Climate change: Threats and opportunities for life and sustainable development

Jean-Pascal van Ypersele

(Université catholique de Louvain)

Former IPCC Vice-Chair (2008-2015)

Twitter: @JPvanYpersele

ACP-EU Joint Parliamentary Assembly, European Parliament, Brussels, 16 June 2018

Thanks to the Walloon government (funding the Walloon Platform for IPCC, see www.plateforme-wallonne-giec.be) for its support

Let us think about the future of these children from Machakos (Kenya) in a warming climate

April 2015
Photo: @JPvanYpersele

Why the IPCC (Intergovernmental Panel on Climate Change)?

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

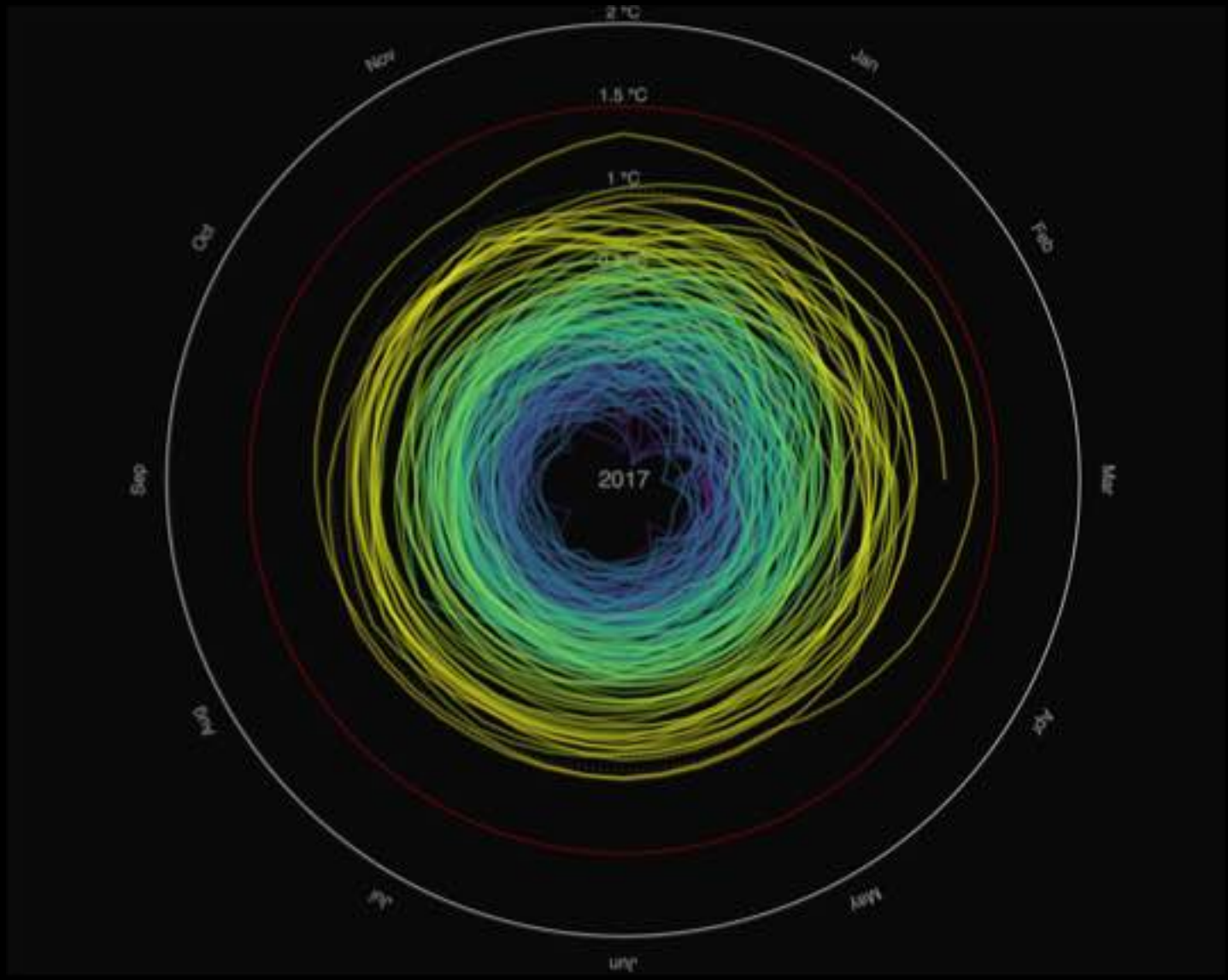
Key messages from IPCC AR5

- → **Human influence on the climate system is clear**
- → **Continued emissions of greenhouse gases will increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems**
- → **While climate change is a threat to sustainable development, there are many opportunities to integrate mitigation, adaptation, and the pursuit of other societal objectives**
- → **Humanity *has* the means to limit climate change and build a more sustainable and resilient future**

AR5 = 5th IPCC Assessment Report (2013-2014)

ipcc INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

Temperature spiral

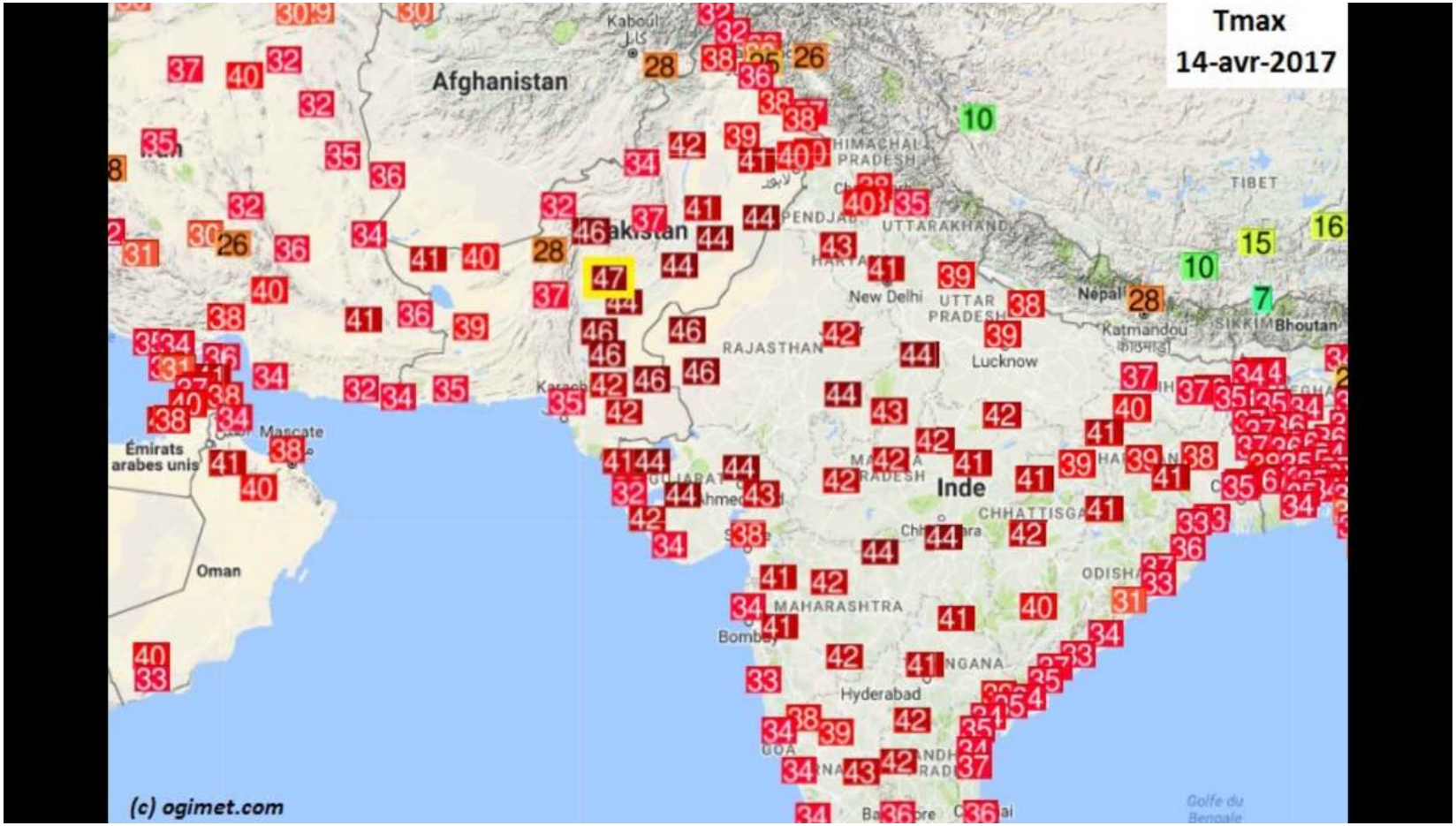


Global Mean Temperature in °C relative to 1850 – 1900
Graph: Ed Hawkins (Climate Lab Book) – Data: HadCRUT4 global temperature dataset
Animated version available on http://openclimatedata.net/climate-spirals/temperature

Since 1950, extreme hot days and heavy precipitation have become more common

There is evidence that anthropogenic influences, including increasing atmospheric greenhouse gas concentrations, have changed these extremes

Heat waves kill

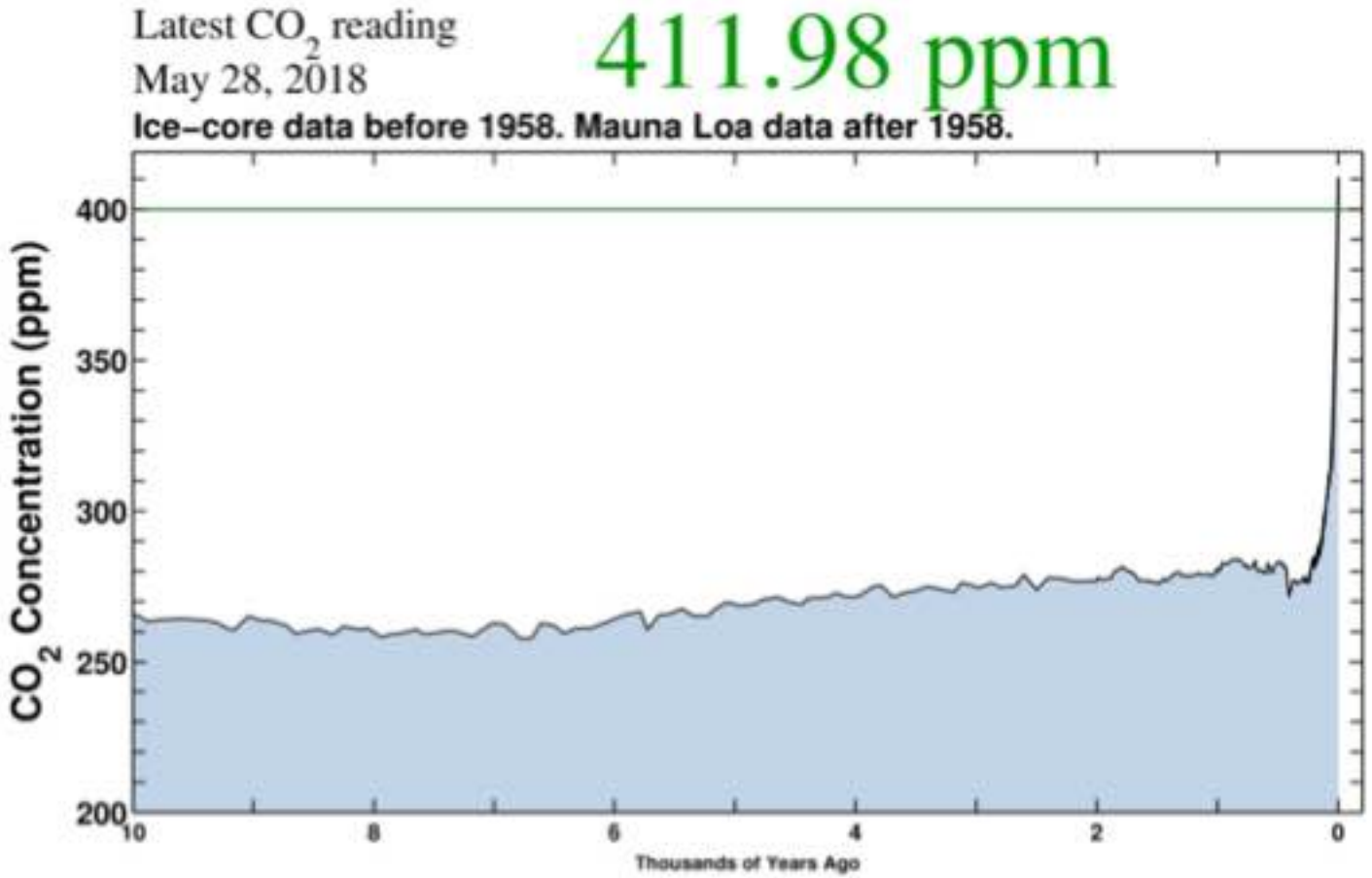


Fact: Because we use the atmosphere as a dustbin for our greenhouse gases, we thicken the insulation layer around the planet

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

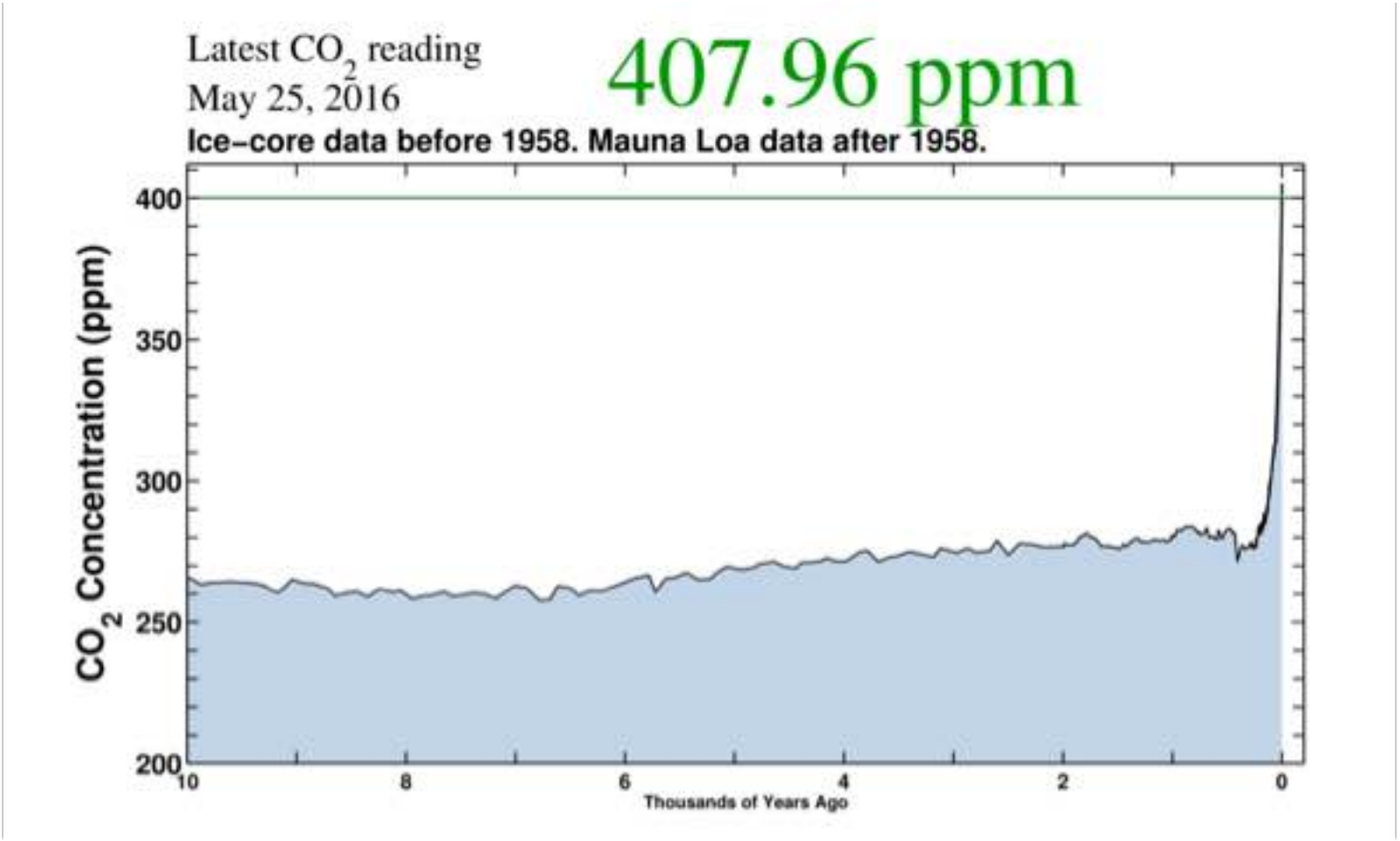
@JPvanYpersele

CO_2 Concentration, 28 May 2018 (Keeling curve)



