Climate Change Scenarios and Expected Impacts in Europe: Context for the Mission Board for “Adaptation to Climate Change, Including Societal Transformation”

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Citizens’ engagement event, Belgium (teleconference), 22 August 2020

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

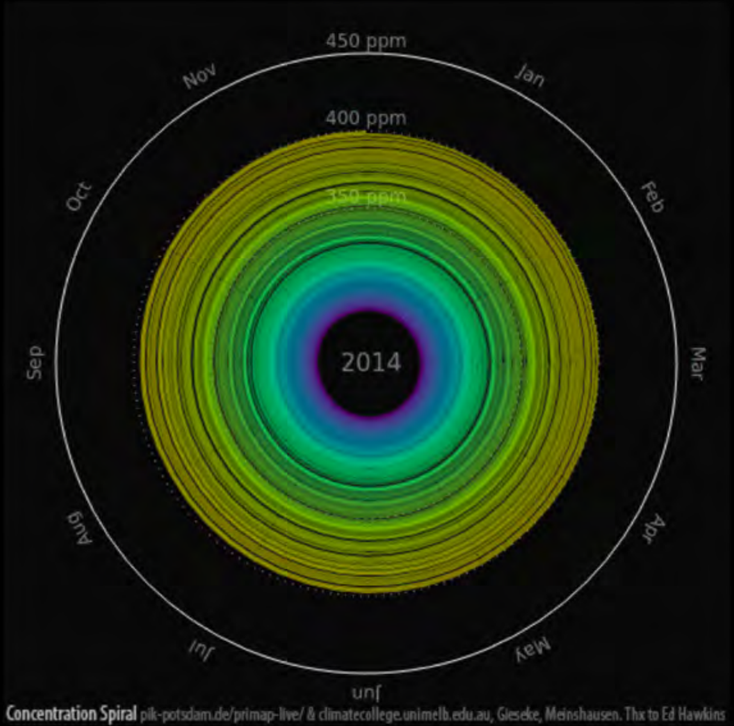
The Essential Truth About Climate Change in Ten Words

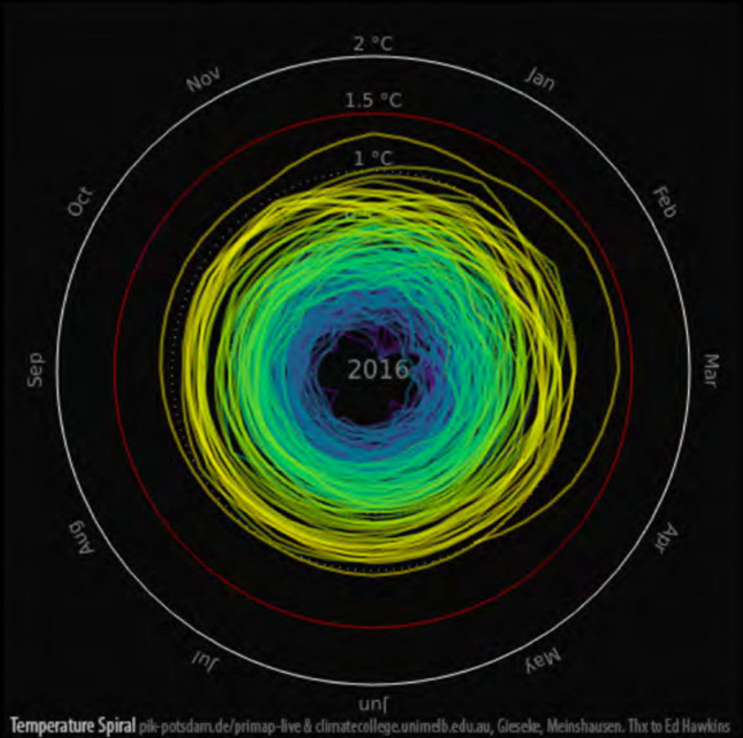
The basic facts of climate change, established over decades of research, can be summarized in five key points:

IT'S REAL	Global warming is happening.
IT'S US	Human activity is the main cause.
EXPERTS AGREE	There's scientific consensus on human-caused global warming.
IT'S BAD	The impacts are serious and affect people.
THERE'S HOPE	We have the technology needed to avoid the worst climate impacts.

Source: @JohnfoCook

CO_2 Concentration and Temperature spirals





CO_2 Concentration since 1850 and Global Mean Temperature in °C relative to 1850 – 1900
Graph: Ed Hawkins (Climate Lab Book) – Data: HadCRUT4 global temperature dataset
Animation available on http://openclimatedata.net/climate-spirals/concentration-temperature/

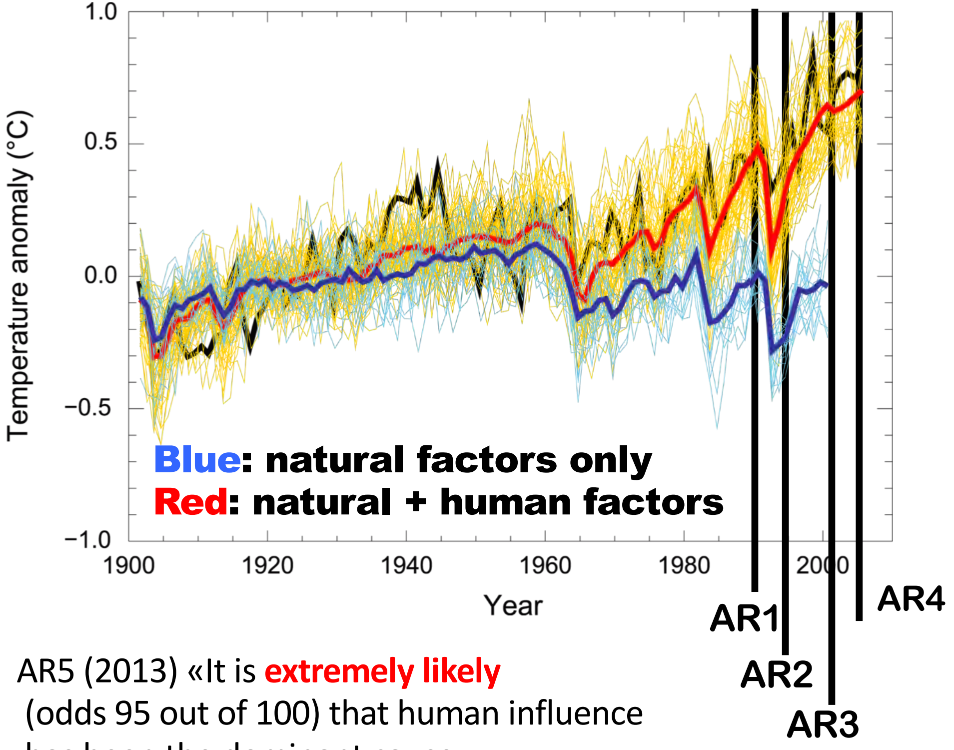
A Progression of Understanding: Greater and Greater Certainty in Attribution

