Climate Change and Peace

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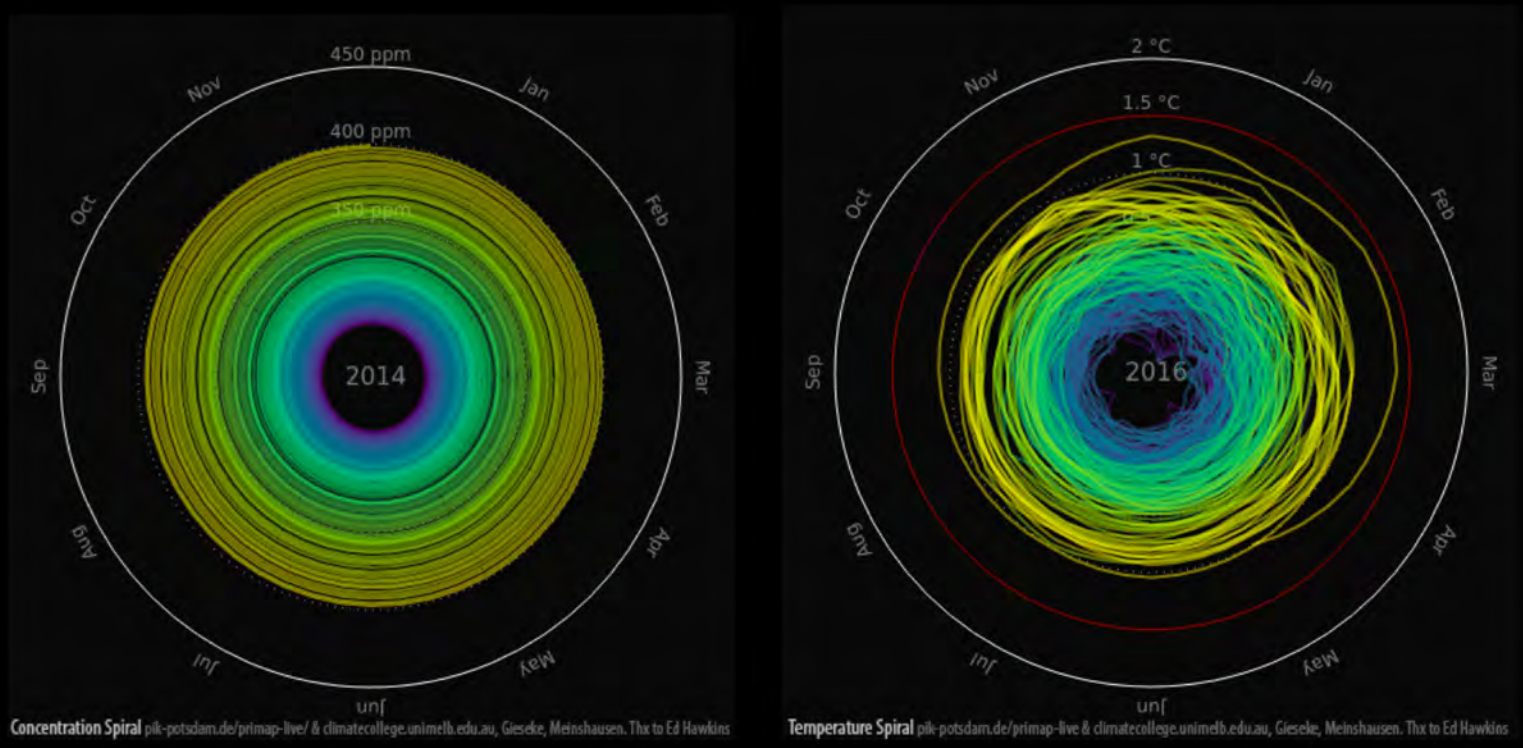
Hautes études de sécurité et de défense, organisées par l'Institut royal supérieur de défense avec le soutien de l'Institut royal des relations internationales – Egmont, École royale militaire, Bruxelles, 12 October 2019

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

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/

“Climate Change War” Is Not a Metaphor

The U.S. military is preparing for conflict, retired Navy Rear Adm. David Titley says in an interview

***On our current path**, climate change could pose an irreversible, **existential risk to civilization as we know it**—but we can still fix it if we decide to work together.*

http://www.slate.com/articles/technology/future_tense/2014/04/david_titley_climate_change_war_an_interview_with_the_retired_rear_admiral.html

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

What is happening in the climate system?

What are the risks?

What can be done?

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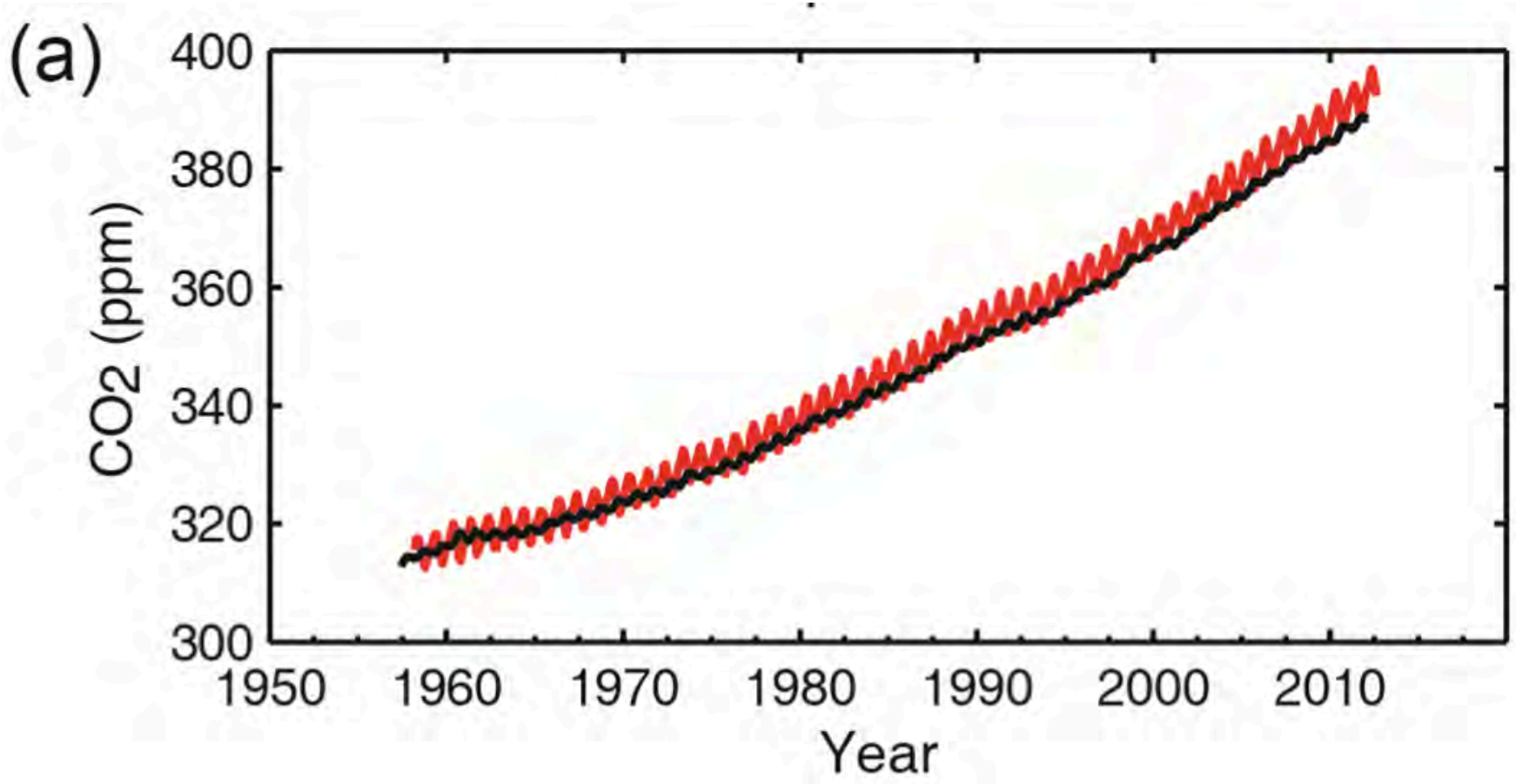
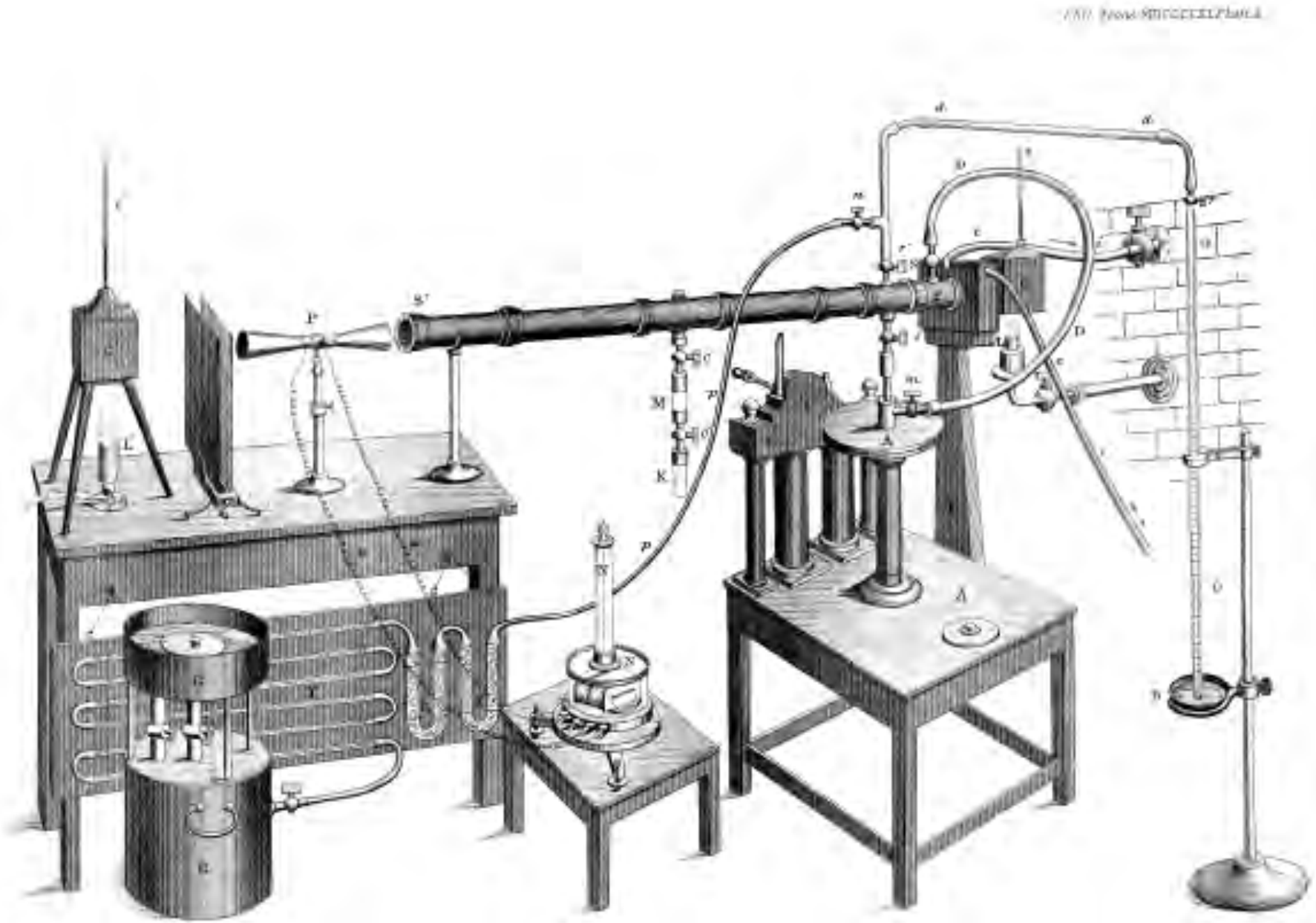
What is happening in the climate system?

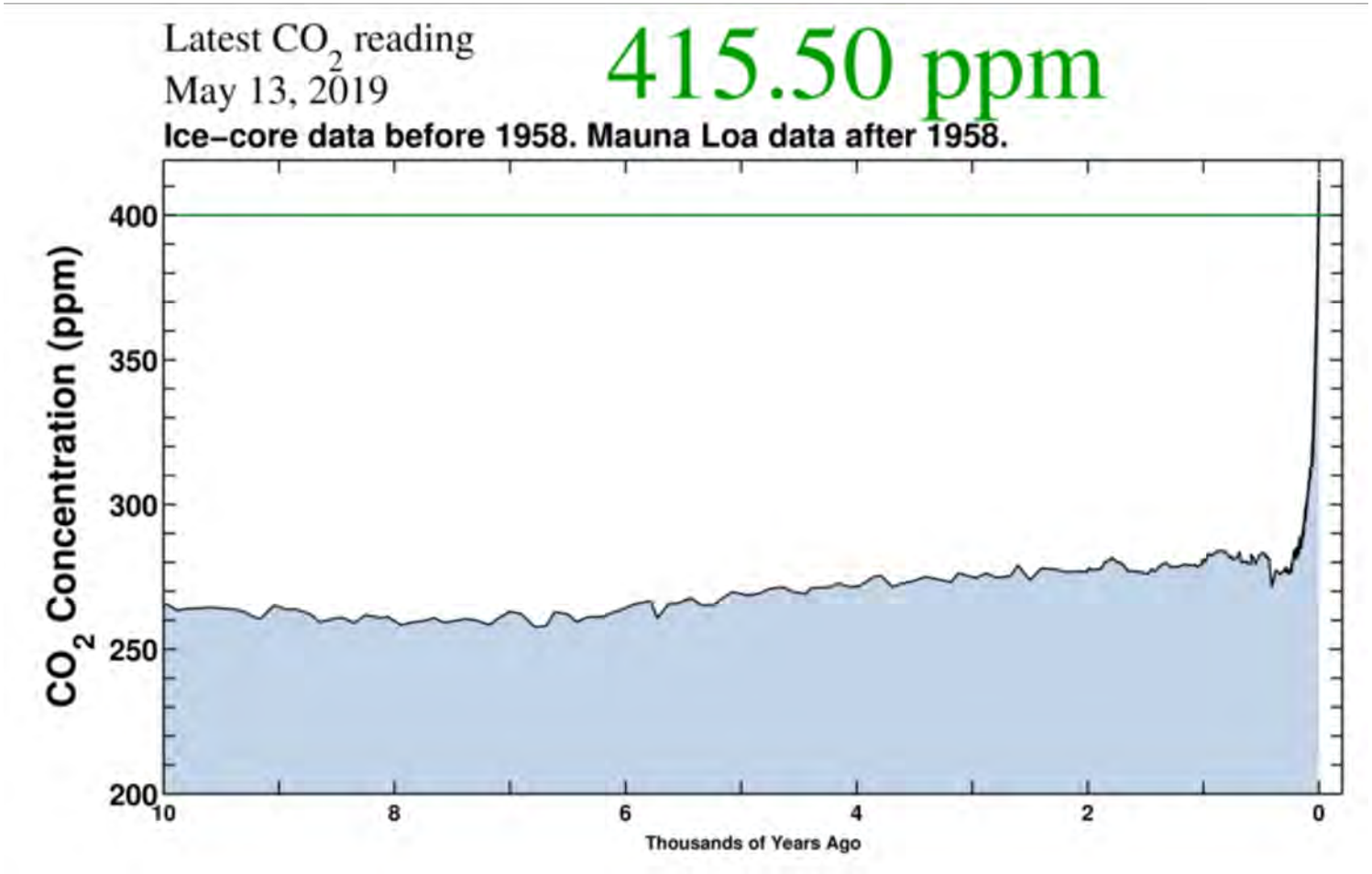
Atmospheric CO_2 concentration





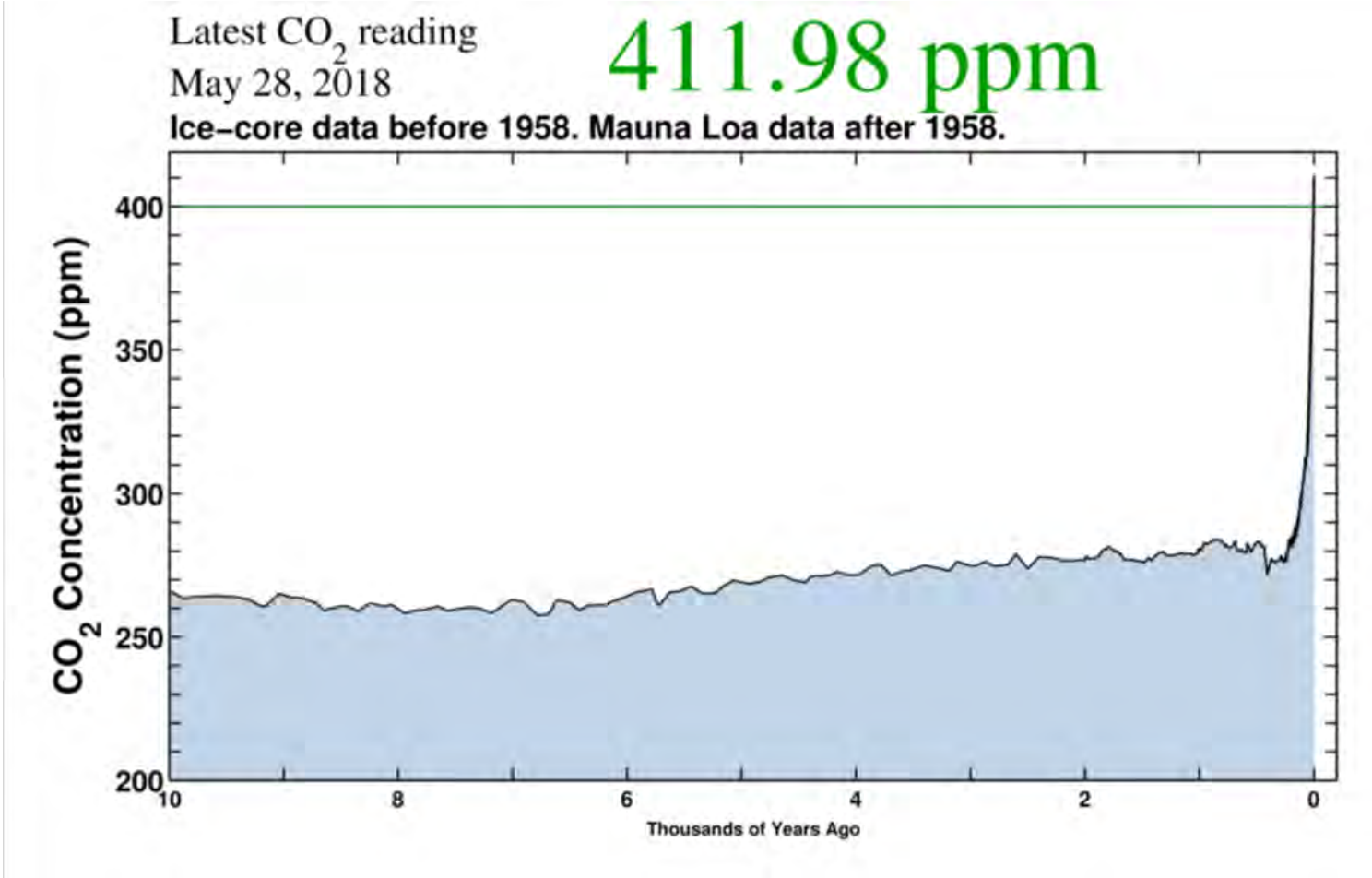
Tyndall (1861) measures gas absorption of radiation as a function of wavelength

