

Some of the reasons for climate urgency, and for keeping hope

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IPCC Vice-Chair from 2008 to 2015

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**Sustainable Investing Forum on « Climate Transition », organized
by [Allianz](#) and [Robeco](#), Brussels, 3 October 2019**

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

Why the IPCC ?

Established by WMO and UNEP in 1988

to provide **policy-makers**
with an **objective source of**
information about

- causes of climate change,
- potential environmental and socio-economic impacts,
- possible response options (adaptation & mitigation).

WMO=World Meteorological
Organization

UNEP= United Nations Environment
Programme

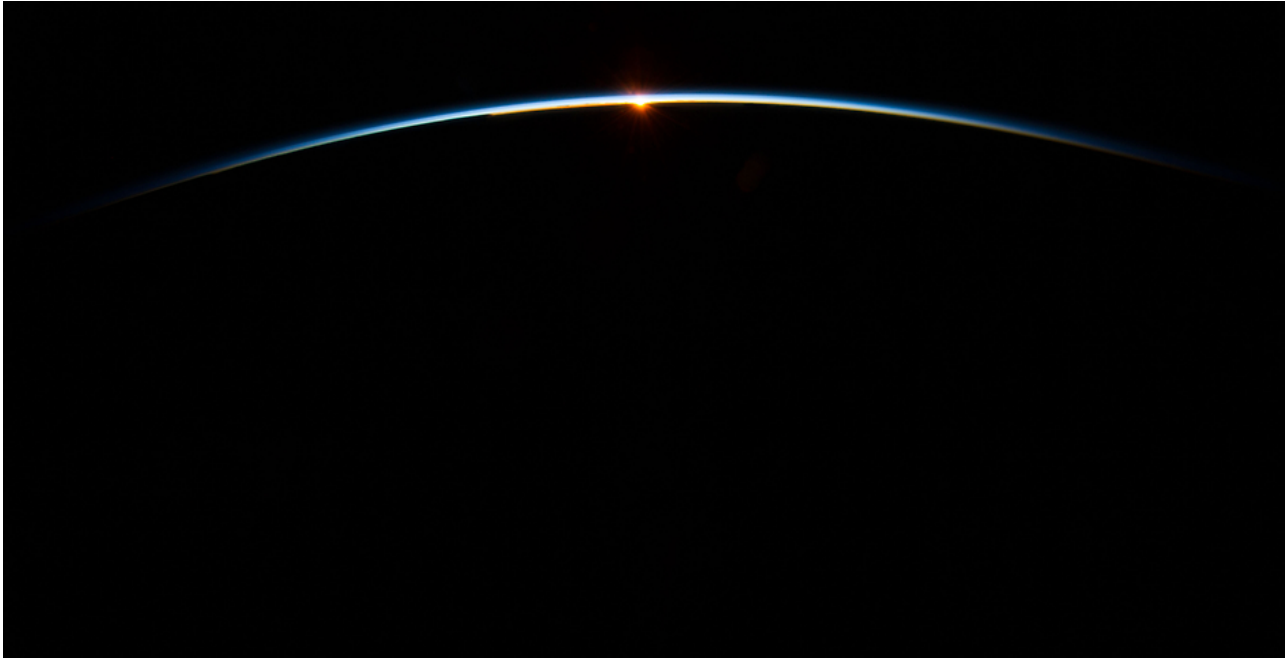


Reminder: There is no planet B

**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)

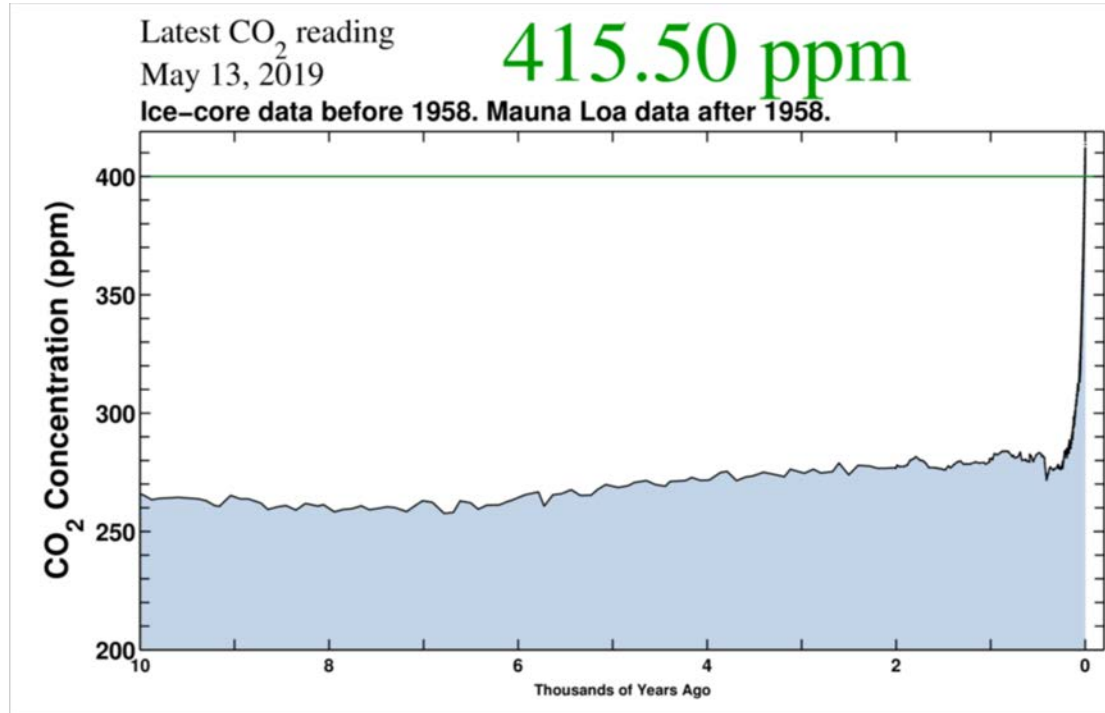


Jean-Pascal van Ypersele
(vanyp@climate.be)

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

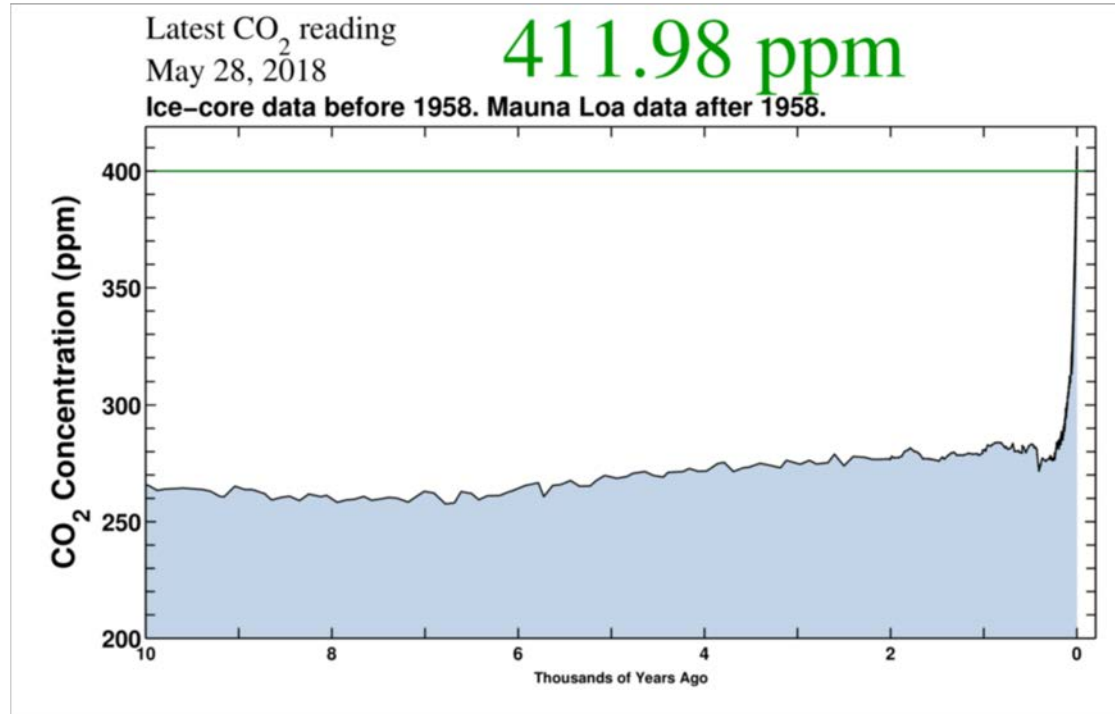
**That is why we must cut emissions
to ZERO as soon as possible**