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… »

IPCC

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

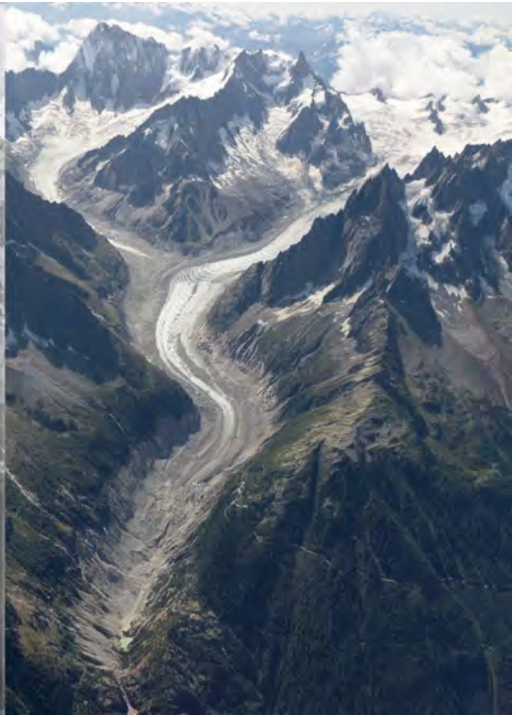
Heat waves kill

Une personne âgée dans un couloir des urgences du centre hospitalier de Versailles en août 2003. I AFP PHOTO MARTIN BUREAU

Floods cost

La Mer de Glace (Massif du Mont-Blanc)

1919 **2019**



Photos disponibles à l’adresse : uod.box.com/s/qu6n9qeq4jdvfvwm0sy4ozeqtxh71etx

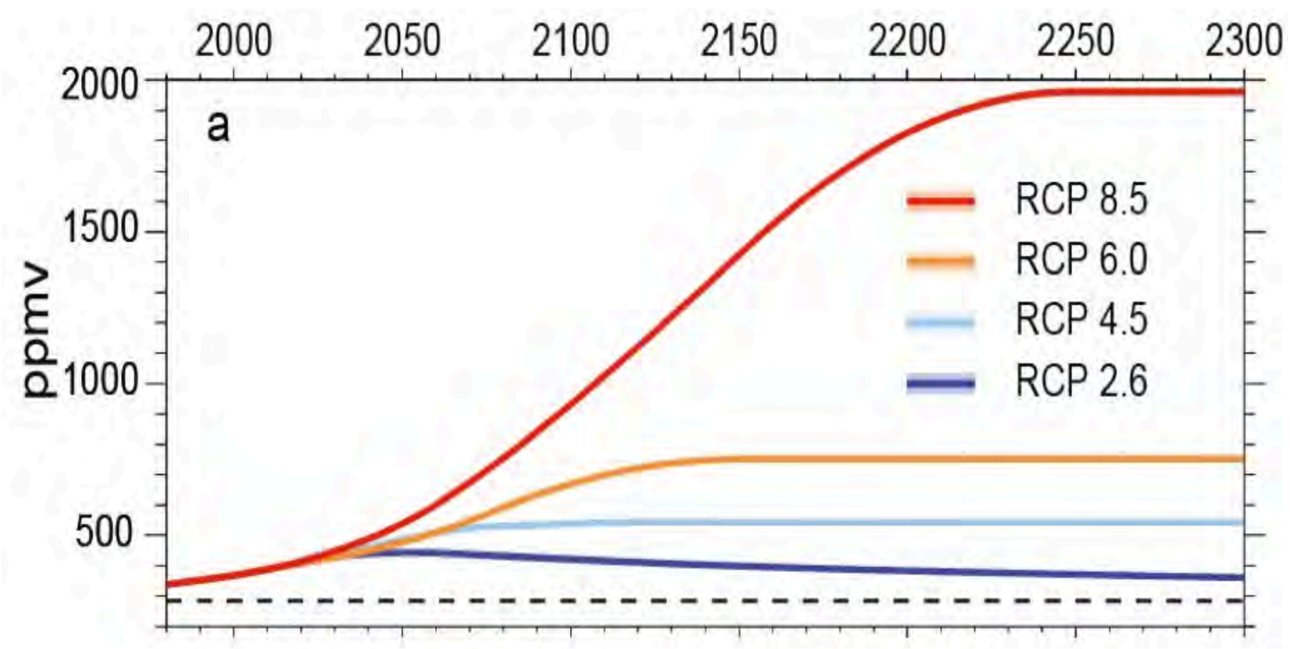
Voir aussi: www.dundee.ac.uk/stories/new-aerial-photographs-shed-light-dark-days-mont-blanc

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)

