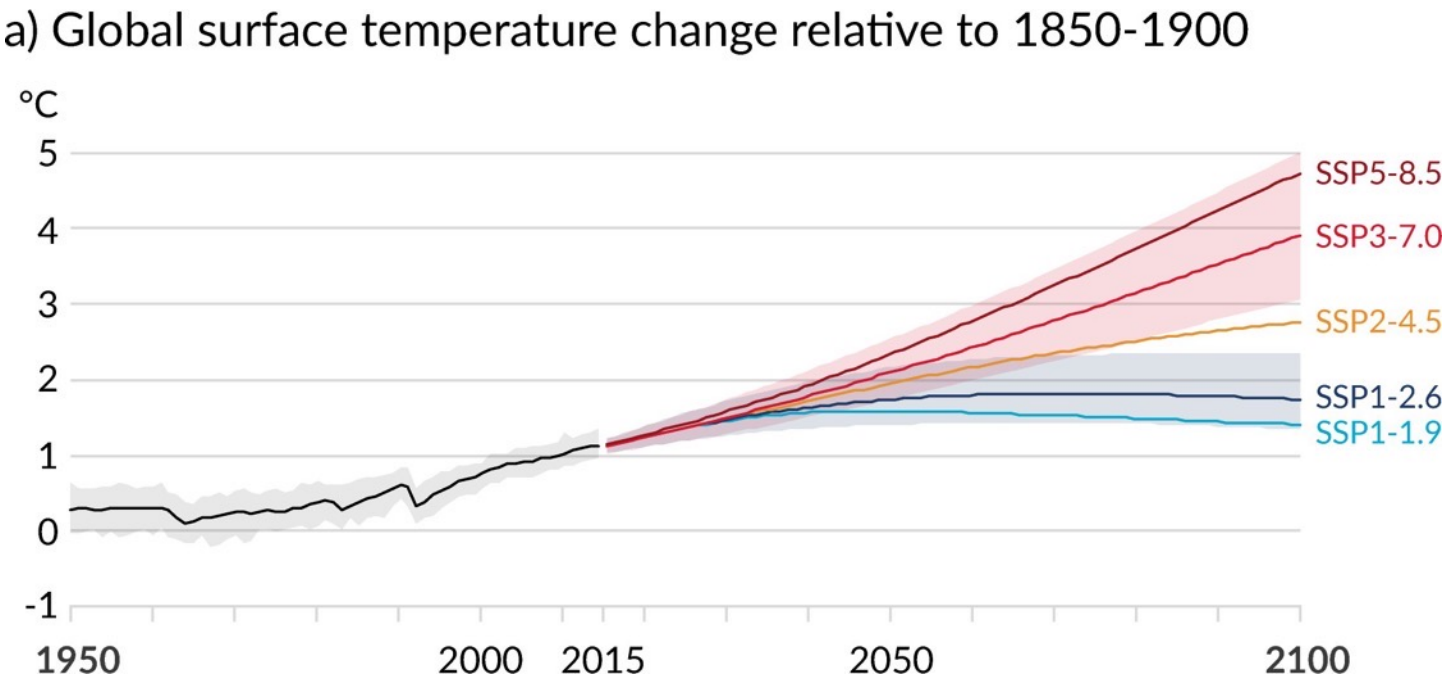
A man helps move a heat wave victim to a Karachi hospital on 22 June 2015.
ASIF HASSAN/AFP/Getty Images https://edition.cnn.com/2015/06/22/asia/gallery/pakistan-heat-wave/index.html

