

# **Climate Alert in the Arctic: The Urgency to Act**

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

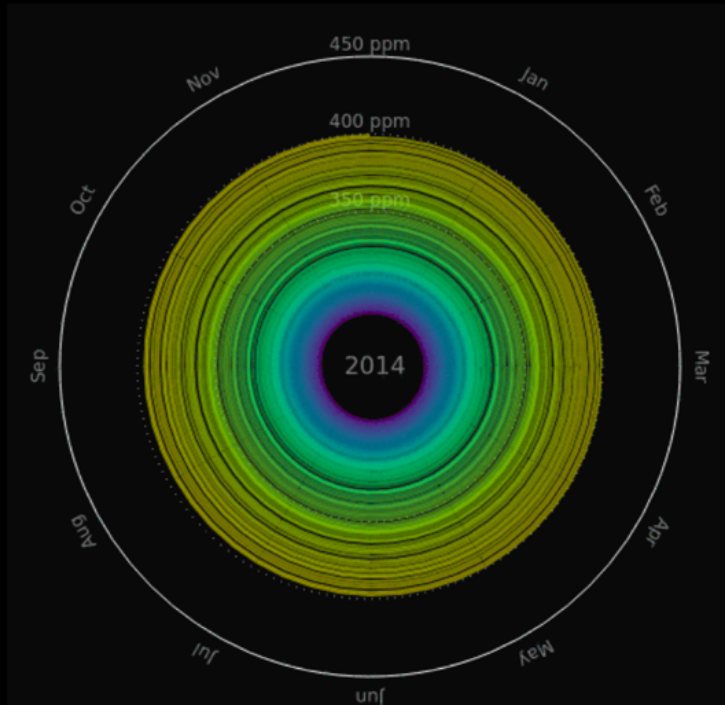
IT'S BAD

The impacts are serious and affect people.

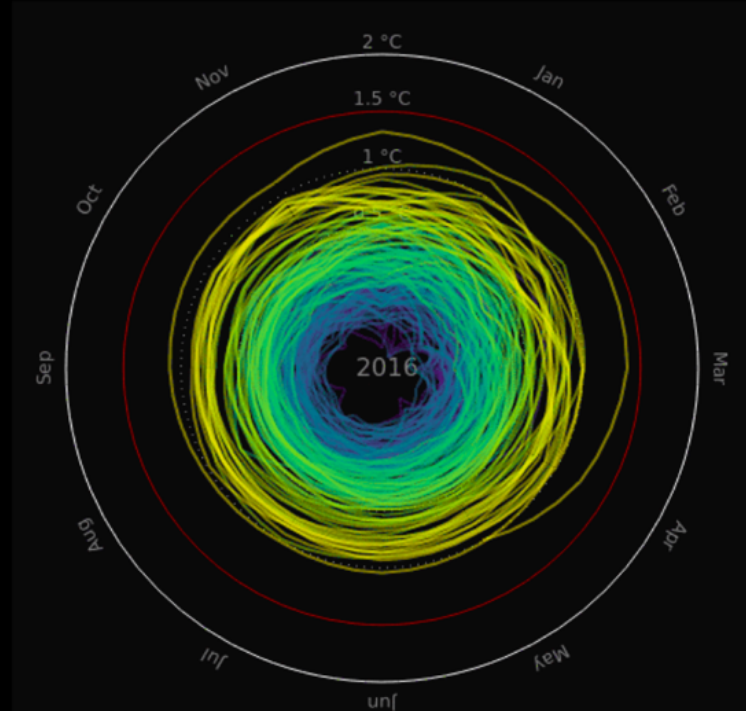
THERE'S HOPE

We have the technology needed to avoid the worst climate impacts.

# CO<sub>2</sub> Concentration and Temperature spirals



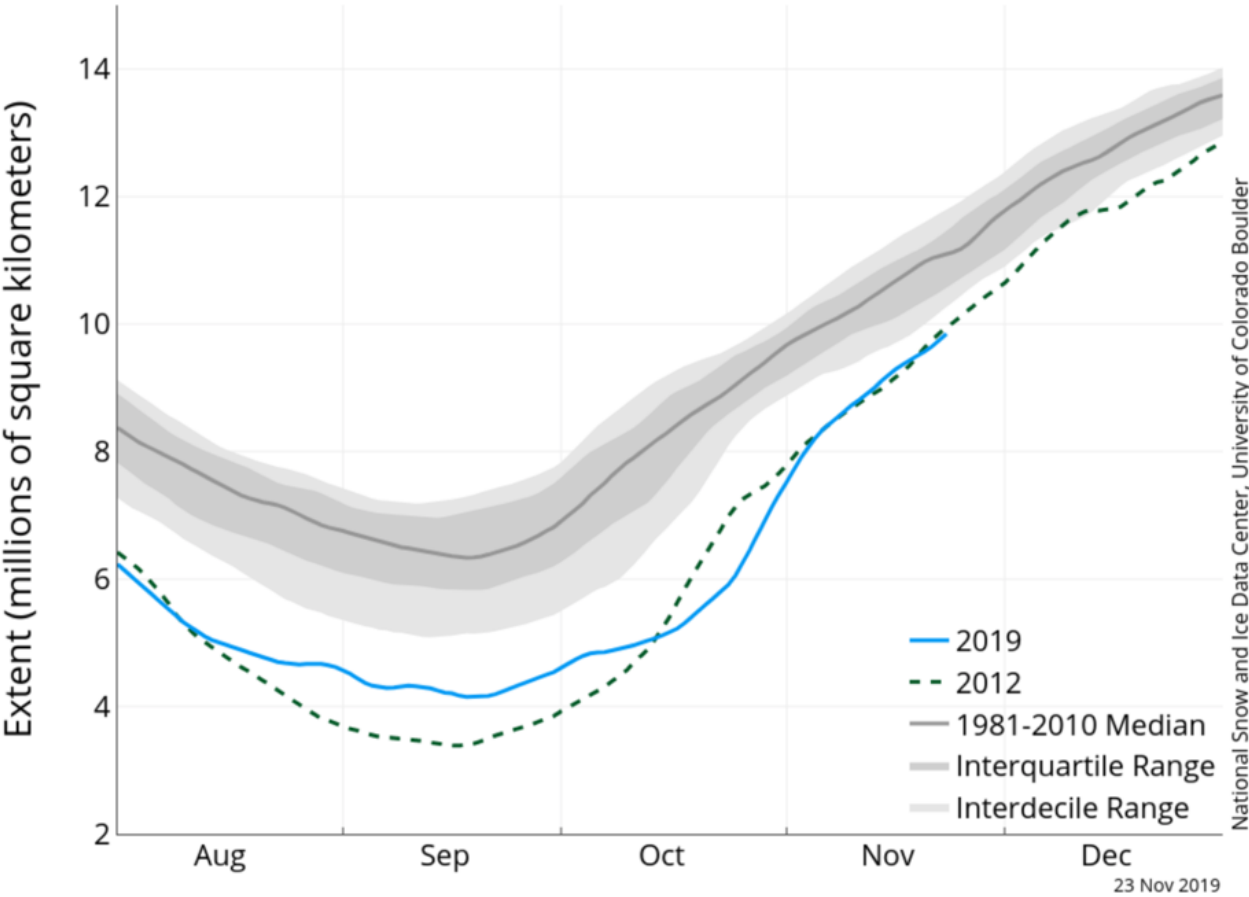
Concentration Spiral pik-potsdam.de/primap-live/ & climatecollege.unimelb.edu.au, Gieseke, Meinshausen. Thx to Ed Hawkins