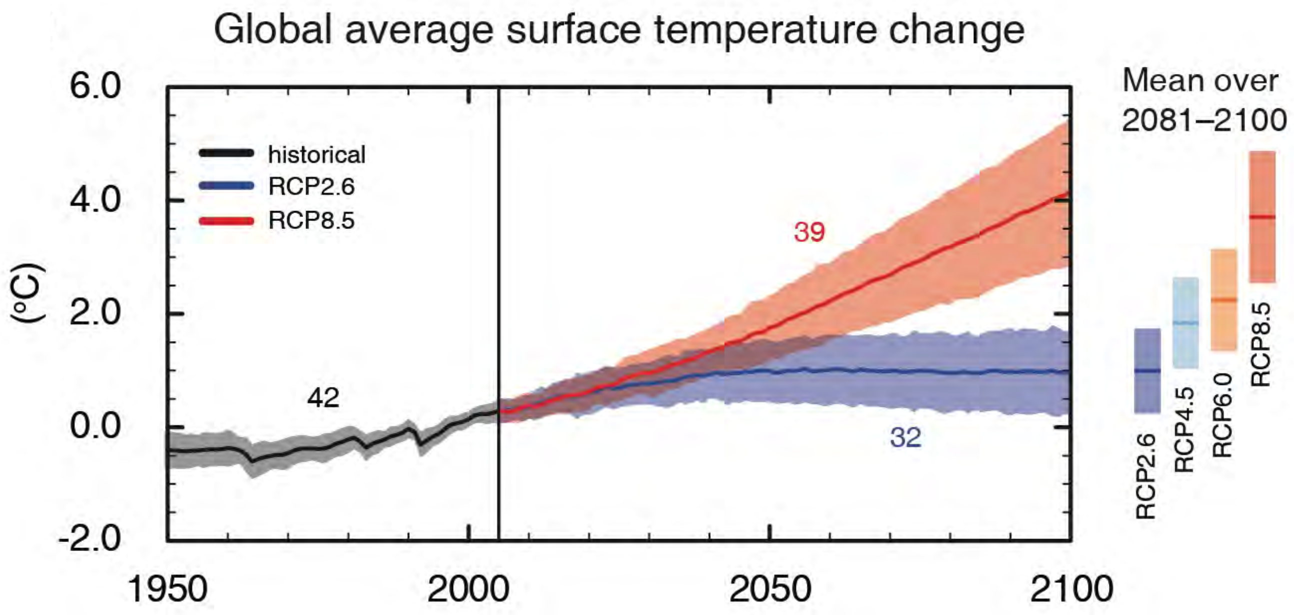
RCP Scenarios: Atmospheric CO_2 concentration