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

CO_2 Concentration, 25 May 2016 (Keeling curve)



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

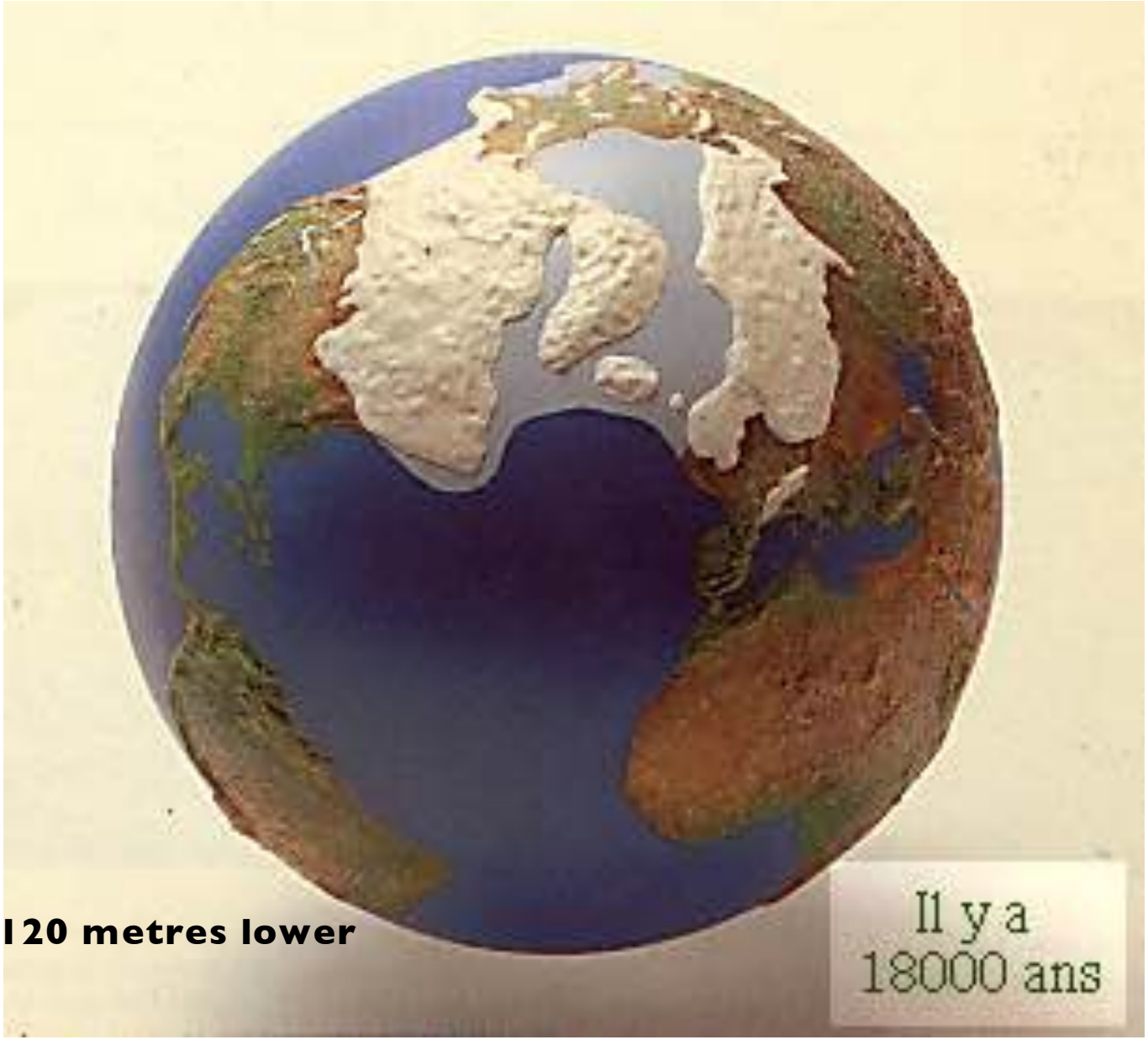
Fact: Average temperature is probably on its way to exceed the « conservation temperature » for the Greenland and (some of the) Antarctic ice sheet

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

@JPvanYpersele

18-20000 years ago (Last Glacial Maximum)

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



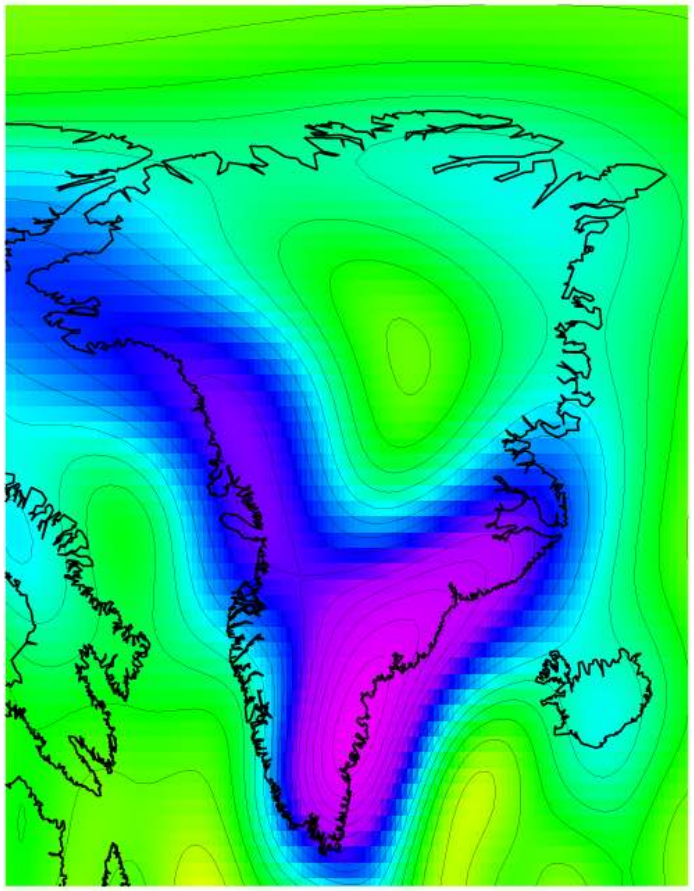
Sea level: 120 metres lower

Today, with +4-5° C globally

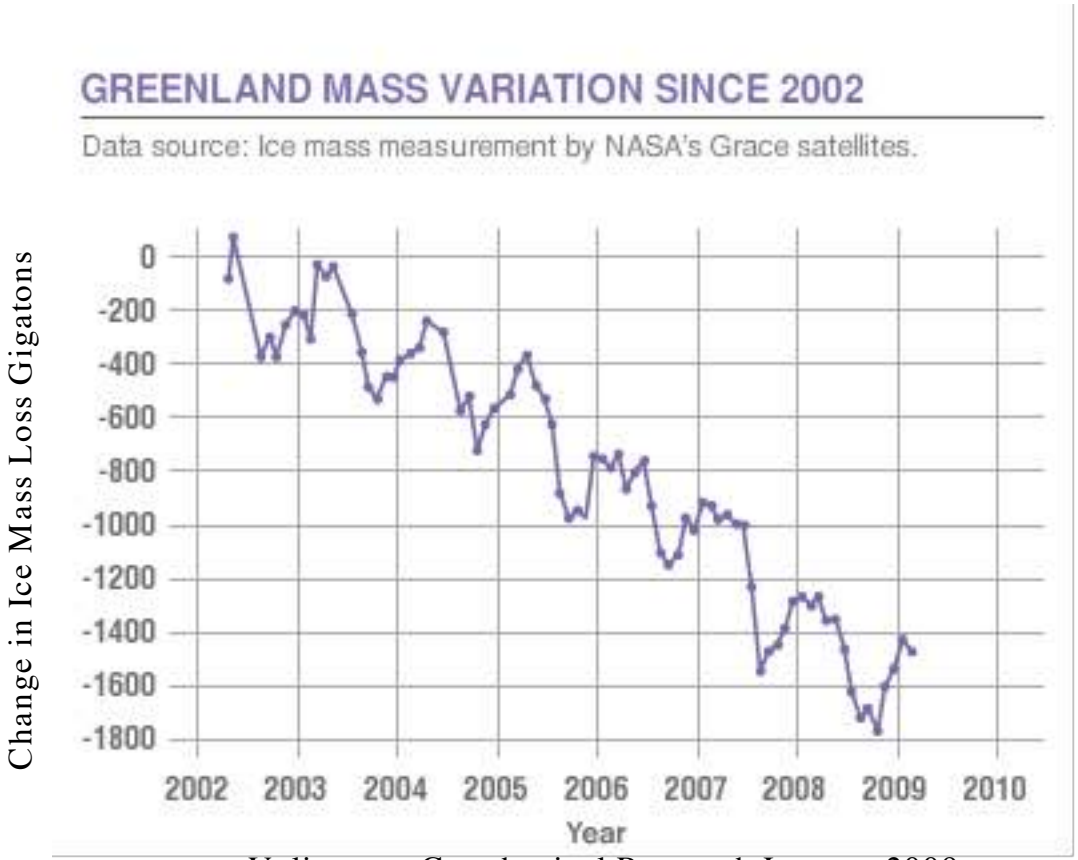
With permission from Dr. S. Joussaume, in « Climat d'hier à demain », CNRS éditions.

Greenland Ice Mass Loss 2002-2009 Derived From NASA GRACE Gravity Mission

Greenland



J. Wahr, U. Colorado



Velicogna, Geophysical Research Letters, 2009

•Contributes to sea level rise

B. Holt - JPL

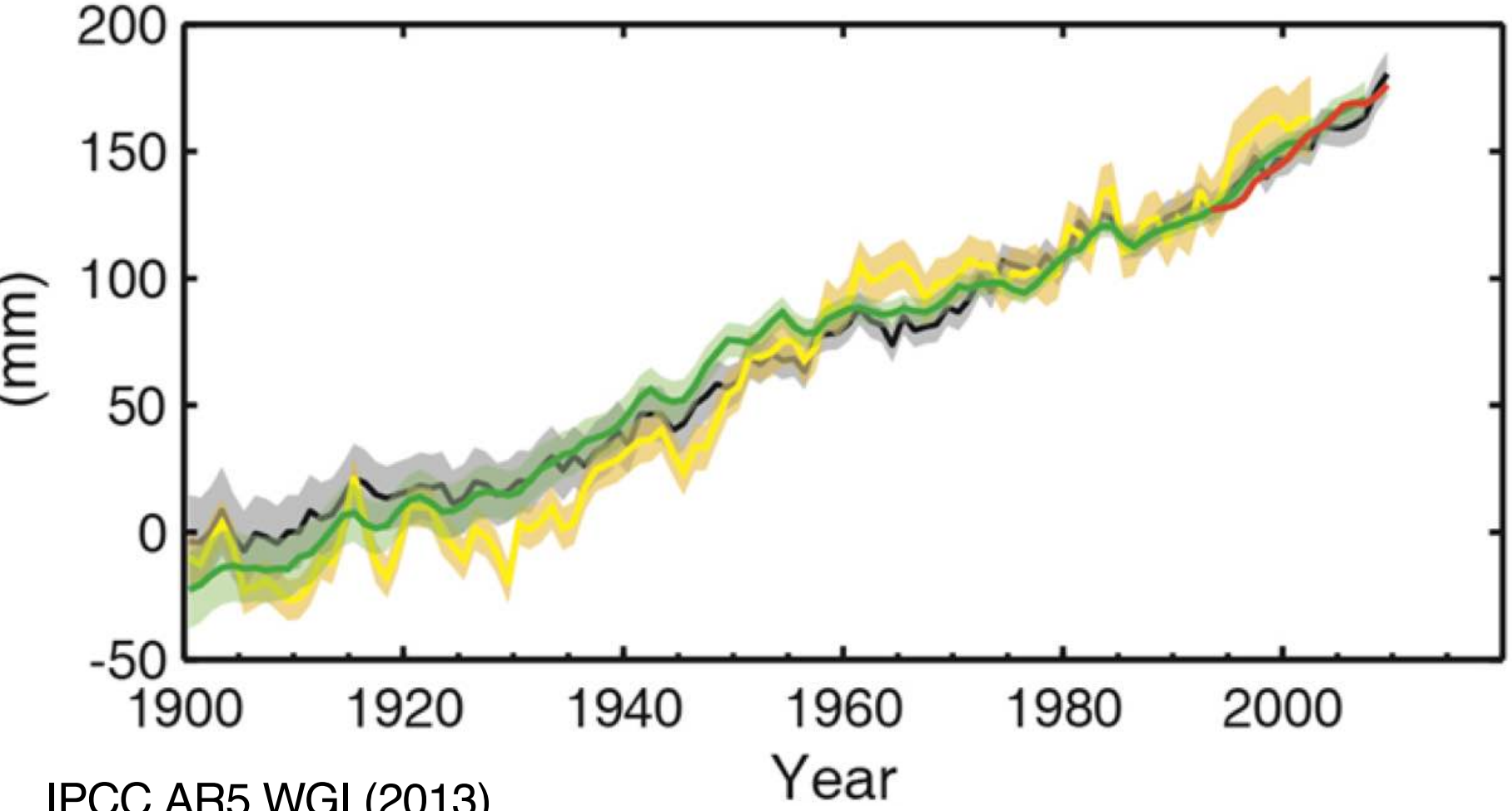
Qori Kalis Glacier (Peru): July 1978

Source: Dr. Lonnie Thompson (OSU),
via http://climate.nasa.gov/images-of-change#543-melting-qori-kalis-glacier-peru

Qori Kalis Glacier (Peru): July 2011

Source: Dr. Lonnie Thompson (OSU),
via http://climate.nasa.gov/images-of-change#543-melting-qori-kalis-glacier-peru

Change in average sea-level change



IPCC AR5 WGI (2013)

Fact: 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 »

