

# Climate change: what can we do?

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**RBC Investor & Treasury Services Luxembourg Citizenship  
Committee, Esch-sur-Alzette, GD de Luxembourg, 14 June 2019**

Thanks to the Walloon government for supporting [www.pplateforme-wallonne-giec.be](http://www.pplateforme-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

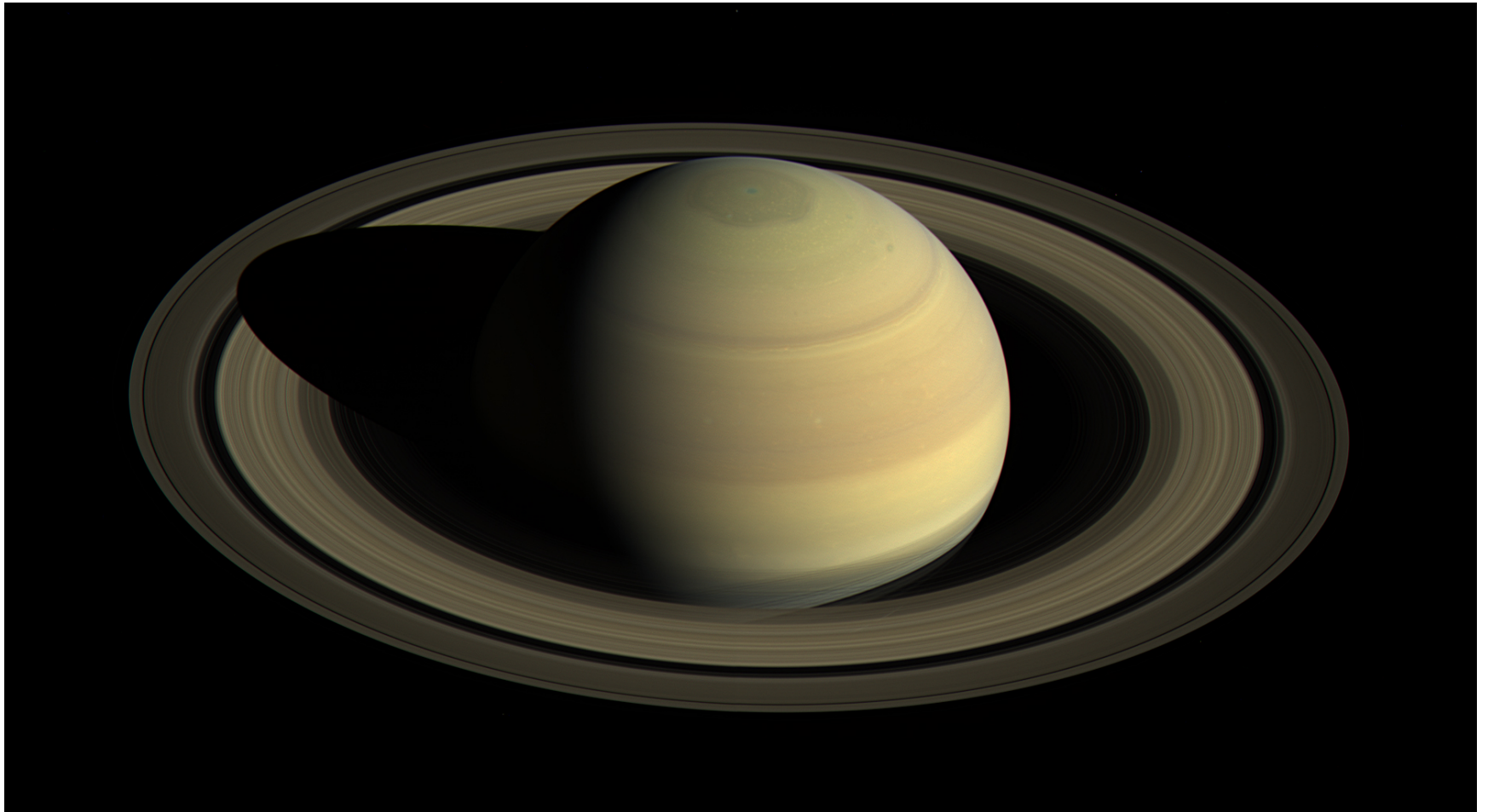
- causes of climate change,
- potential environmental and socio-economic impacts,
- possible response options (adaptation & mitigation).

WMO=World Meteorological Organization  
UNEP= United Nations Environment Programme



Reminder: There is no planet B

**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**

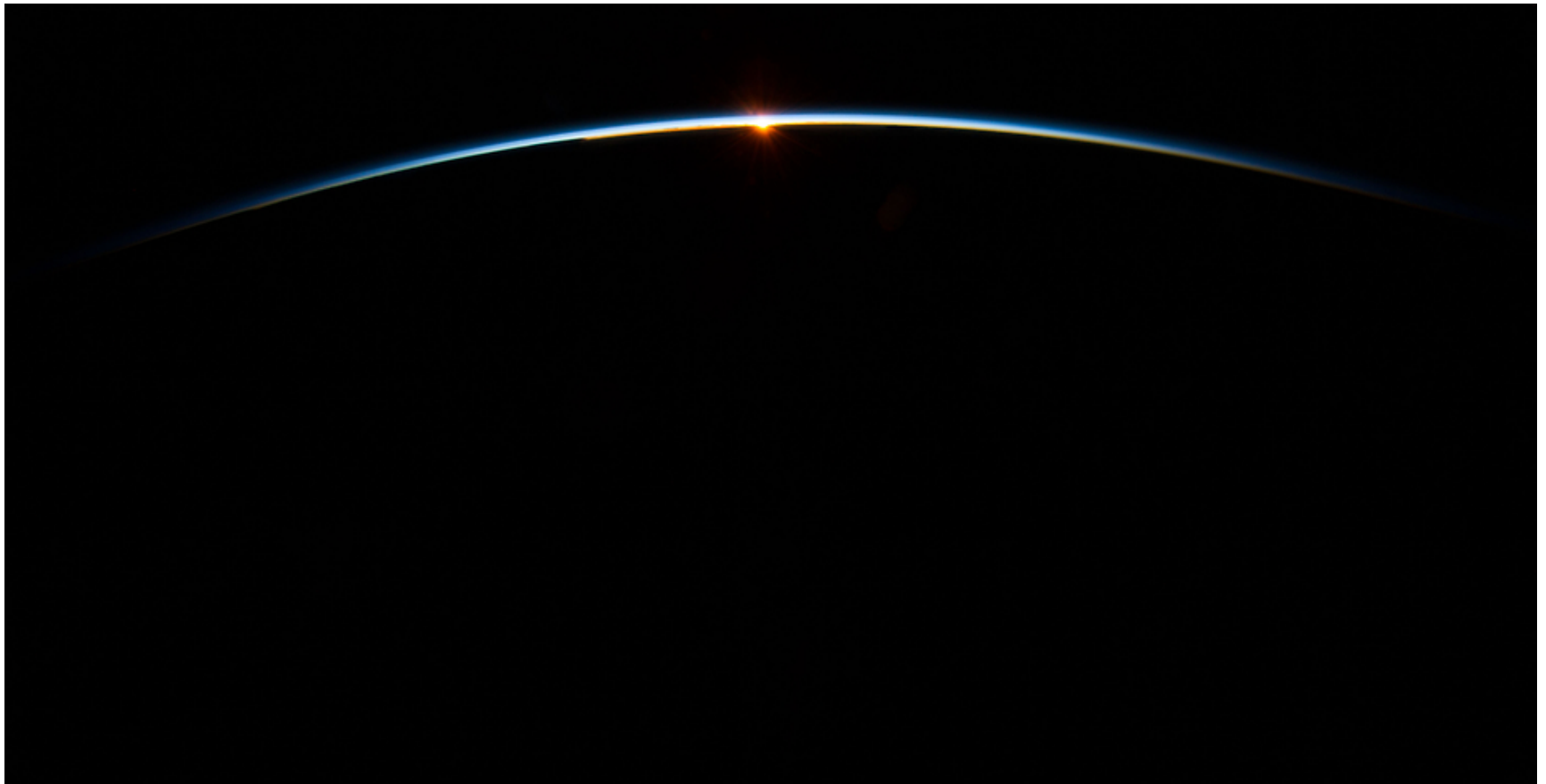




**That small blue dot is the Earth, as seen from Cassini, orbiting Saturn, 1.44 billion km from us, on 19-7-2013**



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

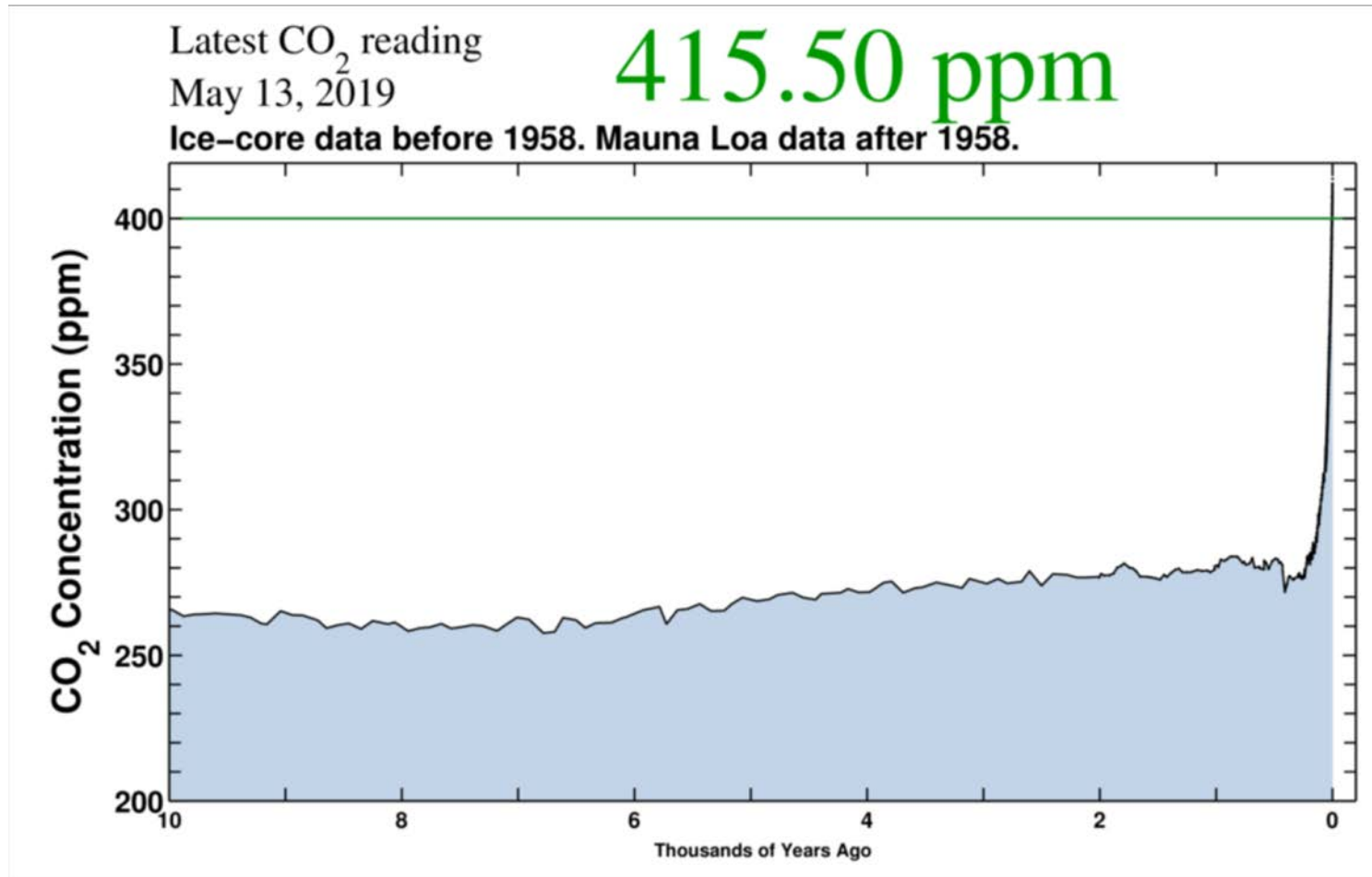


Jean-Pascal van Ypersele  
([vanyp@climate.be](mailto:vanyp@climate.be))