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

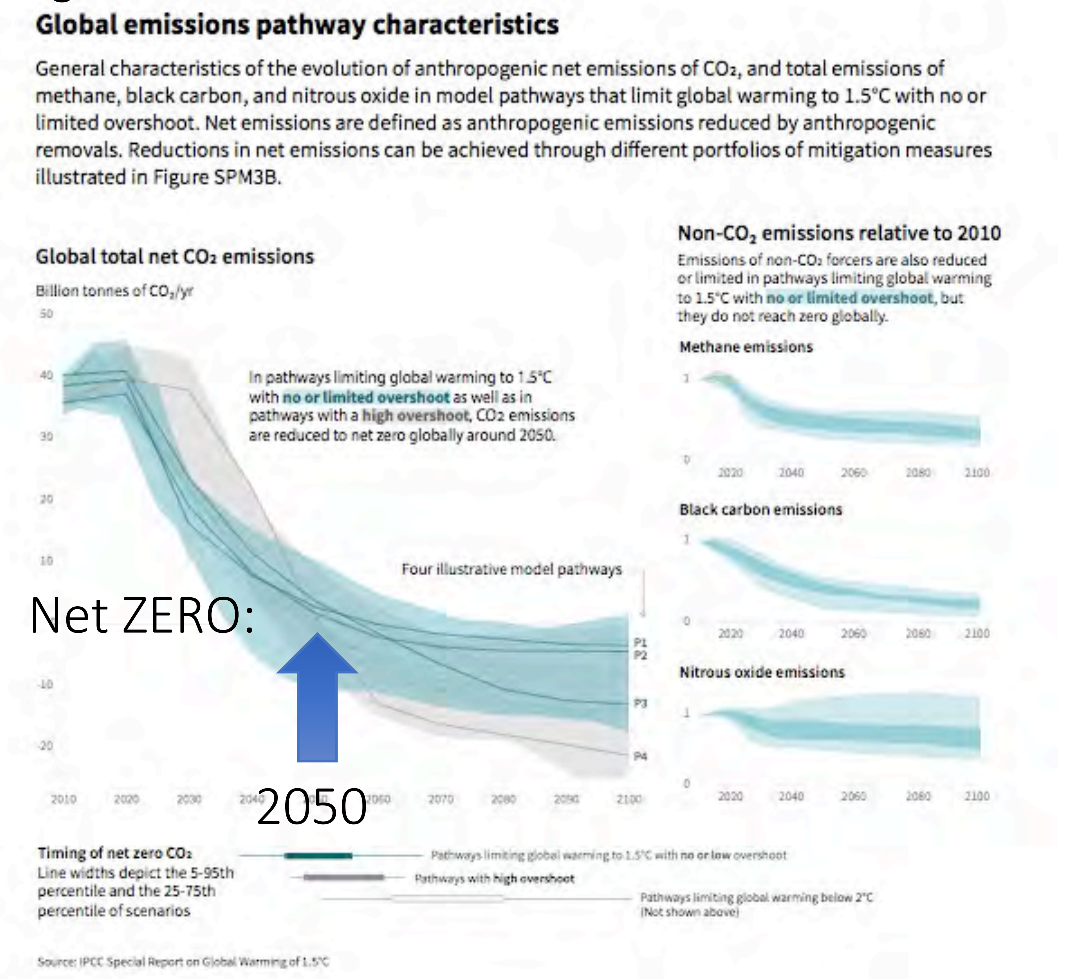
AR5, chapter 12. WGI

Projected global temperature increase during 21st century



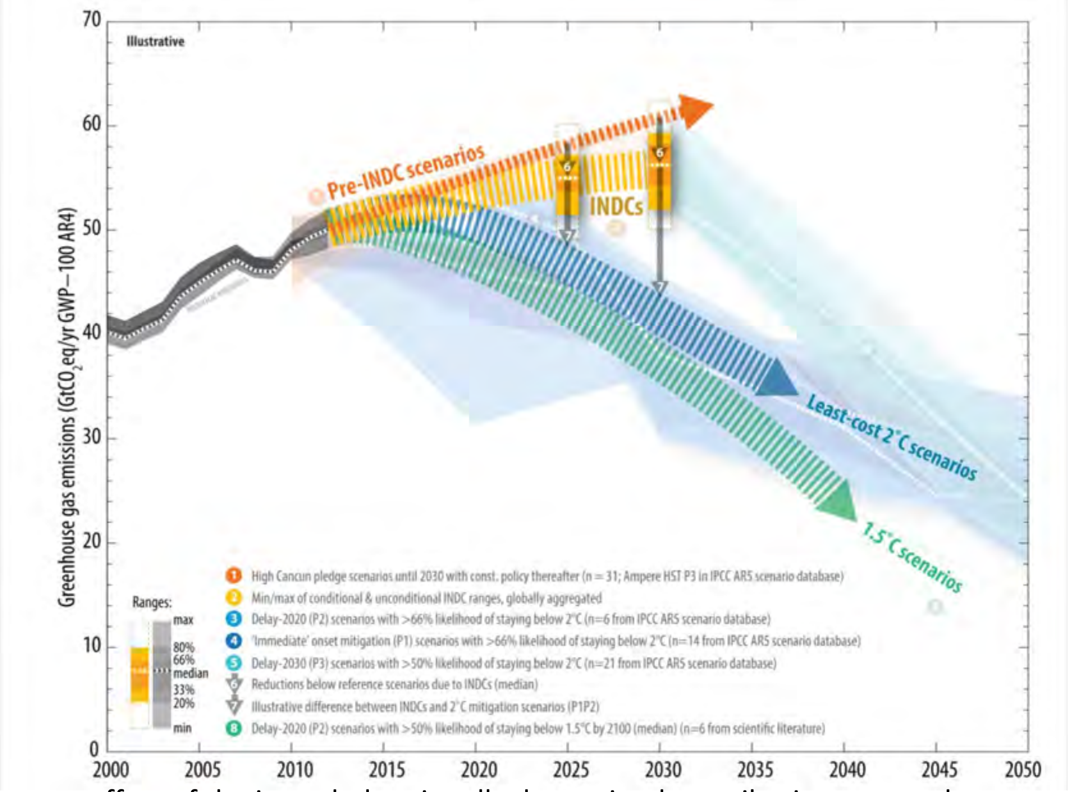
(IPCC 2013, Fig. SPM.7a)

To stay below 1.5°C warm:ing:



