ICAO Symposium on Non-CO_2 Aviation Emissions

16 — 18 September 2024

Montréal, Canada

Jan Fuglestvedt

Research Director, CICERO
and
Vice-Chair, Working Group III
Intergovernmental Panel on Climate Change (IPCC)

Keynote Speech

ICAO

Main findings from IPCC's Sixth Assessment Report

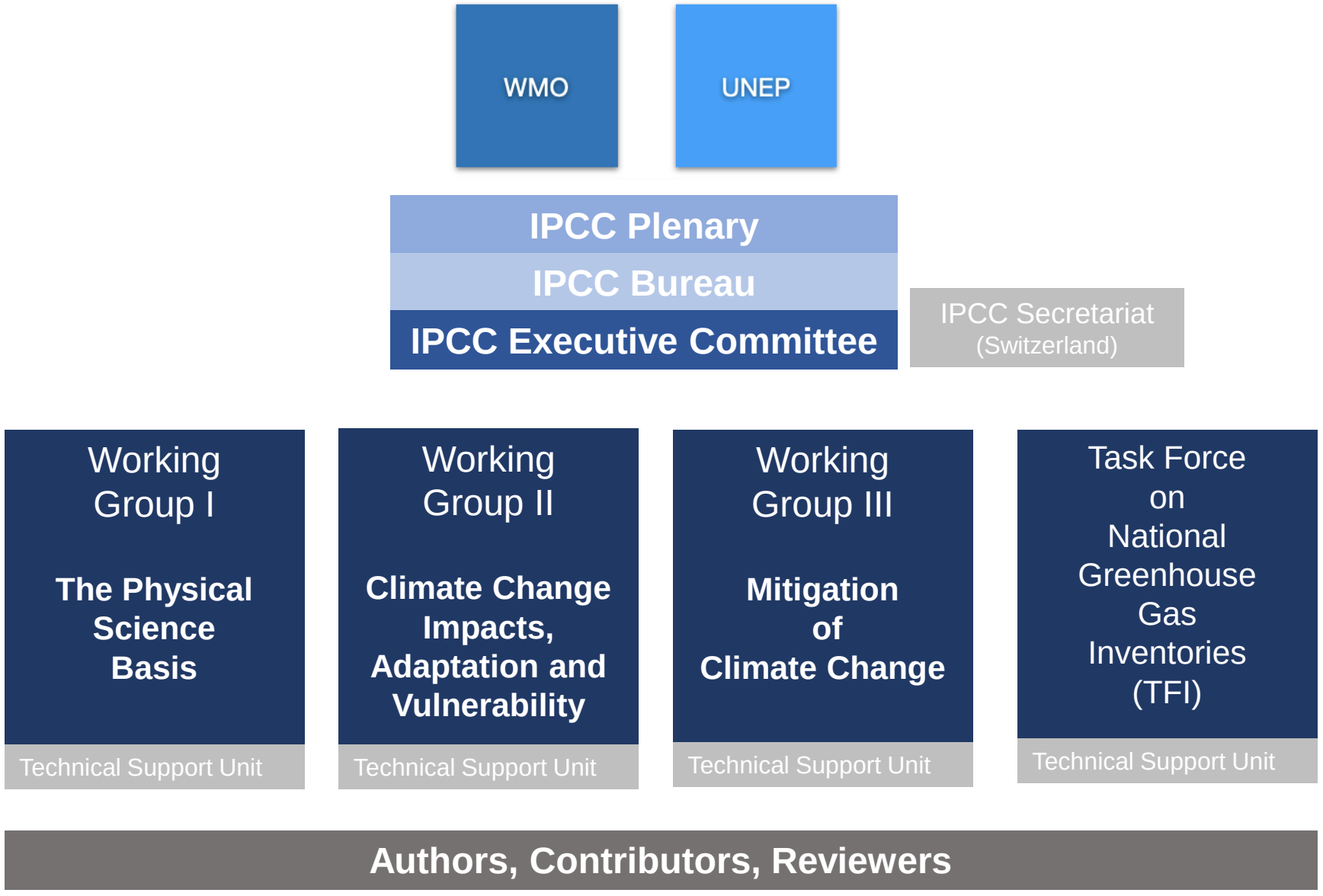
Jan Fuglestvedt

Vice-chair IPCC Working Group III

ICAO Symposium on Non-CO_2 Aviation Emissions

16-18 September 2024

IPCC Structure



The role of the IPCC

Assess the knowledge basis relevant to:

- understanding the risk of human-induced climate change
- potential impacts
- options for adaptation and mitigation