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/

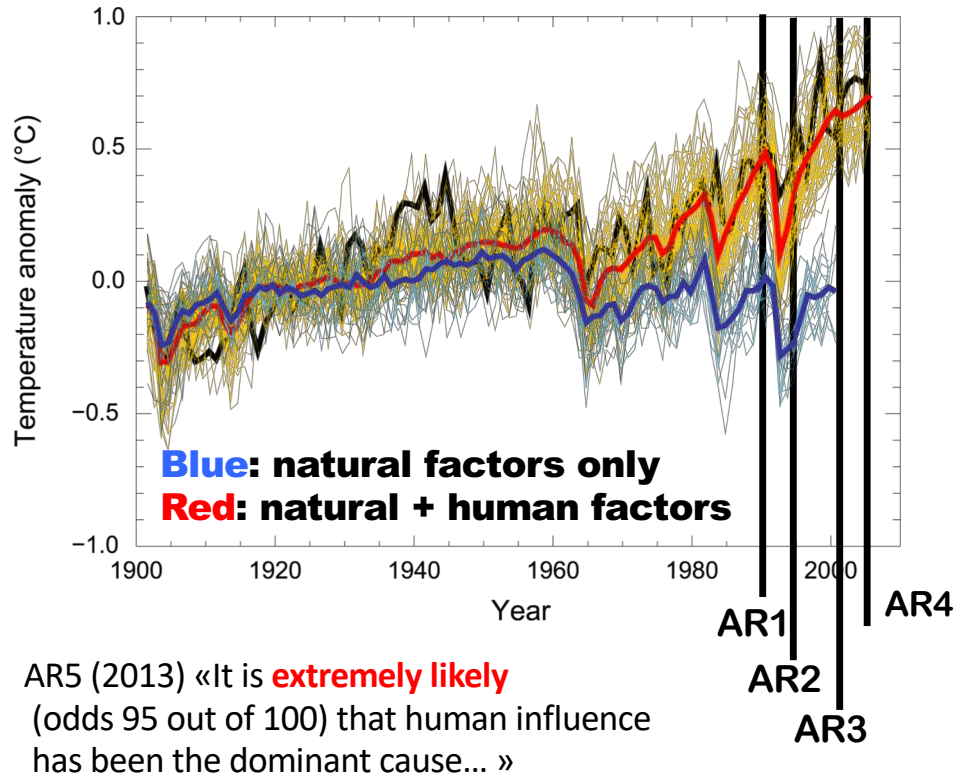
A Progression of Understanding: Greater and Greater Certainty in Attribution

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

AR2 (1995): “balance
of evidence suggests
discernible human
influence”

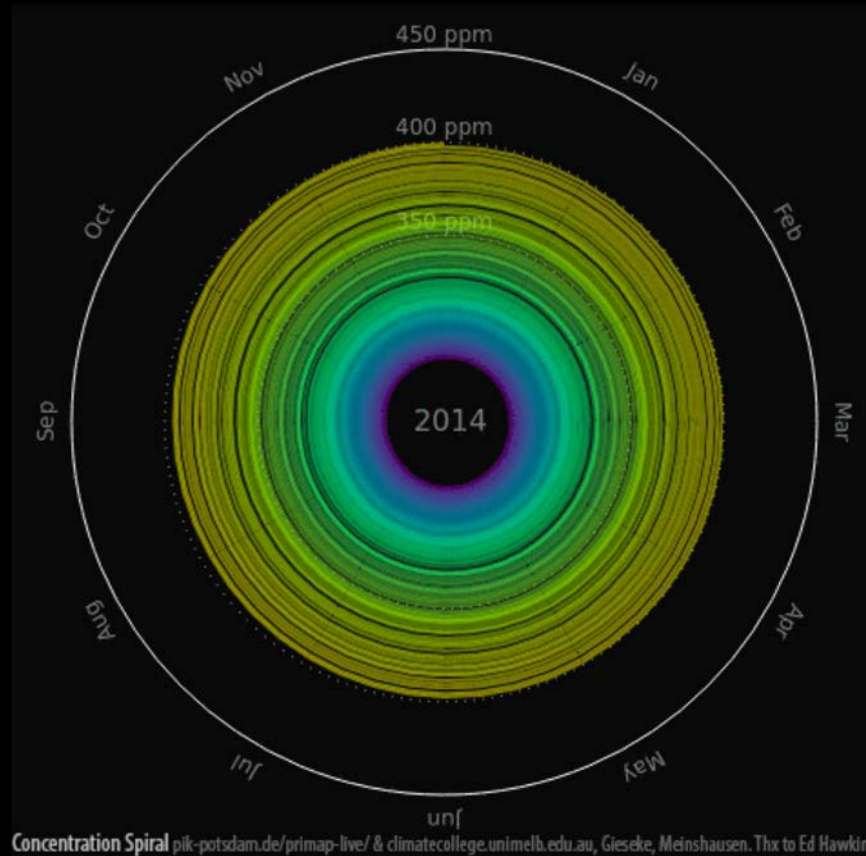
AR3 (2001): “most of
the warming of the
past 50 years is **likely**
(odds 2 out of 3) due
to human activities”

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



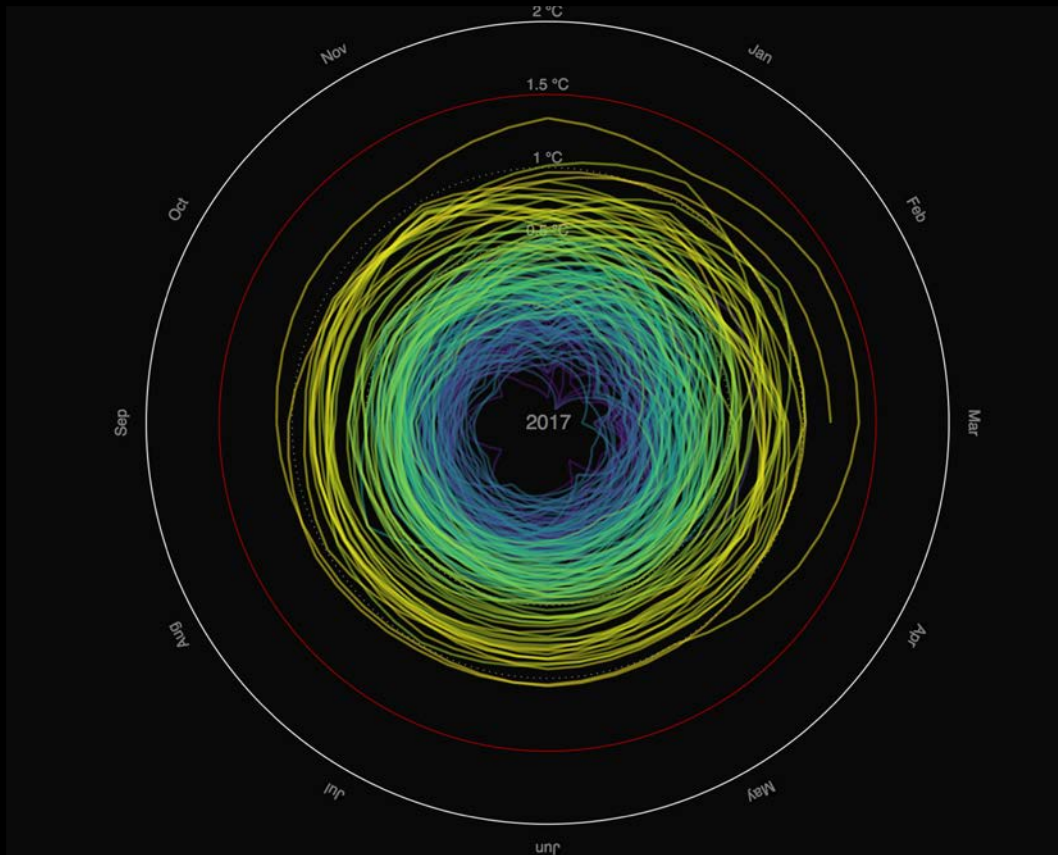
**Fact n° 2: We have changed the
composition of the atmosphere and
disturbed the climate system**