CO_2 Concentration, 13 May 2019 (Keeling curve)



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

CO_2 Concentration, 28 May 2018 (Keeling curve)



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

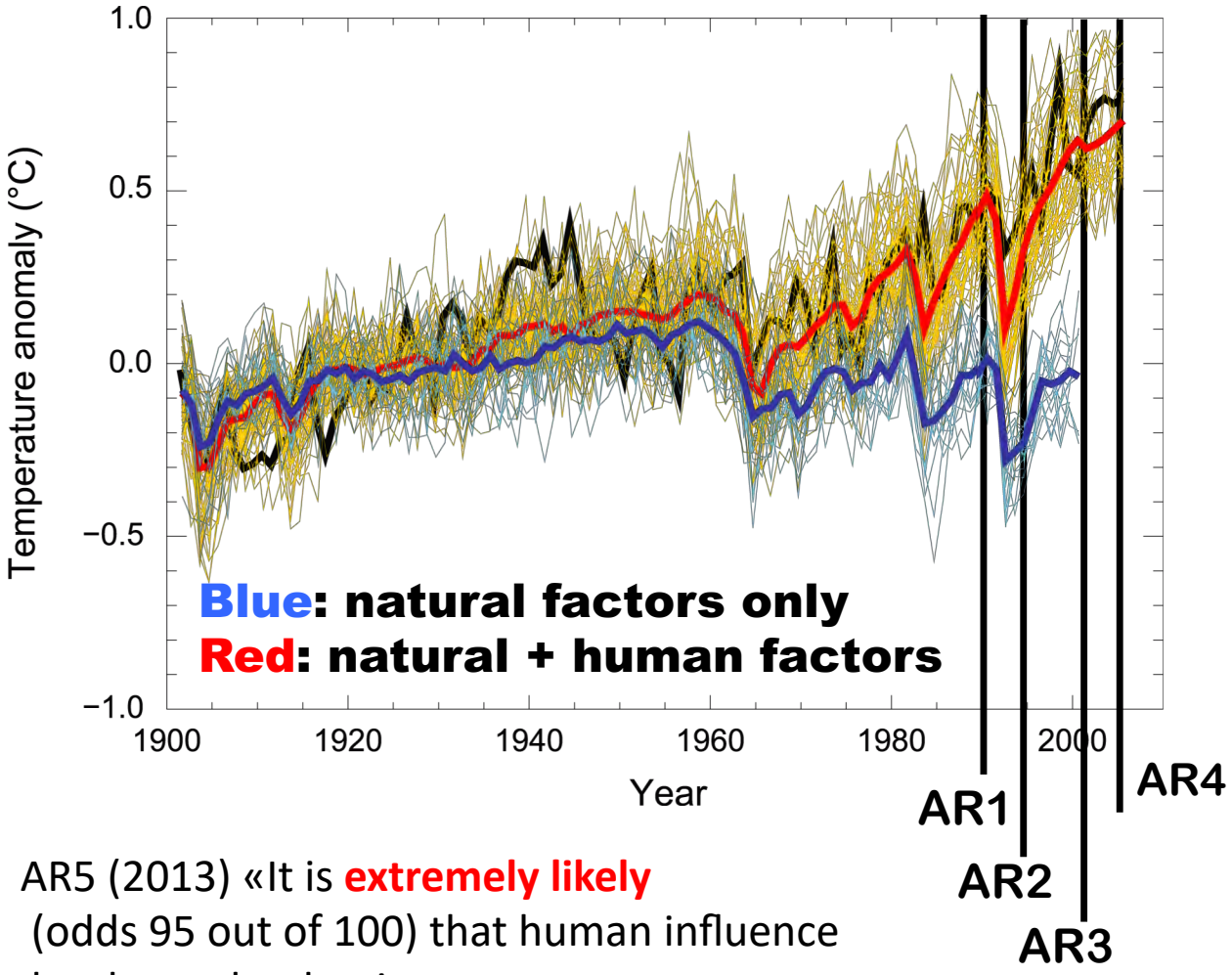
A Progression of Understanding: Greater and Greater Certainty in Attribution

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

AR2 (1995): "balance of evidence suggests **discernible** human influence"

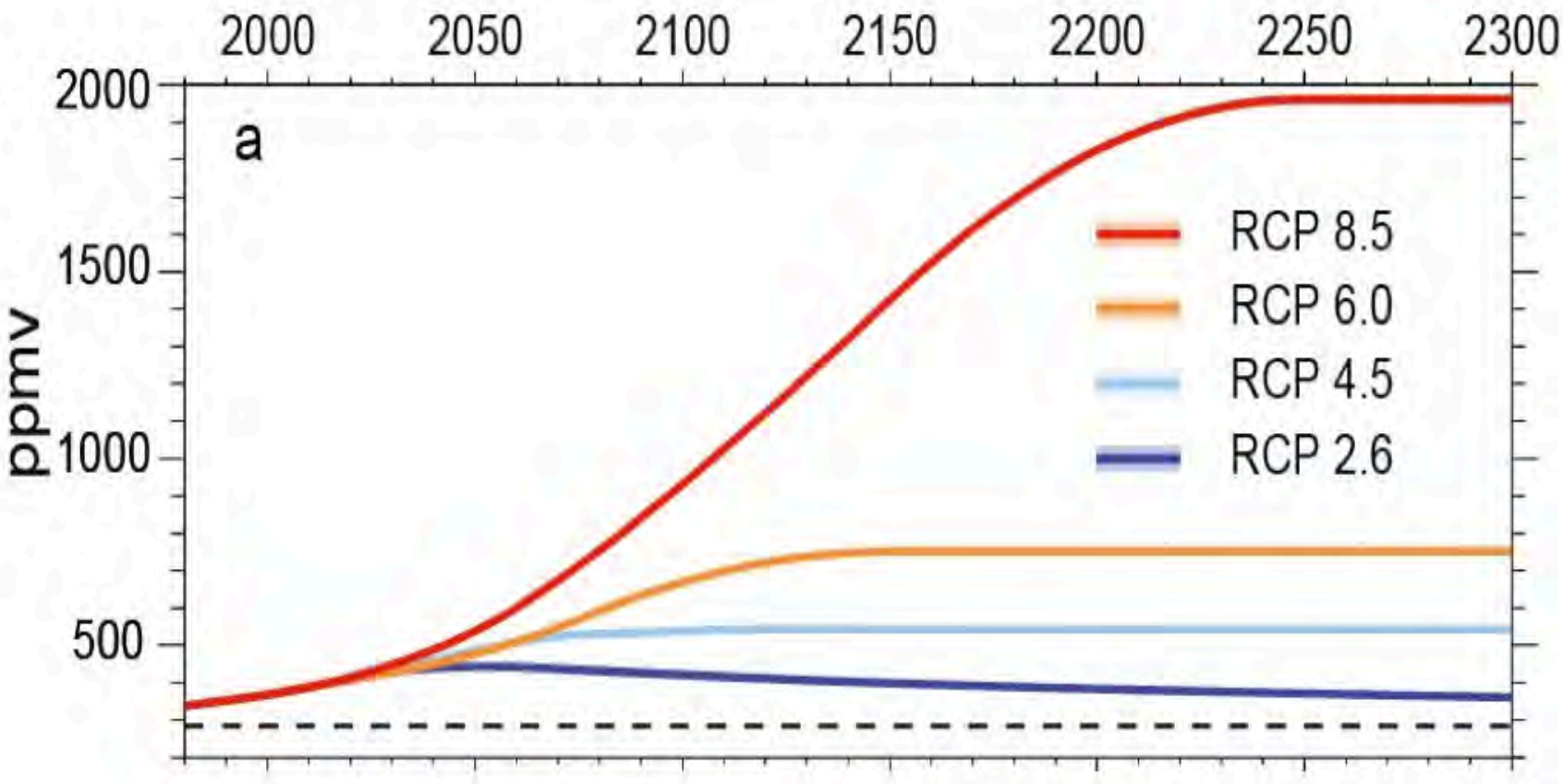
AR3 (2001): "most of the warming of the past 50 years is **likely** (odds 2 out of 3) due to human activities"

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



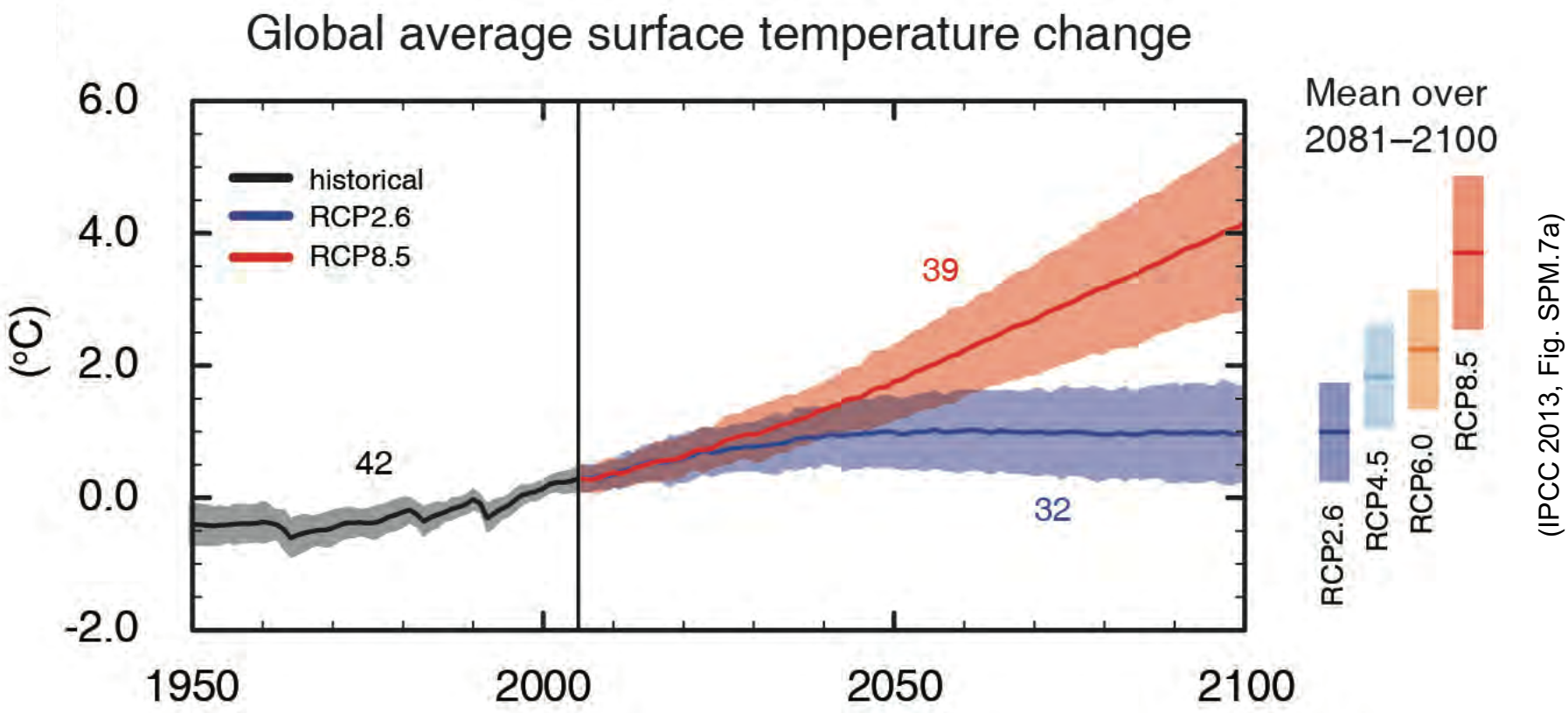
AR5 (2013) «It is **extremely likely** (odds 95 out of 100) that human influence has been the dominant cause… »

RCP Scenarios: Atmospheric CO_2 concentration



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

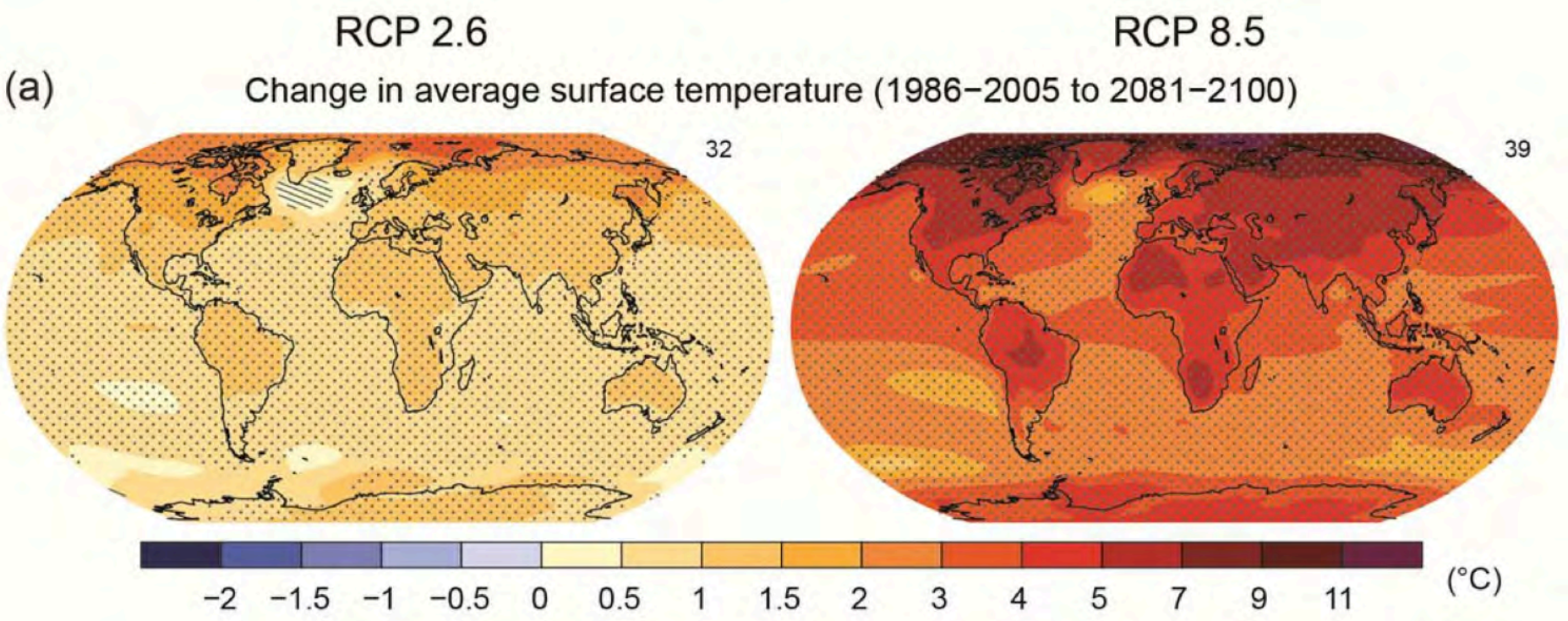
AR5, chapter 12. WGI- Adopted version / subject to final copyedit



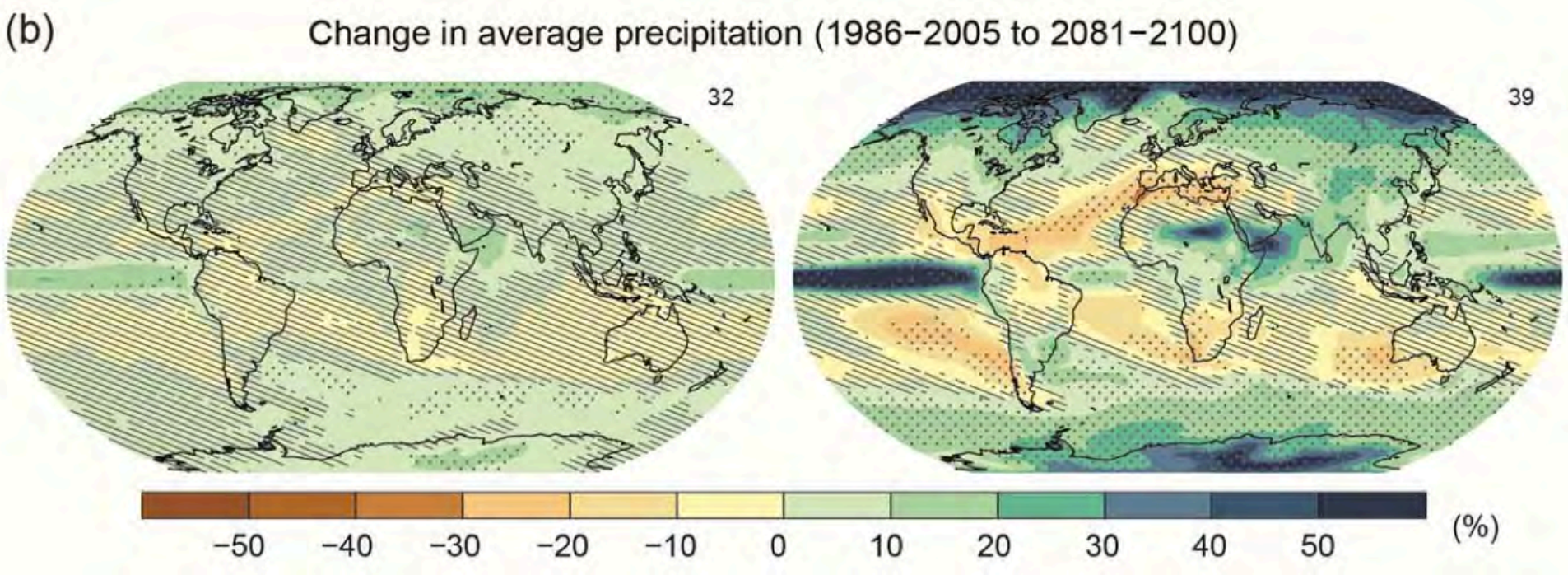
(IPCC 2013, Fig. SPM.7a)