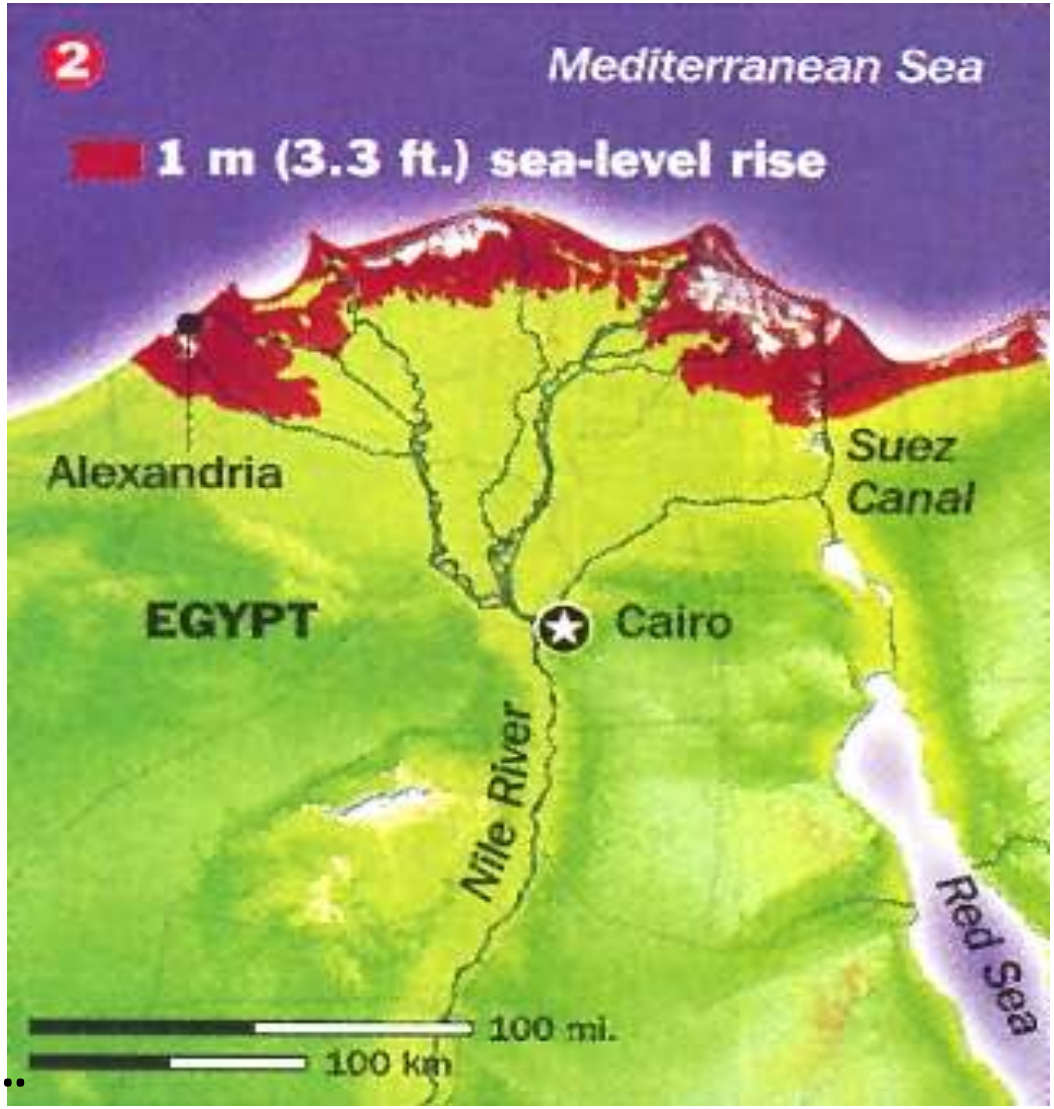
@JPvanYpersele

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)

Small islands are threatened in their very existence. Example: Maldives, in front of the Ministry of Foreign Affairs, August 2015

Photo: @JPvanYpersele

Photo: @JPvanYpersele

Fact: World Health Organization (2018): Air pollution kills 7 million people per year (incl. 1 million in Africa and 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

Children are particularly sensitive to air pollution

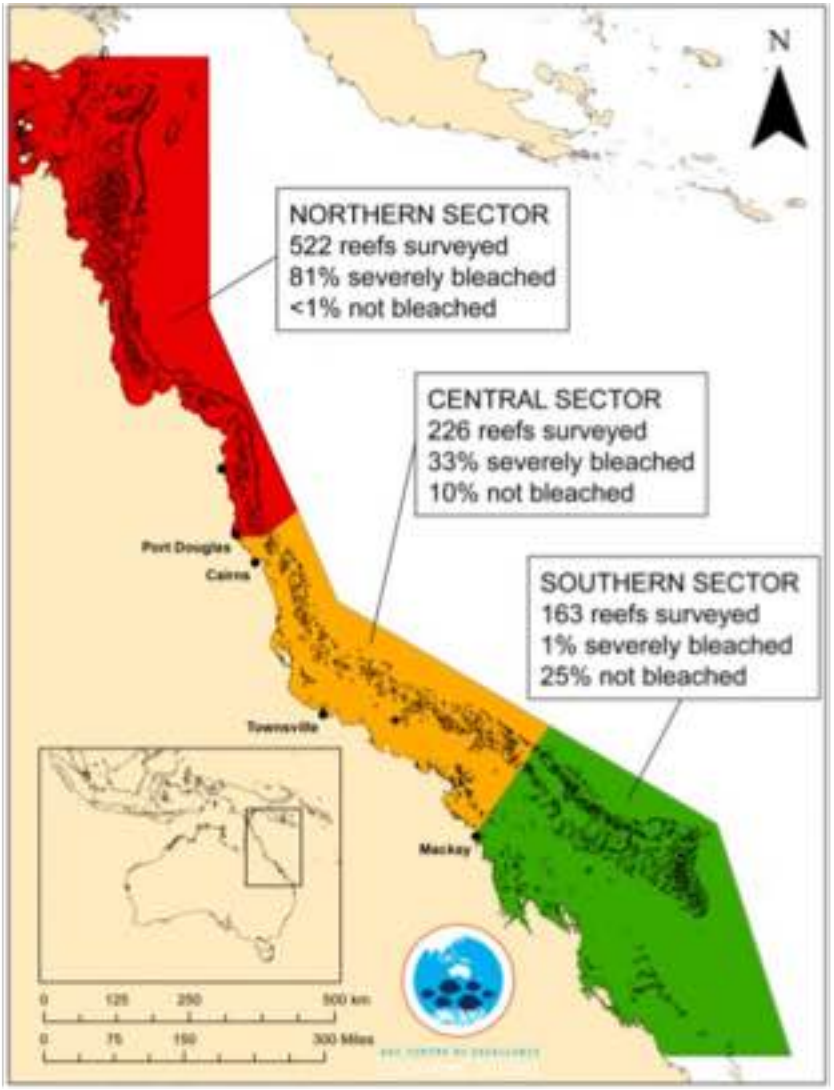
Photo: Indiatoday.in, 6-12-2017

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

« Miners use canaries to warn them of deadly gases. It might not be a bad idea if we took the same warning from the dead birds in the countryside »

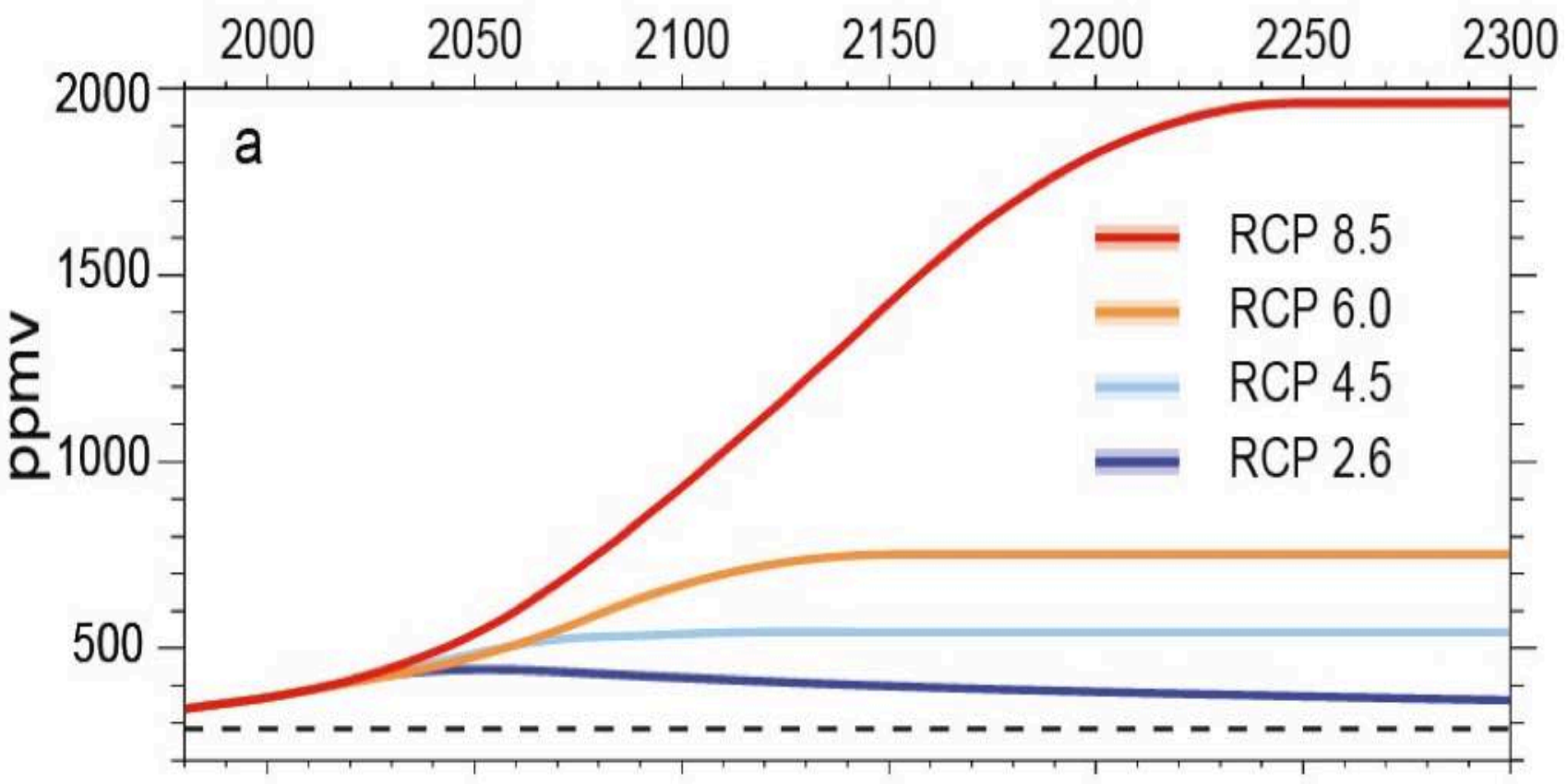
(Duke of Edinburgh at the Wildlife Fund dinner, quoted in « Silent Spring » (Rachel Carson, 1962))

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



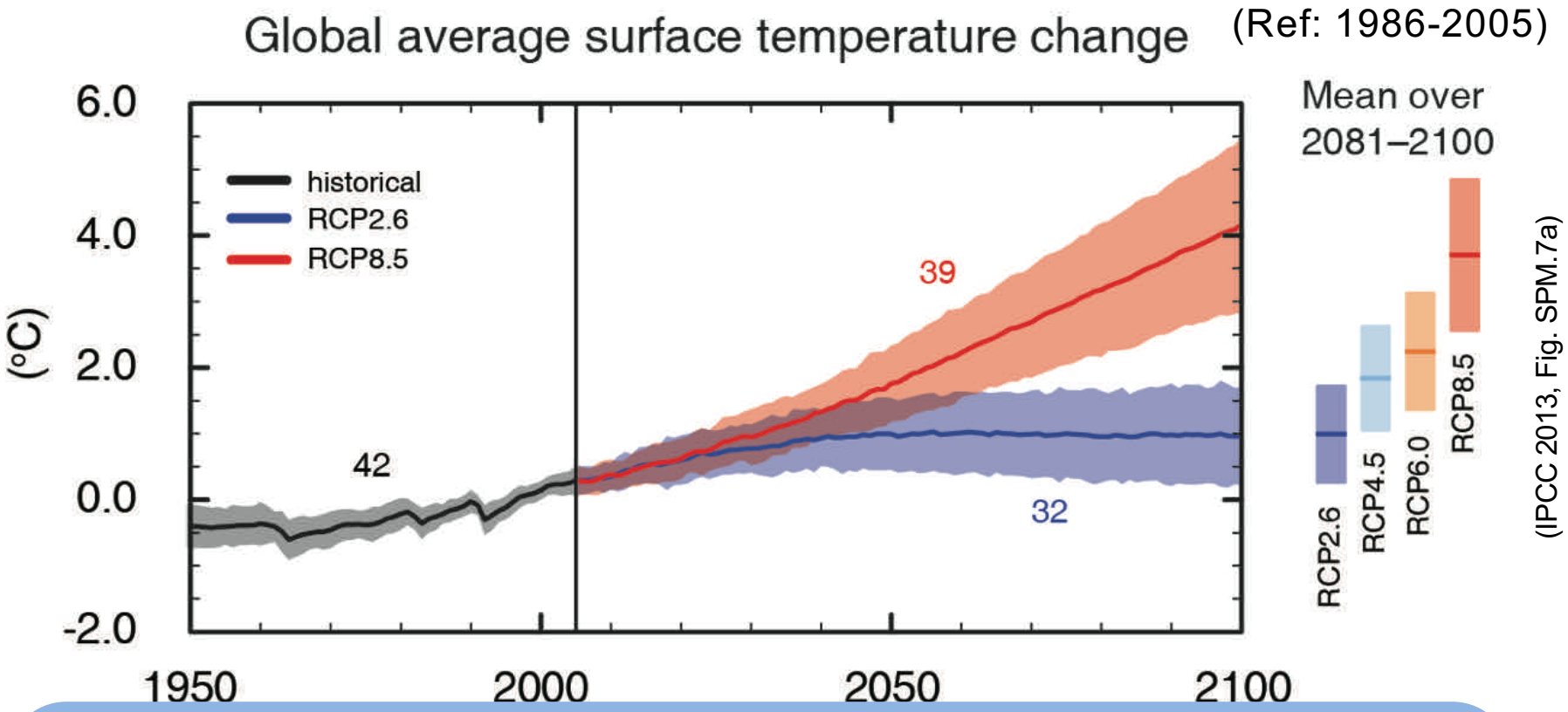
JCU Australia - ARC Centre of Excellence for Coral Reef Studies / Tom Bridge and James Kerry

RCP Scenarios: Atmospheric CO_2 concentration

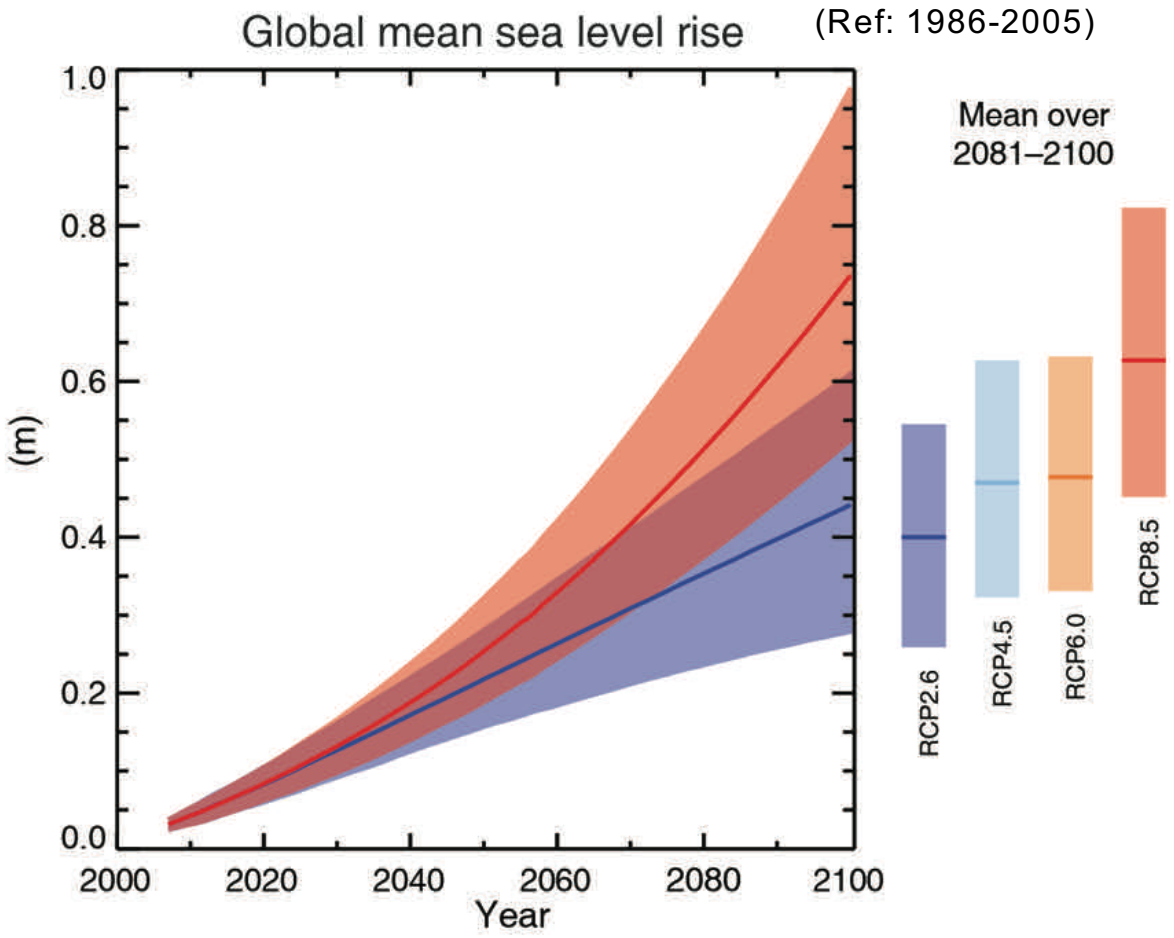


Three stabilisation scenarios: RCP 2.6 to 6
One Business-as-usual scenario: RCP 8.5