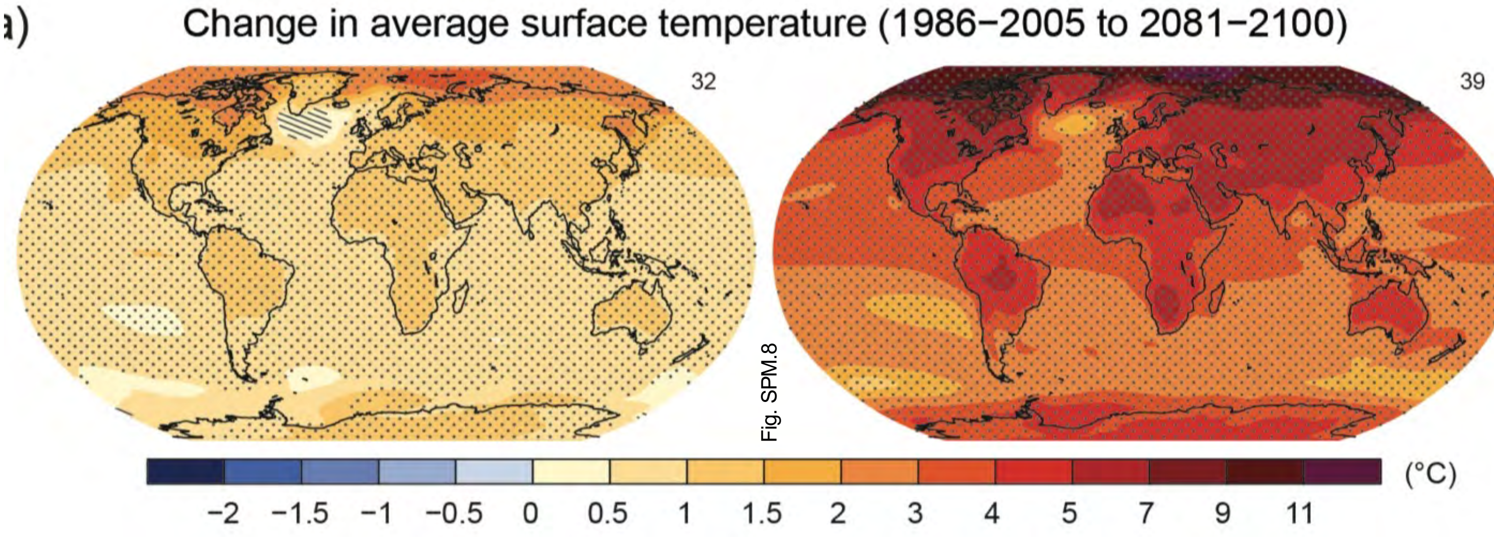
Source: IPCC SR15

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



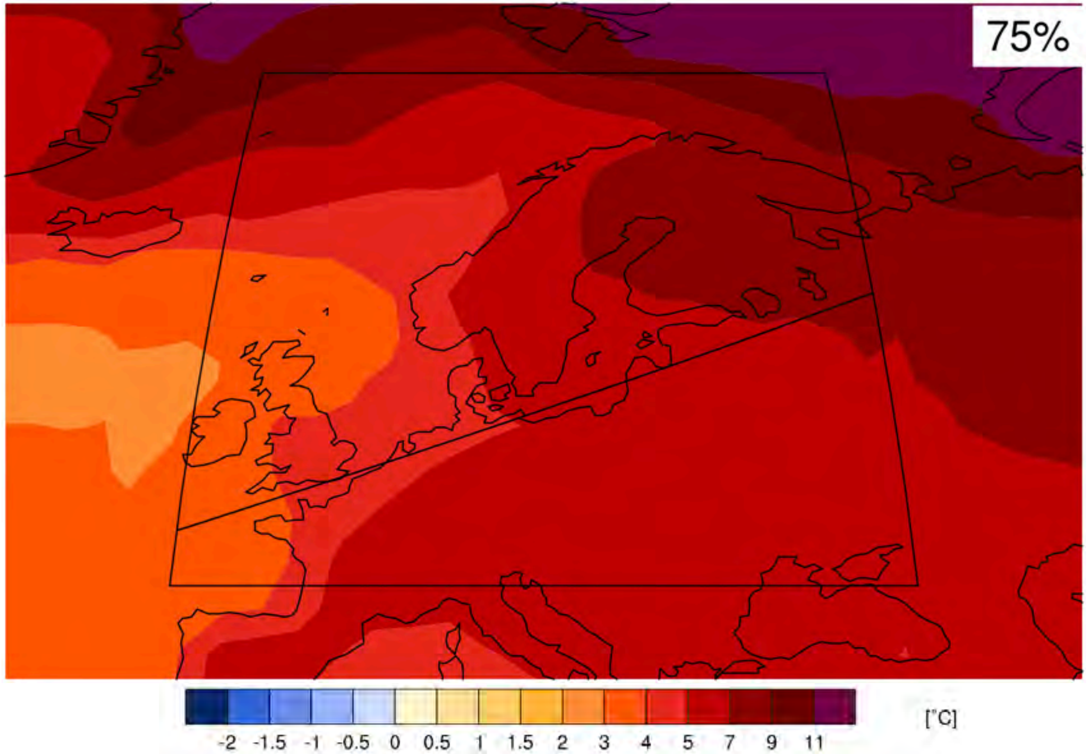
UNFCCC, Aggregate effect of the intended nationally determined contributions: an update
http://unfccc.int/resource/docs/2016/cop22/eng/02.pdf

RCP2.6 RCP8.5



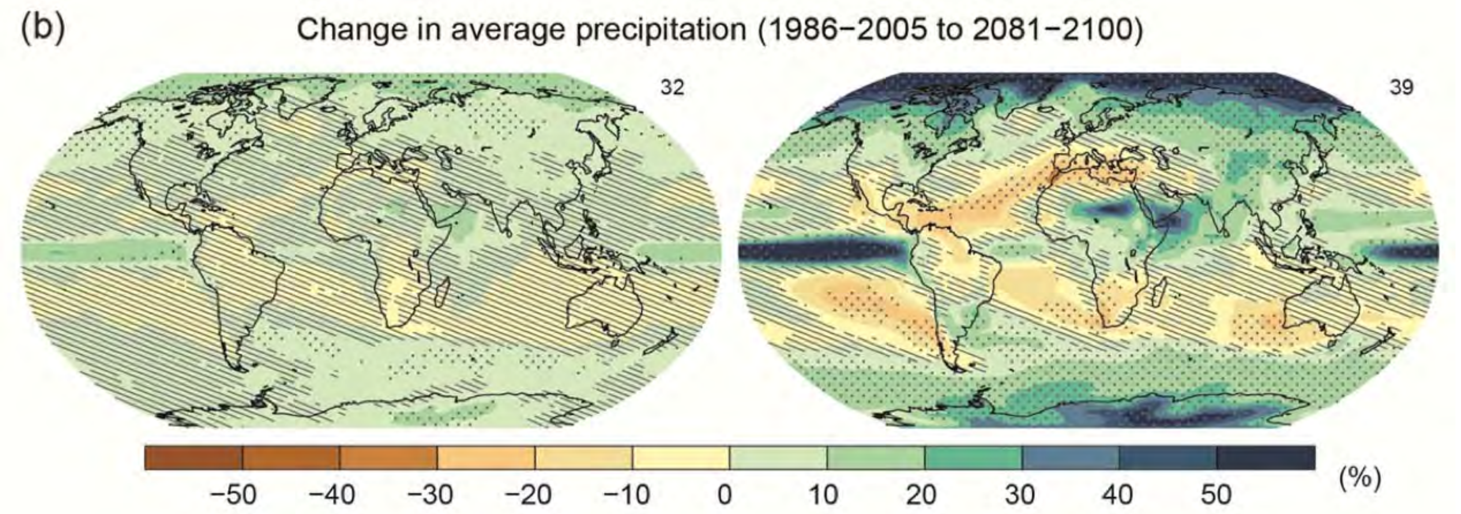
Hatching [hachures] indicates regions where the multi-model mean is small compared to natural internal variability (i.e., less than one standard deviation of natural internal variability in 20-year means).
Stippling [pointillés] indicates regions where the multi-model mean is large compared to natural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



IPCC WG1 Fifth Assessment Report (Final Draft)