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

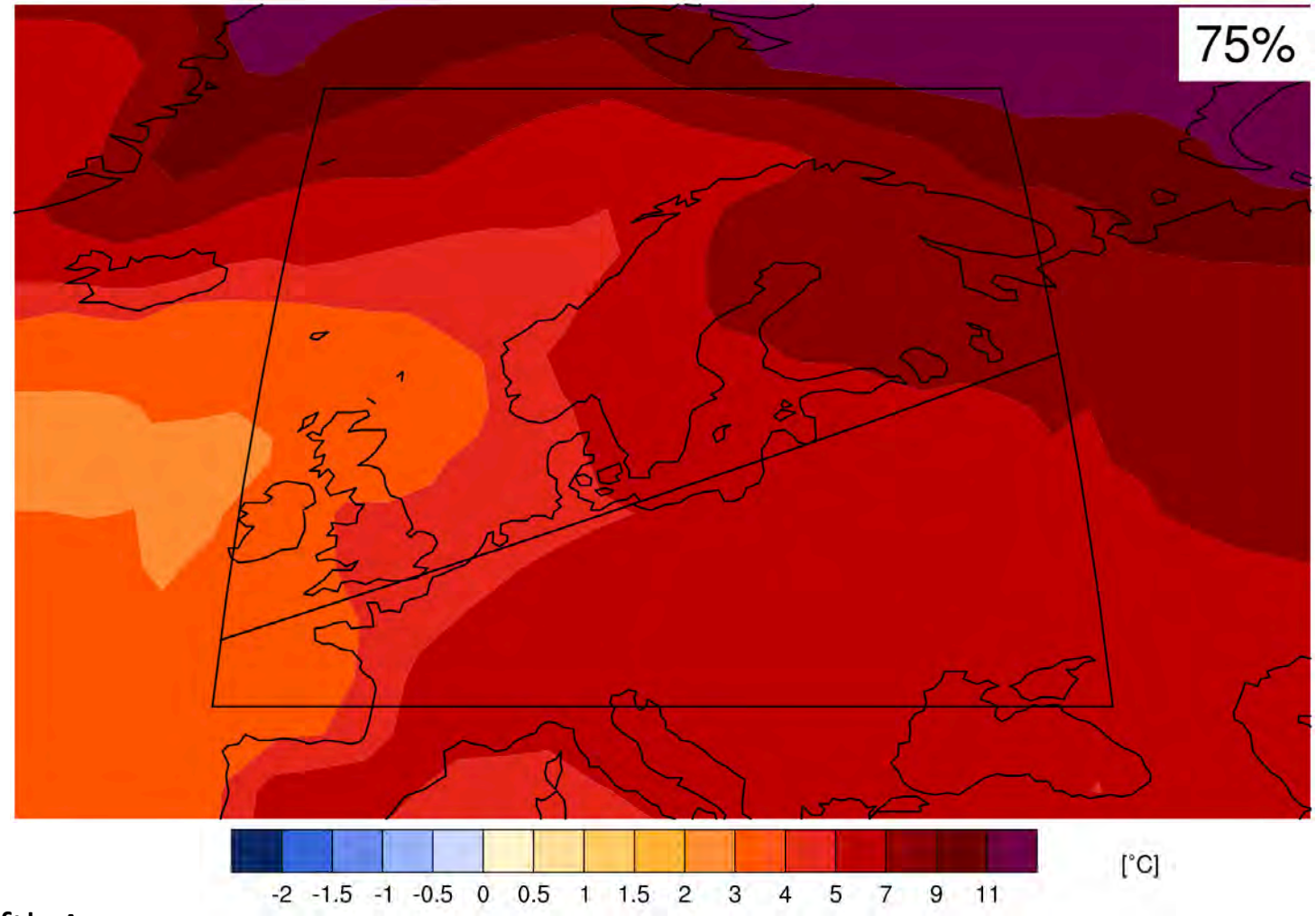
Surface temperature projections



Precipitation projections



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

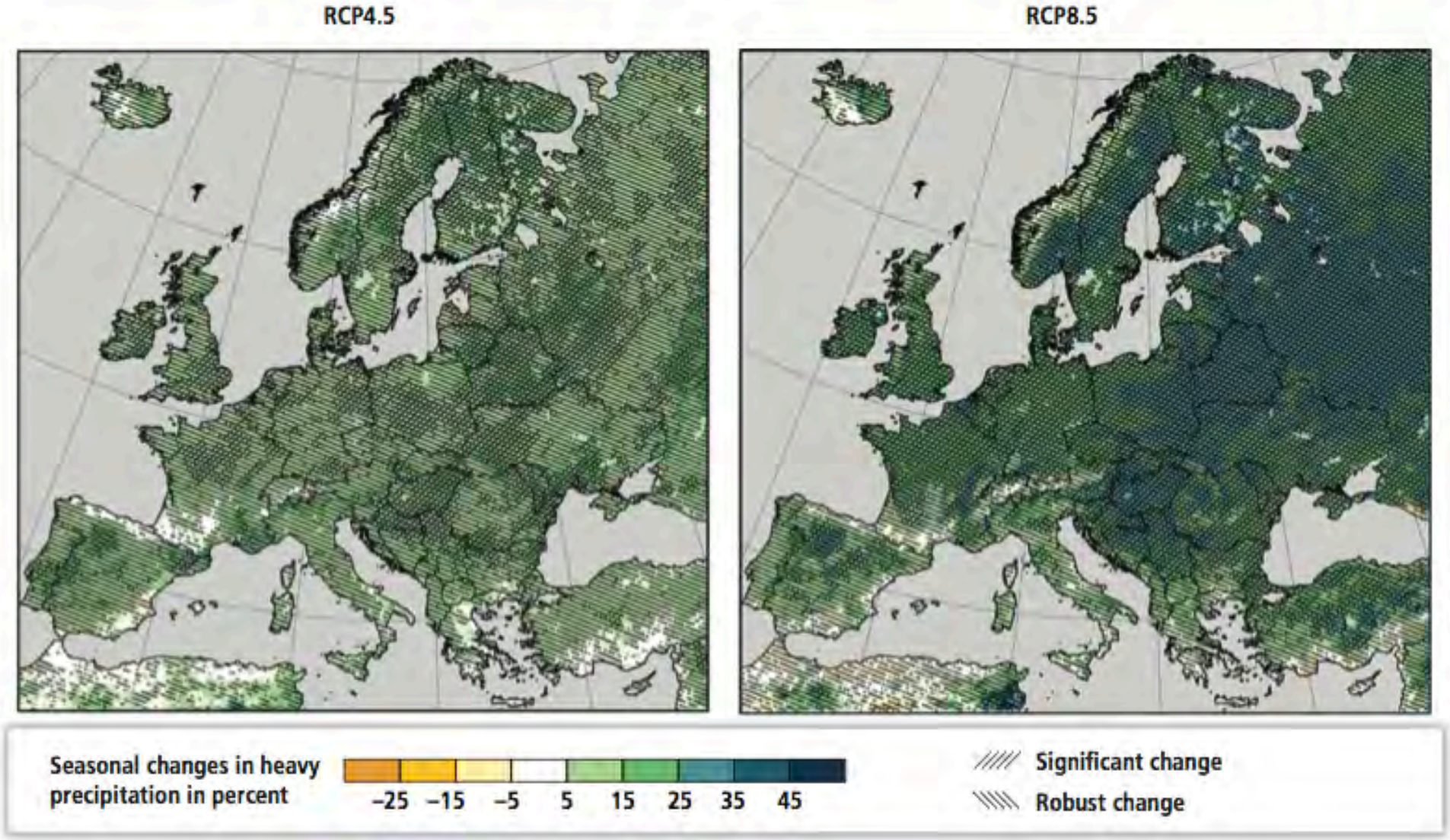


IPCC WG1 Fifth Assessment Report (Final Draft)

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

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



IPCC, AR5, WG II, Chap. 23, p. 1277

Extreme precipitation can affect public infrastructure...

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

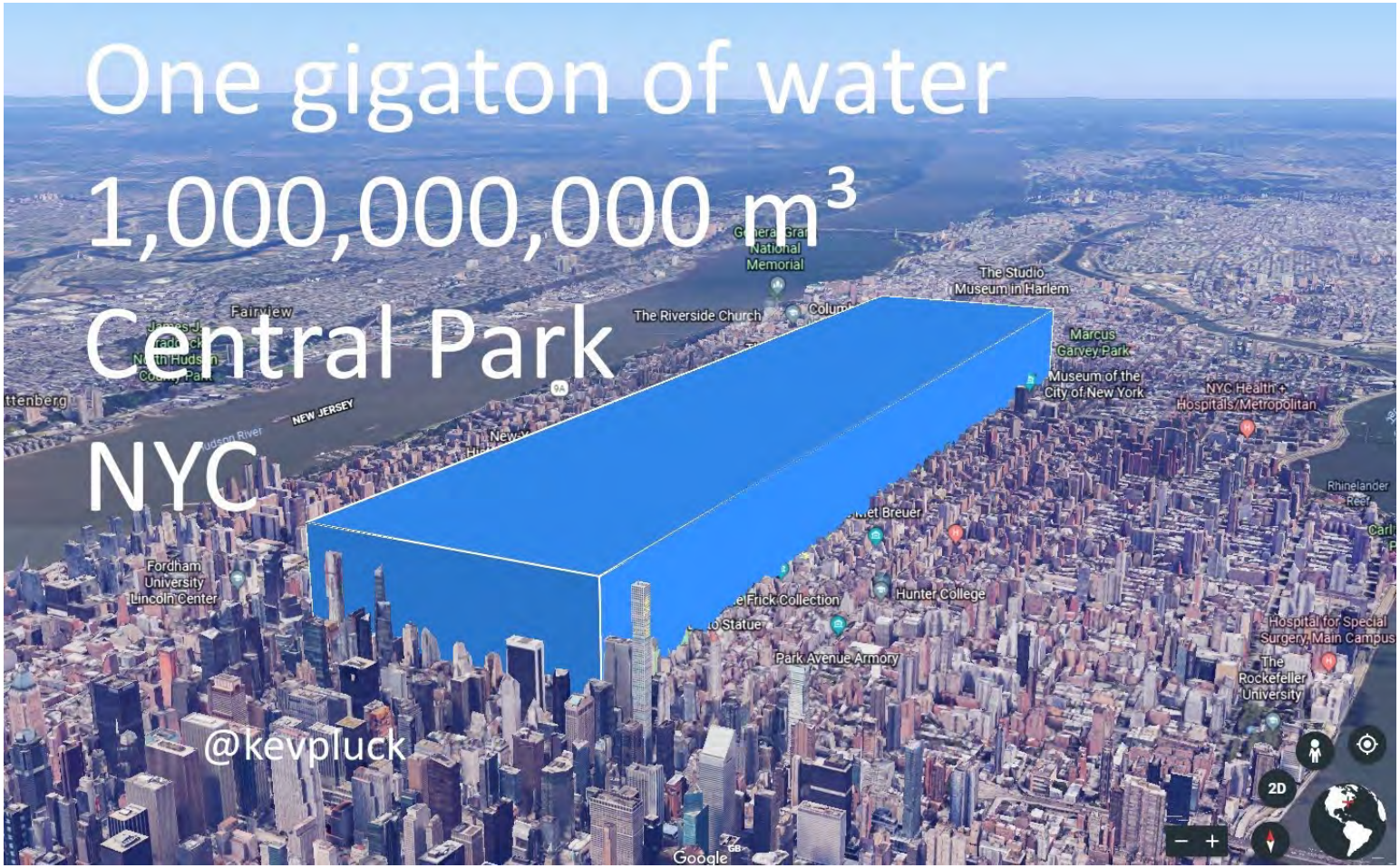
18-20000 years ago (Last Glacial Maximum)

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

Today, with +4-5° C globally

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

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



Source: @Kevpluck, June 2018

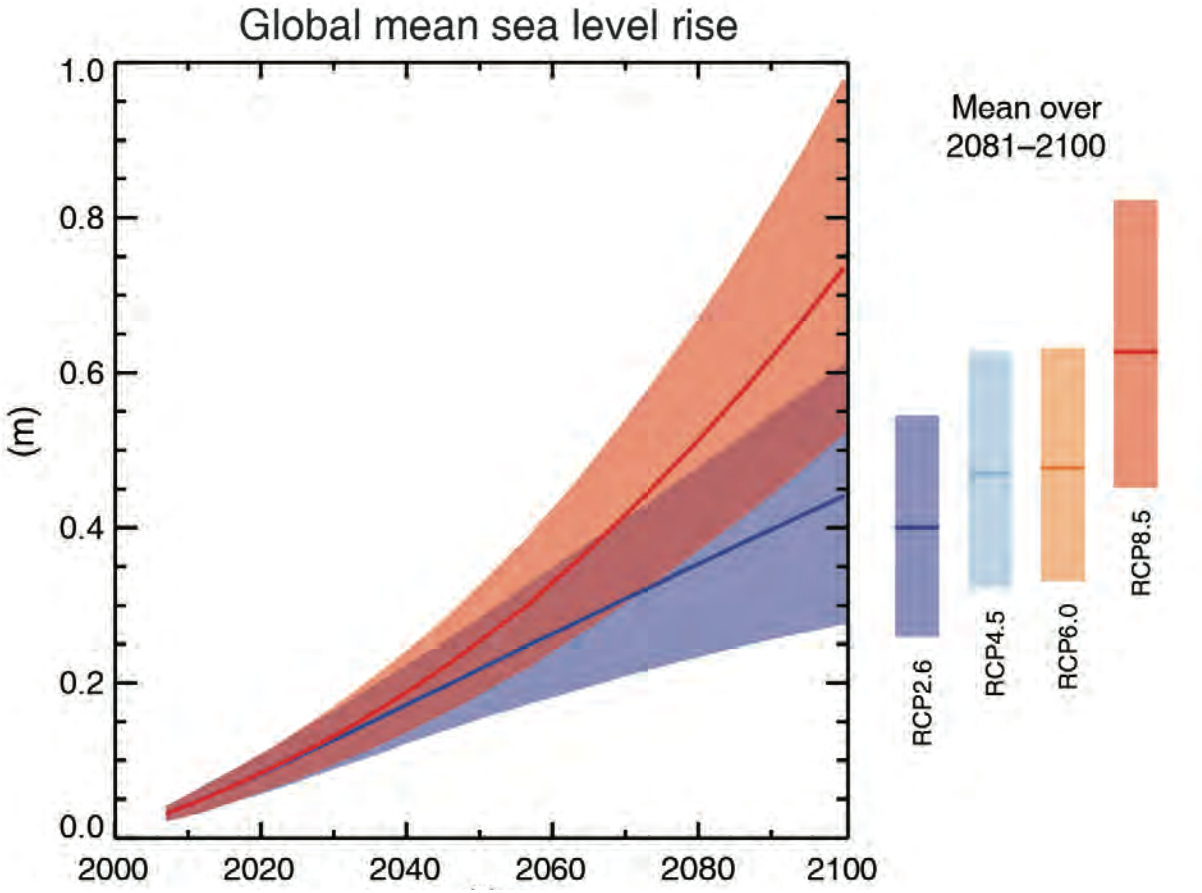


Fig. SPM.9

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

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

(Reference level: 1986-2005)

What are the risks?

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

Risk = Hazard x Vulnerability x Exposure (Katrina flood victim)

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


ADAPTATION IS
ALREADY OCCURRING
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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)

With 8 metre sea-level rise: 3700 km^2 below sea-level in Belgium (very possible in year 3000) (NB: flooded area depends on protection)

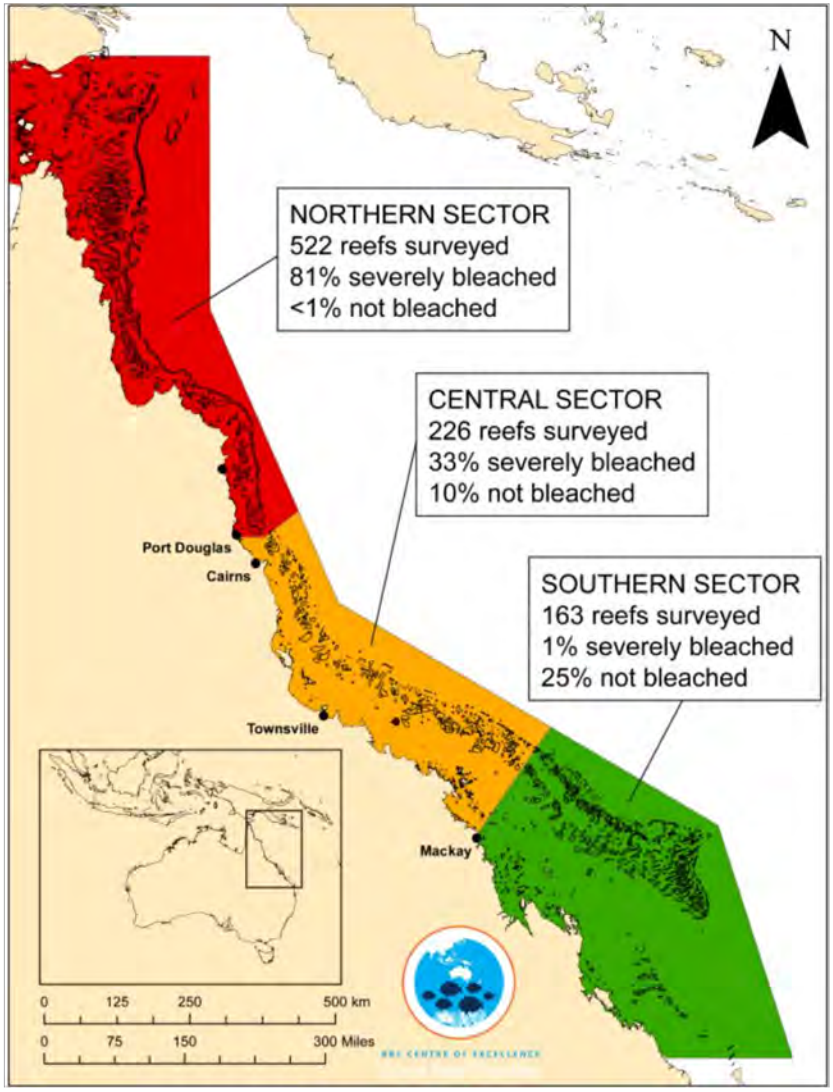
Source: J.P. van Ypersele et P. Marbaix (2004) See www.climate.be/impacts

