

Developing an Ecological Civilization in a Warming Climate: Challenges and Opportunities after the new IPCC Special Report on « Global Warming of 1.5° C »

Jean-Pascal van Ypersele

Twitter: @JPvanYpersele

UCLouvain (Belgium), Earth & Life Institute

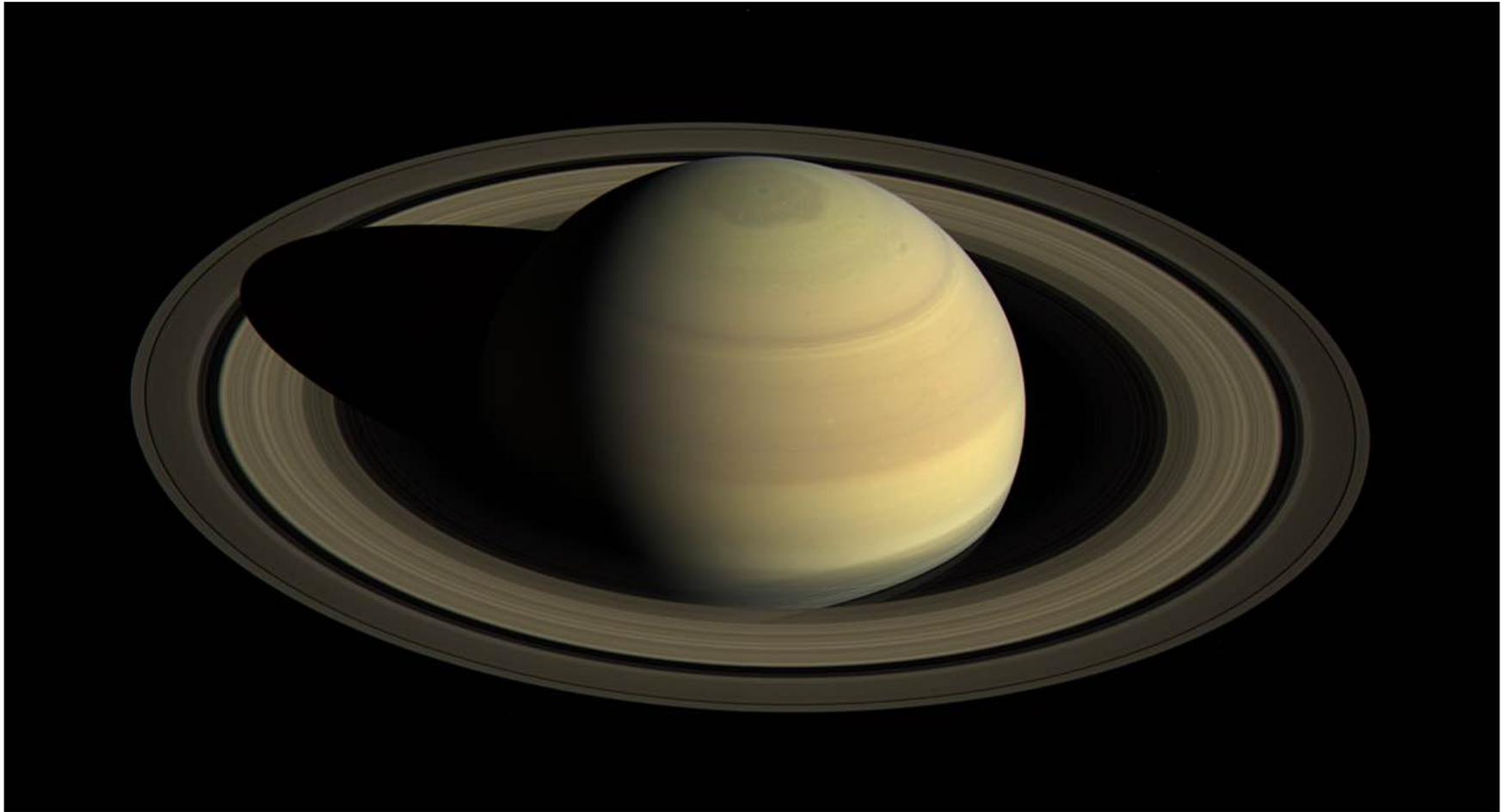
IPCC Vice-Chair from 2008 to 2015

Member of the GSDR 2019 author team

**5th Taihu World Cultural Forum, Beijing,
19 October 2018**

Thanks to the Walloon government for supporting
www.platforme-wallonne-giec.be and my team at UCLouvain

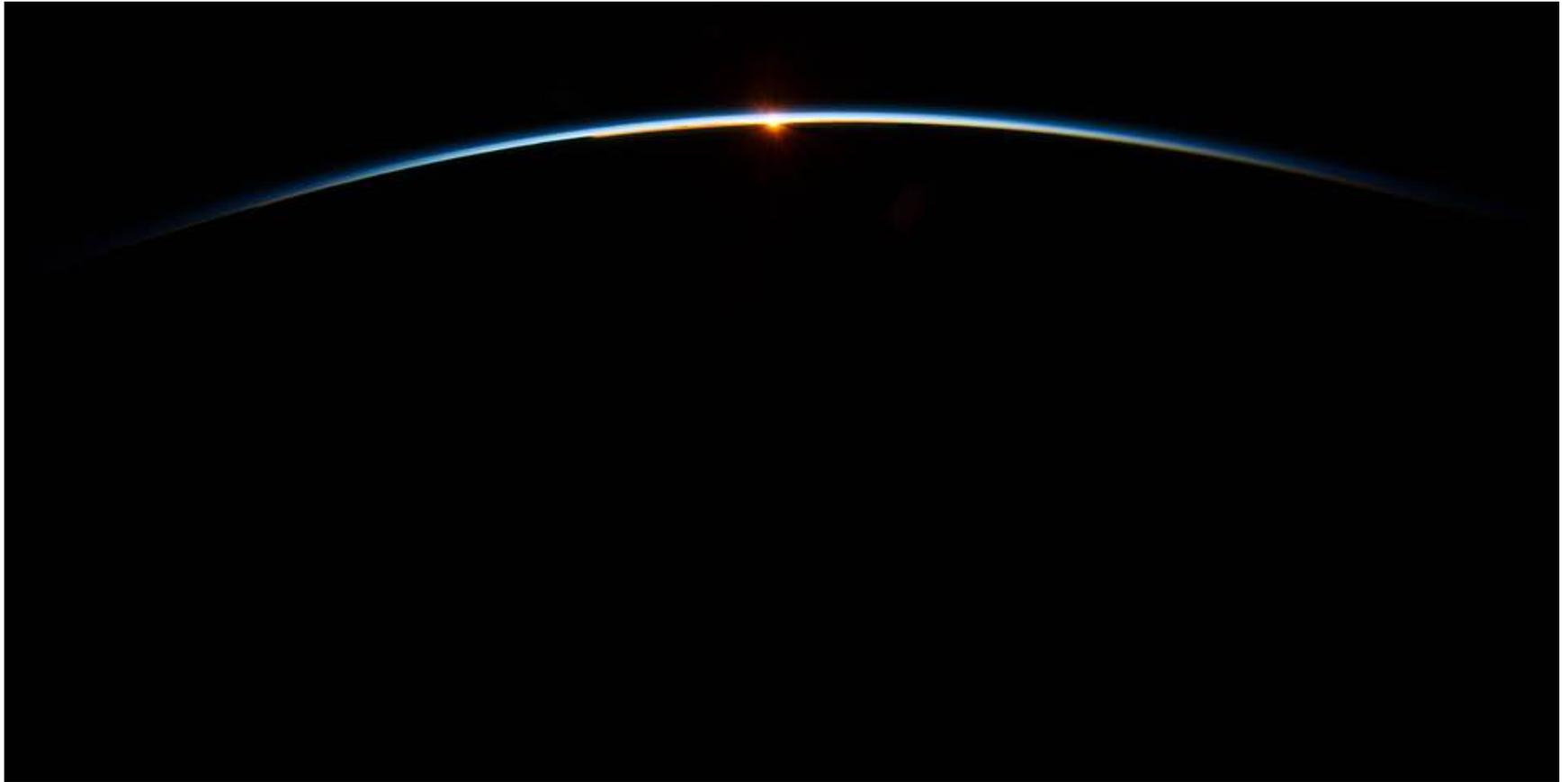
Saturn, as seen on 25-4-2016 from a 3 million km distance by the Cassini satellite launched in October 1997, 40 years after Sputnik



