

On the urgency of addressing climate change

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**Public Transport Leaders Forum, Barcelona (by video),
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and to my team at the Université catholique de Louvain for their support**

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



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

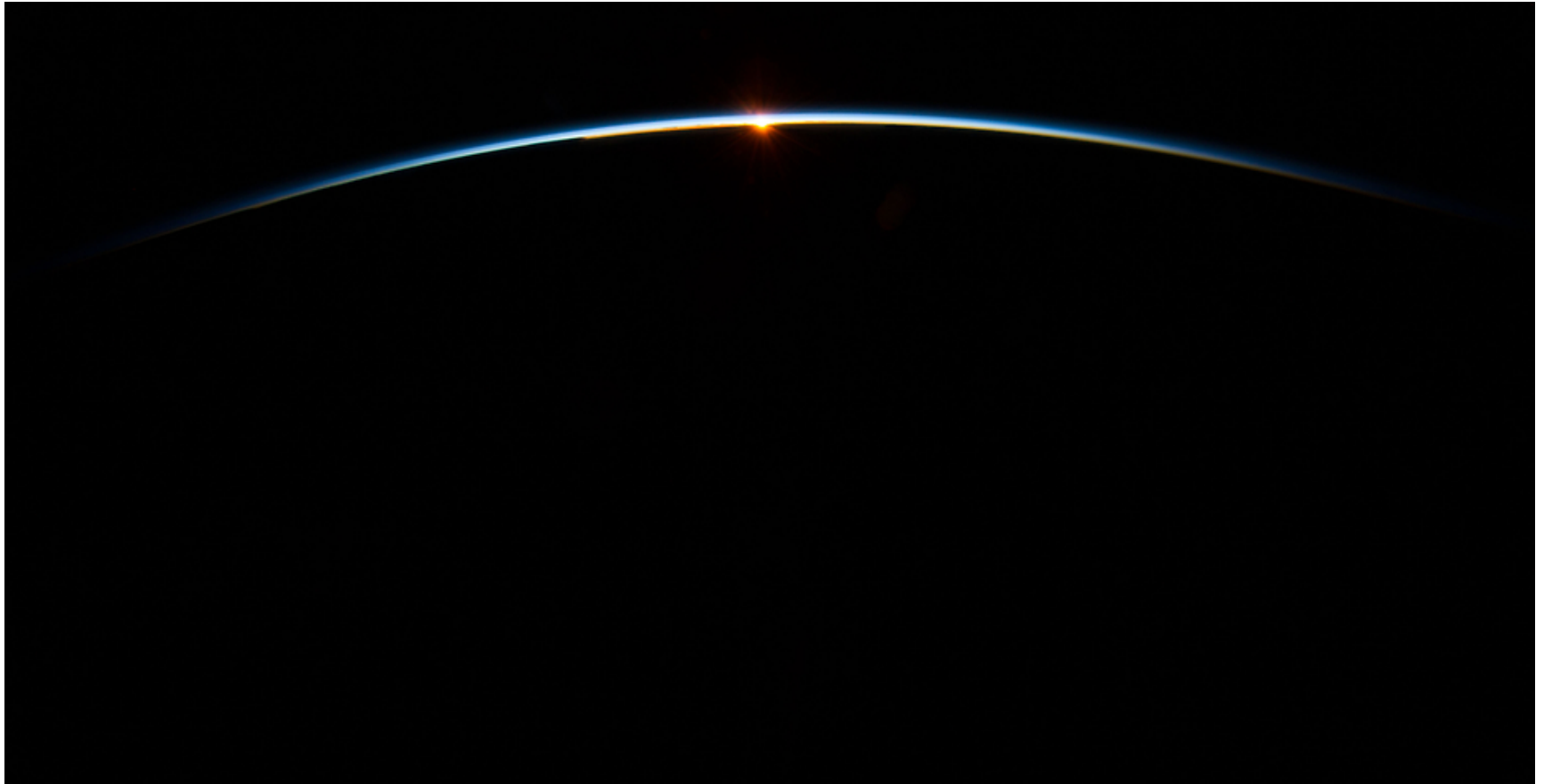
The European Union fares a little better, but many Brussels lobbyists try to dilute the EU environmental efforts (see the car industry...)

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

- Existence of global warming
- Human responsibility in the warming
- Cost of decarbonization
- Drawbacks from alternatives

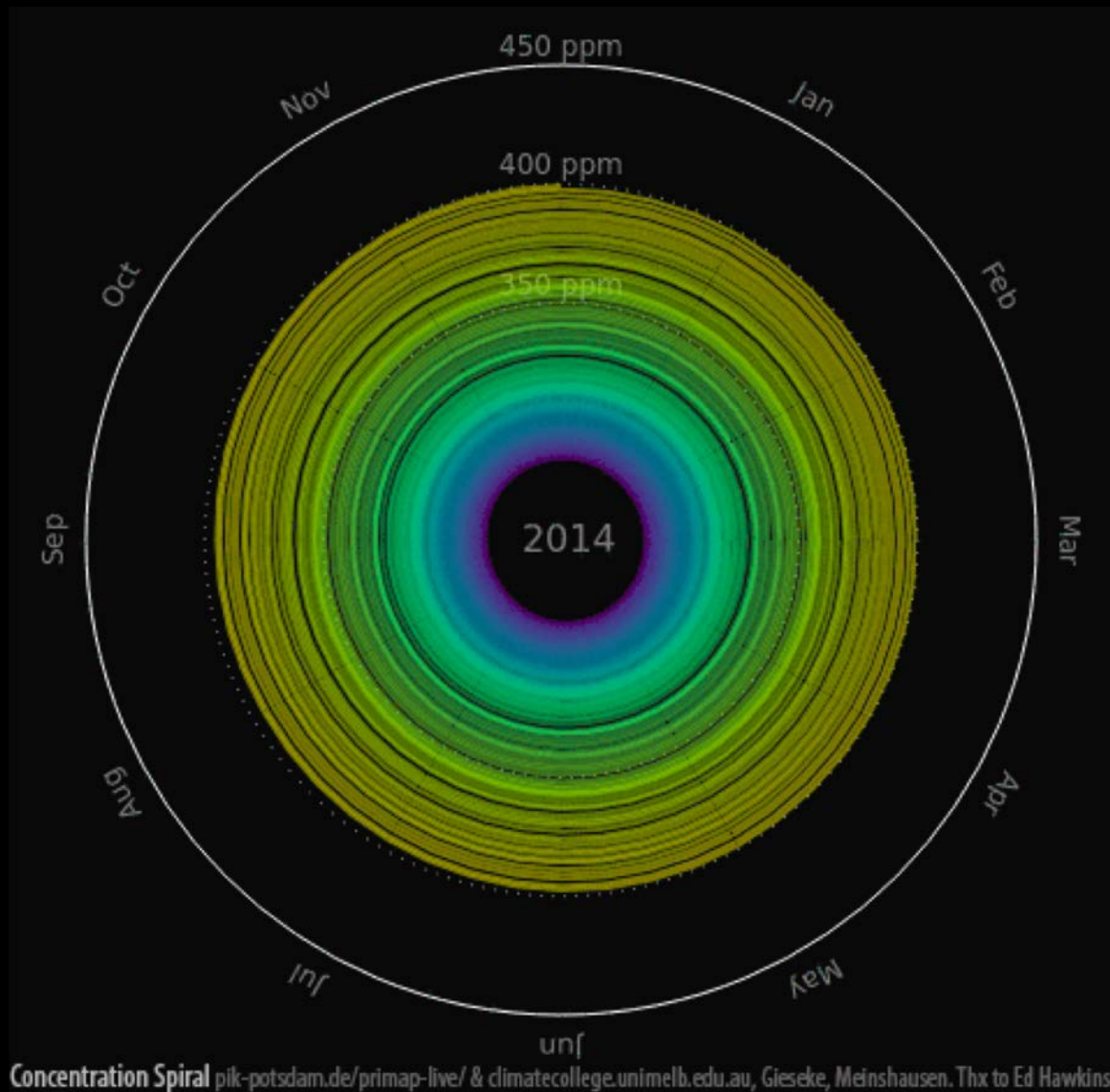
(recent example: so-called enormous needs of cobalt for electric mobility reported on CNN; see critical analysis on <https://www.desmogblog.com/2018/05/02/cnn-wrongly-blames-electric-cars-unethical-cobalt-mining>)

