

The climate change challenge: Will technology solve it alone?

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« ORI.be Conference 2019 », Brussels, 14 June 2019

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

Blog: Technology alone will not solve climate change



By Kathleen Van Brempt, Member of the European Parliament, Committee for Industry, Research and Energy (ITRE)

In recent years, communities worldwide have realised that we cannot solely rely on technology to stem climate change. While many might think that climate and energy policy is strictly tied to technological solutions, the application of climate action initiatives has increasingly taken on a social and human element. When projects began with technical questions like “how many windows do we need to get our energy efficiency and renewables targets?”, they quickly became mainstreamed and personal ones such as “How do we refurbish our house?”

Technology

Technology alone cannot solve climate crisis, warns ING



Michael Holder

07 December 2018



World set to miss 2030 climate targets as new clean technologies take time to scale, warns ING

Technology could reduce today's global energy-related CO2 emissions by 64 per cent by 2050, but effective policies are urgently needed to ensure unintended climate impacts are avoided, new research by...

[Global Agenda](#)[Climate Change](#)[Environment and Natural Resource Security](#)[Emerging Technologies](#)

Technology can help solve the climate crisis – but it will need our help



How can tech companies influence consumers into making low-emission choices?

Image: REUTERS/Kim Kyung-Hoon

15 Sep 2018

Amy Luers

Executive Director, Future Earth

Tech giants are currently getting slammed over ethical issues. As their dominance in the global economy rises, so too do concerns about their influence, misuse of data and embedded biases in algorithms that control advertising and can influence elections, law enforcement and recruiting.

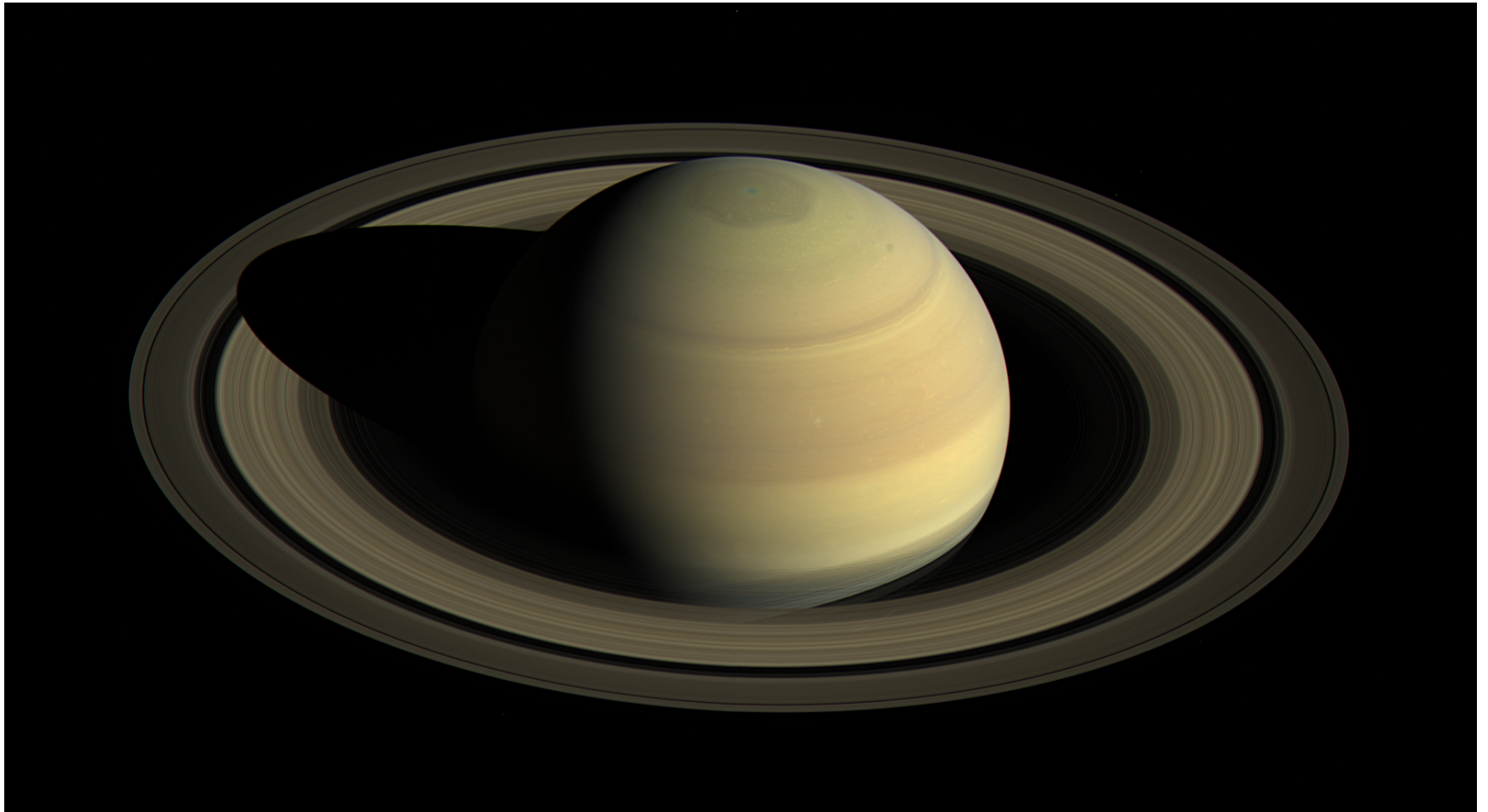
Amy Luers, Executive Director, Future Earth:

Technology alone will not solve the climate crisis. It will require greater climate leadership and much stronger policies. But tech is a necessary part of the solution – it is also a wildcard. As we say in our roadmap, the digital revolution can help determine whether we live on a 1.5-2°C planet or in a +3°C world. As the Fourth Industrial Revolution moves into hyperdrive in the next decade through artificial intelligence, robotics, cloud computing and the internet of things, to stay within the globally agreed 1.5-2°C climate limit this growth must be tied more closely to the climate challenge.

Source: www.weforum.org/agenda/2018/09/technology-alone-wont-solve-our-climate-future/

Reminder: There is no planet B

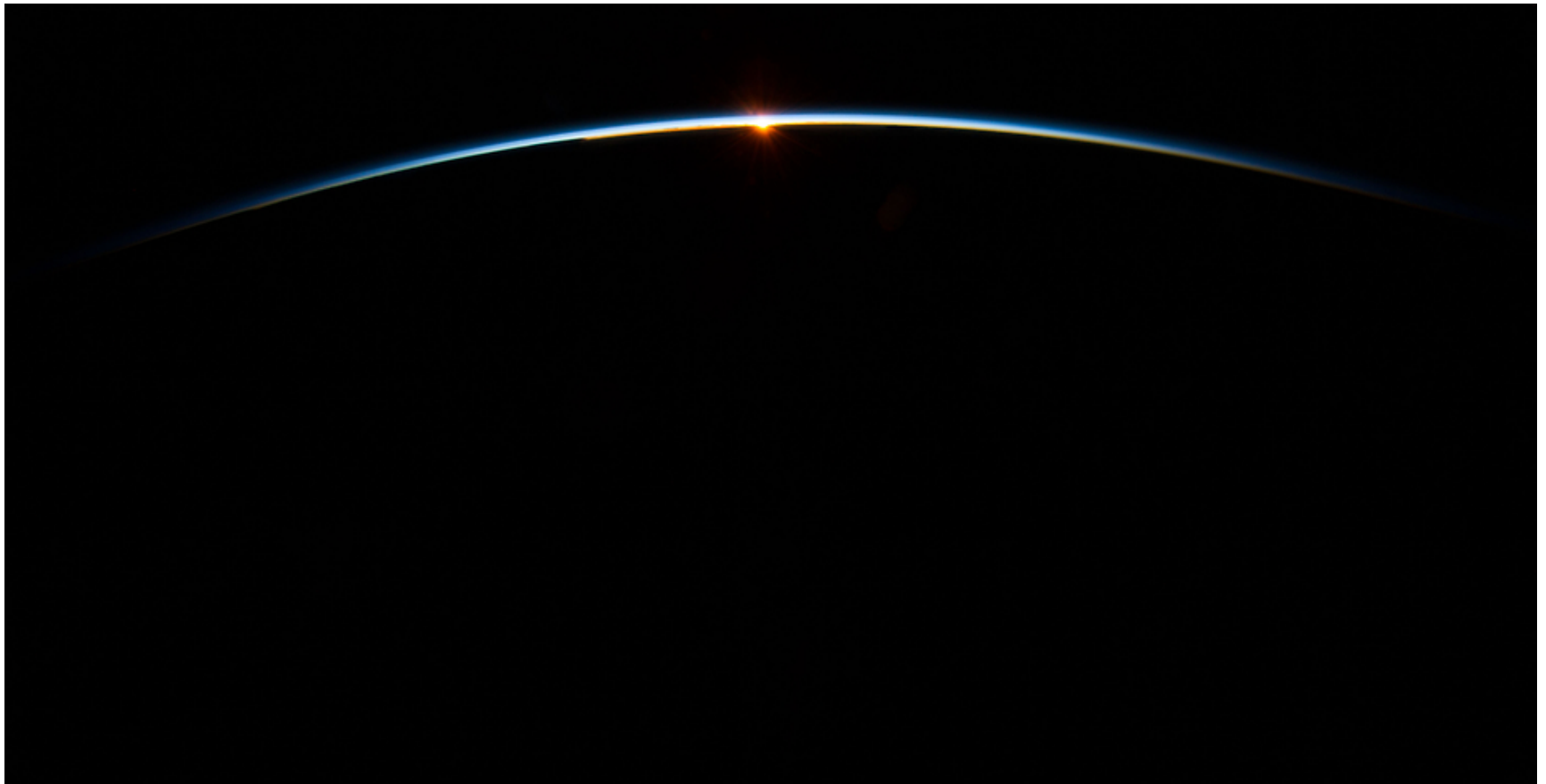
Saturn, as seen on 25-4-2016 from a 3 million km distance by the Cassini satellite launched in October 1997, 40 years after Sputnik



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)

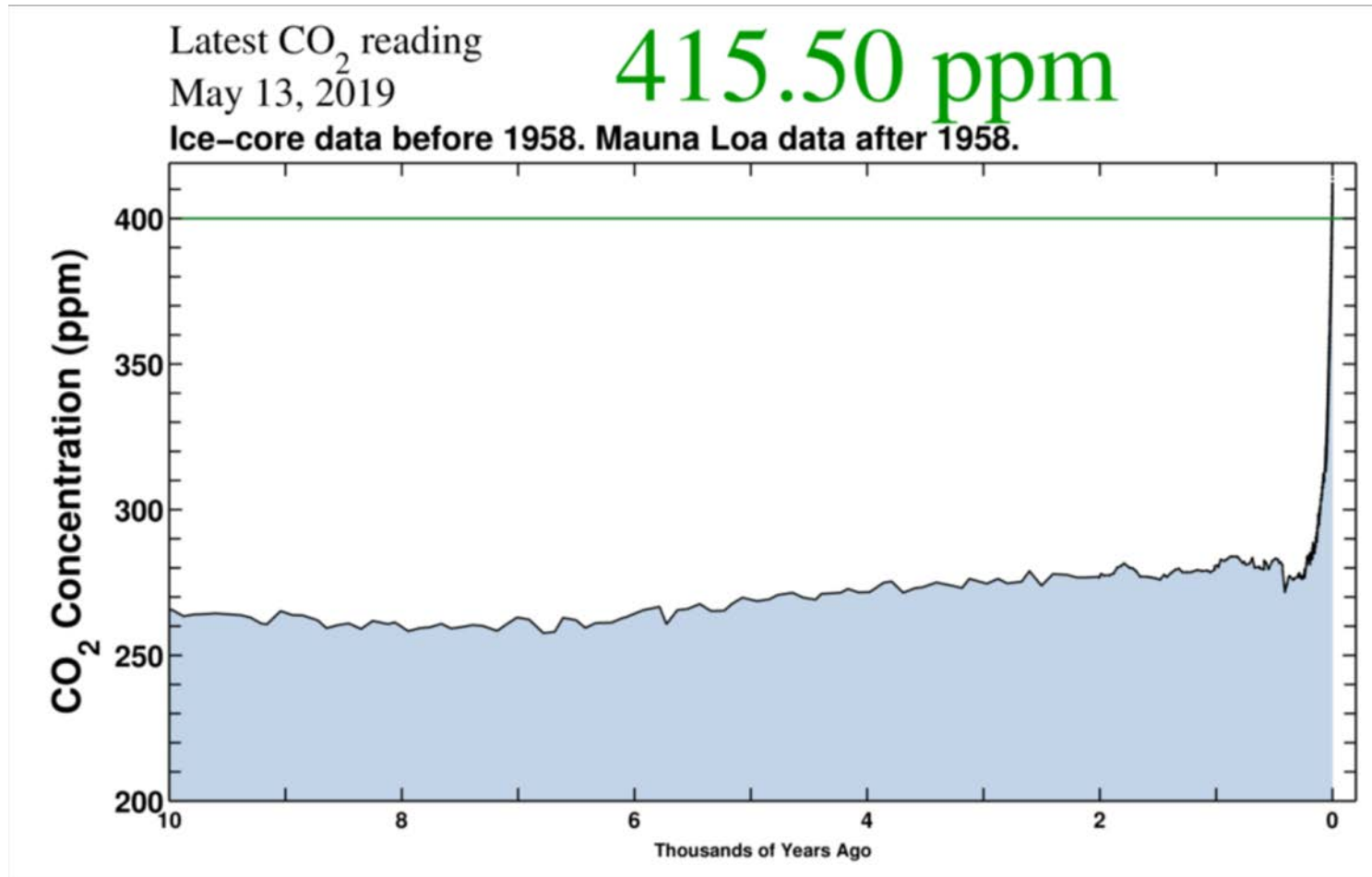


Jean-Pascal van Ypersele
(vanyp@climate.be)

Fact n° 1: Because we use the atmosphere as a dustbin for our greenhouse gases, we thicken the insulation layer around the planet

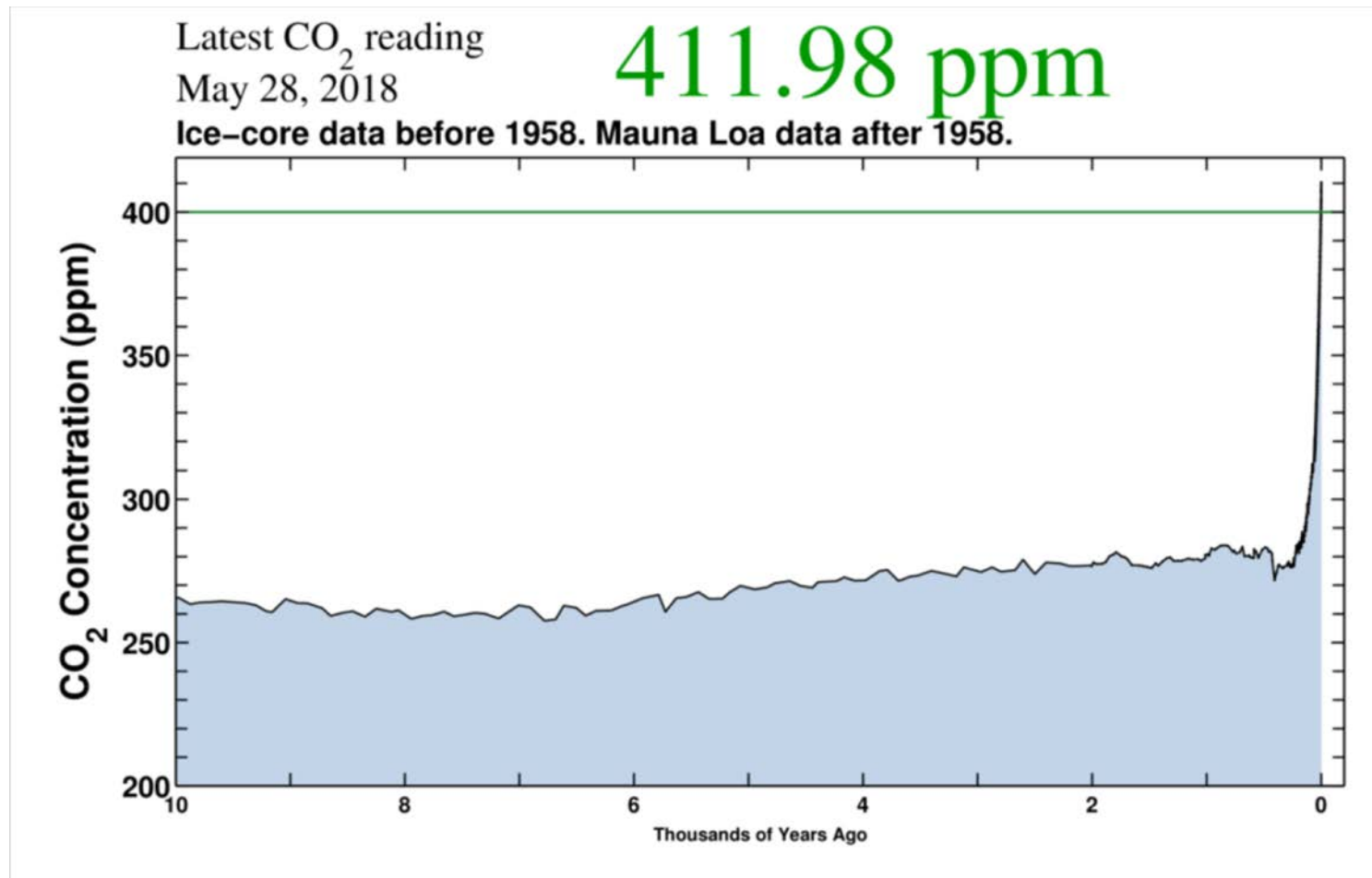
That is why we must cut emissions to ZERO as soon as possible

CO₂ Concentration, 13 May 2019 (Keeling curve)