Temperature Spiral pik-potsdam.de/primap-live & climatecollege.unimelb.edu.au, Gieseke, Meinshausen. Thx to Ed Hawkins

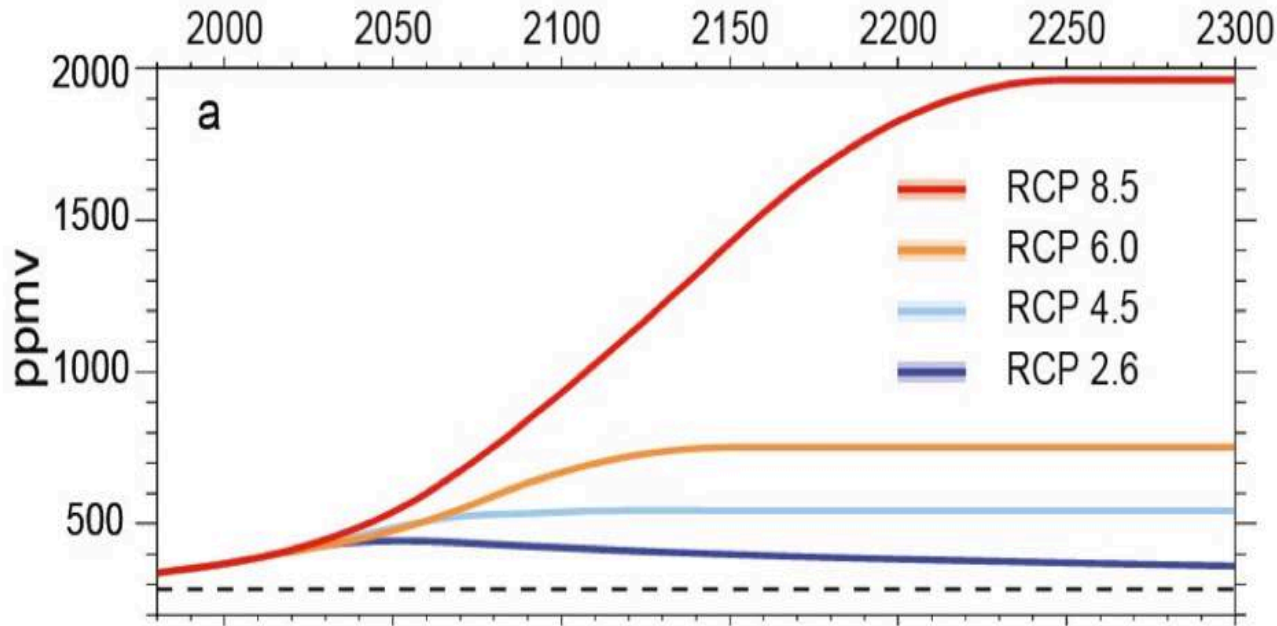
CO<sub>2</sub> Concentration since 1850 and Global Mean Temperature in °C relative to 1850 – 1900  
Graph: Ed Hawkins (Climate Lab Book) – Data: HadCRUT4 global temperature dataset  
Animation available on <http://openclimatedata.net/climate-spirals/concentration-temperature/>

# Arctic Sea Ice Extent (Area of ocean with at least 15% sea ice)



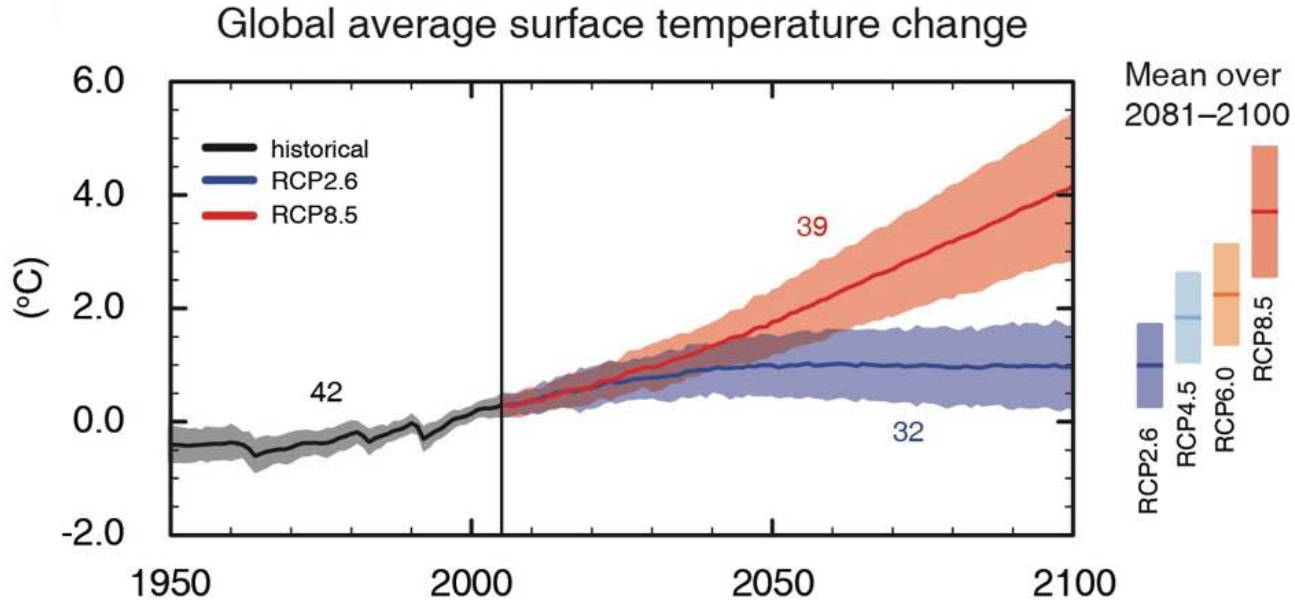
National Snow and Ice Data Center, University of Colorado Boulder