That small blue dot is the Earth, as seen from Cassini, orbiting Saturn, 1.44 billion km from us, on 19-7-2013



Our atmosphere is thin and fragile (as seen by ISS crew on 31 July 2013)



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

**Fact: We use the atmosphere as
a dustbin for our greenhouse
gases, we thicken the insulation
layer around the planet & it
disturbs the climate**

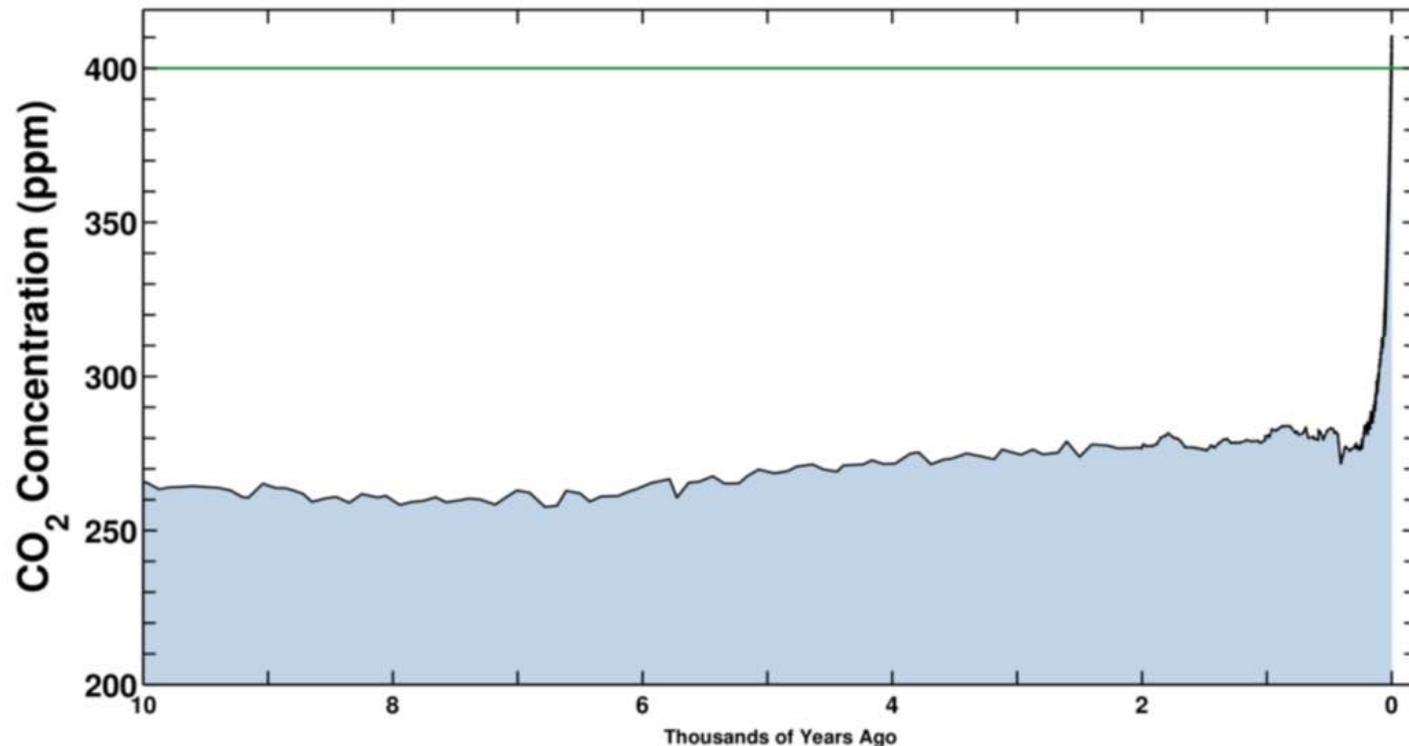
**That is why we must cut emissions
to ZERO as soon as possible**

CO₂ Concentration, 28 May 2018 (Keeling curve)

Latest CO₂ reading
May 28, 2018

411.98 ppm

Ice-core data before 1958. Mauna Loa data after 1958.