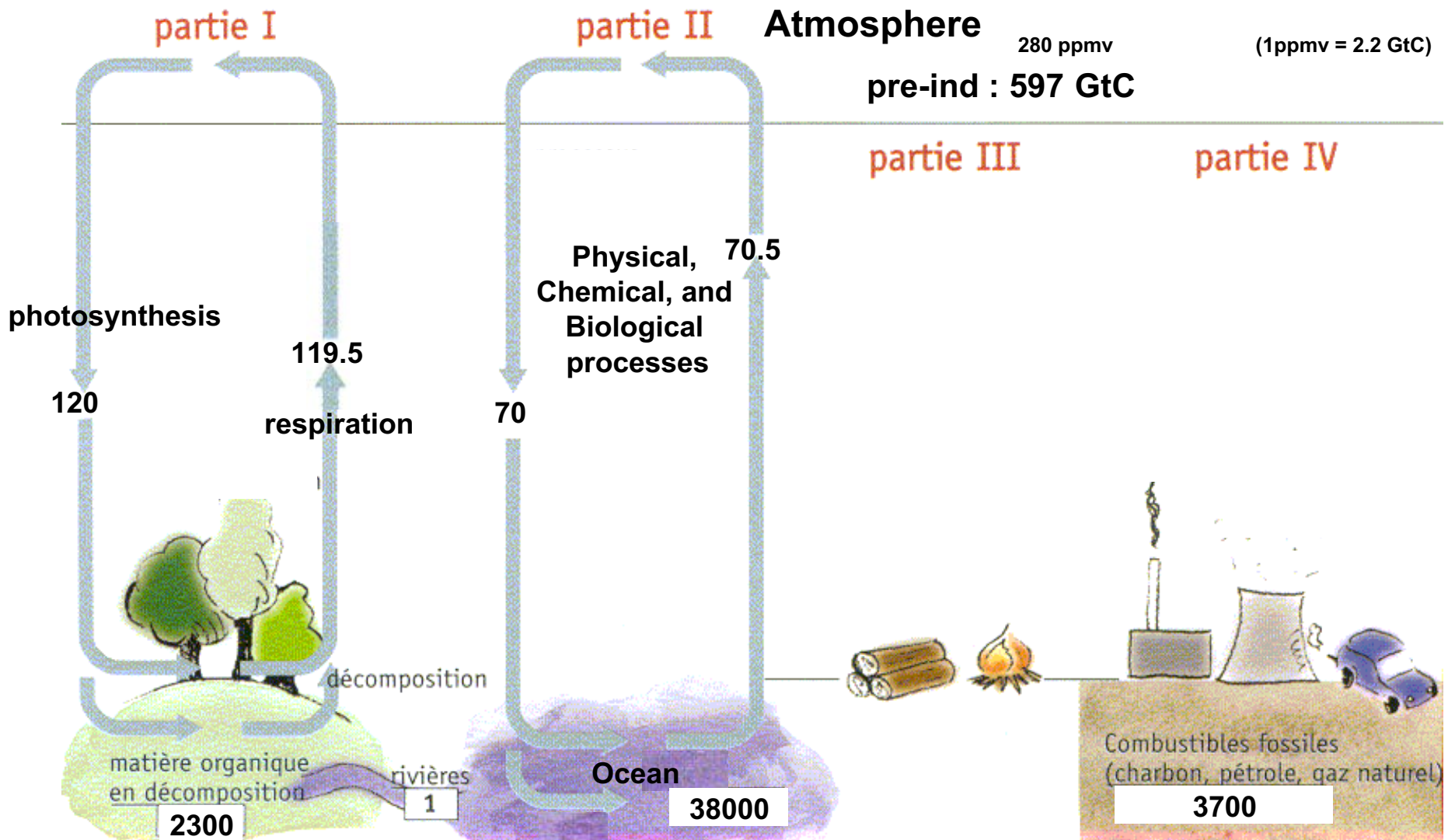
Source: scripps.ucsd.edu/programs/keelingcurve/

CO₂ Concentration, 28 May 2018 (Keeling curve)



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

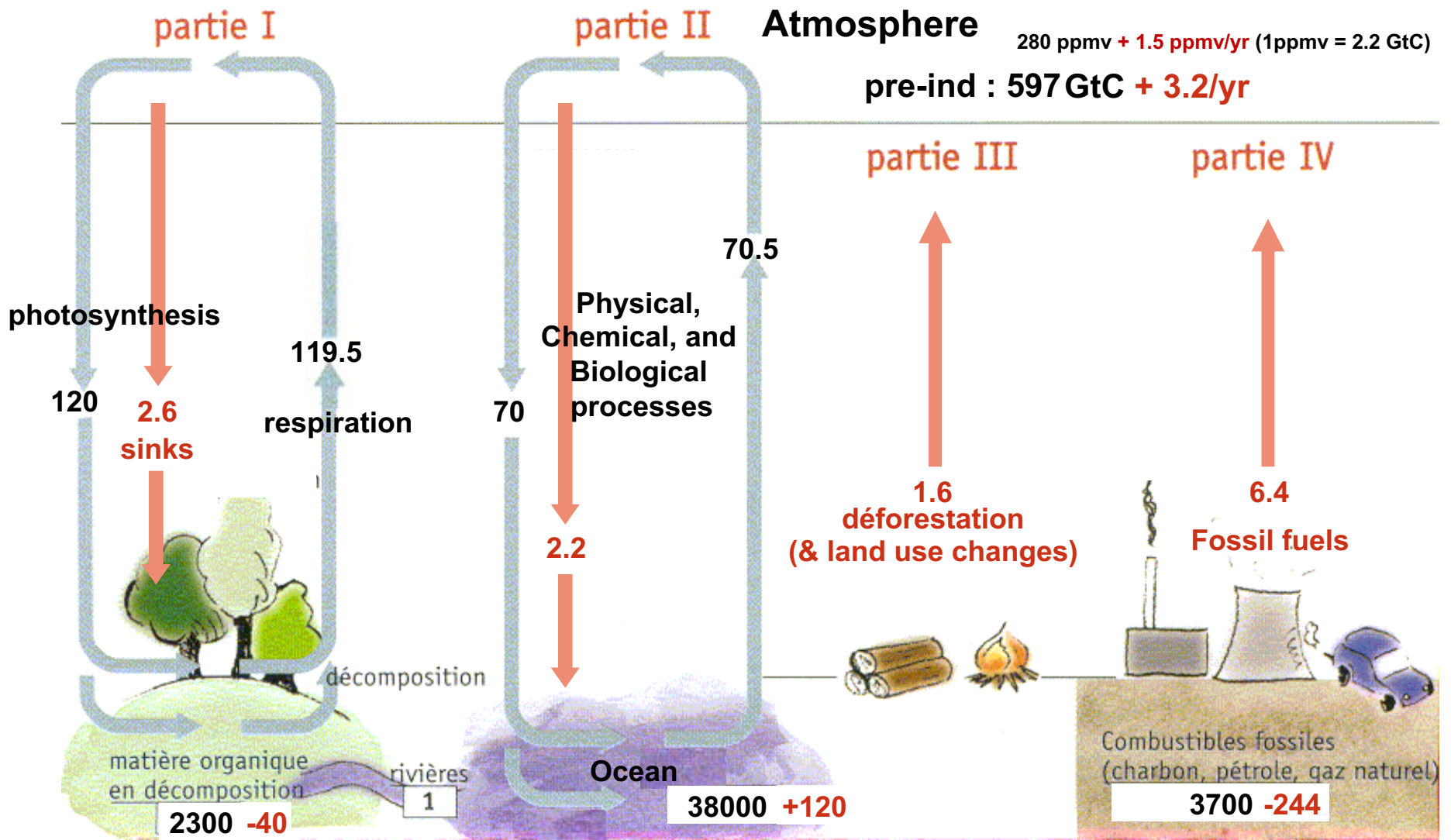
Carbon cycle: unperturbed fluxes



Units: GtC (billions tons of carbon) or GtC/year (multiply by 3.7 to get GtCO₂)

Carbon cycle: perturbed by human activities

(numbers for the decade 1990-1999s, based on IPCC AR4)



Stocks!

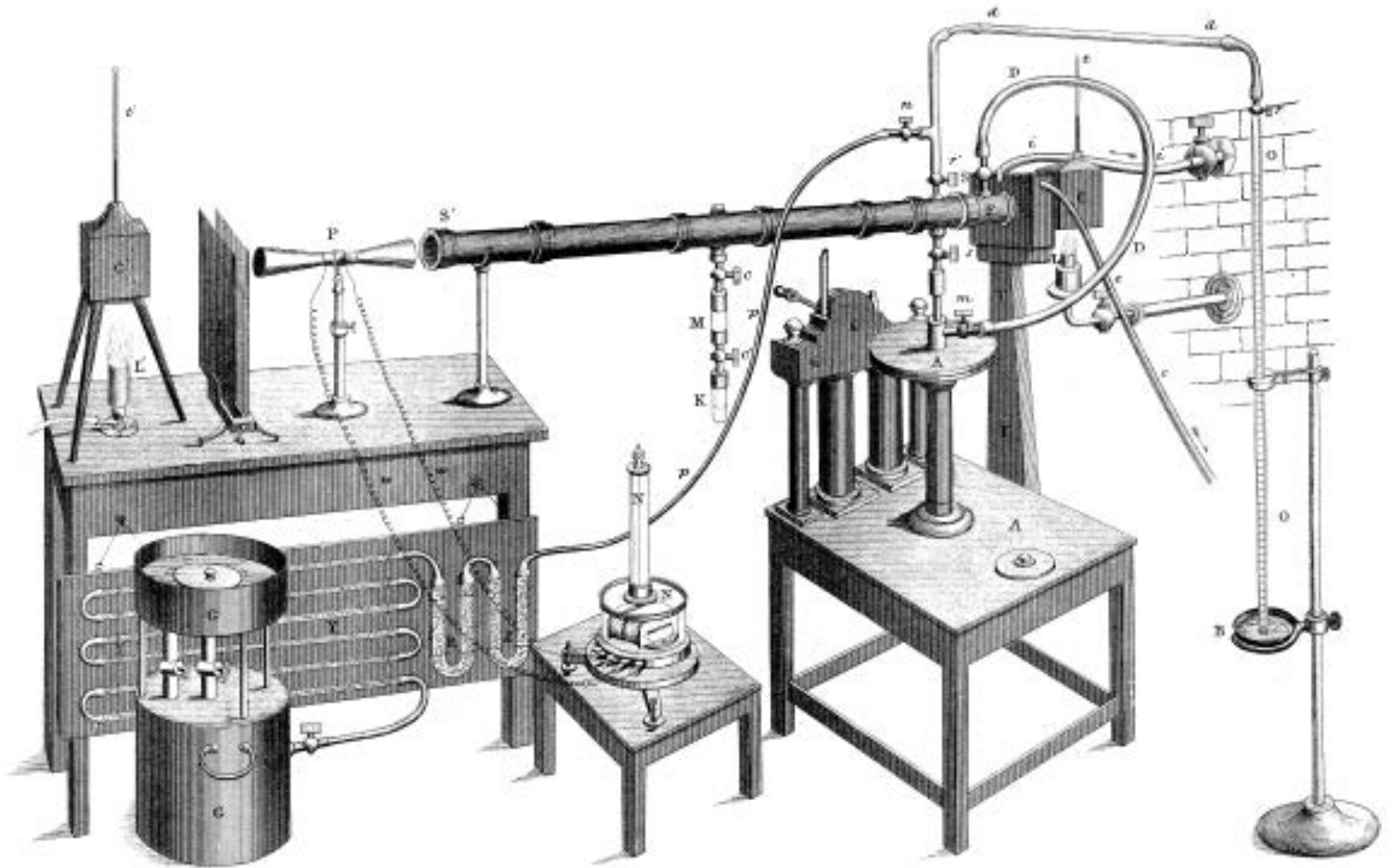
Units: GtC (billions tons of carbon) or GtC/year

Climatic Change: Are We on the Brink of a Pronounced Global Warming? (Broecker, 1975)

Table 1. Reconstruction and prediction of atmospheric CO₂ contents based on fuel consumption data.

Year	Chemical fuel CO ₂ ($\times 10^{16}$ g)	Excess atmospheric CO ₂ * ($\times 10^{16}$ g)	Excess atmospheric CO ₂ (%)	Excess atmospheric CO ₂ (ppm)	CO ₂ content of the atmosphere† (ppm)	Global temperature increase‡ (°C)
1900	3.8	1.9	0.9	2	295	0.02
1910	6.3	3.1	1.4	4	297	.04
1920	9.7	4.8	2.2	6	299	.07
1930	13.6	6.8	3.1	9	302	.09
1940	17.9	8.9	4.1	12	305	.11
1950	23.3	11.6	5.3	16	309	.15
1960	31.2	15.6	7.2	21	314§	.21
1970	44.0	22.0	10.2	29	322§	.29
1980	63	31	14	42	335	.42
1990	88	44	20	58	351	.58
2000	121	60	28	80	373	.80
2010	167	83	38	110	403	1.10

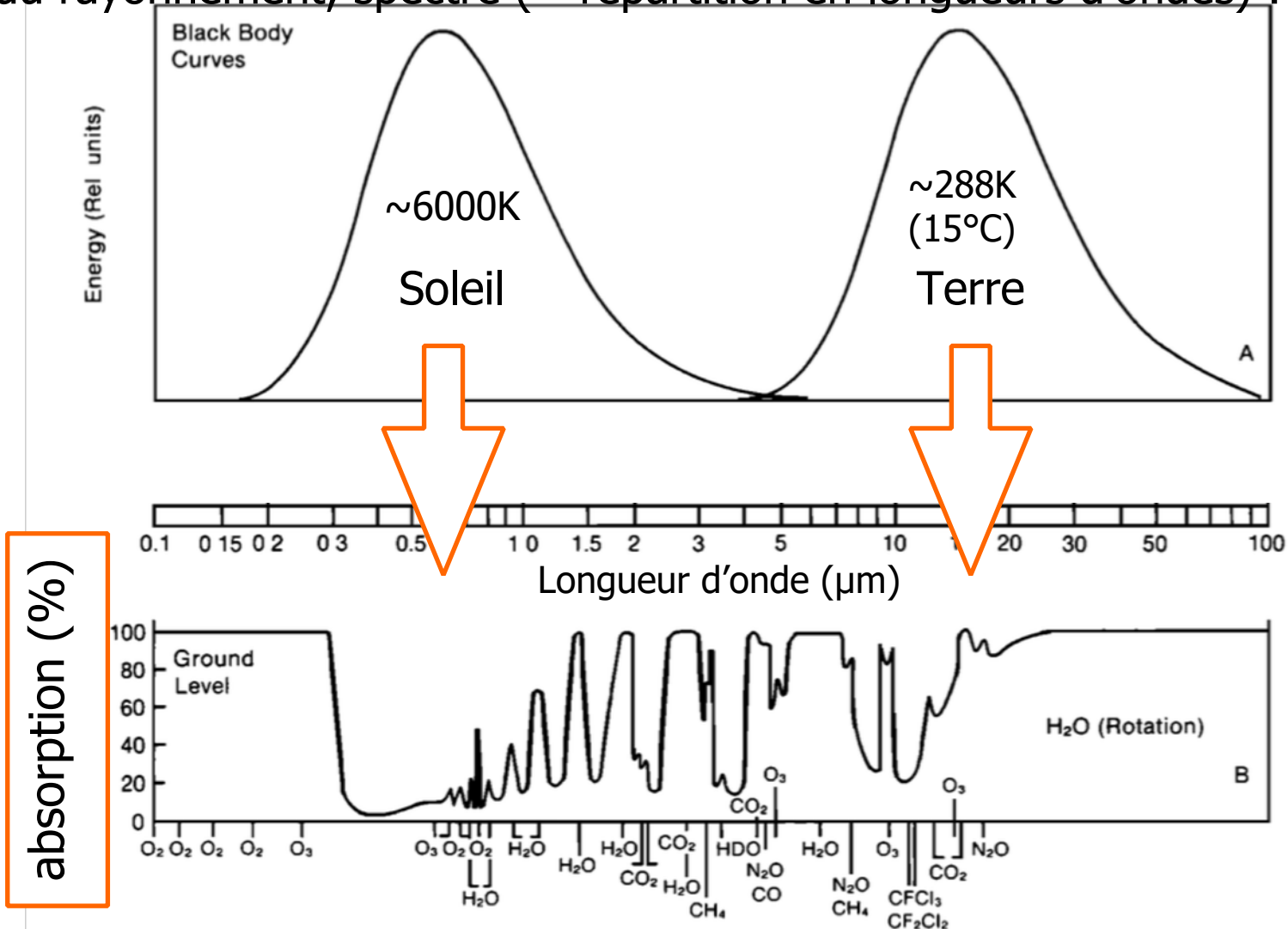
*On the assumption that 50 percent of the CO₂ produced by the burning of fuel remains in the atmosphere.
 †The preindustrial atmospheric partial pressure of CO₂ is assumed to be 293 ppm. ‡Assumes a 0.3°C global temperature increase for each 10 percent rise in the atmospheric CO₂ content. §Value observed on Hawaii for 1960, 314 ppm; value for 1970, 322 ppm (8). ||Post-1972 growth rate taken to be 3 percent per year.



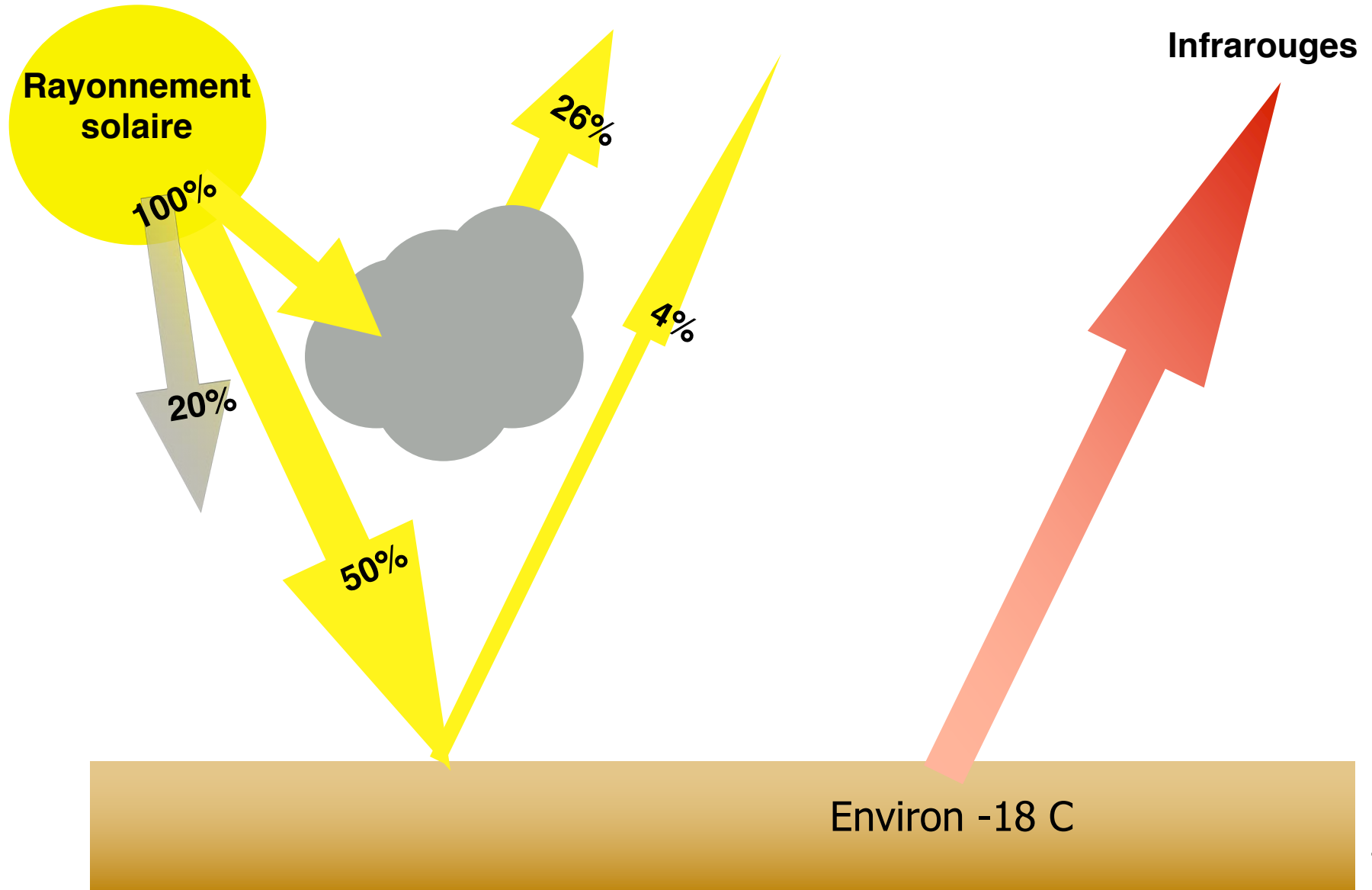
Tyndall (1861) mesure l'absorption du rayonnement par les gaz