Not doing own research

Policy relevant, but not policy prescriptive

HISTORY | EVOLUTION OF THE IPCC

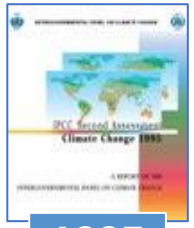
GROWTH IN SCIENTIFIC RESEARCH ON CLIMATE CHANGE

INCREASING STAKEHOLDER INVOLVEMENT

GROWING PUBLIC AWARENESS

1988

IPCC
Jointly established by WMO and UNEP



1995

SAR
Kyoto Protocol

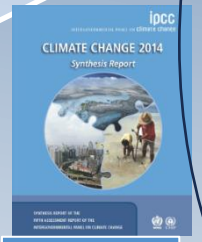
2001

TAR
Adaptation

2007

AR4
2°C limit

Nobel Peace Prize



2013-14

AR5
Paris Agreement

2018

SR15

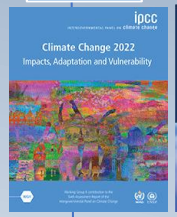
2019

2021 2022 2023

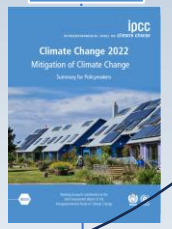
Sixth Assessment Report

WGI

WGII

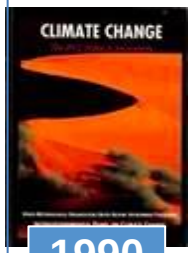


WGIII



SYR

UNFCCC
Global Stocktake



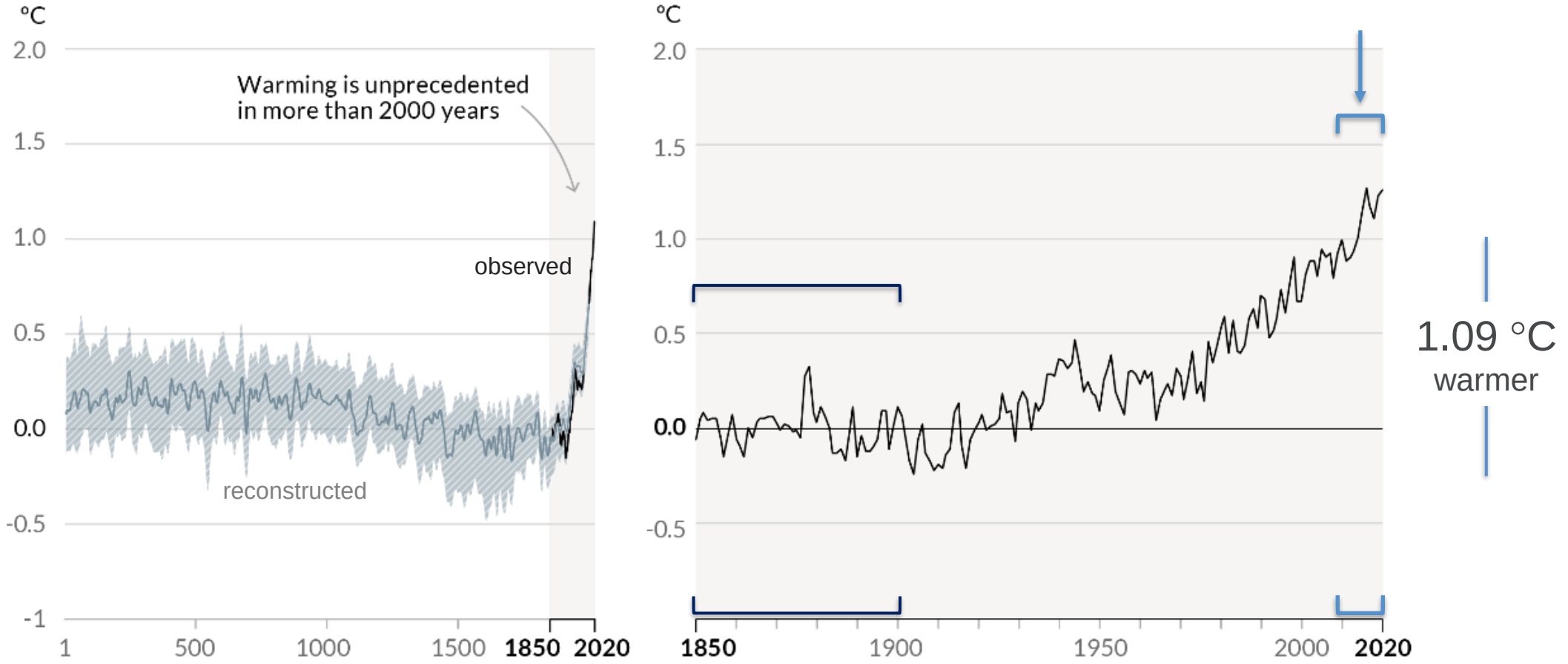
1990

FAR
UNFCCC

1980 — 2000 — 2010 — 2020 — 2030

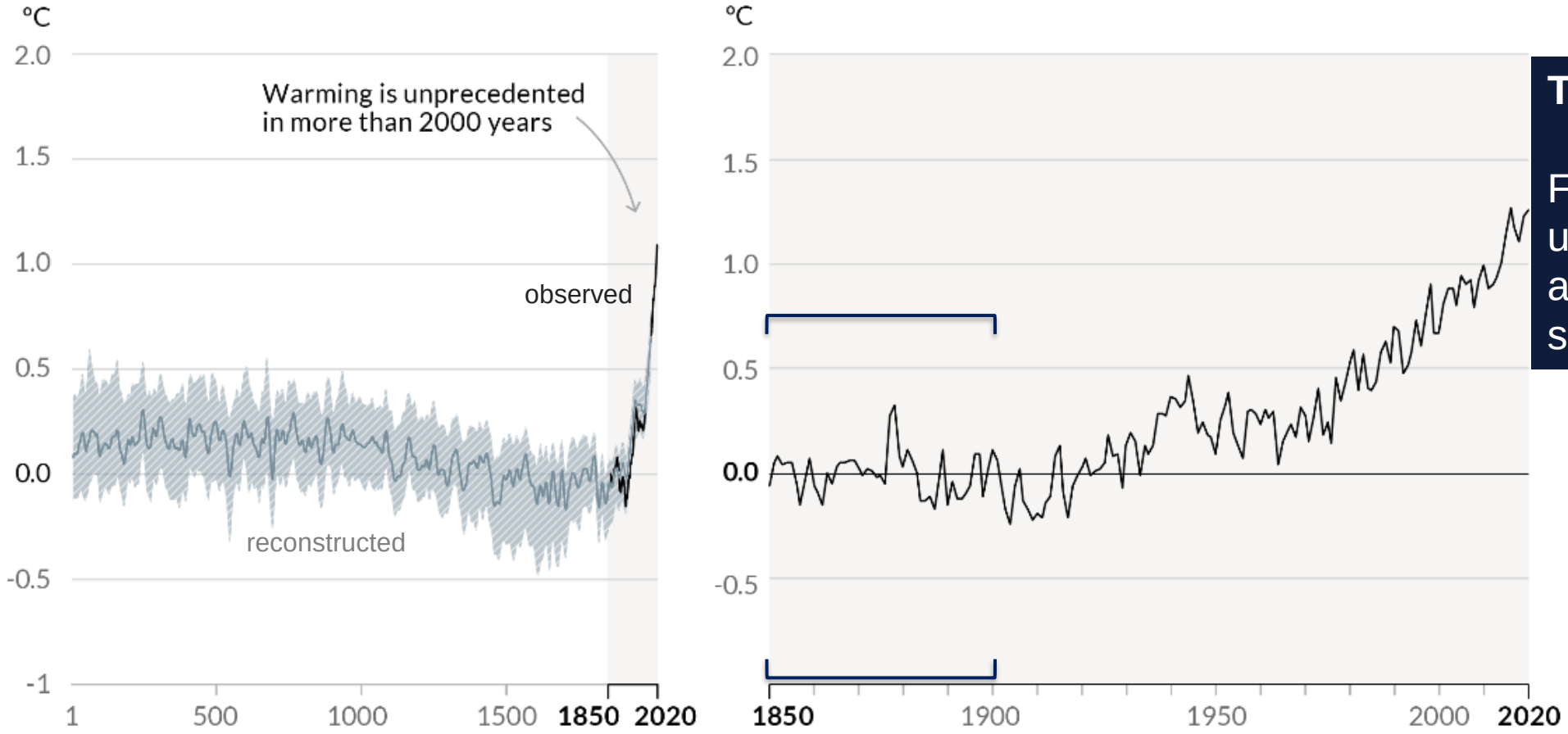
Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