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

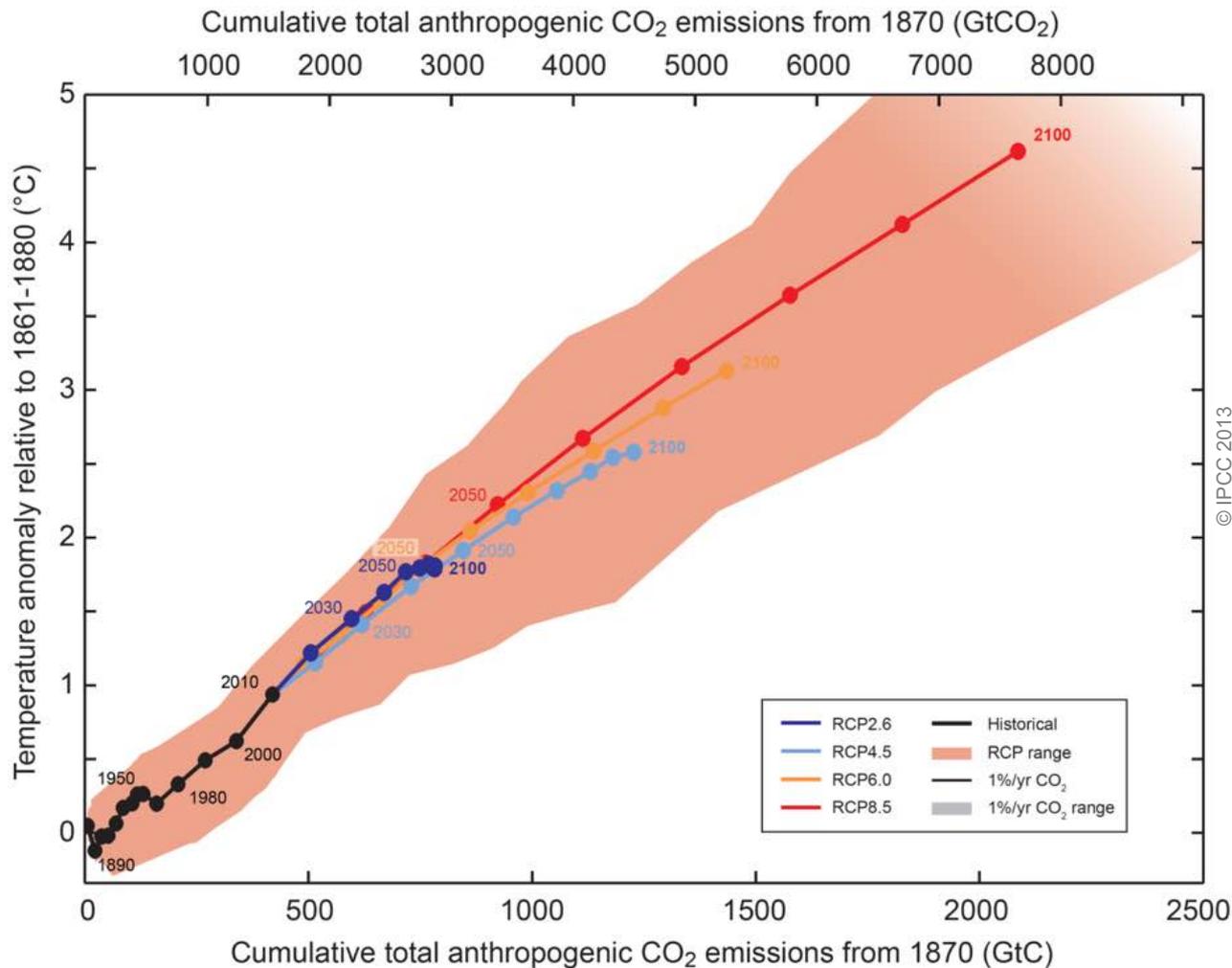
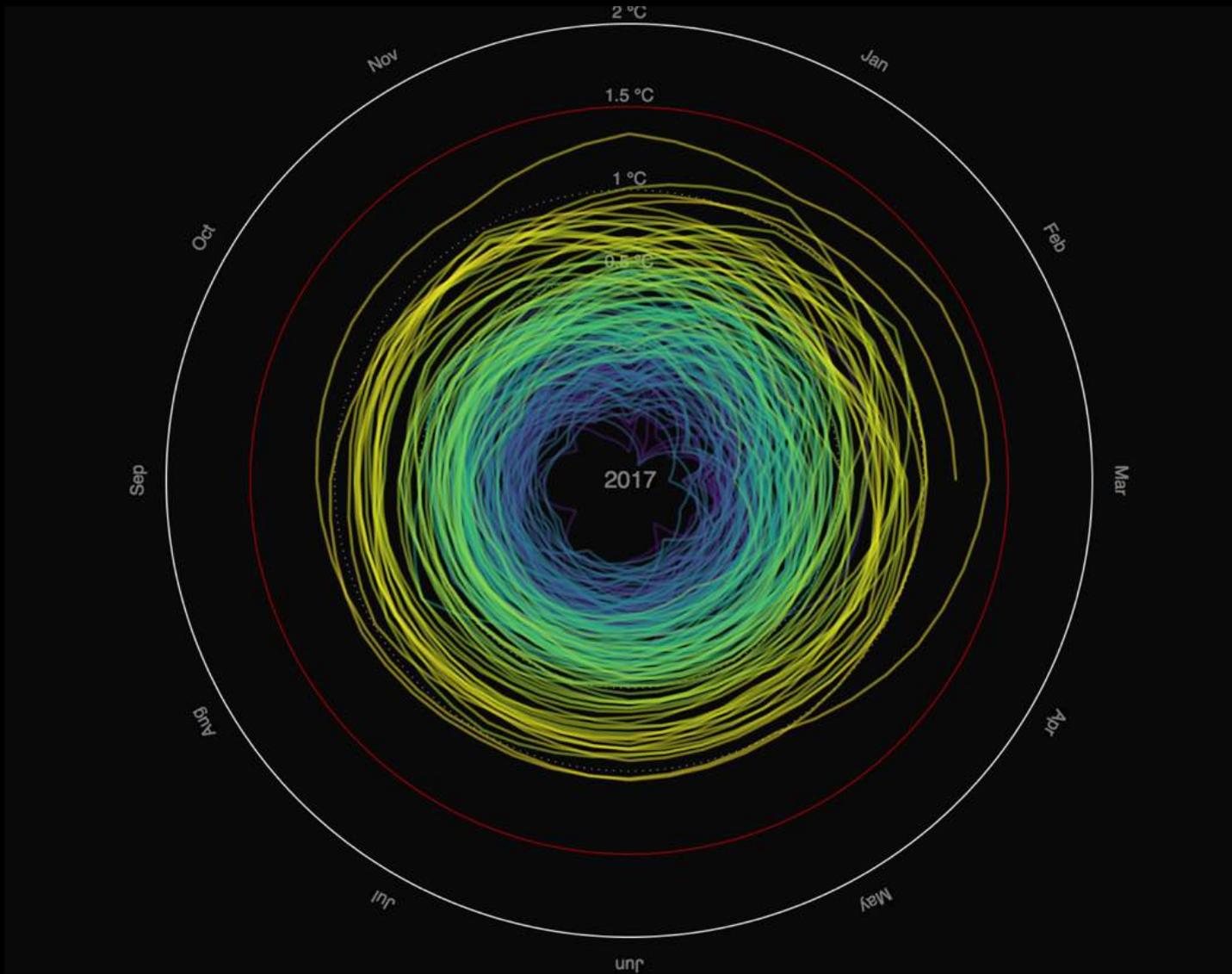


Fig. SPM.10

Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.

Temperature spiral



Global Mean Temperature in °C relative to 1850 – 1900

Graph: Ed Hawkins (Climate Lab Book) – Data: HadCRUT4 global temperature dataset

Animated version available on <http://openclimatedata.net/climate-spirals/temperature>

Since 1950, **extreme hot days** and **heavy precipitation** have become more common



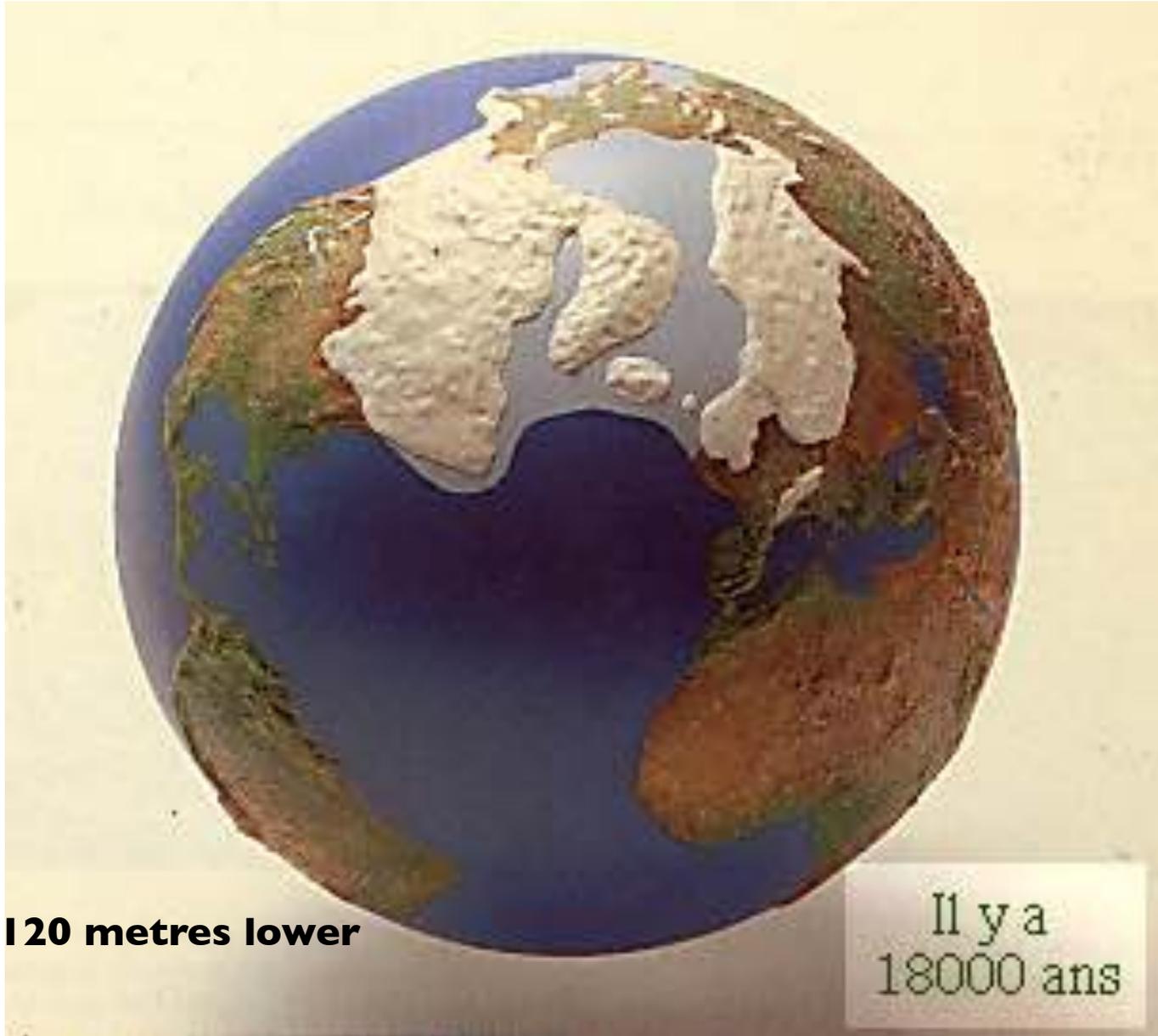
There is evidence that anthropogenic influences, including increasing atmospheric **greenhouse gas concentrations**, have changed these extremes

Fact: Average temperature is probably on its way to exceed the « conservation temperature » for the Greenland and (some of the) Antarctic ice sheet

There is therefore a very high risk that average sea level would increase by several metres over the next century or two

18-20000 years ago (Last Glacial Maximum)

With permission from Dr. S. Jousaume, in « Climat d'hier à demain », CNRS éditions.