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

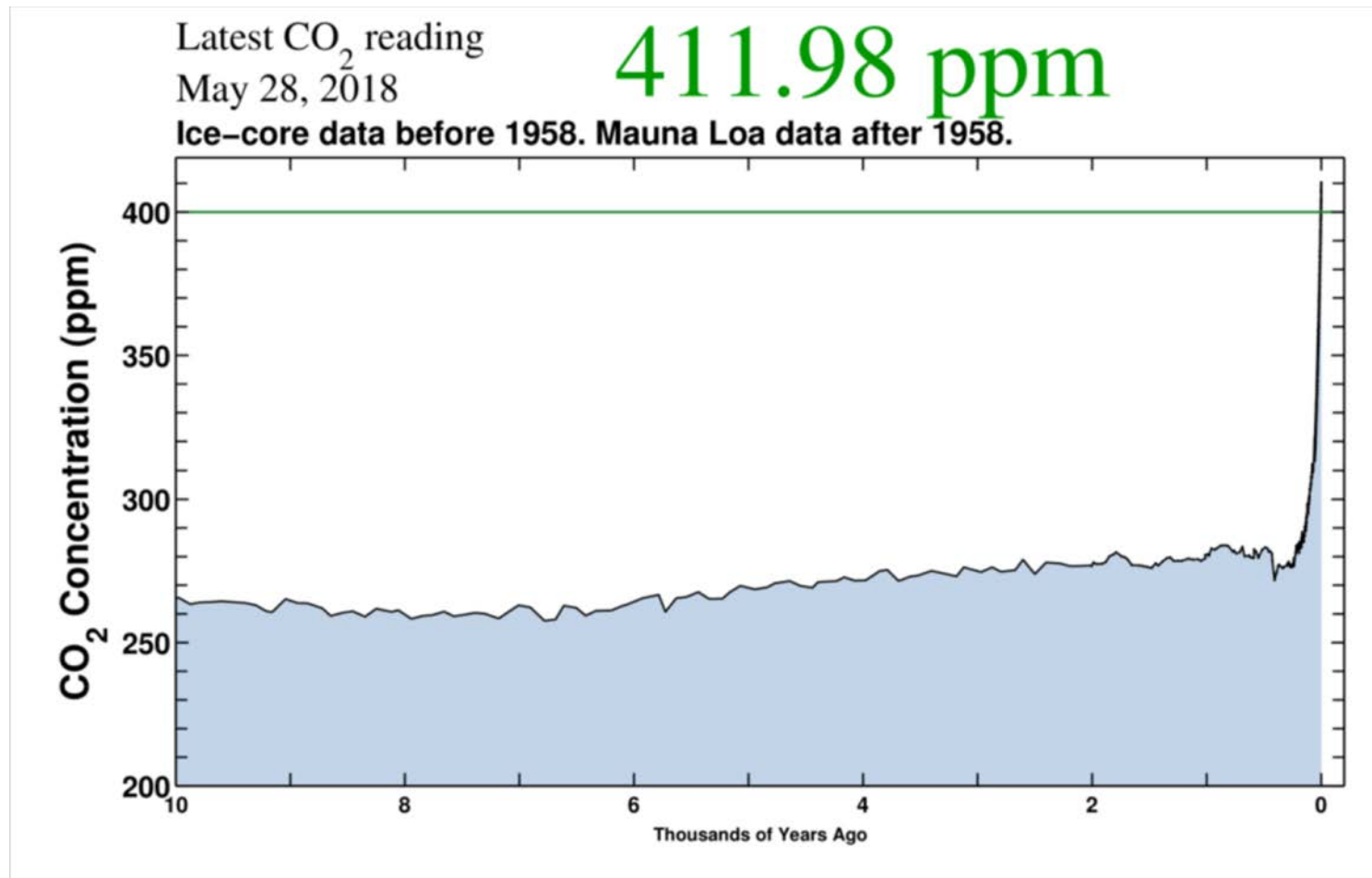
**That is why we must cut emissions to ZERO as soon as possible**

# CO<sub>2</sub> Concentration, 13 May 2019 (Keeling curve)



Source: [scripps.ucsd.edu/programs/keelingcurve/](https://scripps.ucsd.edu/programs/keelingcurve/)

# CO<sub>2</sub> Concentration, 28 May 2018 (Keeling curve)



Source: [scripps.ucsd.edu/programs/keelingcurve/](https://scripps.ucsd.edu/programs/keelingcurve/)

# Modèles climatiques

Atmosphère et surface

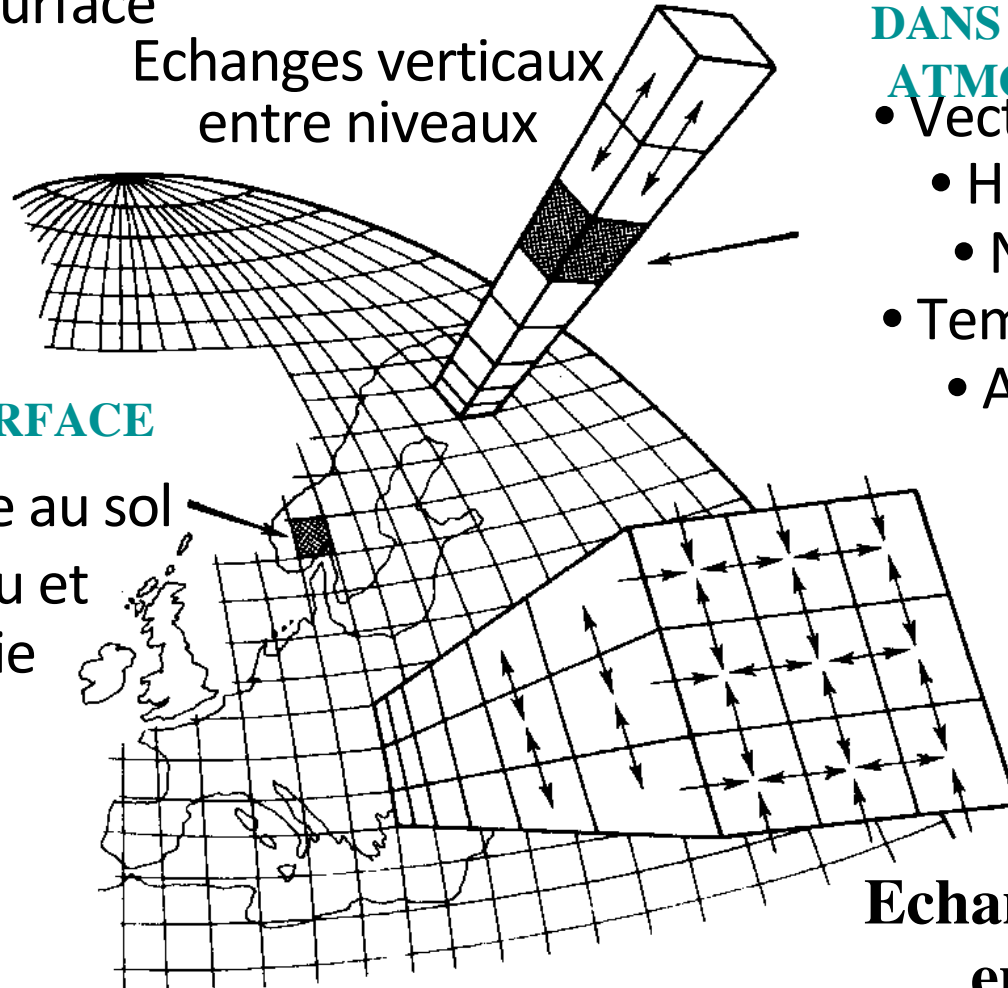
Echanges verticaux  
entre niveaux

**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 :  $\leq 30$  minutes**

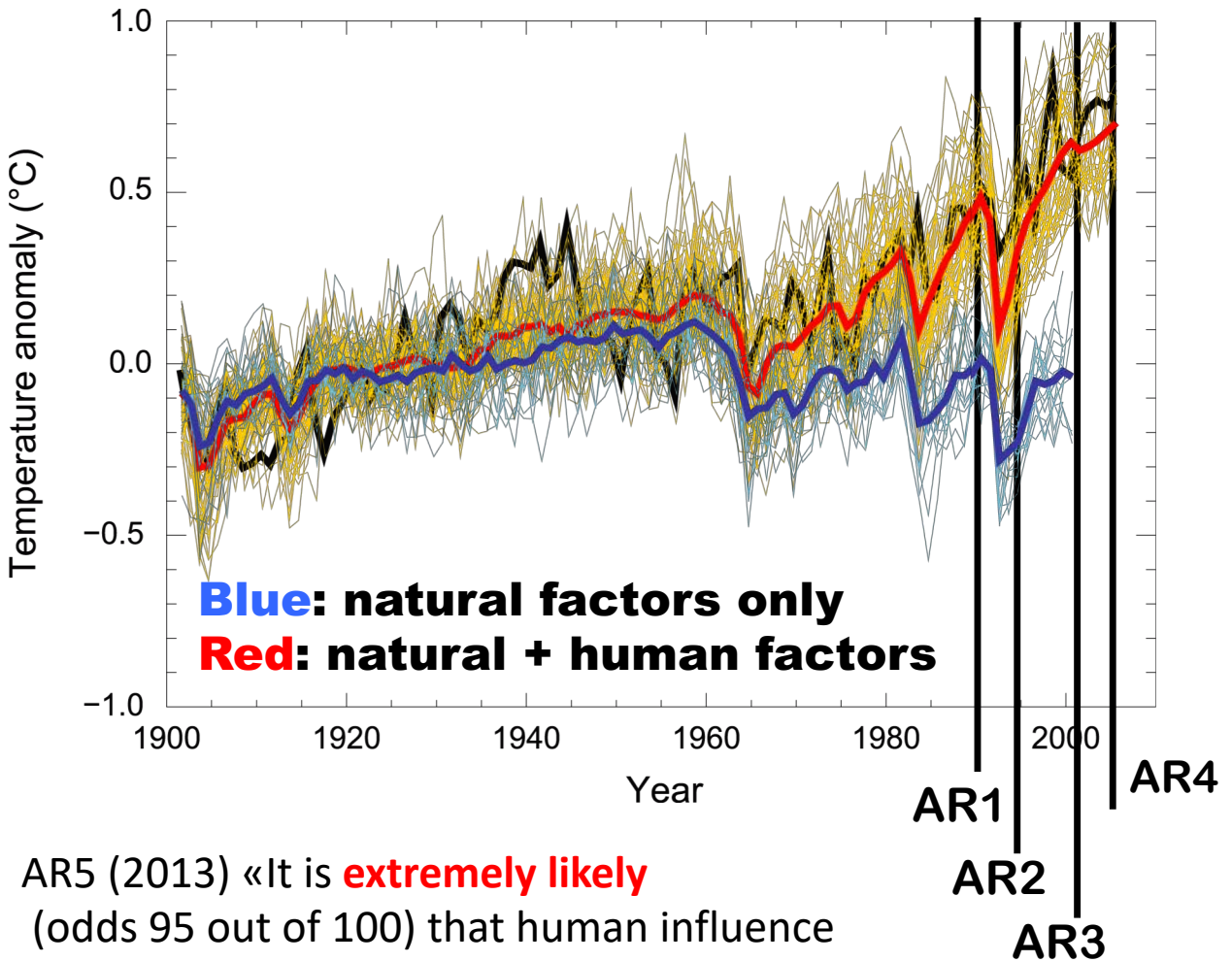
# A Progression of Understanding: Greater and Greater Certainty in Attribution

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”