Le rayonnement solaire passe largement l'atmosphère, mais l'infrarouge est largement absorbé

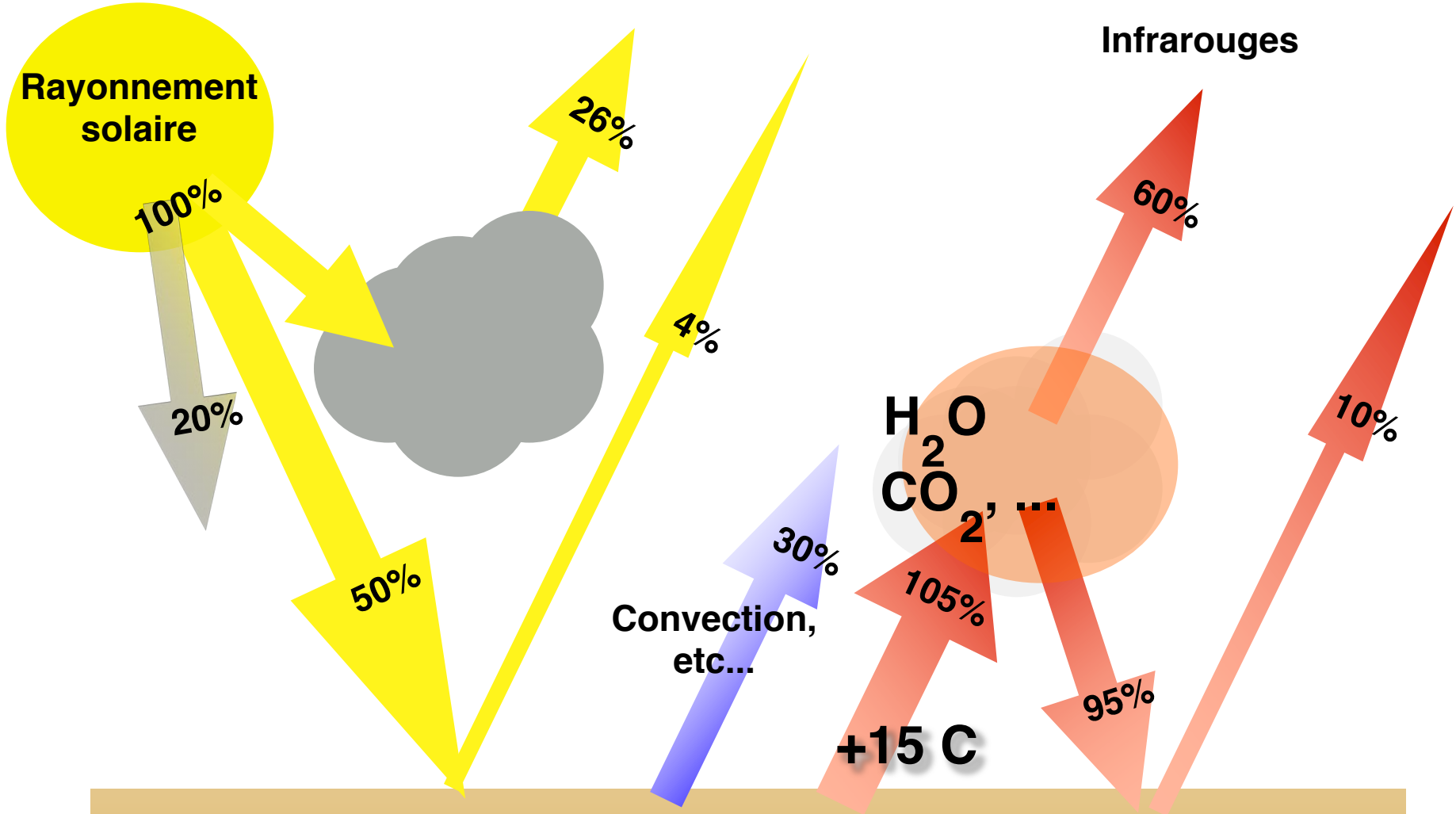
Source du rayonnement, spectre (= répartition en longueurs d'ondes) :



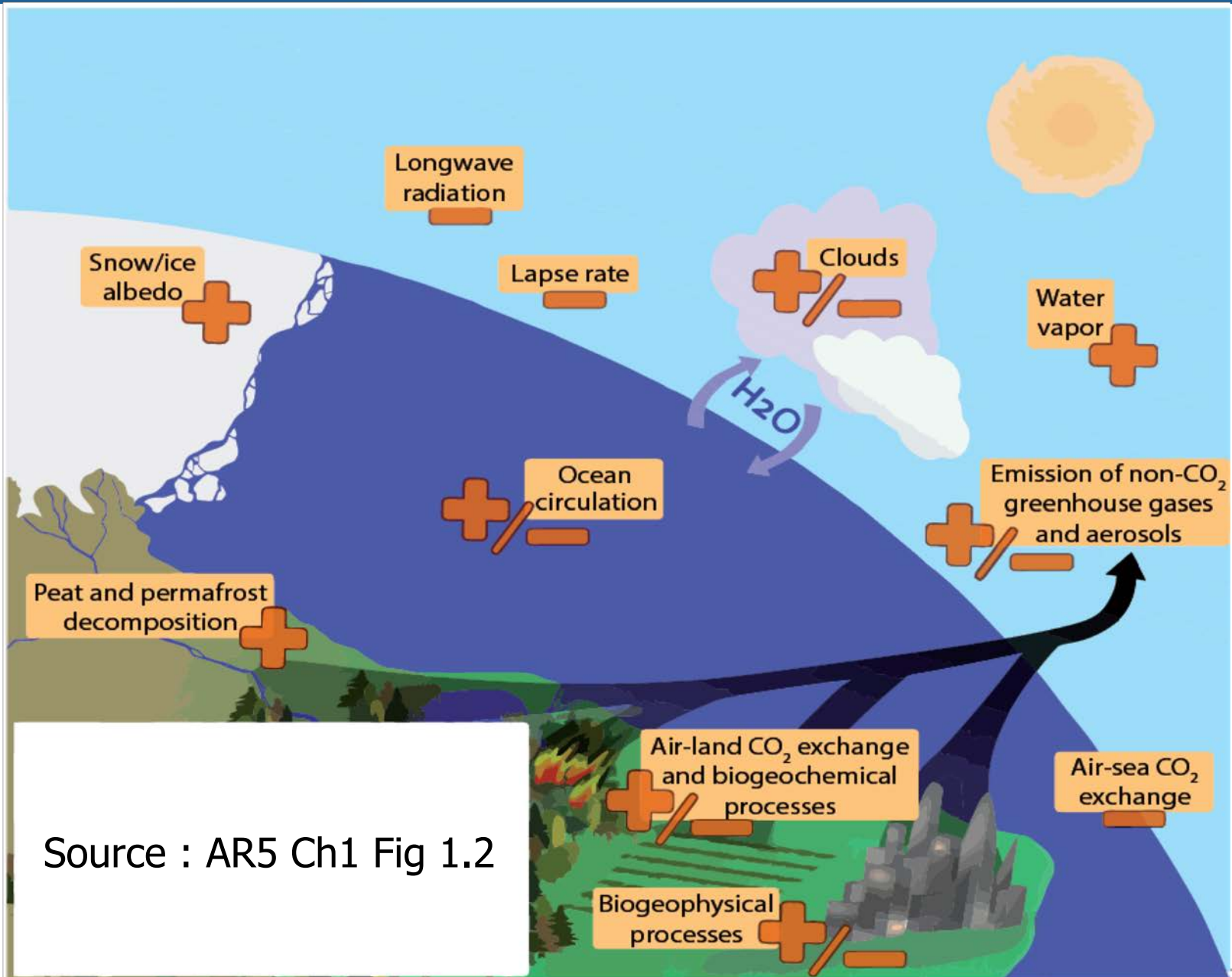
Energie et effet de serre



Energie et effet de serre



Synthesis of main climate feedbacks (IPCC AR5)



Modèles climatiques

Atmosphère et surface

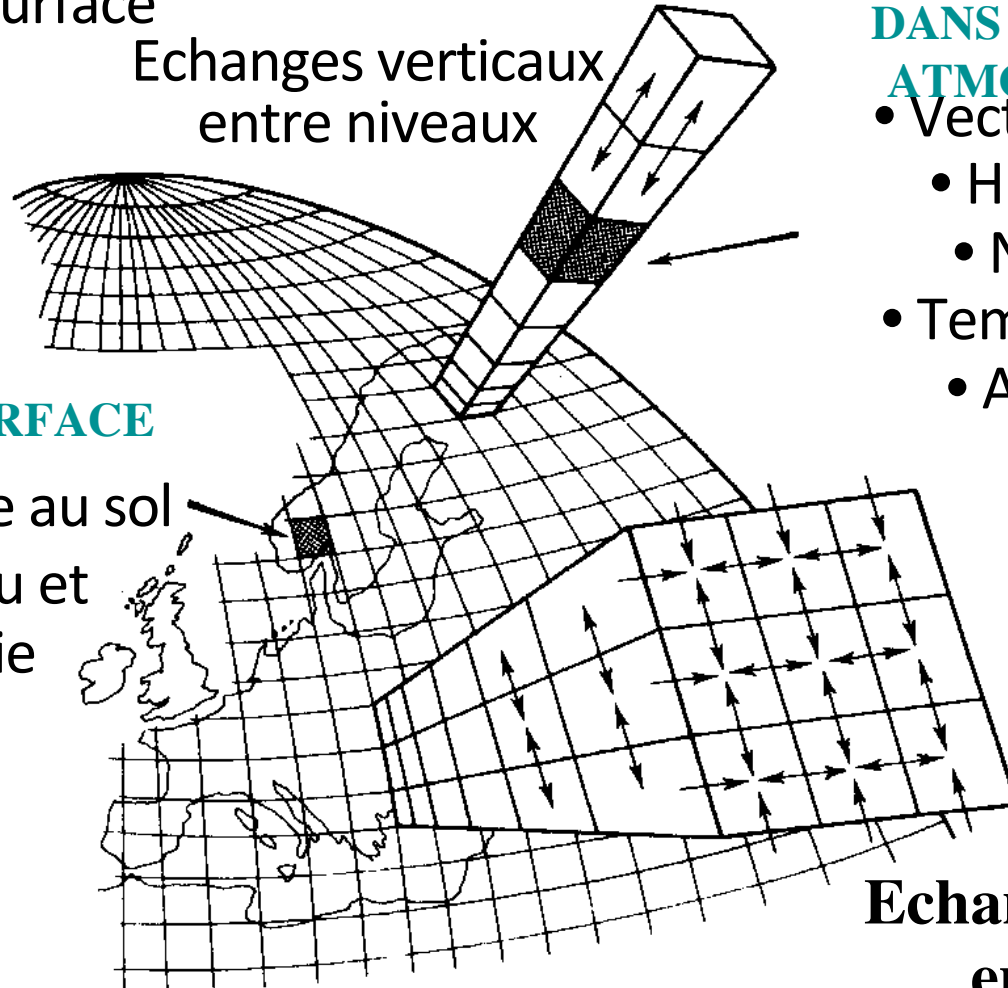
Echanges verticaux
entre niveaux

**DANS LA COLONNE
ATMOSPHERIQUE**

- Vecteurs vent
 - Humidité
 - Nuages
- Température
- Altitude

A LA SURFACE

- Température au sol
- Flux d'eau et d'énergie



**Echanges horizontaux
entre colonnes**

Résolution typique $\sim 2^\circ \times 2^\circ$ (modèle global, atmosphère)

Intervalle de temps typique : ≤ 30 minutes

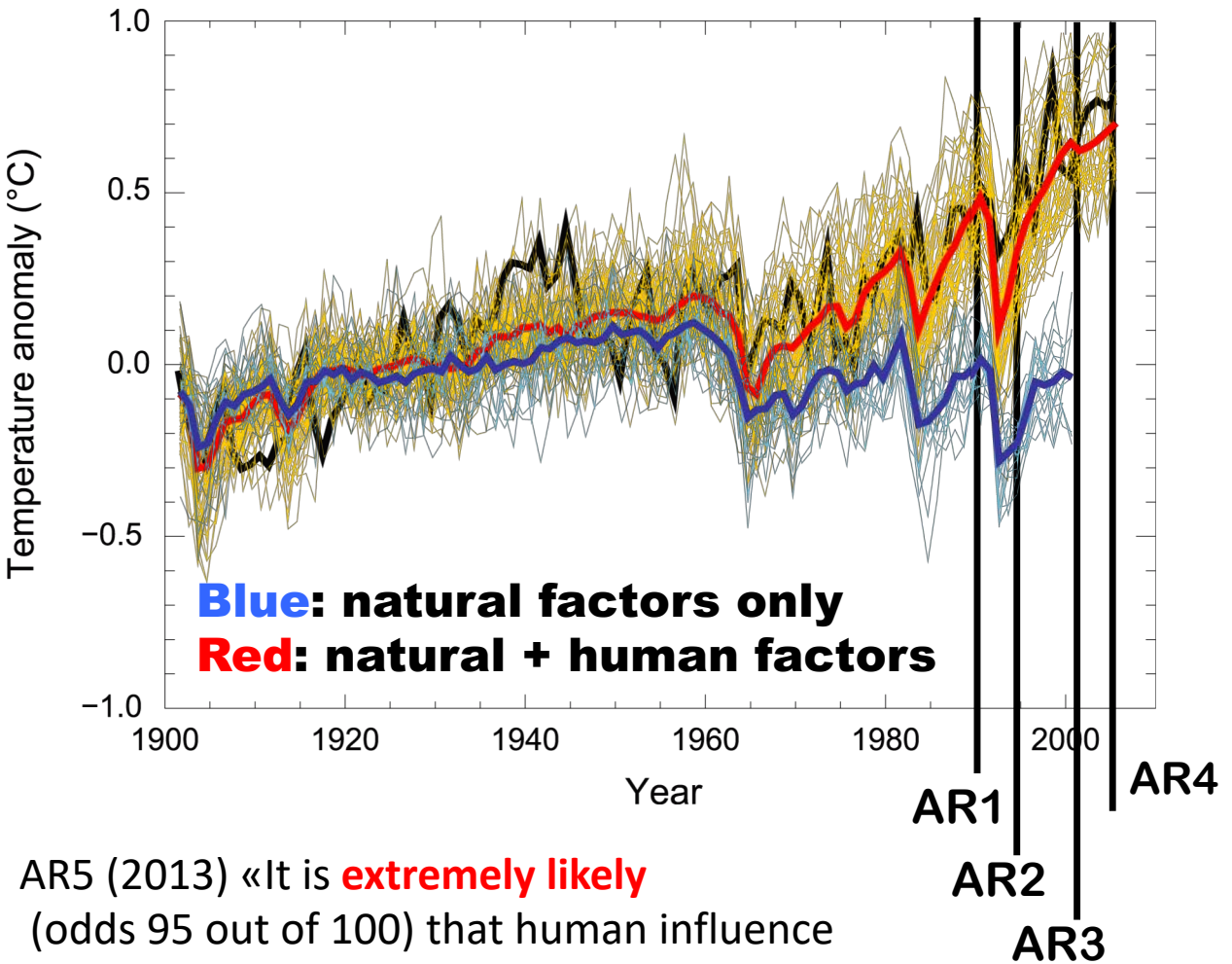
A Progression of Understanding: Greater and Greater Certainty in Attribution

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”

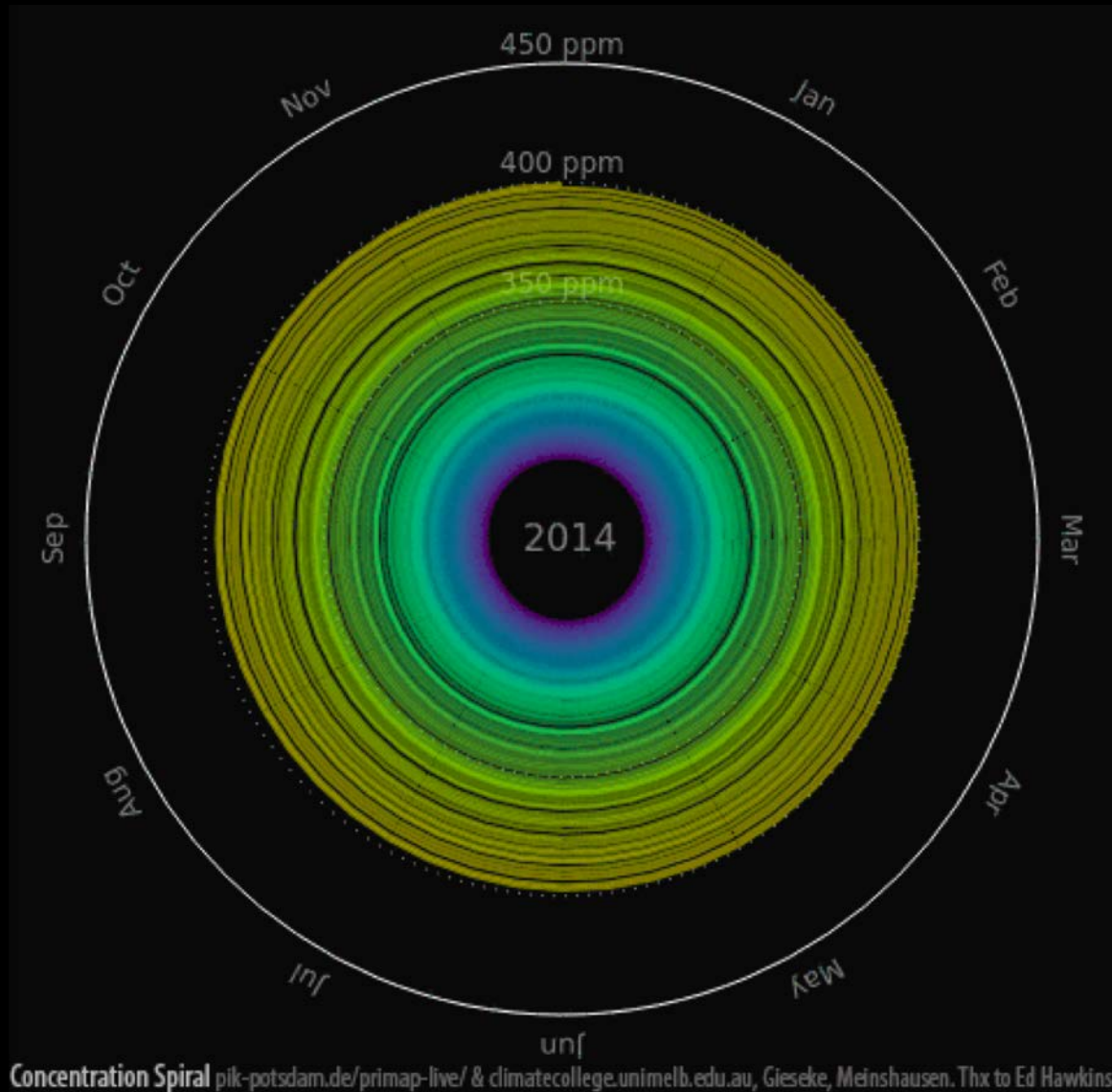
AR4 (2007): “most of
the warming is **very
likely** (odds 9 out of 10)
due to greenhouse
gases”