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



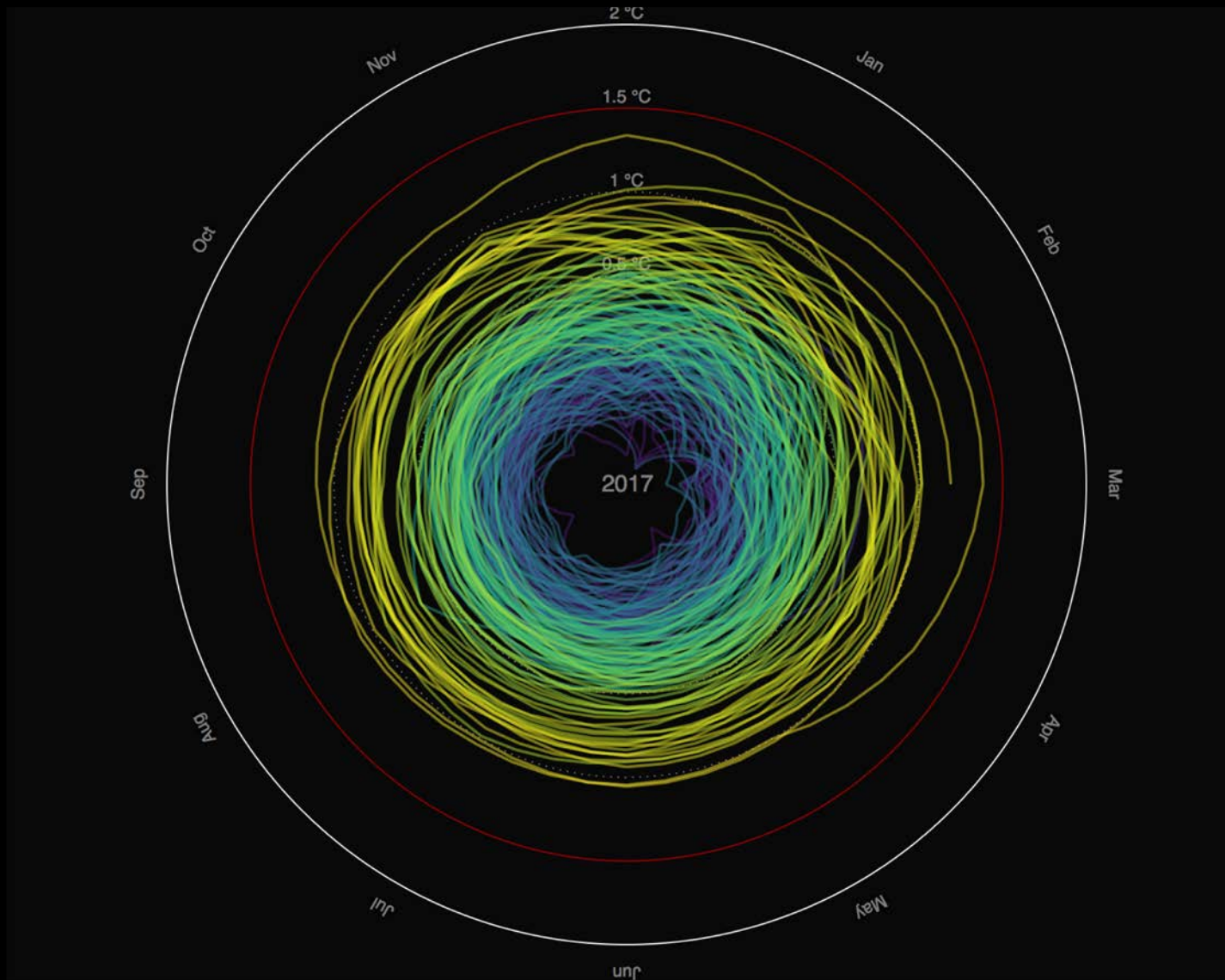
@JPvan Ypersele

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

Plateau Glacier (1961) (Alaska)



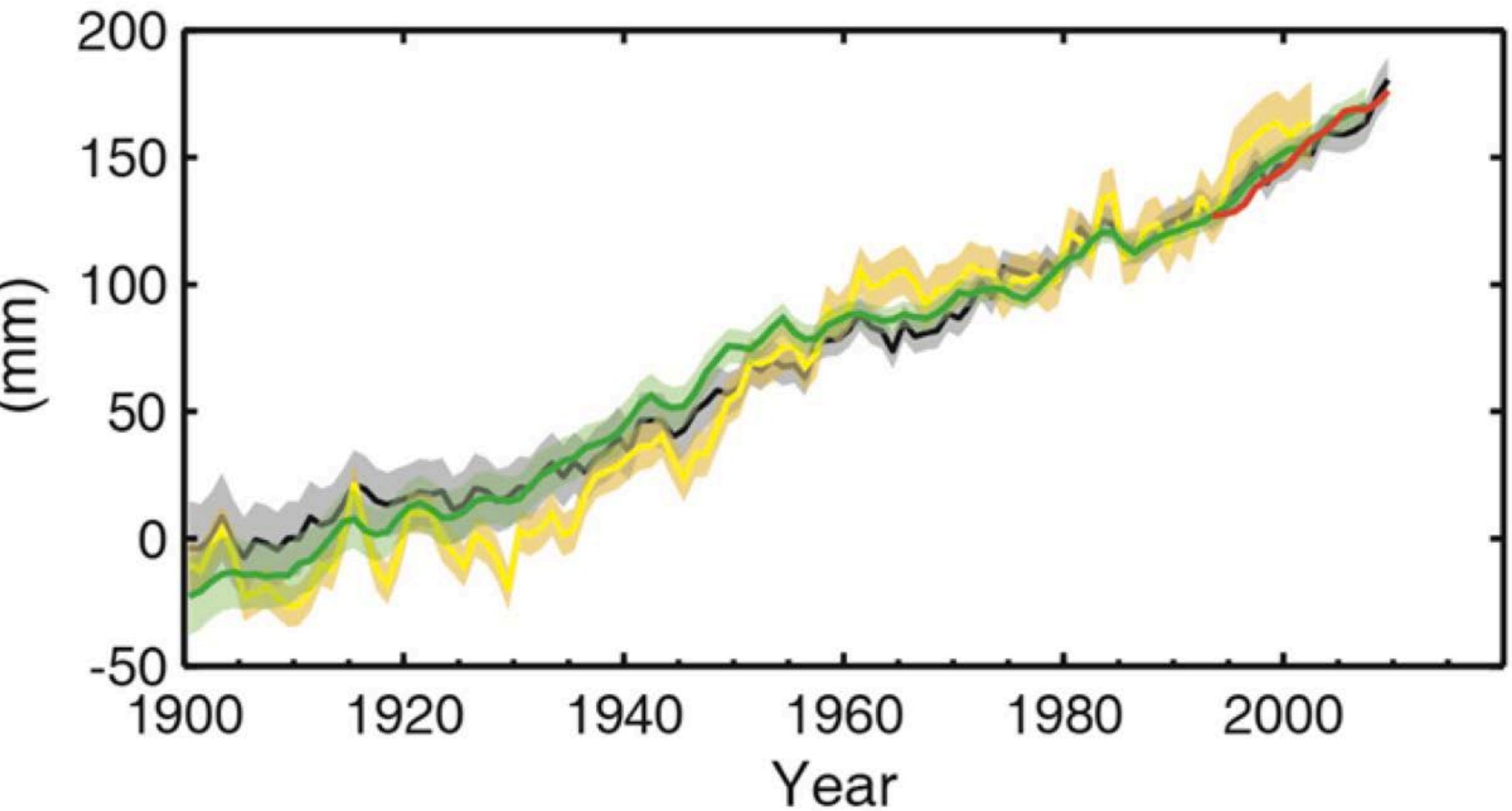
http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Plateau Glacier (2003) (Alaska)