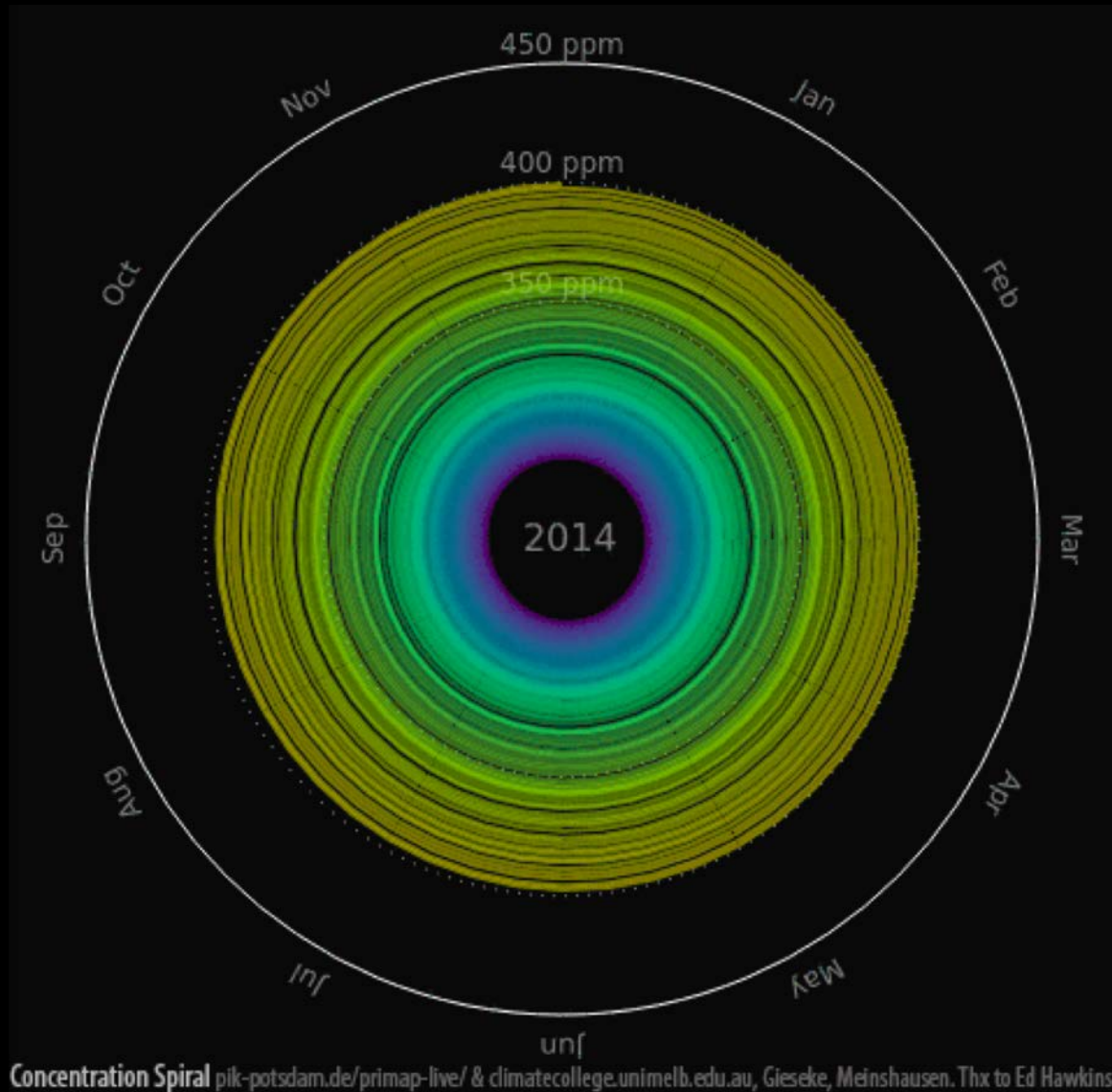


AR5 (2013) «It is **extremely likely**  
(odds 95 out of 100) that human influence  
has been the dominant cause... »

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

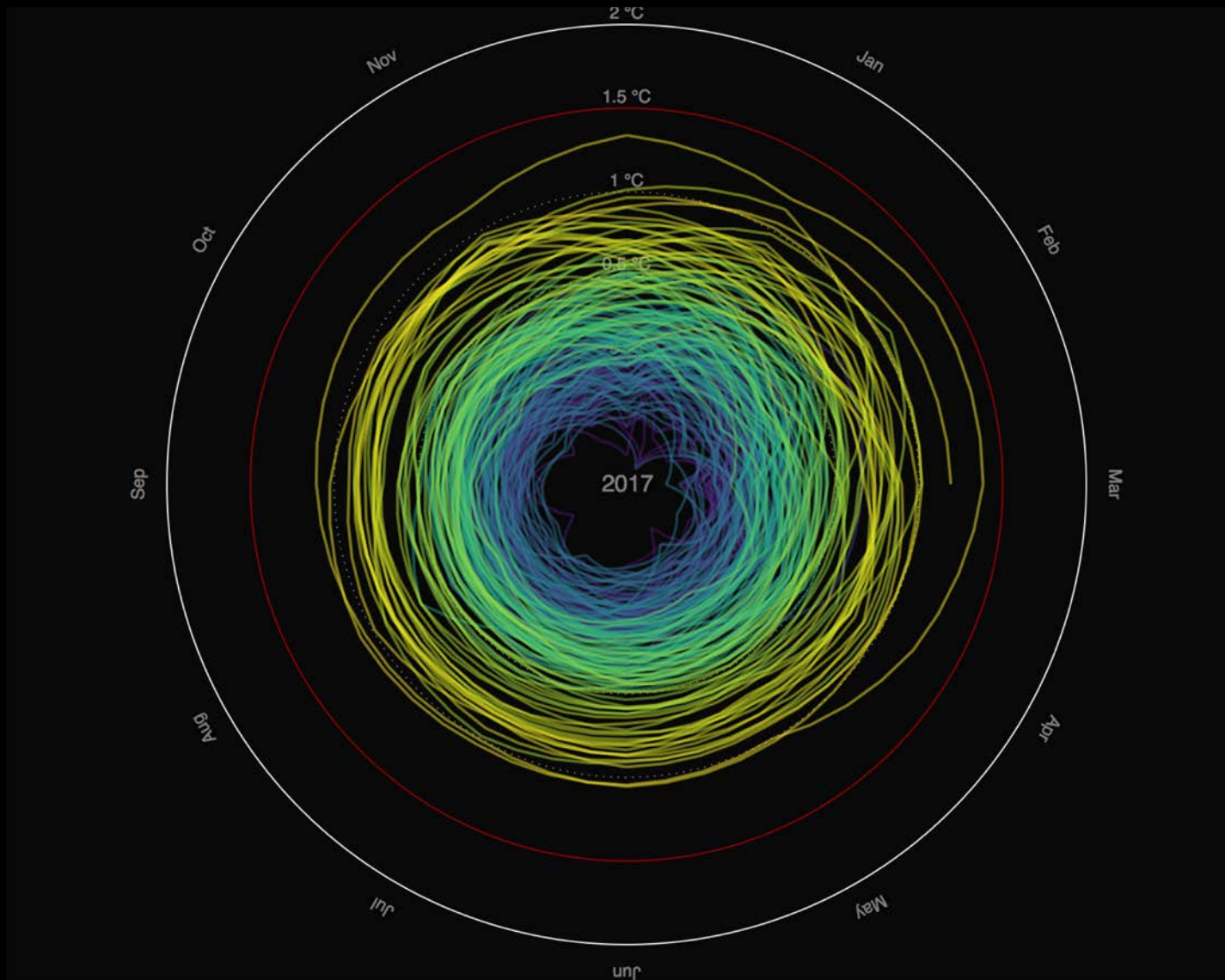


# CO<sub>2</sub> concentration spiral: the insulation thickens!



CO<sub>2</sub> 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











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](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](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**

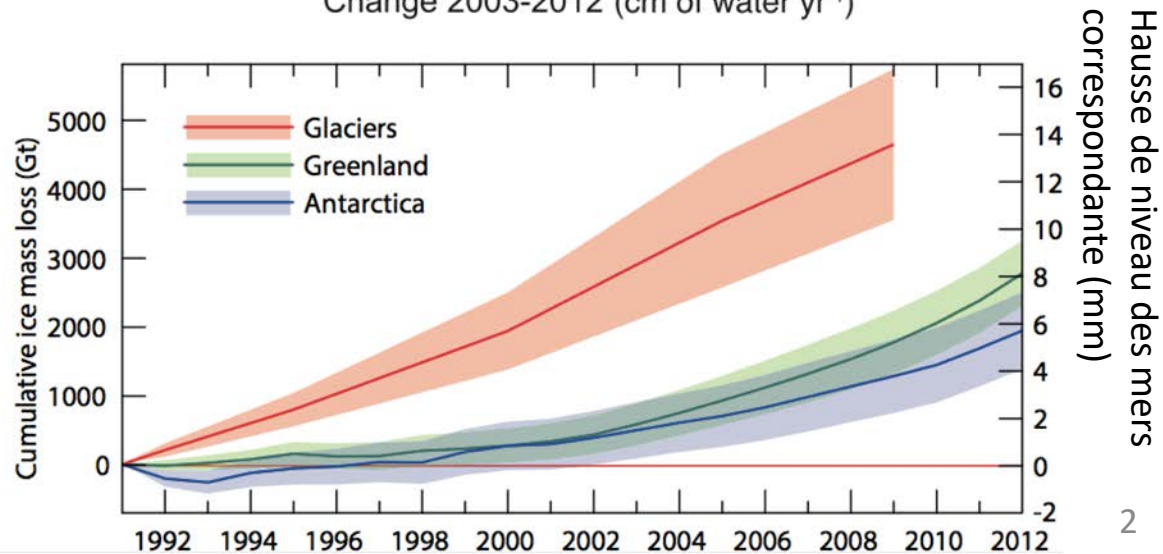
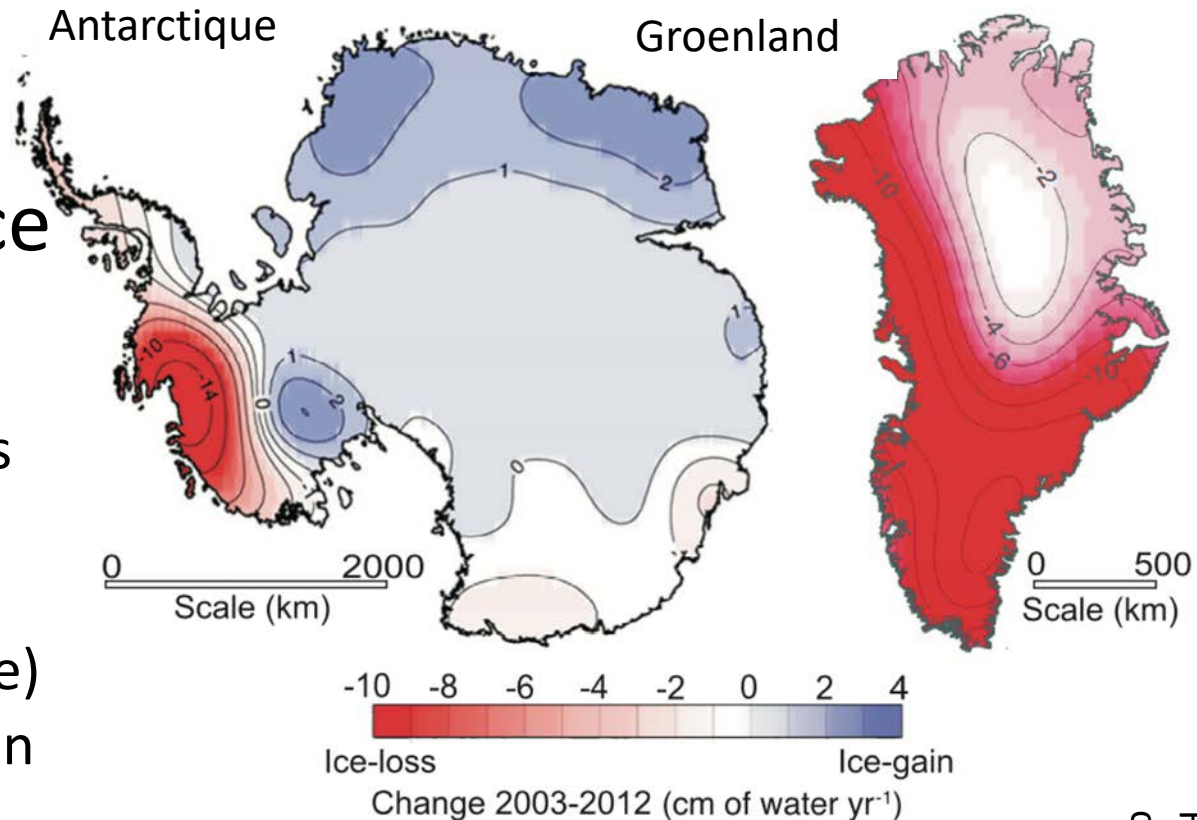
There is therefore a very high risk that average sea level would increase by several metres over the next century or two