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



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

# Projected global temperature increase during 21st century



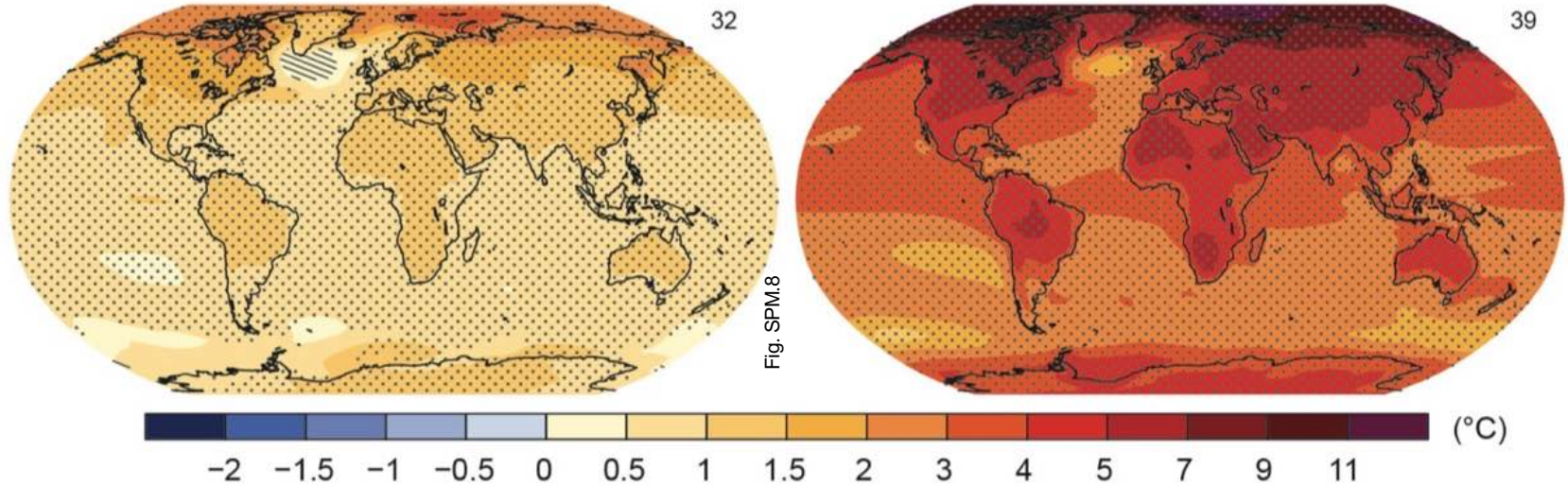
(IPCC 2013, Fig. SPM.7a)



# RCP2.6

# RCP8.5

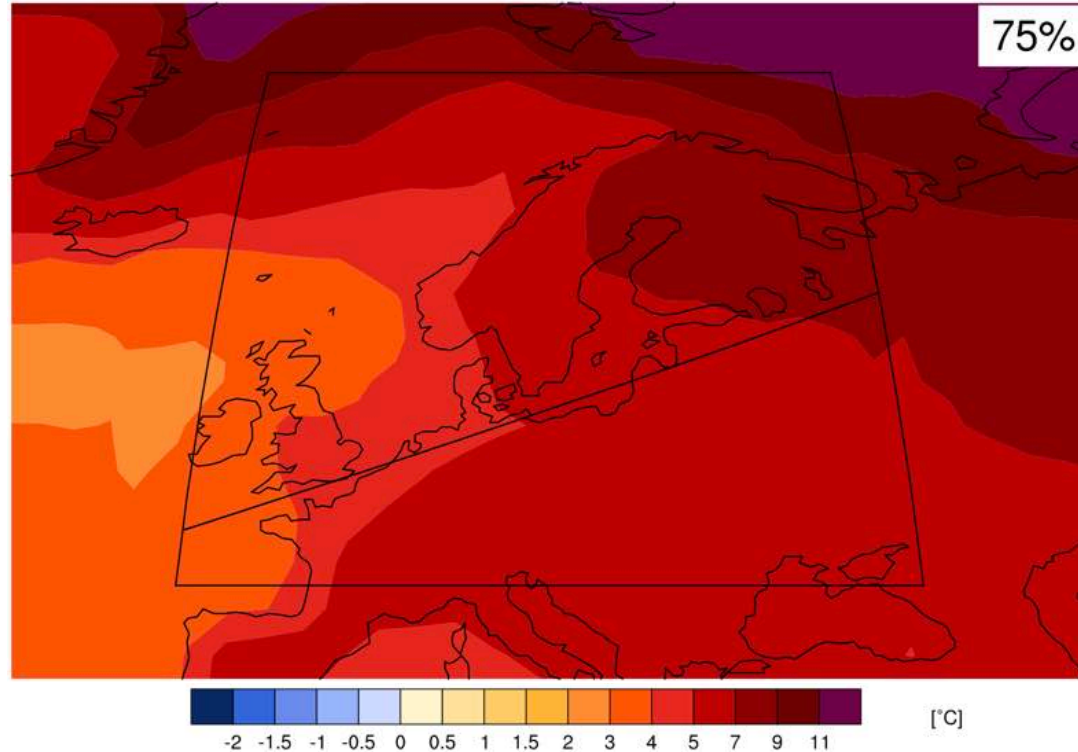
a) Change in average surface temperature (1986–2005 to 2081–2100)



**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)





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# The Ocean and Cryosphere in a Changing Climate

This Summary for Policymakers was formally approved at the Second Joint Session of Working Groups I and II of the IPCC and accepted by the 51st Session of the IPCC, Principality of Monaco, 24th September 2019

Summary for Policymakers



WG I WG II



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WG I WG II



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# Plateau Glacier (1961) (Alaska)



[http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm\\_ven=Email&cm\\_cat=ENVIRONMENT\\_us\\_share](http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share)