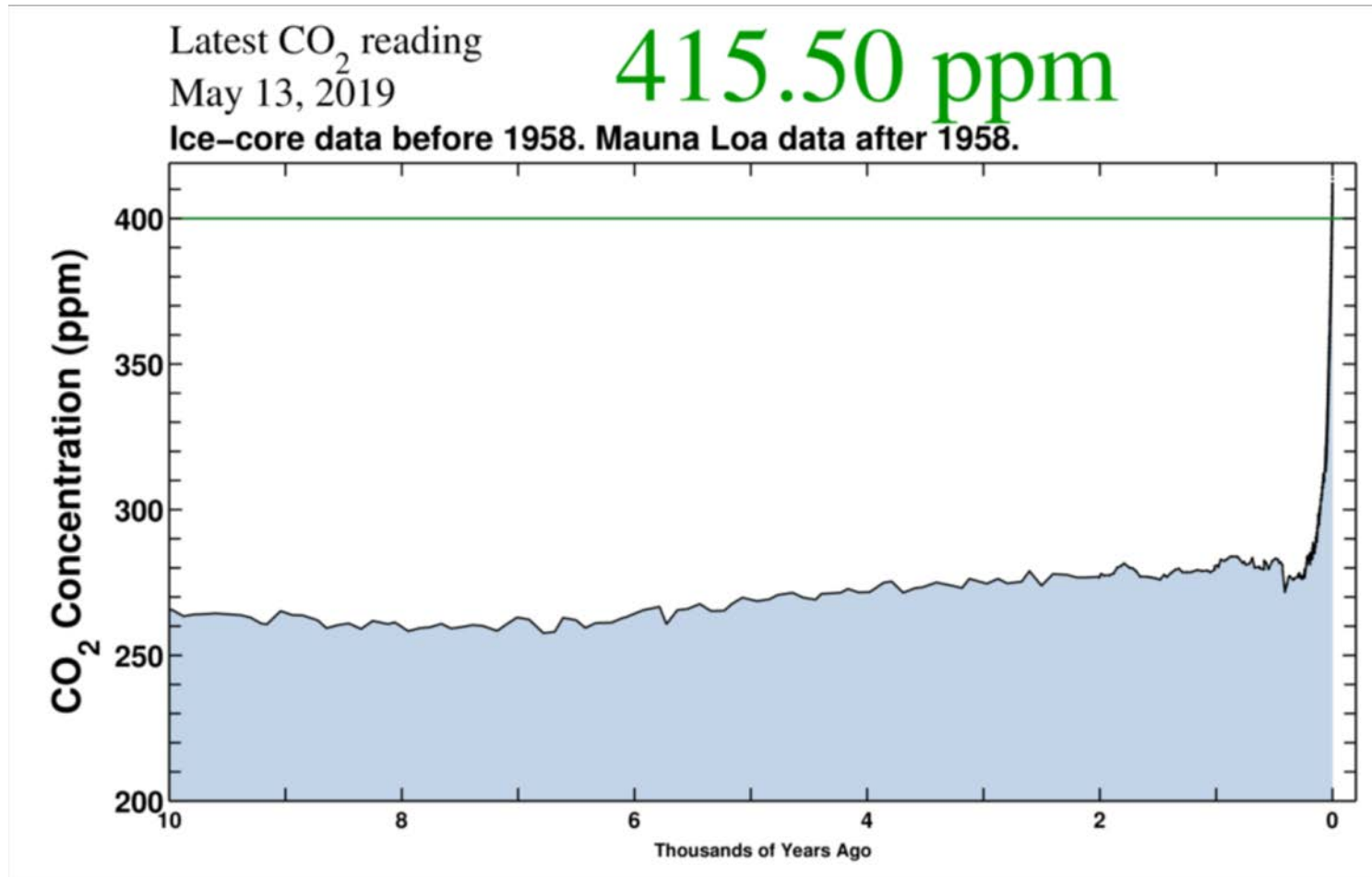


http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share

Change in average sea-level change



CO₂ Concentration, 13 May 2019 (Keeling curve)



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

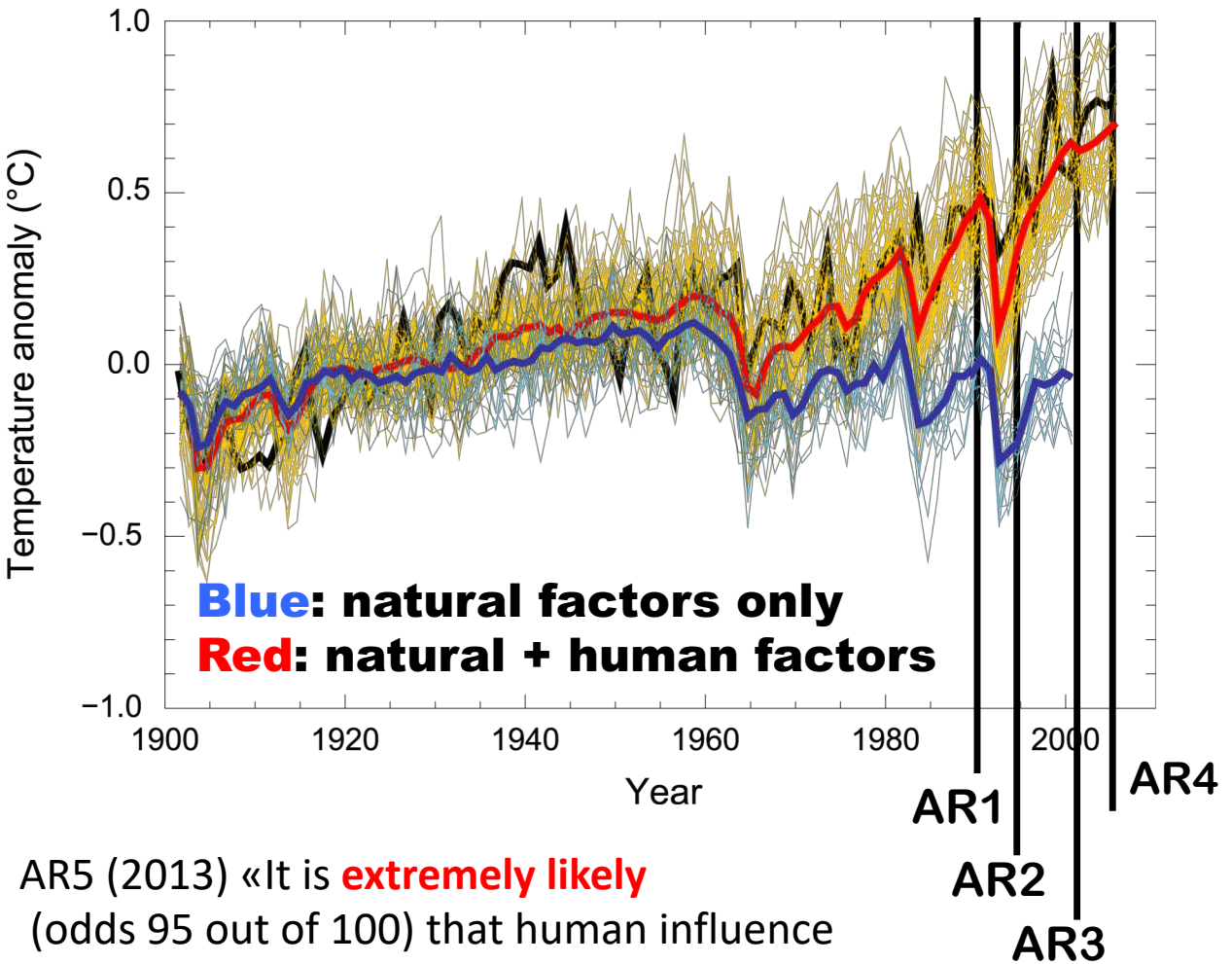
A Progression of Understanding: Greater and Greater Certainty in Attribution

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”