# 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

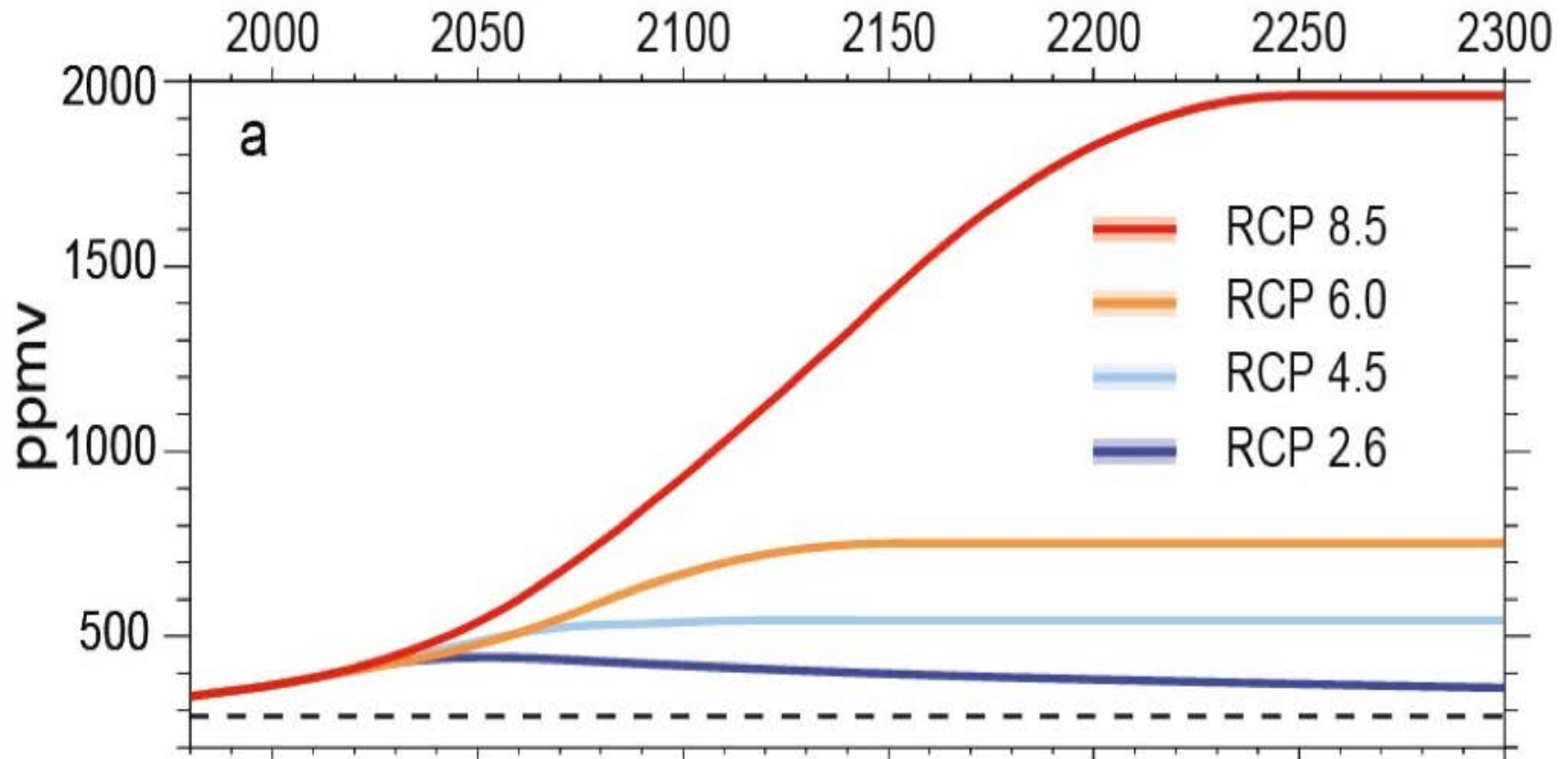
Source: IPCC AR5 WG1 fig TS.3







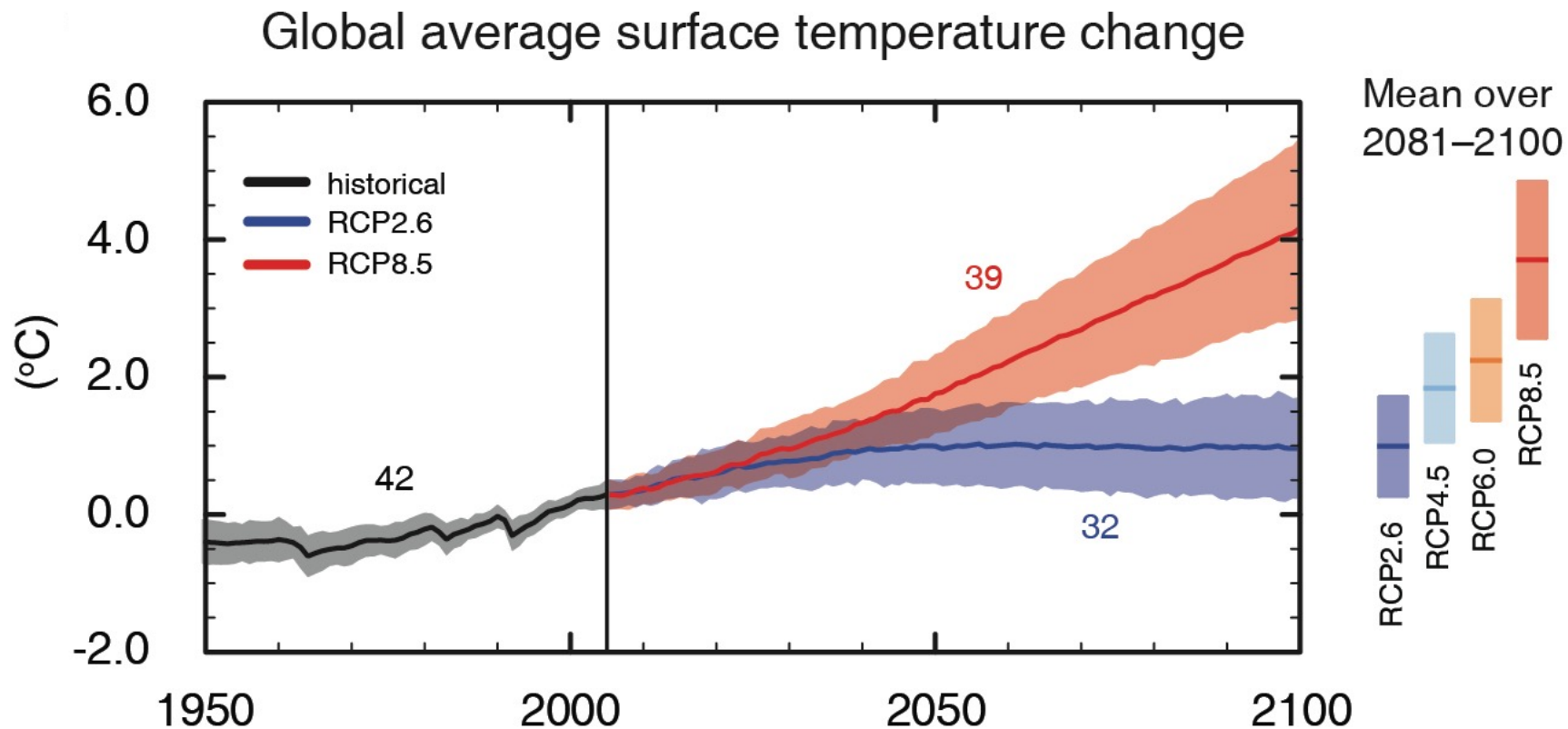
# AR5 RCP: Atmospheric CO<sub>2</sub> concentration



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



(IPCC 2013, Fig. SPM.7a)

# RCP2.6

# RCP8.5

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

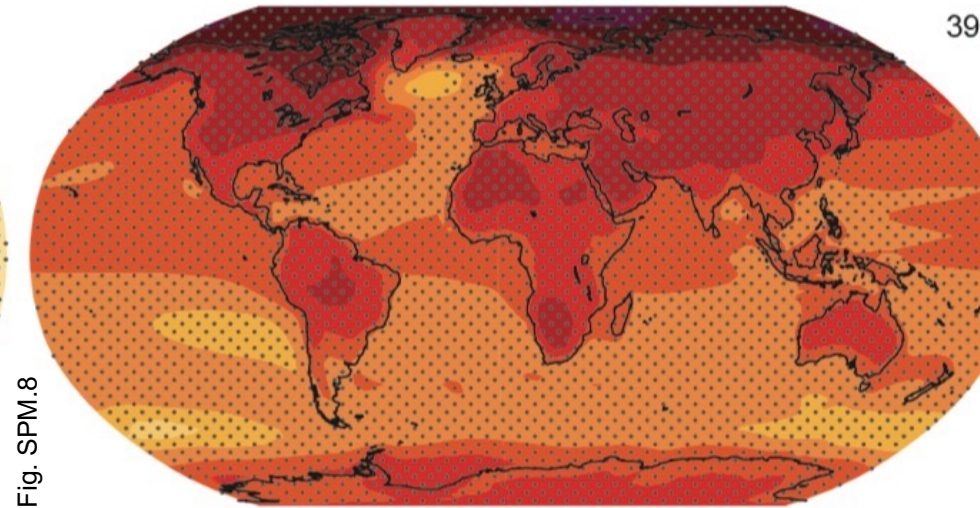
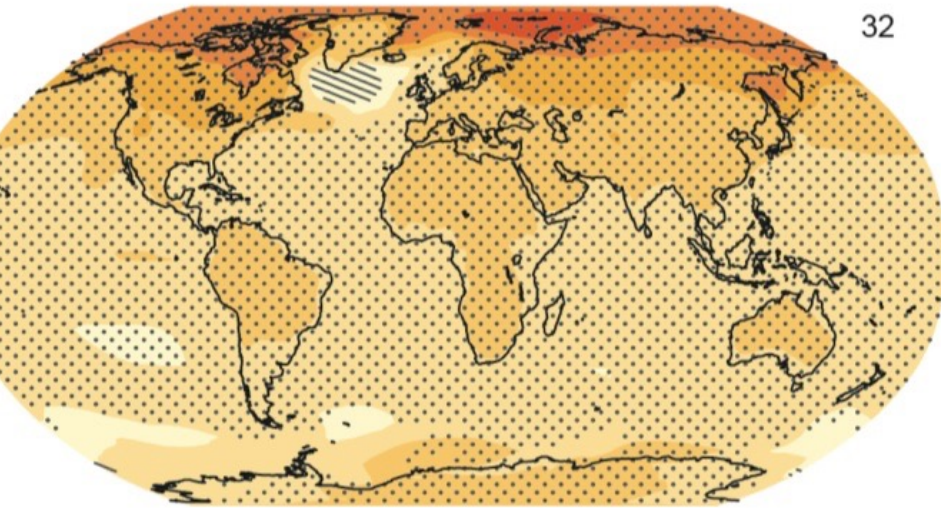
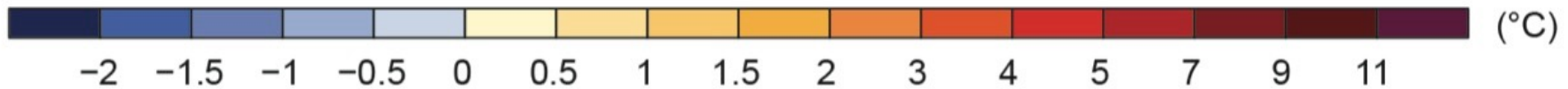