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

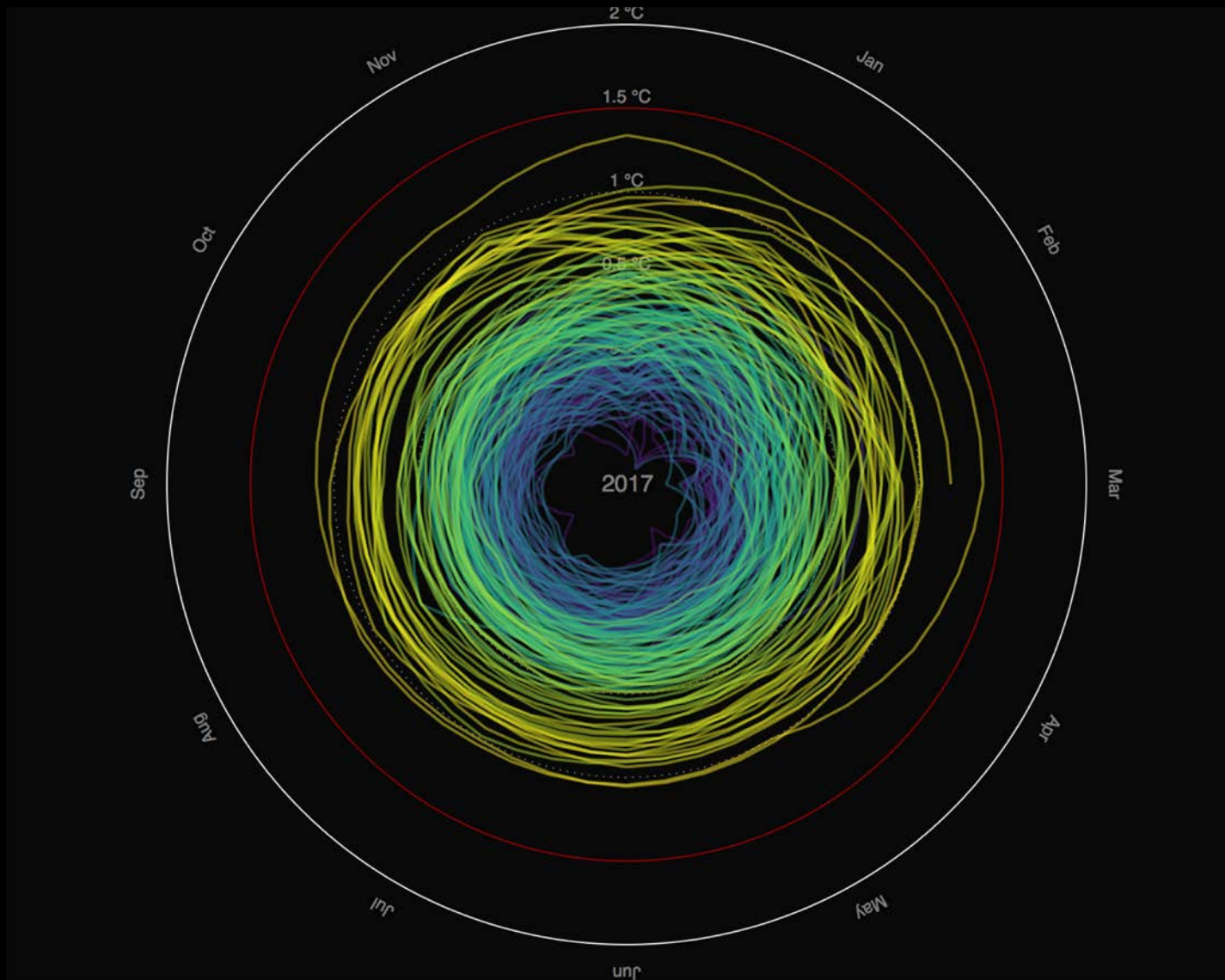
**Fact n° 2: We have changed the
composition of the atmosphere
and disturbed the climate
system**

CO₂ concentration spiral: the insulation thickens!



CO₂ concentration spiral 1851-2014 (ppm), by Gieseke & Meinshausen,
Available on <http://pik-potsdam.de/primap-live>

Temperature spiral



Global Mean Temperature in °C relative to 1850 – 1900

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

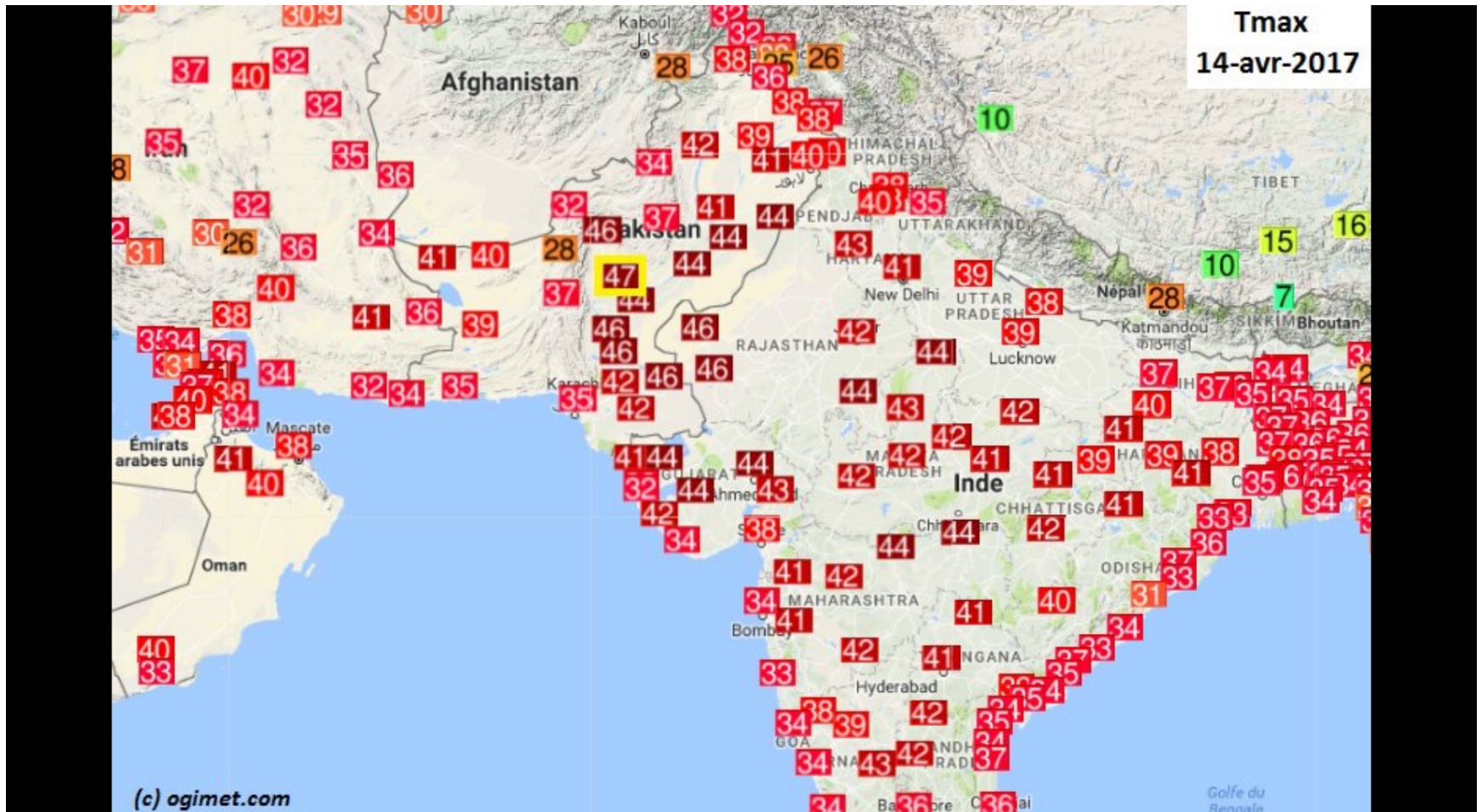
Animated version available on <http://openclimatedata.net/climate-spirals/temperature>

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

Heat waves kill





Plateau Glacier (1961) (Alaska)



http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Plateau Glacier (2003) (Alaska)



http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Fact n° 3: Average temperature is probably on its way to exceed the « conservation temperature » for the Greenland and (some of the) Antarctic ice sheet

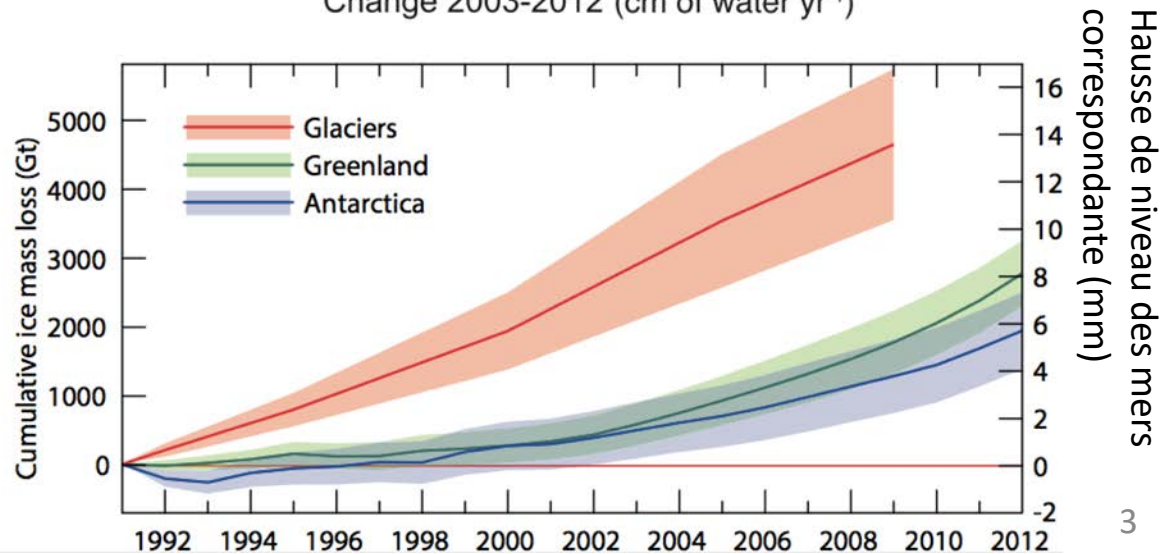
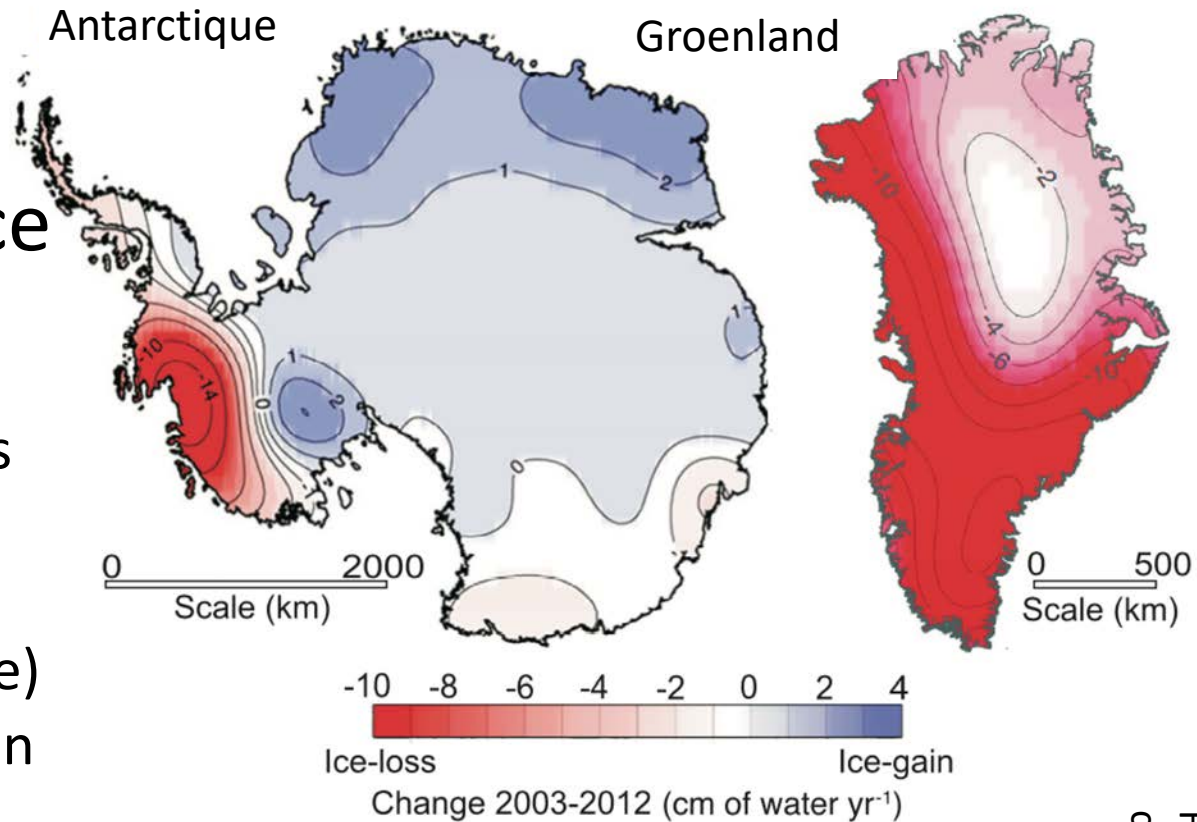
There is therefore a very high risk that average sea level would increase by several metres over the next century or two

Le Groenland et l'Antarctique perdent de la glace

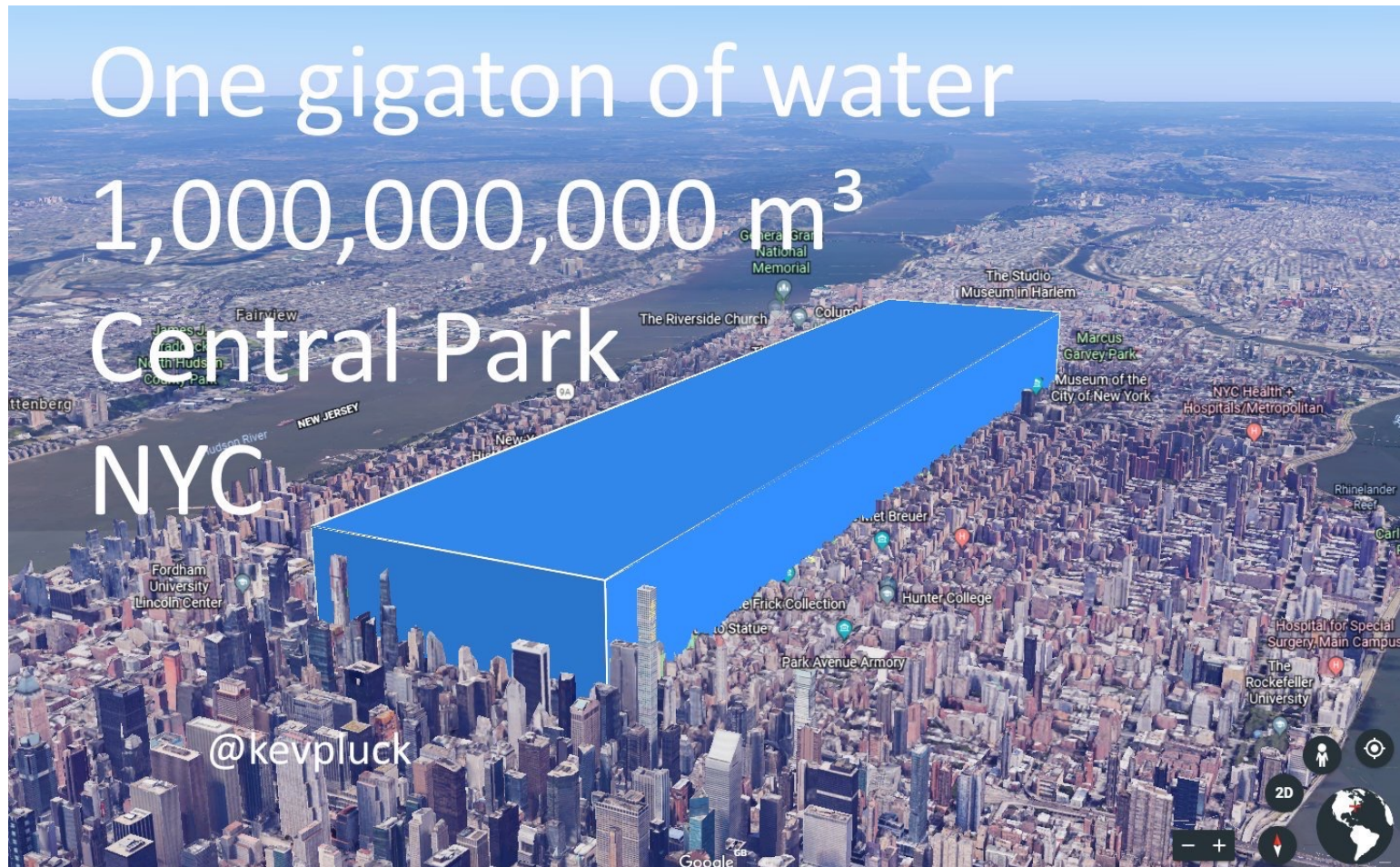
- Au Groenland, la perte de masse a lieu près des côtes car l'altitude est plus élevée au centre (environ 3000m de glace) donc il y fait plus froid en surface

- La figure ci-contre montre l'évolution de la contribution à la hausse du niveau des mers, comparée à celle des glaciers de montagne