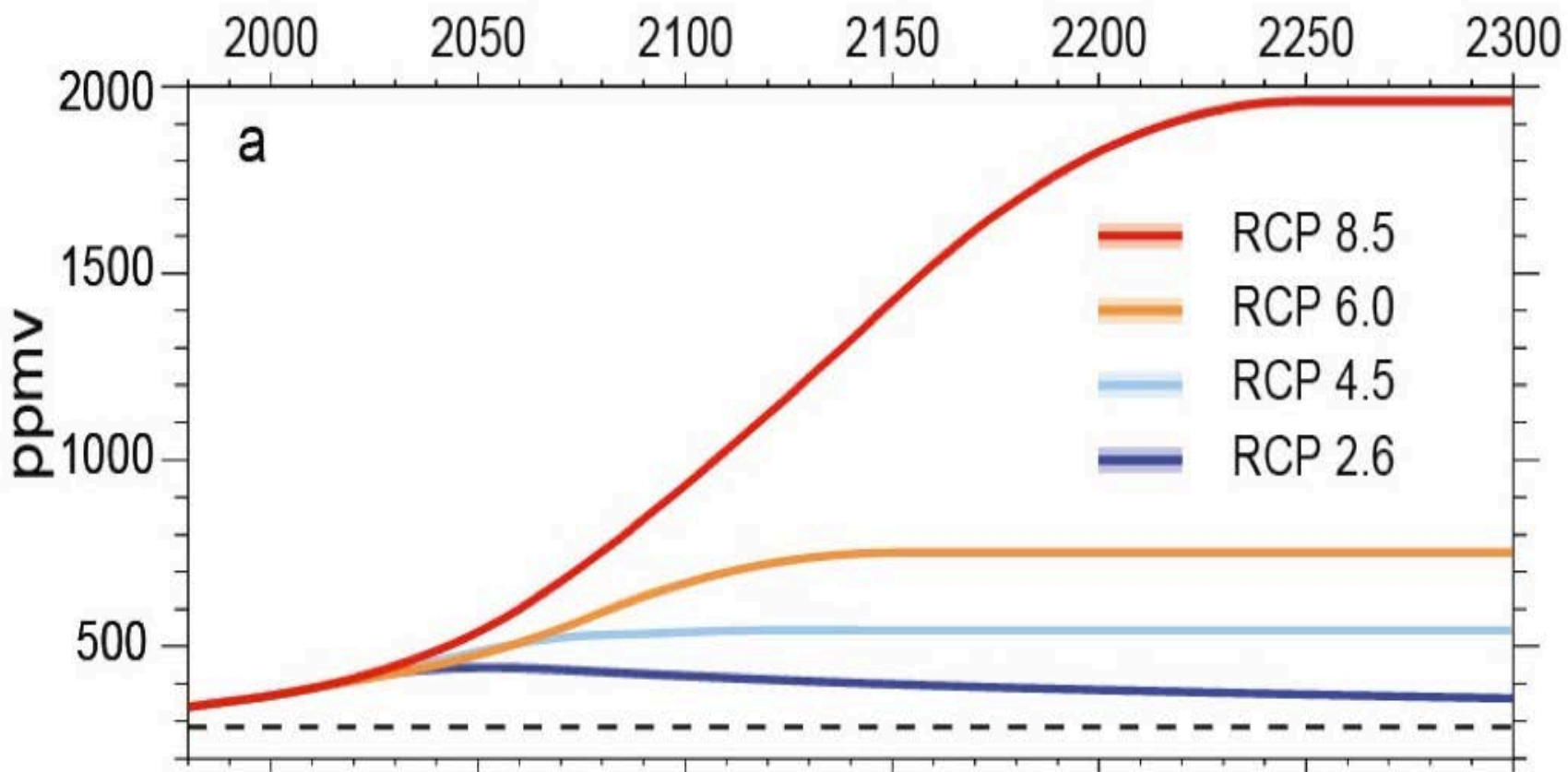


AR5 (2013) «It is **extremely likely**
(odds 95 out of 100) that human influence
has been the dominant cause... »

**Because we use the atmosphere
as a dustbin for our greenhouse
gases, we thicken the insulation
layer around the planet**

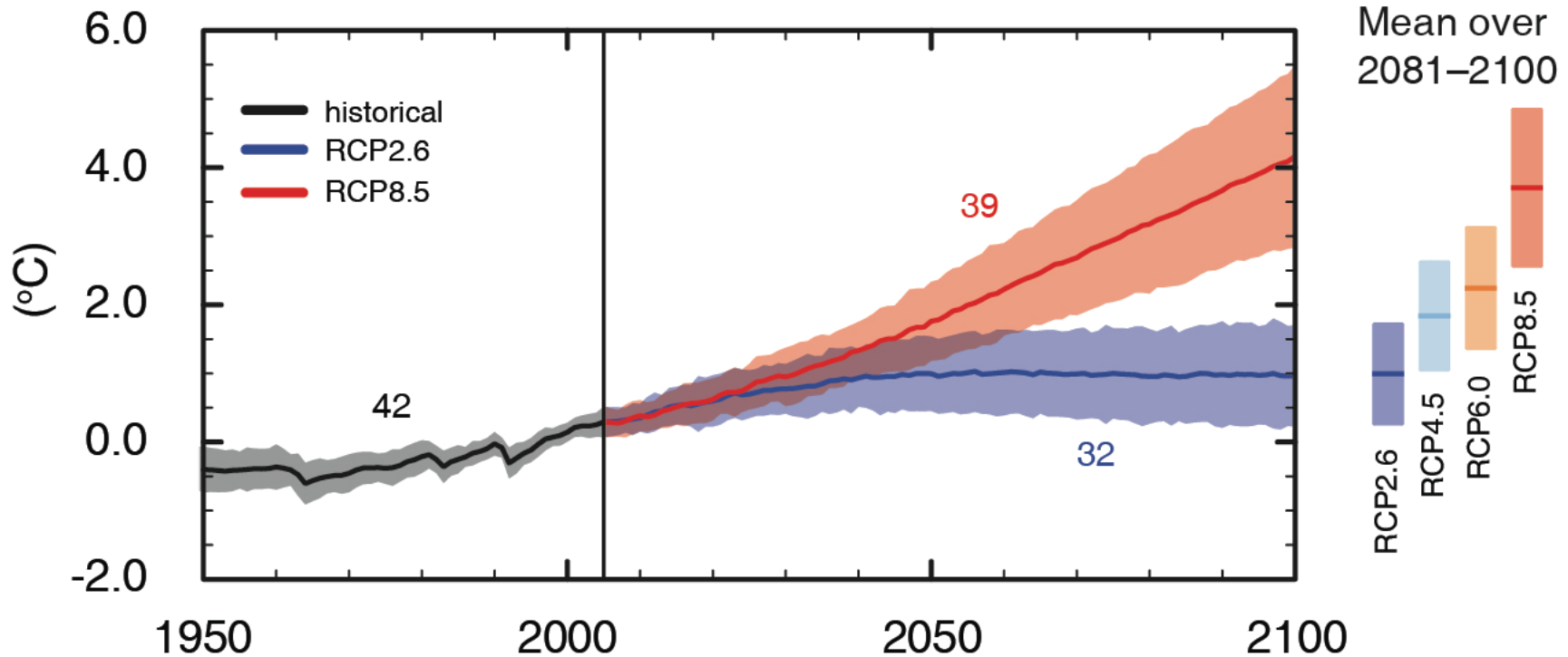
That is why we must cut emissions
to (net) ZERO as soon as possible

RCP Scenarios: Atmospheric CO₂ concentration



Three stabilisation scenarios: RCP 2.6 to 6
One Business-as-usual scenario: RCP 8.5

Global average surface temperature change



(IPCC 2013, Fig. SPM.7a)

Only the lowest (RCP2.6) scenario maintains the global surface temperature increase above the pre-industrial level to less than 2° C with at least 66% probability

18-20000 years ago (Last Glacial Maximum)