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

@JPvanYpersele

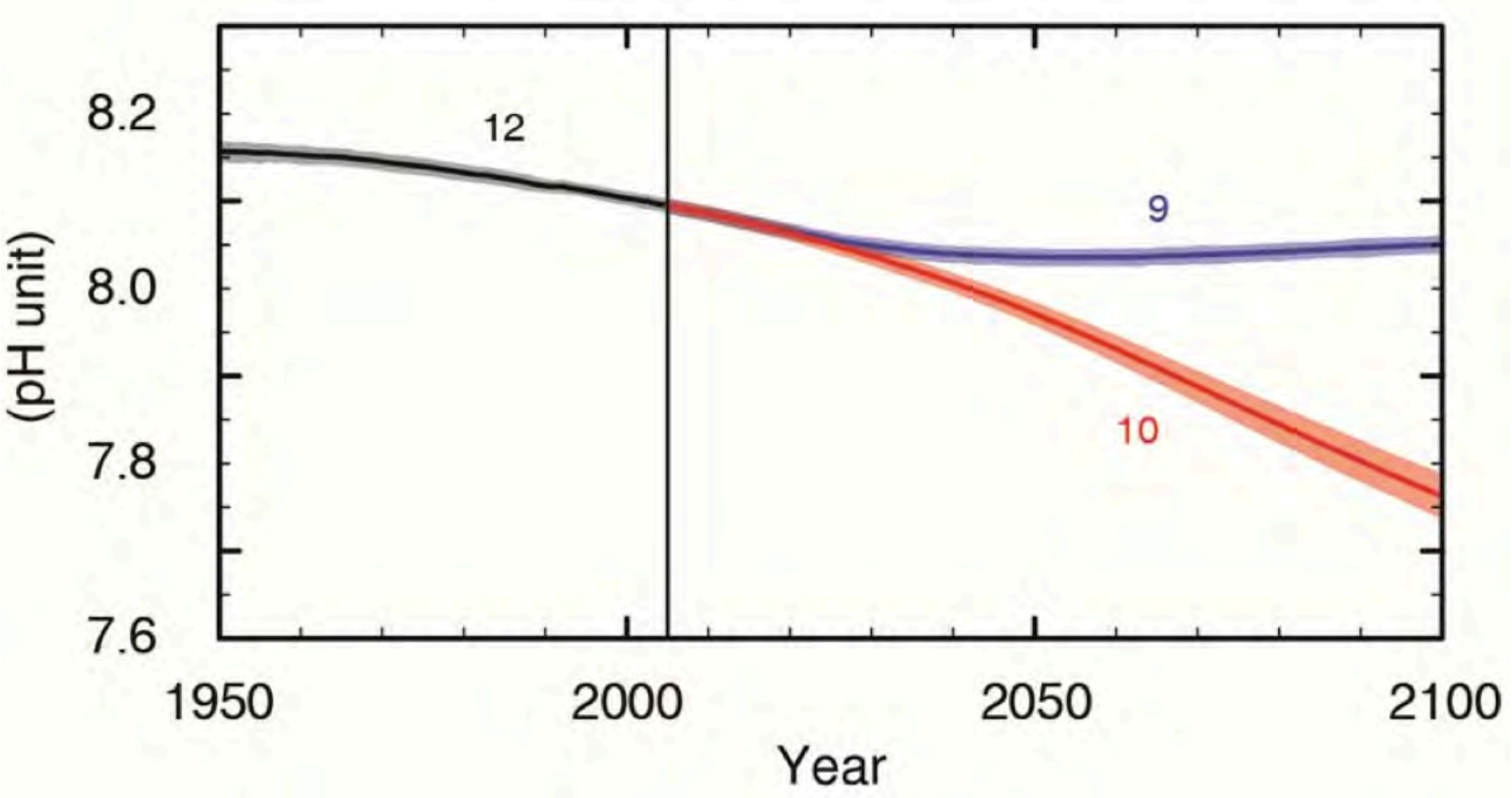
2016: Only 7% of the Great Barrier Reef has avoided coral bleaching



JCU Australia - ARC Centre of Excellence for Coral Reef Studies / Tom Bridge and James Kerry

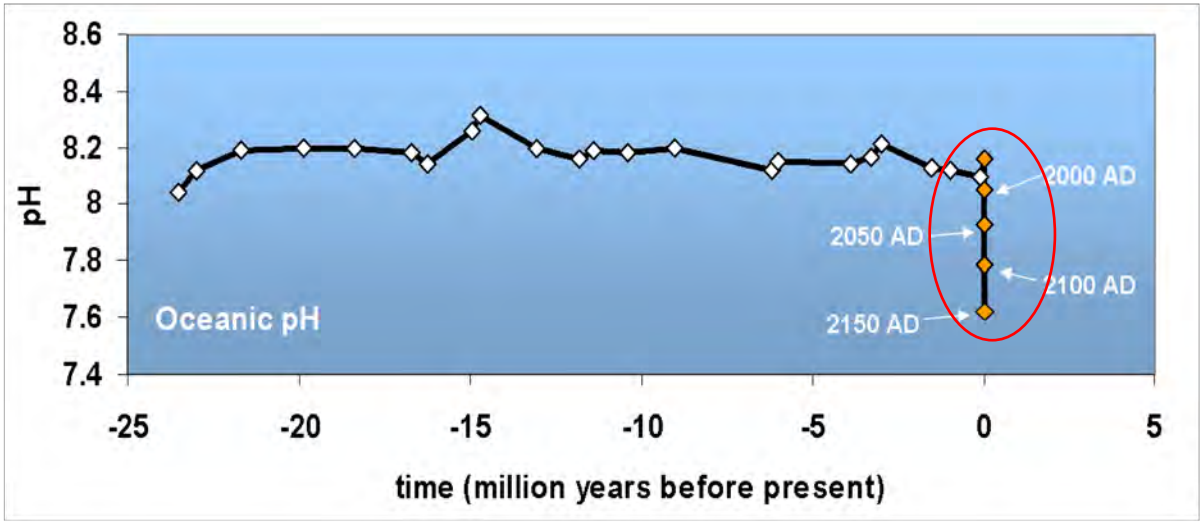
Global ocean surface pH (projections)

Ocean Acidification, for RCP 8.5 (orange) & RCP2.6 (blue)



Oceans are Acidifying Fast…

Changes in pH over the last 25 million years

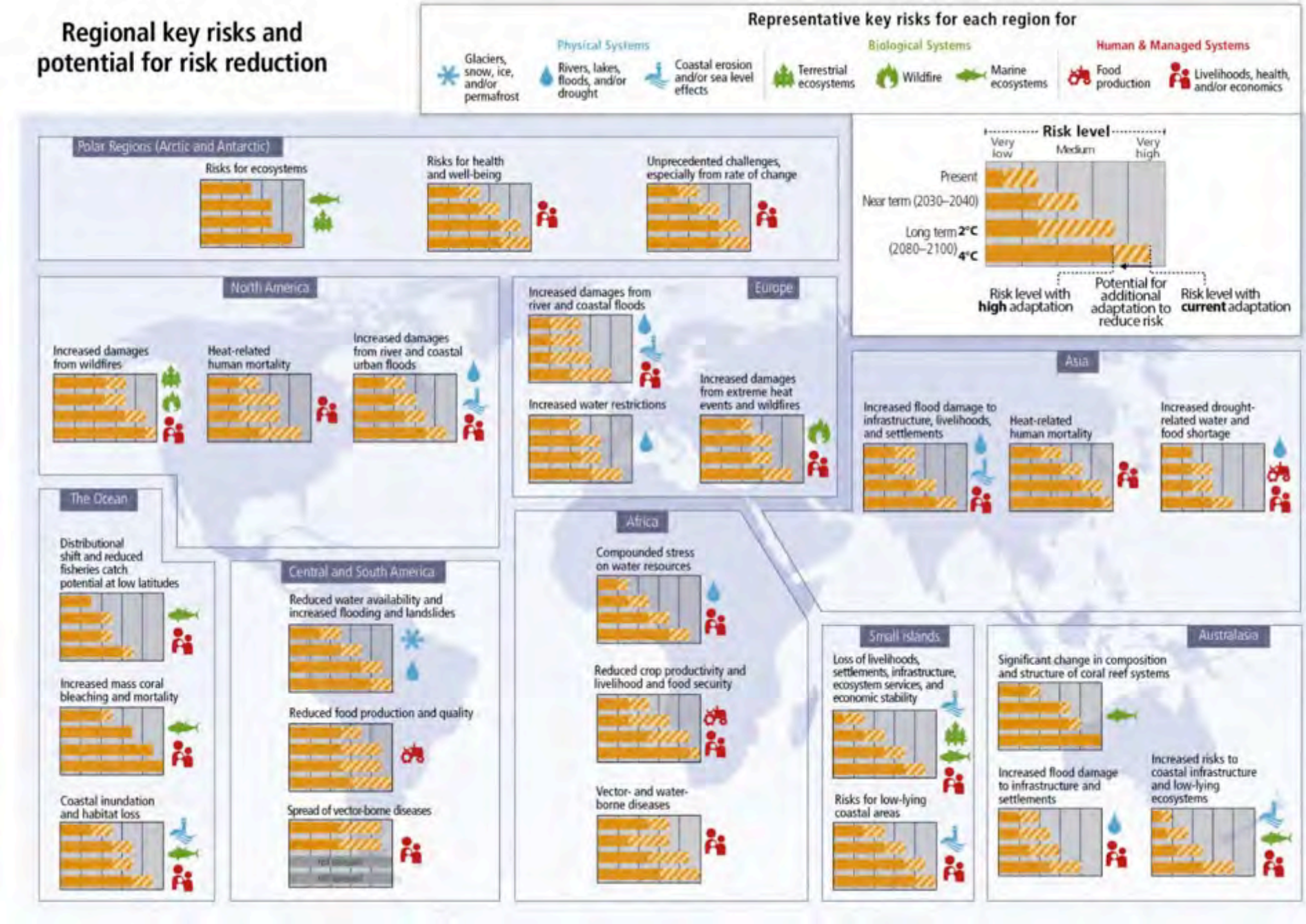


"Today is a rare event in the history of the World"

- **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**

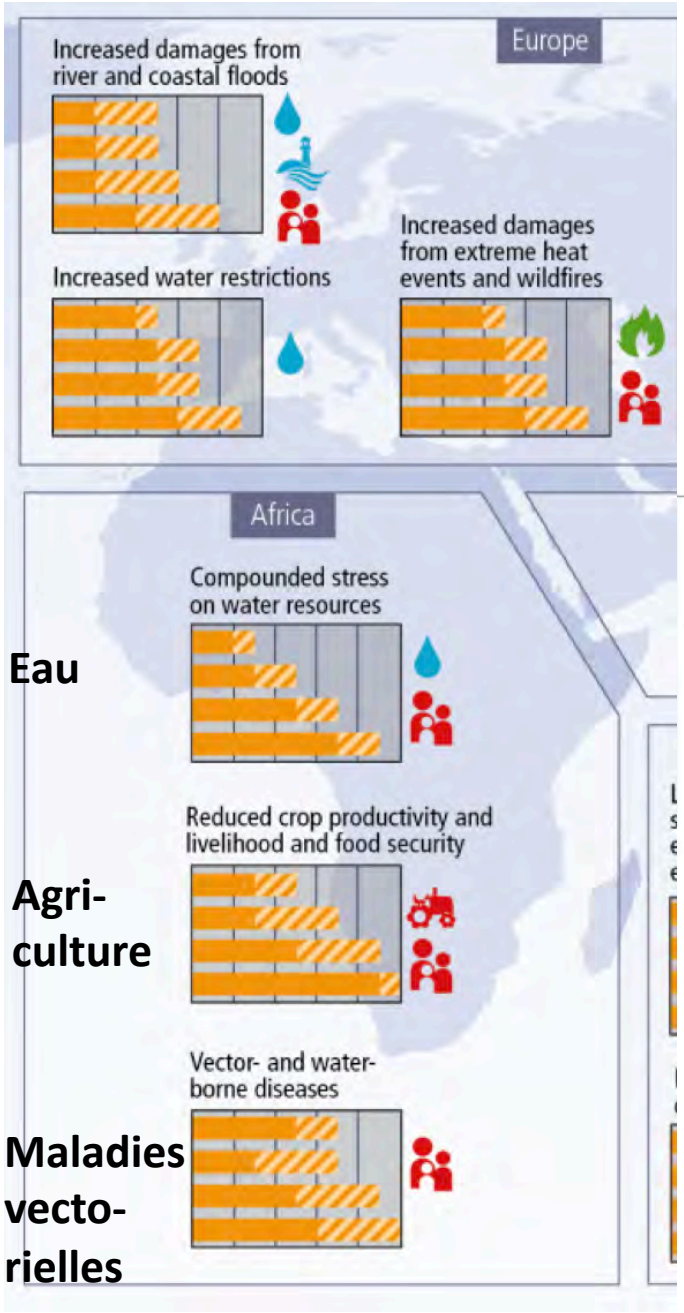
Turley et al. 2006

Slide courtesy of Carol Turley, PML



IPCC, AR5, SPM, Figure SPM.8

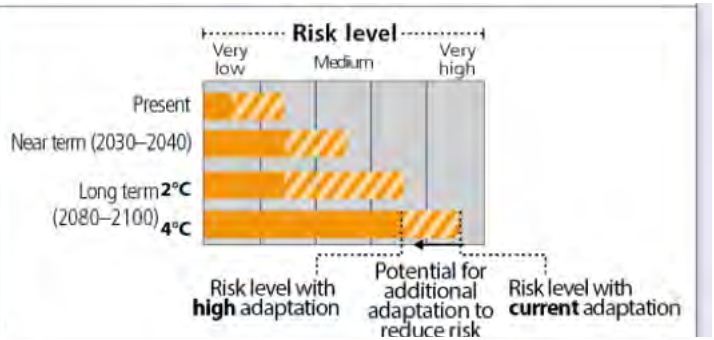
Risques clés à l'échelle régionale et potentiel de réduction du risque par l'adaptation: Afrique

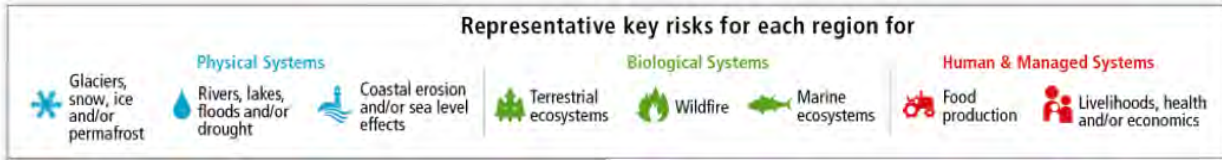


Eau

Agri-culture

Maladies vecto-rielles

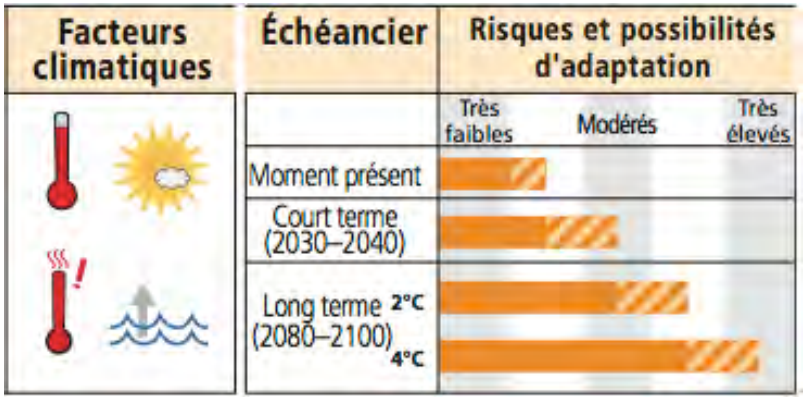


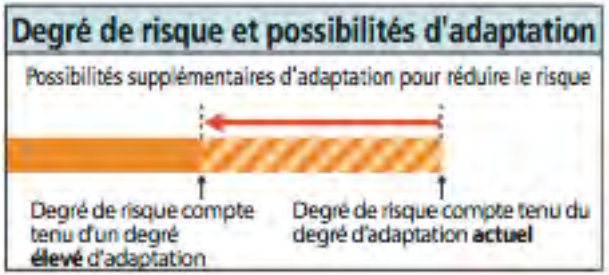


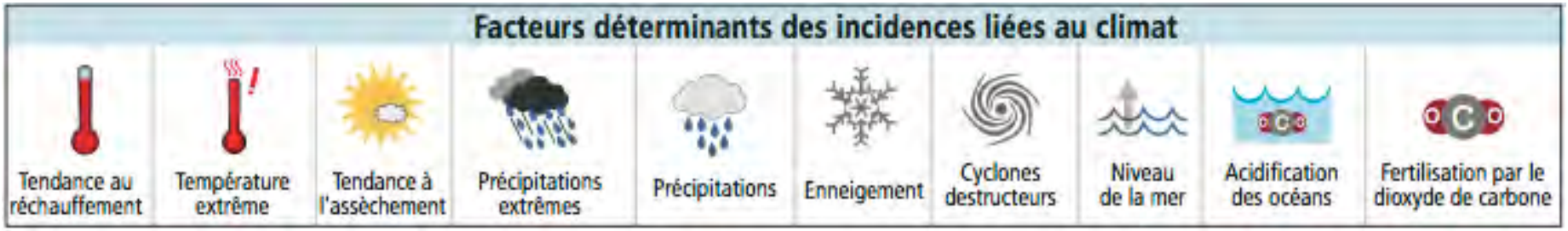
IPCC, AR5, SYR, SPM.8

Risque majeur pour l'Afrique: eau

Aggravation des pressions exercées sur les ressources hydriques déjà lourdement sollicitées par la surexploitation et la dégradation, et qui feront face à l'avenir à une demande accrue. Stress dû à la sécheresse exacerbé dans les régions africaines déjà exposées à ce fléau (degré *de confiance élevé).*