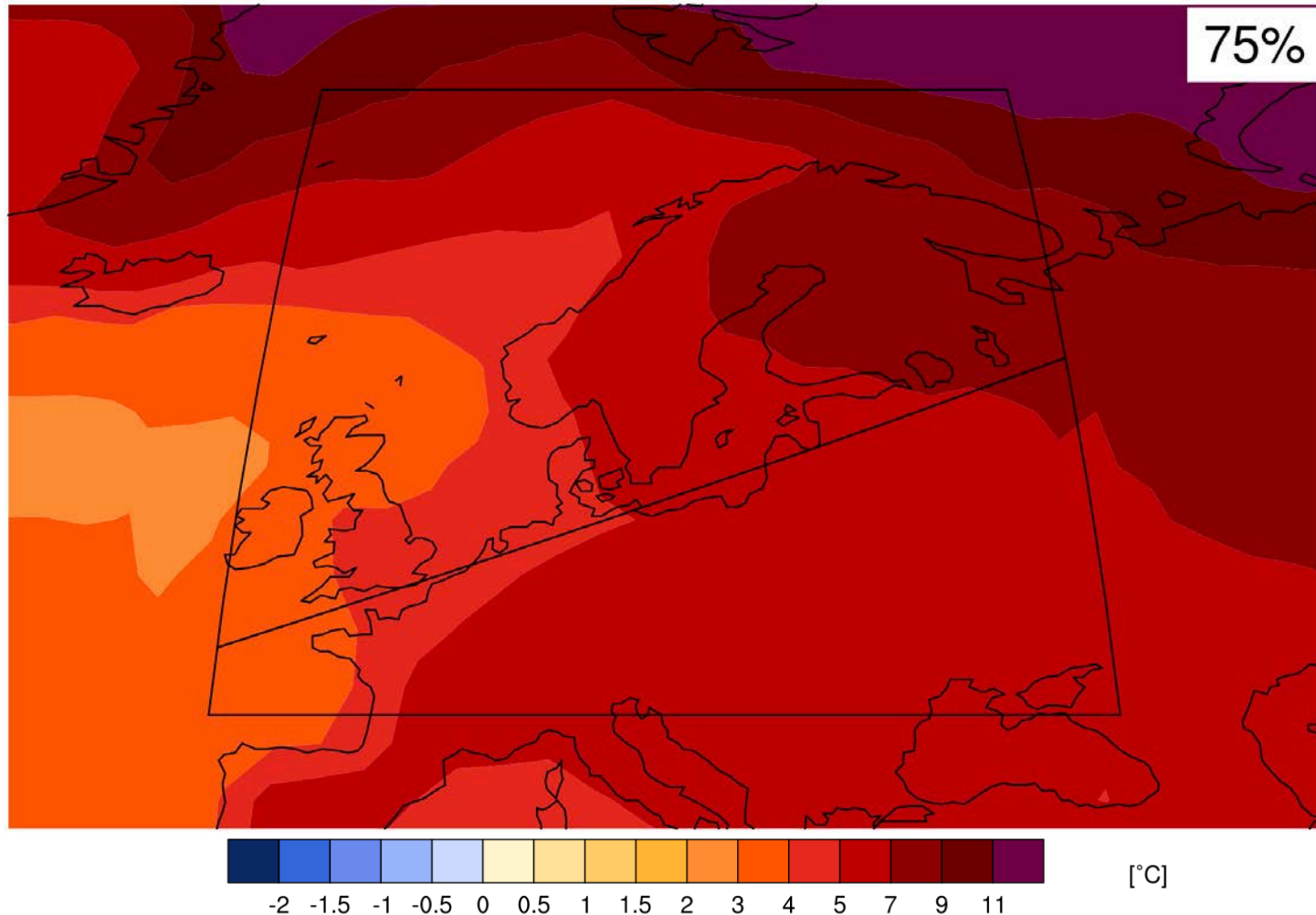
Fig. SPM.8



**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).

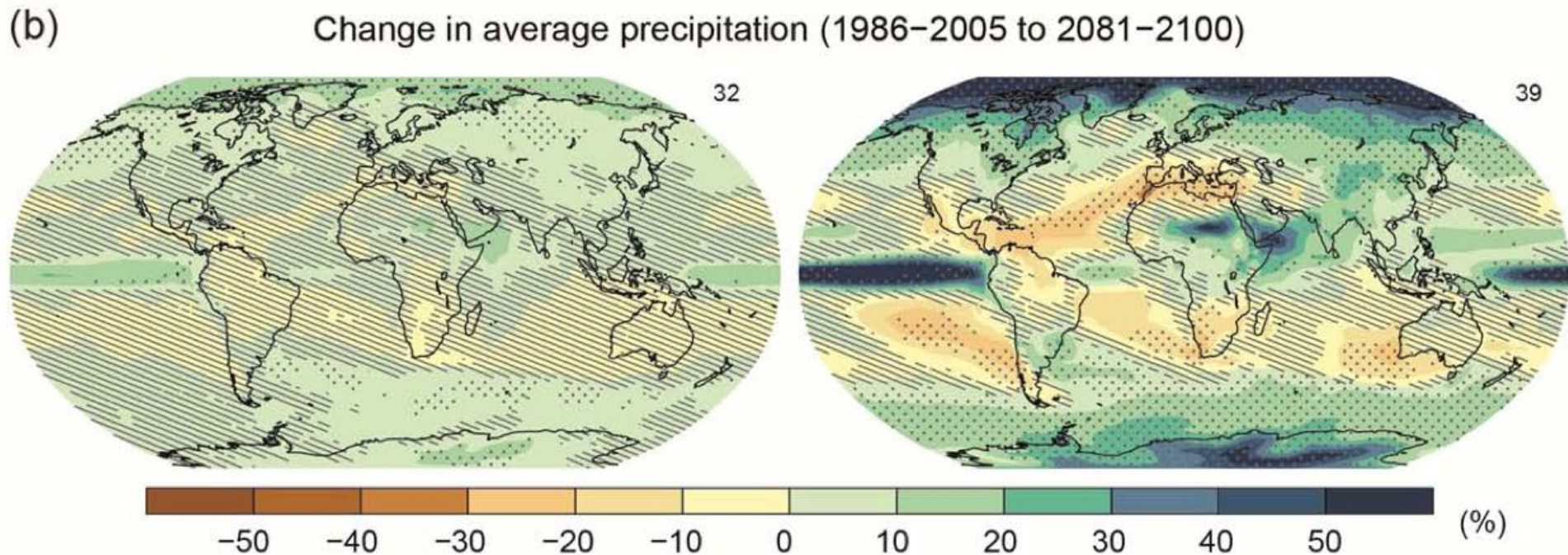
**Stippling [pointillés]** indicates regions where the multi-model mean is large compared to natural internal variability (i.e., greater than two standard deviations of natural internal variability in 20-year means) and where at least 90% of models agree on the sign of change

# 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



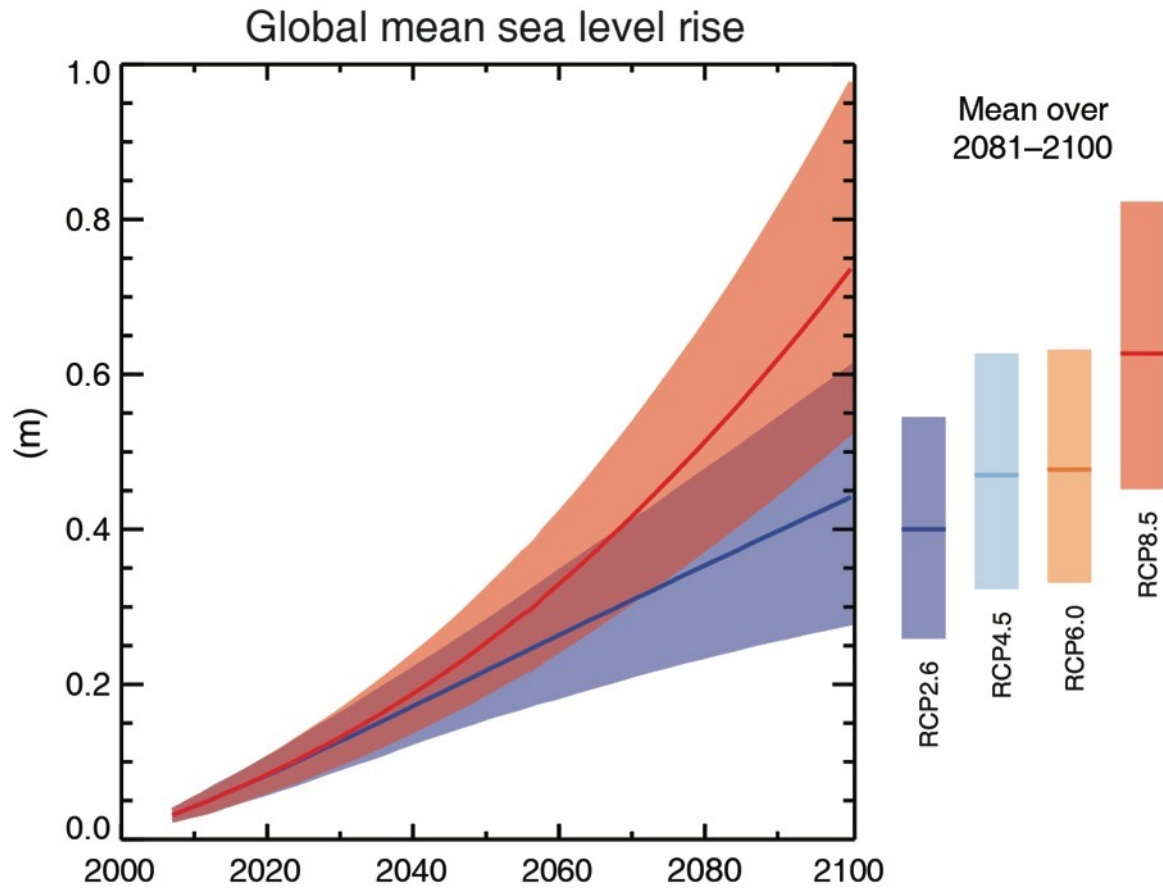


Fig. SPM.9

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

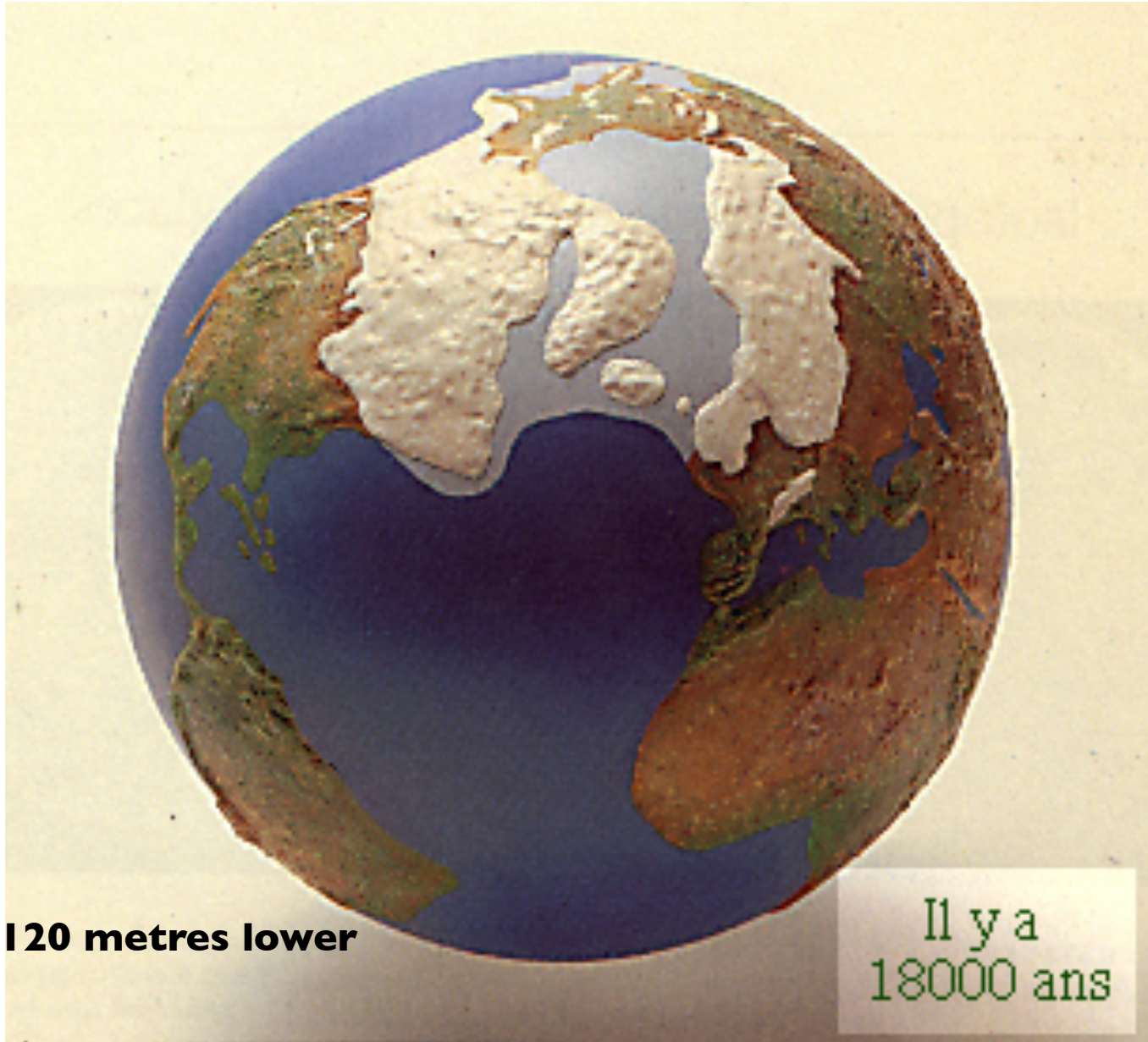
26 to 55 cm

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**

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.