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



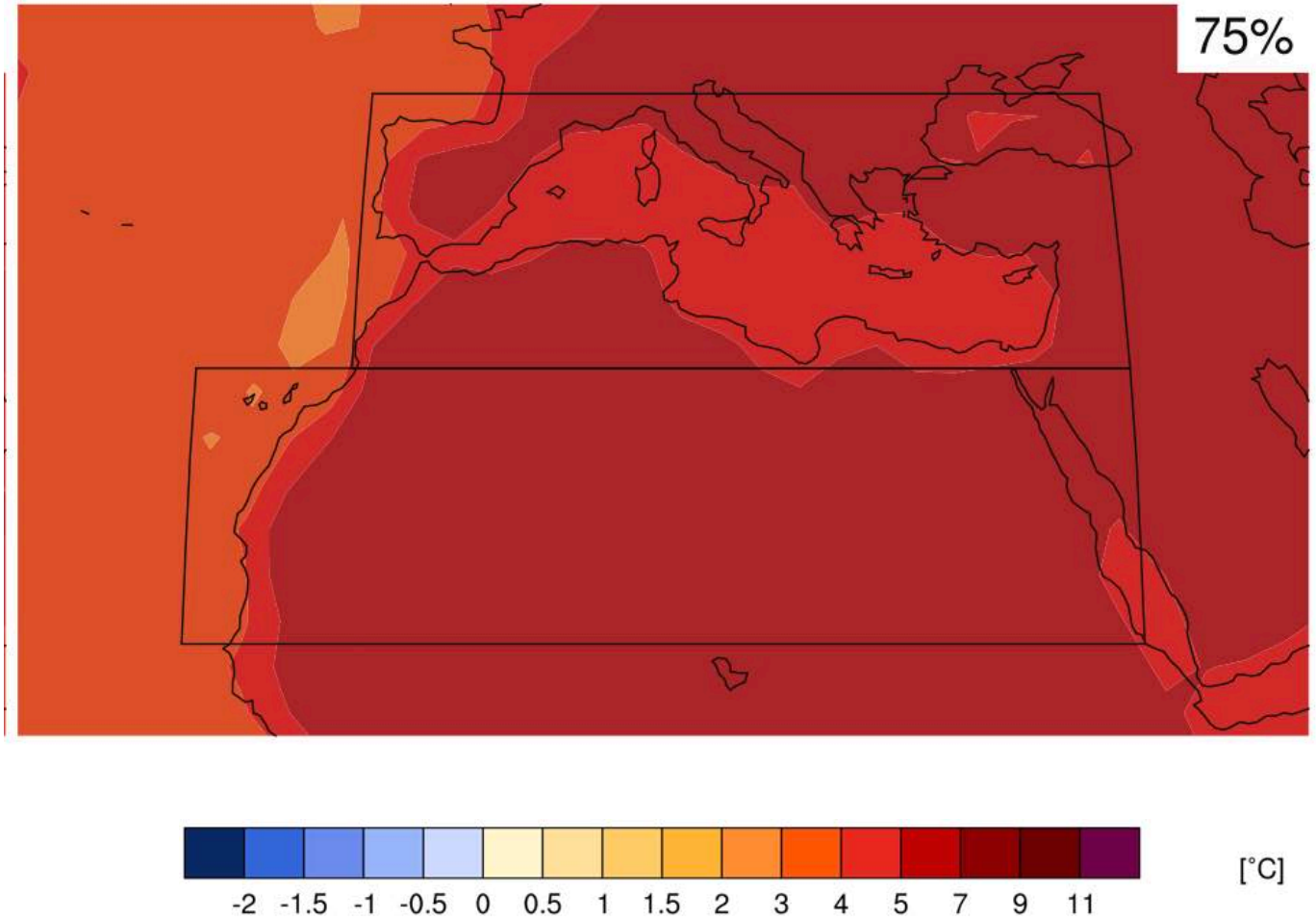
Only the lowest (RCP2.6) scenario maintains the global surface temperature increase above the pre-industrial level to less than 2° C with at least 66% probability



(IPCC 2013, Fig. SPM.9)

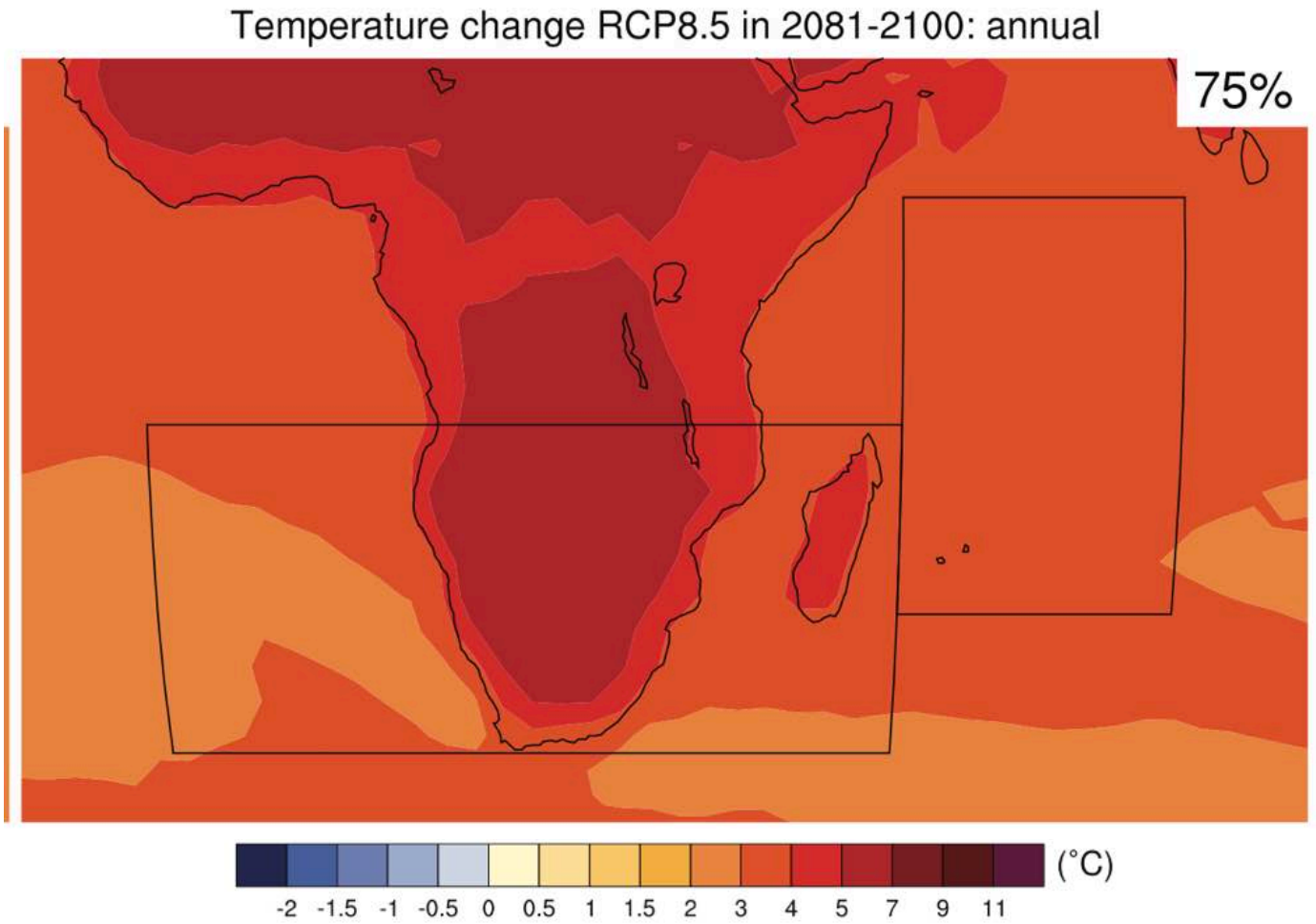
Sea level due to continue to increase

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



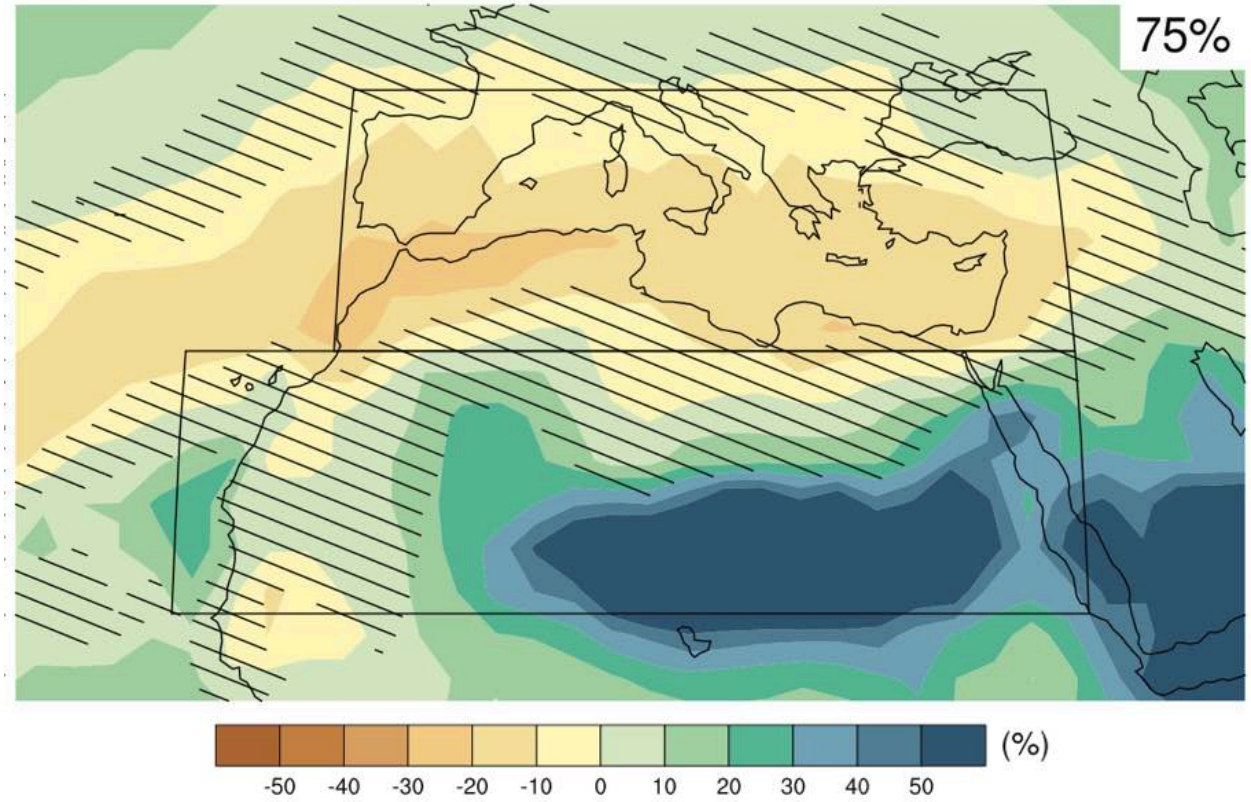
IPCC WG1 Fifth Assessment Report-Atlas of Global and Regional Climate Projections (Final Draft)

Map of temperature changes in 2081–2100 , with respect to 1986–2005 in the RCP8.5 scenario



IPCC, WGI, Annex I: Atlas of Global and Regional Climate Projections Supplementary Material RCP8.5

Map of precipitation changes in 2081–2100 with respect to 1986–2005 in the RCP8.5 scenario

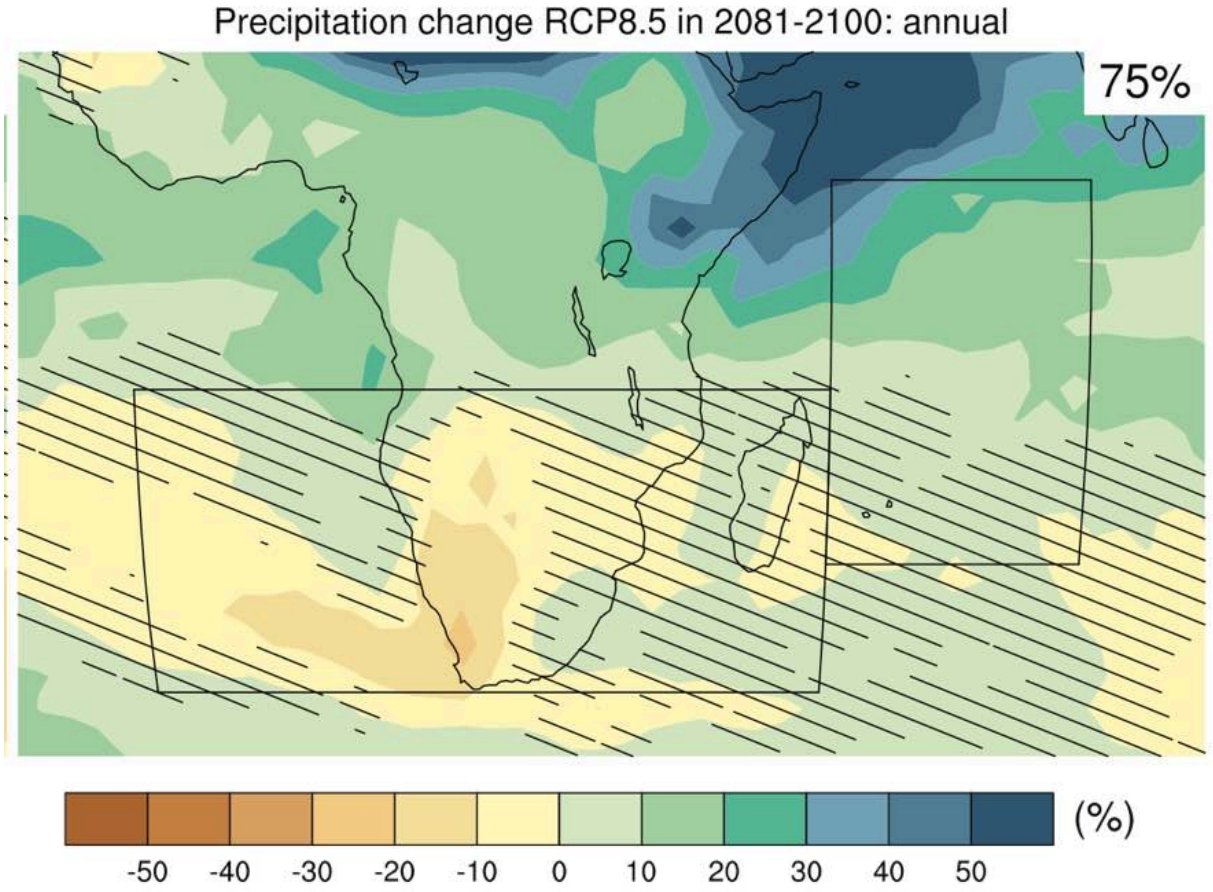


Regions where the projected change is less than one standard deviation of the natural internal variability

Regions where the projected change is large compared to natural internal variability, and where at least 90% of models agree on a sign of change

IPCC, AR5, WGI, Annex I: Atlas of Global and Regional Climate Projections Supplementary Material RCP8.5

Map of precipitation changes in 2081–2100, with respect to 1986–2005 in the RCP8.5 scenario



Regions where the projected change is less than one standard deviation of the natural internal variability

Regions where the projected change is large compared to natural internal variability, and where at least 90% of models agree on a sign of change

IPCC, WGI, Annex I: Atlas of Global and Regional Climate Projections Supplementary Material RCP8.5