# Plateau Glacier (2003) (Alaska)



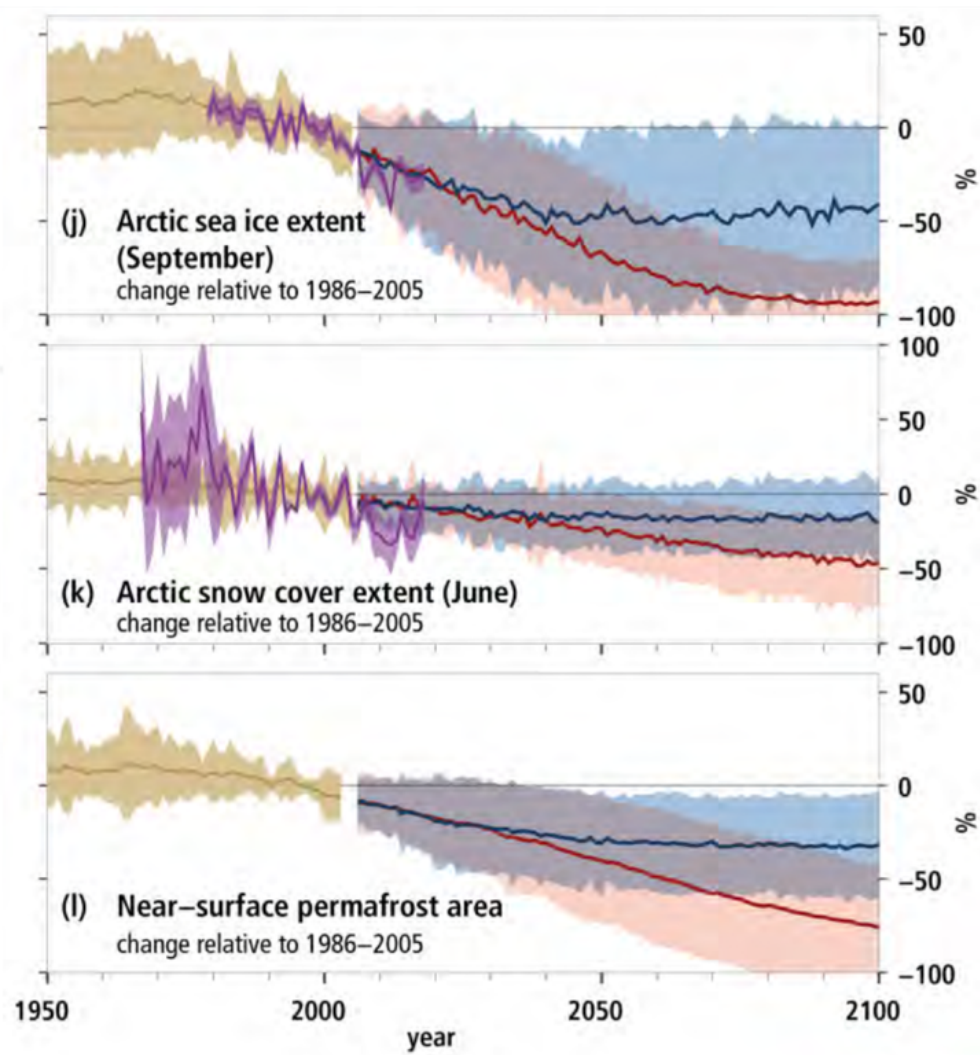
[http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm\\_ven=Email&cm\\_cat=ENVIRONMENT\\_us\\_share](http://www.weather.com/news/science/environment/alaskas-glaciers-capturing-earth-changing-our-eyes-20131125?cm_ven=Email&cm_cat=ENVIRONMENT_us_share)



## Changes in polar regions

- The Greenland and Antarctic ice sheets are losing mass, accelerating global sea level rise. They will continue to melt, committing the planet to **long-term** global sea level rise.
- **Arctic sea ice is declining in every month of the year**, and is getting thinner.
- At global warming of 1.5°C, the Arctic Ocean will **rarely be free of sea ice** in September. At 2°C warming, this will occur **up to one year in three**.







## Changes in polar regions

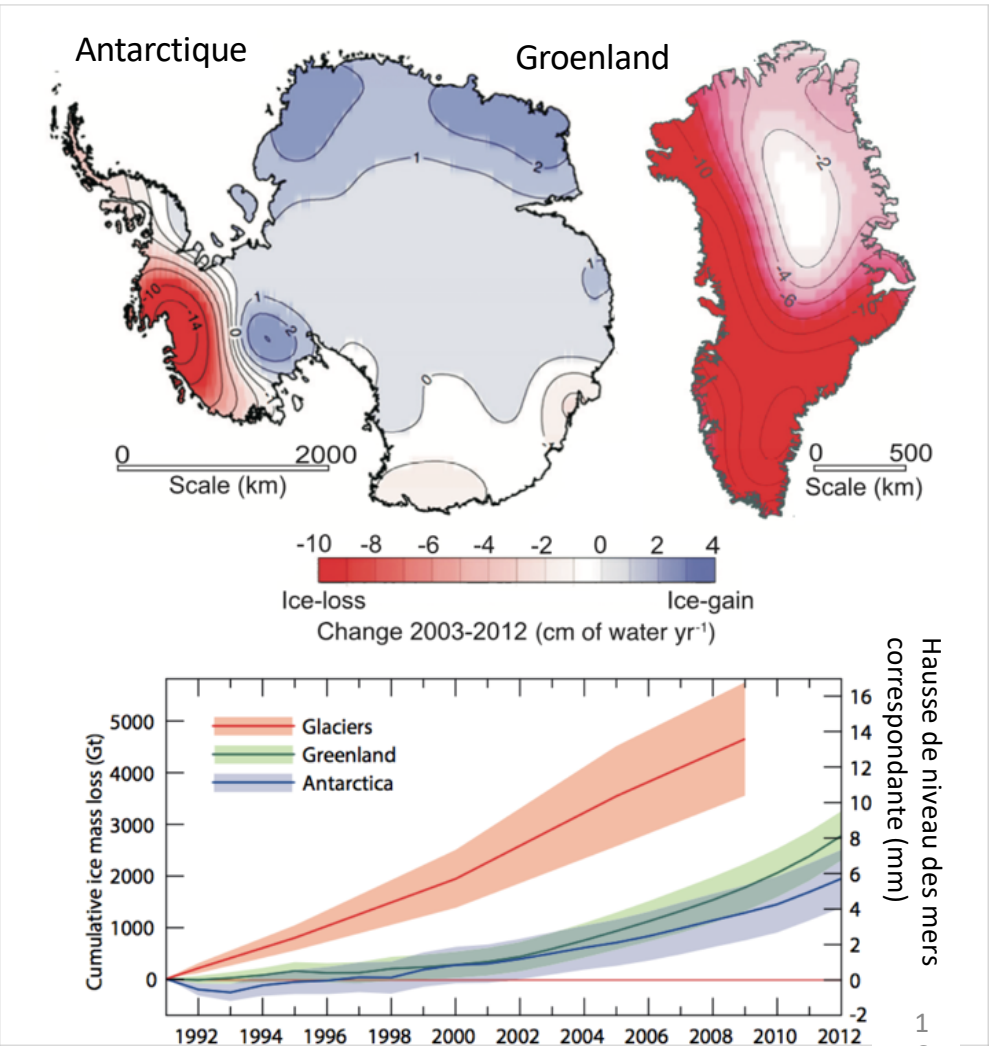
- Permafrost is **thawing**, with the potential of **adding more greenhouse gases to the atmosphere**, as it contains **almost 2X the carbon in the atmosphere**
- With global warming limited to well below 2°C, **around one quarter** of near-surface permafrost will thaw by 2100. If emissions continue to increase strongly, **around 70% near-surface permafrost could be lost**.
- People living in the Arctic, especially indigenous peoples, are already **adjusting their travel and hunting activities** to the seasonality and safety of land, ice and snow conditions. Their success in adapting depends on **funding, capacities and institutional support**.