Changes in global surface temperature relative to 1850-1900



Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

Changes in global surface temperature relative to 1850-1900

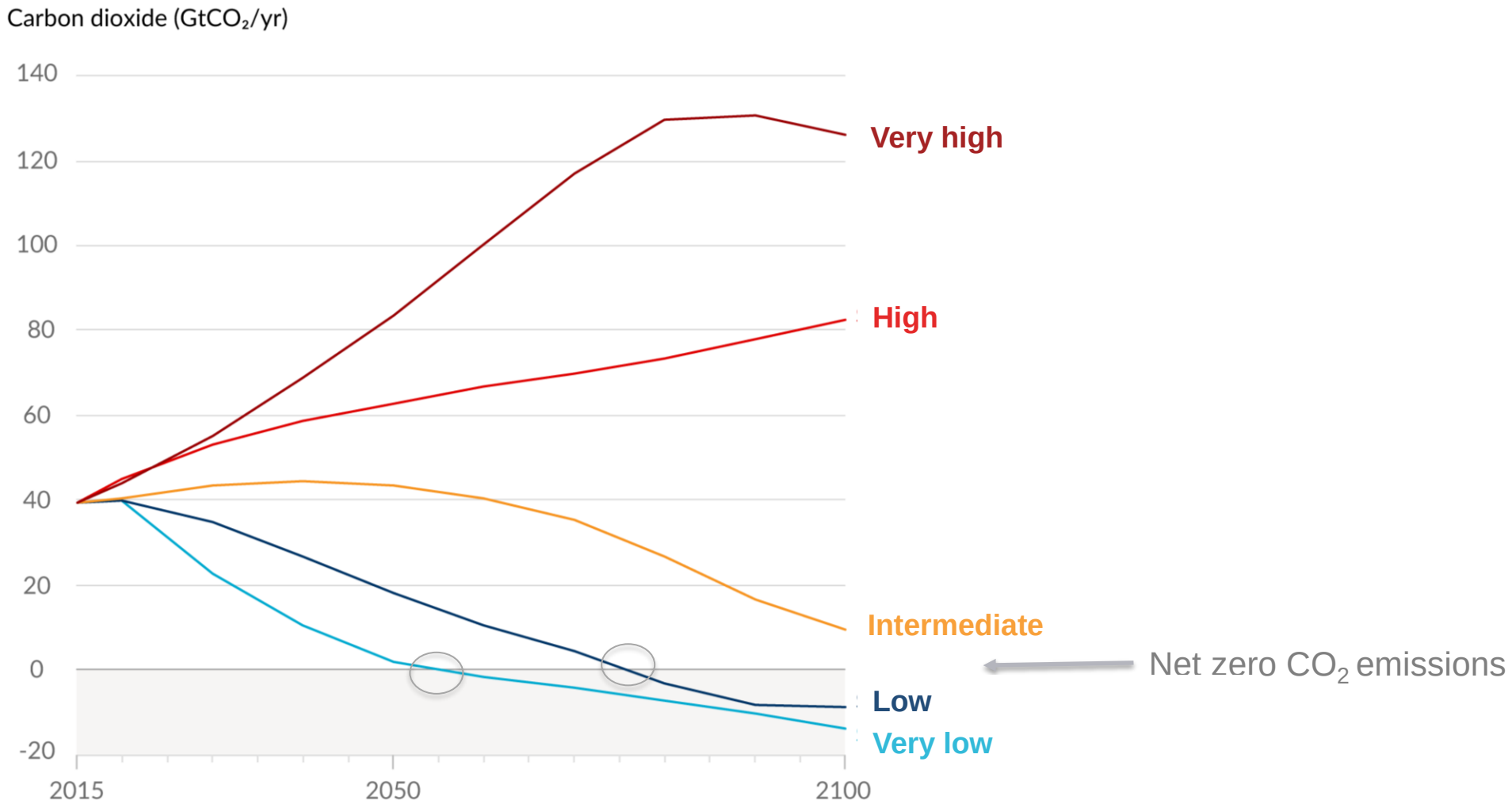


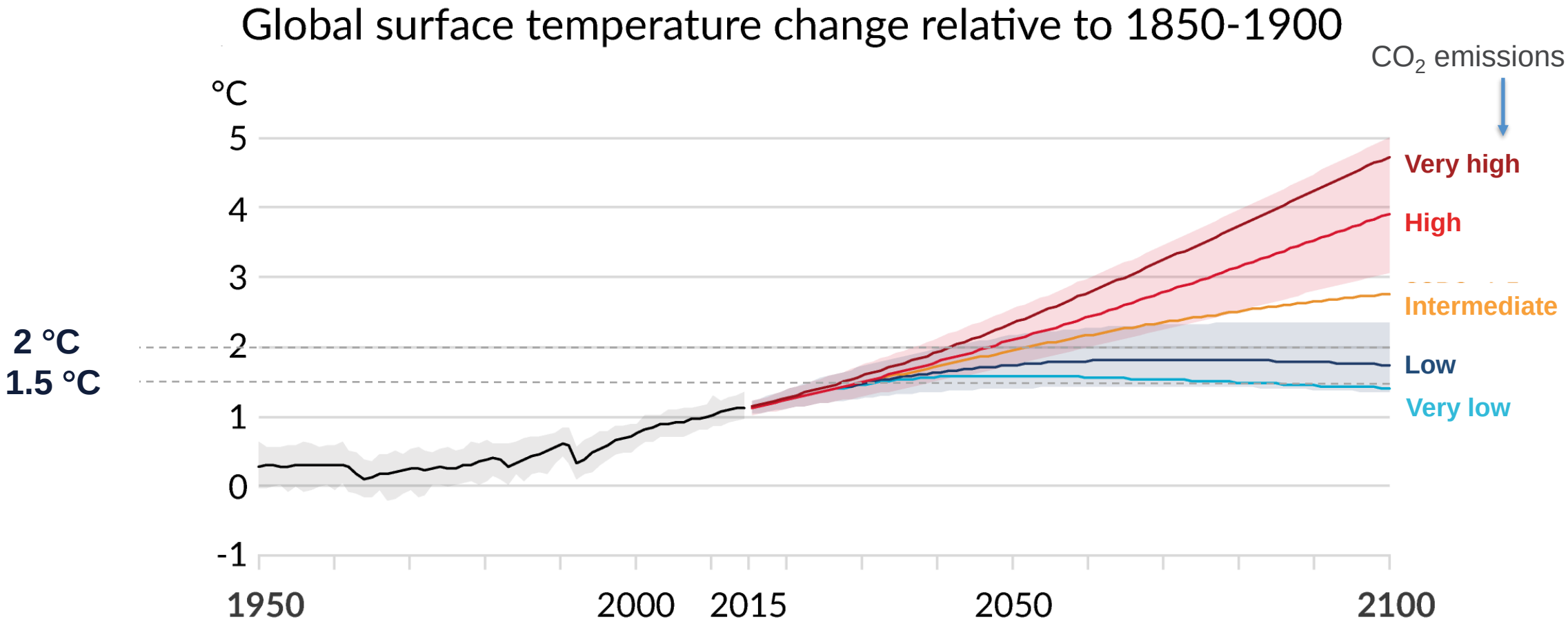
The Synthesis Report:

For 2013–2022 the updated calculations are **1.15°C** for global surface temperature

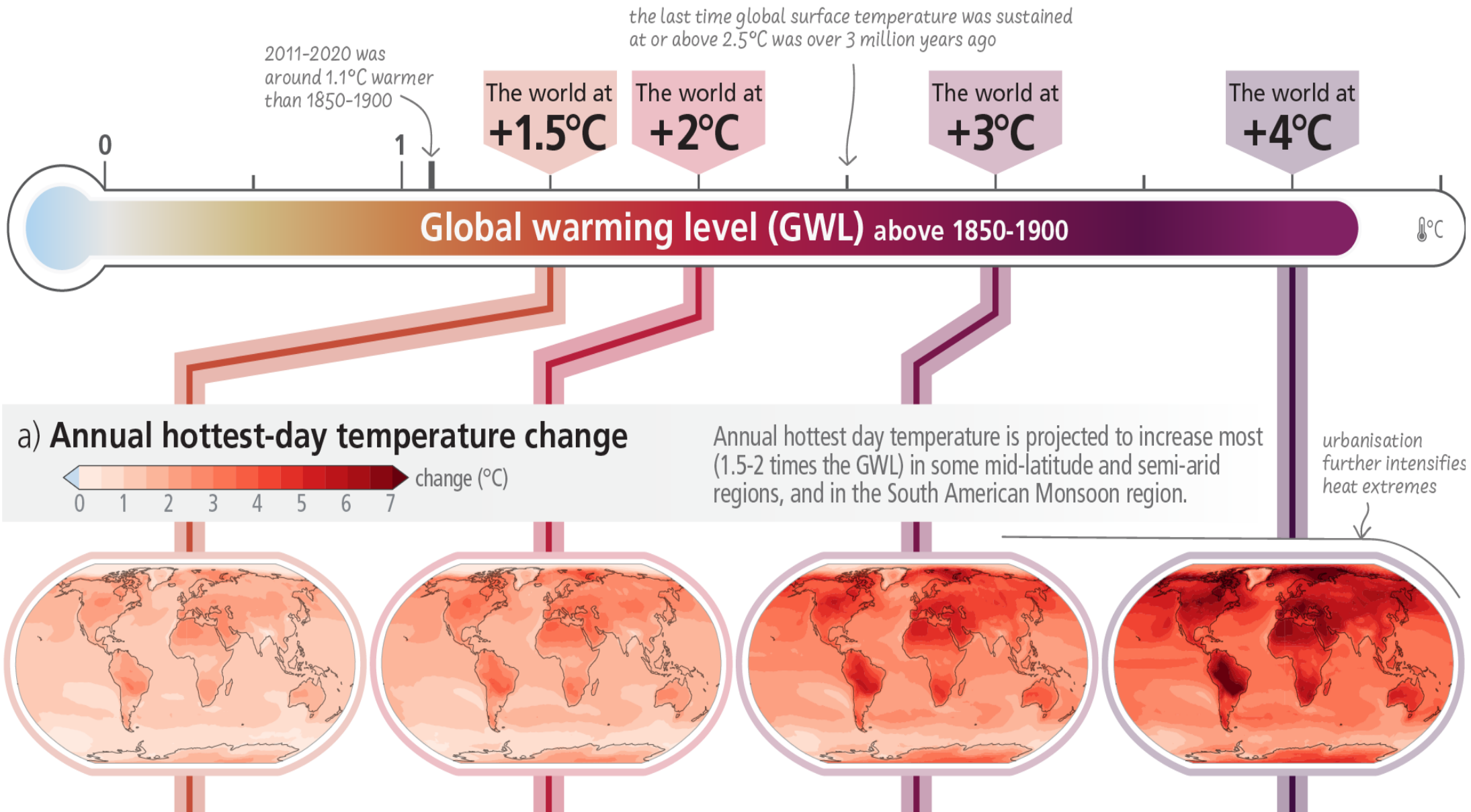
Scenarios used in IPCC AR6 WorkingGroup I