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).
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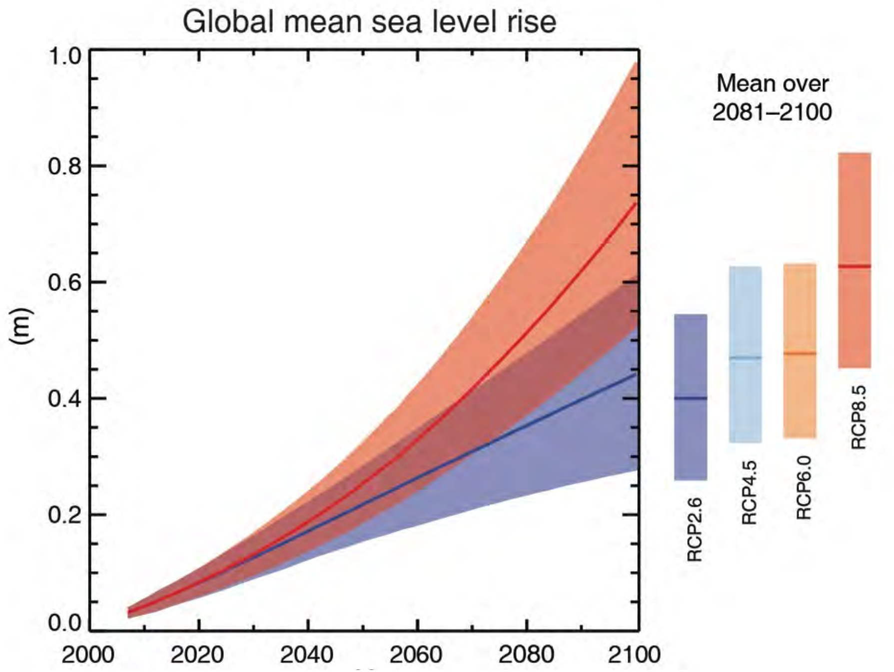

Fig. SPM.9

RCP2.6 (2081-2100), *likely* range: **26 to 55 cm**

RCP8.5 (in 2100), *likely* range: **52 to 98 cm**

JRC Peseta IV Final Report (2020) « Climate change impacts and adaptation in Europe »

Available on https://op.europa.eu

Key findings from JRC Peseta IV (2020) report (« Climate change impacts and adaptation in Europe »):

- *Ecosystems, people and economies in the EU are projected to face major impacts from unmitigated climate change*
- *The burden of climate change shows a clear north-south divide, with southern regions in Europe impacted more*
- *Climate mitigation can considerably lower the impacts of climate change in the EU*
- *Climate change adaptation can reduce unavoidable impacts of climate change in the EU in a cost-efficient way*

@JPvanYpersele

Ecosystems, people and economies in the EU are projected to face major impacts from unmitigated climate change (1)

Without climate mitigation (warming of 3°C or more above pre-industrial temperature) and adaptation actions the EU could face the following impacts:
□ The alpine tundra domain would contract by 84% and practically disappear in the Pyrenees. The natural climatic tree line would shift vertically up by up to 8 m/year. □ Ecological domains would shift northwards, resulting in severe changes of the prevailing domains in southern Europe and Boreal areas and the encroachment of the Tropical domain in Europe. □ Wildfire and pest outbreaks would become more frequent and severe, increasing biomass loss and carbon release. □ An additional 15 million Europeans living in the proximity of wildland would be exposed to high-to-extreme fire danger for at least 10 days/year. □ Each year nearly 300 million citizens in the EU and UK would be exposed to deadly heatwaves, resulting in a 30-fold rise in deaths from extreme heat (90,000 annual deaths compared to around 3,000 each year today). □ Water resources availability would drop by up to 40% in southern regions of Europe and droughts would happen more frequent in most of southern and western Europe. □ Water scarcity and drought would increasingly affect agriculture, energy production and water supply in regions that already suffer from water stress.

Source: JRC Peseta IV (2020) report

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Without climate mitigation (warming of 3°C or more above pre-industrial temperature) and adaptation actions the EU could face the following impacts:

- **Each year nearly 300 million citizens in the EU and UK would be exposed to deadly heatwaves, resulting in a 30-fold rise in deaths from extreme heat (90,000 annual deaths compared to around 3,000 each year today).**

Source: JRC Peseta IV (2020) report @JPvanYpersele

Ecosystems, people and economies in the EU are projected to face major impacts from unmitigated climate change (2)

Without climate mitigation (warming of 3°C or more above pre-industrial temperature) and adaptation actions the EU could face the following impacts:
□ In the absence of international market adjustments, crop yields would drop by more than 10% in southern Europe. □ Total drought losses for the EU and UK would increase to nearly 45 €billion/year with 3°C warming in 2100 compared to 9 €billion/year at present. □ Almost half a million people in the EU and UK would be exposed to river flooding each year, or nearly three times the number at present, and river flood losses would rise 6-fold in magnitude, reaching nearly 50 €billion/year with 3°C in 2100. □ Coastal flood losses in the EU and UK would grow by two orders of magnitude and climb to 250 €billion/year in 2100, while 2.2 million people would be exposed per year to coastal inundation compared to 100,000 at present. □ If 3°C global warming would occur in today's economy, annual welfare loss in the EU and UK could represent 1.4% of GDP, when considering a limited set of climate impacts (river flooding, coastal flooding, agriculture, droughts, energy supply, mortality from temperature extremes, and windstorms). With 4°C global warming annual welfare loss would be 1.9% of GDP (PESETA III).

Source: JRC Peseta IV (2020) report

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Ecosystems, people and economies in the EU are projected to face major impacts from unmitigated climate change (2)

Without climate mitigation (warming of 3°C or more above pre-industrial temperature) and adaptation actions the EU could face the following impacts:
Coastal flood losses in the EU and UK would grow by two orders of magnitude and climb to 250 €billion/year in 2100, while 2.2 million people would be exposed per year to coastal inundation compared to 100,000 at present.