Sea level: 120 metres lower

Il y a
18000 ans

Today, with +4-5° C globally

With permission from Dr. S. Joussaume, in « Climat d'hier à demain », CNRS éditions.

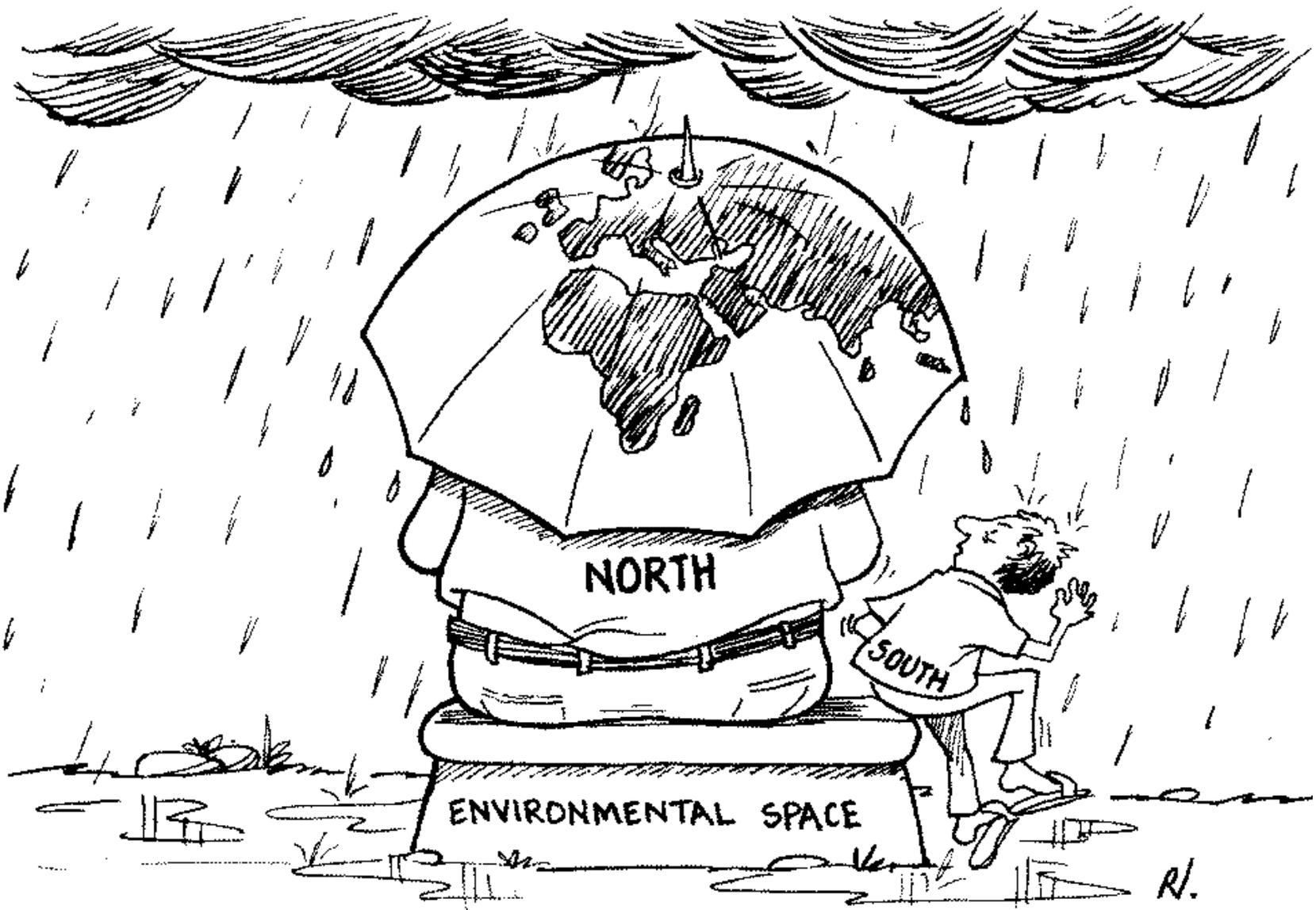


Fact: Climate change impacts poor people first, but we are all on the same spaceship (with common but differentiated responsibilities)

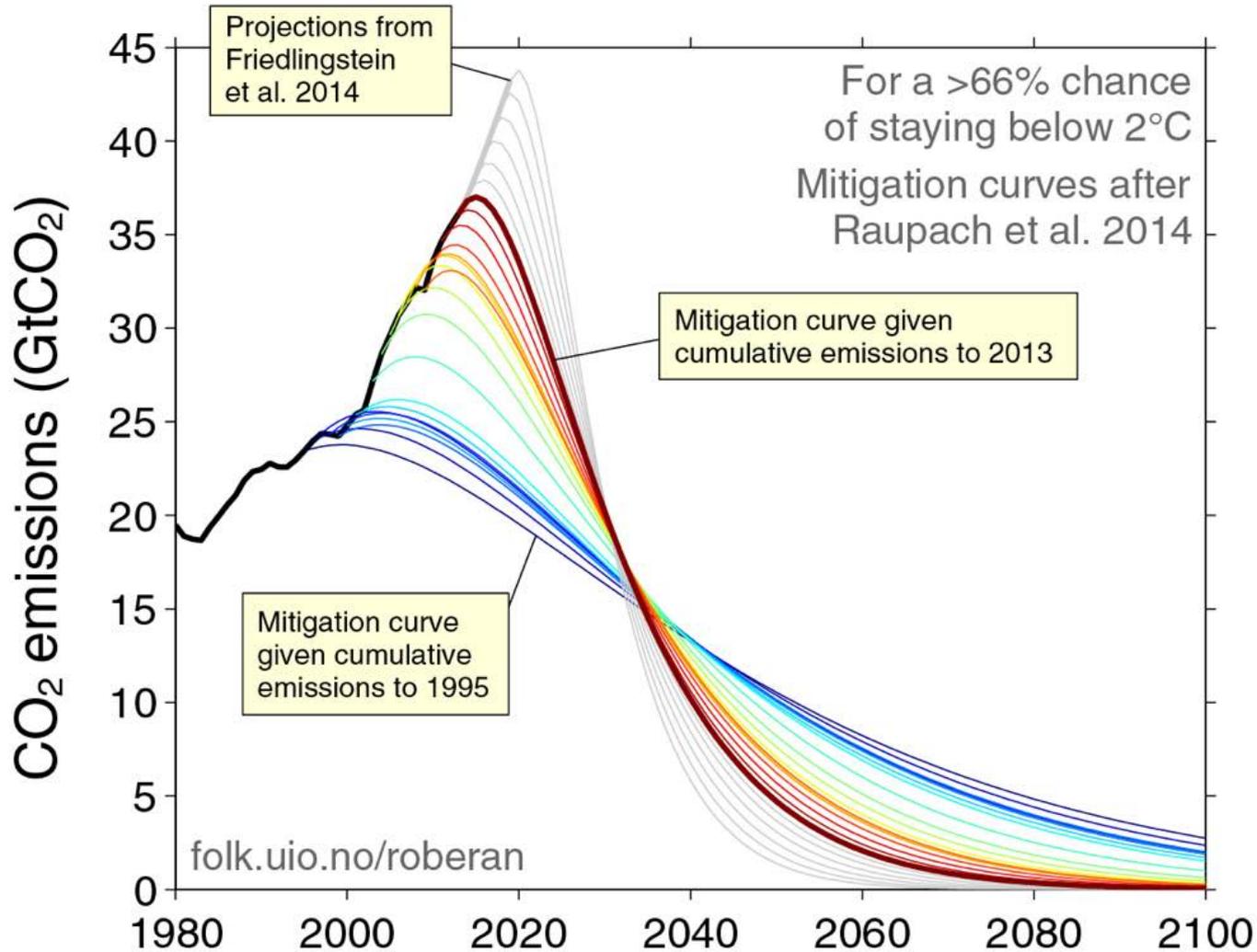
Risk = Hazard x Vulnerability x Exposure