CO_2 emissions

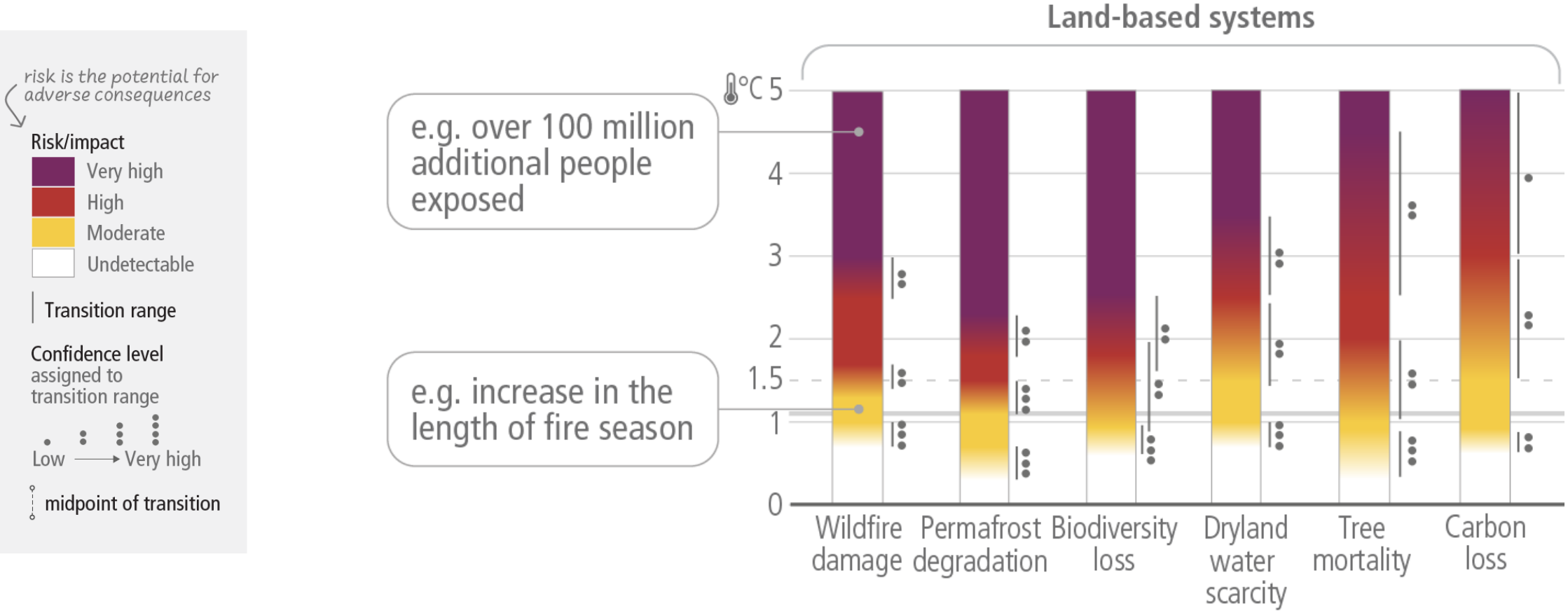



Global surface temperature change relative to 1850-1900
°C
5
4
3
2
1
0
-1
2 °C
1.5 °C
1950
2000
2015
2050
2100
CO2 emissions
Very high
High
Intermediate
Low
Very low

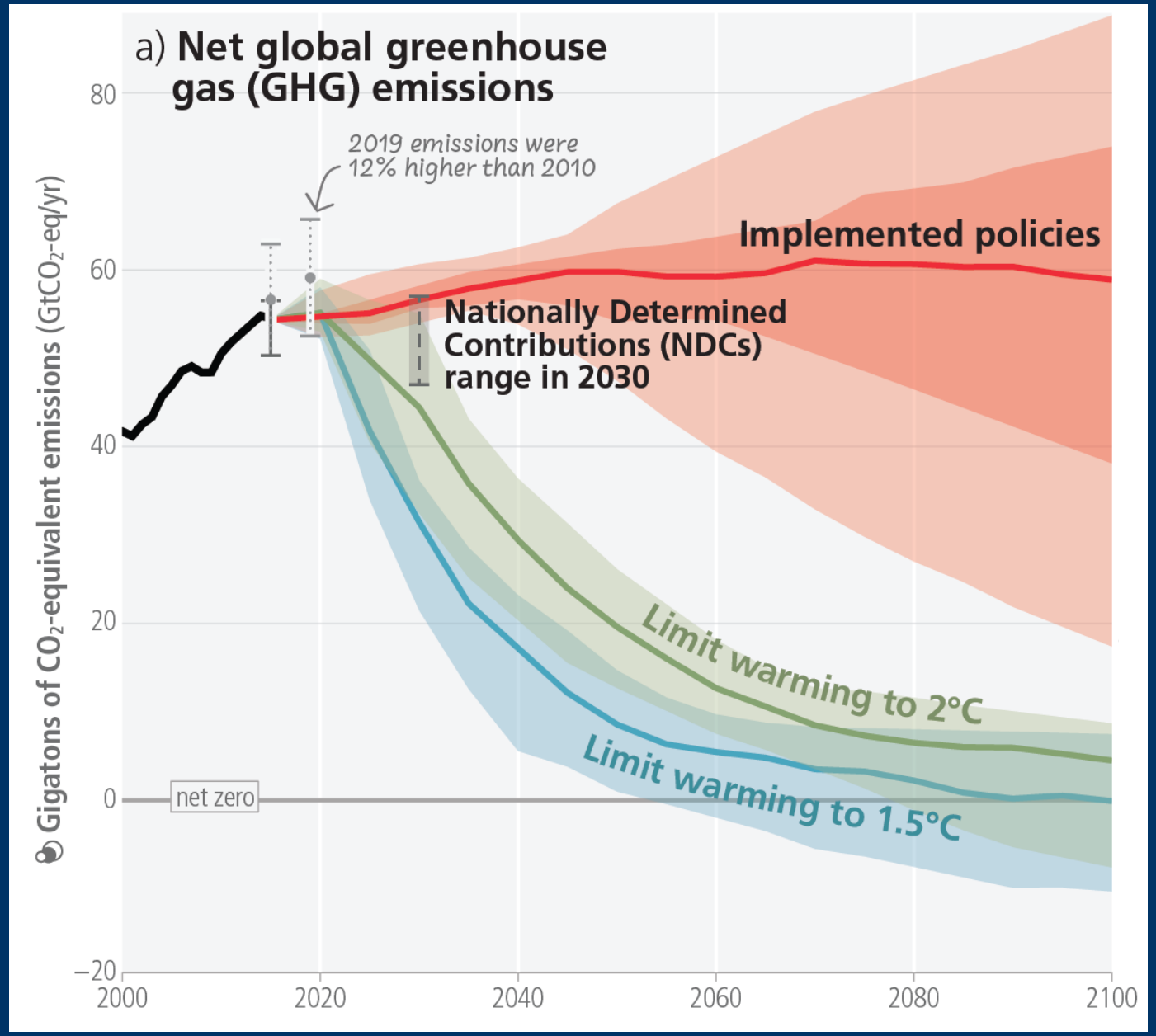
With every increment of global warming, regional changes in mean climate and extremes become more widespread and pronounced



Risks are increasing with every increment of warming

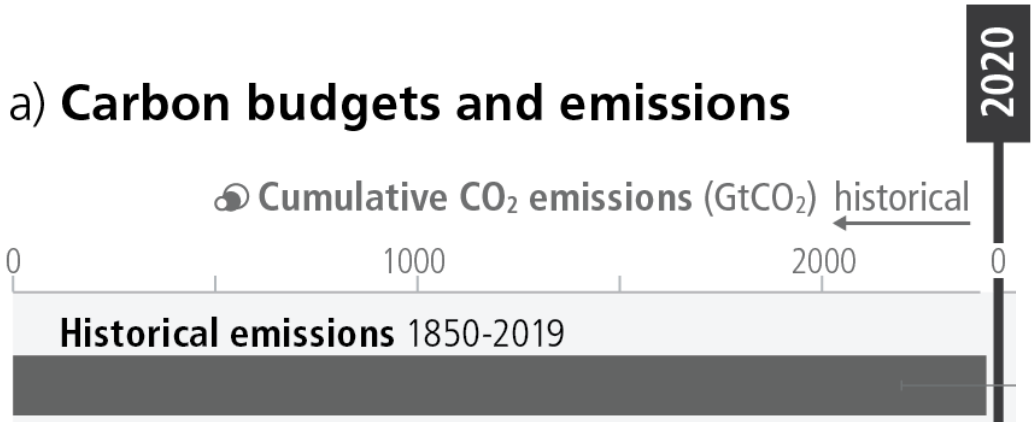


Unless there are immediate and deep emissions reductions across all sectors, 1.5°C is beyond reach.