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

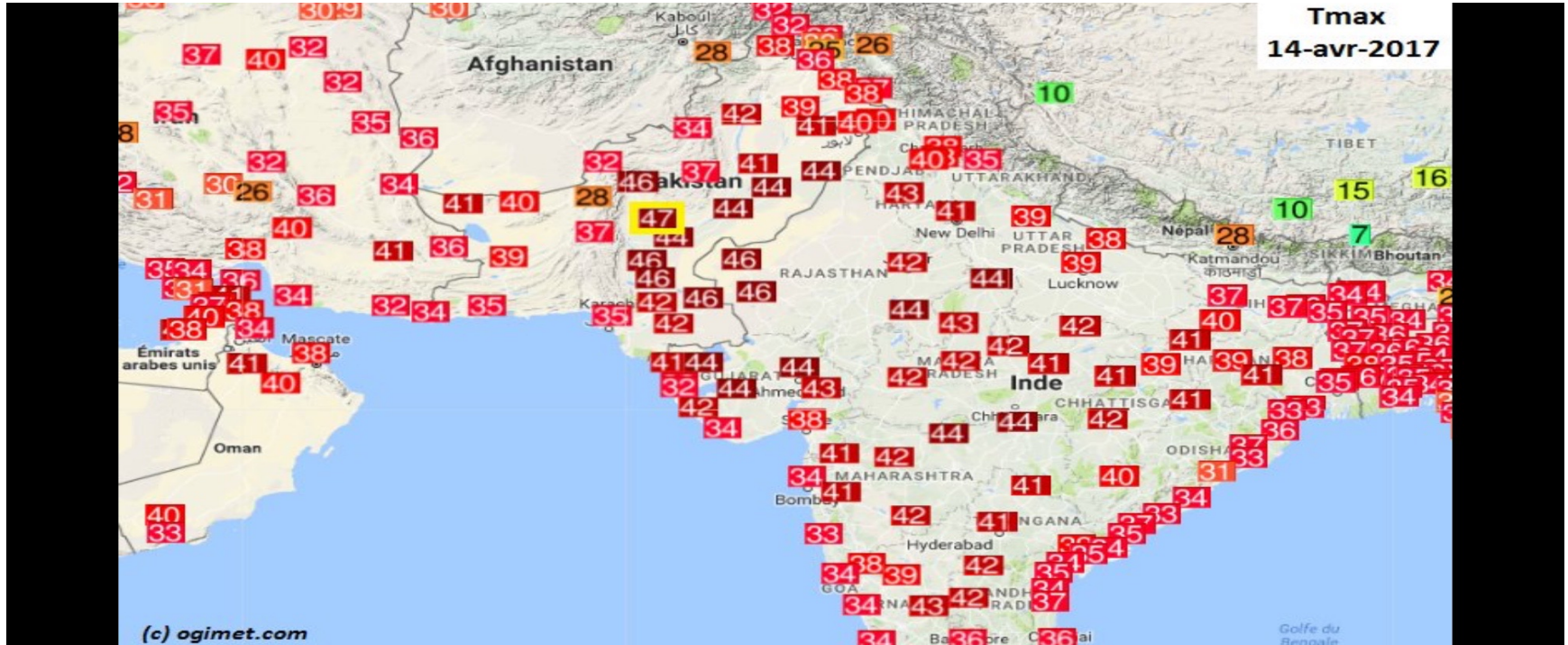
Animated version available on <http://openclimatedata.net/climate-spirals/temperature>

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







Felix Schaad (Tages Anzeiger, Switzerland)

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)

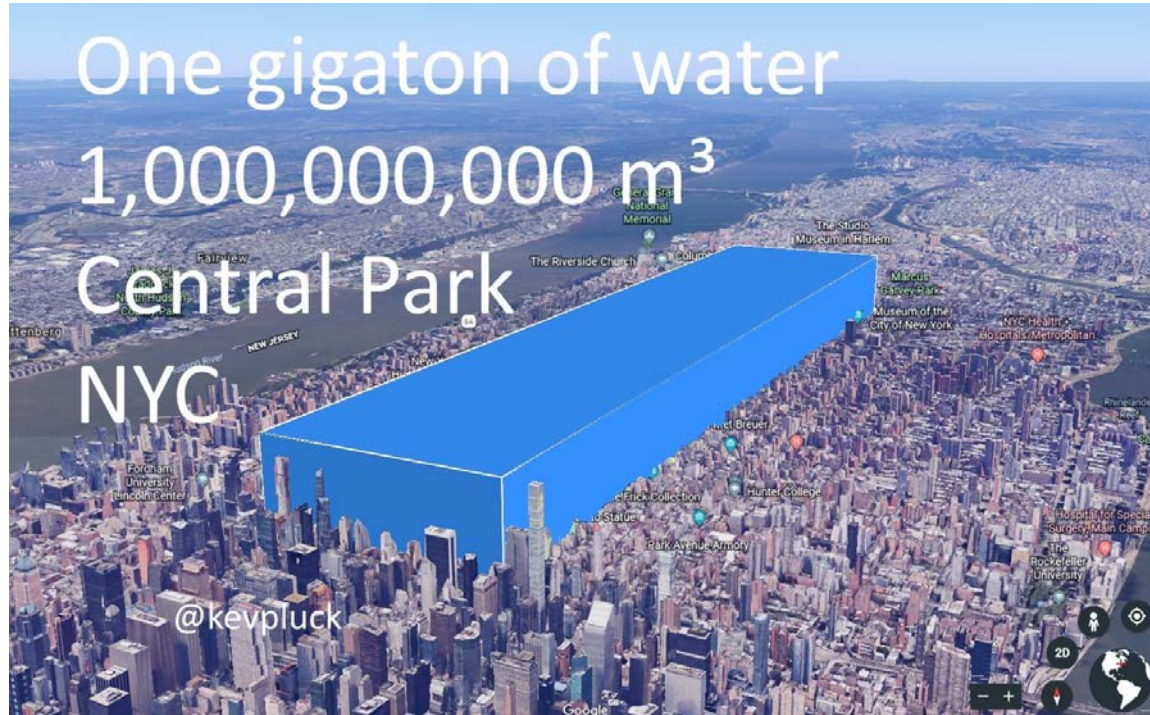


http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

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

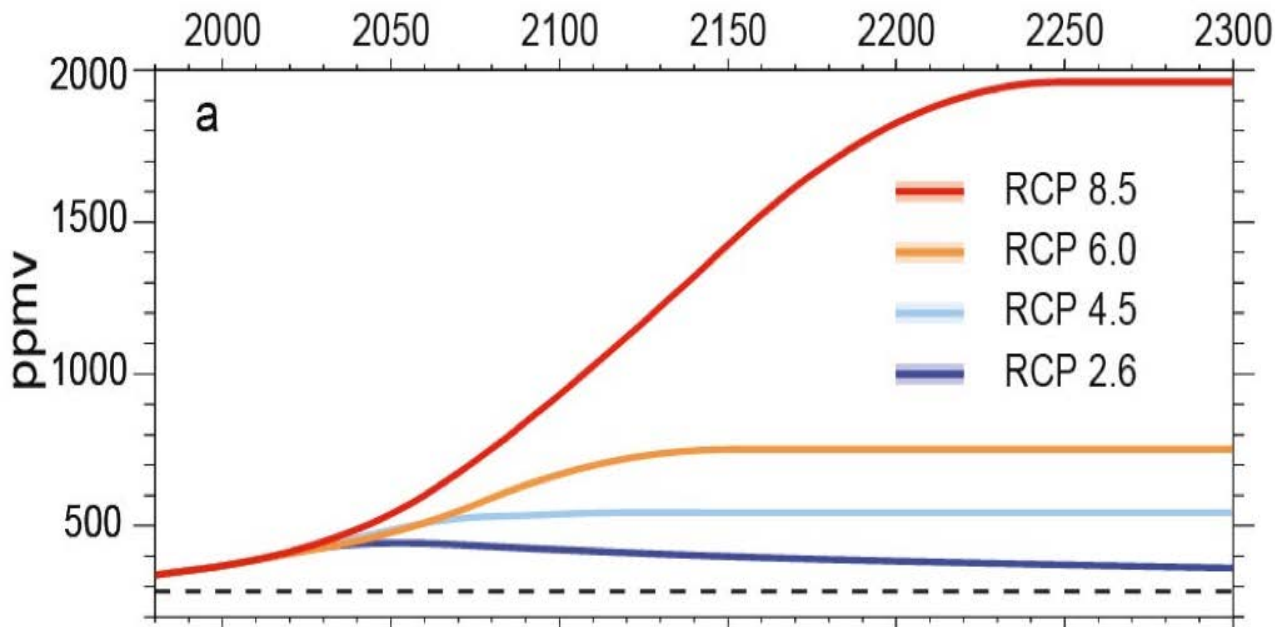
There is therefore a very high risk that average sea level would increase by several metres over the next century or two