Climate change 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

Potential Impacts of Climate Change

Food and water shortages

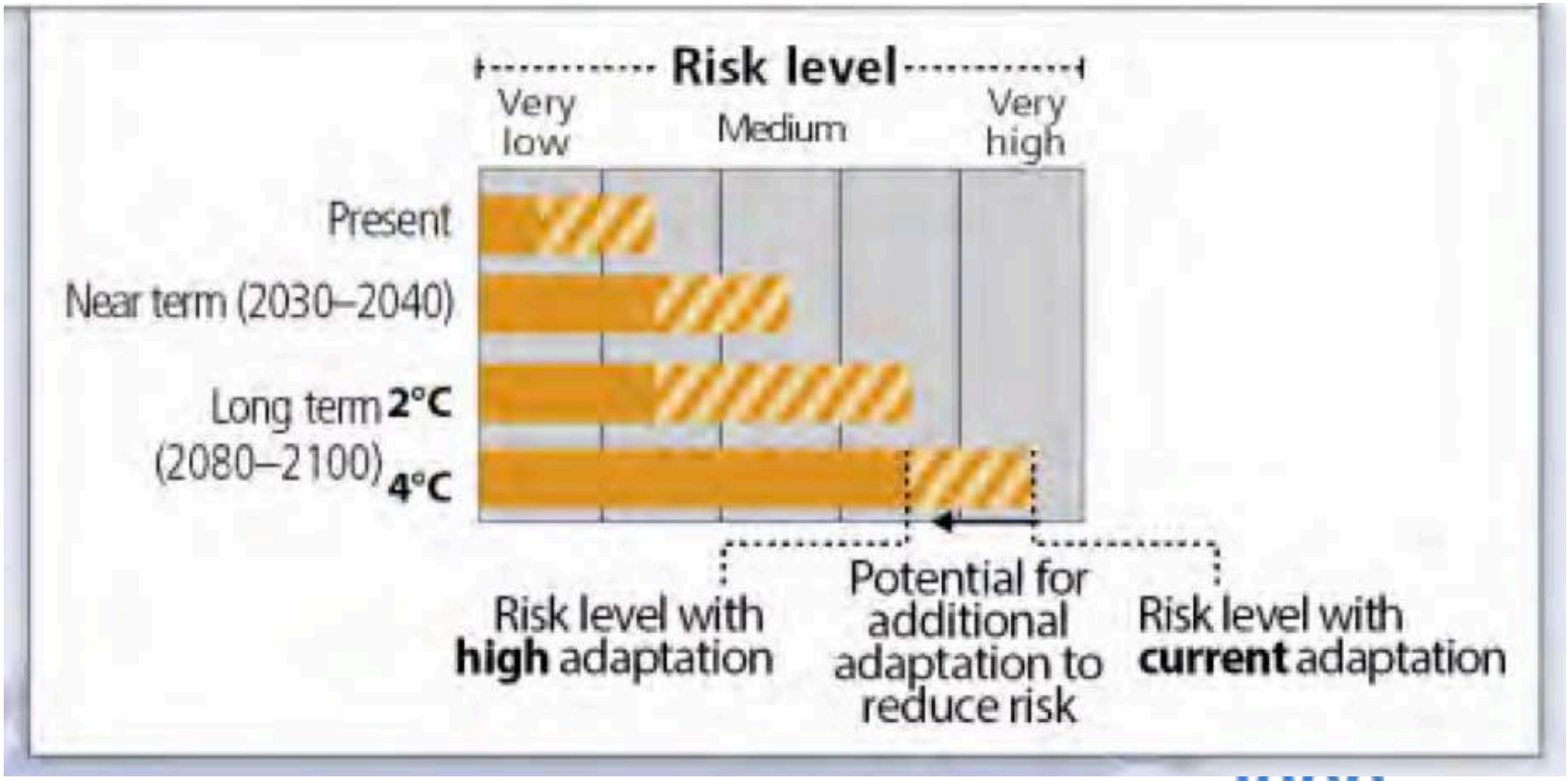
Increased displacement of people

Increased poverty

Coastal flooding

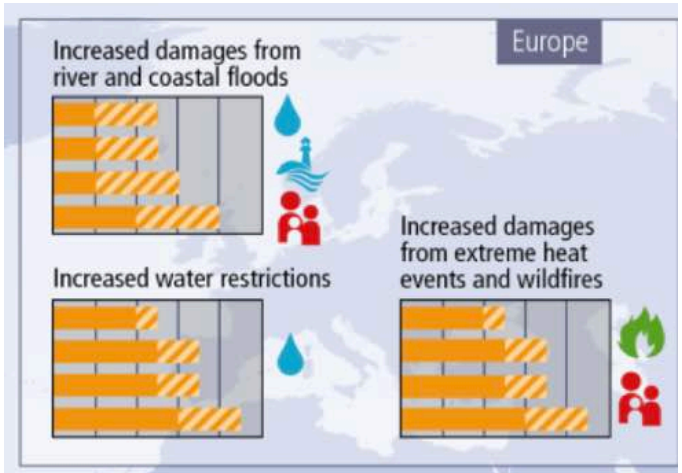
AR5 WGII SPM

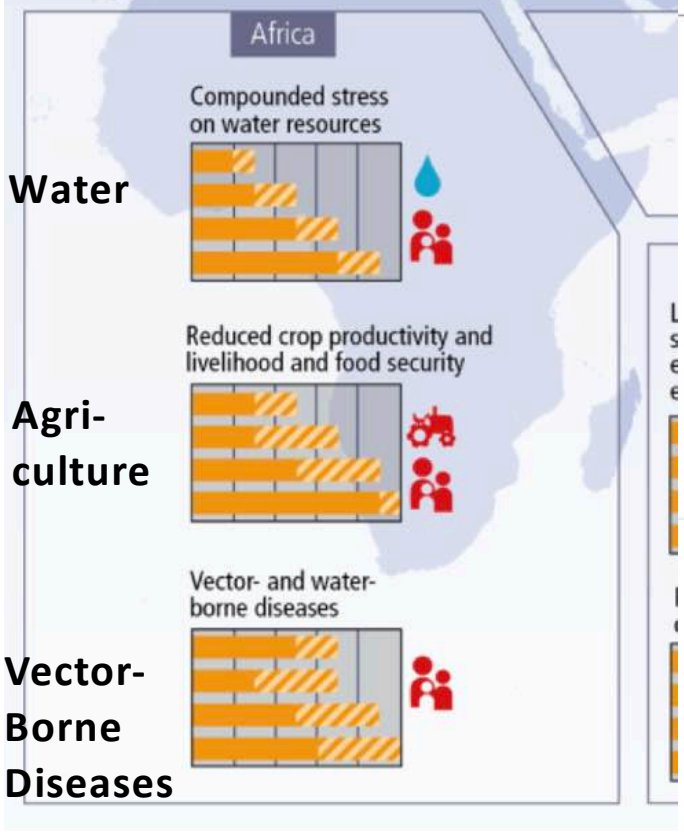
Regional key risks and potential for risk reduction through adaptation

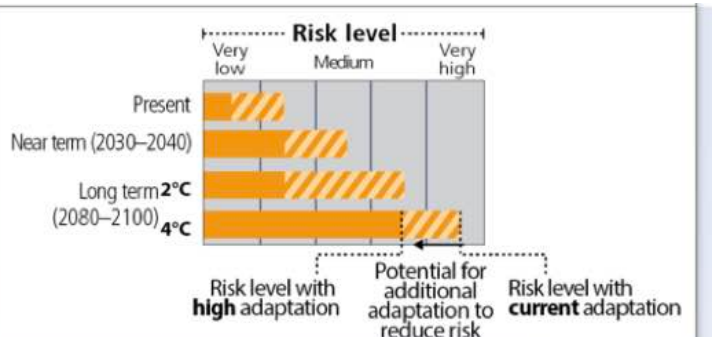


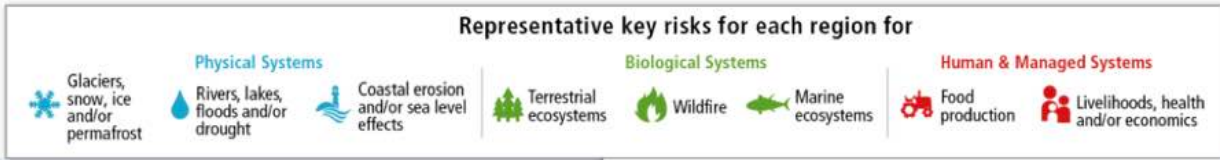
IPCC, AR5, SPM, Figure SPM.8

Regional key risks and risk reduction through adaptation: Europe & Africa



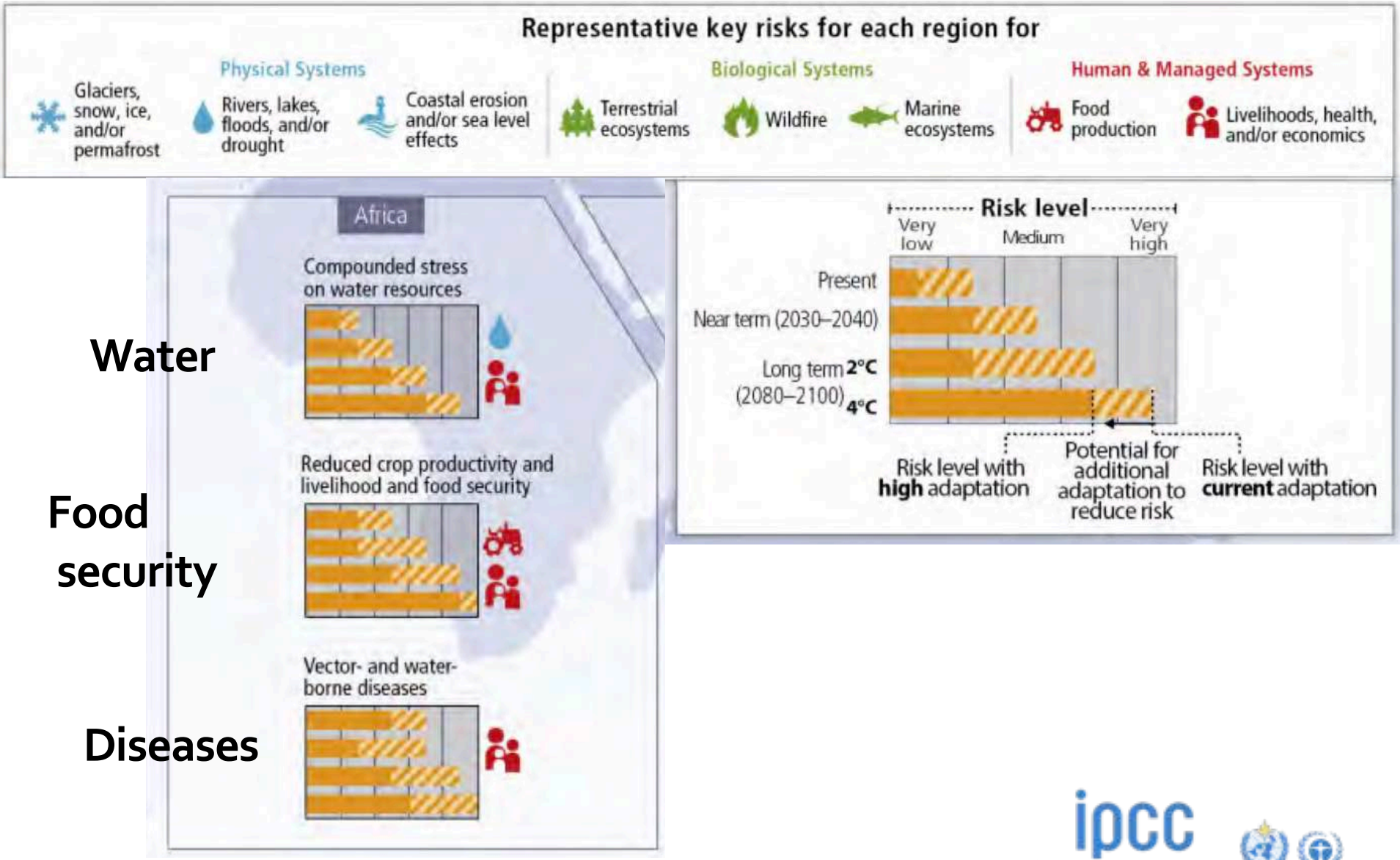






IPCC, AR5, SYR, SPM.8

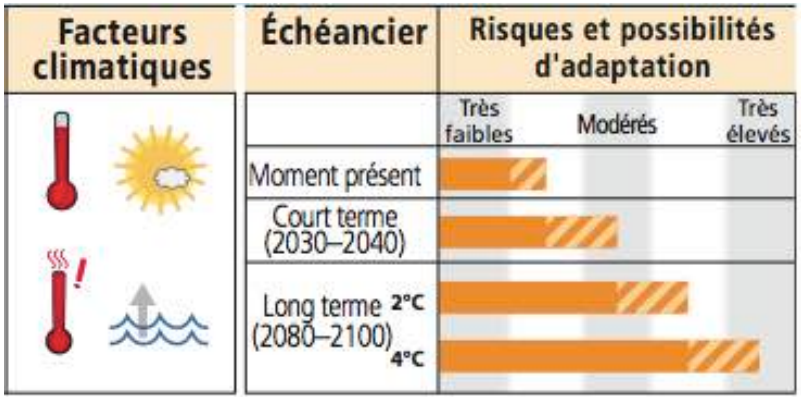
Regional key risks and risk reduction through adaptation