# Time Magazine, today (14 June 2019)



**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



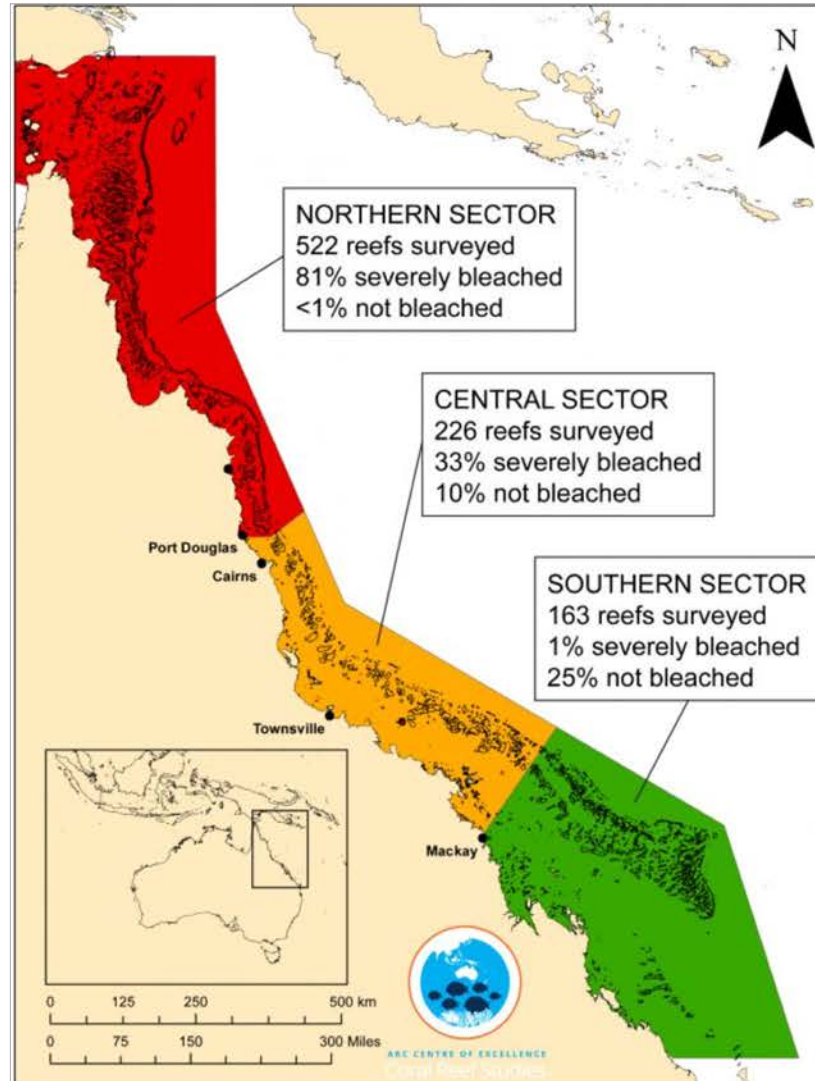
NB: + 1 m is possible  
in the next 100 years...

(Time 2001)

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

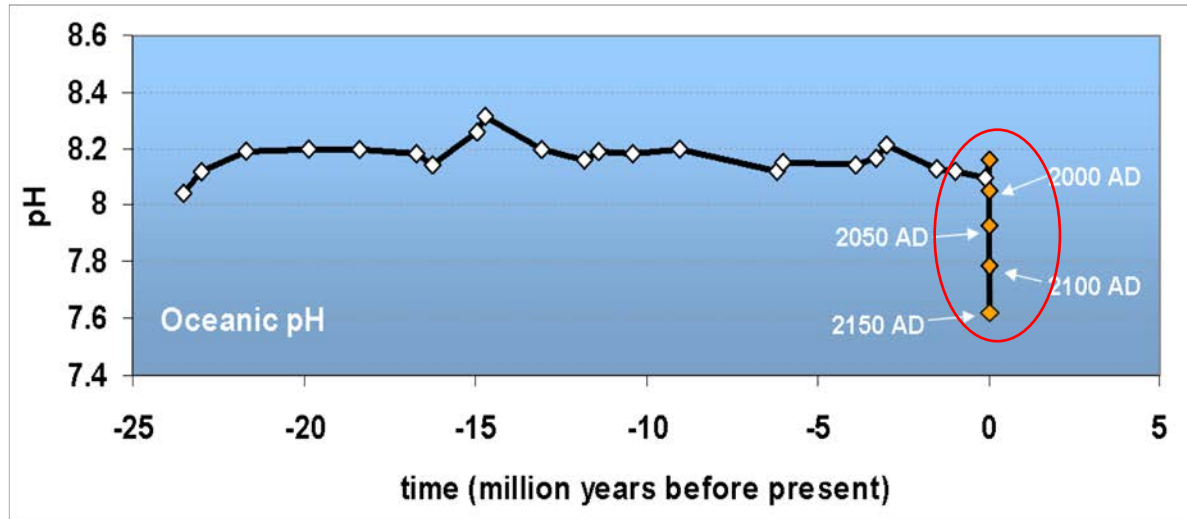
The « Sixth Extinction » has started, and climate change is one of the causing factors

# 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.





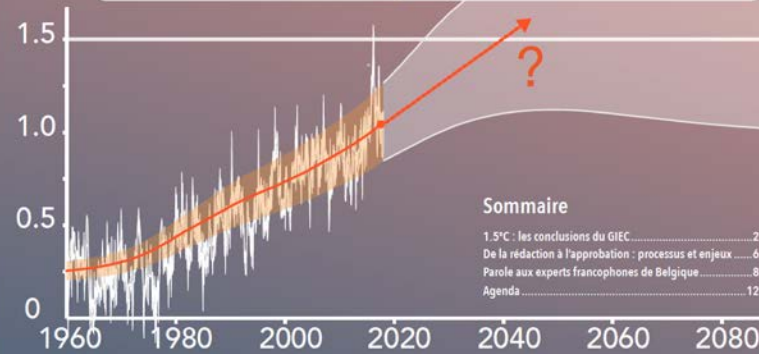
# Global warming of 1.5°C

*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)

## Le rapport spécial du GIEC Réchauffement planétaire de 1.5°C



**P**our 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<sup>e</sup> 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



# HALF A DEGREE OF WARMING MAKES A BIG DIFFERENCE:

EXPLAINING IPCC'S 1.5°C SPECIAL REPORT



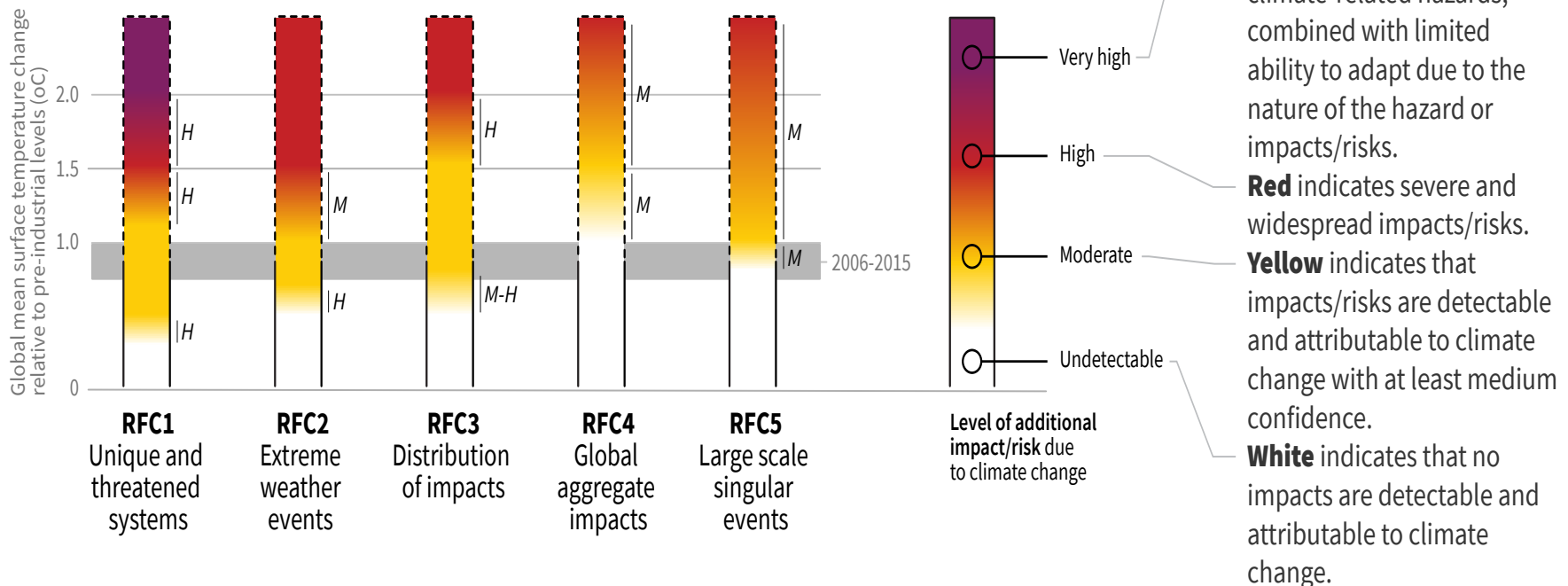
Responsibility for content: WRI



# 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.

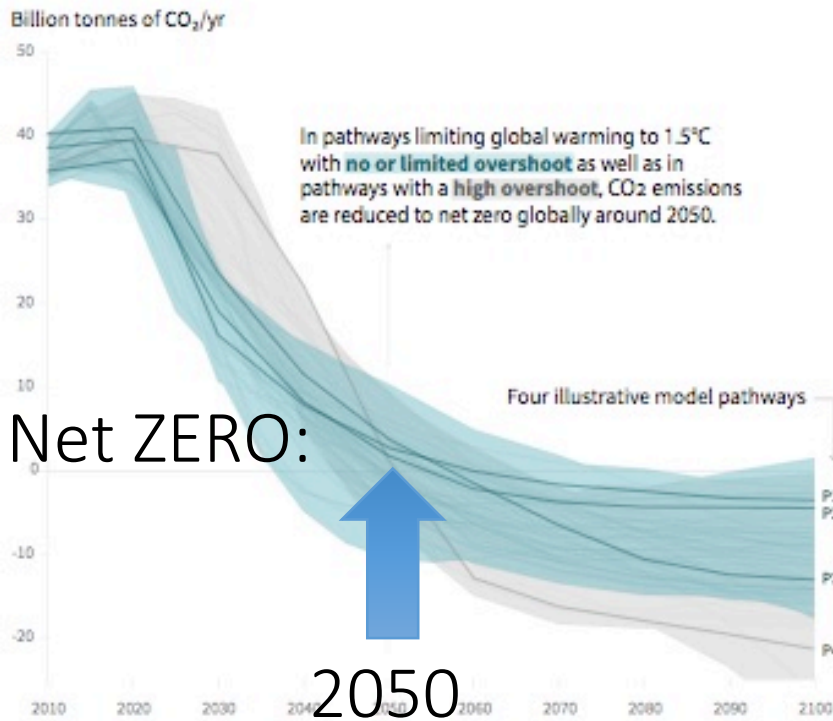
## Impacts and risks associated with the Reasons for Concern (RFCs)



## Global emissions pathway characteristics

General characteristics of the evolution of anthropogenic net emissions of CO<sub>2</sub>, 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 CO<sub>2</sub> emissions



#### Timing of net zero CO<sub>2</sub>

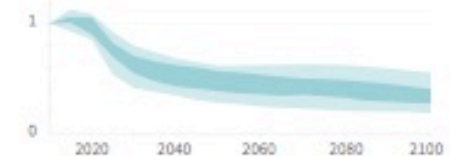
Line widths depict the 5-95th percentile and the 25-75th percentile of scenarios



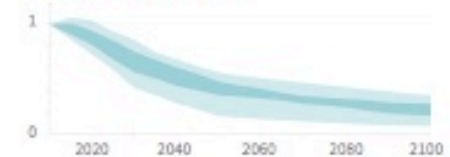
### Non-CO<sub>2</sub> emissions relative to 2010

Emissions of non-CO<sub>2</sub> 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.