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



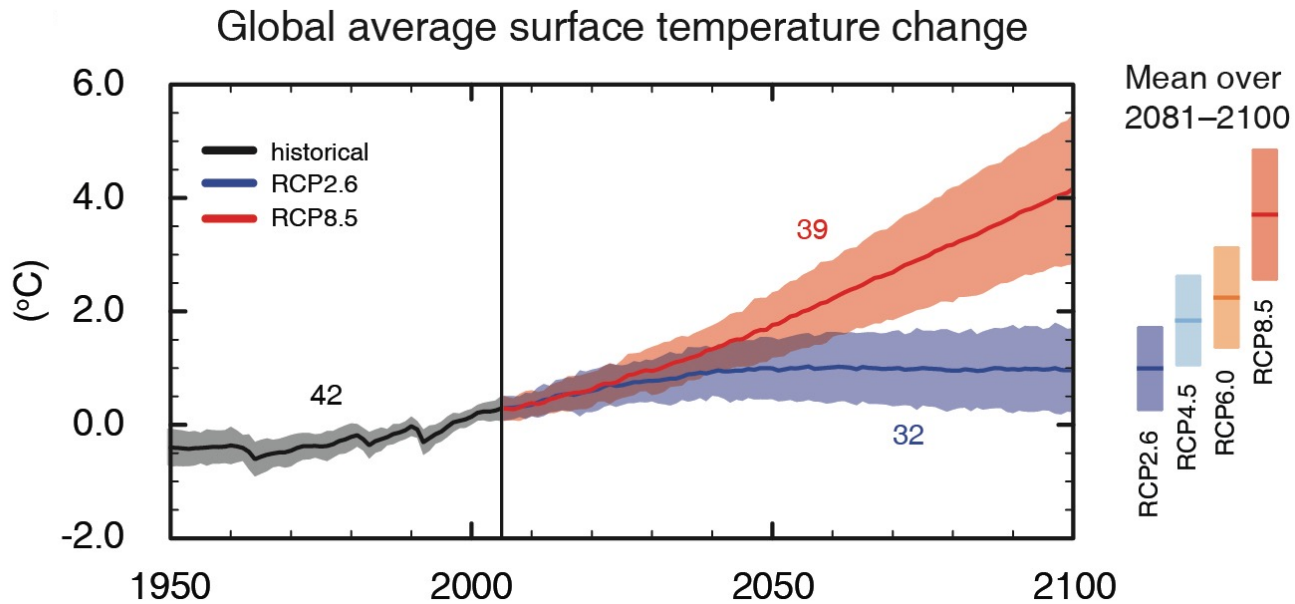
Source: @Kevpluck, June 2018

AR5 RCP: Atmospheric CO₂ concentration



RCP = Representative Concentration Pathway

Réchauffement moyen – scén. RCP, 21s

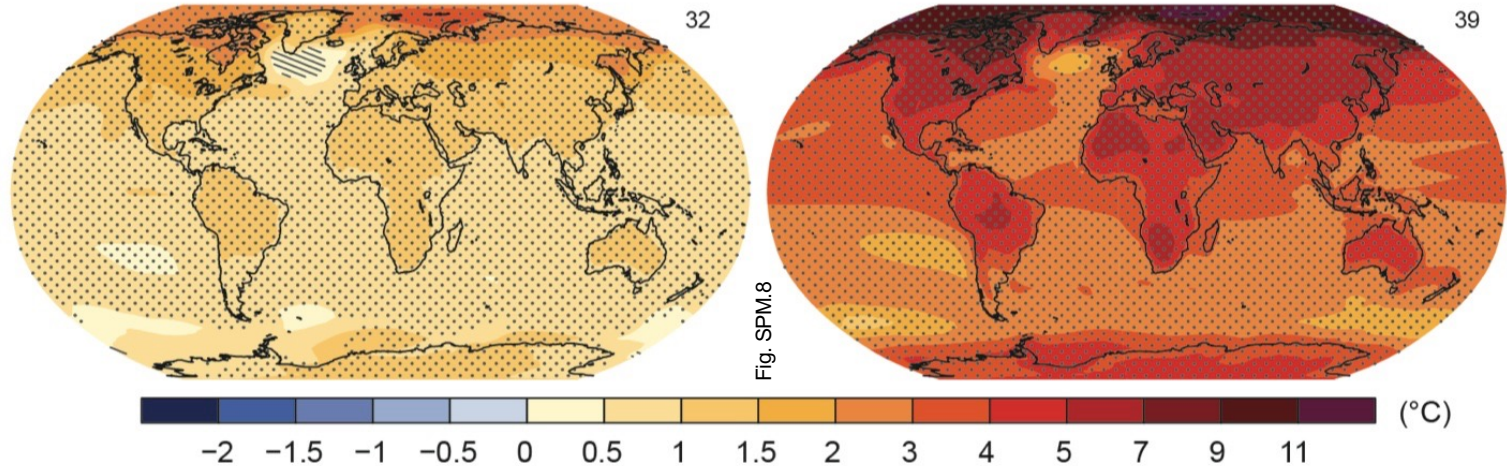


(IPCC 2013, Fig. SPM.7a)

RCP2.6

RCP8.5

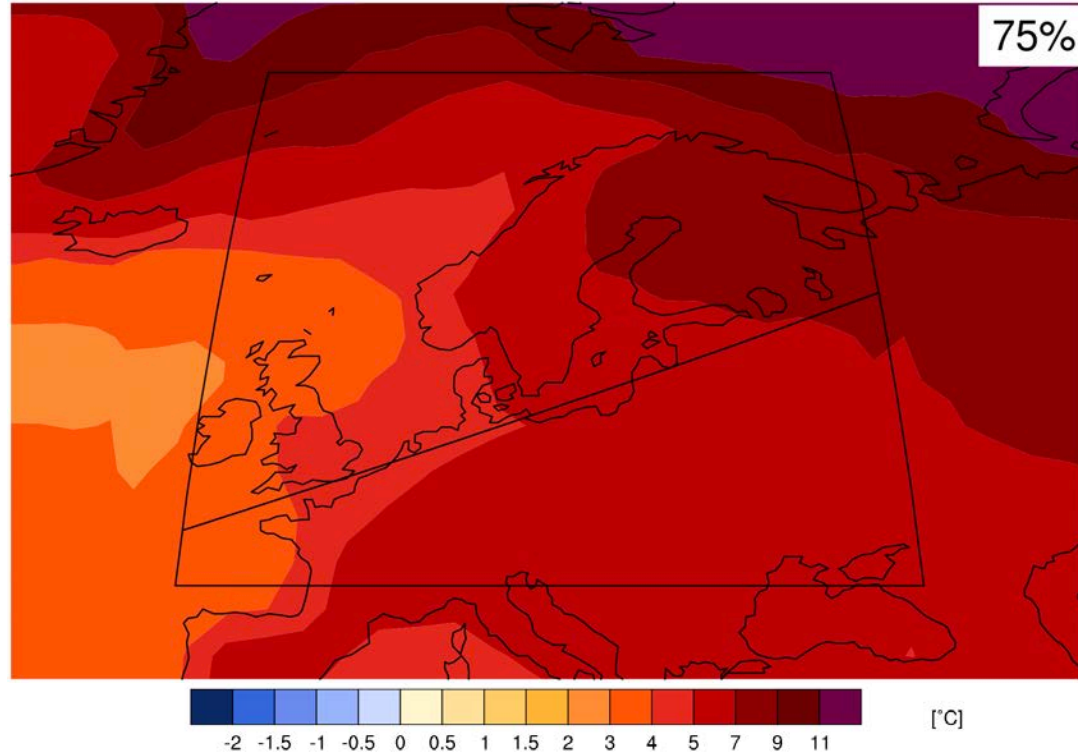
a) Change in average surface temperature (1986–2005 to 2081–2100)