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

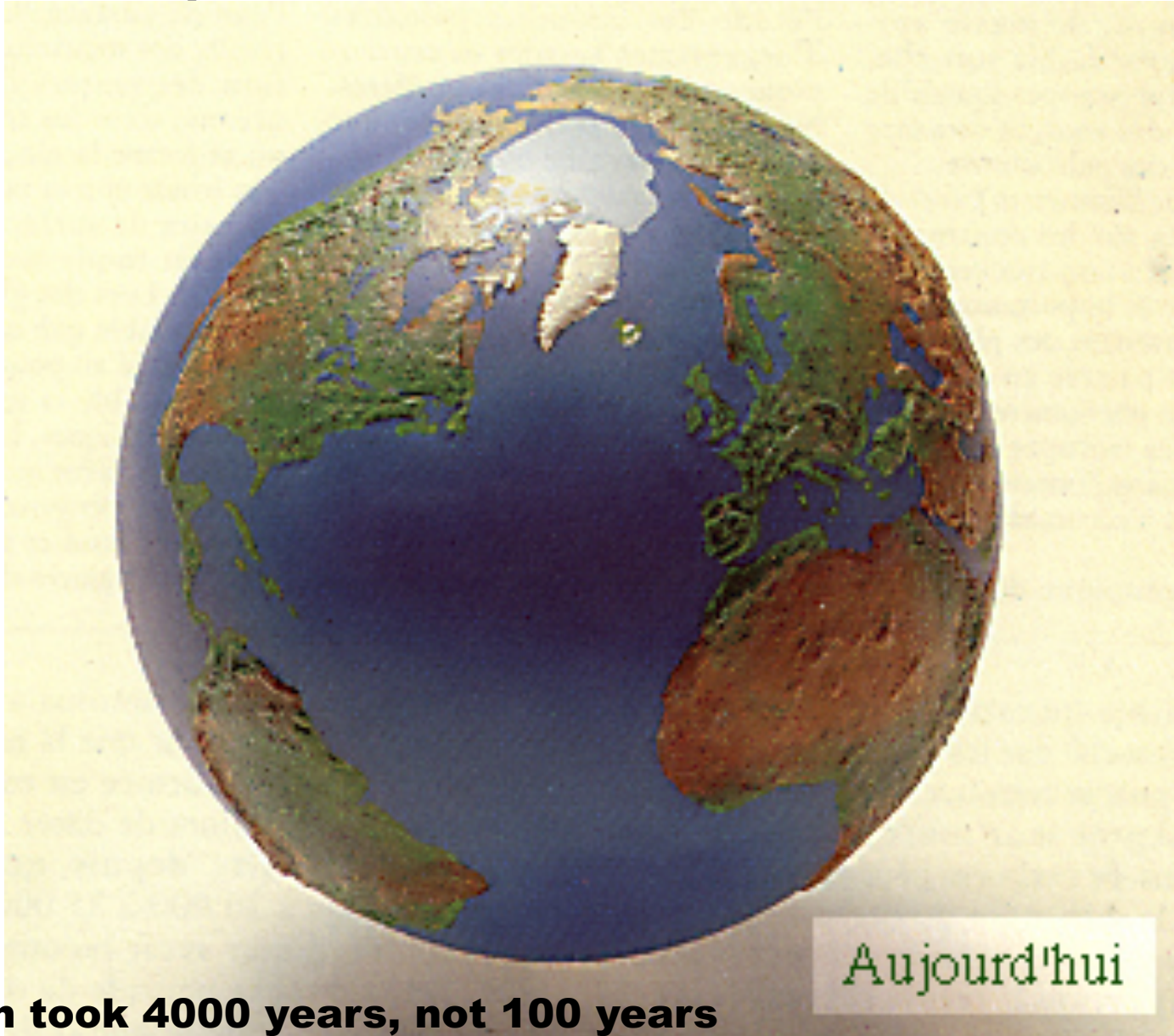


Sea level: 120 m lower

Il y a
18000 ans

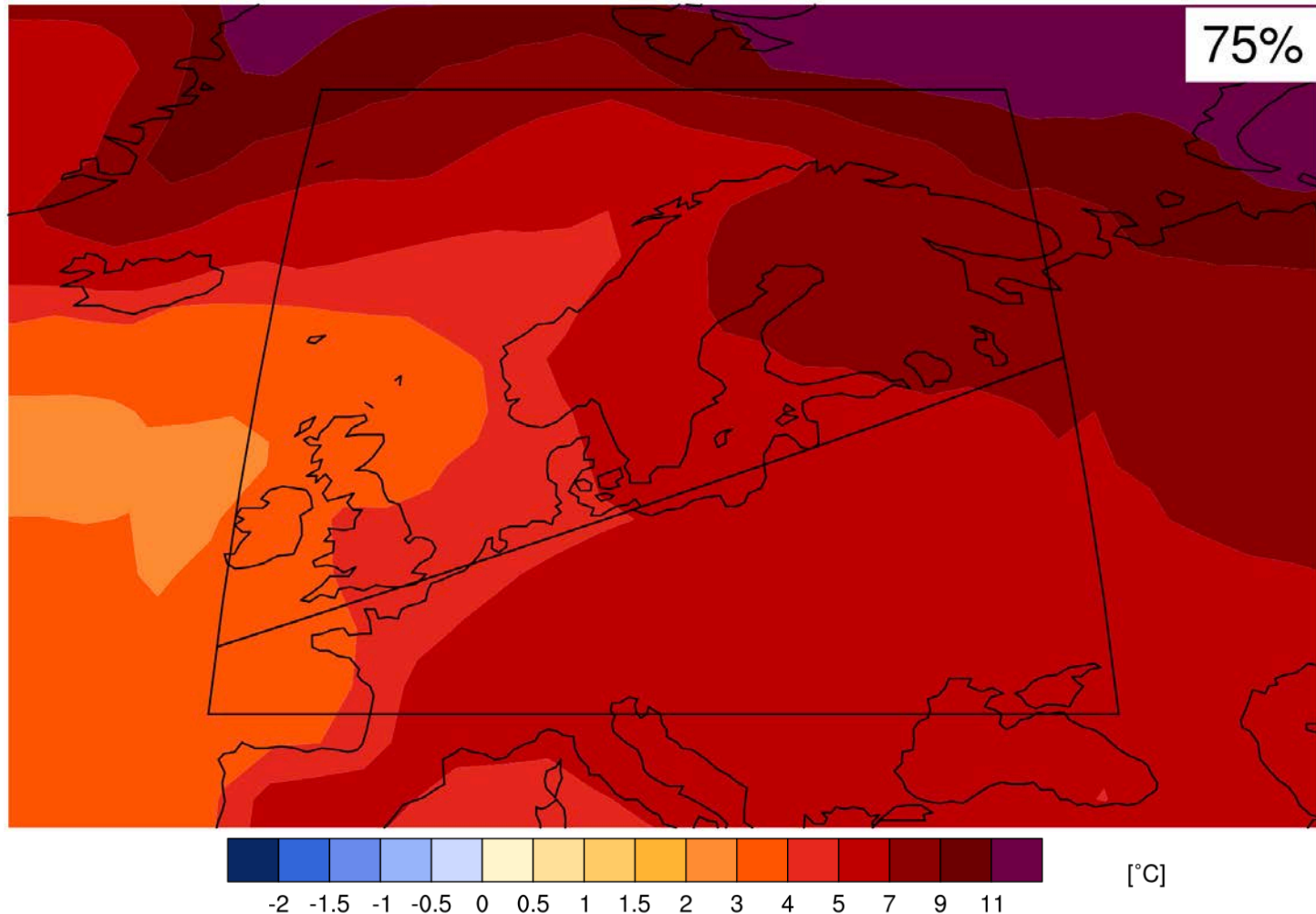
Today, with +4-5° C globally

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



Transition took 4000 years, not 100 years

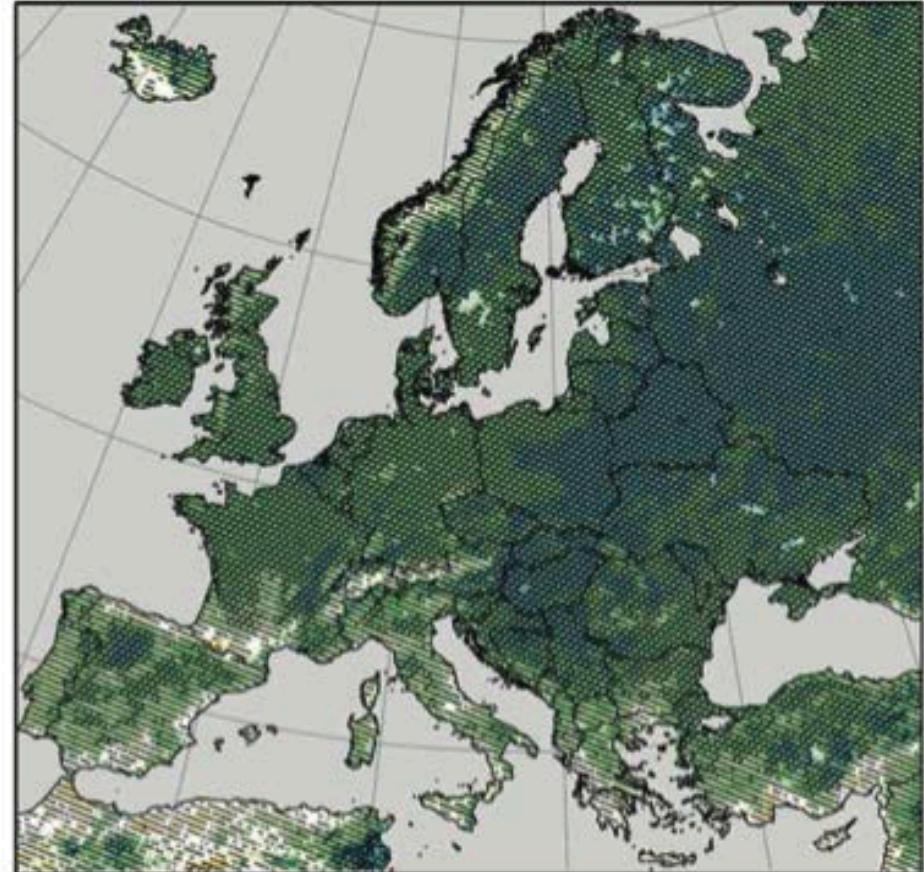
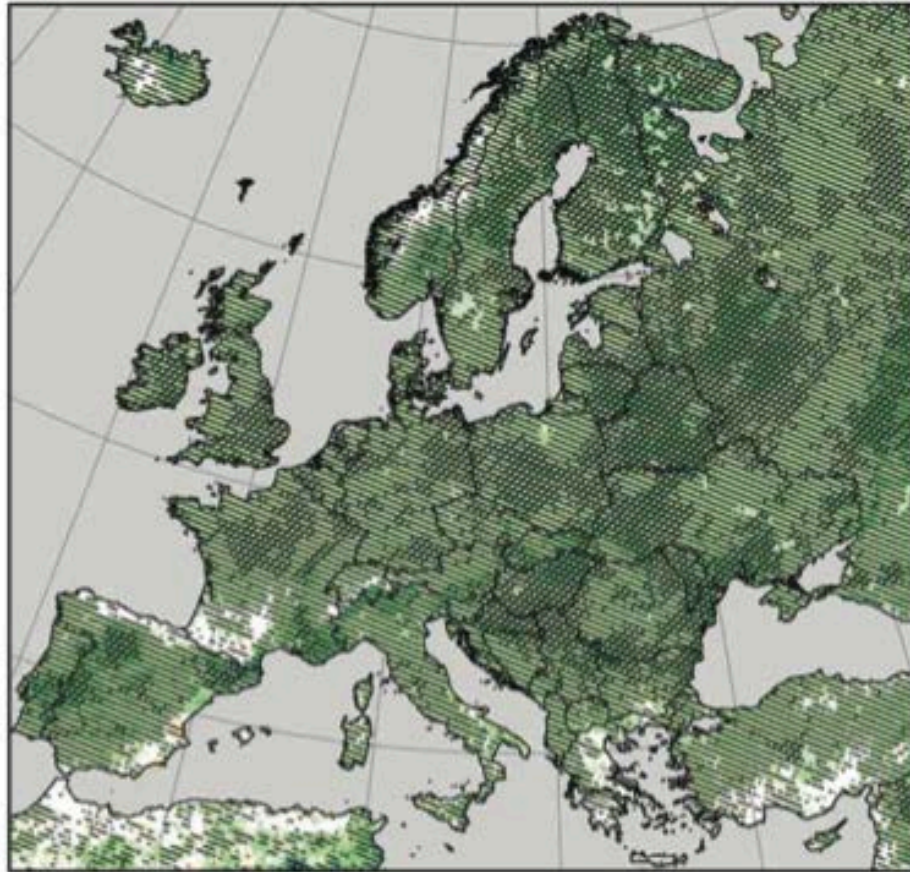
North Europe - Map of temperature changes: 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario (annual)