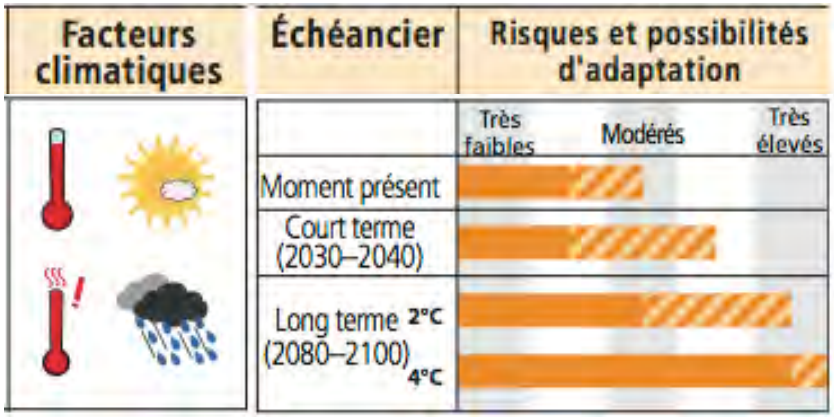


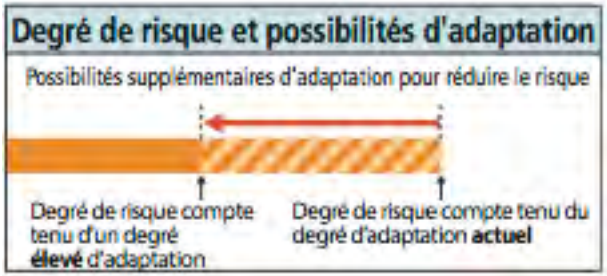


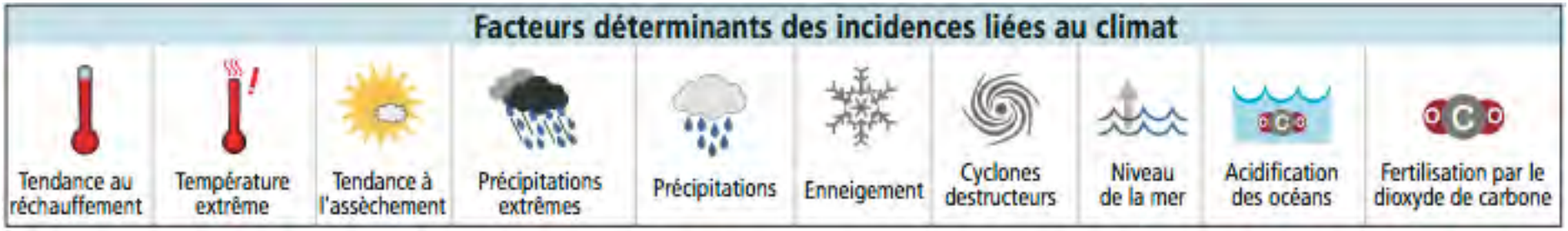
IPCC, AR5, GT II, RID, p. 21

Risque majeur pour l'Afrique: agriculture

Baisse de la productivité des cultures due à la chaleur et à la sécheresse — dont les conséquences sur les moyens de subsistance et la sécurité alimentaire des pays, des régions et des ménages pourraient être graves — ainsi qu'aux dommages causés par les ravageurs, les maladies et les inondations sur l'infrastructure des systèmes alimentaires (degré *de confiance élevé)*





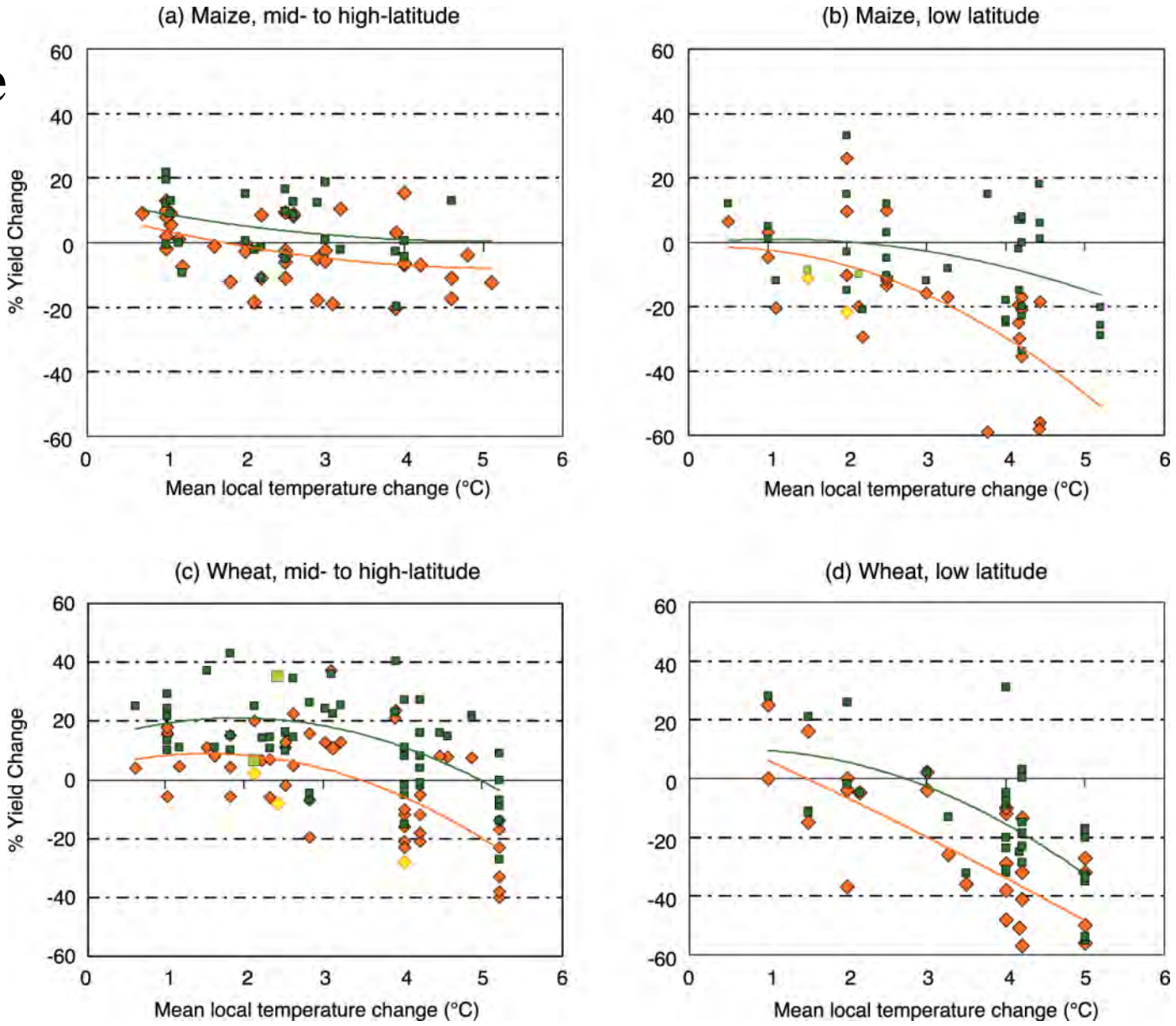


IPCC, AR5, GT II, RID, p. 21

Figure TS.7. Sensitivity of cereal yield to climate change

Maize

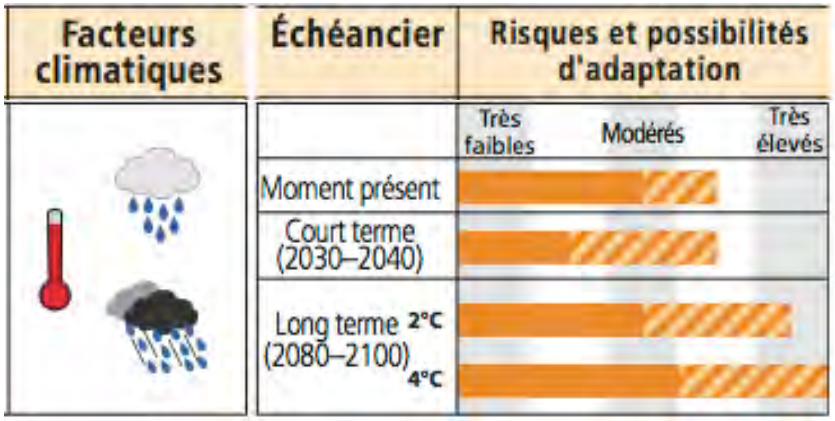
Wheat

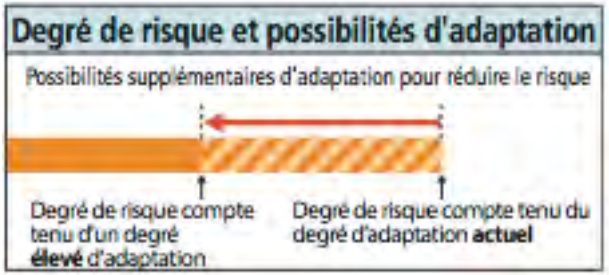


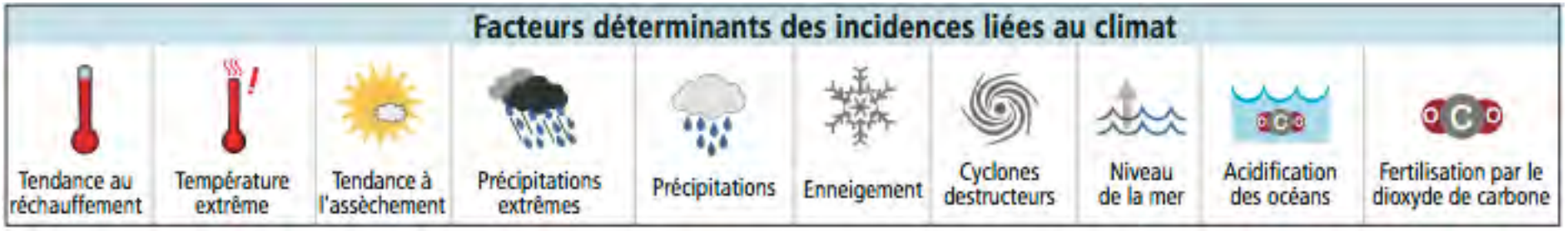
IPCC AR4 WGII

Risque majeur pour l'Afrique: santé

Variations de l'incidence et de l'extension géographique des maladies à transmission vectorielle ou d'origine hydrique dues à l'évolution des températures et des précipitations moyennes et de leur variabilité, en particulier aux limites de leurs aires de répartition (degré *de confiance moyen)*

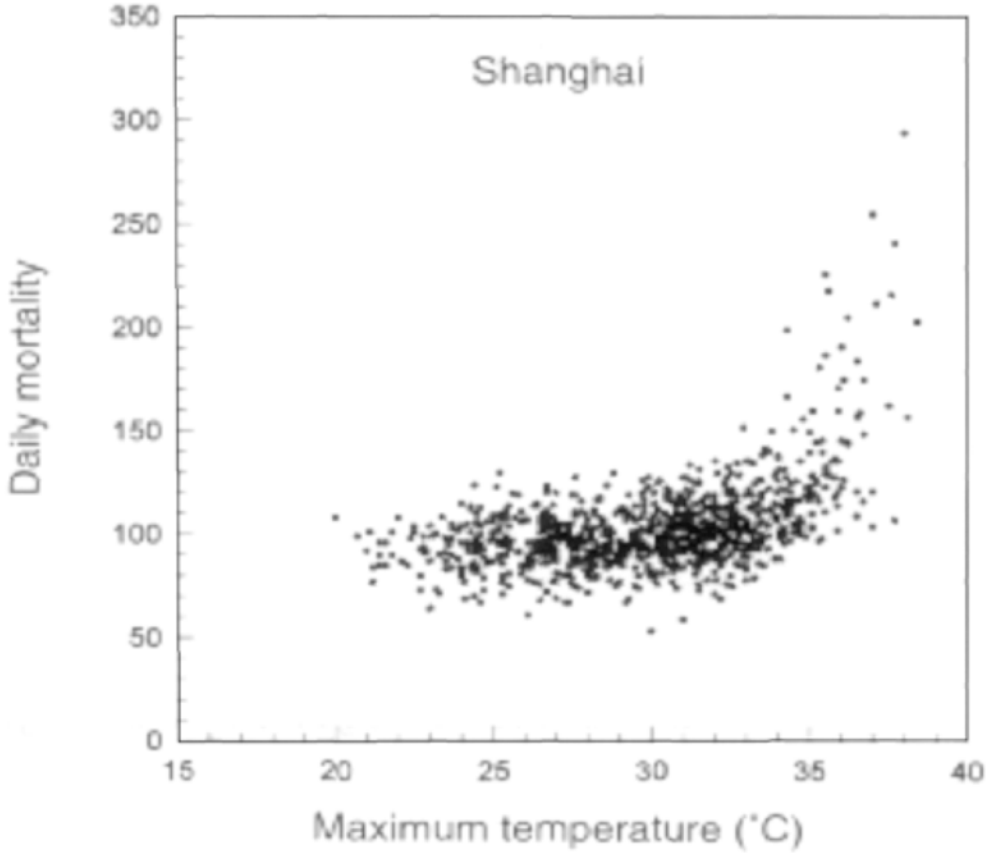






IPCC, AR5, GT II, RID, p. 21

Relationship between maximum temperature and mortality in Shanghai, China, 1980-89



Référence : CILIMATE CHANGE AND HUMAN HEALTH, 1996

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

The SR15

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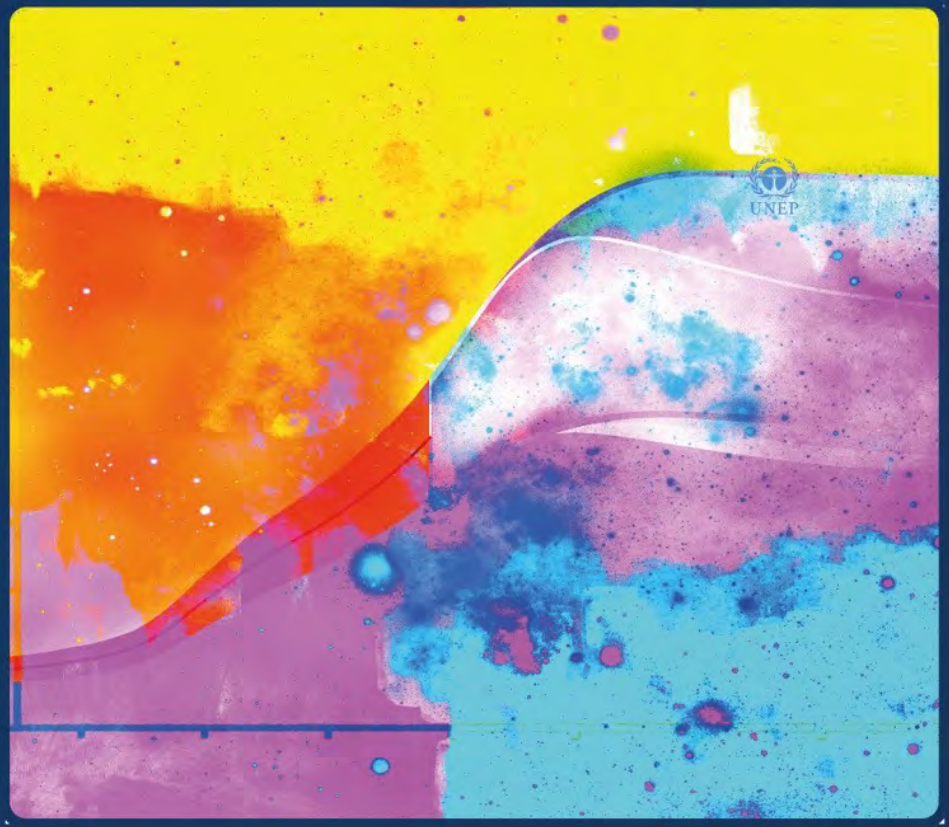
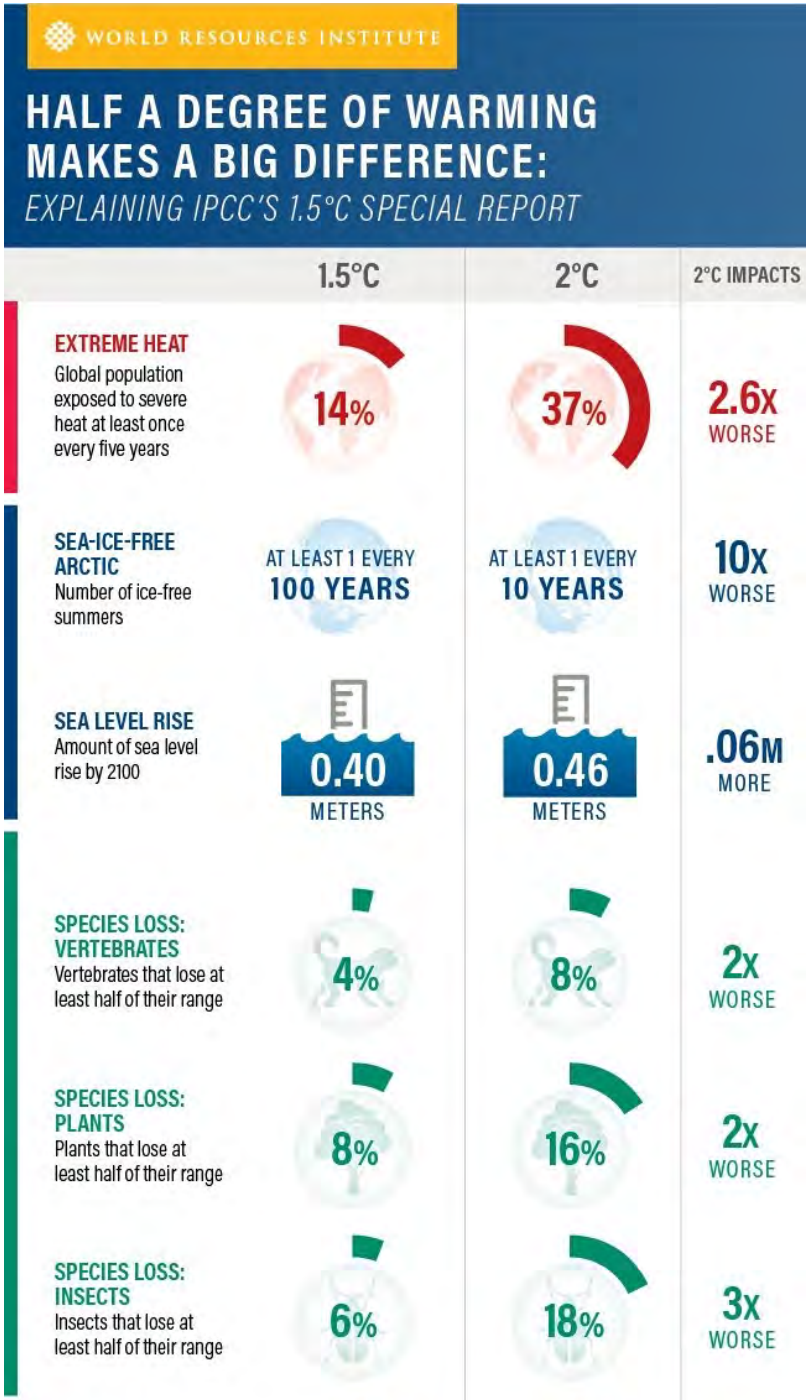
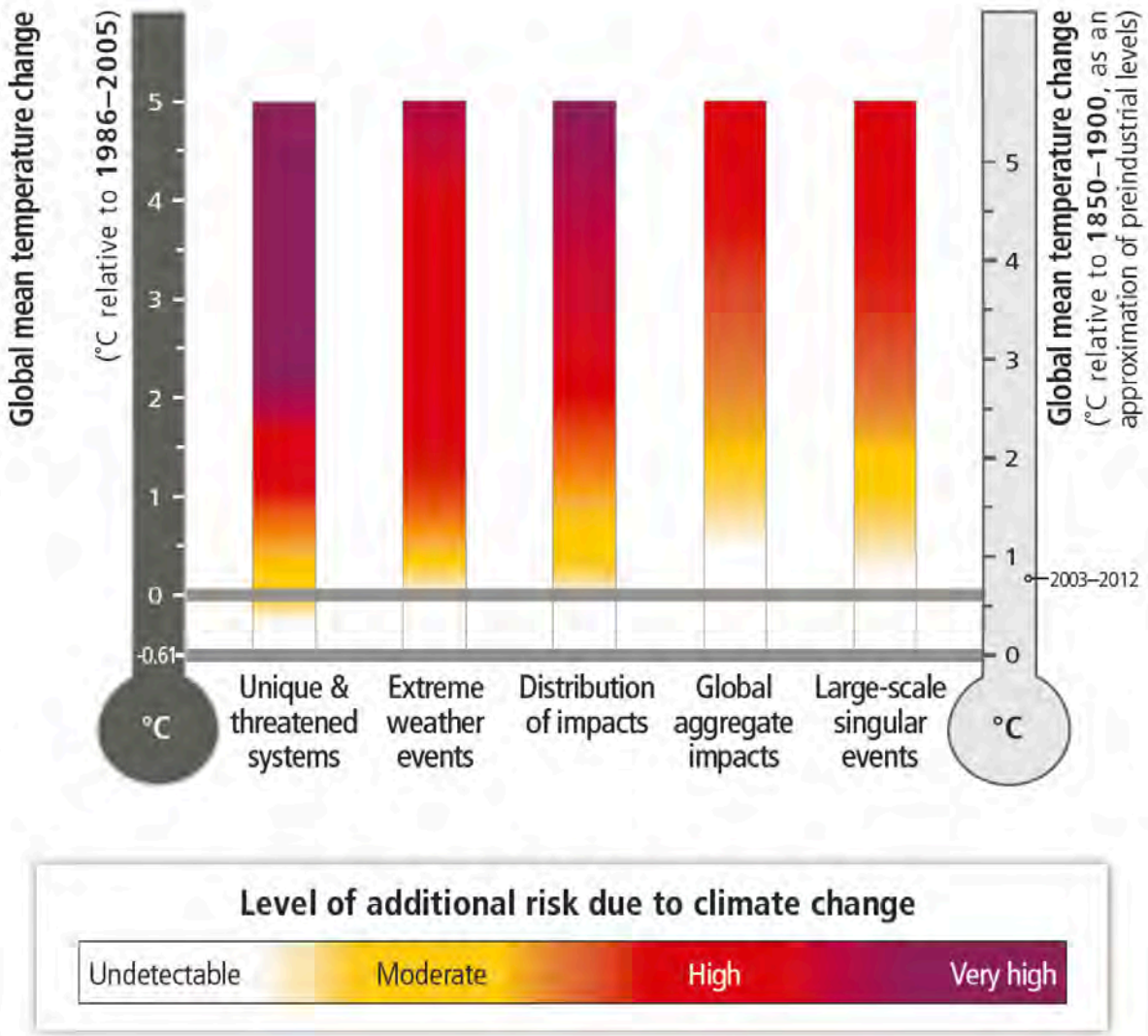
Global Warming of 1.5°C