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

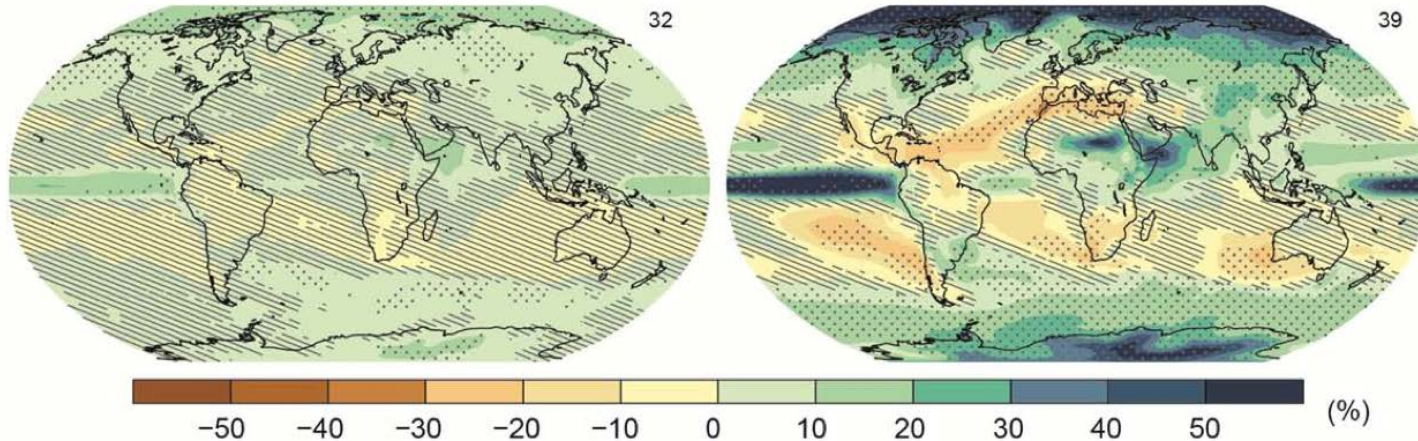
North Europe - Map of temperature changes: 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)



Projected Change in Precipitation

(b)

Change in average precipitation (1986–2005 to 2081–2100)



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).

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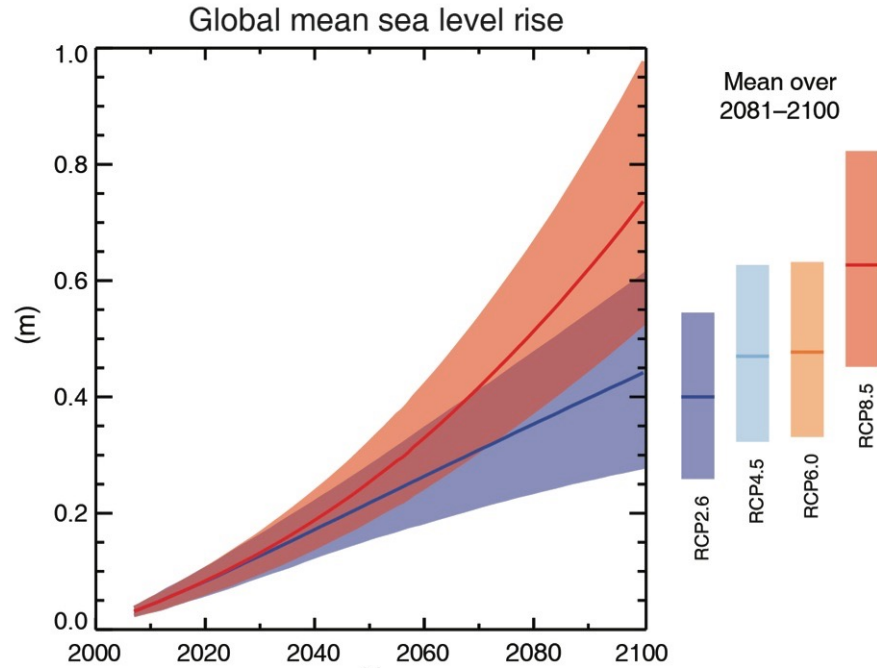


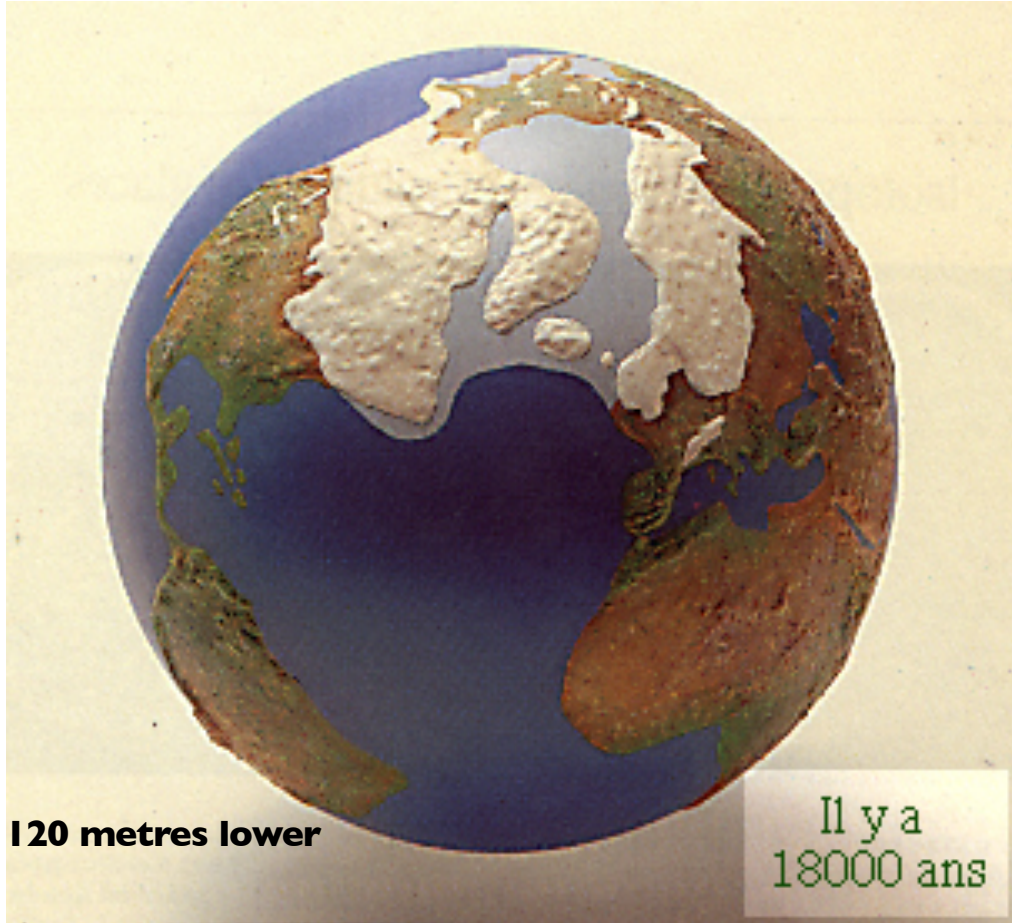
Fig. SPM.9

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. Joussaume, 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 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 »

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



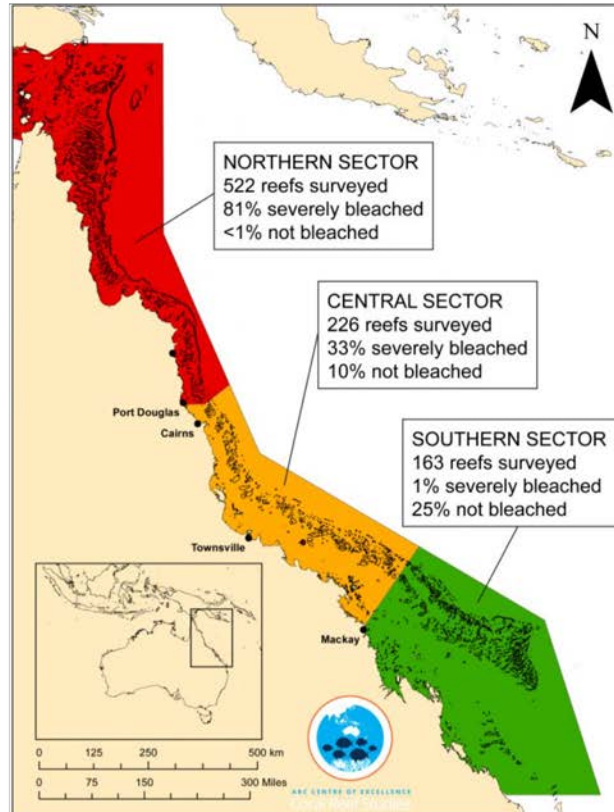
NB: + 1 m is possible
in the next 100 years..