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

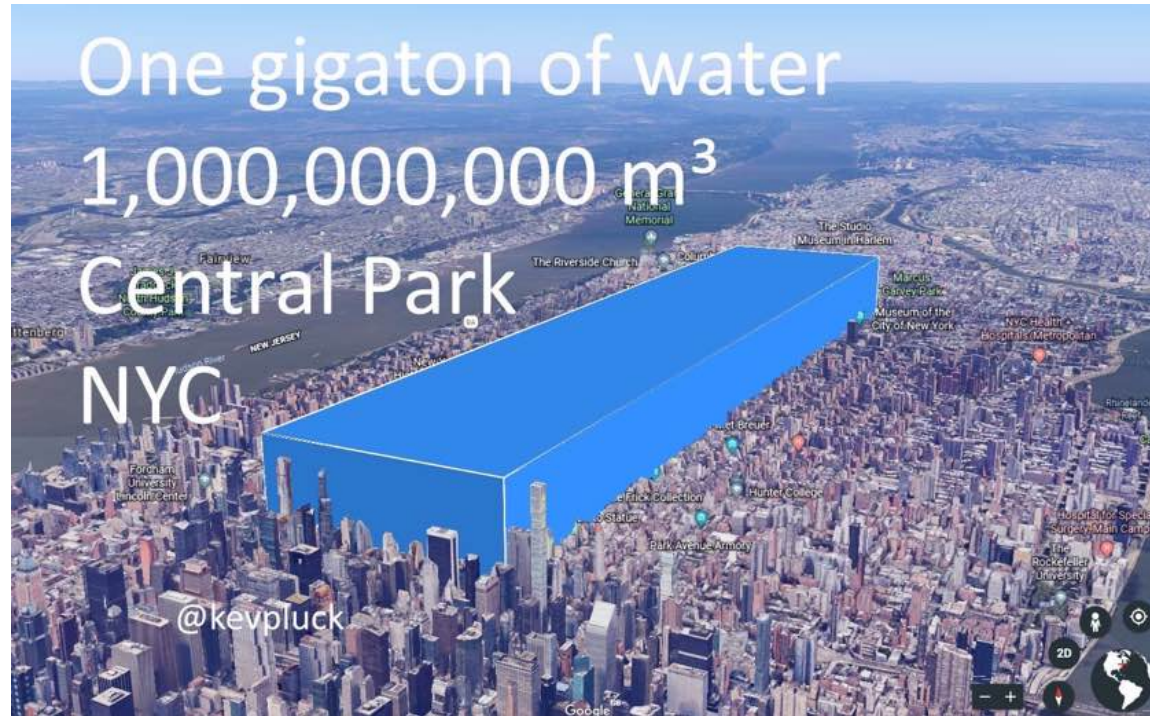
There is therefore a very high risk that average sea level would increase by several metres over the next century or two

