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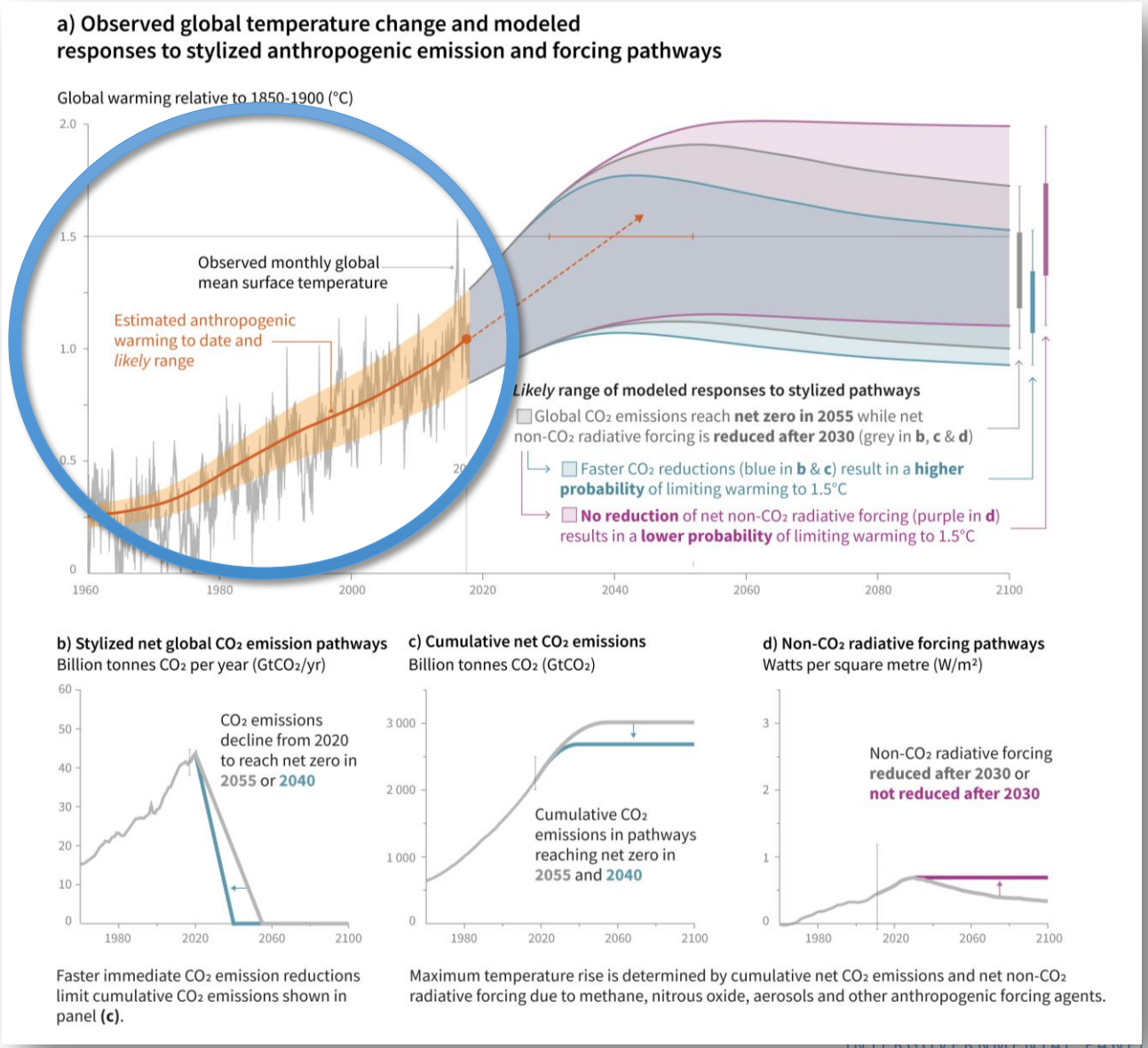
Where are we now?

Since pre-industrial times, human activities have caused approximately 1°C of global warming, increasing at 0.2°C per decade.

- If the current rate continues, warming would reach 1.5°C between 2030 and 2052.
- But past emissions alone do not commit the world to 1.5°C global warming.
- Cumulative emissions of CO_2 and future non-CO_2 radiative forcing determine the probability of limiting global warming to 1.5°C.