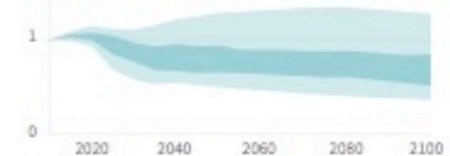
#### Methane emissions



#### Black carbon emissions



#### Nitrous oxide emissions



## Greenhouse gas emissions pathways

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

# Remaining carbon budget in 2018

(Source: IPCC SR15)

- The remaining carbon budget of 580 GtCO<sub>2</sub> for a 50% probability of limiting warming to 1.5°C, and 420 GtCO<sub>2</sub> for a 66% probability (medium confidence)
- The remaining budget is being depleted by current emissions of  $42 \pm 3$  GtCO<sub>2</sub> 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 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

**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



# EU: annual cost of buying fossil fuels



# 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



# Conférence sur les Changements Climatiques

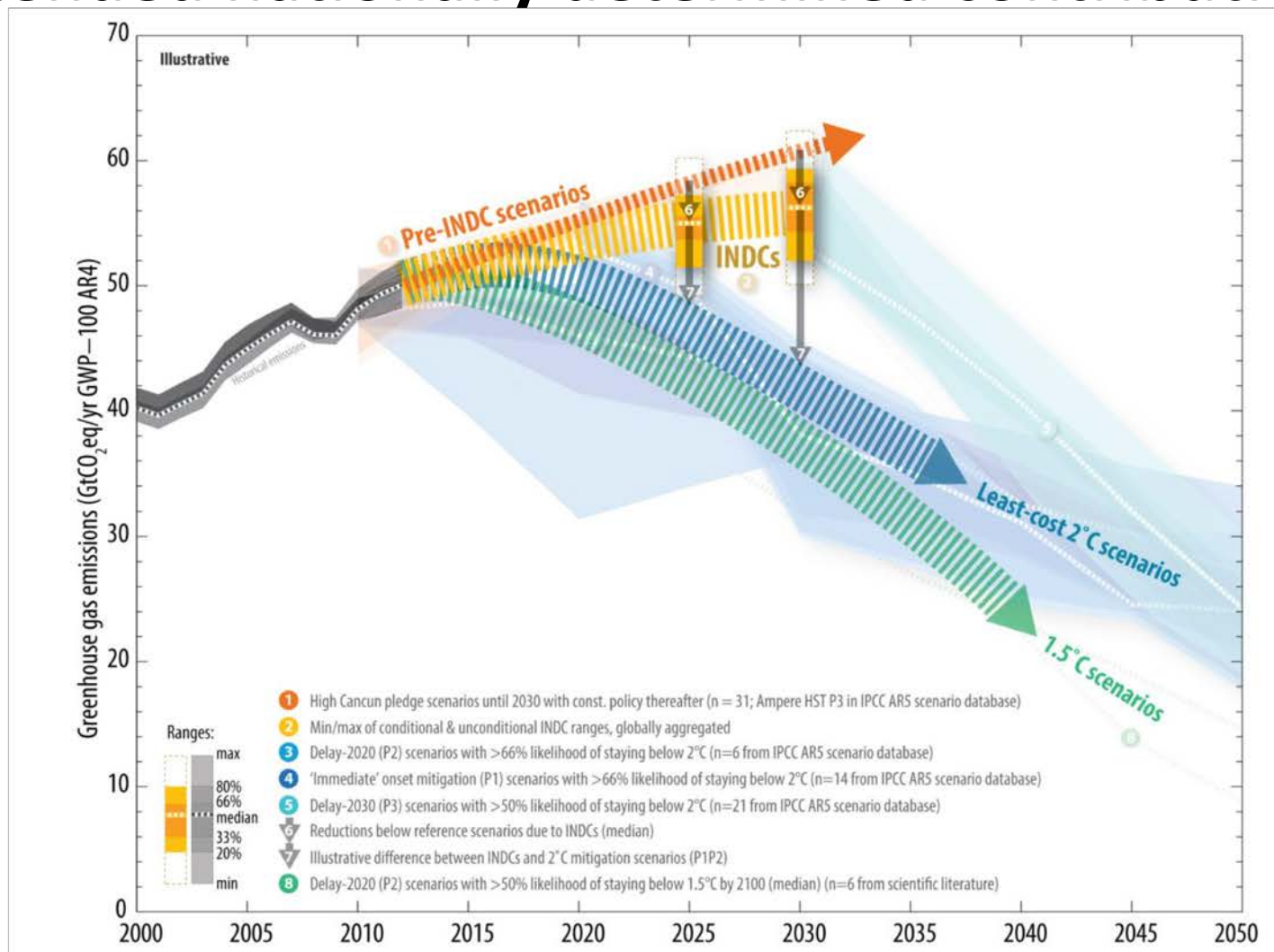
## Nations Unies

COP21/CMP11

### Paris, France



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

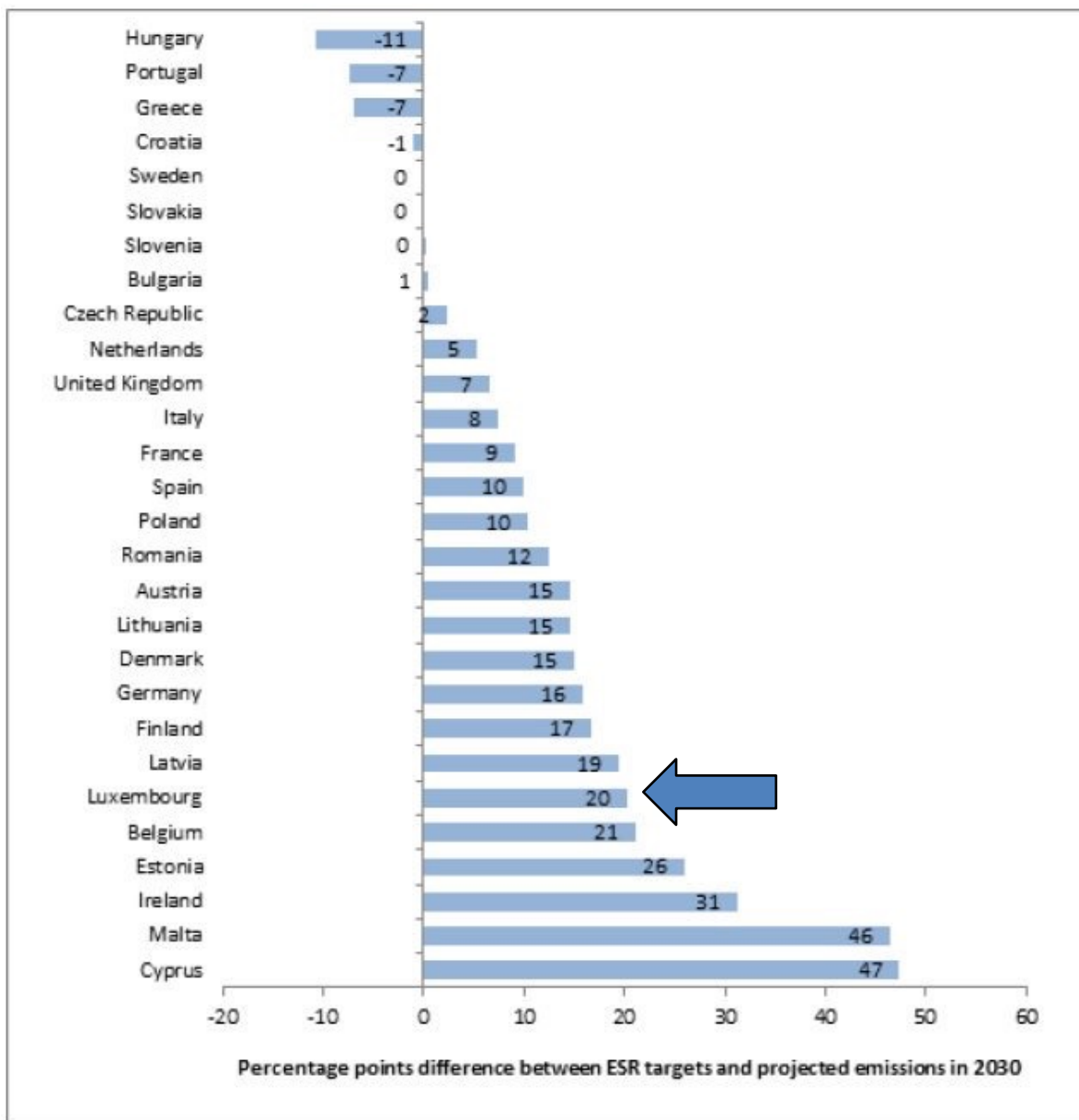


UNFCCC, Aggregate effect of the intended nationally determined contributions: an update

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



# 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.

# 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, CO<sub>2</sub> taxes, fines, internal CO<sub>2</sub> price (firms do « as if » CO<sub>2</sub> 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





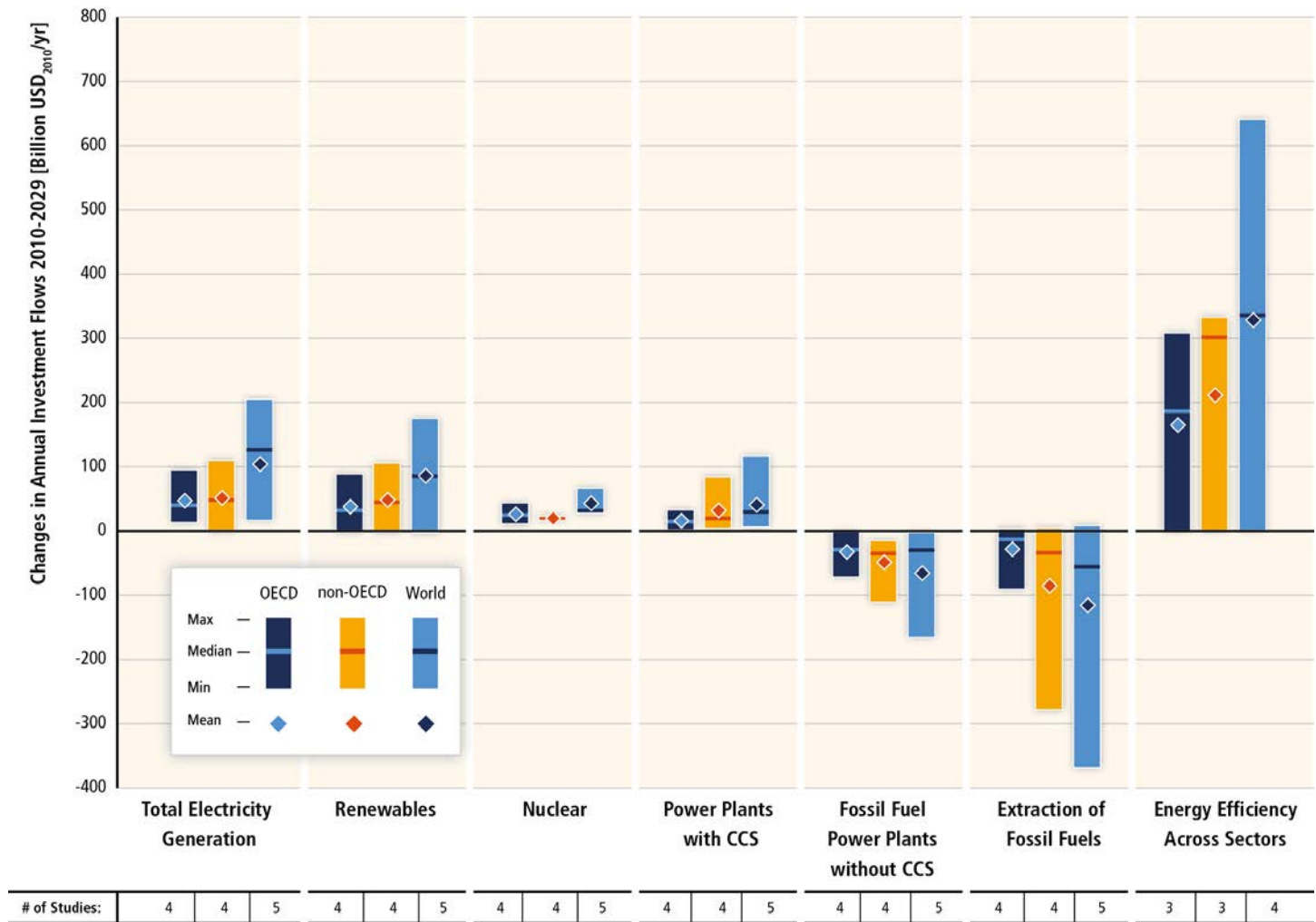
Joel Pett, USA Today

**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...**

# Trying to practice what I « preach »:

- Energy audit before renovation
- Strong external insulation (wood fiber)
- Super-efficient windows
- Air tightness + heat recovery ventilation system
- Ground-water heat pump replacing oil furnace
- Solar PV covering all consumption
- No tropical wood
- Small, used electric car
- Electric bicycles