# Greenland and Antarctica lose ice

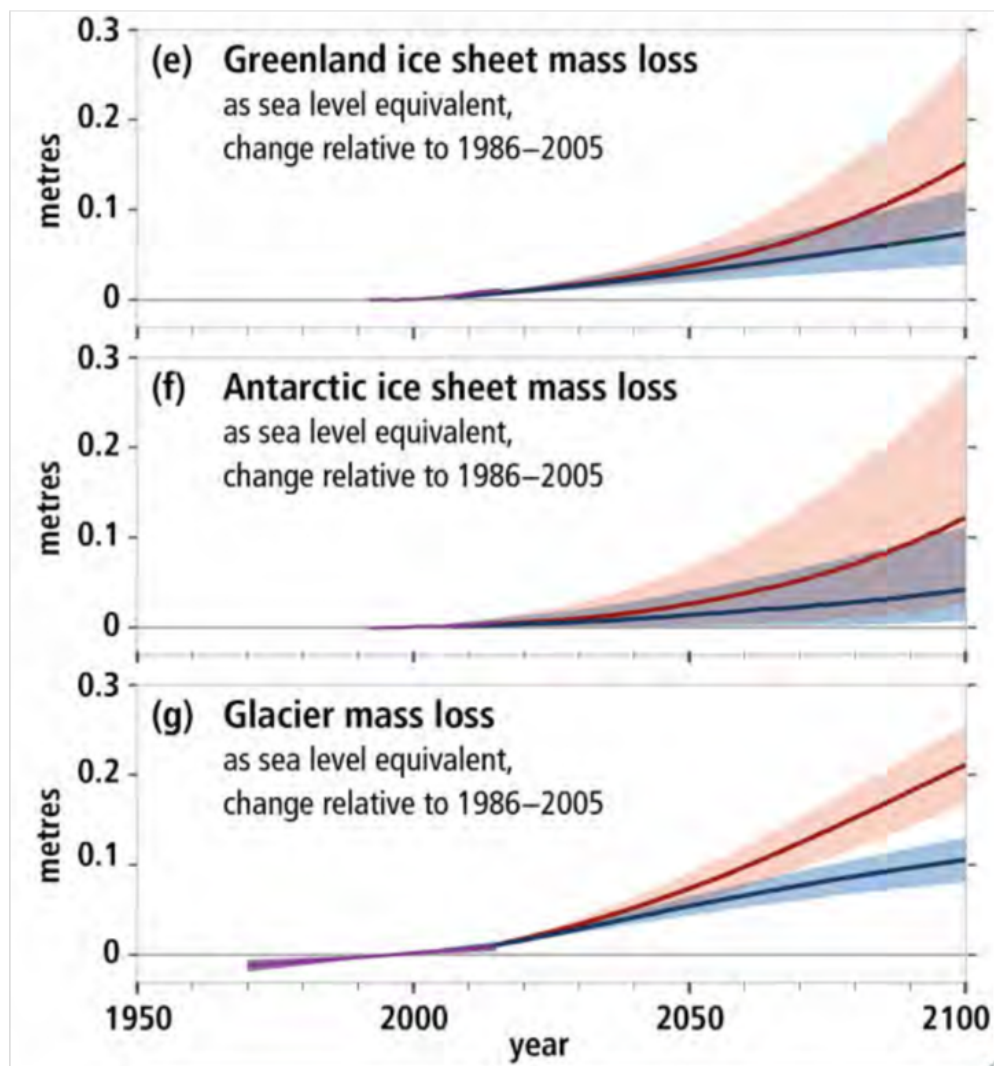


Source: IPCC AR5 WG1 fig TS.3

# The Greenland Ice Sheet presently loses 1 Gt of water every 30 hours (280 Gt/yr)



Source: @Kevpluck, June 2018



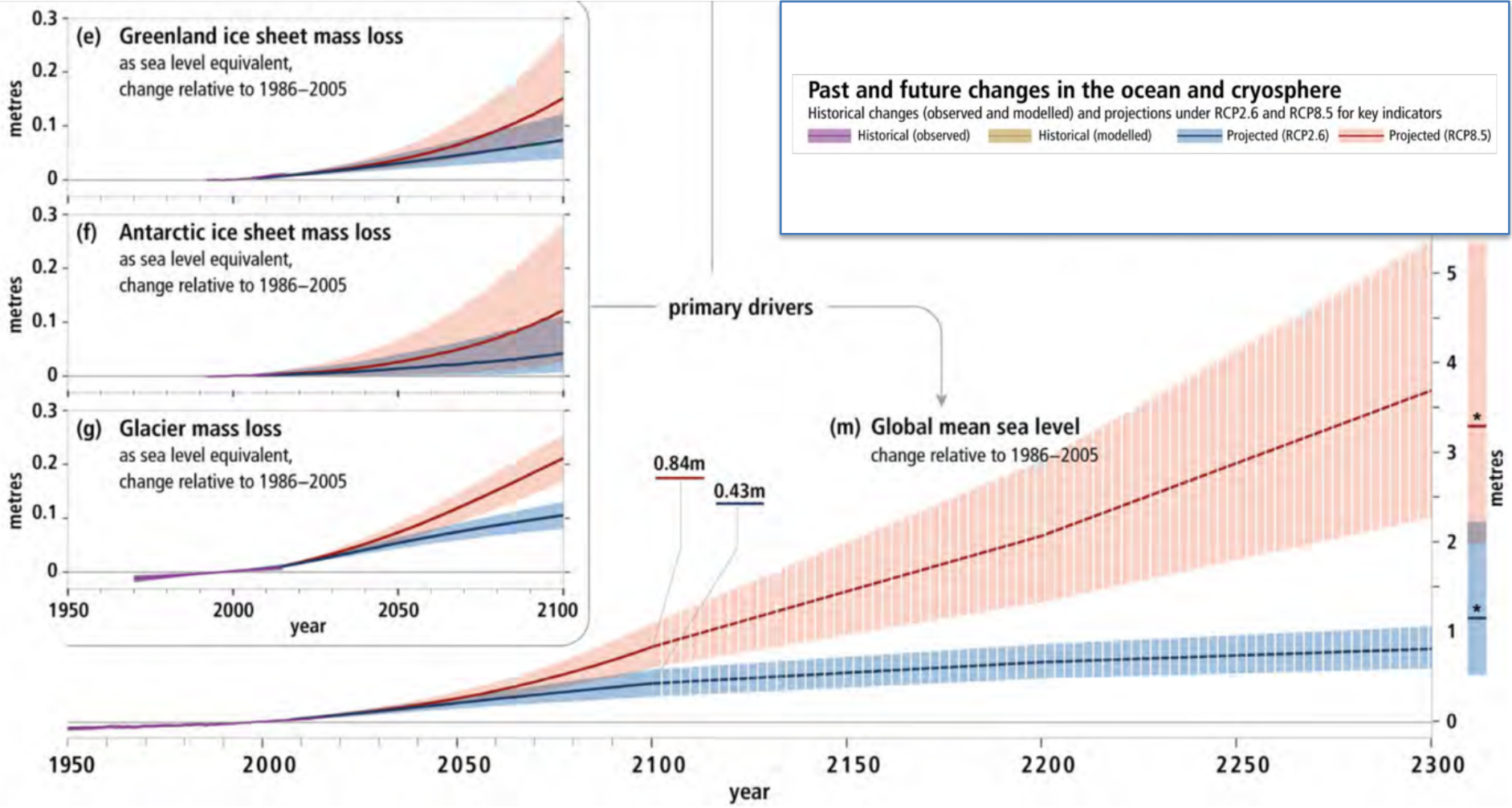
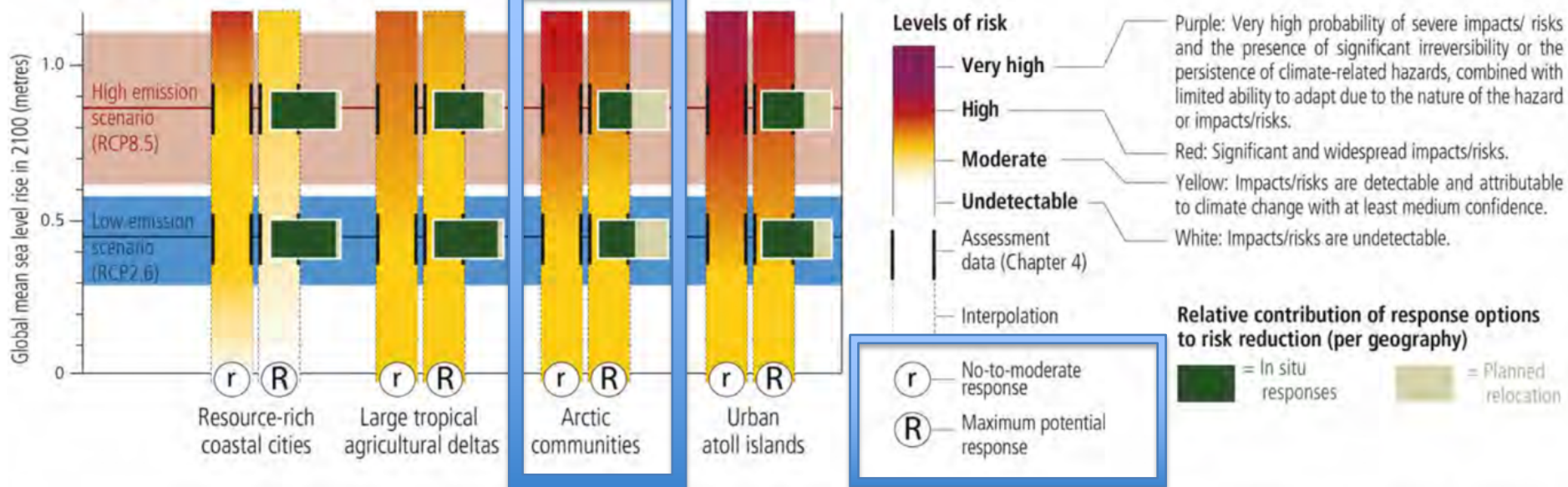