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

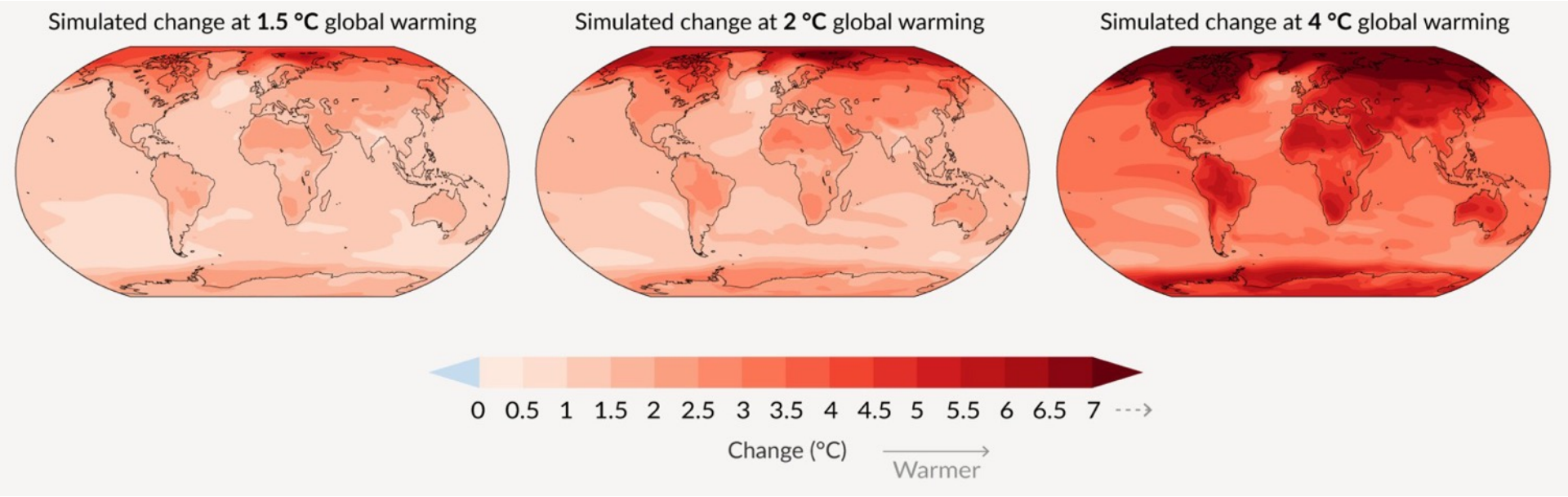


Across warming levels, land areas warm more than oceans, and the Arctic and Antarctica warm more than the tropics