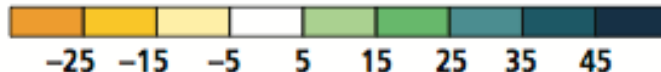
DJF seasonal changes in heavy precipitation (%), 2071-2100 compared to 1971-2000

RCP4.5

RCP8.5



Seasonal changes in heavy
precipitation in percent



//// Significant change

\\\\ Robust change

Extreme precipitation can affect public infrastructure...



Impacts are already underway

- **Tropics to the poles**
- **On all continents and in the ocean**
- **Affecting rich and poor countries (but the poor are more vulnerable everywhere)**

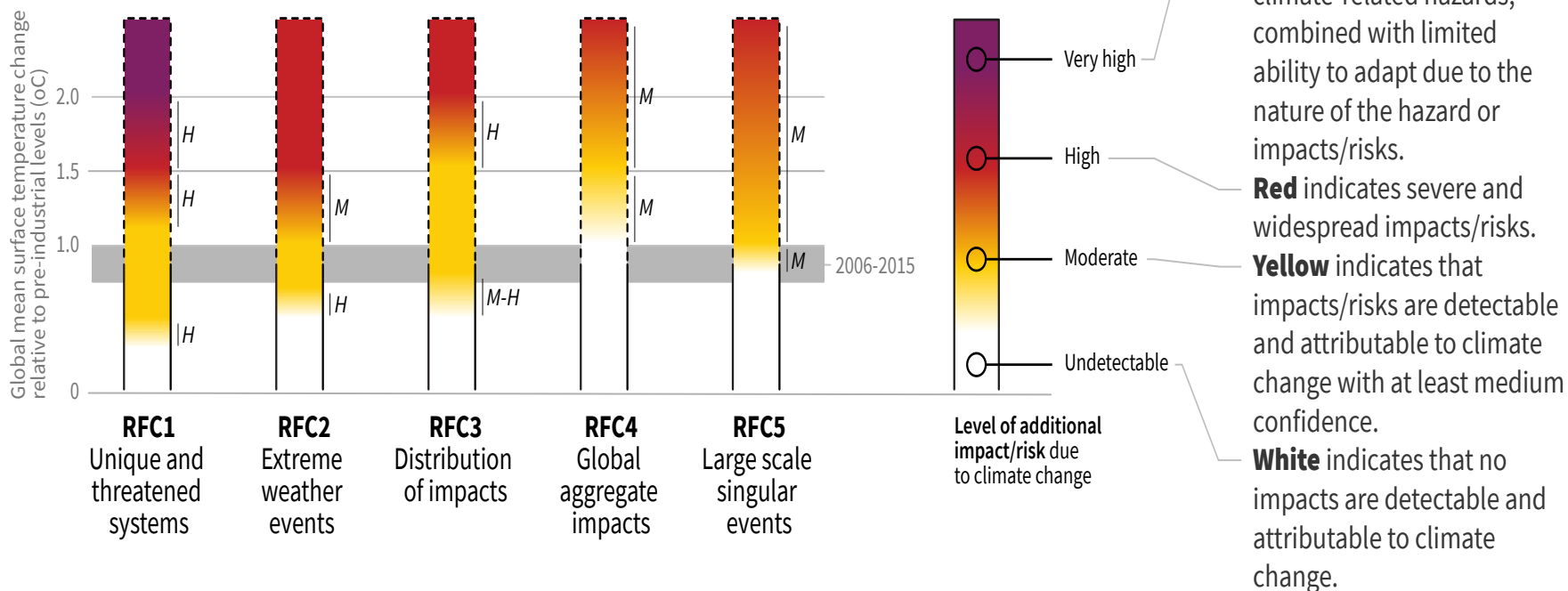


AR5 WGII SPM

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













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

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



HALF A DEGREE OF WARMING MAKES A BIG DIFFERENCE:

EXPLAINING IPCC'S 1.5°C SPECIAL REPORT

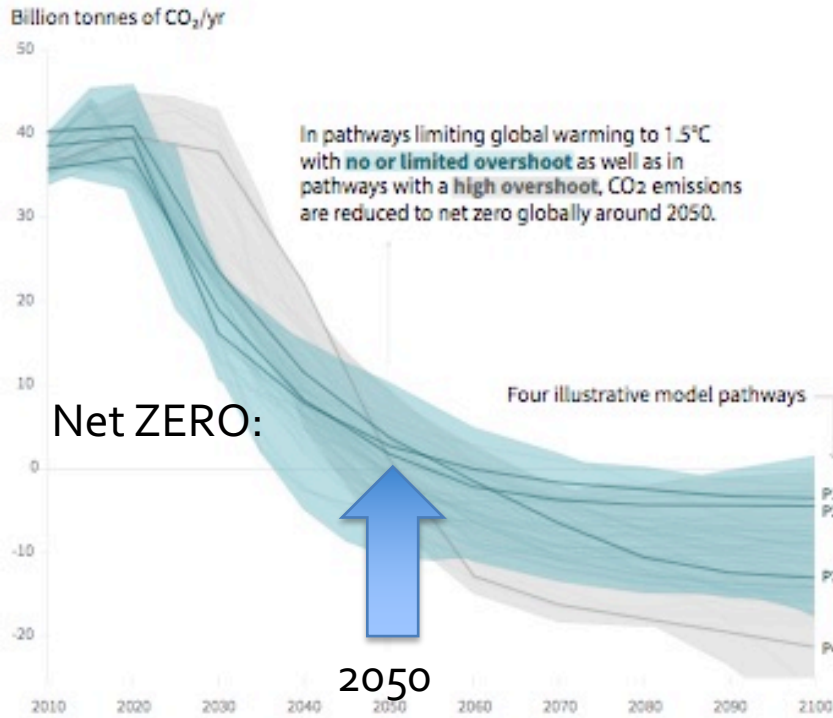
	1.5°C	2°C	2°C IMPACTS
EXTREME HEAT Global population exposed to severe heat at least once every five years	 <p>14%</p>	 <p>37%</p>	2.6x WORSE
SEA-ICE-FREE ARCTIC Number of ice-free summers	AT LEAST 1 EVERY 100 YEARS 	AT LEAST 1 EVERY 10 YEARS 	10x WORSE
SEA LEVEL RISE Amount of sea level rise by 2100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

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

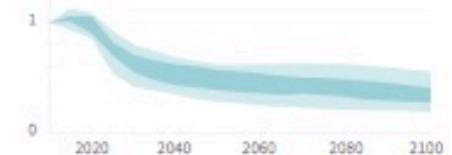
Line widths depict the 5-95th percentile and the 25-75th percentile of scenarios



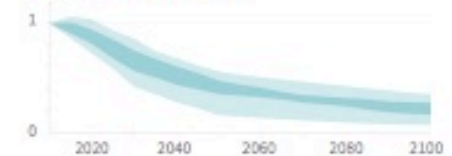
Non-CO₂ emissions relative to 2010

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.