(Time 2001)

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

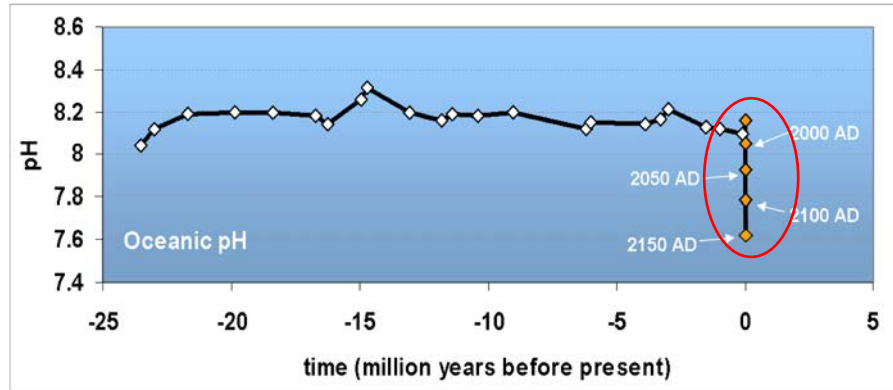
The « Sixth Extinction » has started, and climate change is one of the causing factors

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

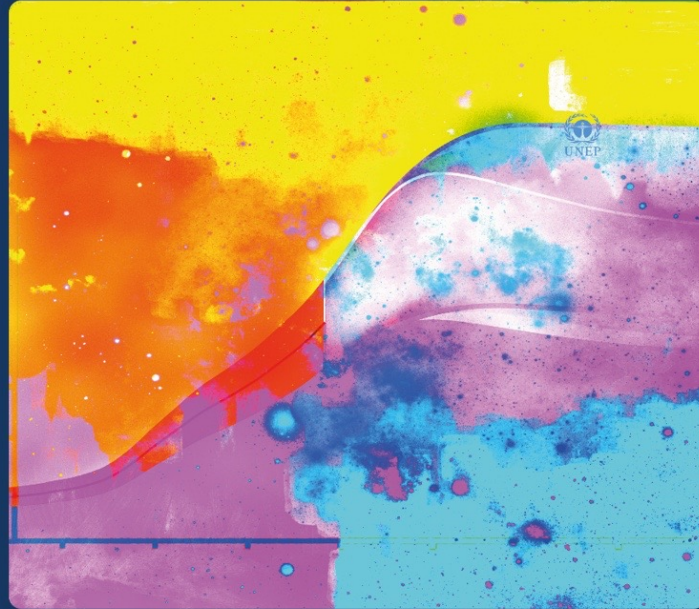
Turley et al. 2006

Slide courtesy of Carol Turley, PML

The SR15











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.



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	 <p>14%</p>	 <p>37%</p>	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	 <p>0.40 METERS</p>	 <p>0.46 METERS</p>	.06M MORE
SPECIES LOSS: VERTEBRATES Vertebrates that lose at least half of their range	 <p>4%</p>	 <p>8%</p>	2X WORSE
SPECIES LOSS: PLANTS Plants that lose at least half of their range	 <p>8%</p>	 <p>16%</p>	2X WORSE
SPECIES LOSS: INSECTS Insects that lose at least half of their range	 <p>6%</p>	 <p>18%</p>	3X WORSE

Responsibility for content: WRI

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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

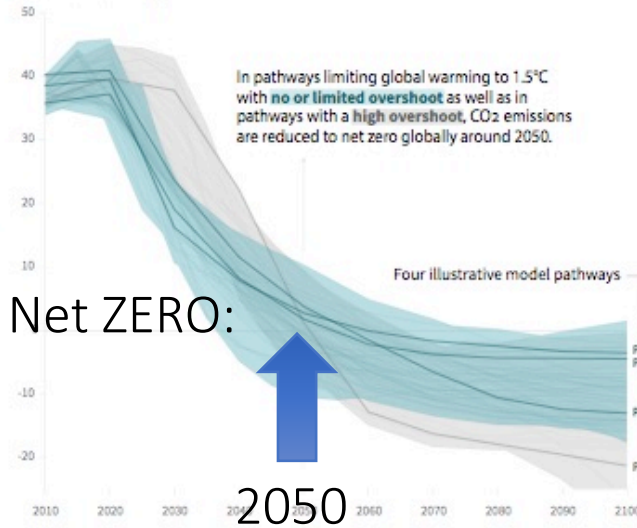
Global emissions pathway characteristics

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.

Source: IPCC SR15

Global total net CO₂ emissions

Billion tonnes of CO₂/yr



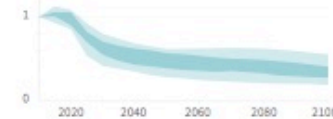
Net ZERO:

2050

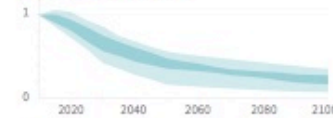
Non-CO₂ emissions relative to 2010

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.

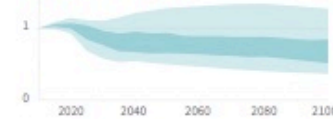
Methane emissions



Black carbon emissions



Nitrous oxide emissions



Timing of net zero CO₂

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





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

**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...)

@JPvanYpersele

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

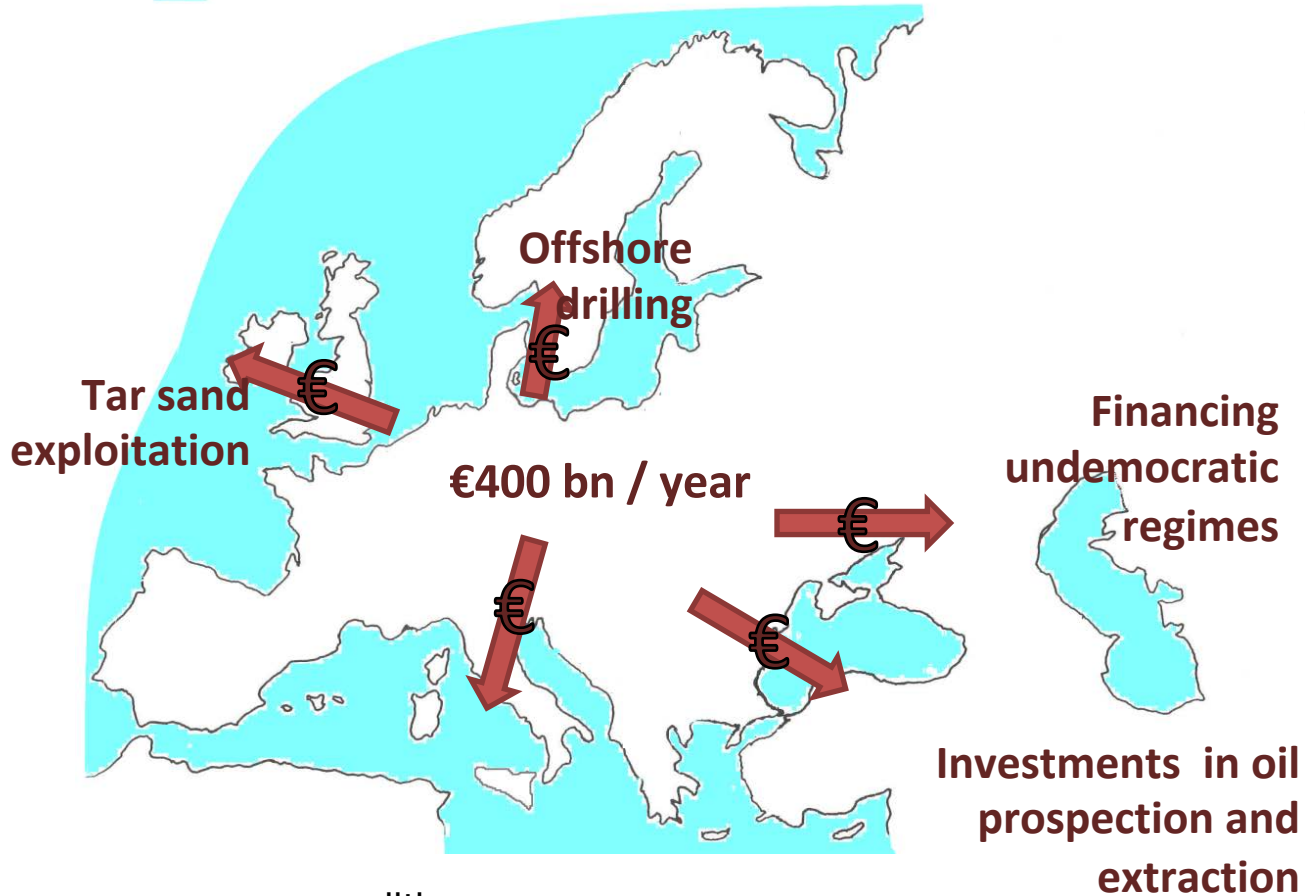
(recent example: so-called enormous needs of cobalt for electric mobility reported on CNN; see critical analysis on