+1.5° C

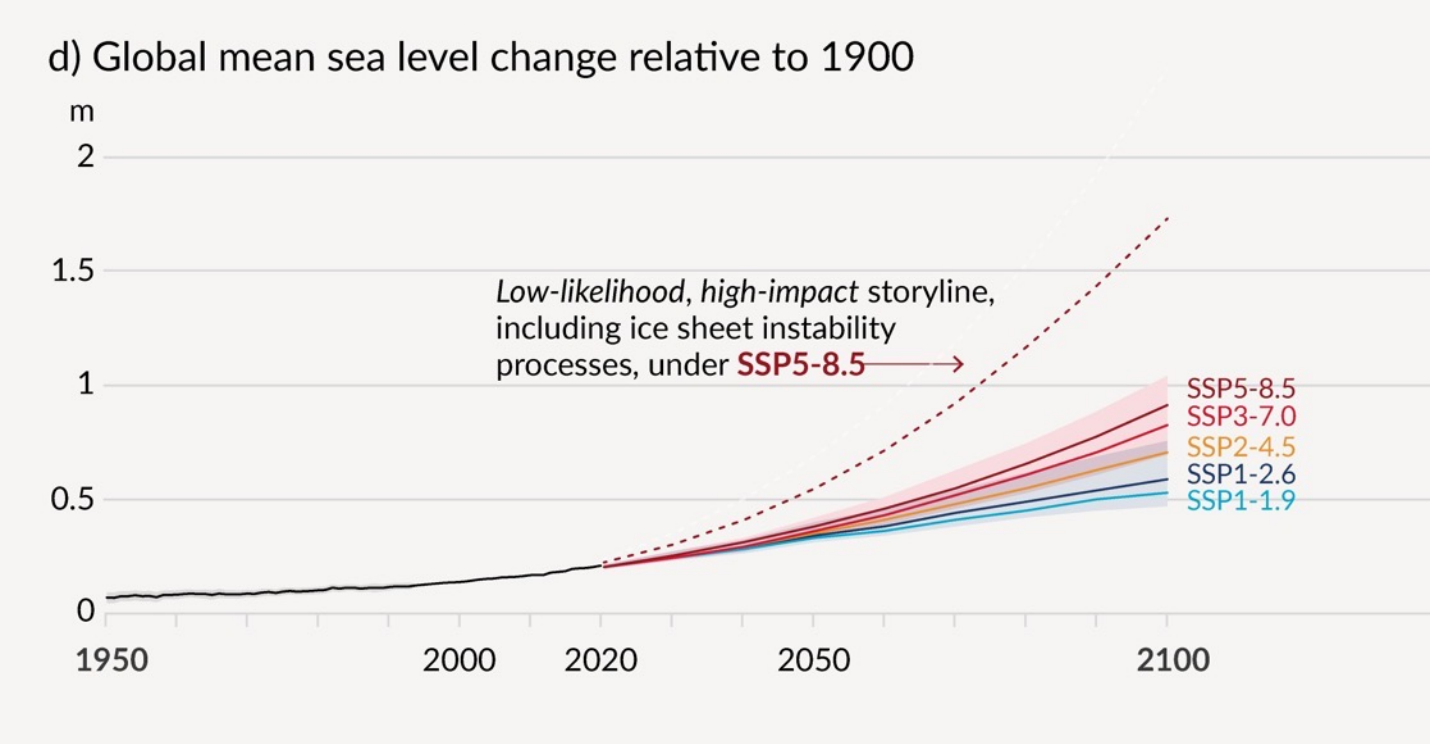
+2° C

+4° C

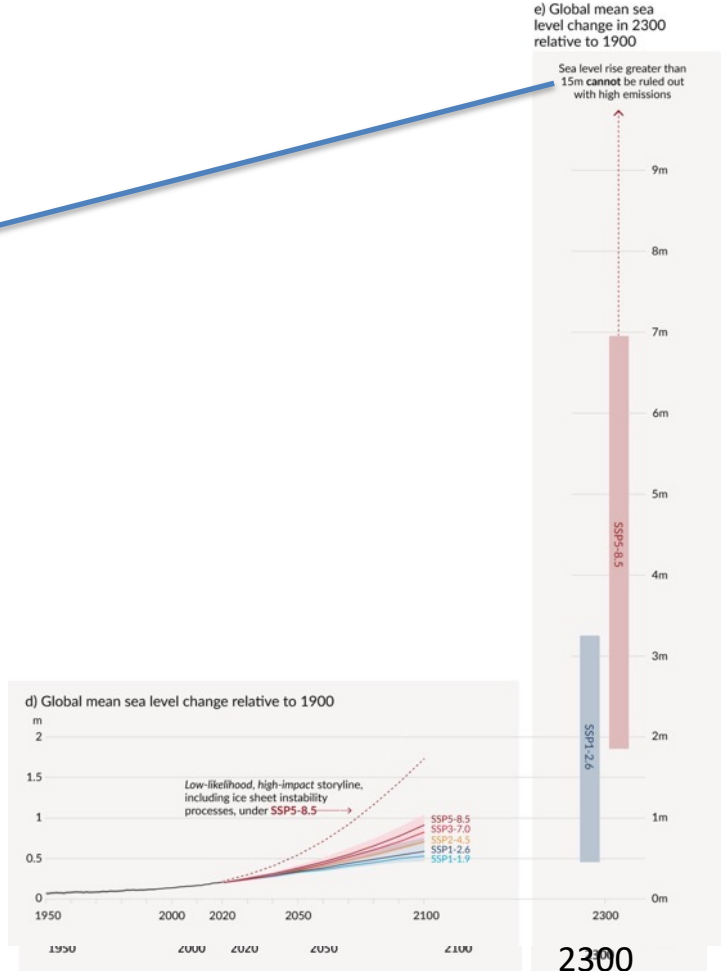


Human activities affect all the major climate system components, with some responding over decades and others over centuries

Figure SPM.8



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



7 m

2 m

2300

Jean-Pascal van Ypersele (vanypersele@astr.ucl.ac.be

Gazet van Antwerpen 8 September 2004

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.

[Well Bred Kannan - WBK Photography CC BY-NC-ND 2.0; Jay Huang CC BY 2.0; Cristina Anne Costello, Marcus Woodbridge / Unsplash]

[Axel Fassio/CIFOR CC BY-NC-ND 2.0]

Accelerating adaptation

- Political commitment and follow-through across all levels of government
- Institutional framework: clear goals, priorities that define responsibilities
- Enhancing knowledge of impacts and risks improves responses
- Monitoring and evaluation of adaptation measures are essential to track progress
- Inclusive governance that prioritises equity and justice – direct participation

There are limits to adaptation

- Even effective adaptation cannot prevent all losses and damages
- Above 1.5° C some natural solutions may no longer work.
- Above 1.5° C, lack of fresh water could mean that people living on small islands and those dependent on glaciers and snowmelt can no longer adapt.
- By 2° C it will be challenging to farm multiple staple crops in many current growing areas.