Source: JRC Peseta IV (2020) report

@JPvanYpersele

The burden of climate change shows a clear north-south divide, with southern regions in Europe impacted more

The south of Europe is expected to suffer relatively more than other parts of Europe with increasing levels of global warming, in large because of consequent changes in high-end temperatures and the spatial and temporal availability of water.
□ The frequency of heatwaves rises more dramatically in the south of Europe. With unmitigated climate change, human exposure to severe heatwaves would be multiplied around 30 times at higher latitudes, while it could be 40 to 50 times more in countries in southern Europe (e.g., Spain and Greece). **□ During summer, water availability would nearly drop to half in southern European regions that already face the highest water stress. Water resources in northern Europe would increase.** **□ Electricity production by hydropower would increase in the north, while hydro and nuclear power would reduce in southern Europe due to lower water availability for direct production and river cooling.** **□ Without market adjustments, wheat and maize yield would drop by more than 10% on average in southern Europe. In northern Europe wheat (maize) yield would increase (decrease) by around 5%.** **□ With high warming nearly half of total EU and UK drought losses would occur in Mediterranean EU countries, compared to 40% at present.** **□ In southern mountain ranges the rate of upward tree line shift is double than that at high latitudes, and the alpine tundra would almost completely vanish with high warming.** **□ The rise in fire danger and exposure to it of people near wildland is stronger at lower latitudes.** **□ Welfare losses from the climate impacts monetised in PESETA IV show a clear north-south divide, with welfare losses in southern regions that would be several times larger compared to those in the north of Europe.**

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Source: JRC Peseta IV (2020) report

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Source: JRC Peseta IV (2020) report

Climate mitigation can considerably lower the impacts of climate change in the EU

All climate impacts considered in PESETA IV would be reduced significantly with mitigation polices attaining the Paris Agreement targets:

□ More than half of the alpine tundra would remain stable, compared to only 16% without mitigation. Vertical tree lines shifts would be reduced by more than 50%.
□ The intensity of change in the prevailing ecological domains in southern Europe and Boreal areas and the encroachment of the Tropical domain in Europe would be limited.
□ The increase in the number of people near wildland that are annually exposed to at least 10 days of high-to-extreme fire danger would be limited to 5 million, compared to 15 million with 3°C global warming.
□ The number of people annually exposed to deadly heatwaves would be reduced by 200 million with 60,000 fewer deaths per year.
□ The drop in water resources availability in southern regions would be halved. The number of people living in areas with severe water stress would remain stable, compared to a fourfold multiplication with high warming.
□ Annual drought losses would be reduced by 20 €billion/year.
□ Each year around 230,000 fewer people would be exposed to river flooding and river flood damage would be halved to 24 €billion/year with 1.5°C in 2100, compared to a 3°C scenario.
□ Coastal flood losses would be lowered by more than 100 €billion/year in 2100.
□ Welfare losses could be reduced by 75% compared to unmitigated climate change.

Source: JRC Peseta IV (2020) report @JPvanYpersele

Climate mitigation can considerably lower the impacts of climate change in the EU

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- **The increase in the number of people near wildland that are annually exposed to at least 10 days of high-to-extreme fire danger would be limited to 5 million, compared to 15 million with 3°C global warming.**
- **The number of people annually exposed to deadly heatwaves would be reduced by 200 million with 60,000 fewer deaths per year.**

Source: JRC Peseta IV (2020) report @JPvanYpersele

Climate change adaptation can reduce unavoidable impacts of climate change in the EU in a cost-efficient way

Even if global warming were limited to well below 2°C there will be unavoidable impacts in the EU. PESETA IV exemplifies, through pan-European assessments of the costs and benefits of risk reduction measures for river and coastal flooding, that adaptation can reduce climate change impacts in a cost-efficient way. The analyses show that the benefits of adaption measures are long lasting and avoided climate change damage grows in time and with increasing global warming. In case of unmitigated climate change,

□ reducing flood peaks by installing retention reservoirs would reduce annual river flood damage at the end of the century by nearly 40 €billion and around 400,000 fewer people would be exposed each year to flooding in the EU and the UK. The annual investment from now until 2100 to install and maintain the reservoirs would be 3.3 €billion/year. There are additional benefits of nature-based storage areas, such as restoring the natural functioning of floodplain areas and improving ecosystem quality.

□ strengthening protection along coastlines of populated and economically pivotal coastal areas would avoid 220 €billion of coastal flood losses each year in the EU and UK at the end of this century, for an annual cost of less than 2 €billion/year from now until 2100. Also 1.4 million fewer people would be exposed each year to coastal flooding. The effects of global warming on sea level rise will continue long after stabilising the climate, hence so will the benefits of coastal adaptation. An unavoidable drawback of the strong rise in sea levels and consequent need for adaptation is that in about 25% of the coastline of the EU the sea would be disconnected from the hinterland by natural or physical barriers, which in some regions can be up to two metres high.

Source: JRC Peseta IV (2020) report

@JPvanYpersele

Climate change adaptation can reduce unavoidable impacts of climate change in the EU in a cost-efficient way

Even if global warming were limited to well below 2°C there will be unavoidable impacts in the EU. (…) Adaptation can reduce climate change impacts in a cost-efficient way.
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Source: JRC Peseta IV (2020) report

@JPvanYpersele

RCP2.6 RCP8.5

[redacted]