<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

EU: annual cost of buying fossil fuels



Source: www.energycoalition.eu

Ambitious Mitigation Is Affordable

- **Economic growth reduced by ~ 0.06% (BAU growth 1.6 - 3%/year)**
- **This translates into delayed and not forgone growth**
- **Estimated cost does not account for the benefits of reduced climate change**
- **Unmitigated climate change would create increasing risks to economic growth and efforts to eradicate poverty**

AR5 WGI SPM, AR5 WGII SPM

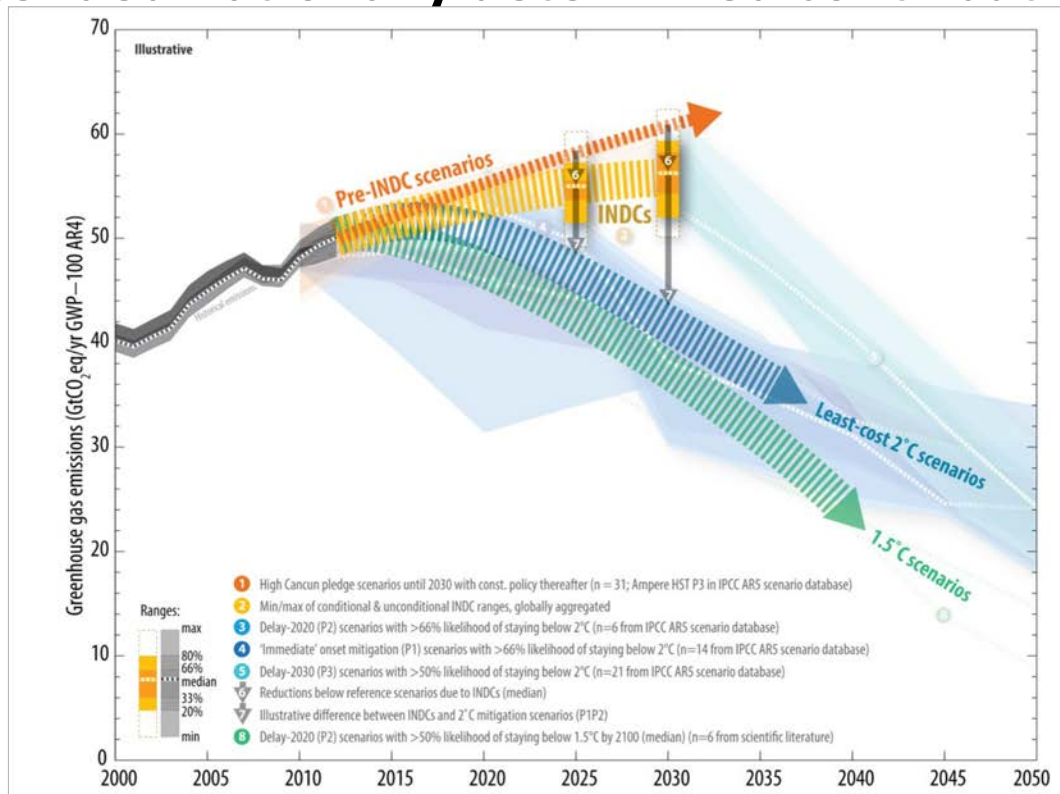
Fact n° 9: China is waking up to the climate and pollution challenge. It might become the world climate leader if the EU (5% of world population in 2050 ?) does not raise its ambition level in line with the Paris Agreement

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

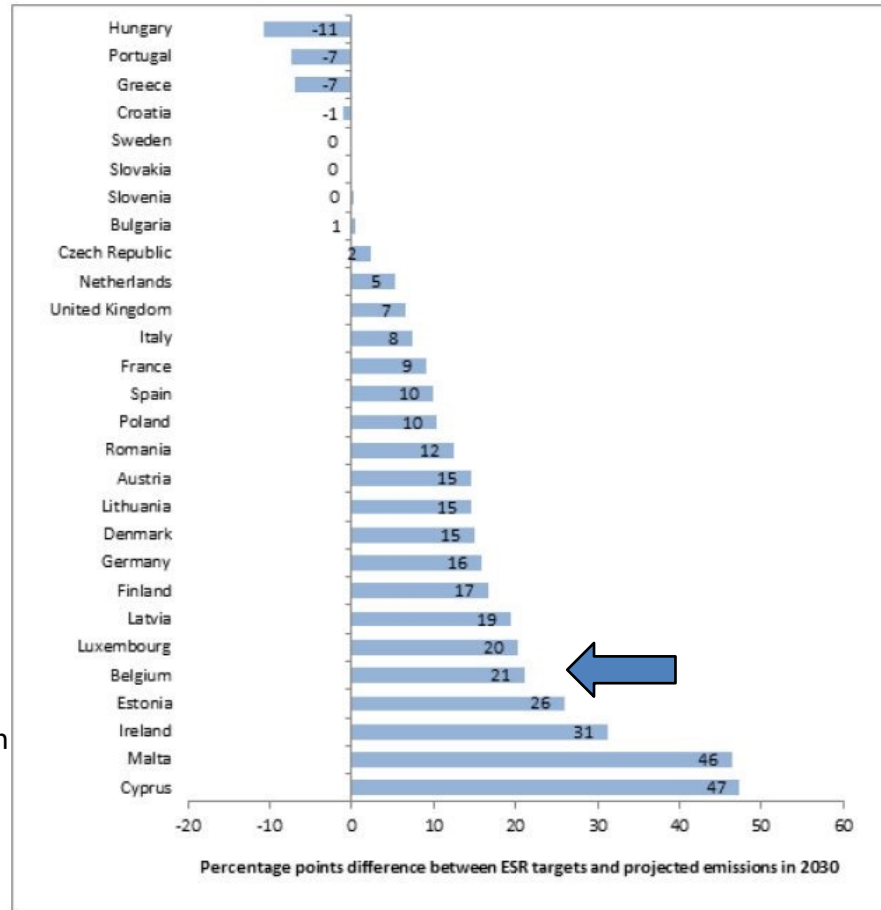
Comparison of global emission levels in 2025 and 2030 resulting from the implementation of the intended nationally determined contributions



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

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

Percentage points difference between ESR targets and projected emissions in 2030



Source:
European Commission

I want you to panic... *and act*

“I don’t want your hope. I don’t want you to be hopeful. I want you to panic ... and act as if the house was on fire. ”

Greta Thunberg
Environmental Activist

WORLD
ECONOMIC
FORUM



**(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.

Nations Unies
Conférence sur les Changements Climatiques
COP21/CMP11
Paris, France