Source: IPCC AR5 WG1 fig TS.3

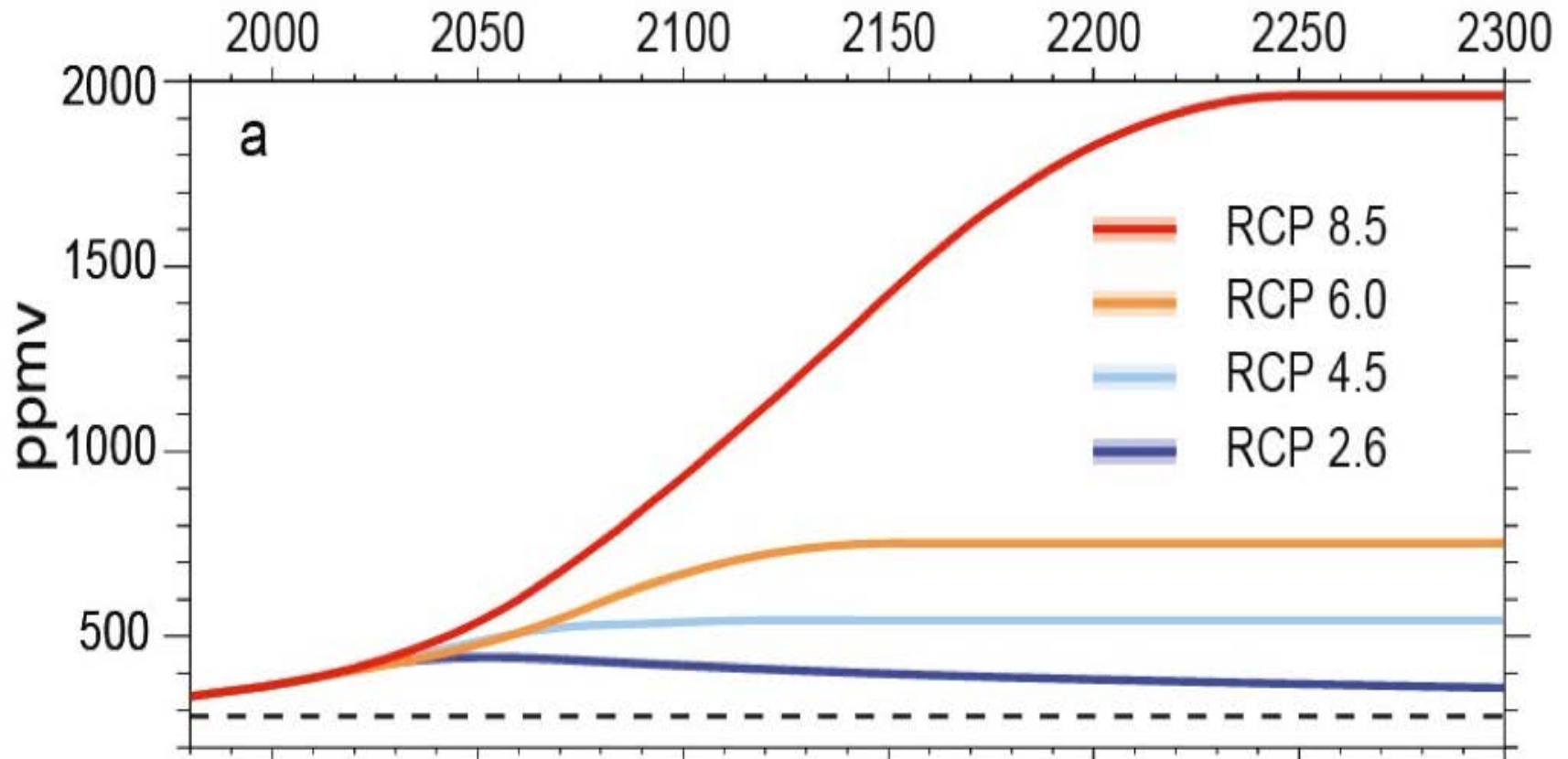


The Antarctic Ice Sheet presently loses 1 Gt of water every 1.5 day



Source: @Kevpluck, June 2018

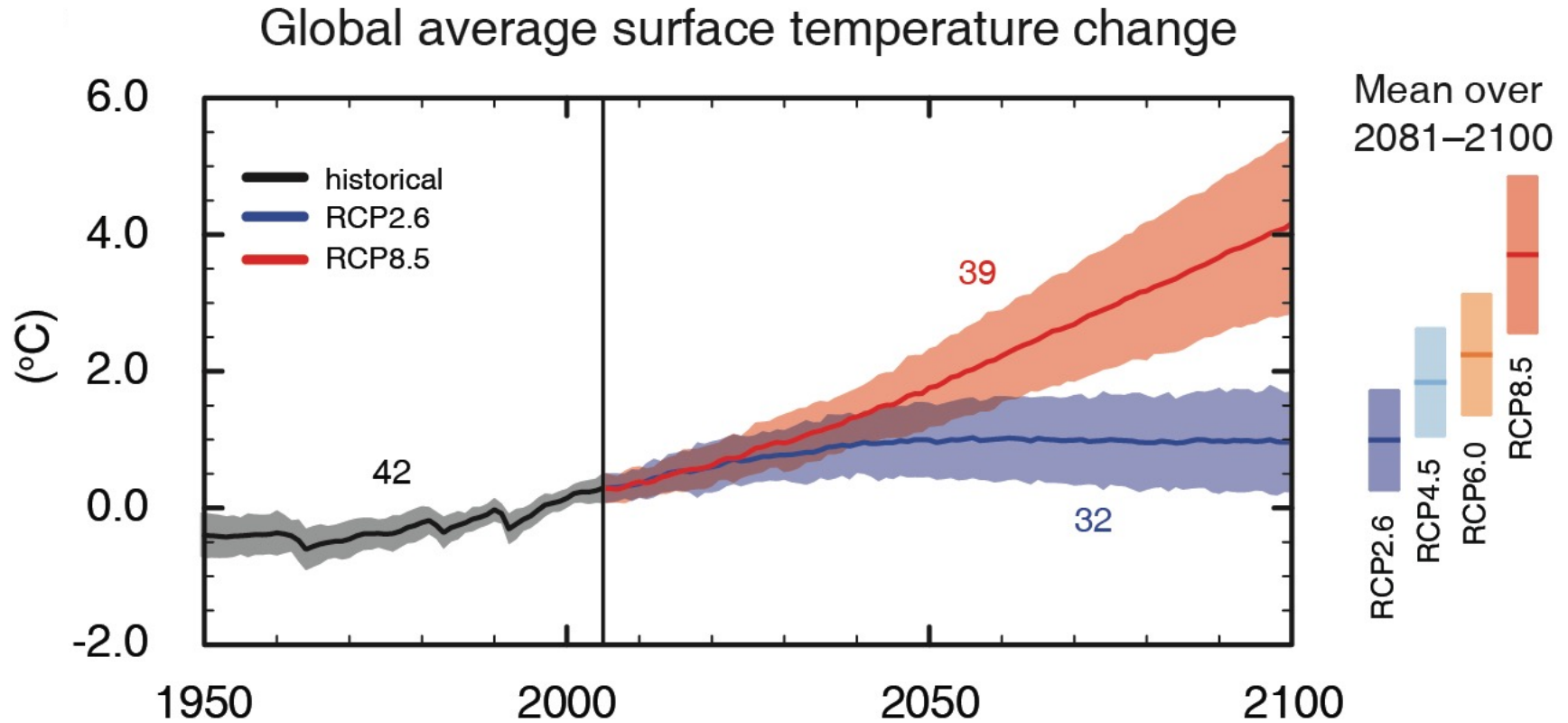
AR5 RCP: Atmospheric CO₂ concentration



Most CMIP5 runs are based on the concentrations, but emissions-driven runs are available for RCP 8.5

Note : « emission-driven » -> knowledge of C-cycle uncertainty

Réchauffement moyen – scén. RCP, 2Is



RCP2.6

RCP8.5

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

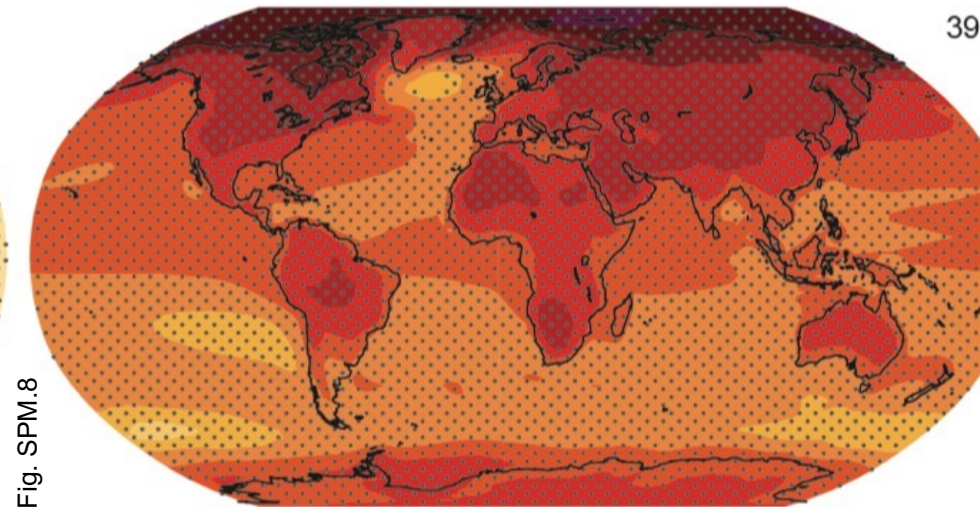
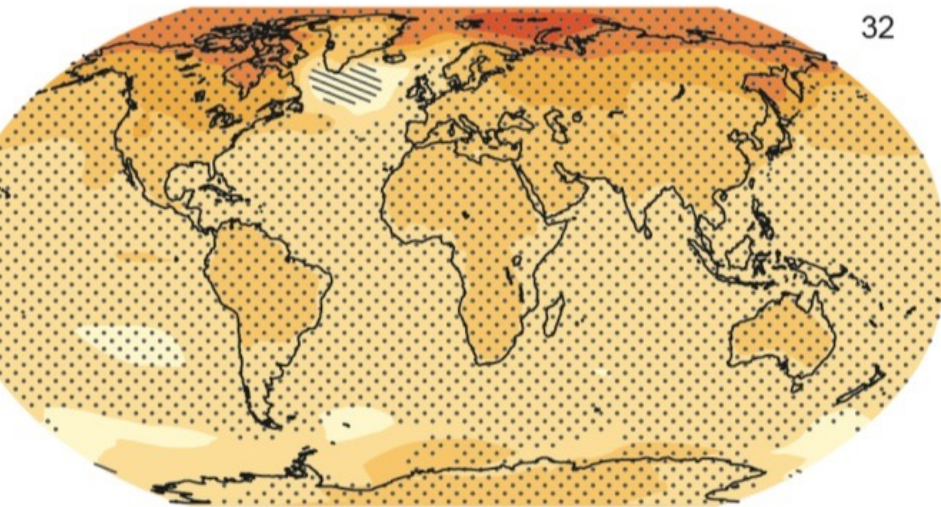
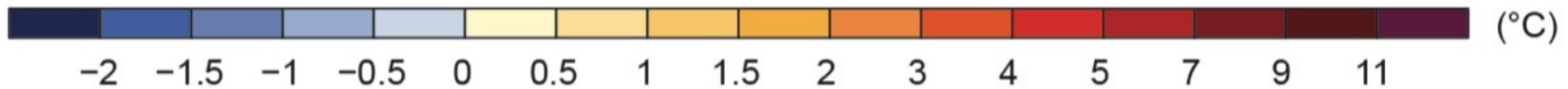


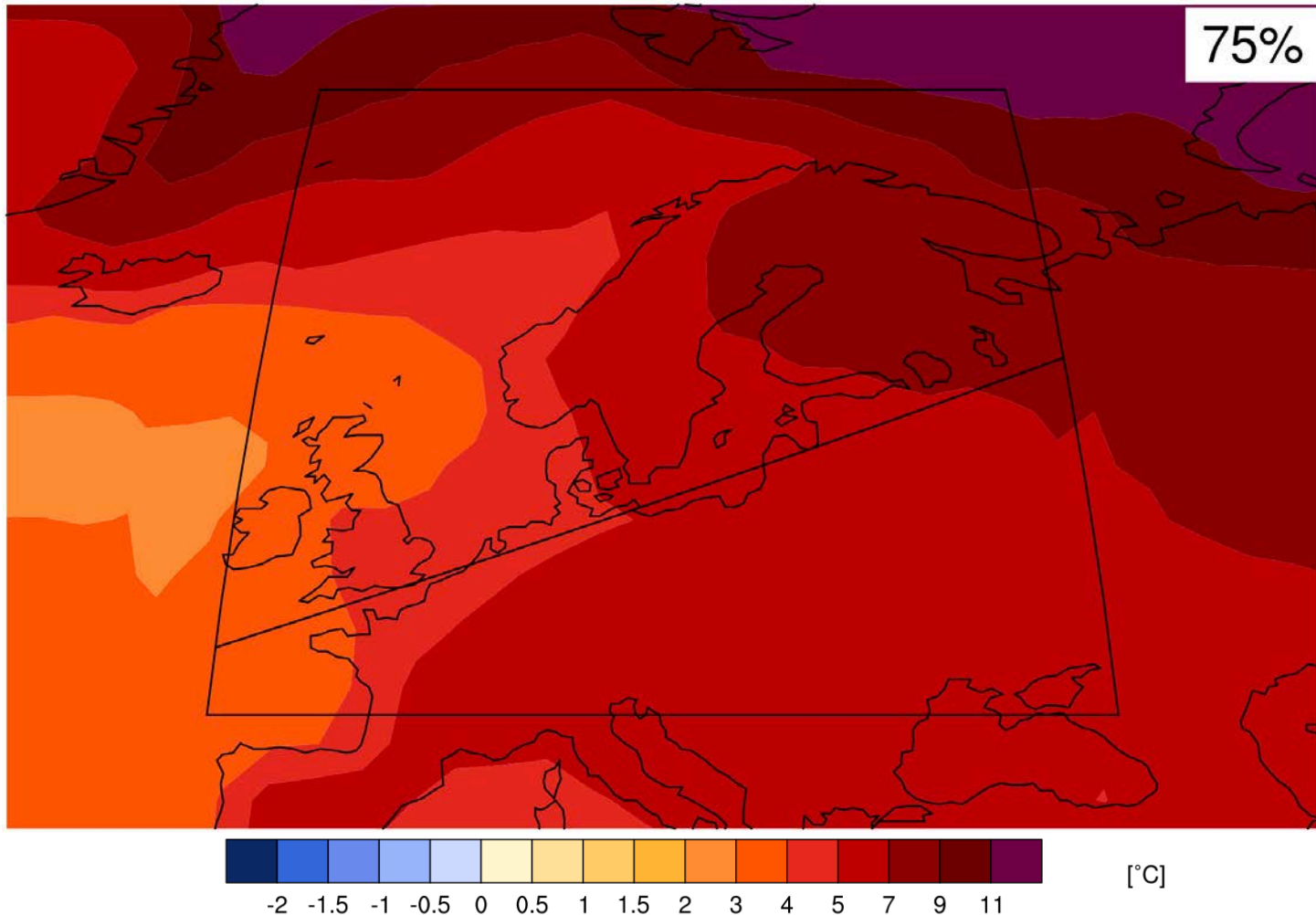
Fig. SPM.8



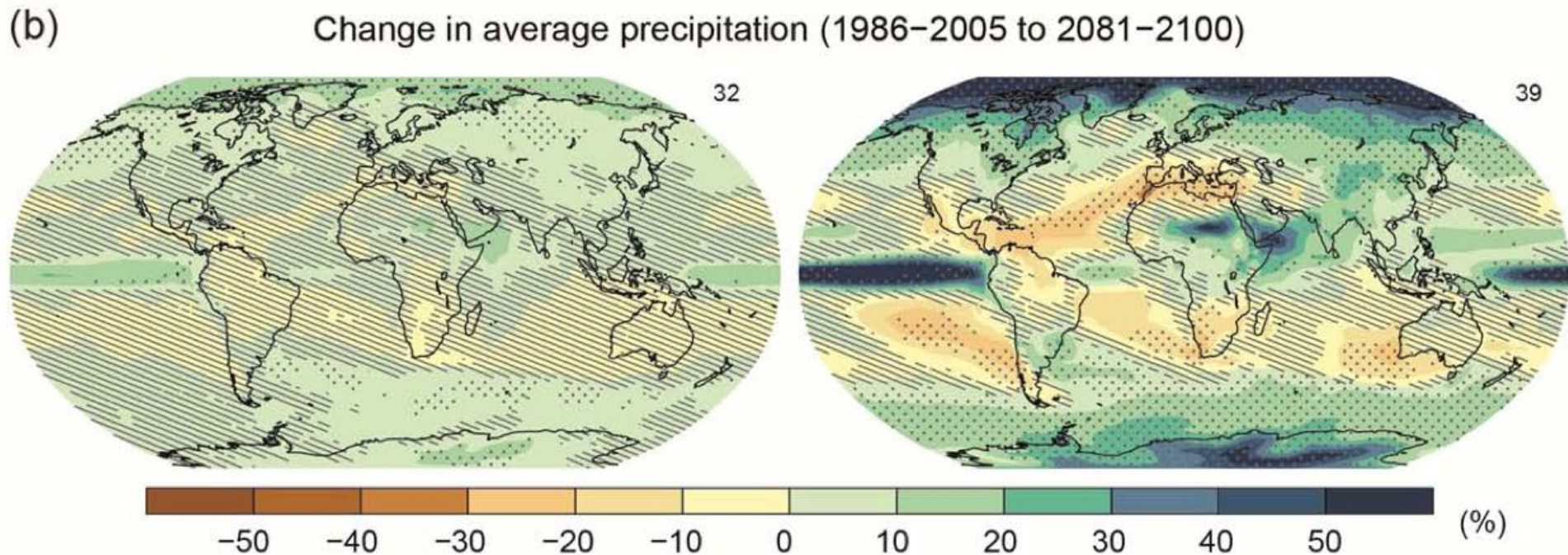
Hatching [hachures] indicates regions where the multi-model mean is small compared to natural internal variability (i.e., less than one standard deviation of natural internal variability in 20-year means).

Stippling [pointillés] indicates regions where the multi-model mean is large compared to natural internal variability (i.e., greater than two standard deviations of natural internal variability in 20-year means) and where at least 90% of models agree on the sign of change

North Europe - Map of temperature changes: 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)



Projected Change in Precipitation



Hatching indicates regions where *the multi-model mean is small compared to natural internal variability* (i.e., less than one standard deviation of natural internal variability in 20-year means).