[Denis Onyodi / KRCS CC BY-NC 2.0]

The wider benefits of adaptation

For more than 3.4 billion people in rural areas: improved roads, reliable energy, clean water, food security

SDG 1: No poverty

Green buildings, green spaces, clean water, renewable energy, sustainable transport – in cities

SDG 3: Good health and wellbeing

Policies that increase youth access to land, credit, knowledge and skills can support agri-food employment

SDG 10: Reduced inequality

Restored and connected habitats can provide corridors for vulnerable species

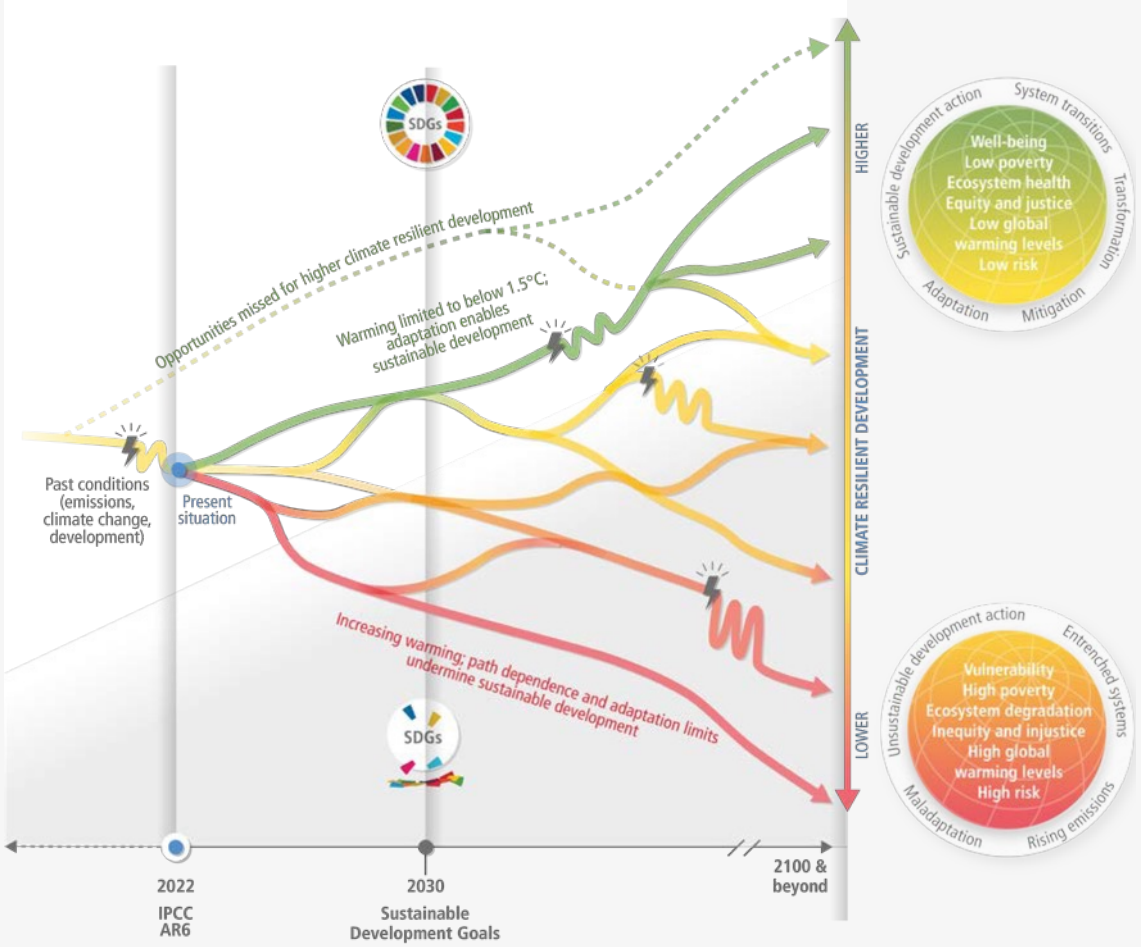
SDG 14/15: Life on land & below water

[Anthony Gale CC BY-SA 2.0; Egor Myznik / Unsplash; Joe Nkadaani/CIFOR CC BY-NC-ND 2.0; Ocean Image Bank / Matt Curnock]