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**

@JPvanYpersele



SUSTAINABLE DEVELOPMENT GOALS



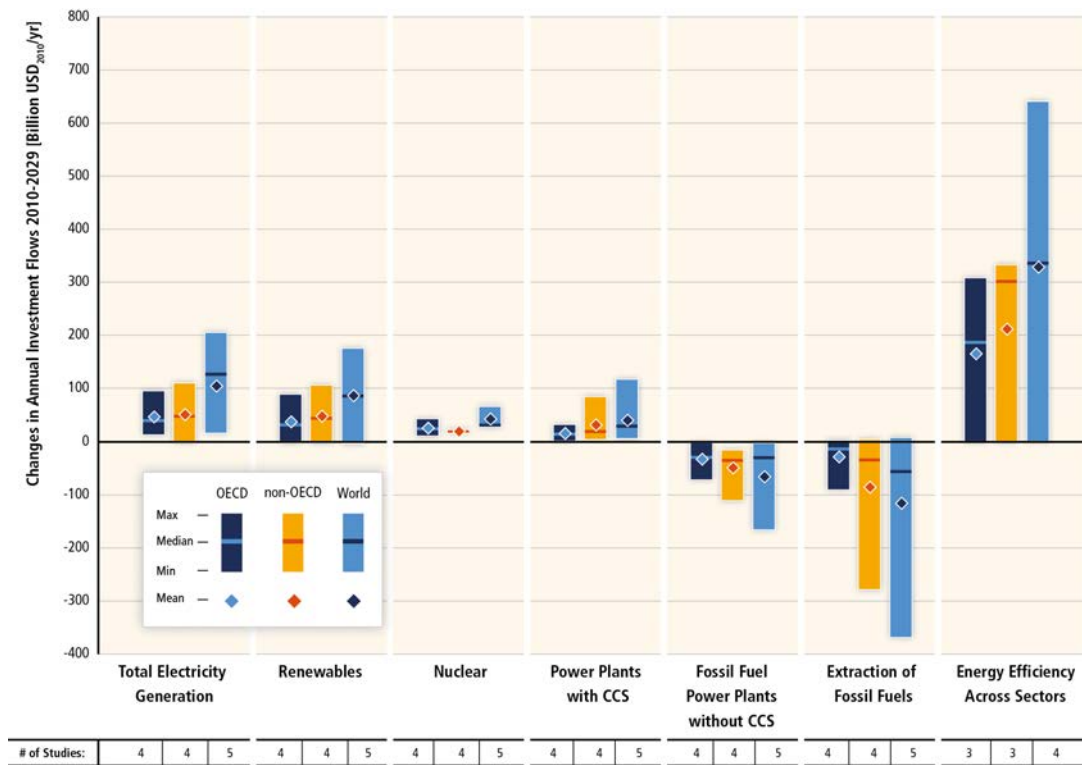


Joel Pett, USA Today

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.

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...**

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

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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

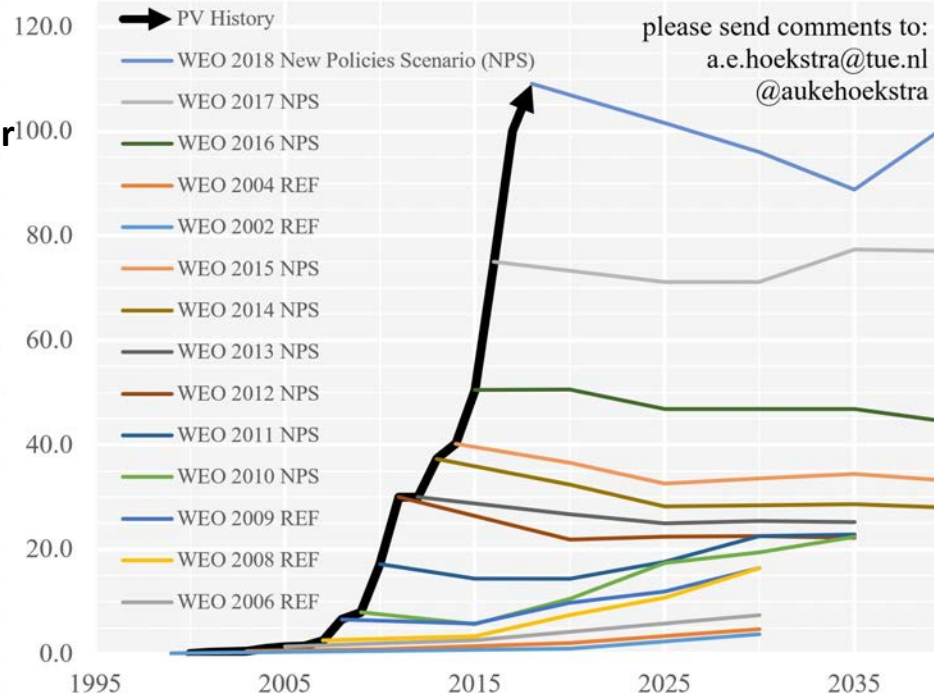
The cost of solar kWh is crashing, wind power, heat and electricity storage, and smart grids are moving forward

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**

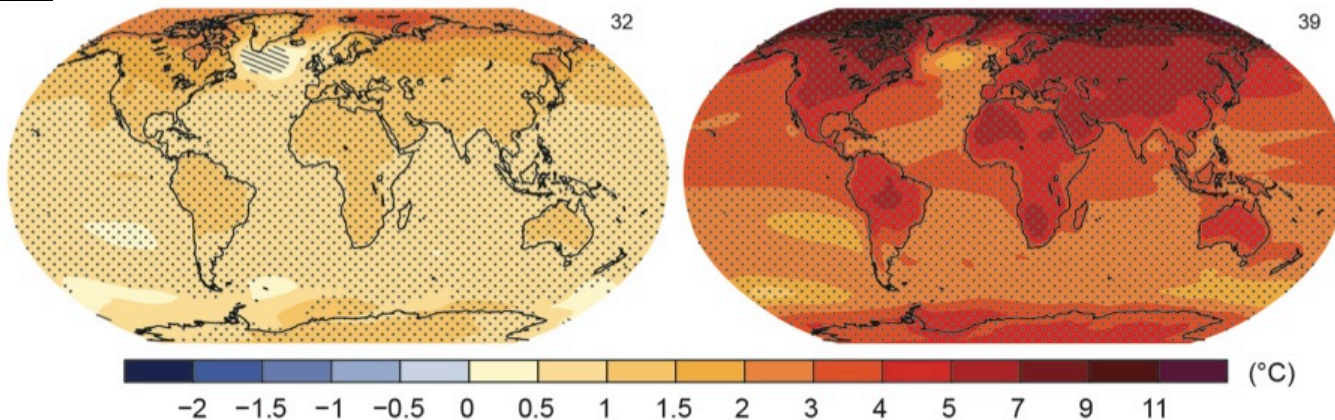
... but their ethical/green
investments are still marginal for
most banks

RCP2.6

RCP8.5

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

Fig. SPM.8



Humanity has the choice

**Yes, the planet got destroyed. But
for a beautiful moment in time we
created value for shareholders**



*"Yes, the planet got destroyed. But for a beautiful moment
in time we created a lot of value for shareholders."*

What did « The Economist » say in 1990 already?

- **“Being dirty has lots of costs: being greener than the competition may have many advantages”**
- **“For far-sighted companies, the environment may turn out to be the biggest opportunity for enterprise and invention the industrial world has seen.”**

(Frances Cairncross, The Economist, 8 September 1990)

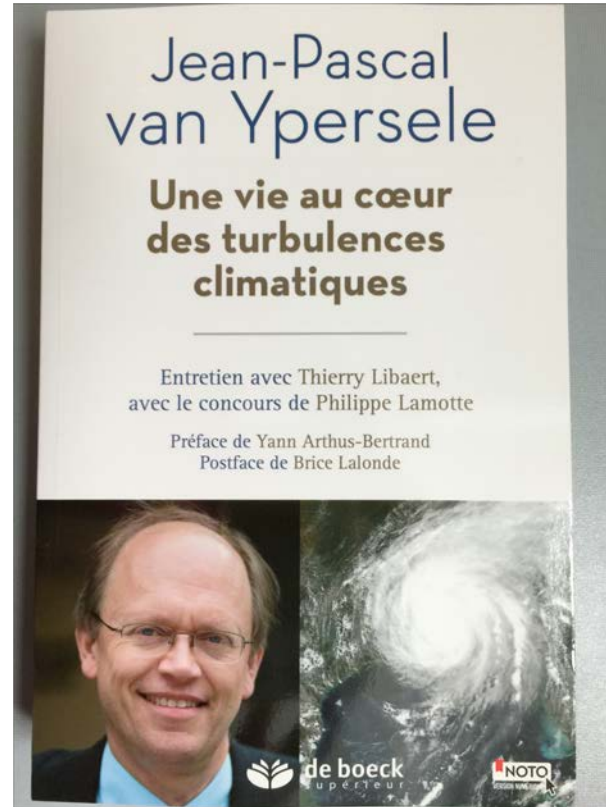
Pour en savoir plus:

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

**Publié chez De Boeck
supérieur**

**Préface: Yann Arthus-
Bertrand**

Postface: Brice Lalonde



Om meer te weten:

Bij EPO (2018)

**Voorwoord:
Jill Peeters**



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

Plateforme Wallonne pour le GIEC
Lettre N°13 - avril 2019

**'Sauver le climat' :
les bases**

Le Saint-Louis & social sciences
Actions against climate change

Suite à l'intense mobilisation des jeunes, les changements climatiques ont fait l'objet de beaucoup d'attention ou d'ours des derniers mois. Éèves 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'importance des efforts nécessaires pour mettre en œuvre les objectifs que 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 societal.

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

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

Sommaire

ABC des changements climatiques	2
Ressources pour l'enseignement	10
Témoignages	14
Agenda	16


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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, latests on SR15, basic climate science
- **Twitter: @JPvanYpersele & @IPCC_CH**