(Victims of New Orleans floods after Katrina in 2005)





Fact: Limiting warming becomes much more difficult when the peak happens later

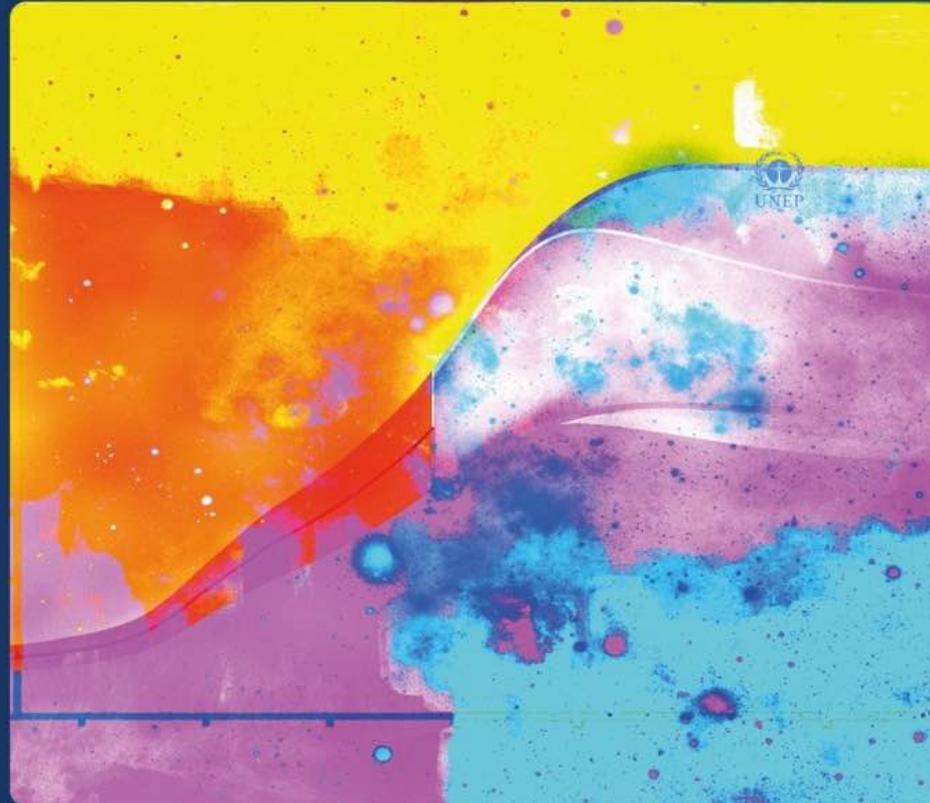


Source and details:

http://folk.uio.no/roberan/t/global_mitigation_curves.shtml

Global Warming of 1.5°C

An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.



Global warming of 1.5°C

*A IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, **in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty***

Proposed outline (as adopted in October 2016; report to be finalized in 2018) :

- Summary for policy makers (max 10 pages)
- Chapters :
 - ▶ 1. Framing and context
 - ▶ 2. Mitigation pathways compatible with 1.5°C in the context of sustainable development
 - ▶ 3. Impacts of 1.5°C global warming on natural and human systems
 - ▶ 4. Strengthening and implementing the global response to the threat of climate change
 - ▶ 5. Sustainable development, poverty eradication and reducing inequalities
- Boxes (integrated case studies/regional and cross-cutting themes),
- FAQs (10 pages)

The report in numbers

91 Authors from 40 Countries

133 Contributing authors

6000 Studies

1 113 Reviewers

42 001 Comments

Impacts of global warming 1.5°C

At 1.5°C compared to 2°C:

- Less extreme weather where people live, including extreme heat and rainfall
- By 2100, global mean sea level rise will be around 10 cm lower
- 10 million fewer people exposed to risk of rising seas

Impacts of global warming 1.5°C

At 1.5°C compared to 2°C:

- Lower impact on biodiversity and species
- Smaller reductions in yields of maize, rice, wheat
- Global population exposed to water shortages up to 50% less

Impacts of global warming 1.5°C

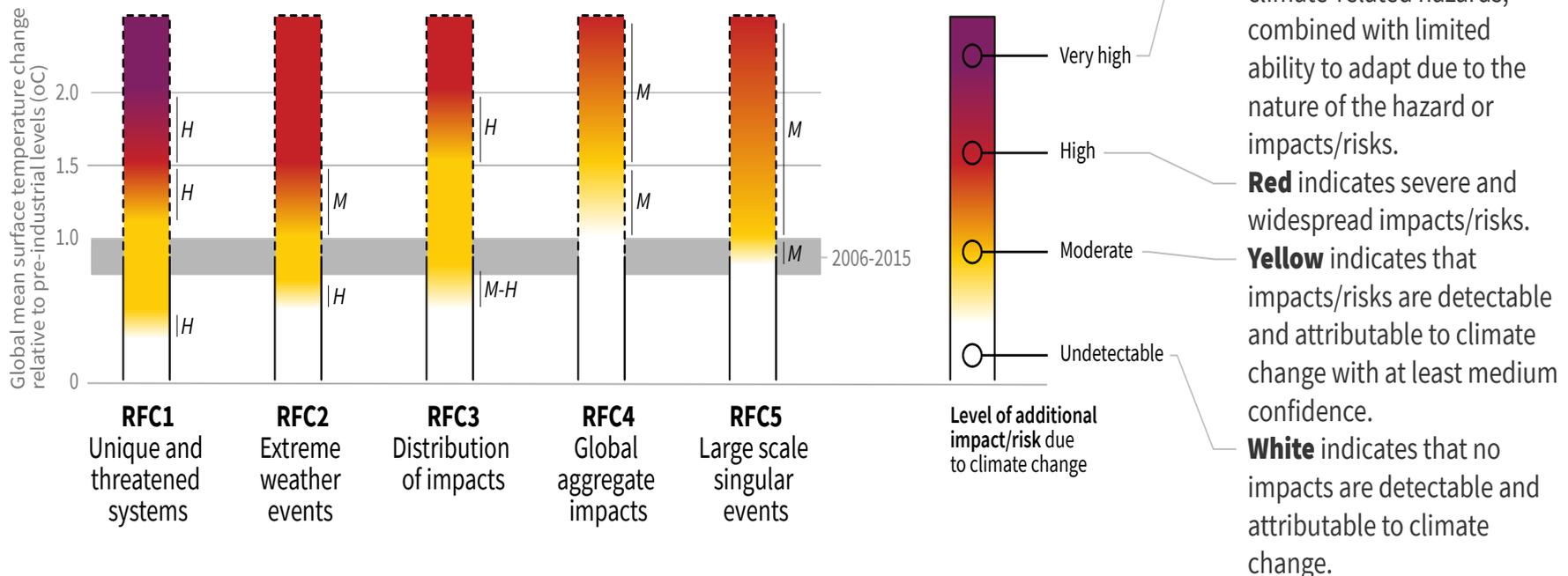
At 1.5°C compared to 2°C:

- Lower risk to fisheries & the livelihoods that depend on them
- Up to several hundred million fewer people exposed to climate-related risk and susceptible to poverty by 2050