Increasing urgency

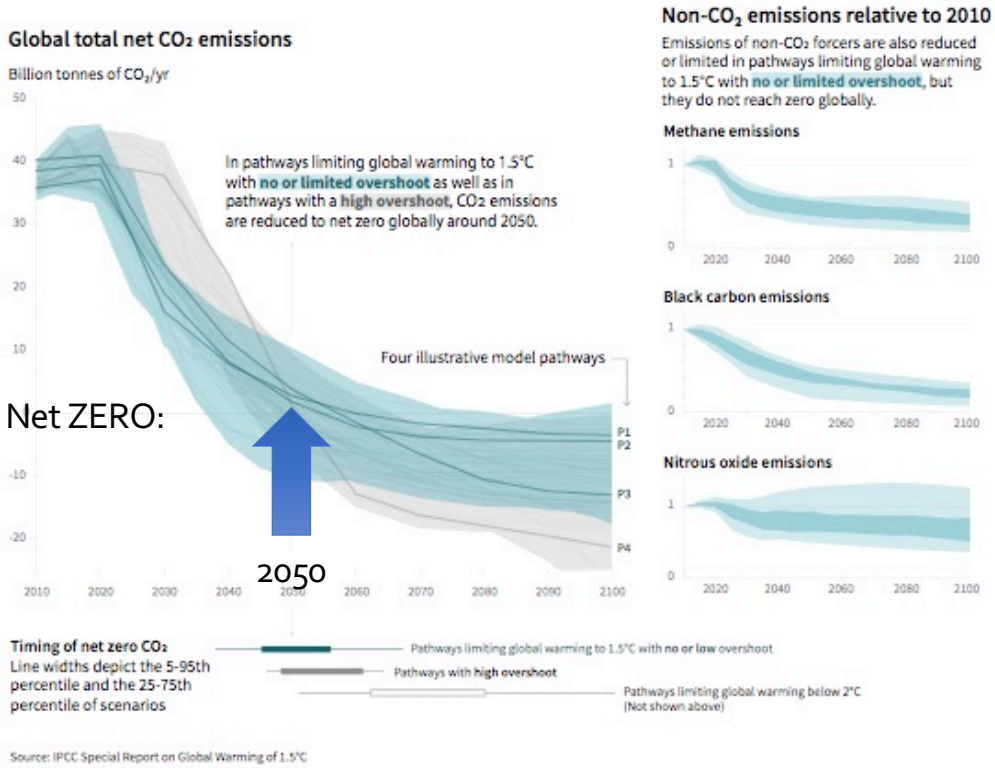
Starting today, every action, every decision matters.

Worldwide action is more urgent than previously assessed.



Global emissions pathway characteristics

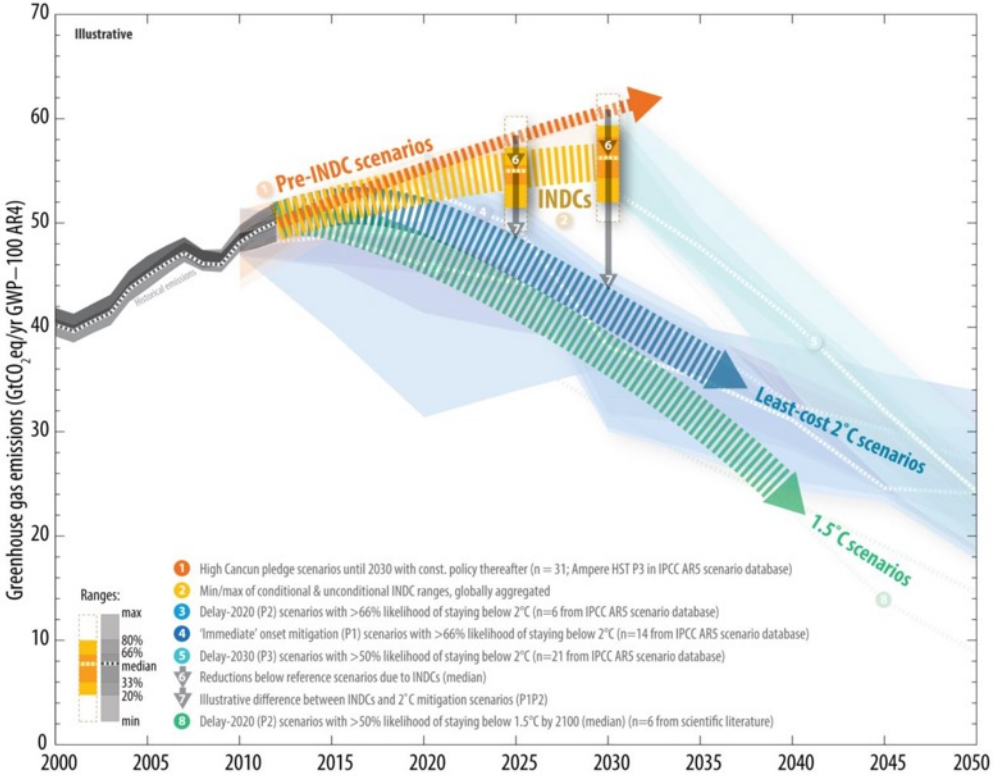
General characteristics of the evolution of anthropogenic net emissions of CO_2, and total emissions of methane, black carbon, and nitrous oxide in model pathways that limit global warming to 1.5°C with no or limited overshoot. Net emissions are defined as anthropogenic emissions reduced by anthropogenic removals. Reductions in net emissions can be achieved through different portfolios of mitigation measures illustrated in Figure SPM3B.