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.

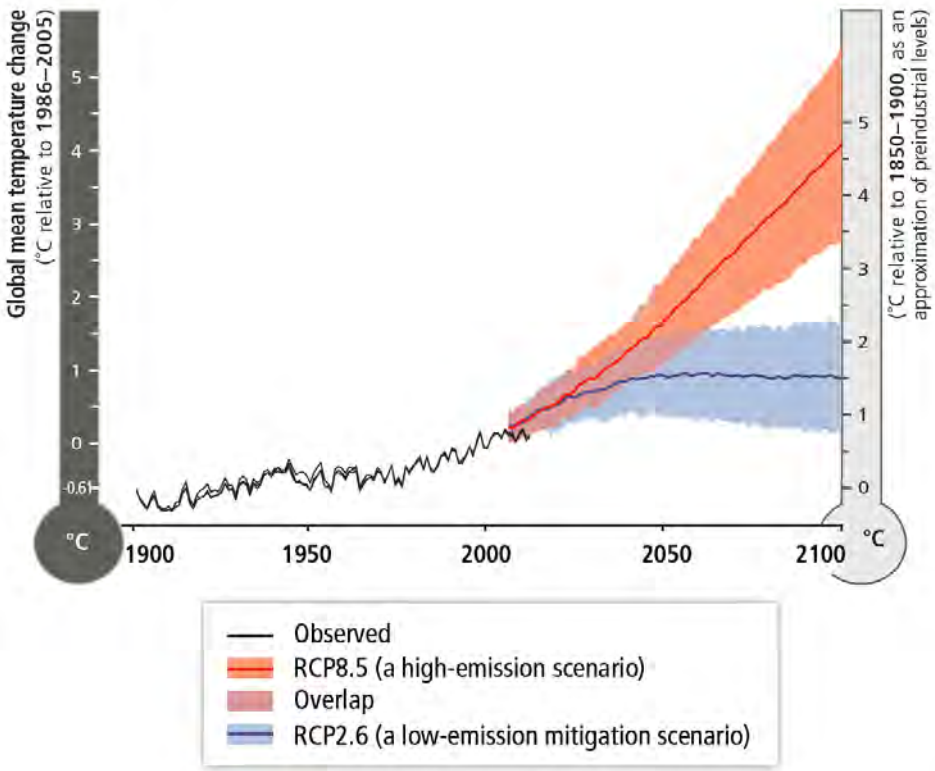


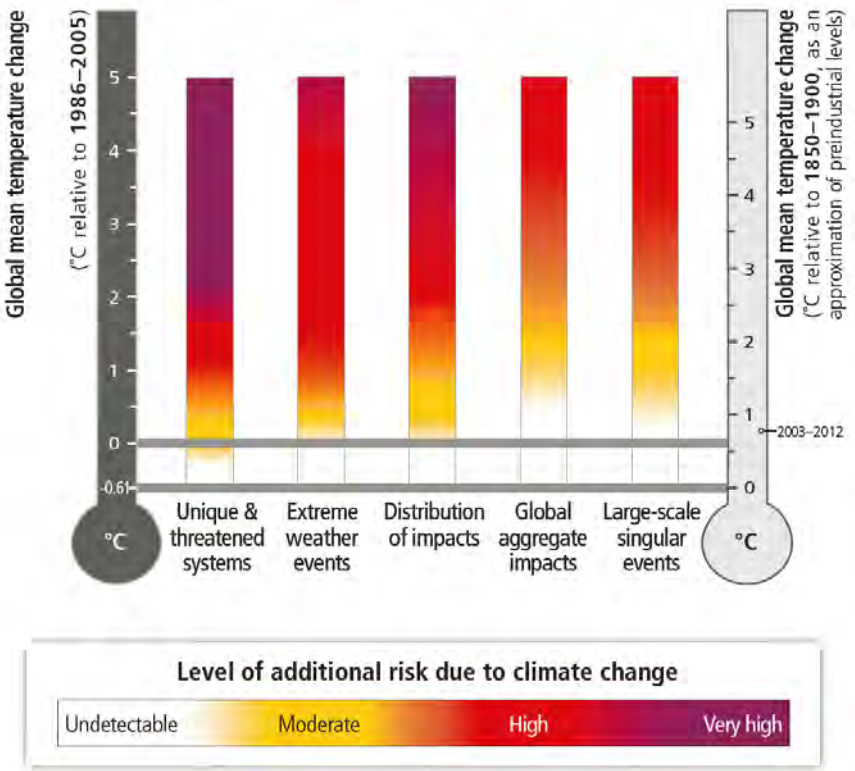


Responsibility for content: WRI



AR5, WGII, Box SPM.1 Figure 1





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What can be done?

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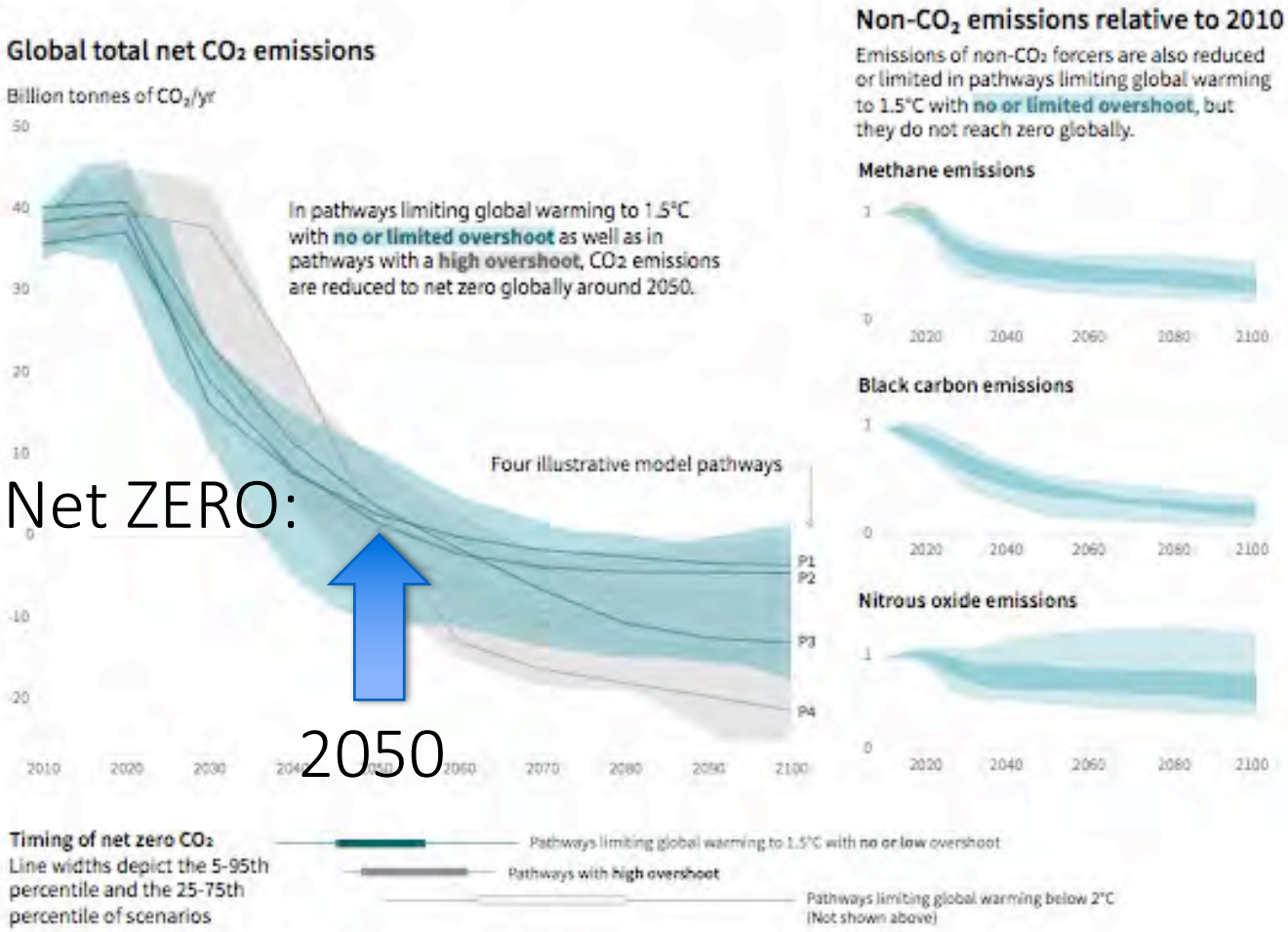
Global emissions pathway characteristics

General characteristics of the evolution of anthropogenic net emissions of CO_2, 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 Special Report on Global Warming of 1.5°C

Greenhouse gas emissions pathways

- To limit warming to 1.5° C, CO_2 emissions fall by about 45% by 2030 (from 2010 levels)
  - Compared to 20% for 2° C
- To limit warming to 1.5° C, CO_2 emissions would need to reach 'net zero' around 2050
  - Compared to around 2075 for 2° C
- Reducing non-CO_2 emissions would have direct and immediate health benefits

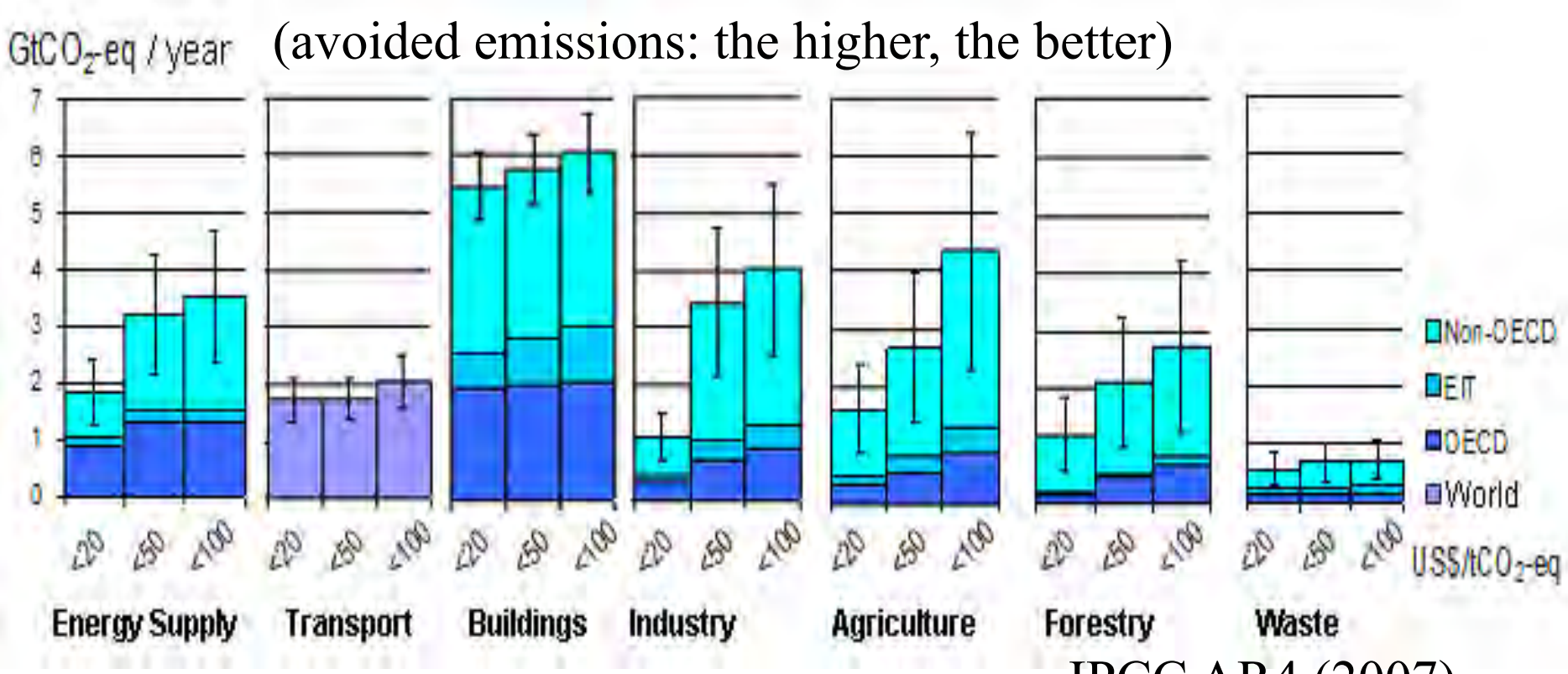
Greenhouse gas emissions pathways

- 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

- **Many scenario studies confirm that it is technically and economically feasible to keep the warming below 2°C, with more than 66% probability (”likely chance”).** This would imply limiting atmospheric concentrations to 450 ppm CO_2-eq by 2100.
- **Such scenarios** for an above 66% chance of staying below 2°C **imply reducing by 40 to 70% global GHG emissions compared to 2010 by mid-century, and reach zero or negative emissions by 2100.**

All sectors and regions have the potential to contribute by 2030

(avoided emissions: the higher, the better)

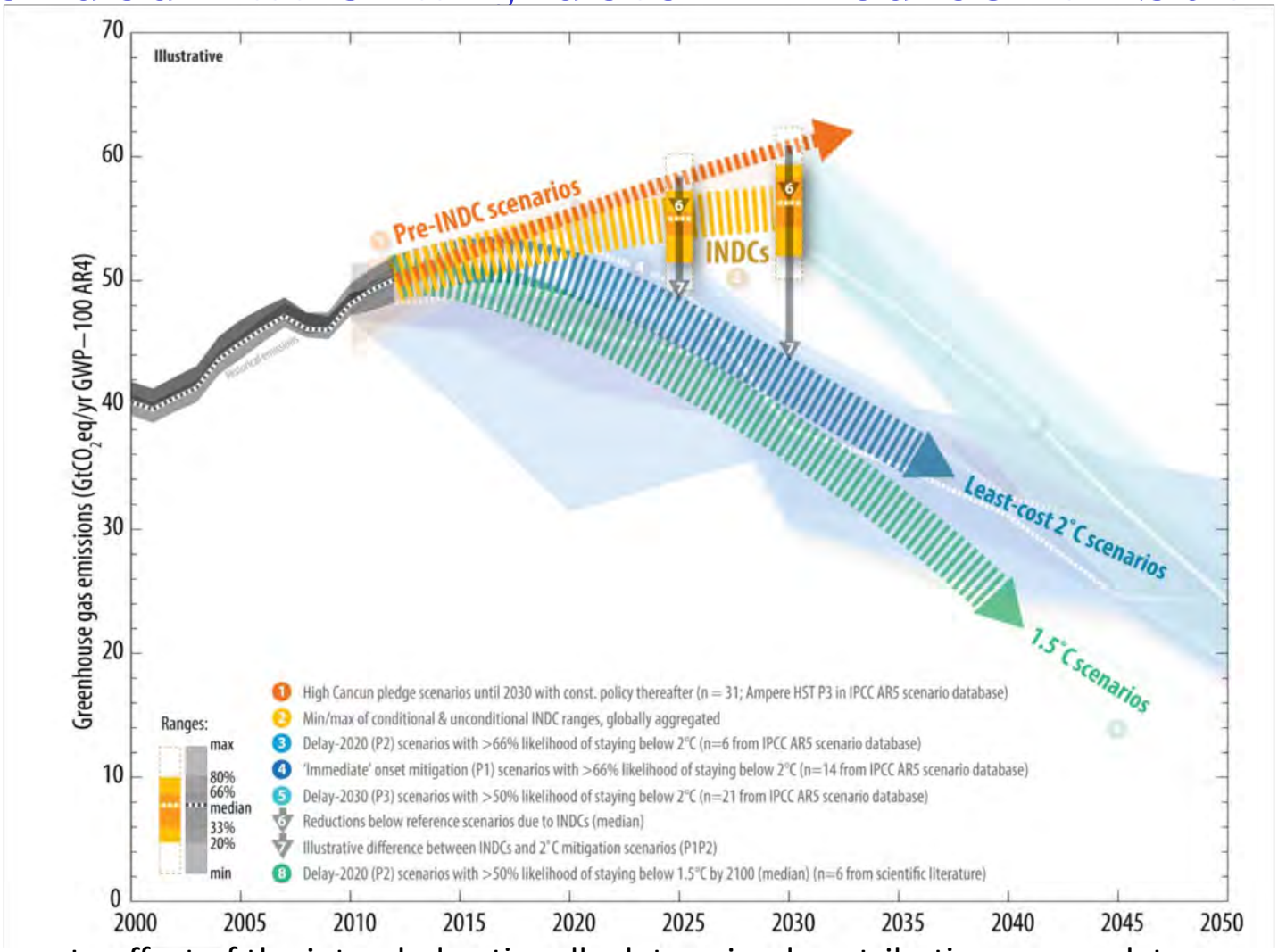


IPCC AR4 (2007)

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


Nations Unies
onférence sur les Changements Climatiques
COP21/CMP11
Paris, France
SECRETAIRE EXECUTIVE CCNUCC
PRESIDENT

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

Geopolitics, conflicts and peace

Climate change and conflicts: summary (IPCC AR5 WGII)

- Climate change [and climate variability] can indirectly increase risks of violent conflicts in the form of civil war and inter-group violence by amplifying well-documented drivers of these conflicts such as poverty and economic shocks (medium confidence)
- Violent conflict increases vulnerability to climate change Large-scale conflicts harms assets that facilitate adaptation, including infrastructure, institutions, natural resources, social capital and livelihood opportunities

Does climate change cause violent conflicts?