Remaining carbon budgets to limit warming to 1.5°C could soon be exhausted, and those for 2°C largely depleted

Remaining carbon budgets are similar to emissions from use of existing and planned fossil fuel infrastructure, without additional abatement



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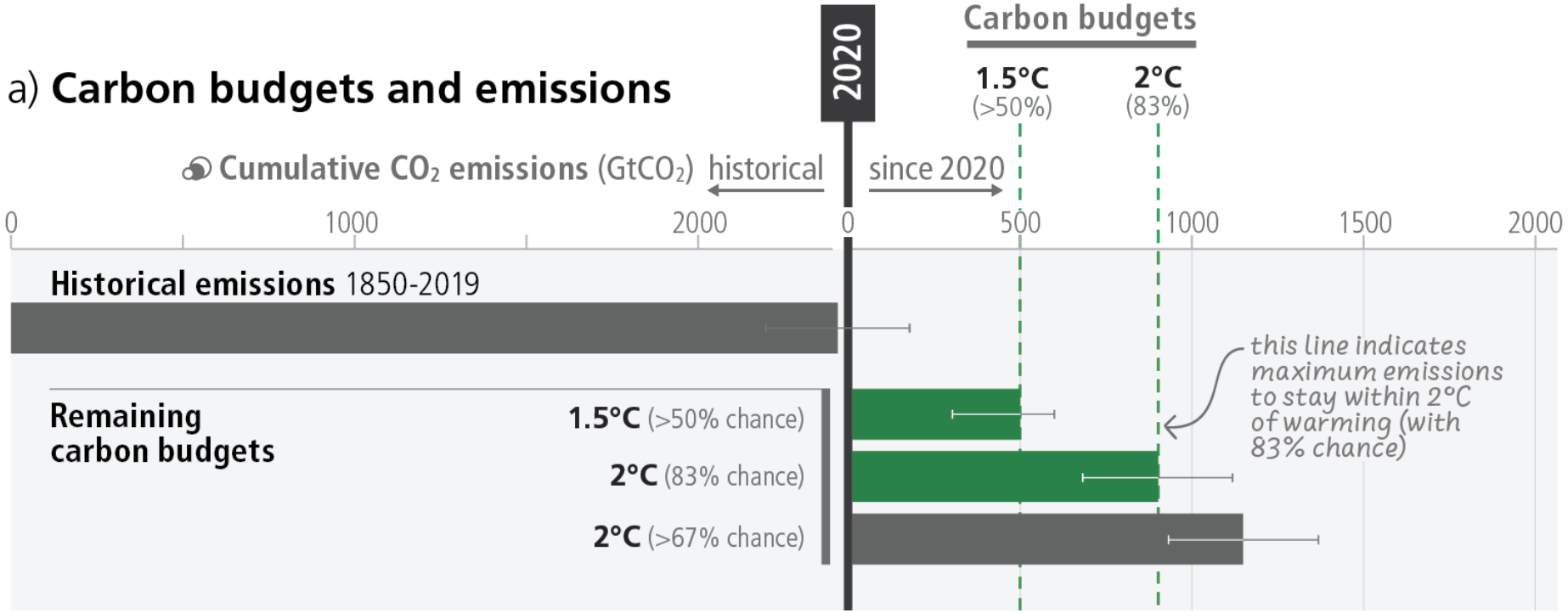

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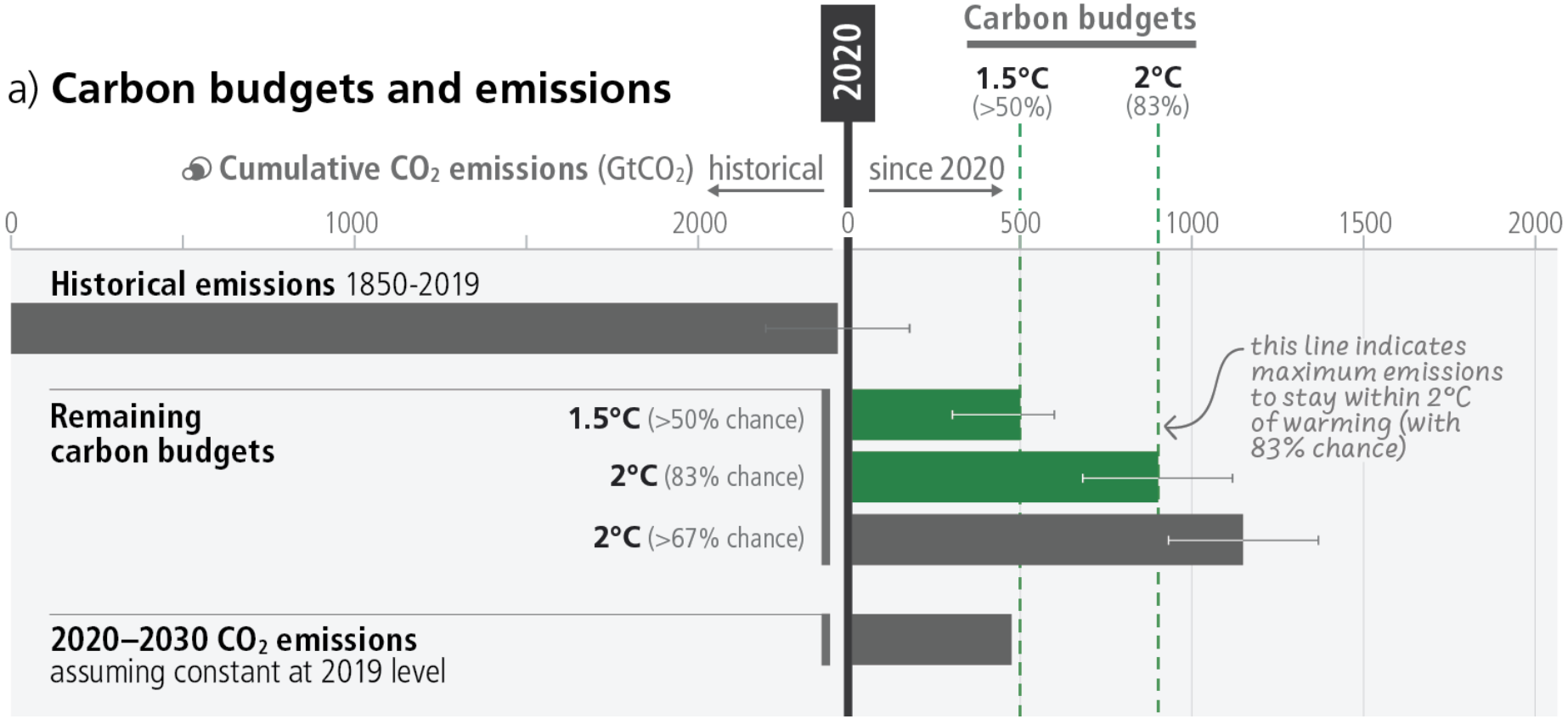


Remaining carbon budgets to limit warming to 1.5°C could soon be exhausted, and those for 2°C largely depleted

Remaining carbon budgets are similar to emissions from use of existing and planned fossil fuel infrastructure, without additional abatement

a) Carbon budgets and emissions

Cumulative CO_2 emissions ($GtCO_2$) historical since 2020

2020

Carbon budgets

1.5°C (>50%)

2°C (83%)

0 1000 2000 0 500 1000 1500 2000

Historical emissions 1850-2019

Remaining carbon budgets

1.5°C (>50% chance)

2°C (83% chance)

2°C (>67% chance)

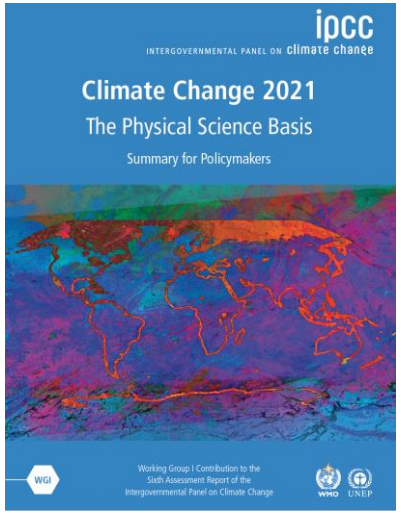
this line indicates maximum emissions to stay within 2°C of warming (with 83% chance)

2020–2030 CO_2 emissions assuming constant at 2019 level

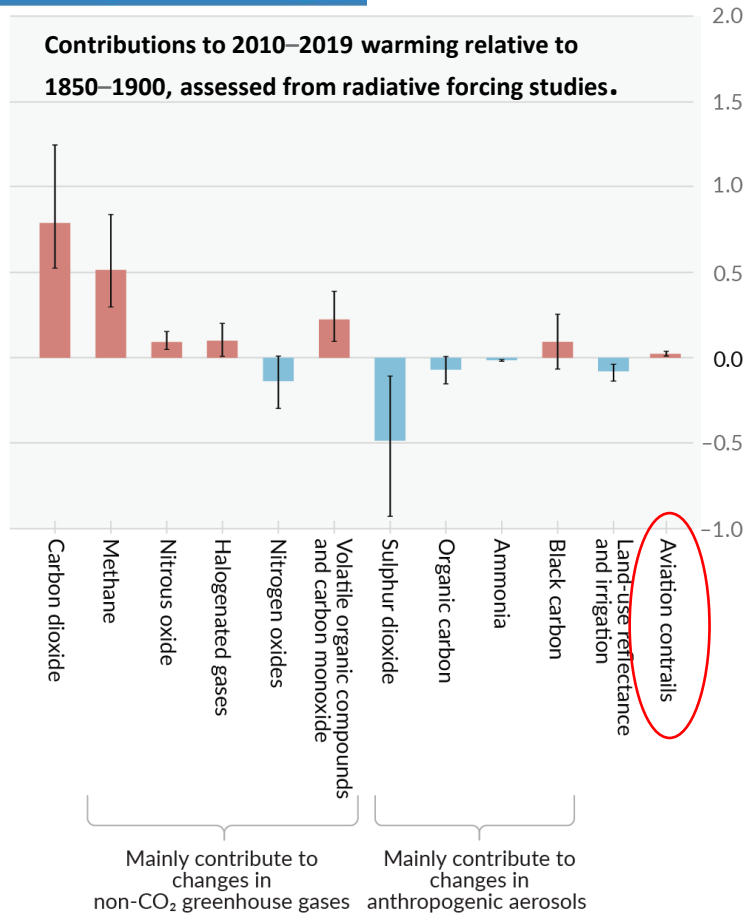
Lifetime emissions from fossil fuel infrastructure without additional abatement, if historical operating patterns are maintained