Source: IPCC Special Report on Global Warming of 1.5°C


Nations Unies
onférence sur les Changements Climatiques
COP21/CMP11
Paris, France
SECRETAIRE EXECUTIVE CCNUCC
PRESIDENT

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

Sixth Assessment Report
WORKING GROUP III – MITIGATION OF CLIMATE CHANGE

ipcc
INTERGOVERNMENTAL PANEL ON climate change

Climate Change 2022

Mitigation of Climate Change

[Matt Bridgestock, Director and Architect at John Gilbert Architects]

ipcc

“

Unless there are immediate and deep emissions reductions across all sectors, 1.5°C is beyond reach.

ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

There are options available **now** in every sector that can at least **halve** emissions by 2030

Demand and services

Energy

Land use

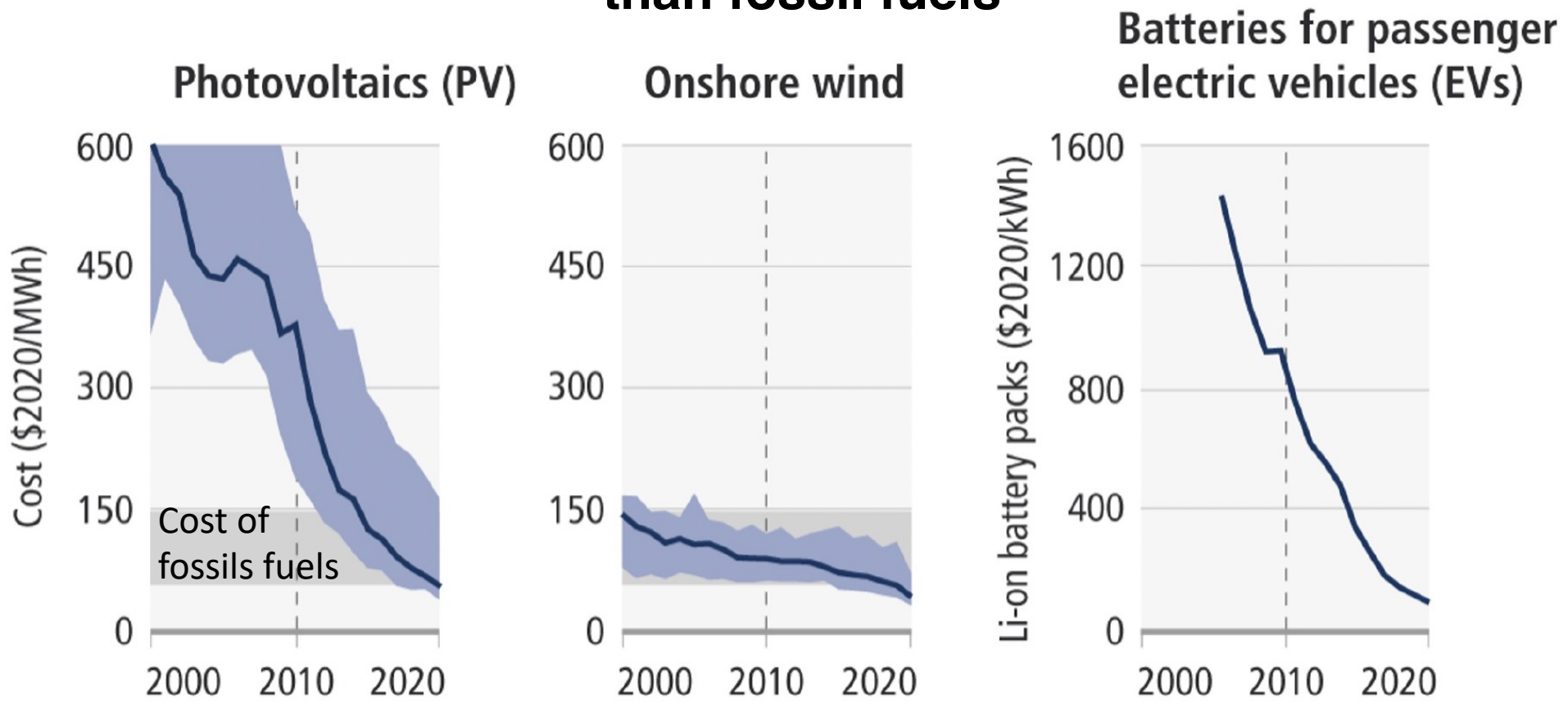
Industry

Urban

Buildings

Transport

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



IPCC WG3 (2022)

Many co-benefits of taking climate action out of its SILO:

How one acts matters

IPCC AR6 SYR (section 4.4):