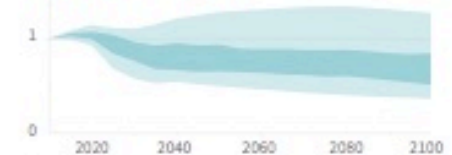
Methane emissions



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

Mitigation Measures



More efficient use of energy



Greater use of low-carbon and no-carbon energy

- Many of these technologies exist today
- But worldwide investment in **research** in support of GHG mitigation is small...



Improved carbon sinks

- **Reduced deforestation** and improved forest management and planting of new forests
- **Bio-energy with carbon capture and storage**



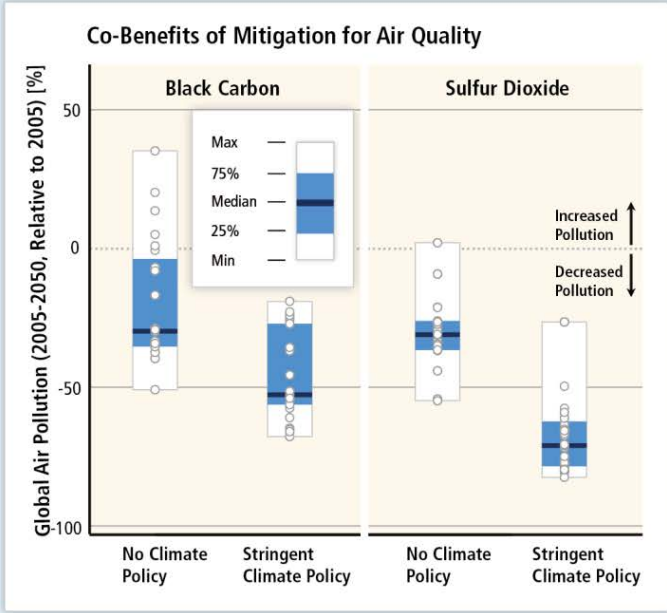
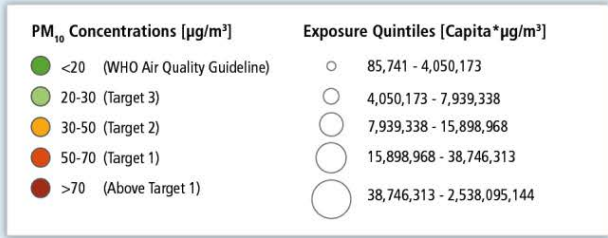
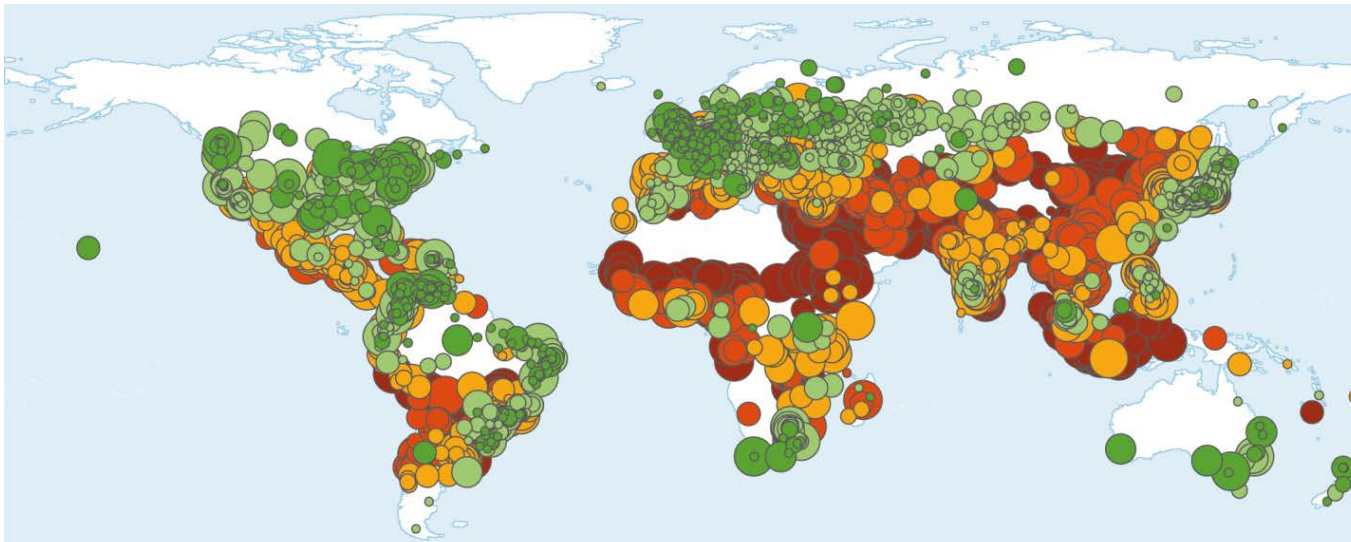
Lifestyle and behavioural changes

AR5 WGIII SPM

- **Substantial reductions in emissions needed to stay below 2° C warming 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**



Mitigation can result in large co-benefits for human health and other societal goals.