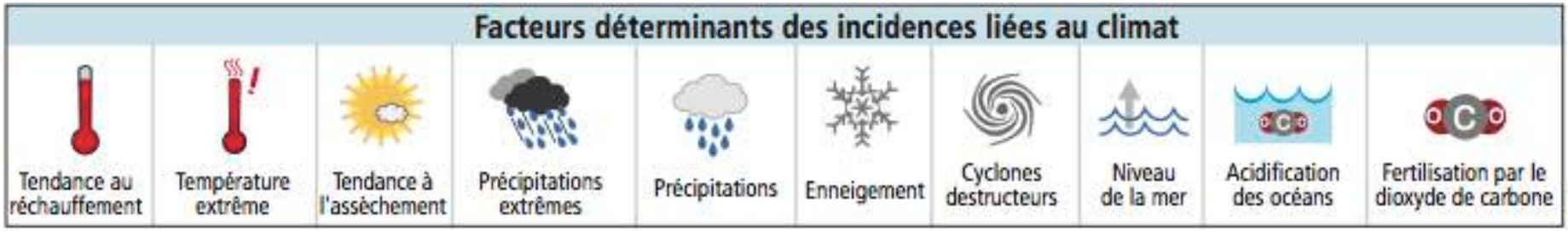


IPCC, AR5, SPM, Figure SPM.8

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).*

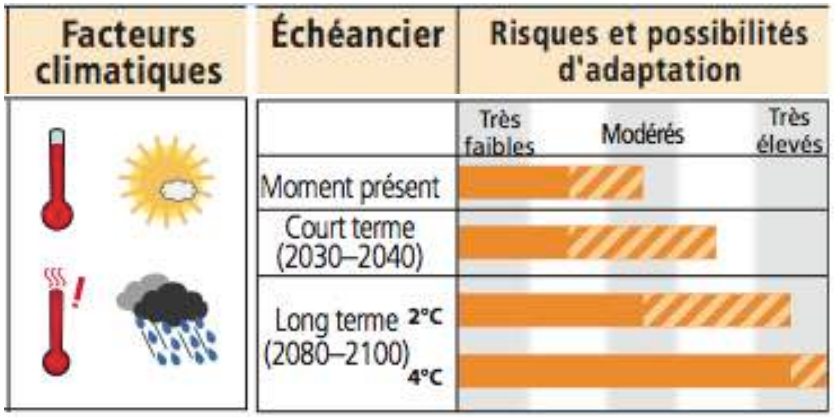


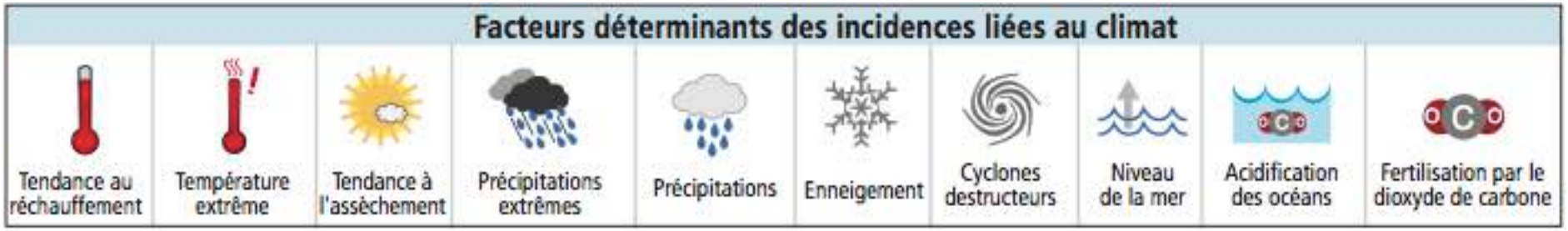


IPCC, AR5, GT II, RID, p. 21

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)*

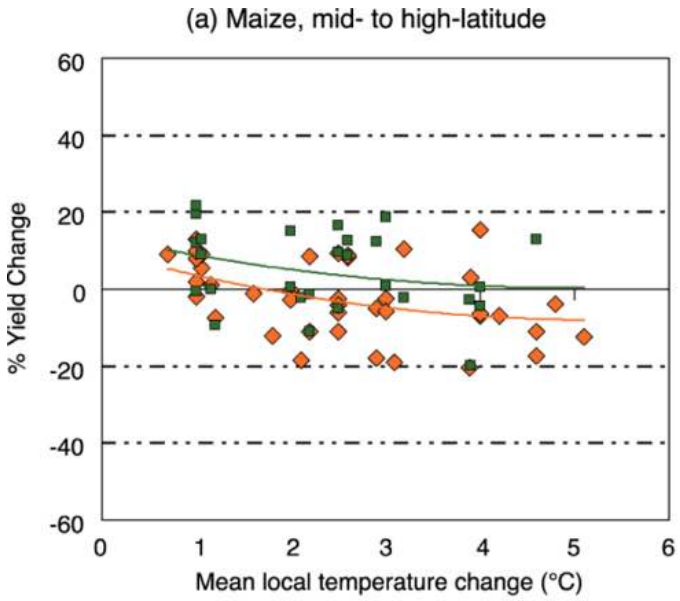


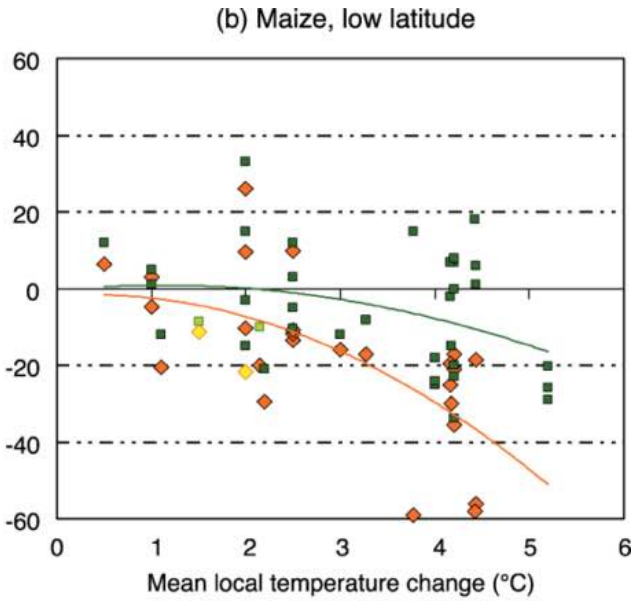


IPCC, AR5, GT II, RID, p. 21

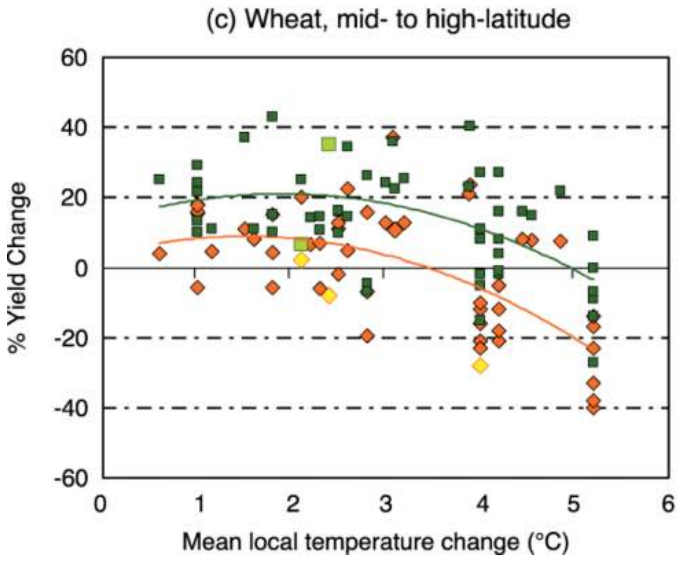
Figure TS.7. Sensitivity of cereal yield to climate change

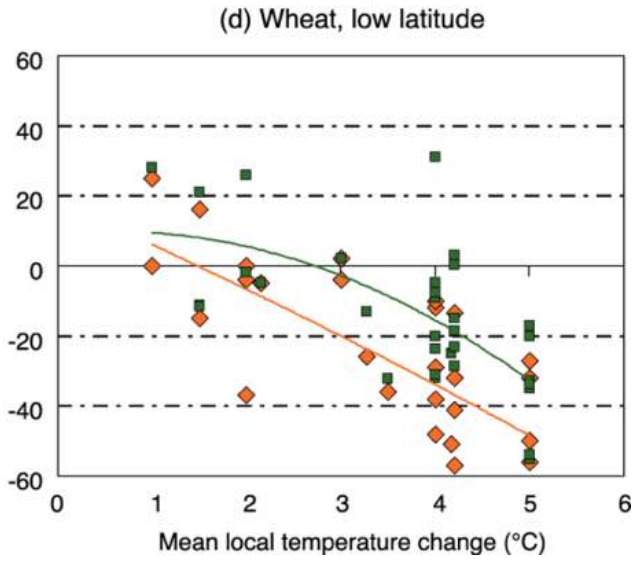
Maïs





Blé



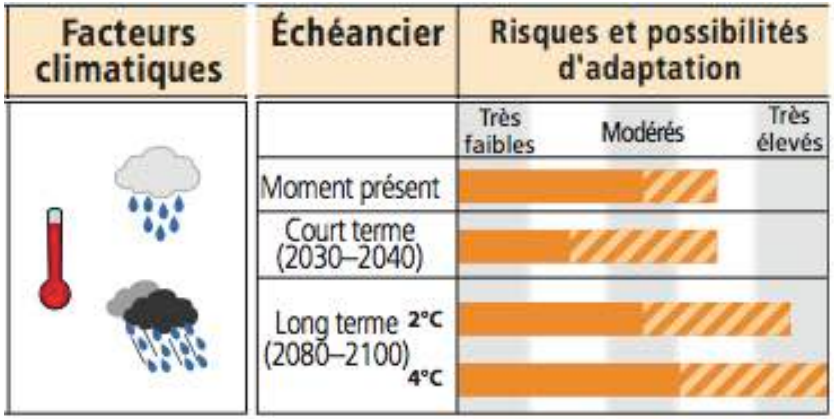


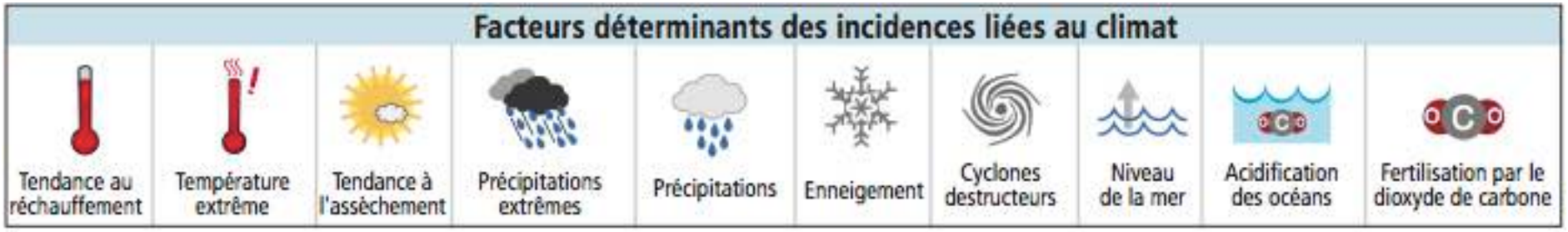
WMO

UNEP

Risque majeur pour l'Afrique: santé

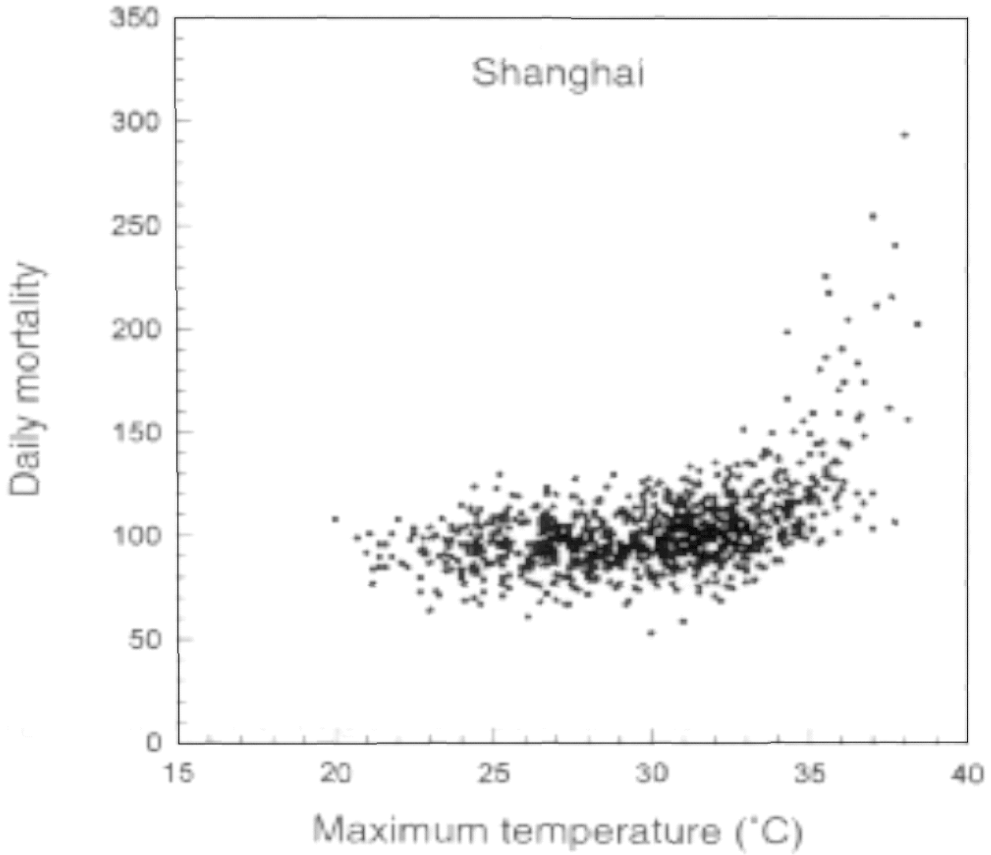
Variations de l'incidence et de l'extension géographique des maladies à transmission vectorielle ou d'origine hydrique dues à l'évolution des températures et des précipitations moyennes et de leur variabilité, en particulier aux limites de leurs aires de répartition (degré *de confiance moyen)*





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

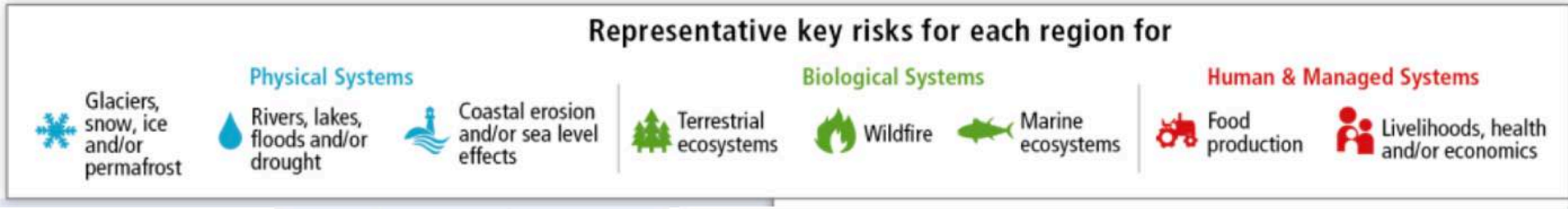
Relationship between maximum temperature and mortality in Shanghai, China, 1980-89



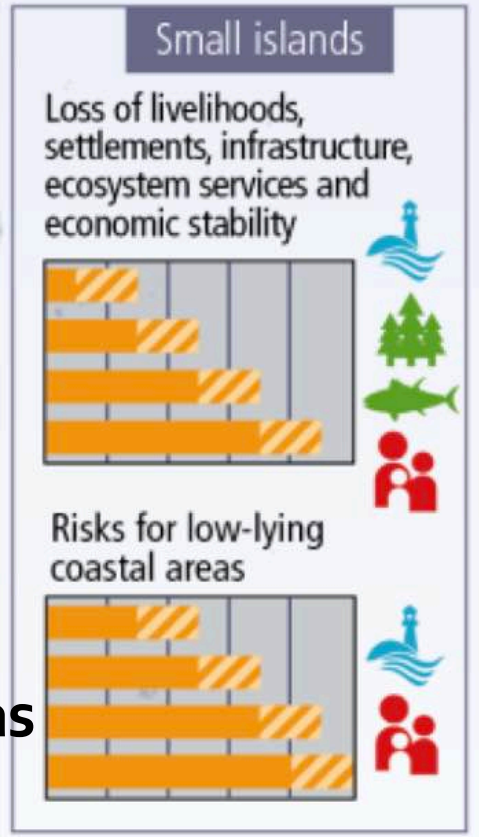
Référence : CILIMATE CHANGE AND HUMAN HEALTH, 1996

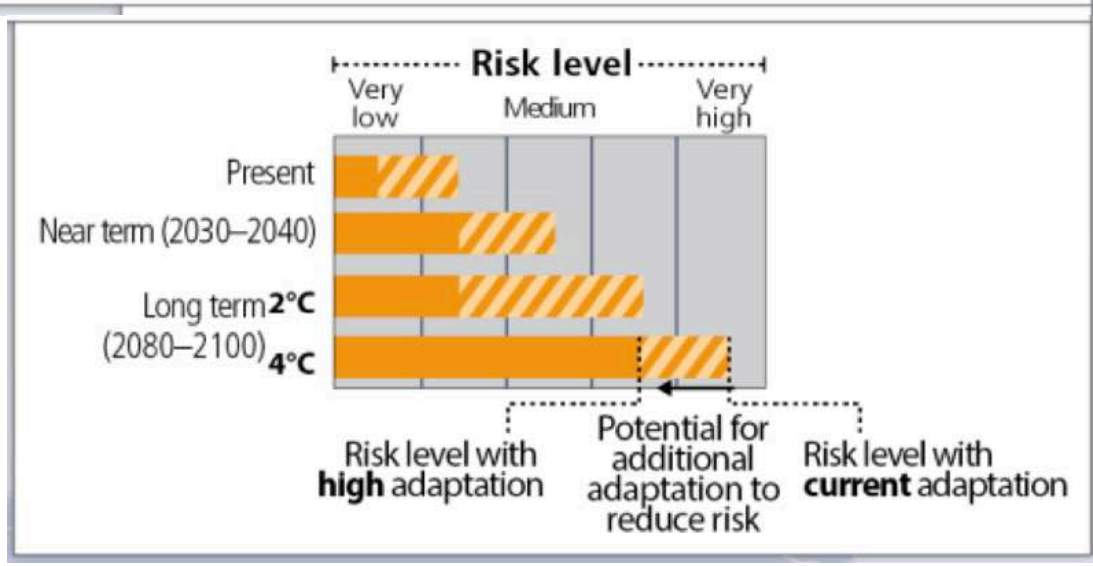
Jean-Pascal van Ypersele
(vanypersele@astr.ucl.ac.be)