« Actions that prioritise equity, climate justice, social justice and inclusion lead to more sustainable outcomes, co-benefits, reduce trade-offs, support transformative change and advance climate resilient development.

Adaptation responses are immediately needed to reduce rising climate risks, especially for the most vulnerable.

Equity, inclusion and just transitions are key to progress on adaptation and deeper societal ambitions for accelerated mitigation. (*high confidence*) »

Just transition

IPCC definition (AR6 glossary):

« A set of principles, processes and practices that aim to ensure that no people, workers, places, sectors, countries or regions are left behind in the transition from a high-carbon to a low carbon economy »

Low emission scenario

High emission scenario

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

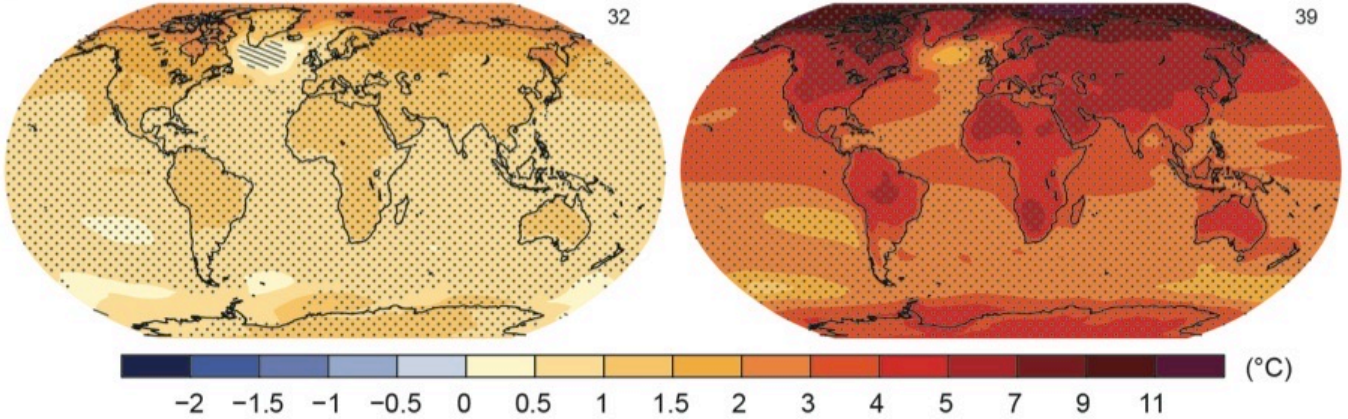


Fig. SPM.8

Humanity has the choice

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

Jean-Pascal van Ypersele
(vanyp@climate.be)