Children are particularly sensitive to air pollution



Photo: Indiatoday.in, 6-12-2017



Joel Pett, USA Today



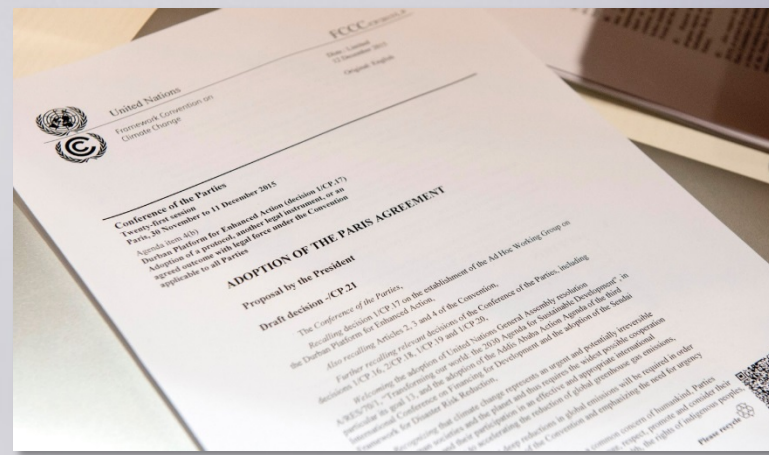
SUSTAINABLE DEVELOPMENT GOALS



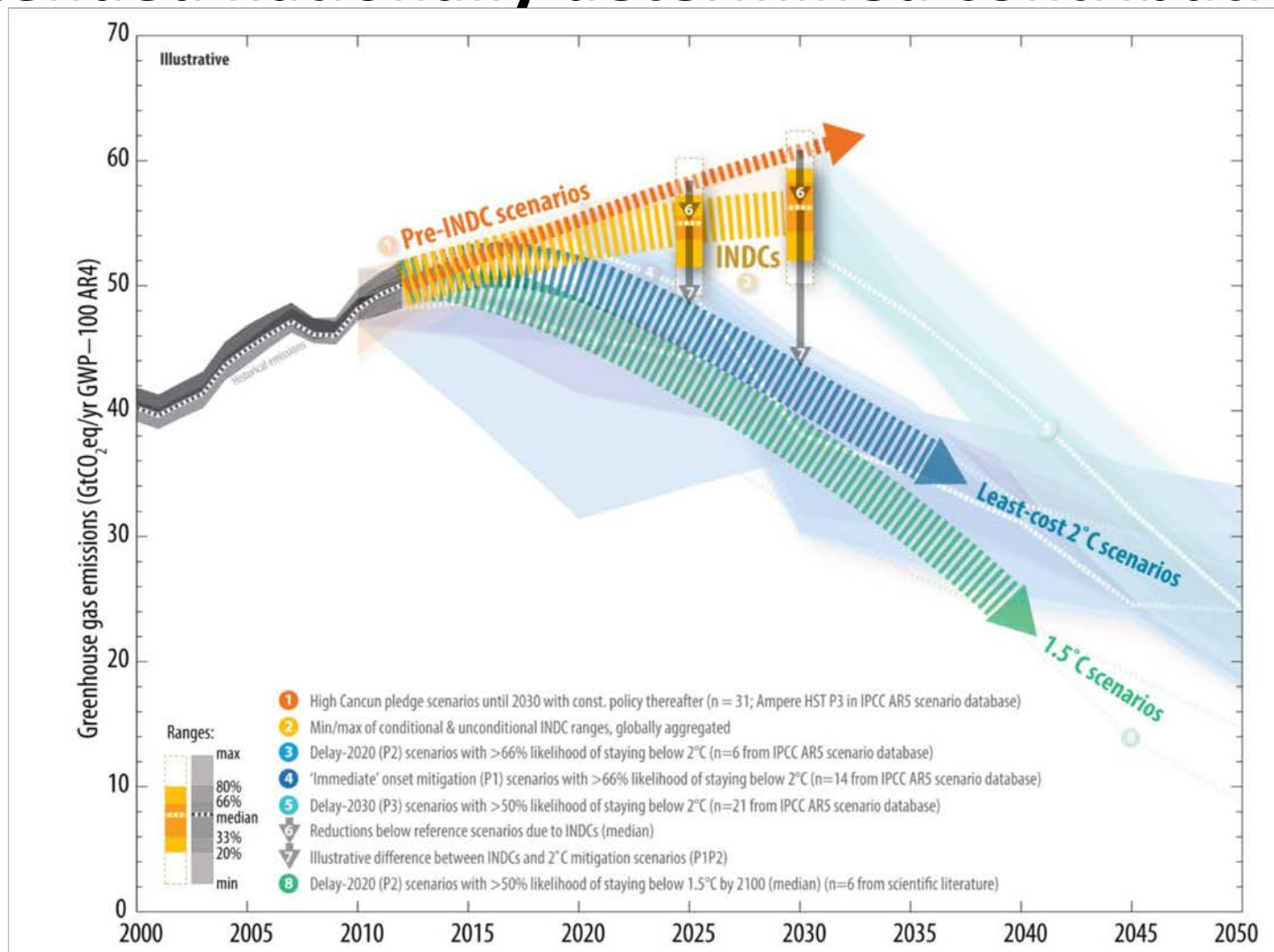
Sur les Changements Climatiques 2015

COP21/CMP11

Paris, France



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



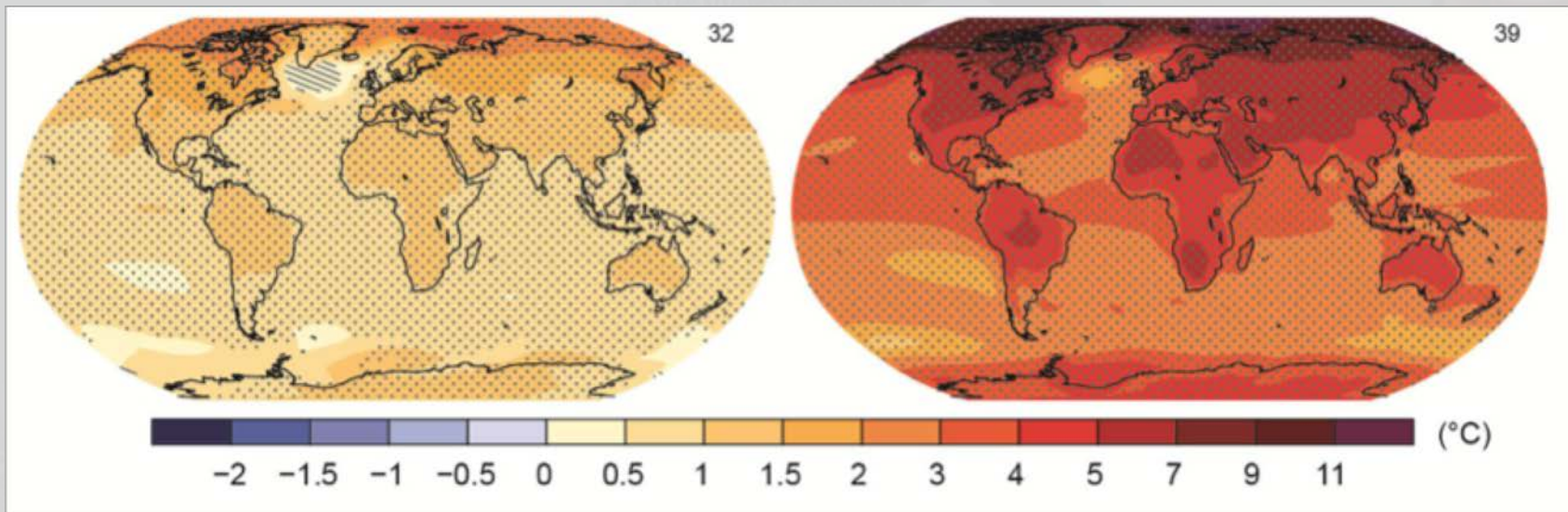
UNFCCC, Aggregate effect of the intended nationally determined contributions: an update

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

The Choices Humanity Makes Will Create Different Outcomes (and affect prospects for effective adaptation)

With substantial mitigation

Without additional mitigation



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

AR5 WGI SPM

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)

Final remarks

- 1) There is no business on a too hot planet
- 2) There is no climate mitigation without ambitious business action

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 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

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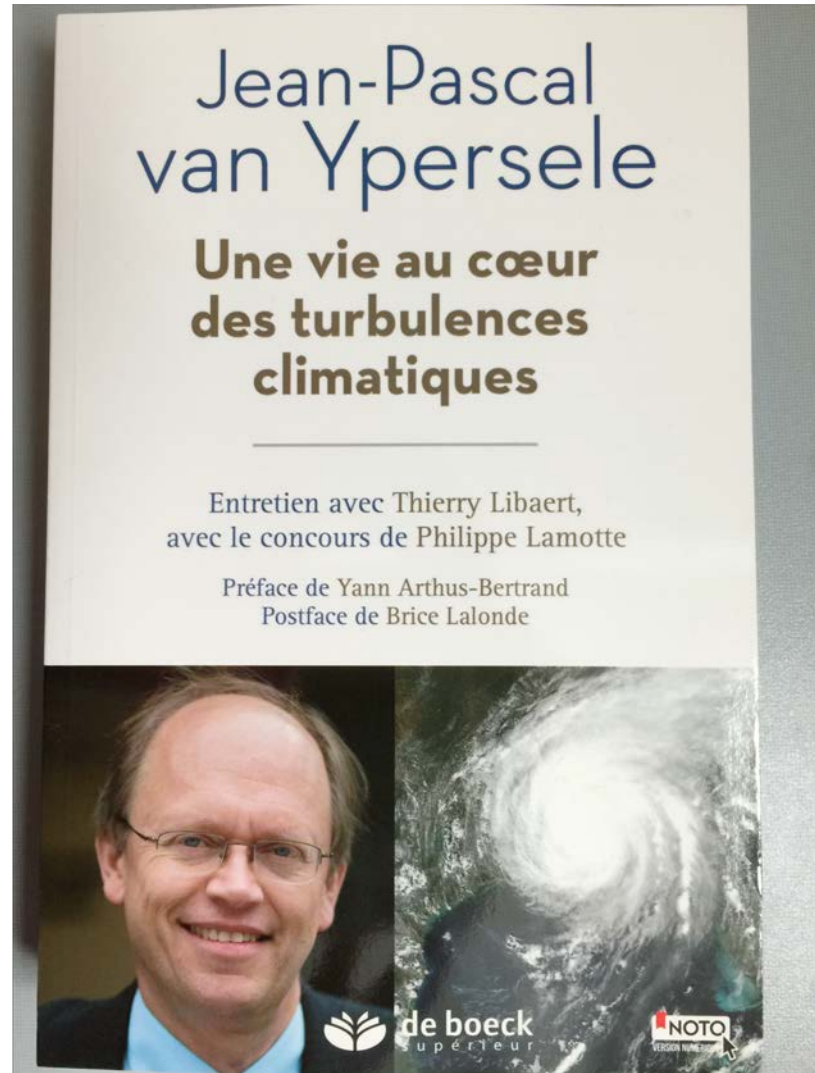
Pour en savoir plus:

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

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supérieur**

**Préface: Yann Arthus-
Bertrand**

Postface: Brice Lalonde



Bij EPO (2018)

**Voorwoord:
Jill Peeters**



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, COP24, basic climate change
- **Twitter: @JPvanYpersele & @IPCC_CH**