How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed and human systems

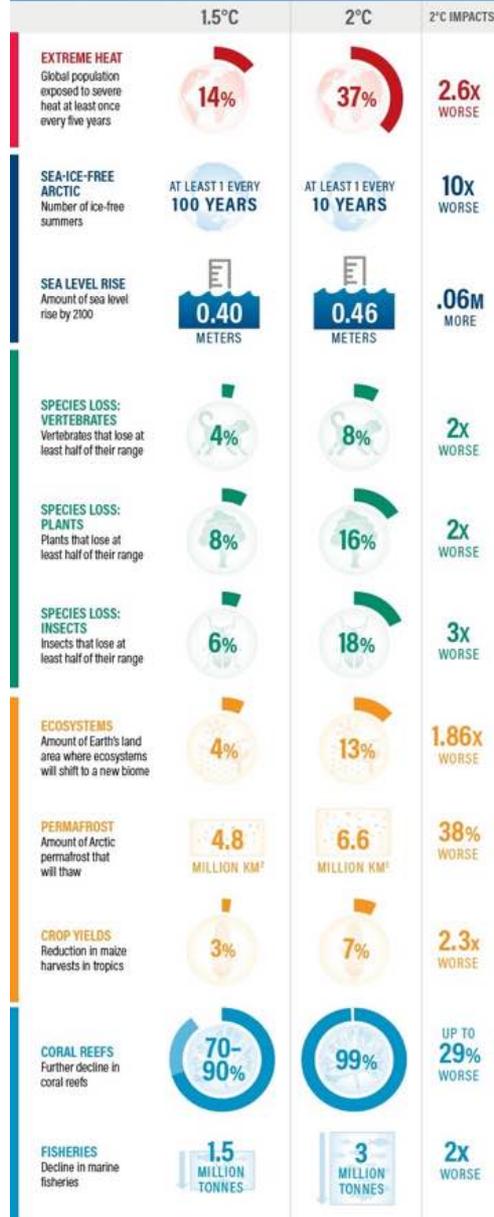
Five Reasons For Concern (RFCs) illustrate the impacts and risks of different levels of global warming for people, economies and ecosystems across sectors and regions.

Impacts and risks associated with the Reasons for Concern (RFCs)



HALF A DEGREE OF WARMING MAKES A BIG DIFFERENCE:

EXPLAINING IPCC'S 1.5°C SPECIAL REPORT



Responsibility for content: WRI



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Responsibility for content: WRI

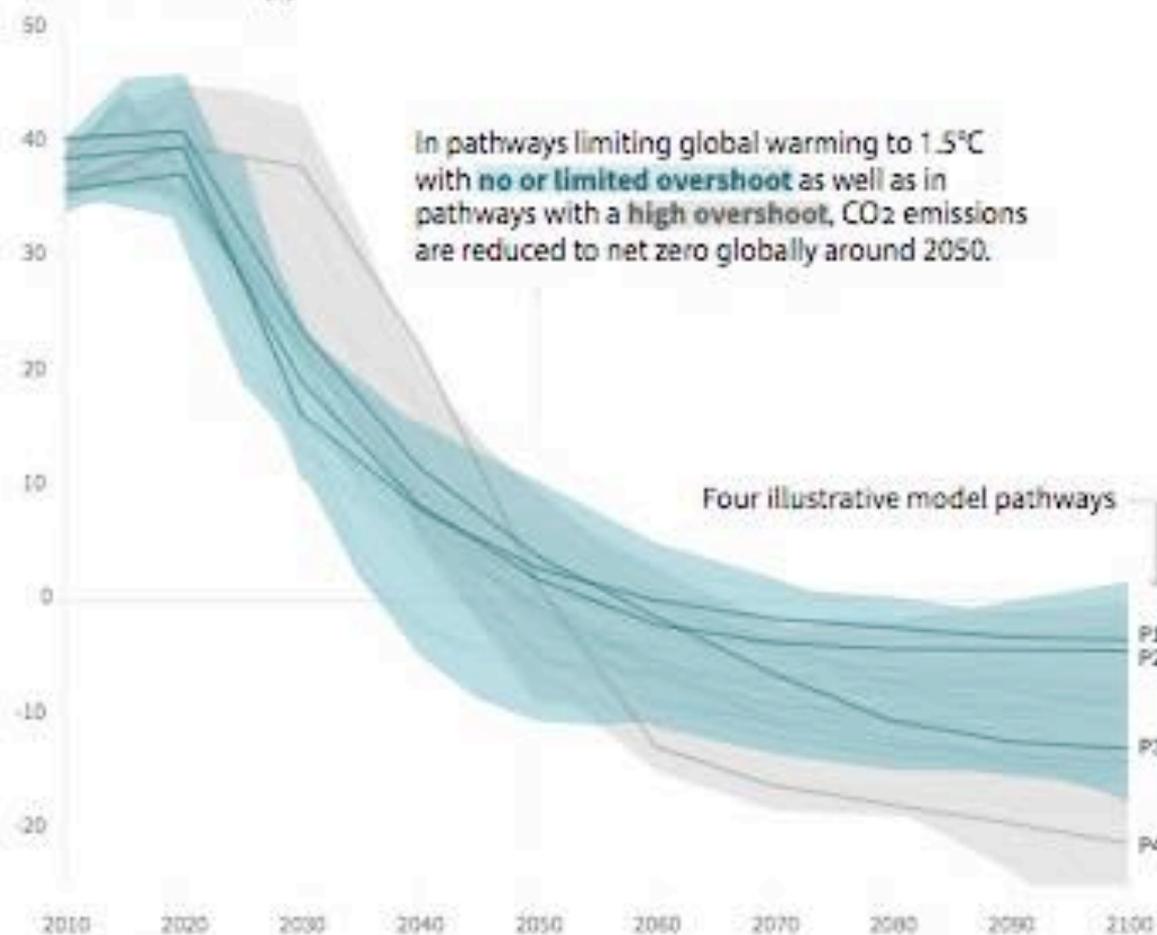
	1.5°C	2°C	2°C IMPACTS
<p>EXTREME HEAT Global population exposed to severe heat at least once every five years</p>	 14%	 37%	2.6x WORSE
<p>SEA-ICE-FREE ARCTIC Number of ice-free summers</p>	 AT LEAST 1 EVERY 100 YEARS	 AT LEAST 1 EVERY 10 YEARS	10x WORSE
<p>SEA LEVEL RISE Amount of sea level rise by 2100</p>	 0.40 METERS	 0.46 METERS	.06M MORE

Greenhouse gas emissions pathways

- To limit warming to 1.5° C, CO₂ emissions fall by about 45% by 2030 (from 2010 levels)
 - Compared to 20% for 2° C
- To limit warming to 1.5° C, CO₂ emissions would need to reach 'net zero' around 2050
 - Compared to around 2075 for 2° C
- Reducing non-CO₂ emissions would have direct and immediate health benefits

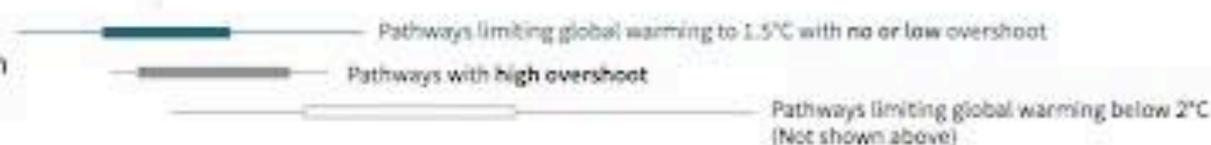
Global total net CO₂ emissions

Billion tonnes of CO₂/yr



Timing of net zero CO₂

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

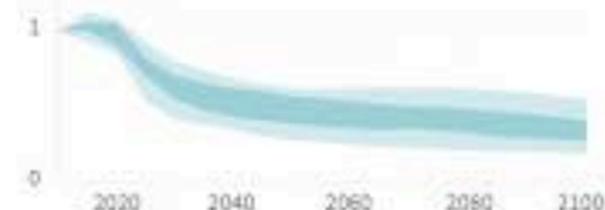


Source: IPCC Special Report on Global Warming of 1.5°C

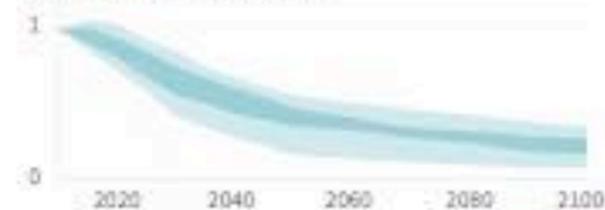
Non-CO₂ emissions relative to 2010

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.