- Some factors that increase risks from violent conflicts and civil wars are sensitive to climate change
  - For example […] factors like low per capita income, economic contraction, and inconsistent state institutions are associated with the incidence of civil wars, and also seem to be sensitive to climate change.
- Climate-change policies, particularly those associated with changing rights to resources, can also increase risks from violent conflict.
- While statistical studies document a relationship between climate variability and conflict, there remains much disagreement about whether climate change directly causes violent conflicts

AR5 WGII (TS) FAQ.9

Will climate change cause war between countries?

- Climate change has the potential to increase rivalry between countries over shared resources
  - For example, (…) rivalry over changing access to the resources in the Arctic and in transboundary river basins.
- Climate changes represent a challenge to the effectiveness of the diverse institutions that already exist to manage relations over these resources.
- However, there is high scientific agreement that this increased rivalry is **unlikely** to lead **directly** to **warfare between states**.
  - The evidence to date shows that the nature of resources such as transboundary water and a range of conflict resolution institutions have been able to resolve rivalries in ways that avoid violent conflict.

(AR5 WGII FAQ.12.5)

Climate change - conflict: insights from the past ?

- Some studies show that the Little Ice Age in the mid-17th century was associated with more cases of political upheaval and warfare than in any other period, but (…) findings from historical antecedents are not directly transferable to the contemporary globalized world.
- collectively the research **does not conclude** that there is a **strong positive relationship** between warming and armed conflict
- There is some agreement that either increased rainfall or decreased **rainfall** in **resource-dependent economies enhances the risk of localized violent conflict**, particularly in pastoral societies in Africa (…)
  Institutions able to peacefully manage conflict are highlighted as the critical factor in mediating such risks

(AR5 section 12.5.1)

Violent Conflict and Vulnerability to Climate Change

- development studies and political science show that violent conflict undermines capacity to cope with changes
- conflict creates poverty and constrains livelihoods that, in turn, increases vulnerability to the impacts of climate change; violent conflict is a major cause of hunger and famines.
- armed conflict can decrease the capacity of governments to function effectively as well as the capacity for collective action, which also impedes adaptation

(AR5 section 12.5.3)

State Integrity and Geopolitical Rivalry

- Examples
  - sea-level rise and other changes compromise human security, in particular in countries made up entirely of low-lying atolls
  - Productive ocean fisheries are already directly affected by climate change (…) the movement of fish stocks has been suggested to increase transboundary rivalry
  - The **impacts of climate-induced water variability on transboundary water basins** generates geopolitical concerns (…) particularly where challenges stemming from rising consumption and growing populations are already present.
  - Uncertainty and high likelihood of differential geographic impacts of **geoengineering** are anticipated sources of tension or conflict between states. These include regional effects of solar radiation management on reduced precipitation in specific areas in Asia or in the Sahel with negative food production implications

(AR5 section 12.6)

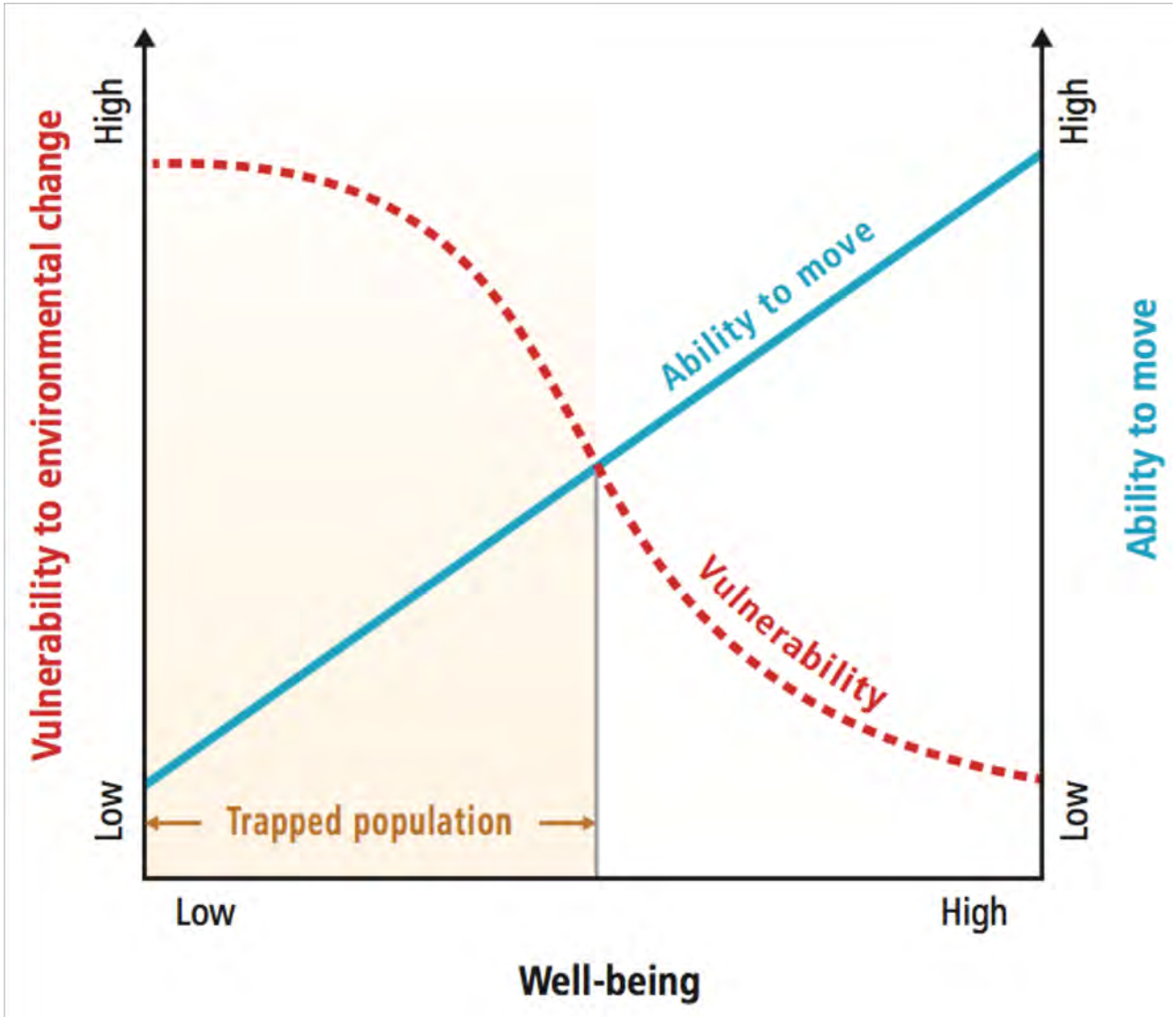
Geopolitical Dimensions of Climate Change Impacts in the Arctic

- The Arctic has been warming at about twice the global rate since 1980, resulting in unprecedented loss in sea ice
- These changes have implications for land-based infrastructure, shipping, resource extraction, coastal communities, and transport
- There is medium evidence that changes will create or revive terrestrial and maritime boundary disputes among Arctic countries. There is little evidence the changing Arctic will become a site for violent conflict between states
- At present, political institutions are providing forums for managing resource competition, new transportation practices, and boundary disputes, but anticipated increased stresses will test these institutions in the future

(AR5 Box 12-6)

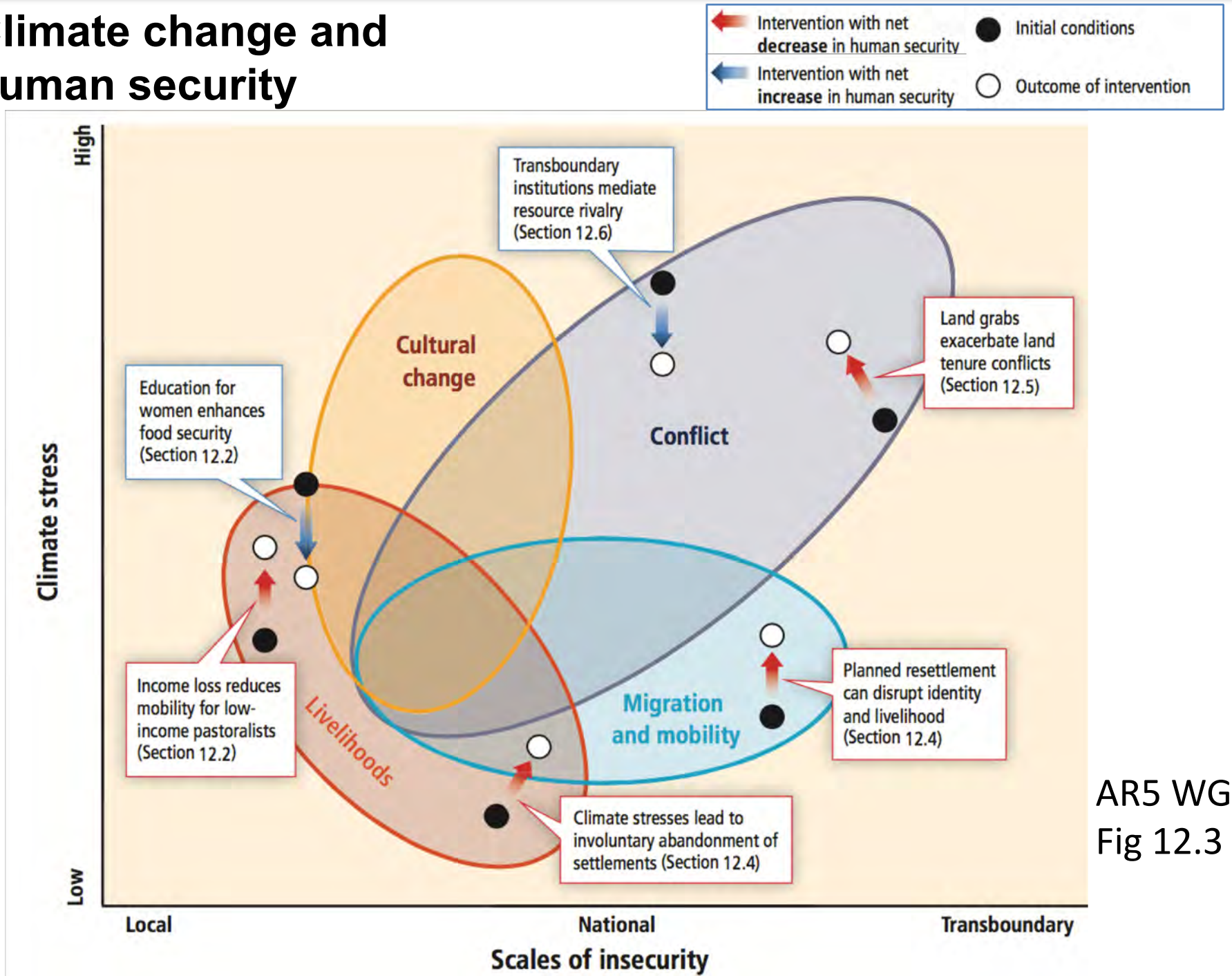
Climate change and migrations

- populations most exposed and vulnerable to the impacts of climate change may have least ability to migrate

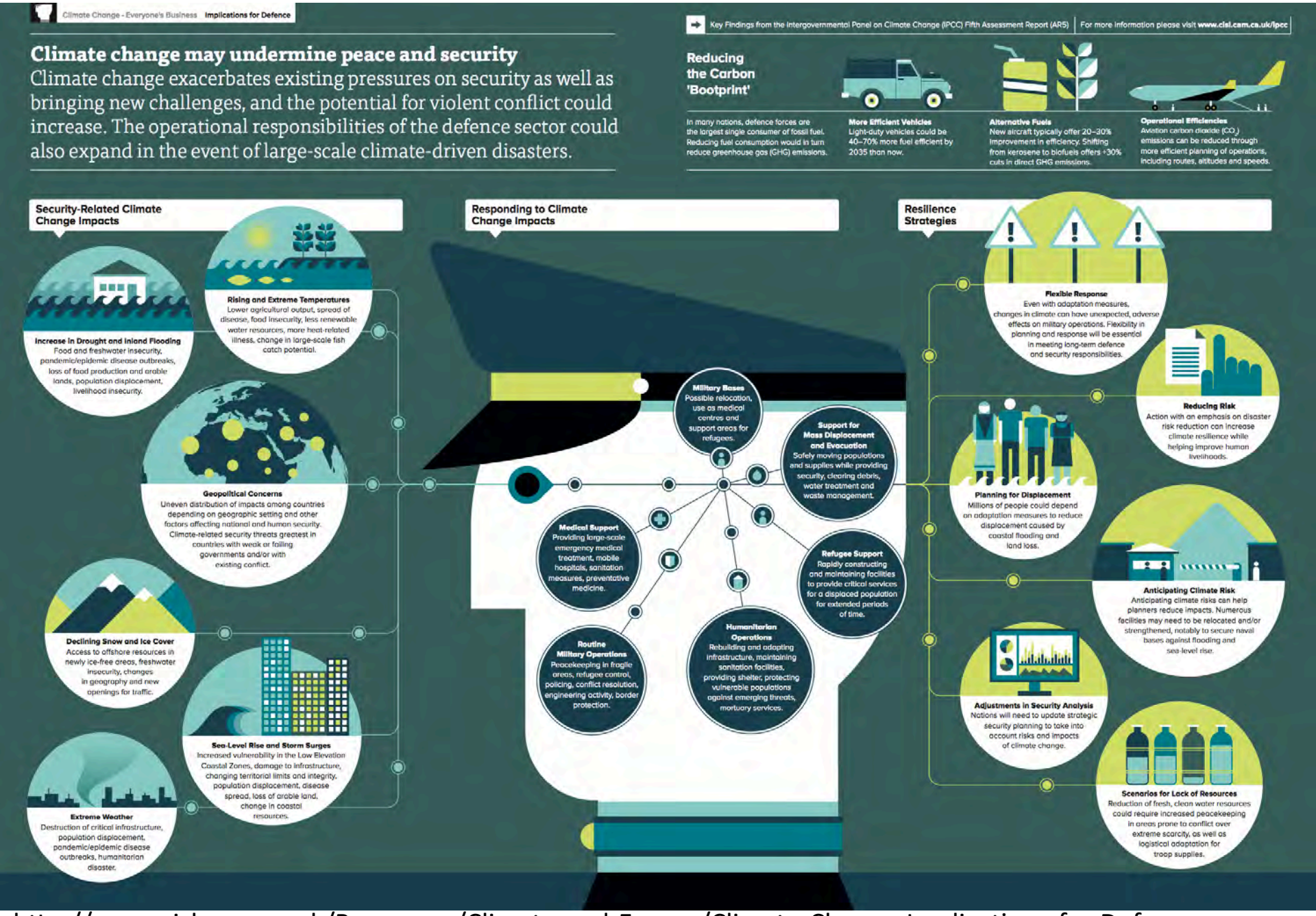


AR5 WGII
Fig 12.1

Climate change and human security



AR5 WGII
Fig 12.3



http://www.cisl.cam.ac.uk/Resources/Climate-and-Energy/Climate-Change-Implications-for-Defence.aspx

Climate change may undermine peace and security

Climate change exacerbates existing pressures on security as well as bringing new challenges, and the potential for violent conflict could increase. The operational responsibilities of the defence sector could also expand in the event of large-scale climate-driven disasters.