Existing

Existing and planned

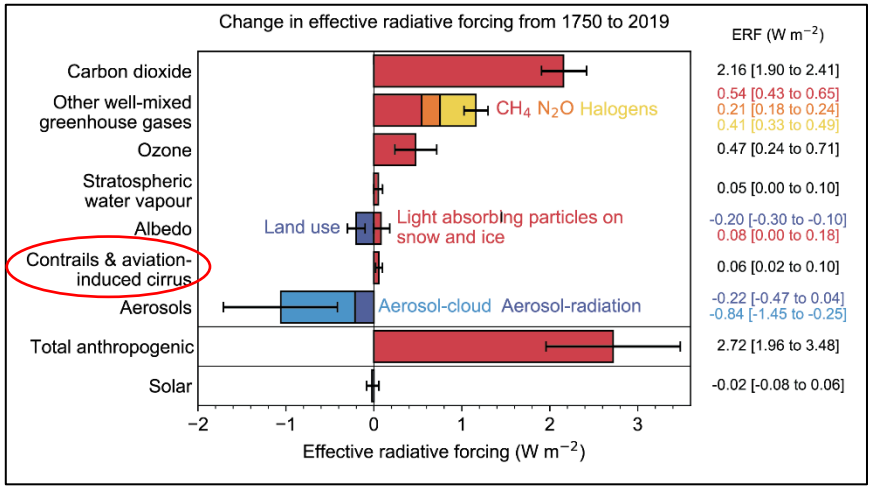


Summary for Policy Makers (SPM)



7.3.4.2 Contrails and Aviation-induced Cirrus

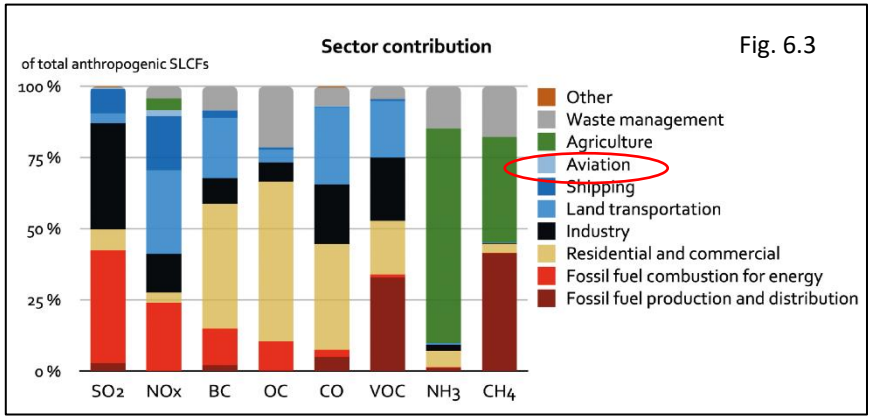
ERF from contrails and aviation-induced cirrus is taken from the assessment of Lee et al. (2020), at 0.057 [0.019 to 0.098] W m^{-2} in 2018 (see Section 6.6.2 for an assessment of the total effects of aviation). This is rounded up to address its *low confidence* and the extra year of air traffic to give an assessed ERF over 1750–2019 of 0.06 [0.02 to 0.10] W m^{-2}. This assessment is given *low confidence* due to the potential that processes missing from the assessment would affect the magnitude of contrails and aviation-induced cirrus ERF.

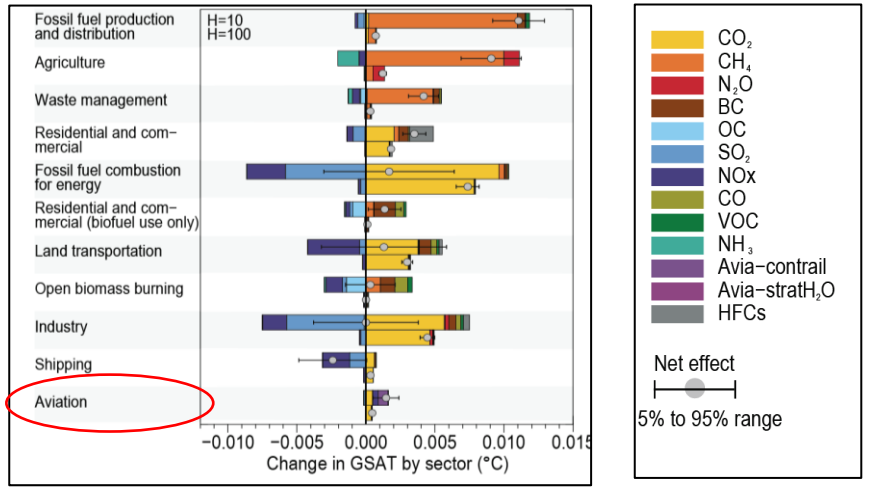


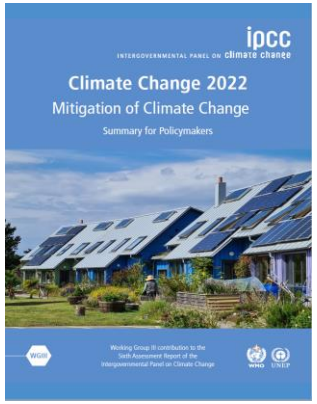
6.6.2.3 Transportation

6.6.2.3.1 Aviation

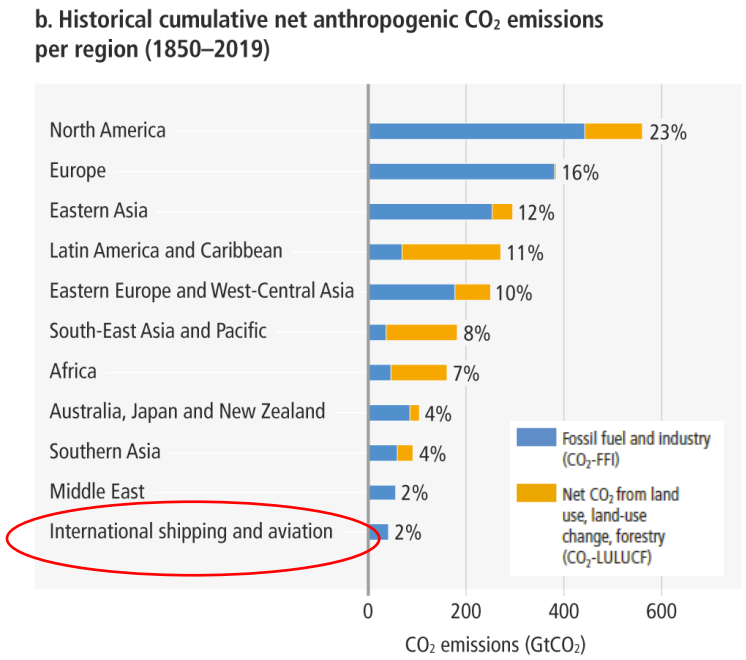
Aviation is associated with a range of SLCFs, in particular emissions of NO_x and aerosol particles, alongside emissions of water vapour and CO_2. The largest SLCF effects are those from the formation of persistent condensation trails (contrails) and NO_x emissions. Persistent contrails are ice-crystal clouds, formed around aircraft soot particles (and water vapour from the engine), injected in ambient cold and ice-supersaturated atmosphere, which can spread and form contrail cirrus clouds. The 'net NO_x' effect arises from the formation of tropospheric ozone, counterbalanced by the destruction of ambient methane and associated cooling effects of reductions in stratospheric water vapour and background ozone. The AR5 assessed the radiative forcing from persistent linear contrails to be +0.01 [+0.005 to +0.03] W m^{-2} for the year 2011, with *medium confidence* (Boucher et al., 2013). The combined linear contrail and their subsequent evolution to contrail cirrus radiative forcing from aviation was assessed to be +0.05 [+0.02 to +0.15] W m^{-2}, with *low confidence*. An additional forcing of +0.003 W m^{-2} due to emissions of water vapour in the stratosphere by aviation was also reported (Boucher et al., 2013). The aviation sector was also estimated to lead