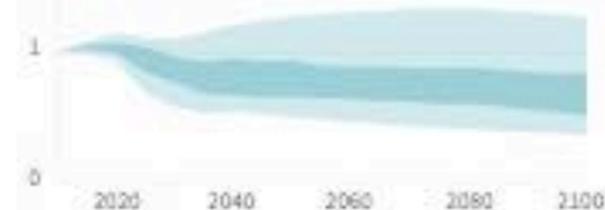
Methane emissions



Black carbon emissions



Nitrous oxide emissions



Greenhouse gas emissions pathways

- Limiting warming to 1.5° C would require changes on an unprecedented scale
 - Deep emissions cuts in all sectors
 - A range of technologies
 - Behavioural changes
 - Increase investment in low carbon options

Greenhouse gas emissions pathways

- Progress in renewables would need to mirrored in other sectors
- We would need to start taking carbon dioxide out of the atmosphere (Afforestation or other techniques)
- Implications for food security, ecosystems and biodiversity

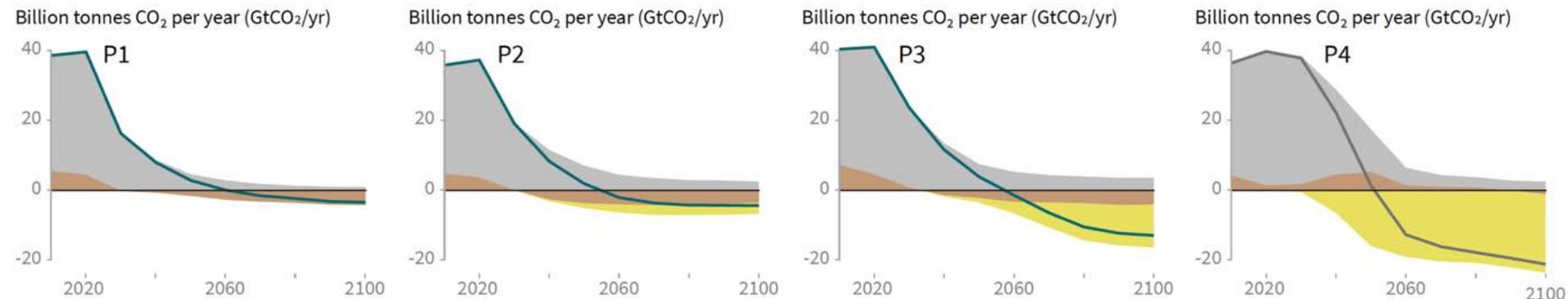
Greenhouse gas emissions pathways

- National pledges are not enough to limit warming to 1.5° C
- Avoiding warming of more than 1.5° C would require carbon dioxide emissions to decline substantially before 2030

Four illustrative model pathways in the IPCC SR15:

Breakdown of contributions to global net CO₂ emissions in four illustrative model pathways

● Fossil fuel and industry ● AFOLU ● BECCS



P1: A scenario in which social, business, and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A down-sized energy system enables rapid decarbonisation of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

P4: A resource and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

Four illustrative model pathways in the IPCC SR15:

Global indicators	P1	P2	P3	P4	Interquartile range
Pathway classification	No or low overshoot	No or low overshoot	No or low overshoot	High overshoot	No or low overshoot
CO ₂ emission change in 2030 (% rel to 2010)	-58	-47	-41	4	(-59,-40)
↳ in 2050 (% rel to 2010)	-93	-95	-91	-97	(-104,-91)
Kyoto-GHG emissions* in 2030 (% rel to 2010)	-50	-49	-35	-2	(-55,-38)
↳ in 2050 (% rel to 2010)	-82	-89	-78	-80	(-93,-81)
Final energy demand** in 2030 (% rel to 2010)	-15	-5	17	39	(-12, 7)
↳ in 2050 (% rel to 2010)	-32	2	21	44	(-11, 22)
Renewable share in electricity in 2030 (%)	60	58	48	25	(47, 65)
↳ in 2050 (%)	77	81	63	70	(69, 87)
Primary energy from coal in 2030 (% rel to 2010)	-78	-61	-75	-59	(-78, -59)
↳ in 2050 (% rel to 2010)	-97	-77	-73	-97	(-95, -74)
from oil in 2030 (% rel to 2010)	-37	-13	-3	86	(-34,3)
↳ in 2050 (% rel to 2010)	-87	-50	-81	-32	(-78,-31)
from gas in 2030 (% rel to 2010)	-25	-20	33	37	(-26,21)
↳ in 2050 (% rel to 2010)	-74	-53	21	-48	(-56,6)
from nuclear in 2030 (% rel to 2010)	59	83	98	106	(44,102)
↳ in 2050 (% rel to 2010)	150	98	501	468	(91,190)
from biomass in 2030 (% rel to 2010)	-11	0	36	-1	(29,80)
↳ in 2050 (% rel to 2010)	-16	49	121	418	(123,261)
from non-biomass renewables in 2030 (% rel to 2010)	430	470	315	110	(243,438)
↳ in 2050 (% rel to 2010)	832	1327	878	1137	(575,1300)
Cumulative CCS until 2100 (GtCO ₂)	0	348	687	1218	(550, 1017)
↳ of which BECCS (GtCO ₂)	0	151	414	1191	(364, 662)
Land area of bioenergy crops in 2050 (million hectare)	22	93	283	724	(151, 320)
Agricultural CH ₄ emissions in 2030 (% rel to 2010)	-24	-48	1	14	(-30,-11)
in 2050 (% rel to 2010)	-33	-69	-23	2	(-46,-23)
Agricultural N ₂ O emissions in 2030 (% rel to 2010)	5	-26	15	3	(-21,4)
in 2050 (% rel to 2010)	6	-26	0	39	(-26,1)

NOTE: Indicators have been selected to show global trends identified by the Chapter 2 assessment. National and sectoral characteristics can differ substantially from the global trends shown above.

* Kyoto-gas emissions are based on SAR GWP-100

** Changes in energy demand are associated with improvements in energy efficiency and behaviour change

For 3 illustrative model pathways that limit warming with no or limited overshoot

	P1	P2	P3
CO ₂ (%rel to 2010) (2030/2050)	-58 / - 93	-47 / -95	-41 / -91
Final energy demand (%rel to 2010) (2030/2050)	-15 / -32	-5 / +2	+17 / +21
Primary energy from coal (%rel to 2010) (2030/2050)	-78/-97	-61/-77	-75/-73
Primary energy from non-biomass renewables (%rel to 2010) (2030/2050)	+430/+832	+470/+1327	+315/+878

IPCC SR15
Fig SPM 3b

Solar Radiation Modification (SRM)

Solar radiation modification (SRM) measures are not included in any of the available assessed pathways. Although some SRM measures may be theoretically effective in reducing an overshoot, they face **large uncertainties and knowledge gaps** as well as **substantial risks**, institutional and social constraints to deployment related to governance, ethics, and impacts on sustainable development. They also **do not mitigate ocean acidification**.