Stippling indicates regions where the multi-model mean is large compared to natural internal variability (i.e., greater than two standard deviations of natural internal variability in 20-year means) and where at least 90% of models agree on the sign of change

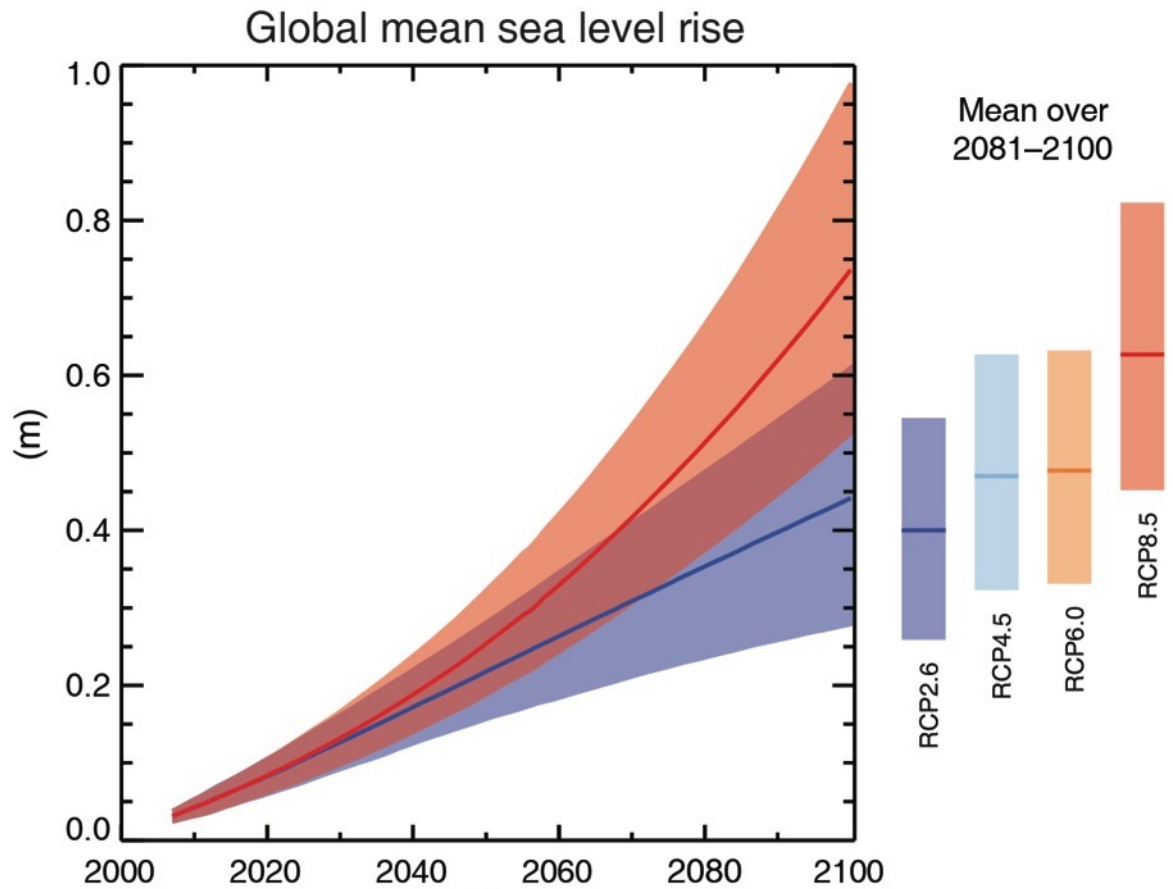


Fig. SPM.9

RCP2.6 (2081-2100), *likely* range:

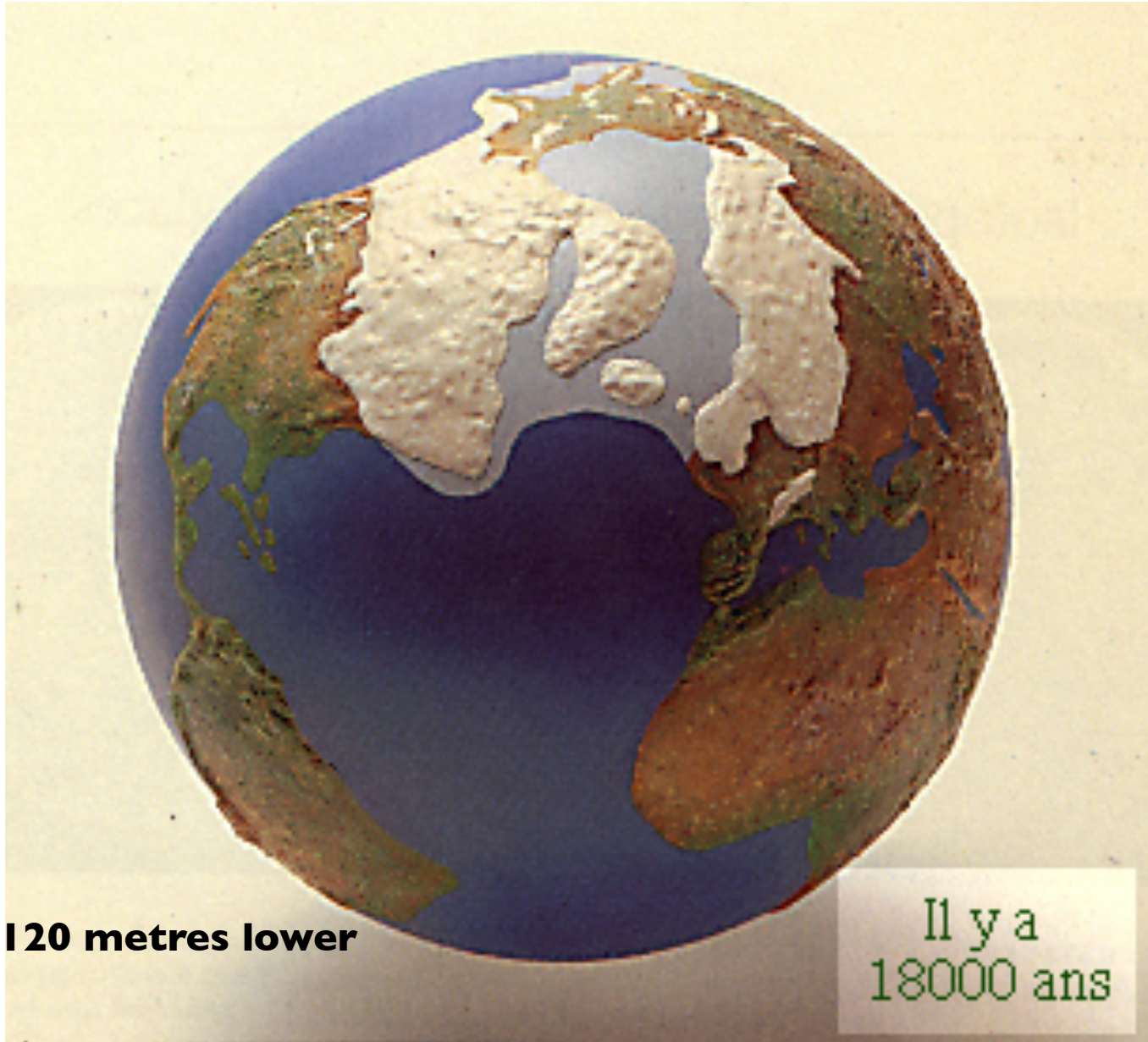
26 to 55 cm

RCP8.5 (in 2100), *likely* range:

52 to 98 cm

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

Today, with +4-5° C globally

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



Fact n° 4: World Health Organization (2018): Air pollution kills 7 million people per year (inc. 500 000 in Europe)

Sources of air pollution are broadly the same as those affecting climate: fossil fuels, wood and biomass combustion

Fine particulates from fossil fuel and wood burning kill



Photo: Jerzy Gorecki, Pixabay

**Fact n° 5: Climate change
impacts poor people first, but we
are all on the same spaceship**

Belgian Prime Minister Charles Michel (RTBF,
4 May 2018): « when there is a geopolitical
instability, we pay the cost as well »

Risk = Hazard x Vulnerability x Exposure

(Victims of New Orleans floods after Katrina in 2005)



AP Photo - Lisa Krantz (<http://lisakrantz.com/hurricane-katrina/zspbn1k4cn17phidupe4f9x5t1mzdr>)

Effects on the Nile Delta, where more than 10 million people live less than 1 m above sea level



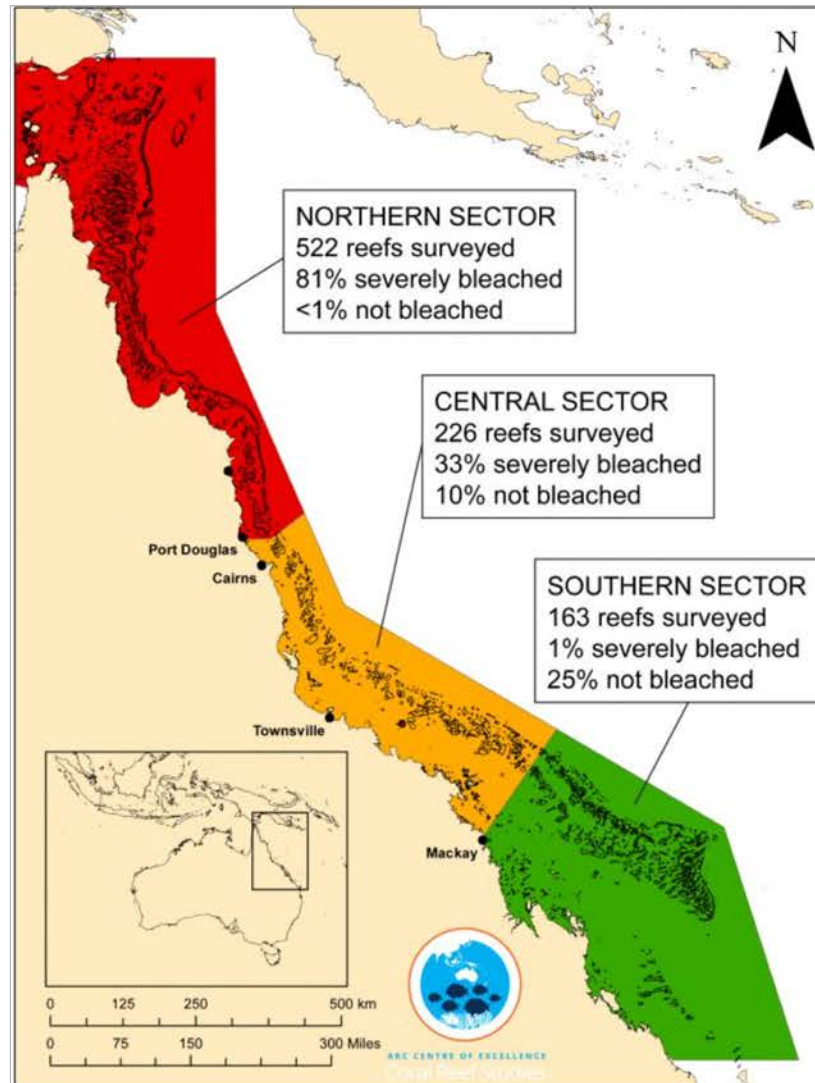
NB: + 1 m is possible
in the next 100 years...

(Time 2001)

Fact n° 6: Ecosystems suffer more and more, while our wellbeing depends on their good state

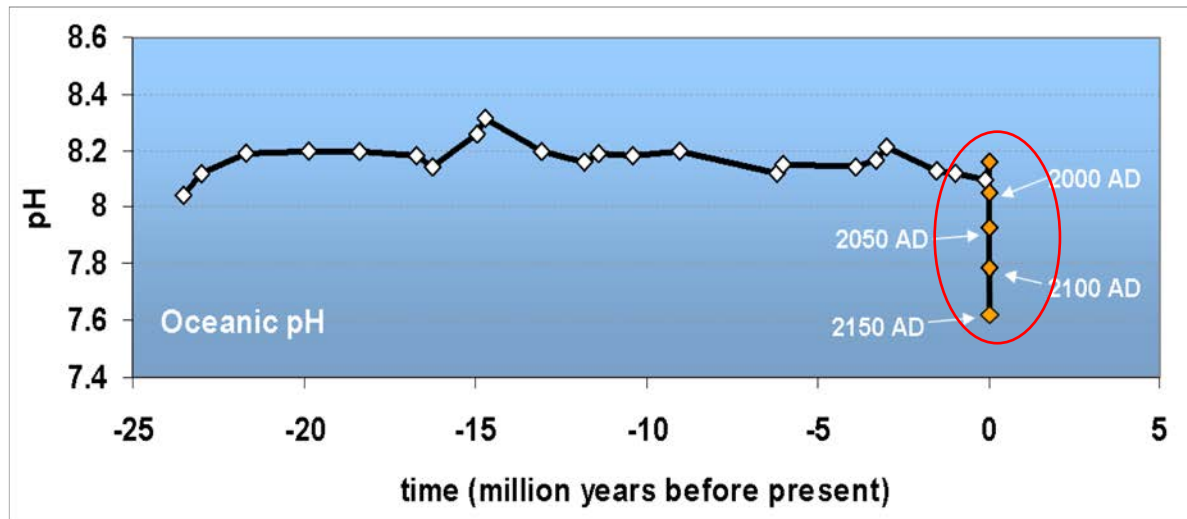
The « Sixth Extinction » has started, and climate change is one of the causing factors

2016: Only 7% of the Great Barrier Reef has avoided coral bleaching



Oceans are Acidifying Fast

Changes in pH over the last 25 million years



“Today is a rare event in the history of the World”

- It is happening now, at a **speed and to a level** not experienced by marine organisms for about 60 million years
- Mass extinctions linked to previous ocean acidification events
- Takes 10,000's of years to recover

Turley et al. 2006

Slide courtesy of Carol Turley, PML

The SR15

ipcc
INTERGOVERNMENTAL PANEL ON climate change



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)

HALF A DEGREE OF WARMING MAKES A BIG DIFFERENCE:

EXPLAINING IPCC'S 1.5°C SPECIAL REPORT

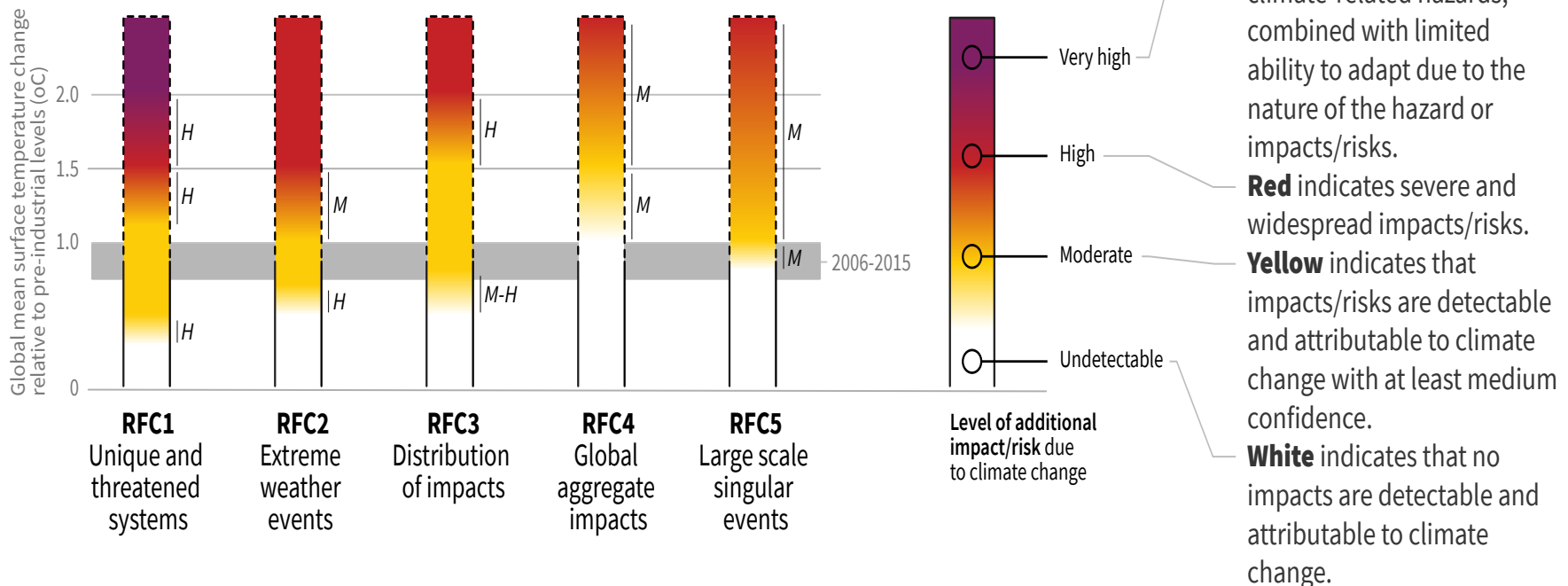
	1.5°C	2°C	2°C IMPACTS
EXTREME HEAT Global population exposed to severe heat at least once every five years	14%	37%	2.6x WORSE
SEA-ICE-FREE ARCTIC Number of ice-free summers	AT LEAST 1 EVERY 100 YEARS	AT LEAST 1 EVERY 10 YEARS	10x WORSE
SEA LEVEL RISE Amount of sea level rise by 2100	0.40 METERS	0.46 METERS	.06M MORE
SPECIES LOSS: VERTEBRATES Vertebrates that lose at least half of their range	4%	8%	2x WORSE
SPECIES LOSS: PLANTS Plants that lose at least half of their range	8%	16%	2x WORSE
SPECIES LOSS: INSECTS Insects that lose at least half of their range	6%	18%	3x WORSE
ECOSYSTEMS Amount of Earth's land area where ecosystems will shift to a new biome	4%	13%	1.86x WORSE
PERMAFROST Amount of Arctic permafrost that will thaw	4.8 MILLION KM ²	6.6 MILLION KM ²	38% WORSE
CROP YIELDS Reduction in maize harvests in tropics	3%	7%	2.3x WORSE
CORAL REEFS Further decline in coral reefs	70-90%	99%	UP TO 29% WORSE
FISHERIES Decline in marine fisheries	1.5 MILLION TONNES	3 MILLION TONNES	2x WORSE

Responsibility for content: WRI

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.

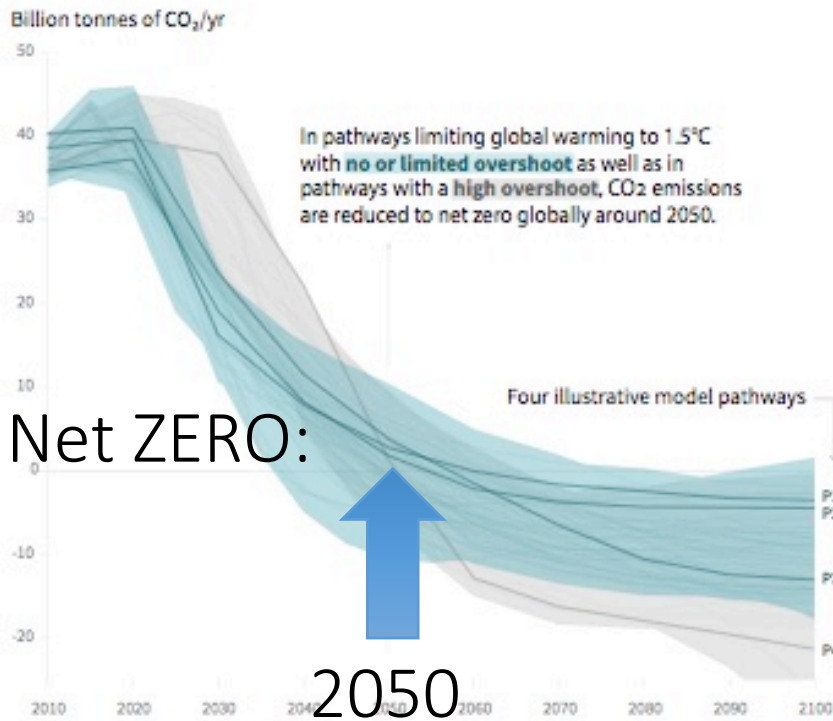
Impacts and risks associated with the Reasons for Concern (RFCs)



Global emissions pathway characteristics

General characteristics of the evolution of anthropogenic net emissions of CO₂, 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.