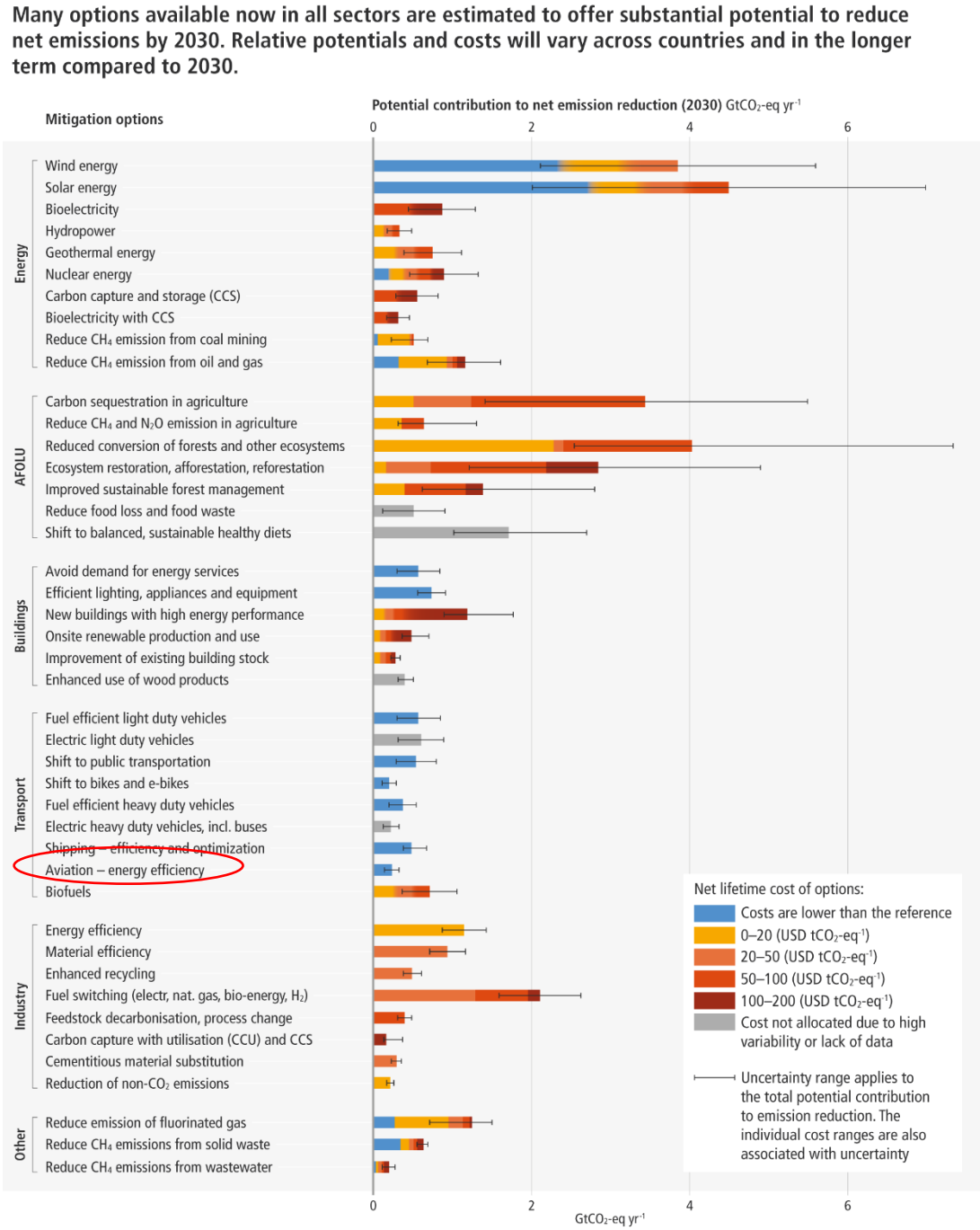


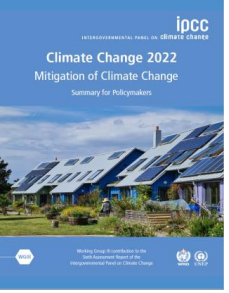
The Report covers literature accepted for publication by 11 October 2021.



Sustainable biofuels, low-emissions hydrogen, and derivatives (including synthetic fuels) can support mitigation of CO_2 emissions from shipping, aviation, and heavy-duty land transport but require production process improvements and cost reductions (*medium confidence*).

Current sectoral levels of ambition vary, with emission reduction aspirations in international aviation and shipping lower than in many other sectors (*medium confidence*). {14.5, 14.6}