Regional key risks and potential for risk reduction: Small Islands



Losses

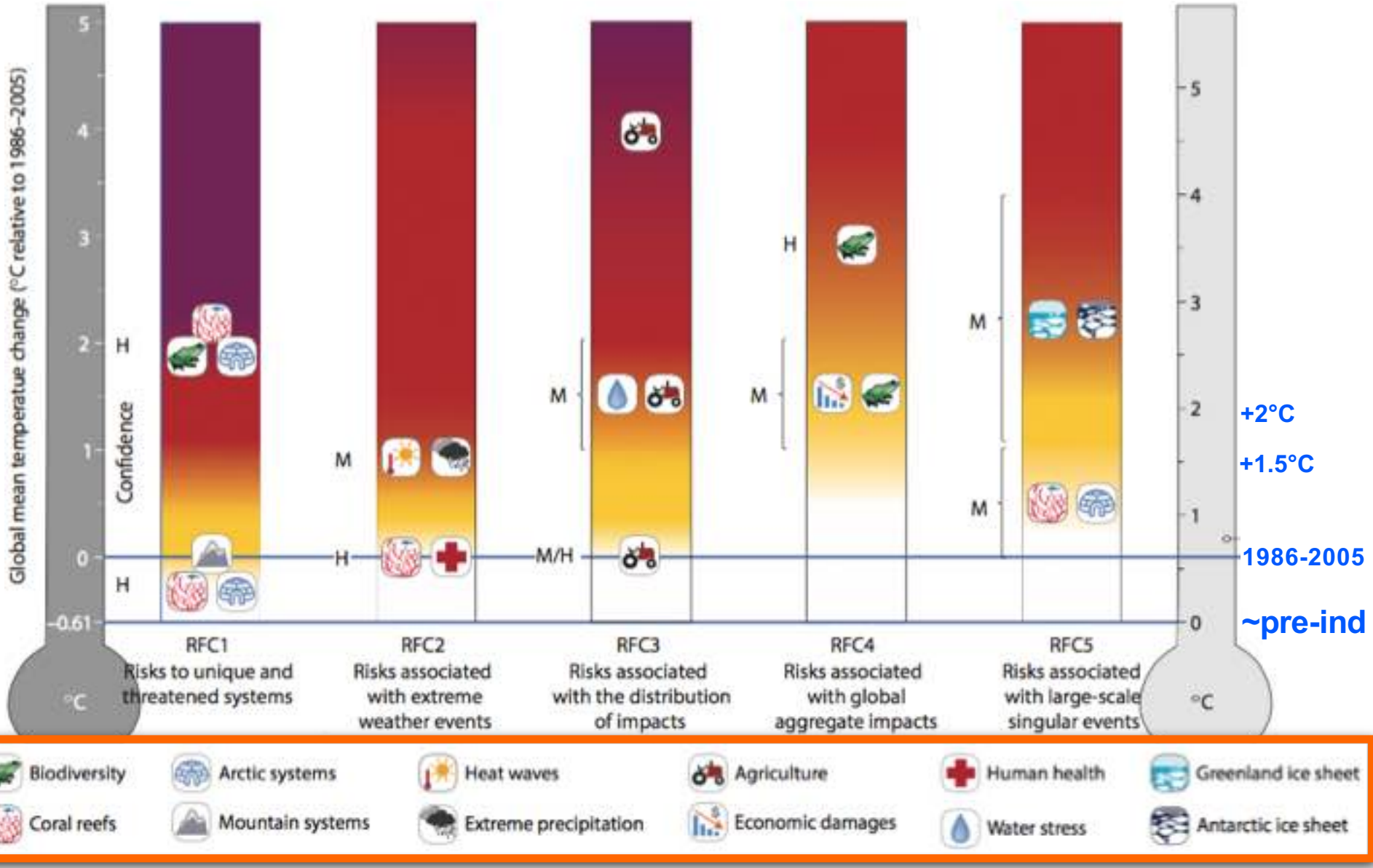




Risk to coastal areas

IPCC, AR5, SYR, SPM 8

IPCC reasons for concern / climate change risks
(Nat Climate Change 2017)



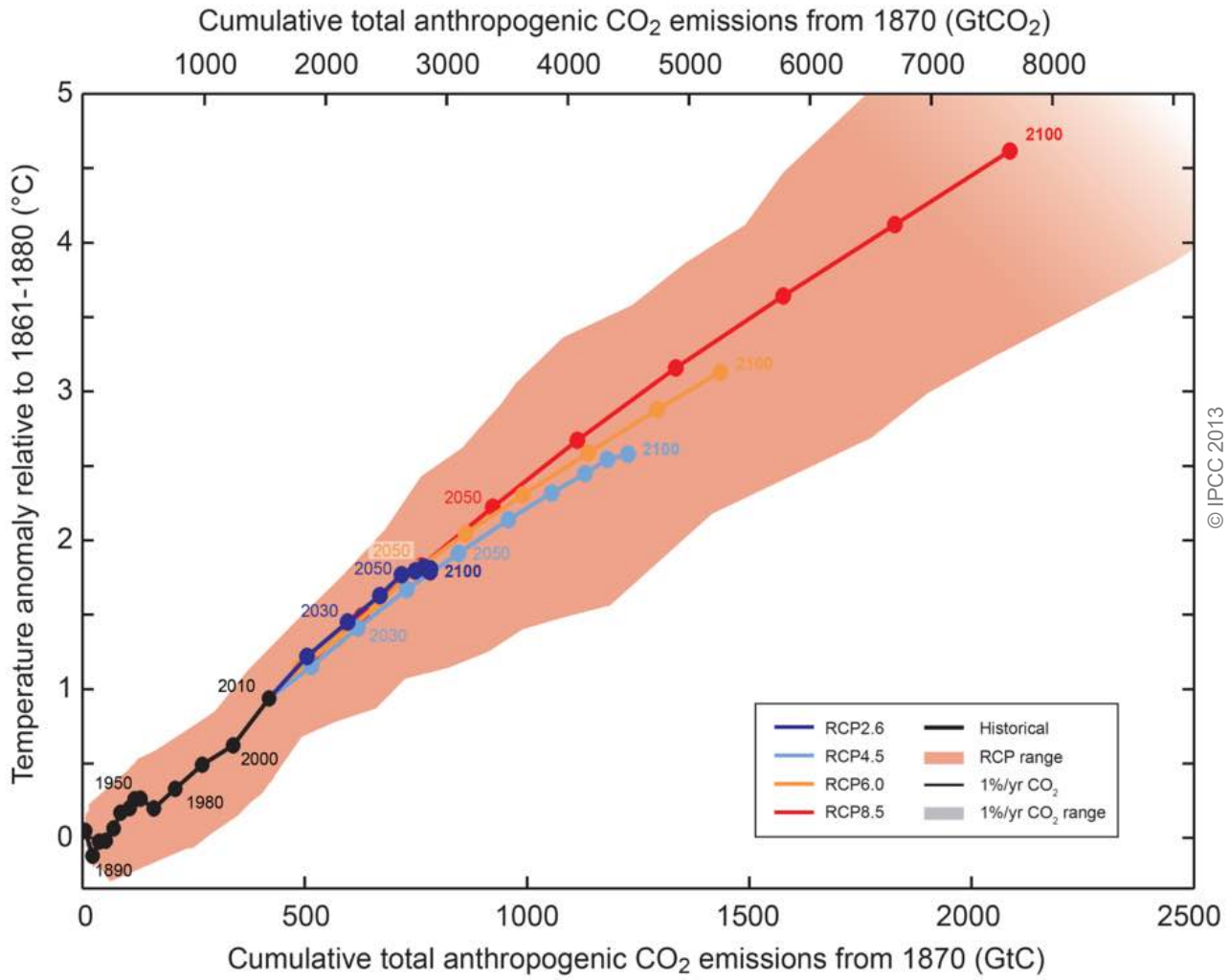
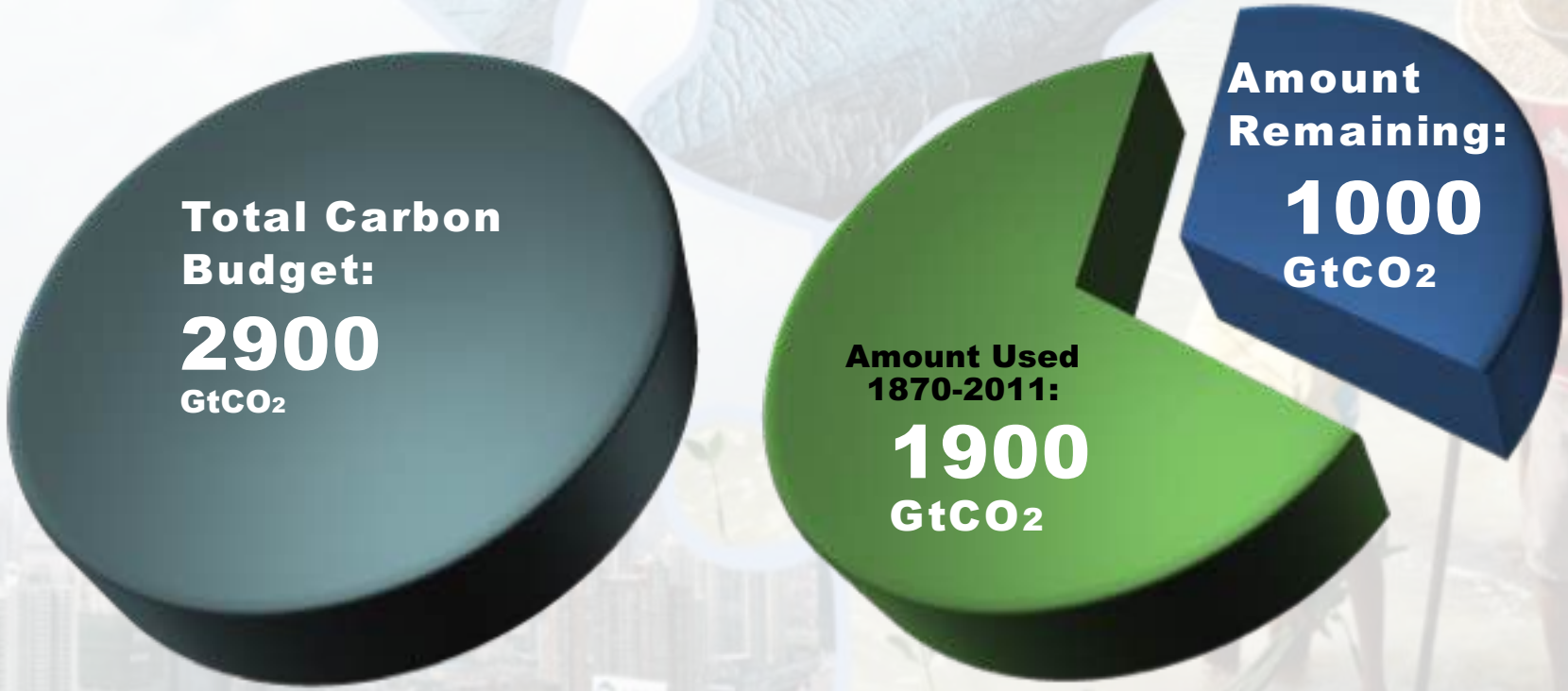


Fig. SPM.10

Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.

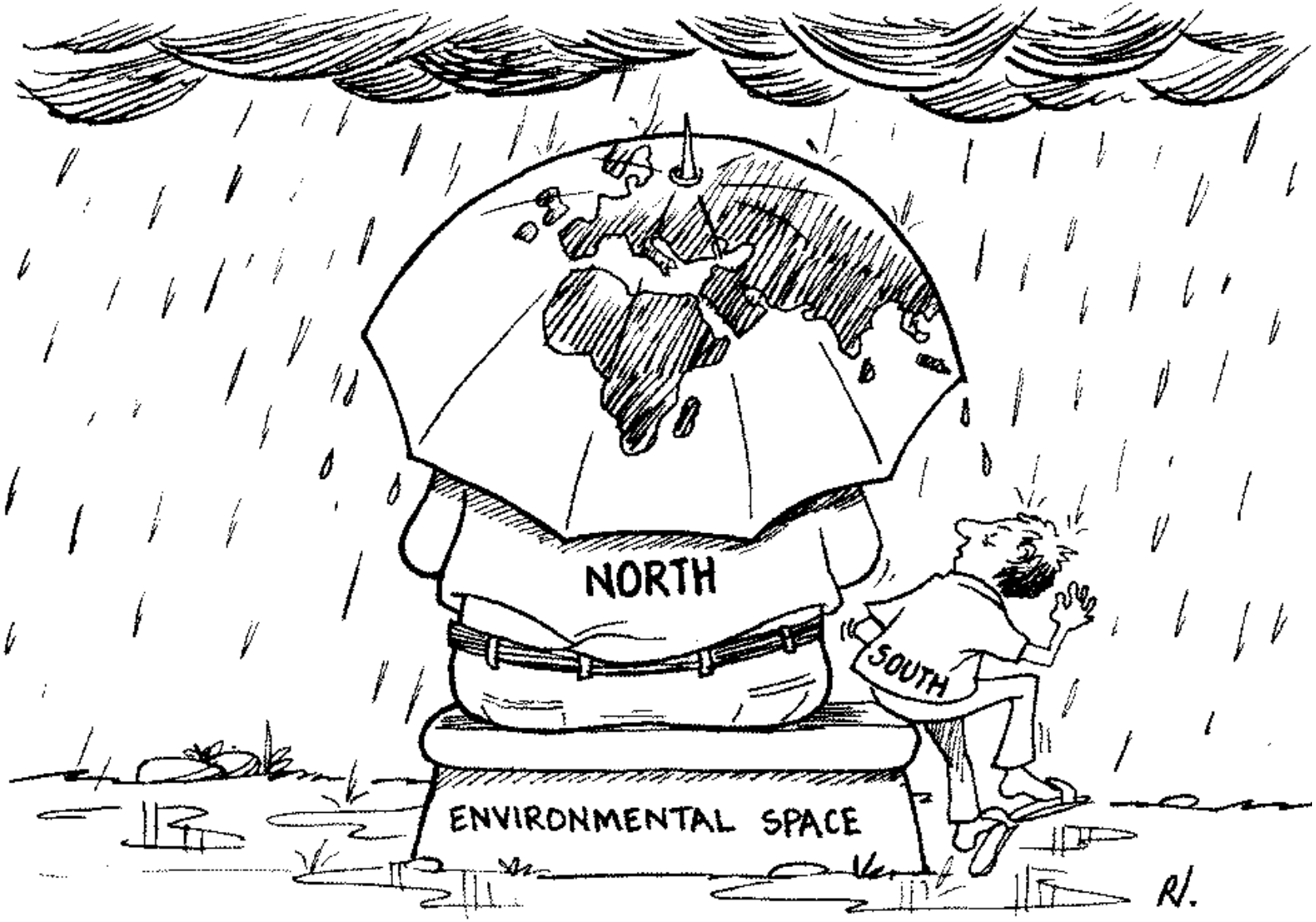
The window for action is rapidly closing

65% of the carbon budget compatible with a 2° C goal is already used
NB: this is with a probability greater than 66% to stay below 2° C



NB: Emissions in 2011: 38 GtCO2/yr

AR5 WGI SPM



Agarwal et al., 1999

Key Mitigation Measures

More efficient use of energy

Much greater use of low-carbon and no-carbon energy

Improved carbon sinks (reduce deforestation, reforest, protect soil carbon)