Global total net CO₂ emissions



Timing of net zero CO₂

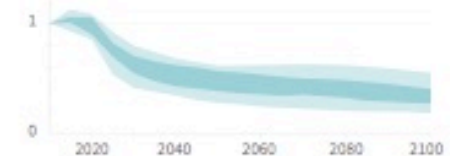
Line widths depict the 5-95th percentile and the 25-75th percentile of scenarios



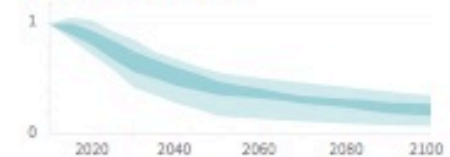
Non-CO₂ emissions relative to 2010

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.

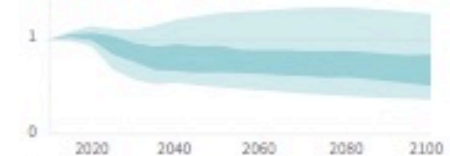
Methane emissions



Black carbon emissions



Nitrous oxide emissions



Greenhouse gas emissions pathways

- 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

Remaining carbon budget in 2018

(Source: IPCC SR15)

- The remaining carbon budget of 580 GtCO₂ for a 50% probability of limiting warming to 1.5°C, and 420 GtCO₂ for a 66% probability (medium confidence)
- The remaining budget is being depleted by current emissions of 42 ± 3 GtCO₂ per year

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 be 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

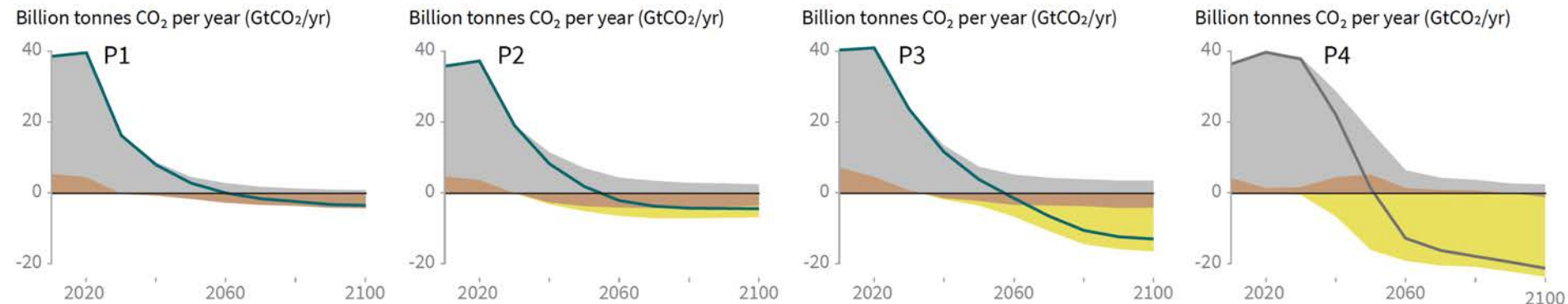
Greenhouse gas emissions pathways

- 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

(%rel to 2010)	P1	P2	P3
CO ₂ (2030/2050)	-58 / - 93	-47 / -95	-41 / -91
Final energy demand (2030/2050)	-15 / -32	-5 / +2	+17 / +21
Primary energy from coal (2030/2050)	-78/-97	-61/-77	-75/-73
Primary energy from non-biomass renewables (2030/2050)	+430/+832	+470/+132 7	+315/+878

IPCC SR15
Fig SPM 3b

**Fact n° 7: In the USA alone,
organizations which sow doubt
about climate change spend almost
a billion dollars/year! (Brulle 2014, average
numbers for 2003-2010)**

The European Union fares a little better, but many Brussels lobbyists try to dilute the EU environmental efforts (see the car industry...)

The « merchants of doubt » have evolved in their arguments:

- Existence of global warming
- Human responsibility in the warming
- Uncertainties around the science
- More research needed before taking measures
- Cost of decarbonization
- Drawbacks from alternatives

(recent example: so-called enormous needs of cobalt for electric mobility reported on CNN; see critical analysis on <https://www.desmogblog.com/2018/05/02/cnn-wrongly-blames-electric-cars-unethical-cobalt-mining>)

**Fact n° 8: European Union
spends at least 1 billion euros
per day simply to buy fossil fuels
outside its borders.**

True, decarbonizing the EU economy will cost, but not doing it could cost much more in impacts. Saving these 400 billions €/year could offer many opportunities

Fact n° 9: China is waking up to the climate and pollution challenge. It might become the world climate leader if the EU (5% of world population in 2050 ?) does not raise its ambition level in line with the Paris Agreement

The US economy will become less and less attractive, as it risks missing the decarbonizing trend. Hopefully, climate measures at the level of US cities and states can somewhat compensate federal actions

Fact n° 10: The present national plans (NDCs) introduced ahead of the Paris Agreement are far from what is needed to respect the 1.5° C objective, and even to stay below 2° C warming

Please note that the Paris Agreement speaks about 1.5° C and « *well below 2° C* » warming, not 2° C

Conférence sur les Changements Climatiques

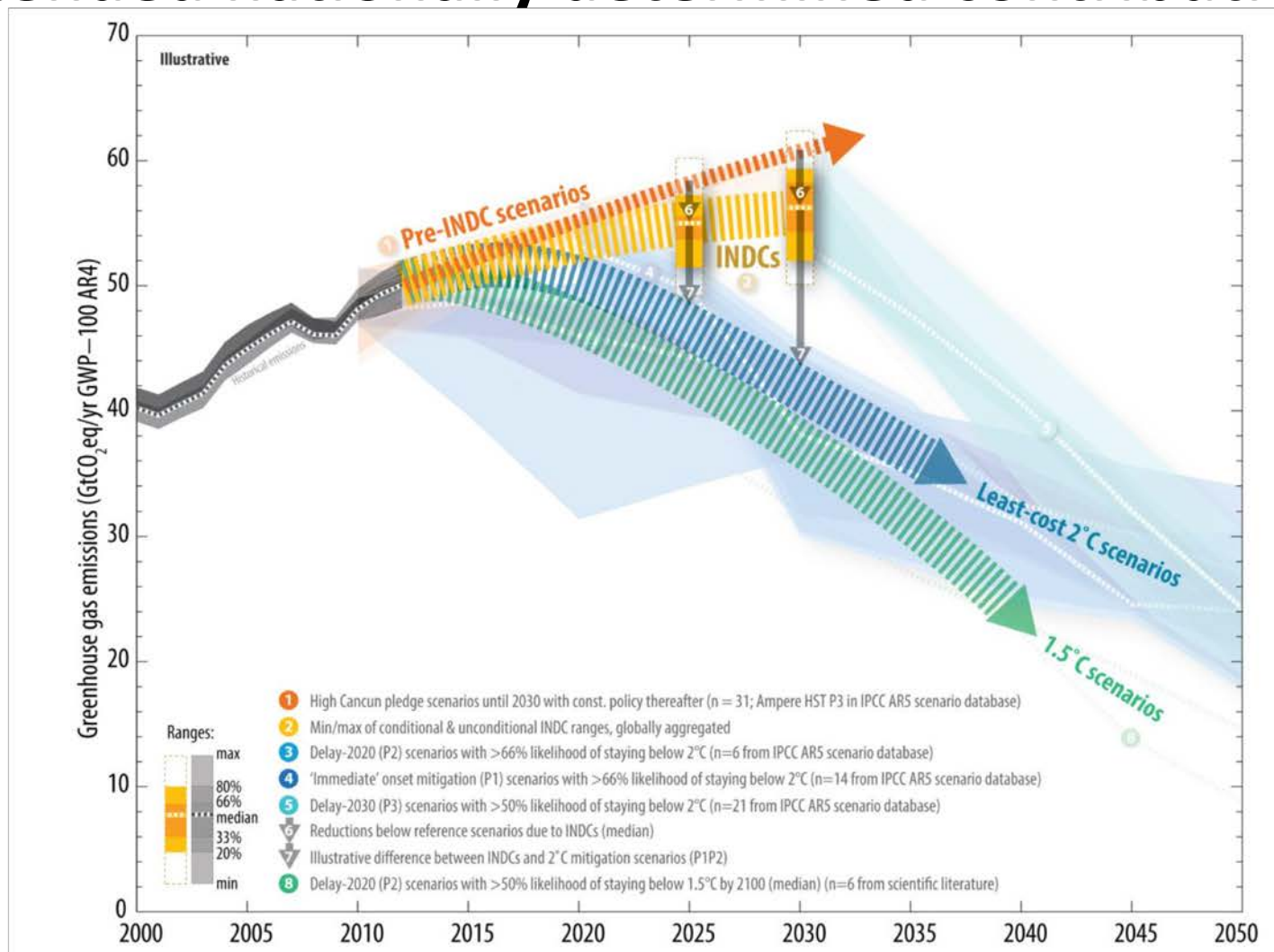
Nations Unies

COP21/CMP11

Paris, France



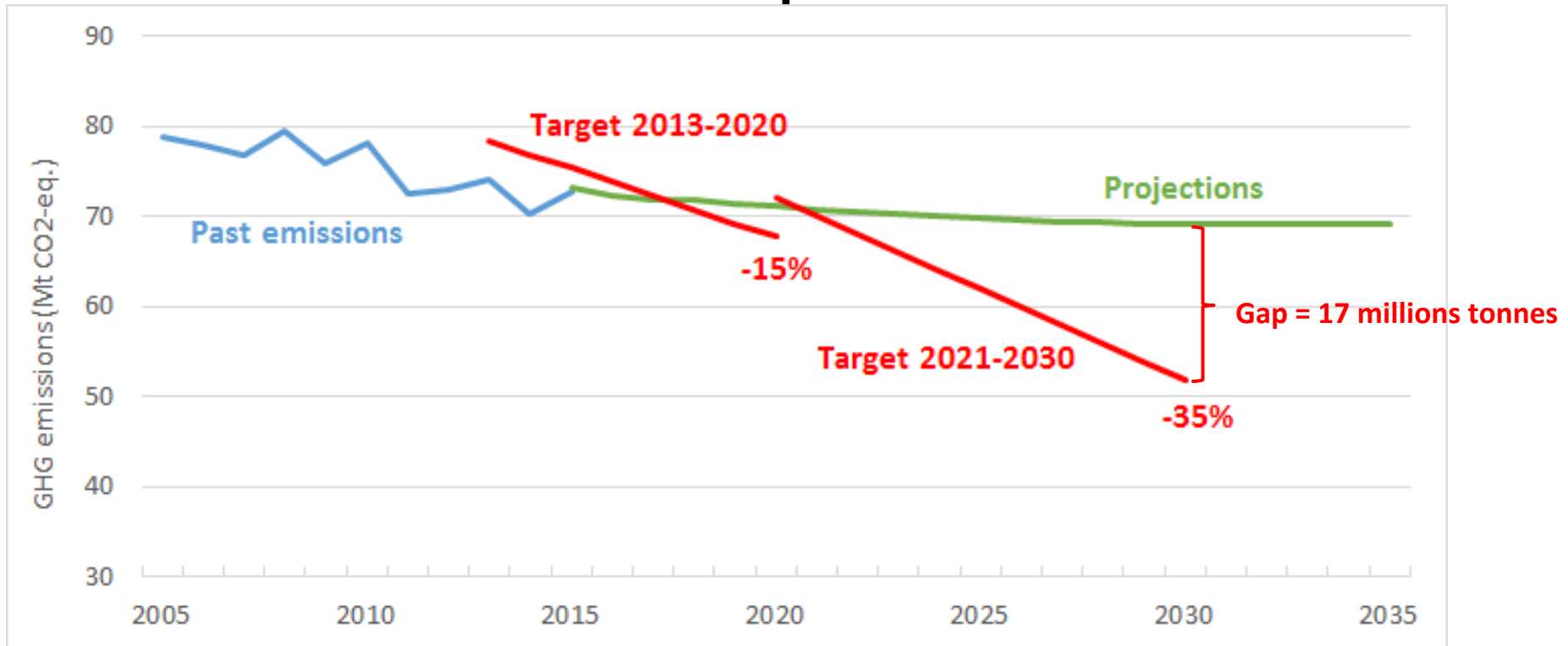
Comparison of global emission levels in 2025 and 2030 resulting from the implementation of the intended nationally determined contributions



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

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

Objectifs de la Belgique dans le cadre européen



- Evolution des émissions en Belgique et objectifs de réduction (secteurs non-ETS)
- (2005-2015: émissions réelles; 2015-2035: projections)

Source: Commission Nationale Climat (2017)

**(Element) of solution n° 1: The
survival of humanity and
ecosystems must become a
much higher political priority**

... as if we were all running for our life.

The Paris Agreement (COP21, December 2015)

Vision

« ...strengthen the **global response to the threat of climate change**, in the context of **sustainable development** and efforts to **eradicate poverty** »

Objectives

a) Holding the increase in the global average temperature:

- « *to well below 2°C above pre-industrial levels* »
- « *pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change* »

b) Adaptation and Mitigation

- « *Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and*
- *low greenhouse gas emissions development, in a manner that does not threaten food production*»

c) Finances

- « *Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.* »

Solution n° 2: Economic actors must be confronted much more clearly with their responsibilities

Degrowth of climate-unfriendly activities must be accepted, while growth of activities helping climate protection and poverty eradication must be encouraged

Solution n° 3: The best understood language is the price. Destroying the environment must become more and more expensive. Collected funds must be used to help the decarbonization, and avoid impacting the poor disproportionately

EU Emission Trading System, CO₂ taxes, fines, internal CO₂ price (firms do « as if » CO₂ emission was expensive). NB: Price must match the effect desired!

**Solution n° 4: Transition towards
a clean and sustainable economy
and energy system must be
« just », and other synergies with
the SDGs must be sought**

**Ex : The Polish energy system cannot
be transformed without facilitating
the coal miners reconversion**



SUSTAINABLE DEVELOPMENT GOALS



Solution n° 5: Before looking at how to produce energy cleanly, much more attention must be given to reducing energy demand and efficiency, in all sectors

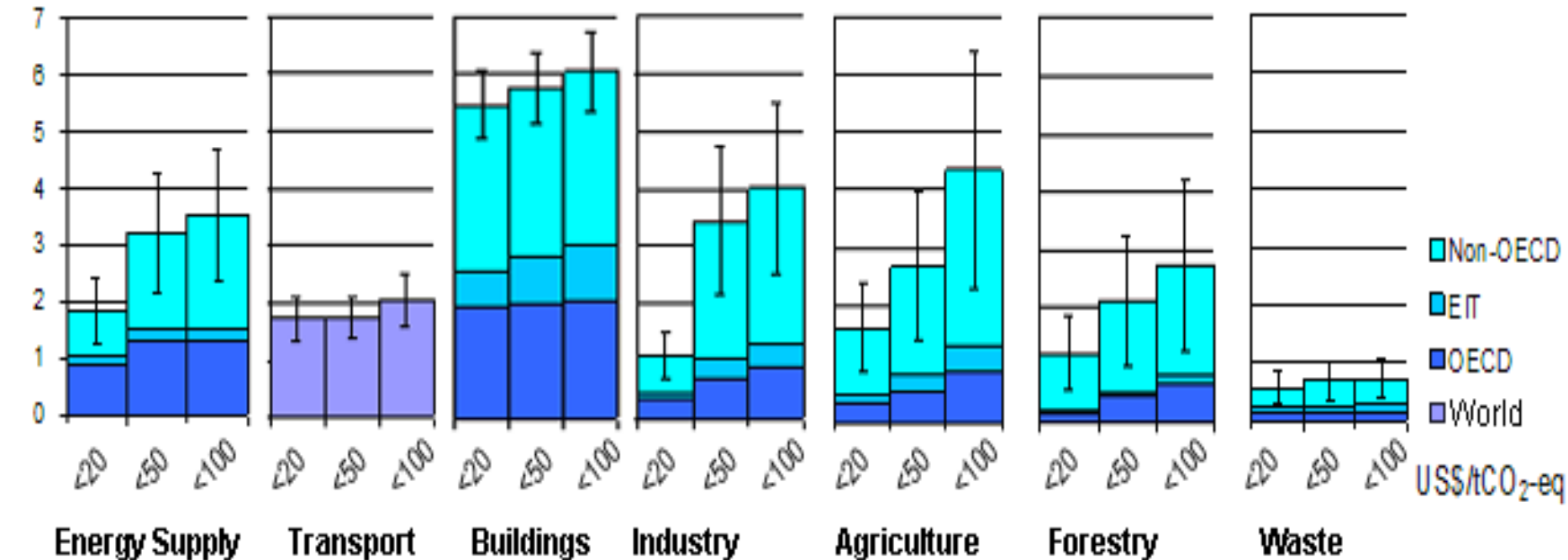
All production and consumption patterns must be reconsidered, helped by energy audits, etc.

- Many scenario studies confirm that it is **technically** and economically feasible to keep the warming below 2°C, with more than 66% probability (“likely chance”). This would imply limiting atmospheric concentrations to 450 ppm CO₂-eq by 2100.
- Such scenarios for an above 66% chance of staying below 2°C imply reducing by 40 to 70% global GHG emissions compared to 2010 by mid-century, and reach zero or negative emissions by 2100.

- **These scenarios are characterized by rapid improvements of energy efficiency and a near quadrupling of the share of low-carbon energy supply (renewables, nuclear, fossil and bioenergy with CCS), so that it reaches 60% by 2050.**
- **Keeping global temperature increase below 1.5°C would require even lower atmospheric concentrations (<430 ppm CO₂eq) to have a little more than 50% chance.** There are not many scenario studies available that can deliver such results, **requiring even faster reductions** in the medium term, indicating how difficult this is.