Figure showing projected sea level rise from 2100 to 2300 under RCP2.6 and RCP8.5 scenarios, including historical and projected mass loss from Greenland, Antarctica, and glaciers.



### (a) Risk in 2100 under different sea level rise and response scenarios

Risk for illustrative geographies based on mean sea level changes (*medium confidence*)



In this assessment, the term response refers to in situ responses to sea level rise (hard engineered coastal defenses, restoration of degraded ecosystems, subsidence limitation) and planned relocation. Planned relocation in this assessment refers to proactive managed retreat or resettlement only at a local scale, and according to the specificities of a particular context (e.g. in urban atoll islands: within the island, in a neighbouring island or in artificially raised islands). Forced displacement and international migration are not considered in this assessment.





## Knowledge for action

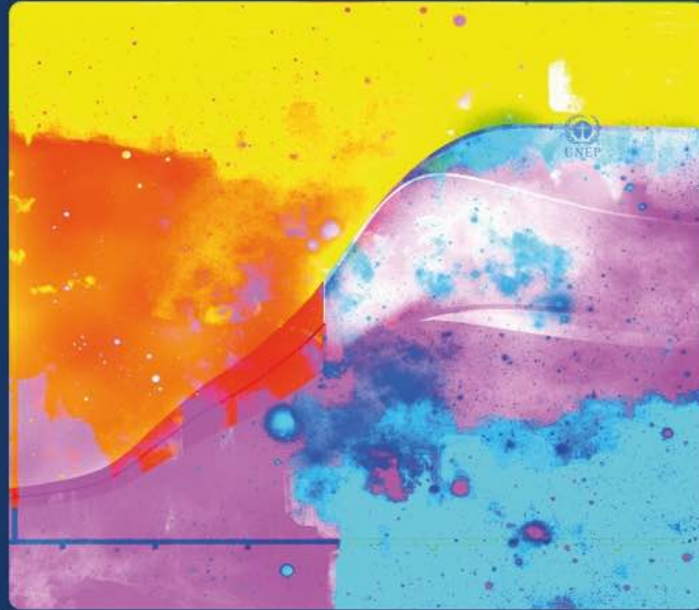
The IPCC Special Report on the Ocean and Cryosphere in a Changing Climate

- highlights **the urgency** of prioritizing **timely, ambitious and coordinated action** to address **widespread and enduring changes** in the ocean and cryosphere;
- empowers people, communities and governments to tackle the unprecedented transitions in all aspects of society;
- provides evidence of the benefits of combining scientific with local and indigenous knowledge;
- focuses, for the first time, on the importance of education and climate literacy.

## The SR15

# 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.

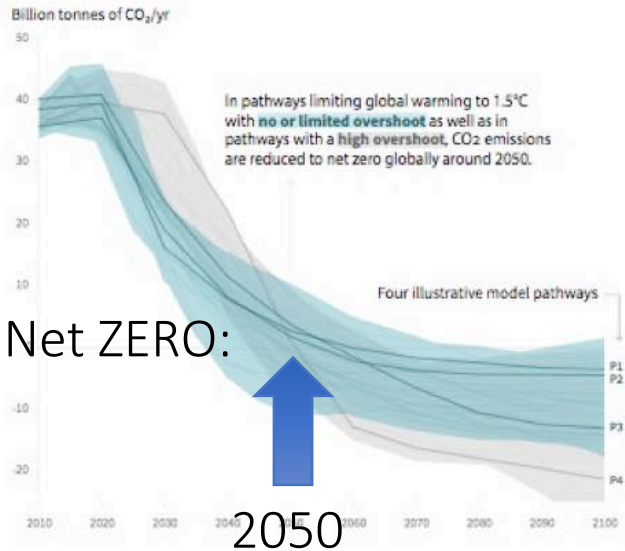


# To stay below 1.5°C warming:

## Global emissions pathway characteristics

General characteristics of the evolution of anthropogenic net emissions of CO<sub>2</sub>, and total emissions of methane, black carbon, and nitrous oxide in model pathways that limit global warming to 1.5°C with no or limited overshoot. Net emissions are defined as anthropogenic emissions reduced by anthropogenic removals. Reductions in net emissions can be achieved through different portfolios of mitigation measures illustrated in Figure SPM3B.

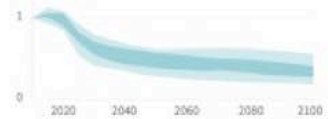
### Global total net CO<sub>2</sub> emissions



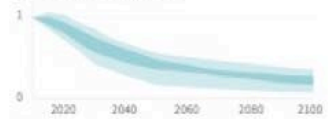
### Non-CO<sub>2</sub> emissions relative to 2010

Emissions of non-CO<sub>2</sub> forcers are also reduced or limited in pathways limiting global warming to 1.5°C with **no or limited overshoot**, but they do not reach zero globally.