Lifestyle and behavioural changes

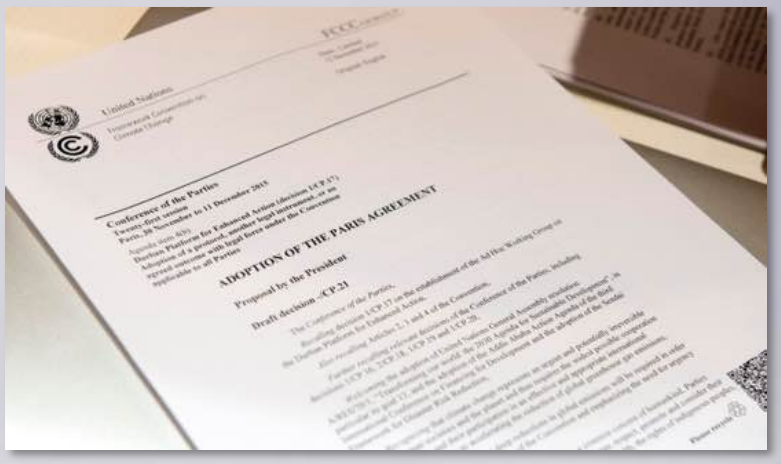
AR5 WGIII SPM

- **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**

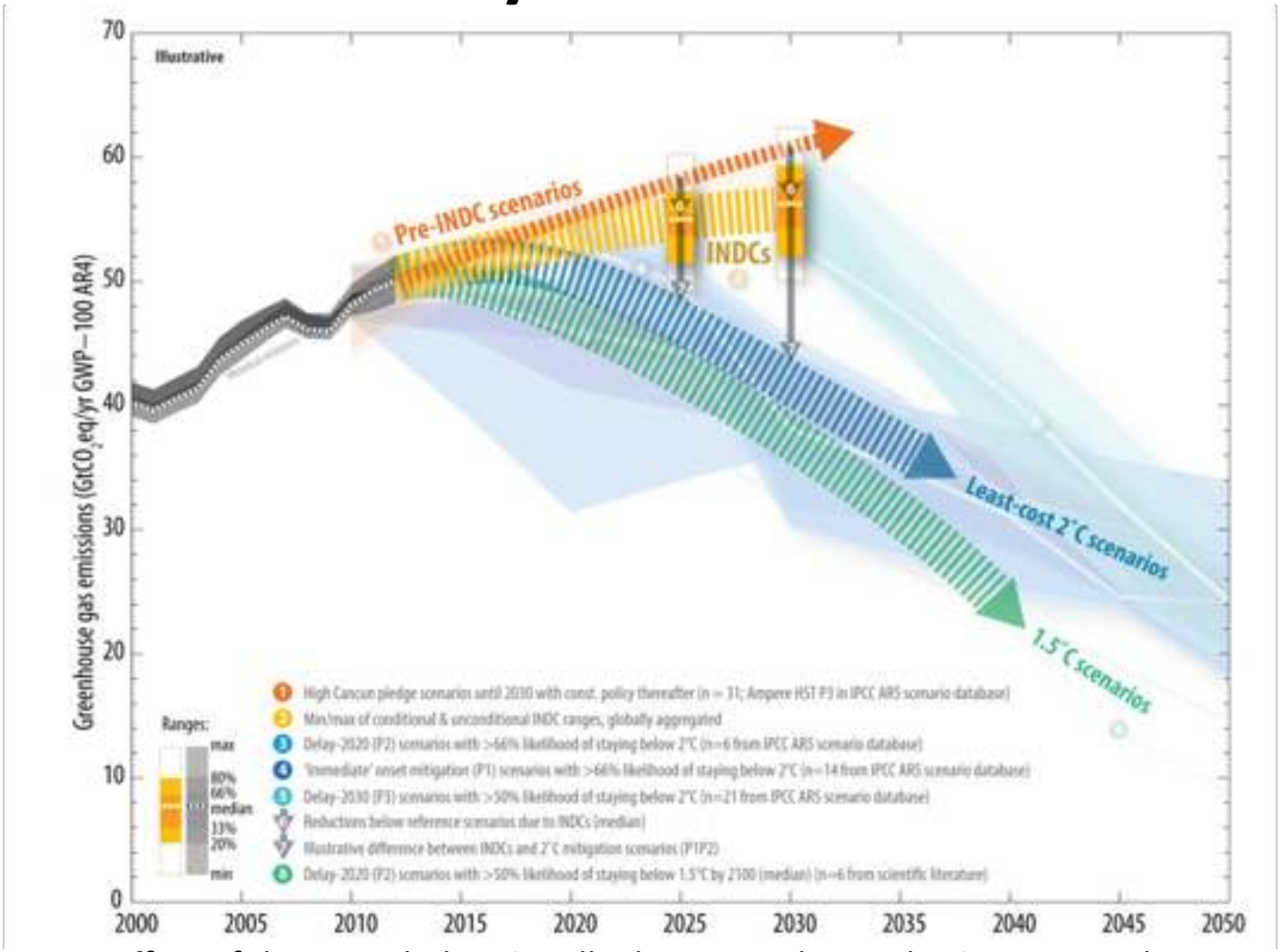
ur les Changements Climatiques 2015

COP21/CMP11

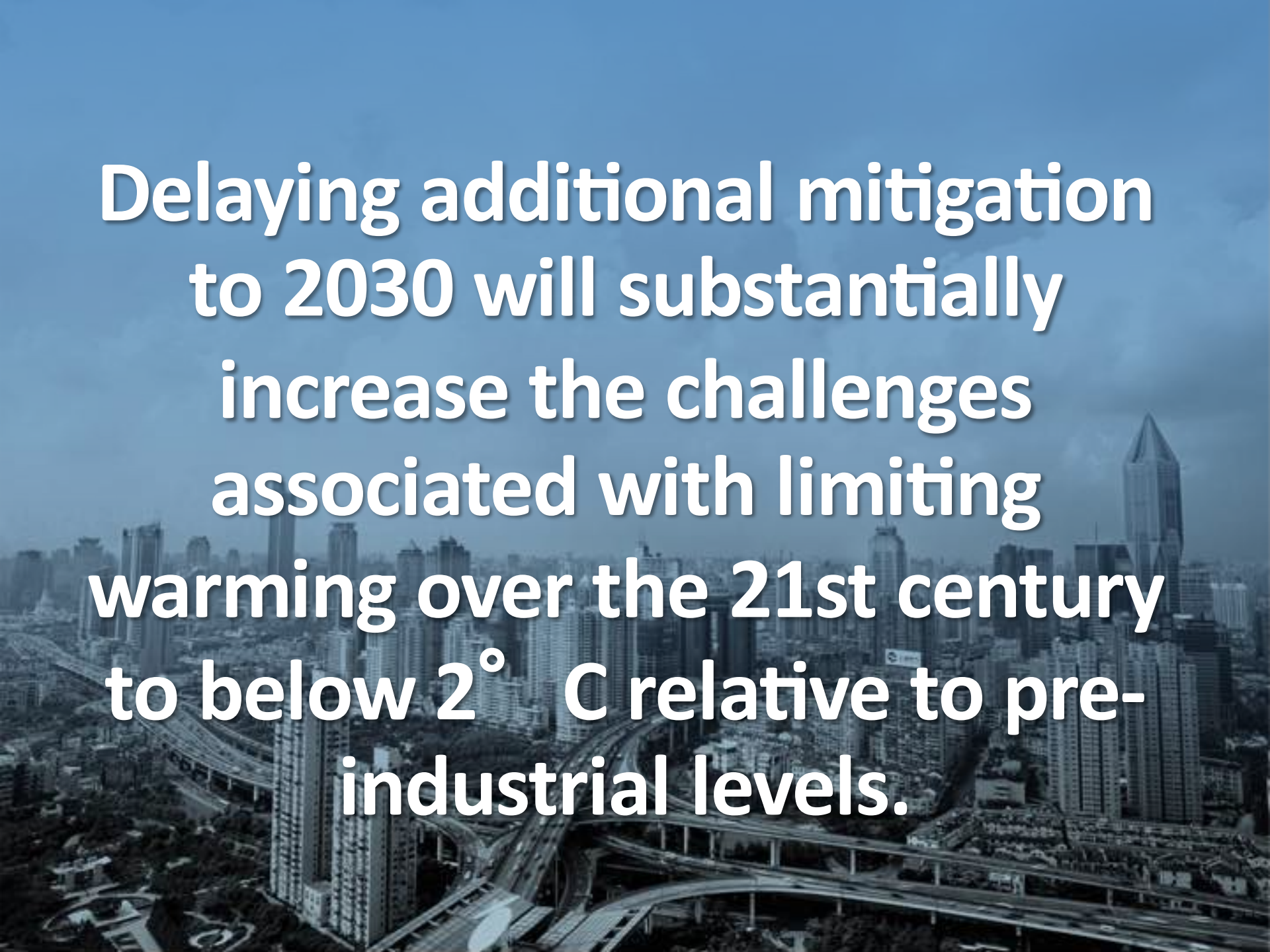
Paris, France



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


Delaying additional mitigation to 2030 will substantially increase the challenges associated with limiting warming over the 21st century to below 2° C relative to pre-industrial levels.


YO! AMIGO!!
WE NEED THAT TREE TO PROTECT US FROM THE GREENHOUSE EFFECT!
!?
DEVELOPED COUNTRIES

Walking the talk…

- Energy audit of our home
- Strong external insulation (wood fibre)
- Ultra-efficient windows
- Airtightness inspecting + heat-recovery mechanical ventilation
- Oil furnace replaced by geothermal heat pump principally fed with PV pannels
- Non-tropical wood
- Small, used electric car
- Electric bicycles

Trying to practice what I « preach »

Trying to practice what I « preach »

Some hints about what the IPCC Special Report on 1.5°C Warming will likely say:

1.5°C matters: reducing the warming, even by tenths of a °C, can make large differences for impacts, as many of these are non-linear, that is they worsen faster with warming than the warming itself.

The probability of extremes (heat waves, drought, floods, extreme sea level) is significantly lower in a 1.5°C world than in a 2°C world

1.5°C is much safer than 2°C in terms of long-term sea-level rise associated to ice-sheet processes, particularly for low-lying regions

Personal conclusions

Lower impacts with 1.5°C would make adaptation less costly than in 2°C world, even if there is a temporary overshoot above 1.5°C

It is very ambitious to reduce net emissions fast enough to ZERO for a 1.5°C long-term average temperature above pre-industrial objective; a little easier with overshoot above 1.5°C for a short period

The slower radical changes in emission patterns take place, the more we may need uncertain or risky technologies, such as large use of carbon dioxide removal from the atmosphere (possibly at the expense of bio-energy competition with food production)

Decision making needs the best scientific information possible – the IPCC SR 1.5 will be essential, but much can be done to raise ambition without waiting for it

RCP2.6 RCP8.5

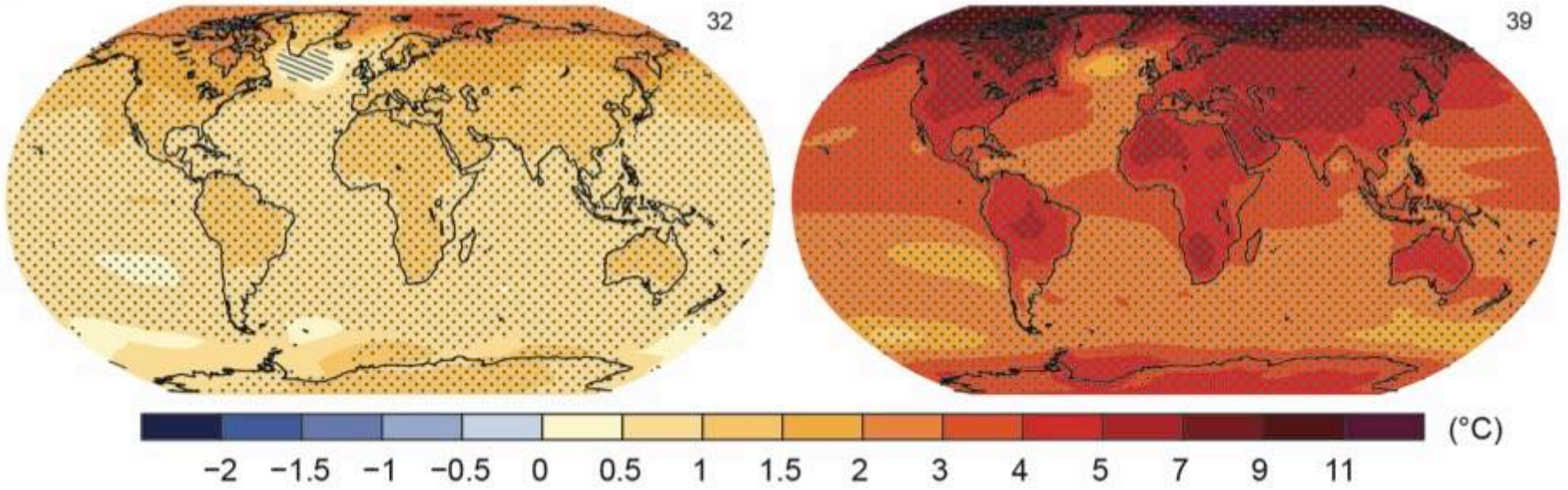
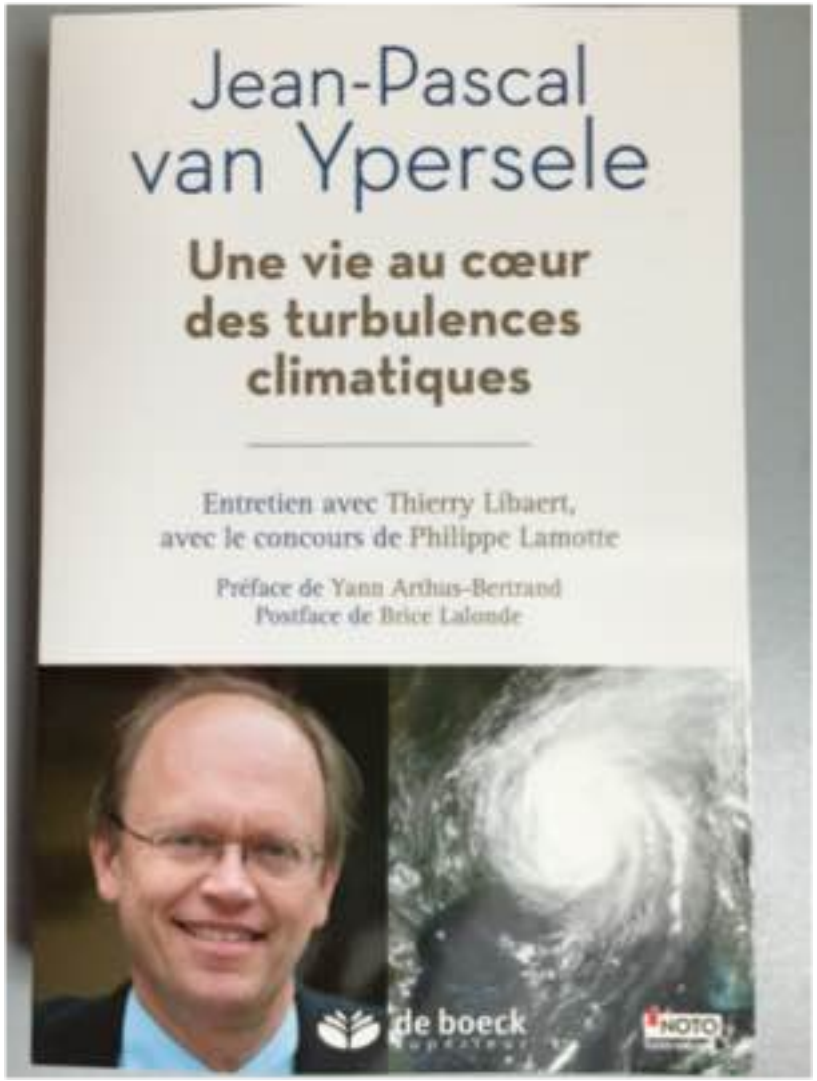


Fig. SPM.8

Humanity has the choice

SUSTAINABLE DEVELOPMENT GOALS

Publié chez De Boeck supérieur, octobre 2015



To go further :

- www.climate.be/vanyp : my slides (under « conferences)
- www.ipcc.ch : IPCC
- www.skepticalscience.com : answers to the merchants of doubt arguments
- www.plateforme-wallonne-giec.be : Plateforme d'information en français sur le GIEC
- **Twitter: @JPvanYpersele**
  @IPCC_CH