Climate change and people

- Close links to United Nations Sustainable Development Goals (SDGs)
- Mix of measures to adapt to climate change and reduce emissions can have benefits for SDGs
- National and sub-national authorities, civil society, the private sector, indigenous peoples and local communities can support ambitious action
- International cooperation is a critical part of limiting warming to 1.5°C



SUSTAINABLE DEVELOPMENT GOALS



Indicative linkages between mitigation options and sustainable development using SDGs (The linkages do not show costs and benefits)

Mitigation options deployed in each sector can be associated with potential positive effects (synergies) or negative effects (trade-offs) with the Sustainable Development Goals (SDGs). The degree to which this potential is realized will depend on the selected portfolio of mitigation options, mitigation policy design, and local circumstances and context. Particularly in the energy-demand sector, the potential for synergies is larger than for trade-offs. The bars group individually assessed options by level of confidence and take into account the relative strength of the assessed mitigation-SDG connections.

Length shows strength of connection

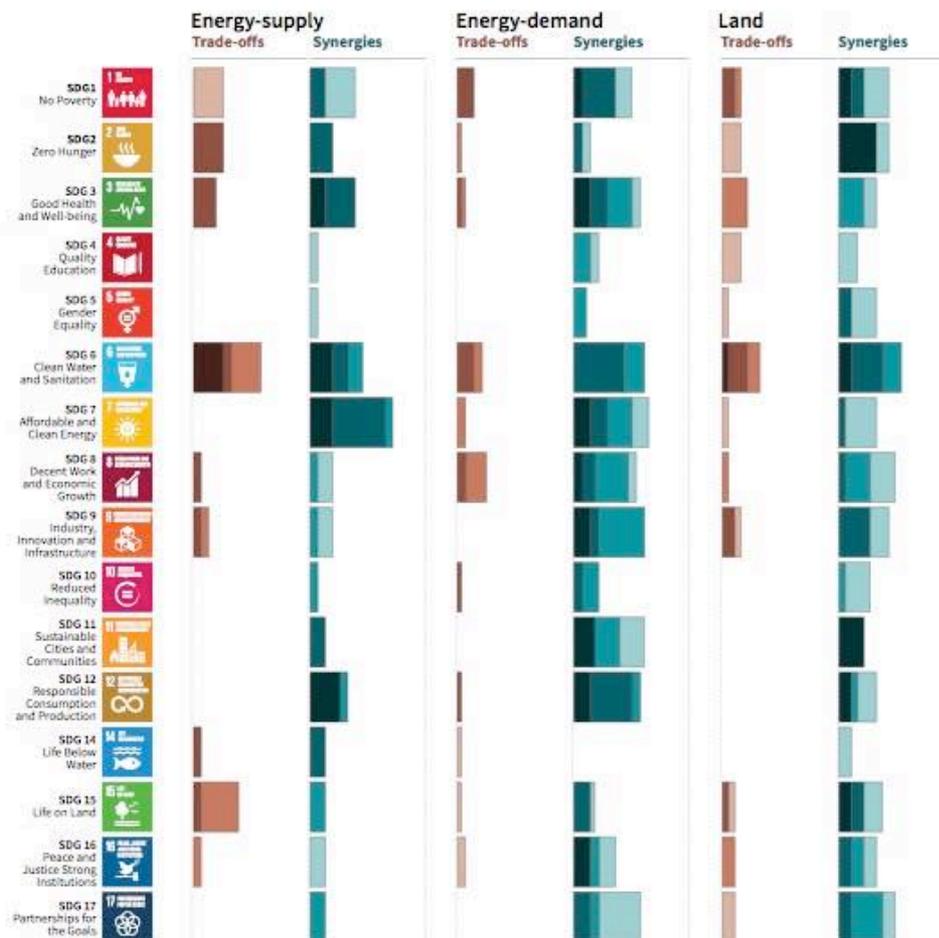


The overall size of the coloured bars depict the relative strength of synergies and trade-offs between the sectoral mitigation options and the SDGs.

Shades show level of confidence



The shades depict the level of confidence of the assessed potential for Trade-offs/Synergies.



**Example of Synergies:
Combustion of fossil fuels,
wood, and biomass also cause
air pollution, which kills 7
million people per year (World Health
Organization, 2018)**

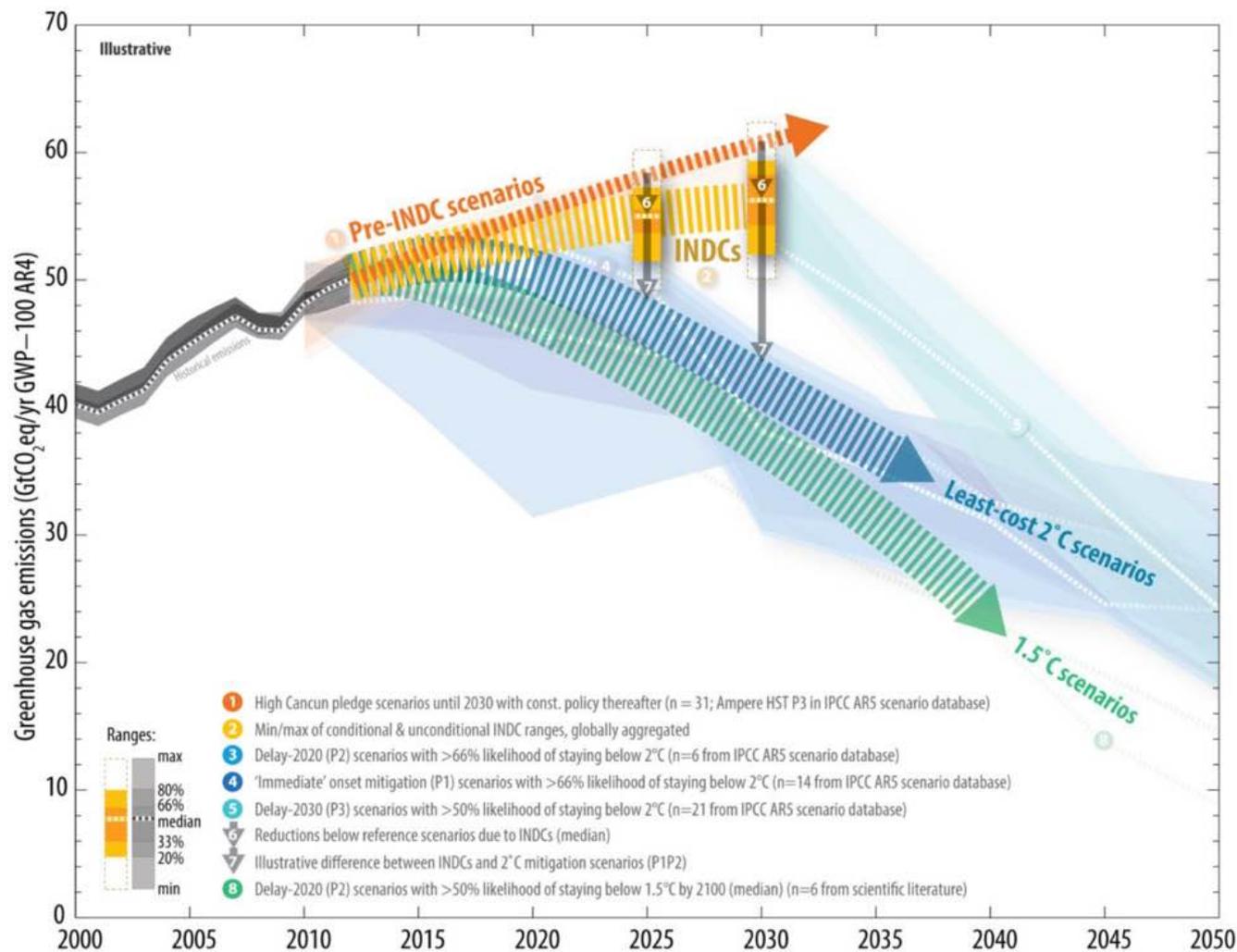
**Opportunity: Addressing the causes of
climate change can also improve air
quality and wellbeing**

Children are particularly sensitive to air pollution



Photo: Indiatoday.in, 6-12-2017

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>

The IPCC 1.5°C Special Report in short:

- Each half degree matters
- Each year counts
- Each decision matters
- Yes, we can (together), but much more political will is needed



Joel Pett, USA Today

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
- **Twitter: @JPvanYpersele**
@IPCC_CH