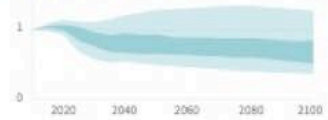
#### Methane emissions



#### Black carbon emissions



#### Nitrous oxide emissions



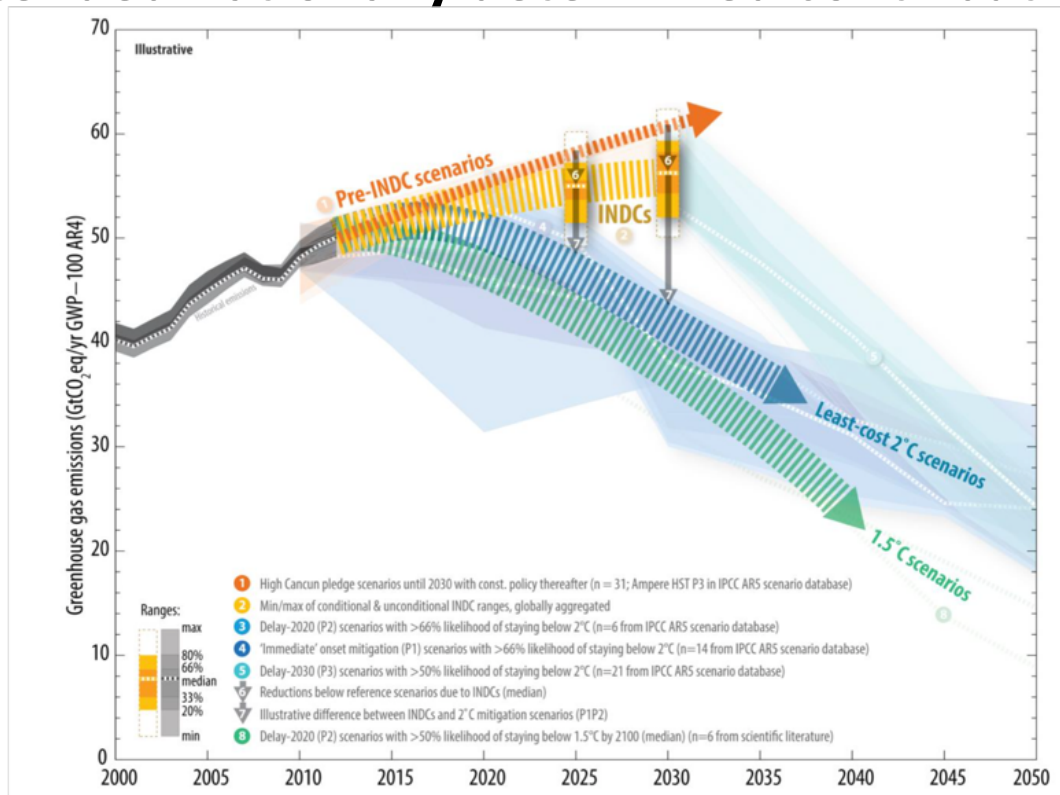
Source: IPCC SR15

Source: IPCC Special Report on Global Warming of 1.5°C

**Fact: The present national plans (NDCs) introduced ahead of the Paris Agreement are far from what is needed to respect the 1.5° C objective, and even to stay below 2° C warming**

Please note that the Paris Agreement speaks about 1.5° C and « *well below 2° C* » warming, not 2° C

# 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 more decisively and earlier we act, the more able we will be to address unavoidable changes, manage risks, improve our lives and achieve sustainability for ecosystems and people around the world – today and in the future.**

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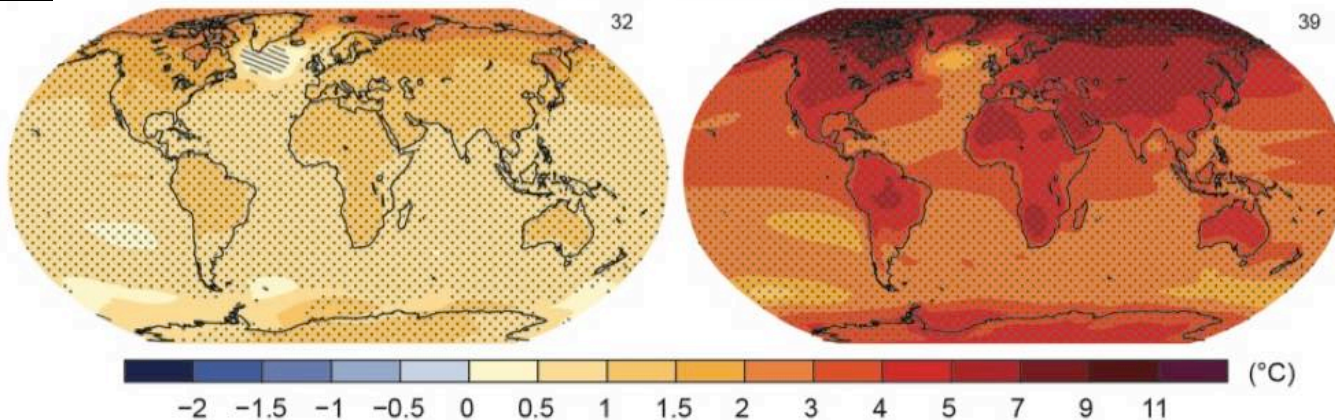


## RCP2.6

## RCP8.5

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

Fig. SPM.8



Humanity has the choice

## Océans et cryosphère

**L**e rapport spécial sur l'Océan et la cryosphère dans le contexte des changements climatiques a été adopté par l'Assemblée plénière du GIEC le 25 septembre 2019 à Monaco.

Dans cette Lettre, nous présentons d'abord un aperçu des principaux éléments de l'évaluation du GIEC, sous une forme accessible et illustrée d'éléments concrets.

Ensuite, trois scientifiques belges nous font bénéficier de leur expertise en présentant chacun un sujet important lié au rapport : la fonte des glaces du Groenland et de l'Antarctique, leurs mécanismes et leur impact sur le niveau des mers, et la perte d'oxygène des océans, perturbation anthropique moins souvent abordée mais à laquelle les changements climatiques contribuent également.

Nous vous souhaitons une agréable lecture de cette Lettre !

Philippe Mathais, Bruna Galno et Jean-Pascal van Ypersele

### Sommaire

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Niveau des mers : toujours plus haut	11
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Basé sur le dernier rapport du GIEC (SROCC). Complété par les articles de spécialistes, avec des liens vers des ressources utiles

Disponible gratuitement, 6X/an: [www.pplateforme-wallonne-giec.be](http://www.pplateforme-wallonne-giec.be)

# To go further :

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