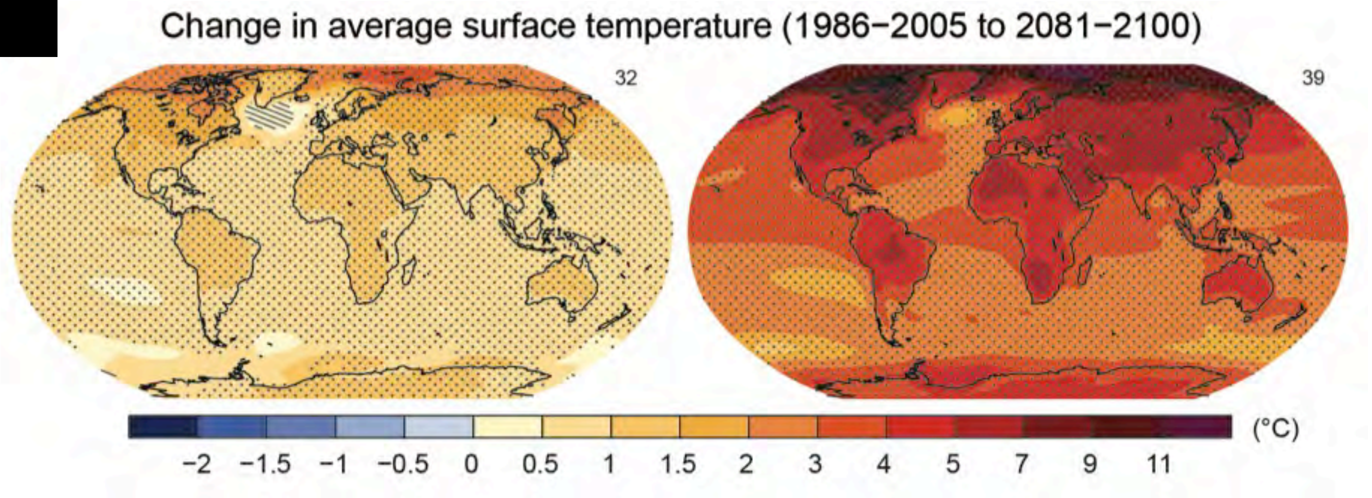


Fig. SPM.8

Humanity has the choice

Horizon Europe Mission Climate Adaptation, including Societal Transformation

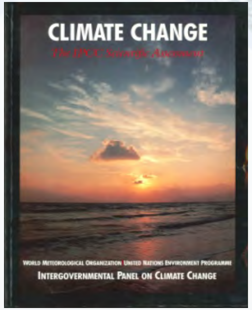
ACCELERATING THE TRANSITION TO A CLIMATE PREPARED AND RESILIENT EUROPE

ACCELERATING THE TRANSITION TO A CLIMATE PREPARED AND RESILIENT EUROPE

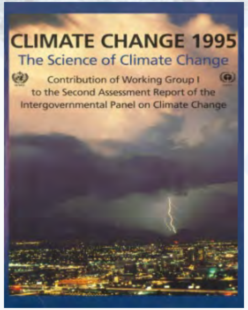
Vision:

“Turning the urgent challenge of adapting to climate change into an opportunity to make Europe more resilient, climate prepared and fair”

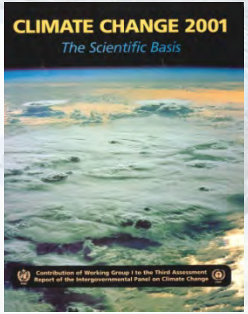
IPCC Assessment Reports



FAR 1990



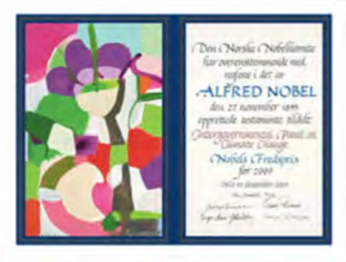
SAR 1995

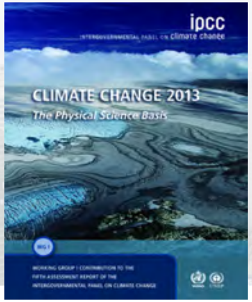


TAR 2001

AR4 2007

Nobel Peace Prize 2007





AR5 WGI 2013

AR5 WGII 2014

AR5 WGIII 2014

IPCC AR5 Synthesis Report

ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

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

Suite à l'intense mobilisation des jeunes, les changements climatiques ont fait l'objet de beaucoup d'attention au cours des derniers mois. Elèves 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

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

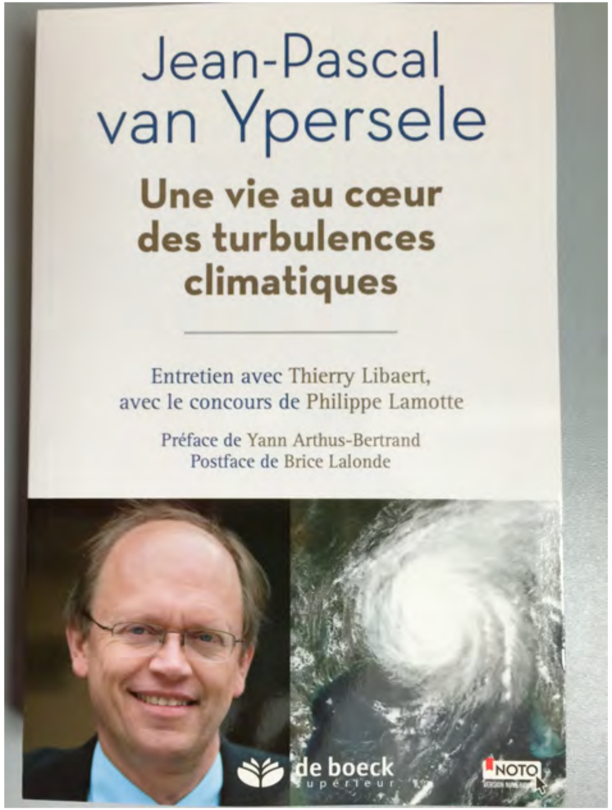
Pour en savoir plus:

Lisez mon livre, où j'aborde tous ces sujets

Publié chez De Boeck supérieur

Préface:Yann Arthus-Bertrand

Postface: Brice Lalonde



Bij EPO
(februari 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, latests on SR15, basic climate science
- **Twitter: @JPvanYpersele & @IPCC_CH**

Site where my slides will be available:

- www.climate.be/vanyp/conferences
- **Twitter: @JPvanYpersele**
  @IPCC_CH

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(vanyp@climate.be)