Key Findings from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) | For more information please visit **www.cisl.cam.ca.uk/ipcc**

Reducing the Carbon 'Bootprint'

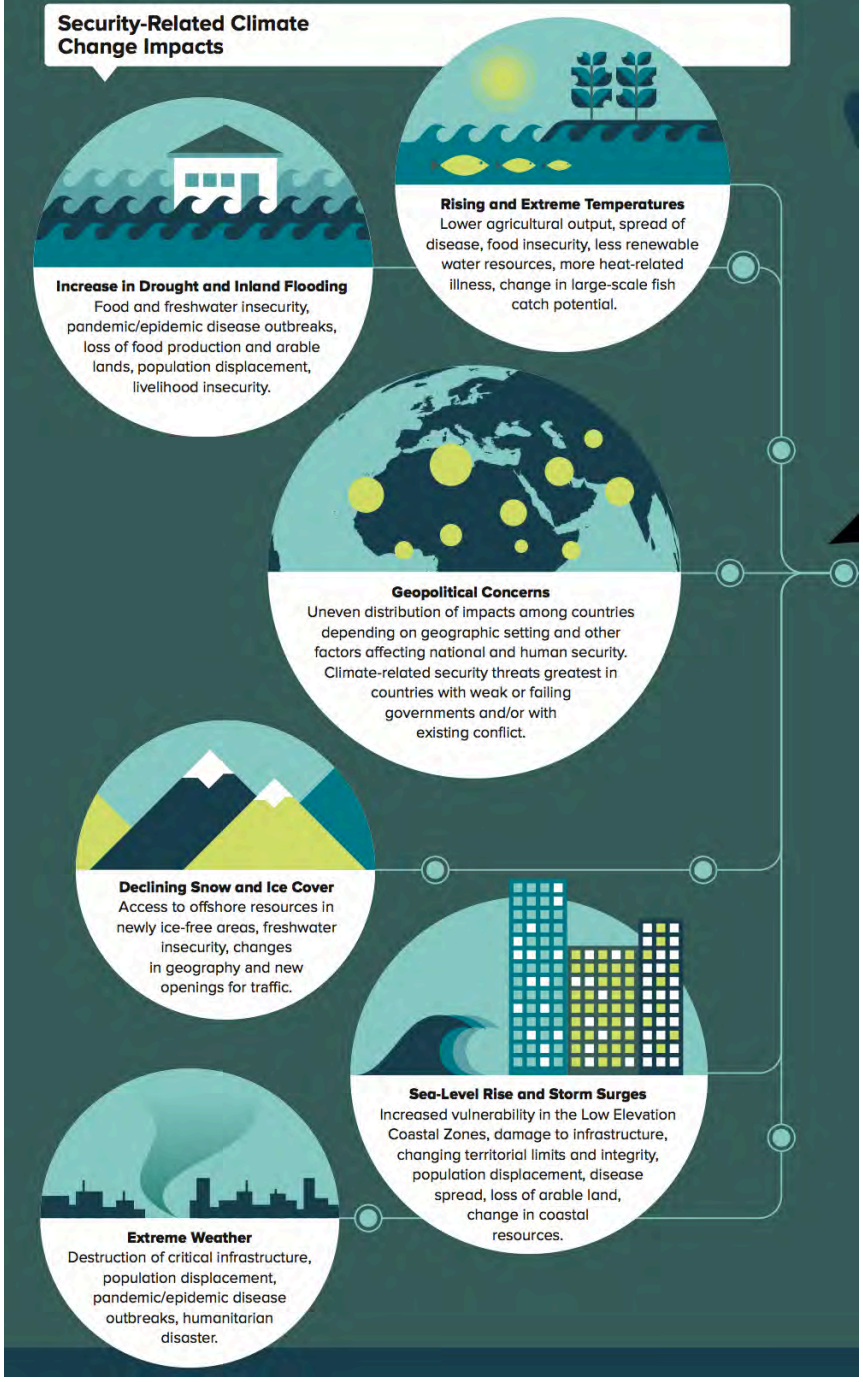
In many nations, defence forces are the largest single consumer of fossil fuel. Reducing fuel consumption would in turn reduce greenhouse gas (GHG) emissions.

More Efficient Vehicles
Light-duty vehicles could be 40–70% more fuel efficient by 2035 than now.

Alternative Fuels
New aircraft typically offer 20–30% improvement in efficiency. Shifting from kerosene to biofuels offers +30% cuts in direct GHG emissions.

Operational Efficiencies
Aviation carbon dioxide (CO_2) emissions can be reduced through more efficient planning of operations, including routes, altitudes and speeds.

http://www.cisl.cam.ac.uk/Resources/Climate-and-Energy/Climate-Change-Implications-for-Defence.aspx



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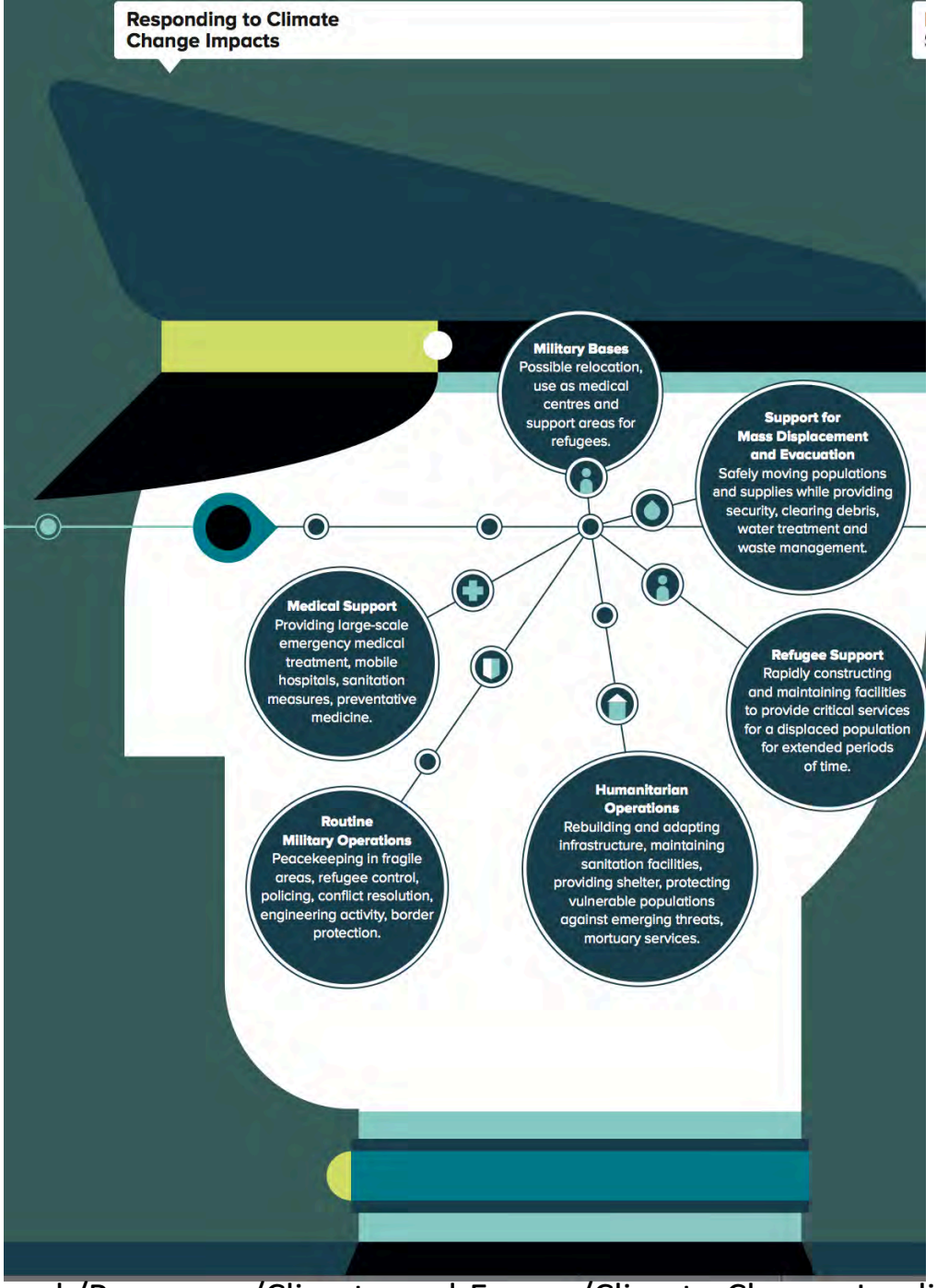

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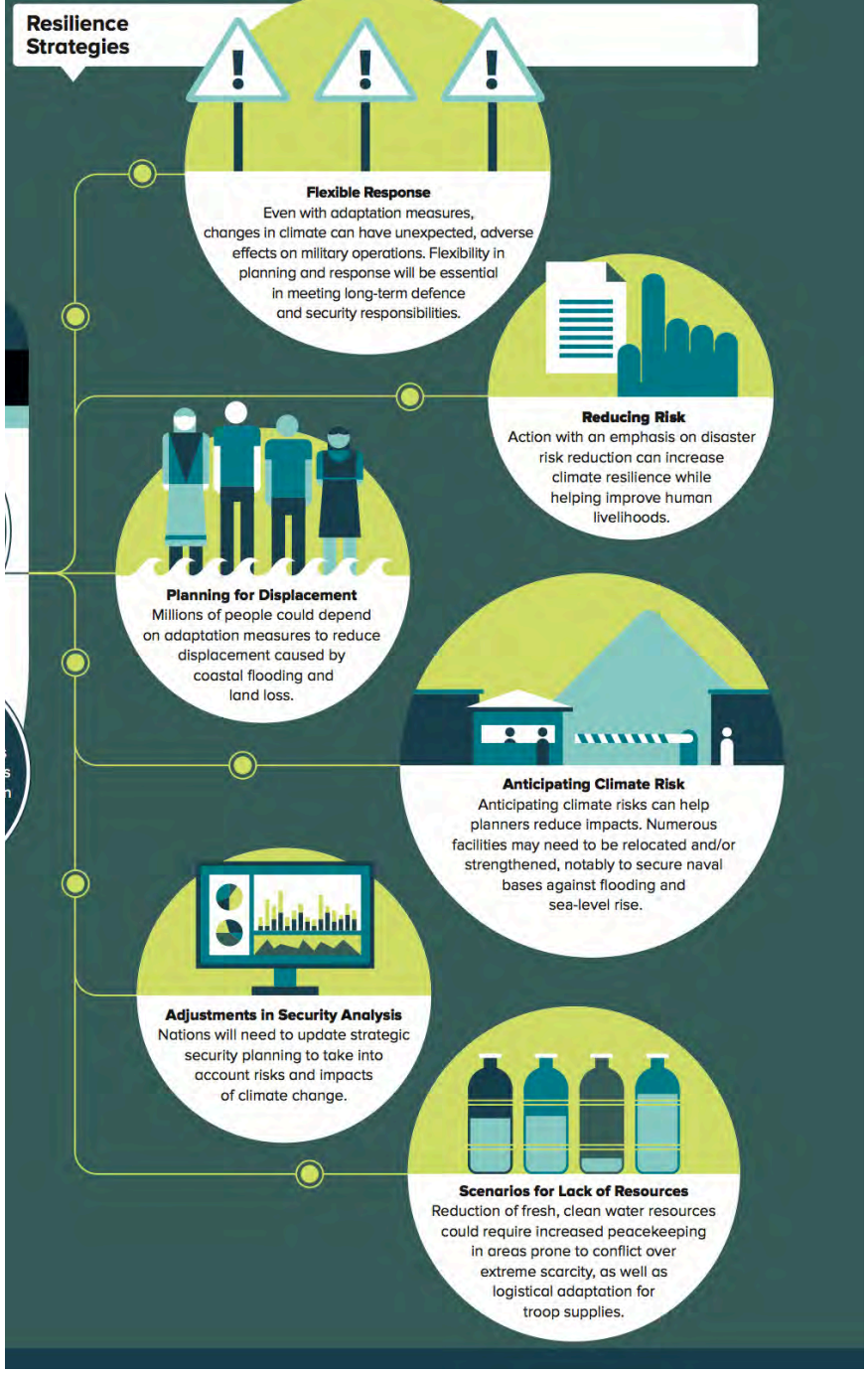

http://www.cisl.cam.ac.uk/Resources/Climate-and-Energy/Climate-Change-Implications-for-Defence.aspx

Resilience

Many **adaptations to climate change that involve the military can result in significant co-benefits**, such as alleviating poverty and enhancing development, especially in developing countries:

- **Flood preparedness**
- **Relocating military installations and bases**
- **Preparing for water insecurity**
- **Increasing resilience**

Mitigation Potential

The **global military complex is an energy-intensive industry** and in many nations, defence forces are the largest single consumer of fossil fuels.

- **More efficient vehicles**
- **Alternative fuels**
- **Operational improvements**
- **NB: Note risk of unintended consequences of mitigation and adaptation**

“Climate Change War” Is Not a Metaphor

Climate change worsens the divide between haves and have-nots, **hitting the poor the hardest**. It can also drive up food prices and spawn megadisasters, creating refugees and taxing the resiliency of governments.

When a threat like that comes along, it’s impossible to ignore. Especially if your job is national security.

http://www.slate.com/articles/technology/future_tense/2014/04/david_titley_climate_change_war_an_interview_with_the_retired_rear_admiral.html

Conclusion

Climate change has the potential to increase the risk of conflict and insecurity because factors such as poverty and economic hardship, associated with a higher risk of violent conflict, are especially sensitive to climate change.

Although many climate risks warrant further investigation and there is a need for more comprehensive evidence across multiple locations and over long durations, **it is likely that climate change over the 21st century** will lead to new challenges to states and **will increasingly shape national security policies**.

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

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

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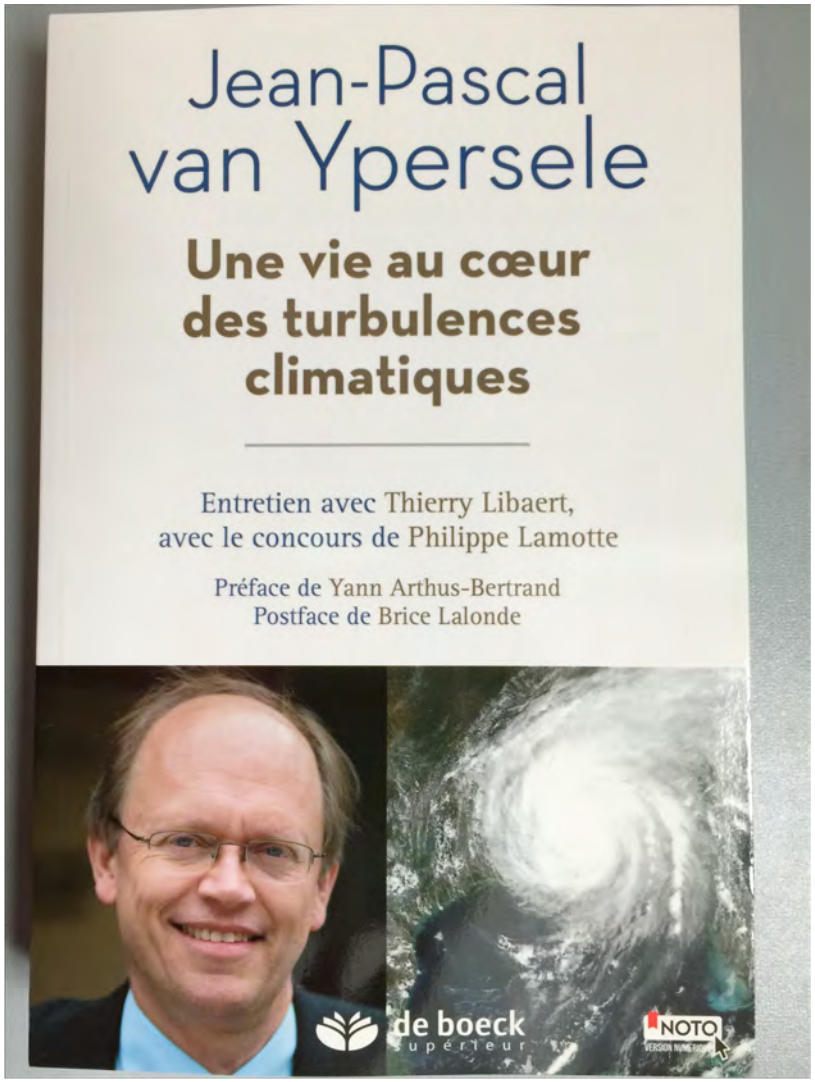
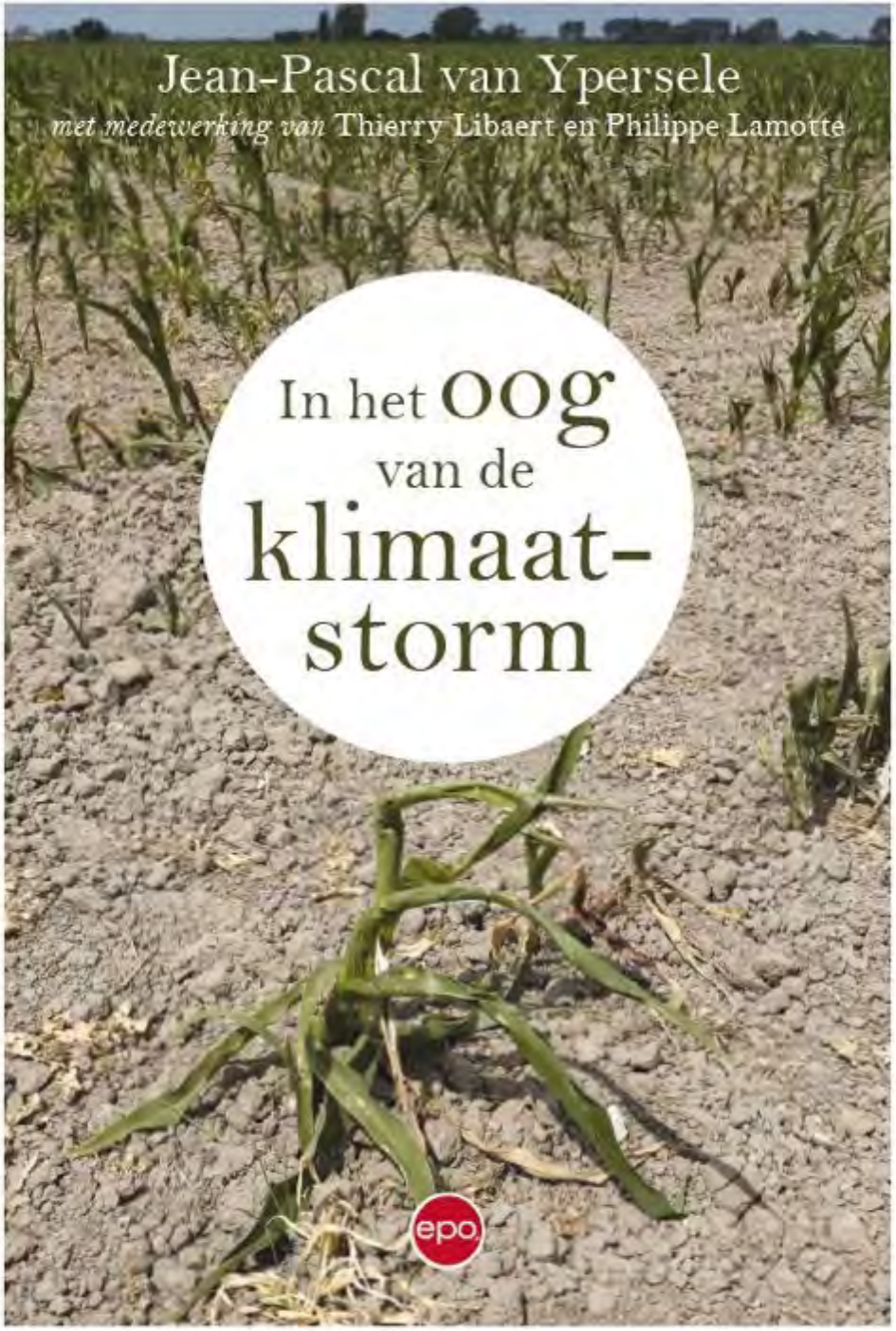


Bij EPO (2018)

Voorwoord:
Jill Peeters



To go further :

- www.climate.be/vanyp : my slides (under « conferences »)
- www.ipcc.ch : IPCC
- www.cisl.cam.ca.uk/ipcc : AR5 summary sheet on security
- 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**