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)<sup>(\*)</sup>**

**...It is good for health as well!**

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

@JPvanYpersele

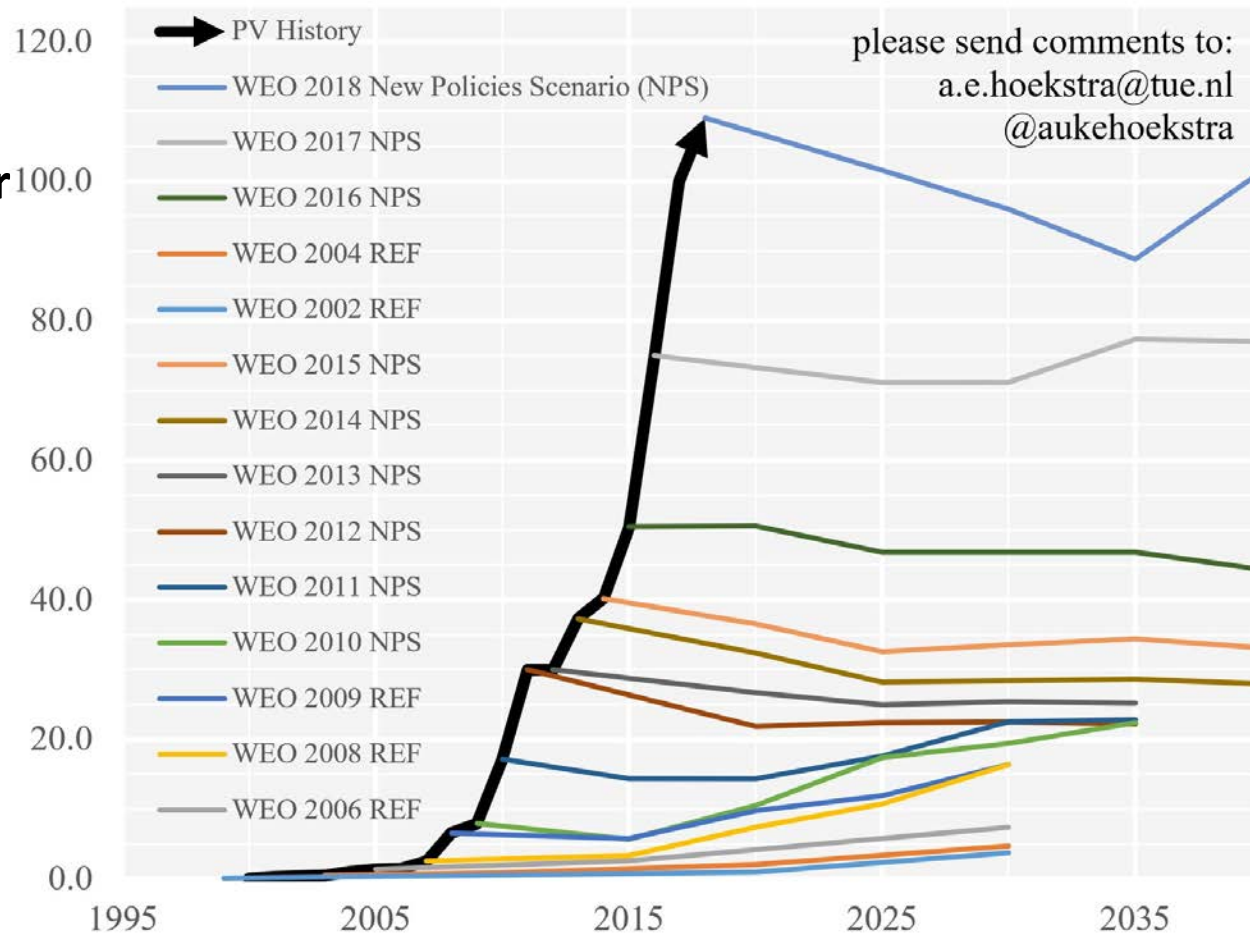
**Solution n° 9: The Sun gives us  
in two hours about as much  
energy as the world uses in *one*  
*year*, all forms of energy  
considered**

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**





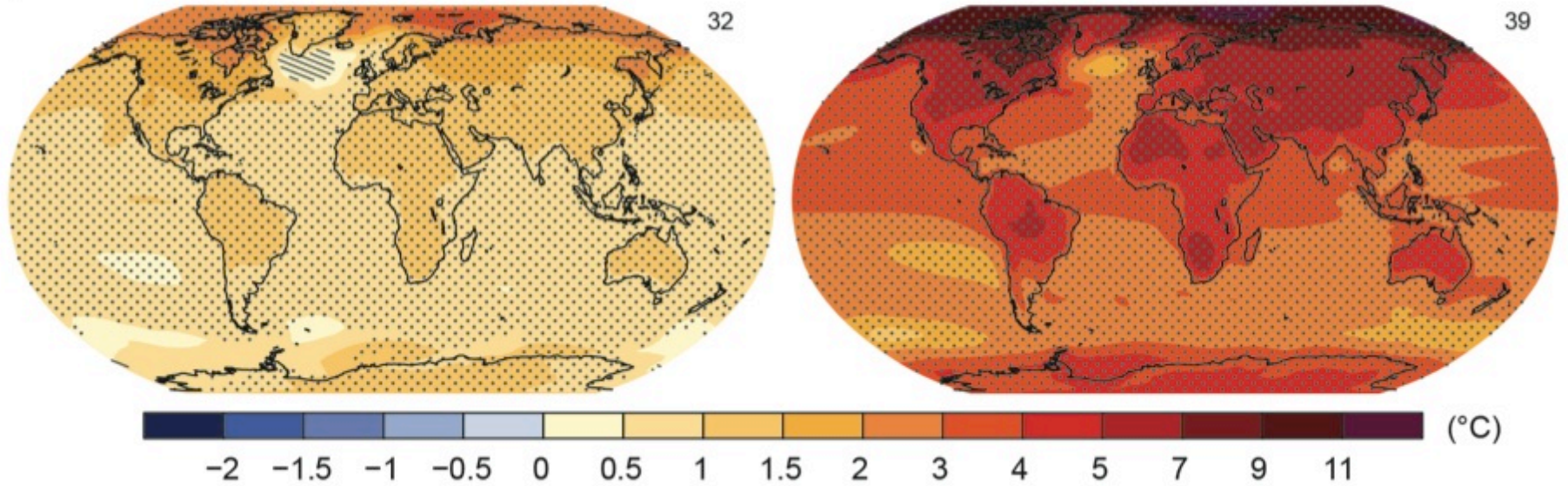
**Solution n° 10: Banks and the  
finance sector increasingly see the  
opportunities in climate-friendly and  
ethical investments promoting the  
17 Sustainable Development Goals**

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

# RCP2.6

# RCP8.5

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



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)*

# What can we do?

- **Analyse the carbon footprint of our activities**
- **Eliminate fossil fuel usage (decarbonize):**
  - ✦ **Heating (improve insulation, lower thermostat, heat pumps, renewables...)**
  - ✦ **Transport: public transport, shared mobility, (electric) bicycles, walking, #flyingless**



# What can we do?

- **Decrease usage of products made with or using fossil fuels, or responsible for greenhouse gas emissions:**
  - ✦ **Ex: meat and dairy products, non-seasonal, non-local food, electronic products, ...**
- **Invest in companies seriously aligned with Agenda 2030 and the Paris Agreement**
- **Speak truth to power, like Greta Thunberg**

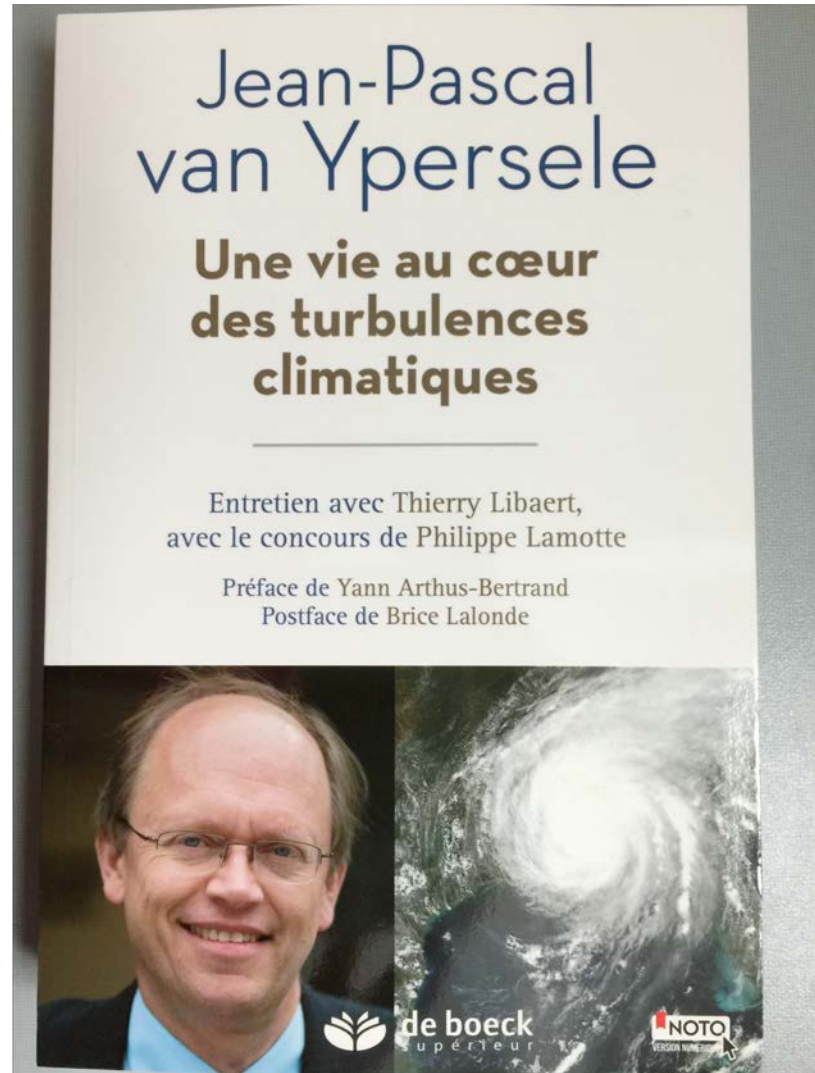
**Pour en savoir plus:**

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

**Publié chez De Boeck  
supérieur**

**Préface: Yann Arthus-  
Bertrand**

**Postface: Brice Lalonde**



This gives me  
hope:

Well-  
informed  
young people  
speaking  
truth to  
power



With @GretaThunberg at COP24



# '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 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 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

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# To go further :

- [www.climate.be/vanyp](http://www.climate.be/vanyp) : my slides (under « conferences)
- [www.ipcc.ch](http://www.ipcc.ch) : IPCC
- [www.realclimate.org](http://www.realclimate.org) : answers to the merchants of doubt arguments
- [www.skepticalscience.com](http://www.skepticalscience.com) : same
- [www.plateforme-wallonne-giec.be](http://www.plateforme-wallonne-giec.be) : IPCC-related in French, Newsletter, latests on SR15, basic climate science
- **Twitter: @JPvanYpersele & @IPCC\_CH**



# New :

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