2

Emissions Trends and Drivers

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10

Transport

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14

International Cooperation

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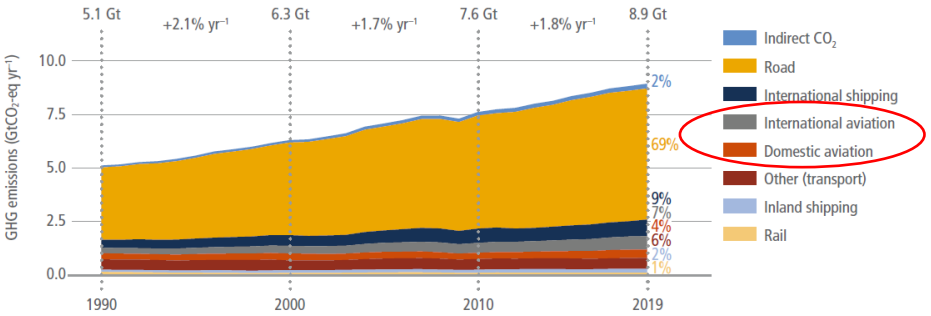
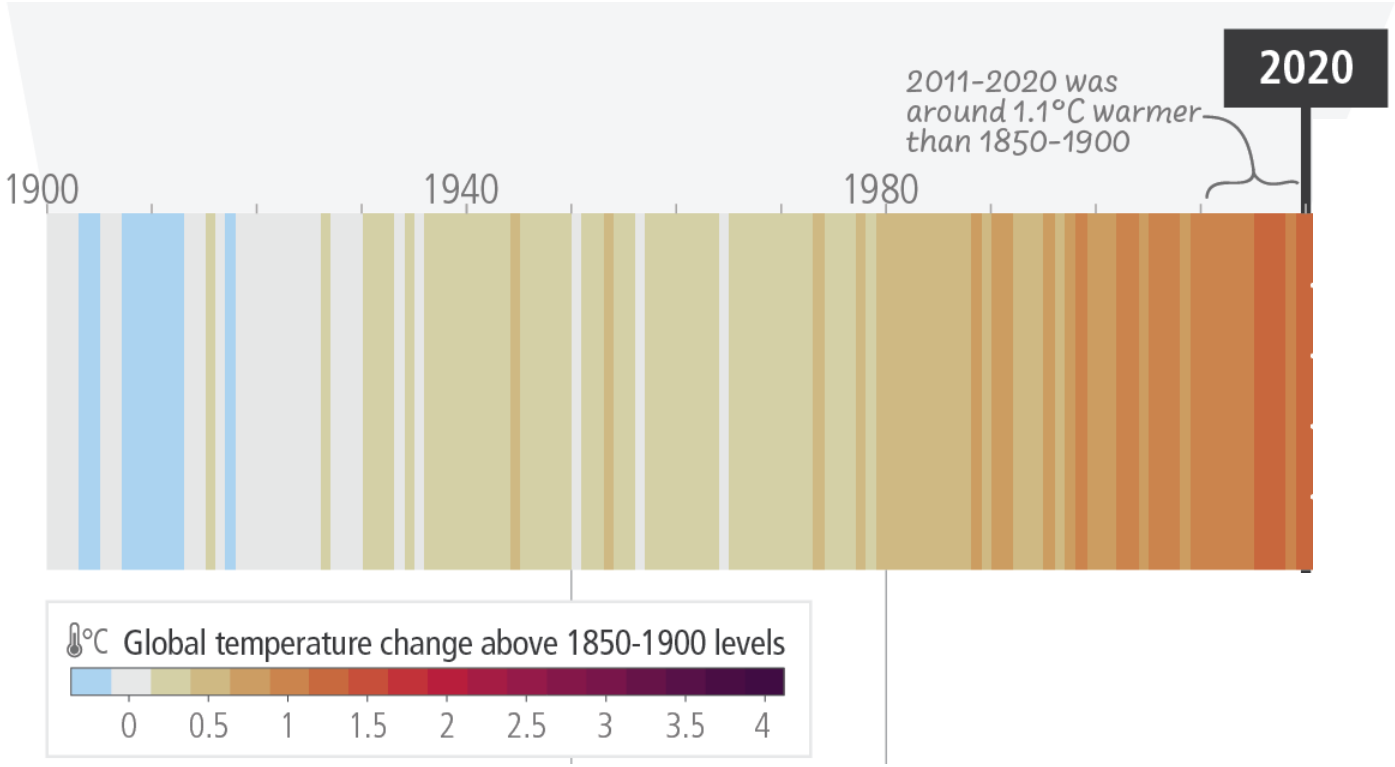
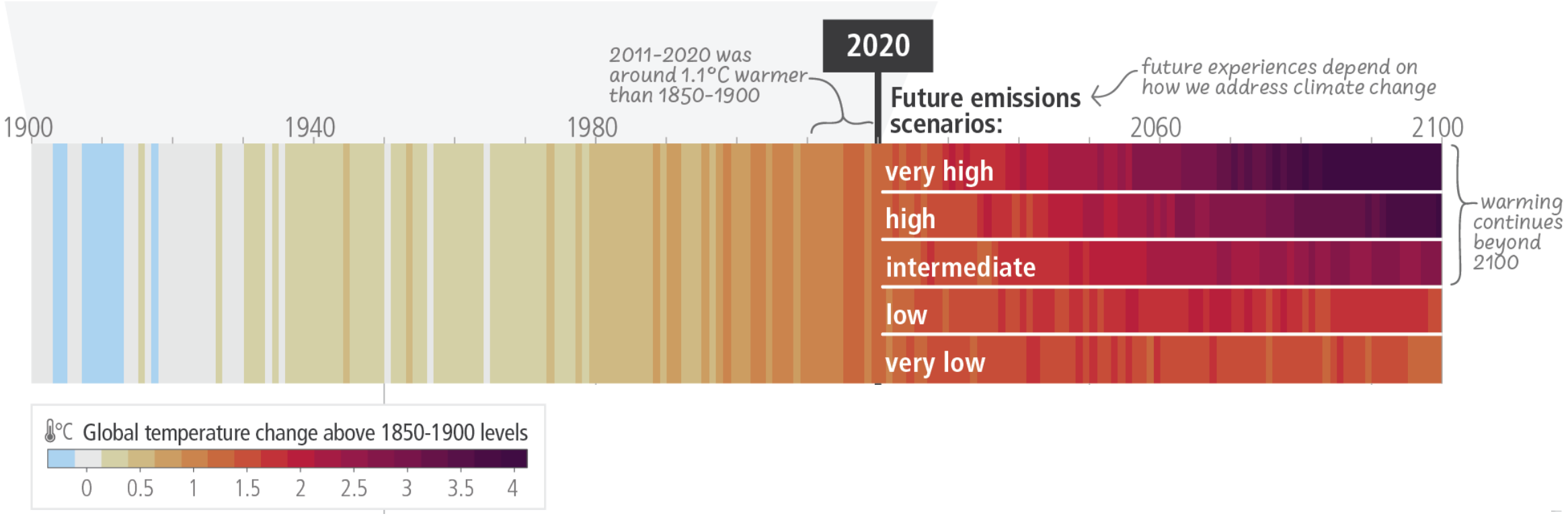
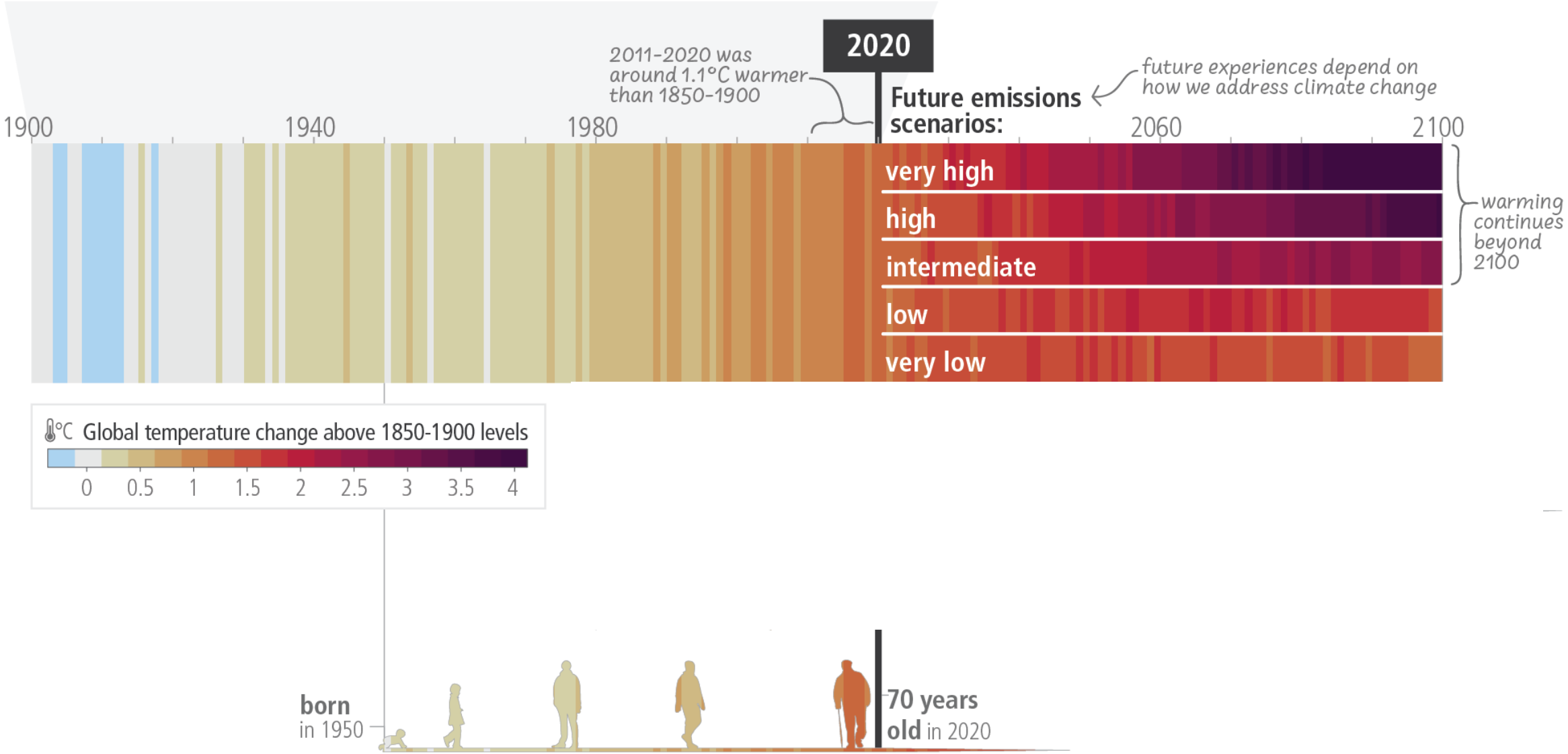
(a) Transport global GHG emission trends by subsectors



Box 10.5 | Governance Options for Shipping and Aviation


2020
2011-2020 was
around 1.1°C warmer
than 1850-1900
1900
1940
1980
°C Global temperature change above 1850-1900 levels
0
0.5
1
1.5
2
2.5
3
3.5
4


2020
2011-2020 was around 1.1°C warmer than 1850-1900
future experiences depend on how we address climate change
Future emissions scenarios:
1900
1940
1980
2060
2100
very high
high
intermediate
low
very low
warming continues beyond 2100
°C Global temperature change above 1850-1900 levels
0
0.5
1
1.5
2
2.5
3
3.5
4


2020
2011-2020 was around 1.1°C warmer than 1850-1900
future experiences depend on how we address climate change
1900
1940
1980
2060
2100
Future emissions scenarios:
very high
high
intermediate
low
very low
warming continues beyond 2100
°C Global temperature change above 1850-1900 levels
0
0.5
1
1.5
2
2.5
3
3.5
4
born in 1950
70 years old in 2020

Thank you

Wednesday: What's next from the IPCC?

STAY IN TOUCH

ipcc.ch

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https://www.ipcc.ch/about/

Find out more in these fact sheets:

- What is the IPCC?
- How does the IPCC select its authors?
- What literature does the IPCC assess?
- How does the IPCC review process work?
- How does the IPCC approve reports?
- How does the IPCC deal with alleged errors?
- What is an Expert Reviewer of IPCC?
- Timeline

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Thank You

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