All sectors and regions have the potential to contribute by 2030

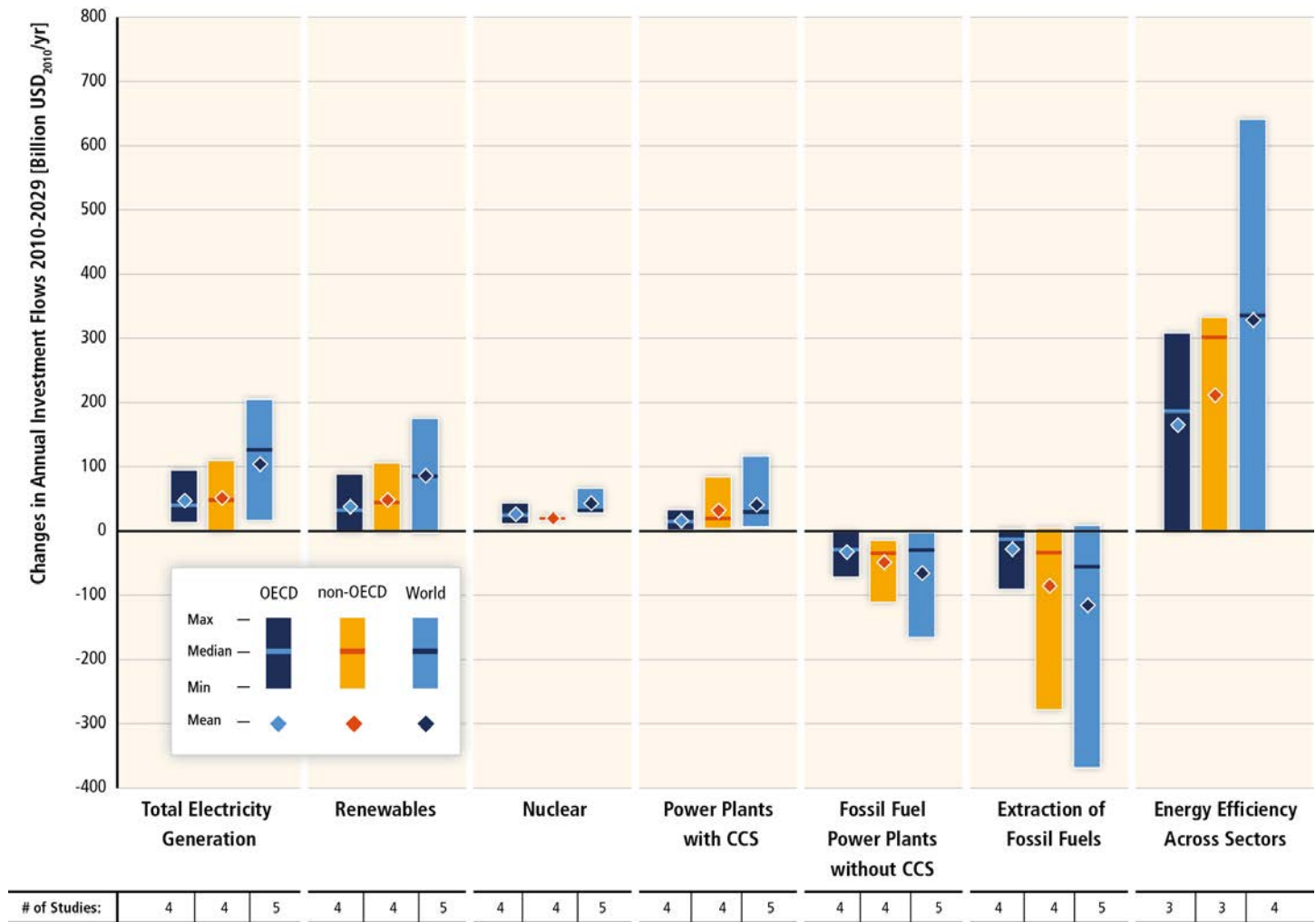
GtCO₂-eq / year (avoided emissions: the higher, the better)



IPCC AR4 (2007)

Note: estimates do not include non-technical options, such as lifestyle changes.

Substantial reductions in emissions would require large changes in investment patterns.



- **Substantial reductions in emissions to stay under 2° C would require large changes in investment patterns e.g., from 2010 to 2029, in billions US dollars/year:** (mean numbers rounded, IPCC AR5 WGIII Fig SPM 9)

- **energy efficiency:** +330
- **renewables:** + 90
- **power plants w/ CCS:** + 40
- **nuclear:** + 40
- **power plants w/o CCS:** - 60
- **fossil fuel extraction:** - 120

Solution n° 6: Building sector: offers many opportunities in energy saving, economic activity, improving wellbeing...

Trying to practice what I « preach »



Trying to practice what I « preach »



Solution n° 7: Mobility : much more space and priority to pedestrians, bicycles, and public transport; reduce priority given too long to individual transport in urban planning

Electrify remaining vehicles (with clean electricity). Fly less, only if essential.

**Solution n° 8: Food and
agriculture. A possible change with
big positive impact: eat less (red)
meat and cheese, of better quality!
Eat more plant-based food
(produced cleanly)^(*)**

...It is good for health as well!

(*) See « Beyond-Meat », page 14 of De Tijd, page 13 of L'Écho, 23 November 2018

@JPvanYpersele

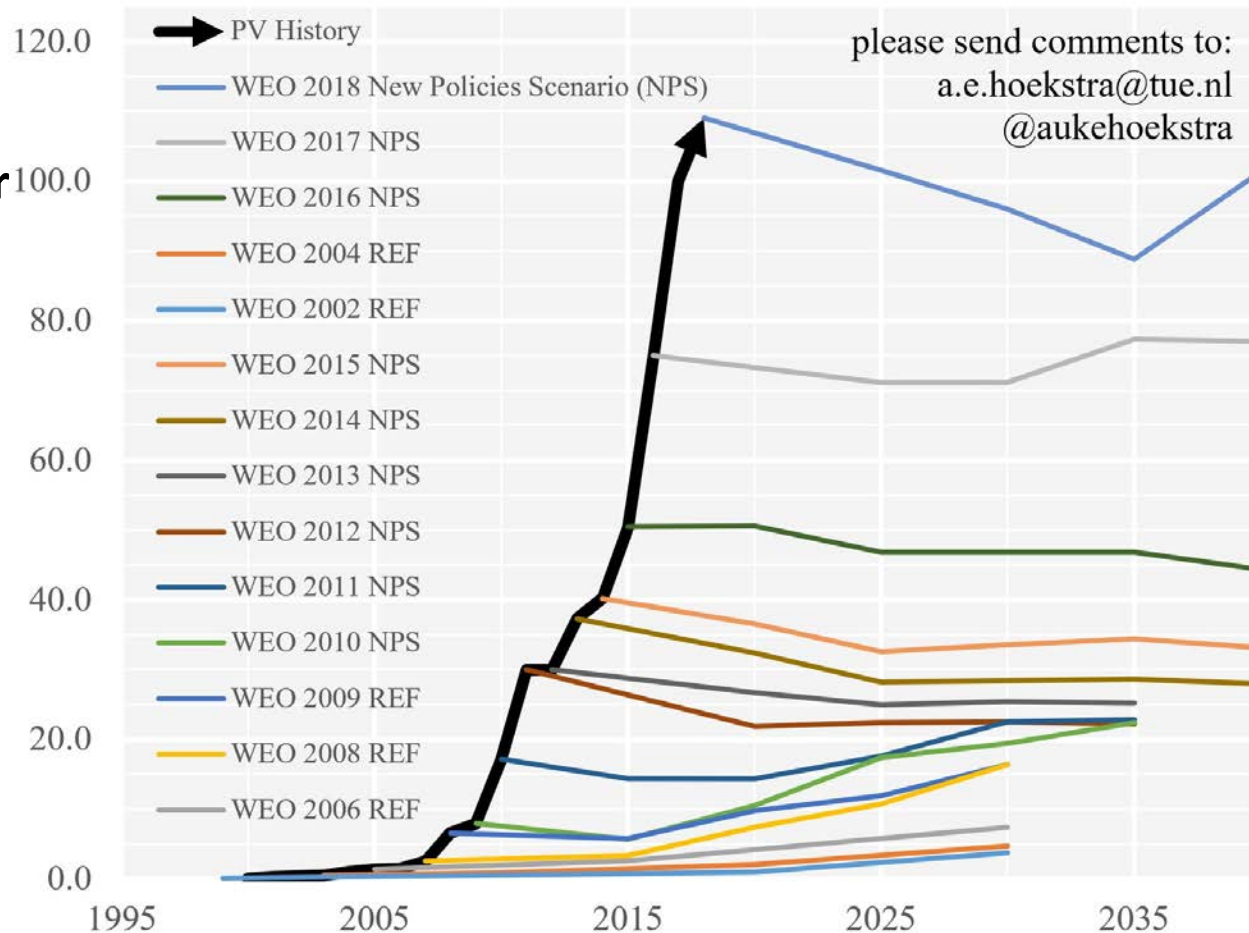
**Solution n° 9: The Sun gives us
in two hours about as much
energy as the world uses in *one*
year, all forms of energy
considered**

The cost of solar kWh is crashing, wind power, heat and electricity storage, and smart grids are moving forward

The International Energy Agency has missed that point...

Annual PV additions: historic data vs IEA WEO predictions
In GW of added capacity per year - source International Energy Agency - World Energy Outlook

GW capacity added per year



Solution n° 10: Banks and the finance sector increasingly see the opportunities in climate-friendly and ethical investments promoting the 17 Sustainable Development Goals

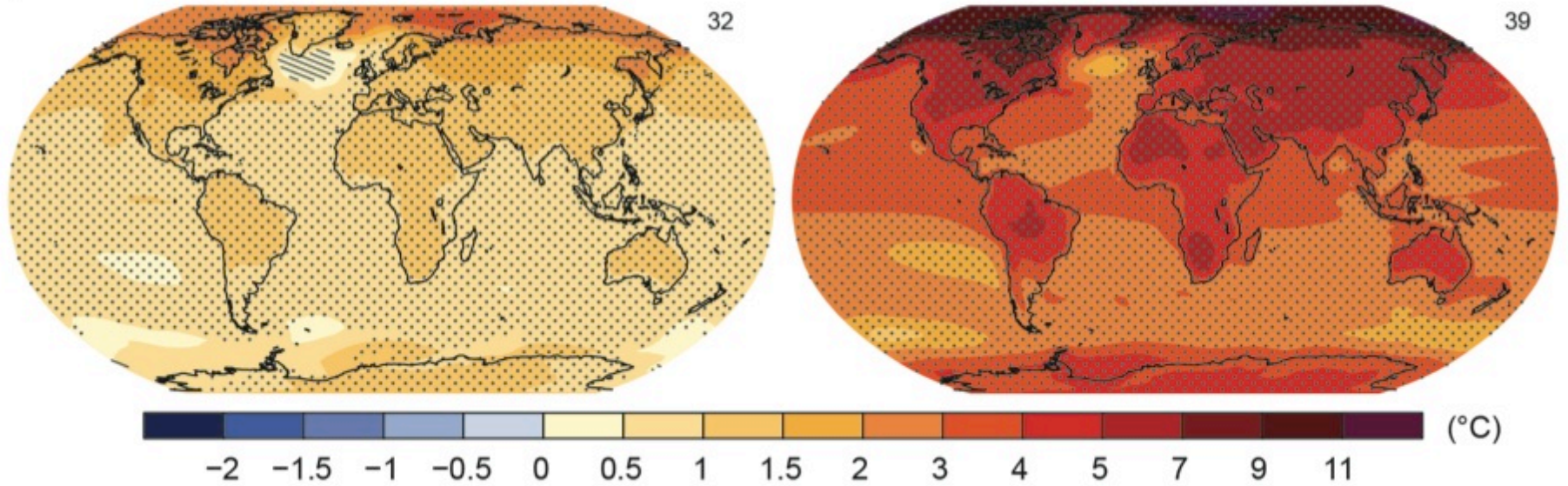
... but their ethical/green investments are still marginal for most banks

@JPvanYpersele

RCP2.6

RCP8.5

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



Humanity has the choice

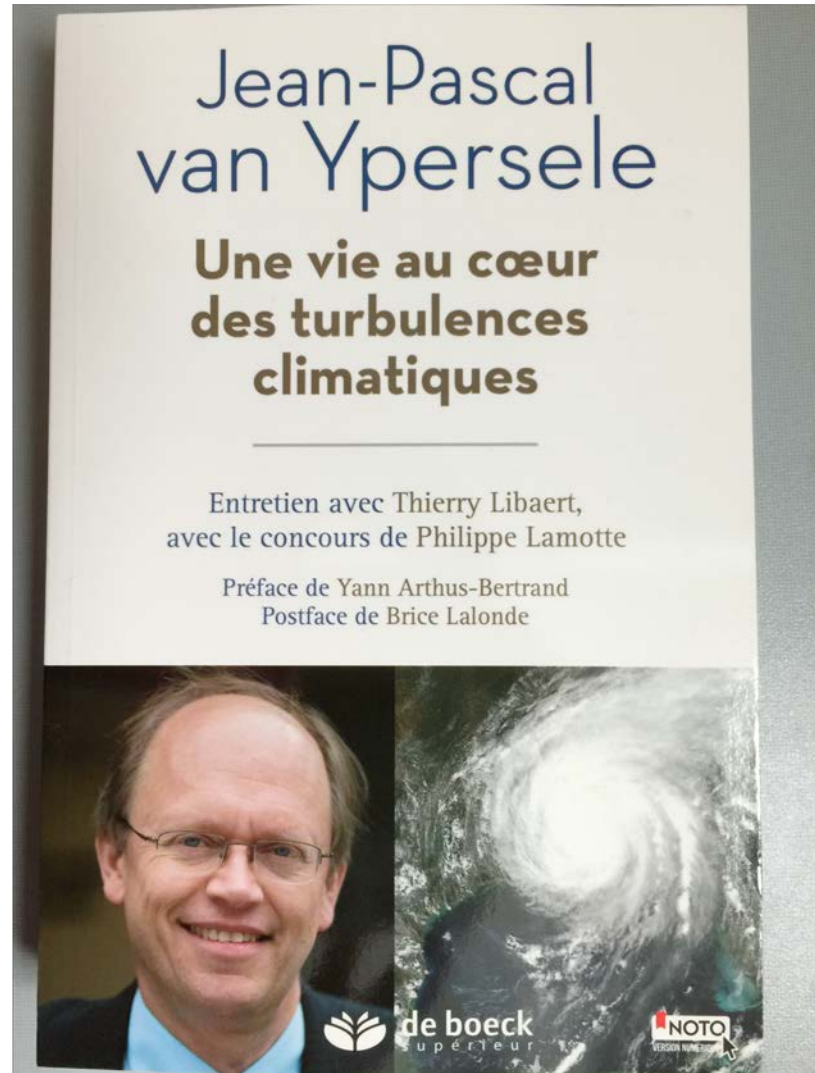
Pour en savoir plus:

**Lisez mon livre, où
j'aborde tous ces sujets**

**Publié chez De Boeck
supérieur**

**Préface: Yann Arthus-
Bertrand**

Postface: Brice Lalonde

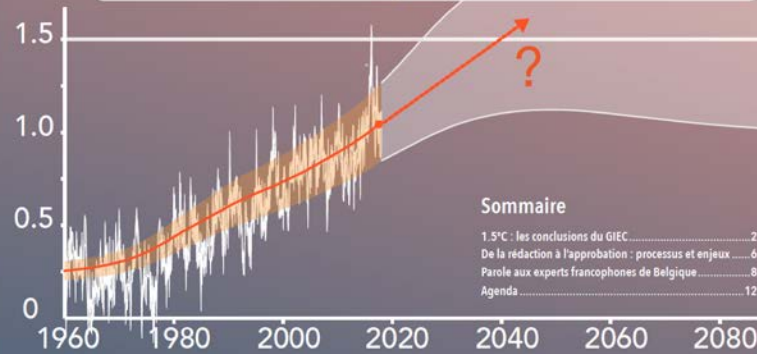


Bij EPO (2018)

**Voorwoord:
Jill Peeters**



Le rapport spécial du GIEC Réchauffement planétaire de 1.5°C



Pour de nombreuses populations et écosystèmes, il est essentiel de limiter le réchauffement à 1.5°C ou de ne dépasser ce niveau que temporairement. Et c'est potentiellement encore réalisable. Le 6 octobre 2018, l'Assemblée Plénière du GIEC a adopté le Rapport Spécial sur un « Réchauffement planétaire de 1.5°C », qui fait le point au sujet des impacts et scénarios correspondant à ce niveau de réchauffement.

Ce rapport conclut que pour limiter le réchauffement climatique à 1.5°C, il faut des transformations radicales et rapides dans tous les domaines de notre société. Il précise que ces changements sont sans précédent en termes d'échelle, mais pas nécessairement en termes de rapidité.

L'origine du rapport est une demande formelle au GIEC de la part des Parties à la Convention cadre des Nations Unies sur les changements climatiques (CNUCC) lors de l'adoption de l'Accord de Paris, en 2015 (21^e Conférence des Parties, COP21). La COP21 avait aussi indiqué que le rapport du GIEC devrait identifier le niveau auquel les émissions mondiales devraient être ramenées en 2030 pour contenir l'élévation de température en-dessous de 1.5°C.

Le rapport a été adopté à l'issue d'une semaine de discussions intenses au sujet de la formulation du Résumé à l'intention des décideurs, sur la base des chapitres et du projet de résumé rédigés par les scientifiques - qui ont toujours le dernier mot en ce qui concerne le contenu. Il forme une base scientifique essentielle pour les prochaines négociations internationales dans le cadre de la CNUCC, qui auront lieu à Katowice (Pologne) en décembre 2018 (COP24).

Dans cette Lettre, nous donnons d'abord un aperçu des conclusions du rapport, ensuite un aperçu du processus d'approbation et des enjeux associés. Pour ouvrir le débat et fournir un ensemble de points de vue, nous avons ensuite donné la parole aux experts francophones de Belgique, qui nous ont aimablement fait part des commentaires que vous trouverez en troisième partie. L'agenda indique les prochaines périodes de relecture de rapports du GIEC et annonce deux événements à venir en Belgique.

Nous vous en souhaitons une bonne lecture,
Jean-Pascal van Ypersele, Bruna Galno et Philippe Marbaix

Image de fond : extrait adapté de la figure SPM1 du Rapport spécial



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

'Sauver le climat' : les bases

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



Suite à l'intense mobilisation des jeunes, les changements climatiques ont fait l'objet de beaucoup d'attention au cours des derniers mois. Éléves du secondaire, étudiants, professeurs, parents et grand-parents sont descendus dans la rue pour montrer leur désarroi face à la lenteur de l'action vis-à-vis des changements climatiques.

Nous nous réjouissons de cette mobilisation, car notre rôle nous met encore plus fréquemment que l'ensemble de la population en position de témoin des risques que font courir les changements climatiques, ainsi que de l'ampleur des efforts nécessaires pour mettre en œuvre les objectifs qui se sont fixés les membres des Nations Unies à Paris en 2015 (COP21).

Une démarche essentielle en faveur de ces jeunes est de les aider à se former, à appréhender les principaux éléments de la problématique du climat, et plus largement, de l'influence de nos activités sur notre environnement et sur le futur de l'humanité. L'éducation est un des instruments essentiels pour évoluer vers une société plus durable et plus juste.

Pour y contribuer, nous présentons ici une brève synthèse de la problématique et une sélection de références commentées. Nous espérons que cette Lettre aidera enseignants et élèves à disposer d'une base d'information solide et ainsi à prendre leur part dans la solution à ce problème planétaire : agir à leur niveau et favoriser l'action dans leur entourage et au niveau sociétal.

Plusieurs témoignages d'élèves ou de professeurs sont également présentés.

Nous vous souhaitons une bonne lecture !
Jean-Pascal van Ypersele, Philippe Marbaix et Bruna Gaino

Sommaire

ABC des changements climatiques	2
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This gives me
hope:

Well-
informed
young people
speaking
truth to
power



With @GretaThunberg at COP24

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 SR15
- **Twitter: @JPvanYpersele & @IPCC_CH**

New :

- www.wechangeforlife.org :
250 Belgians experts speak
- www.climate.be/vanyp : my note (in FR & NL) presented to the royal informers on 4 June 2019