SPM.1: Cumulative emissions of CO_2 and future non-CO_2 radiative forcing determine the probability of limiting warming to 1.5°C



Informal presentation by Myles Allen & Mikiko Kainuma.

Kirsten Zickfeld, Richard Millar & Natalie Mahowald, Chapter 1, Panmao Zhai, WG1 co-Chair

Angela Morelli & Tom Johansen, Infodesignlab, Stuart Jenkins, Univ. Oxford

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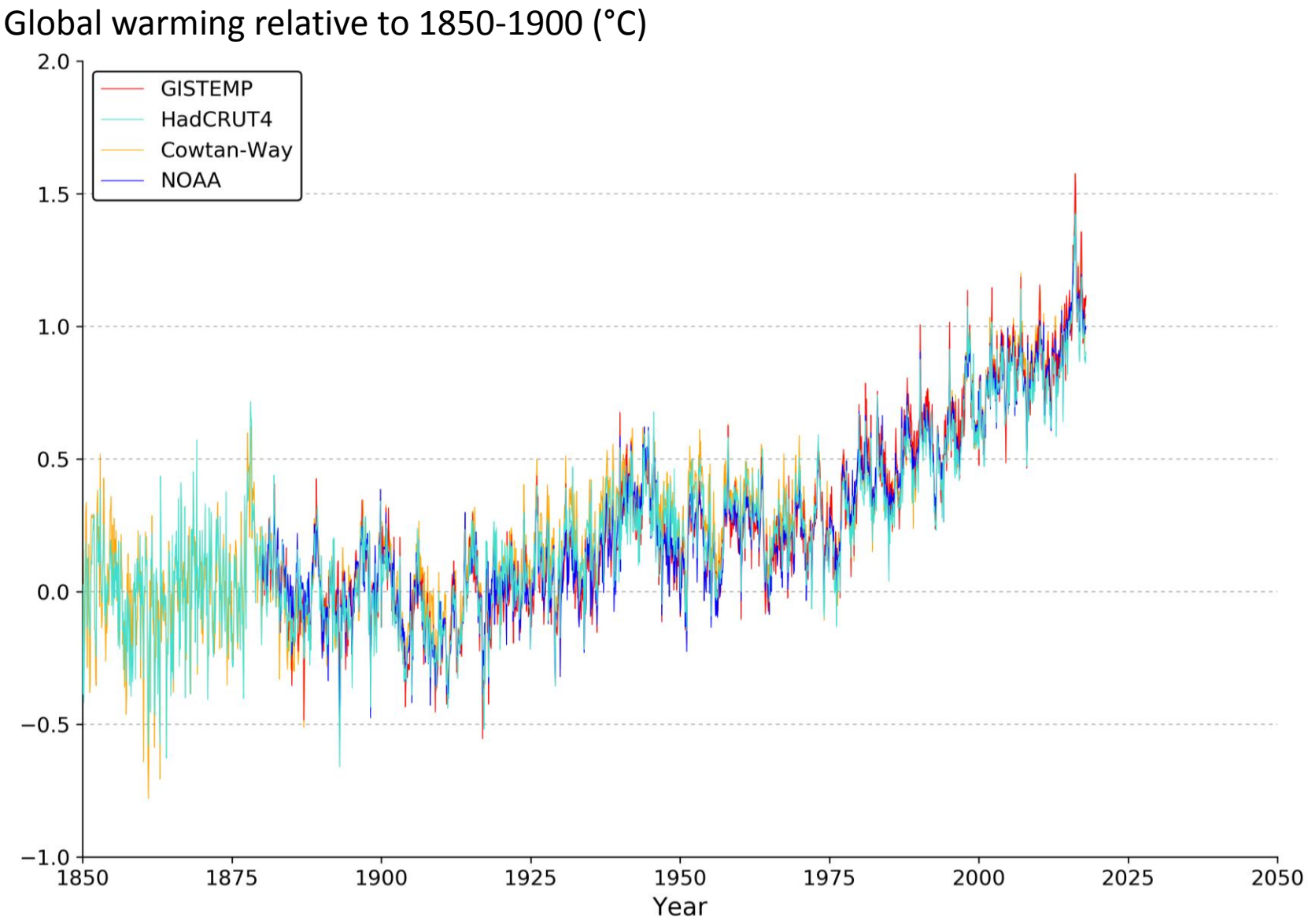
Observed monthly global mean surface temperature from four available published and peer-reviewed datasets



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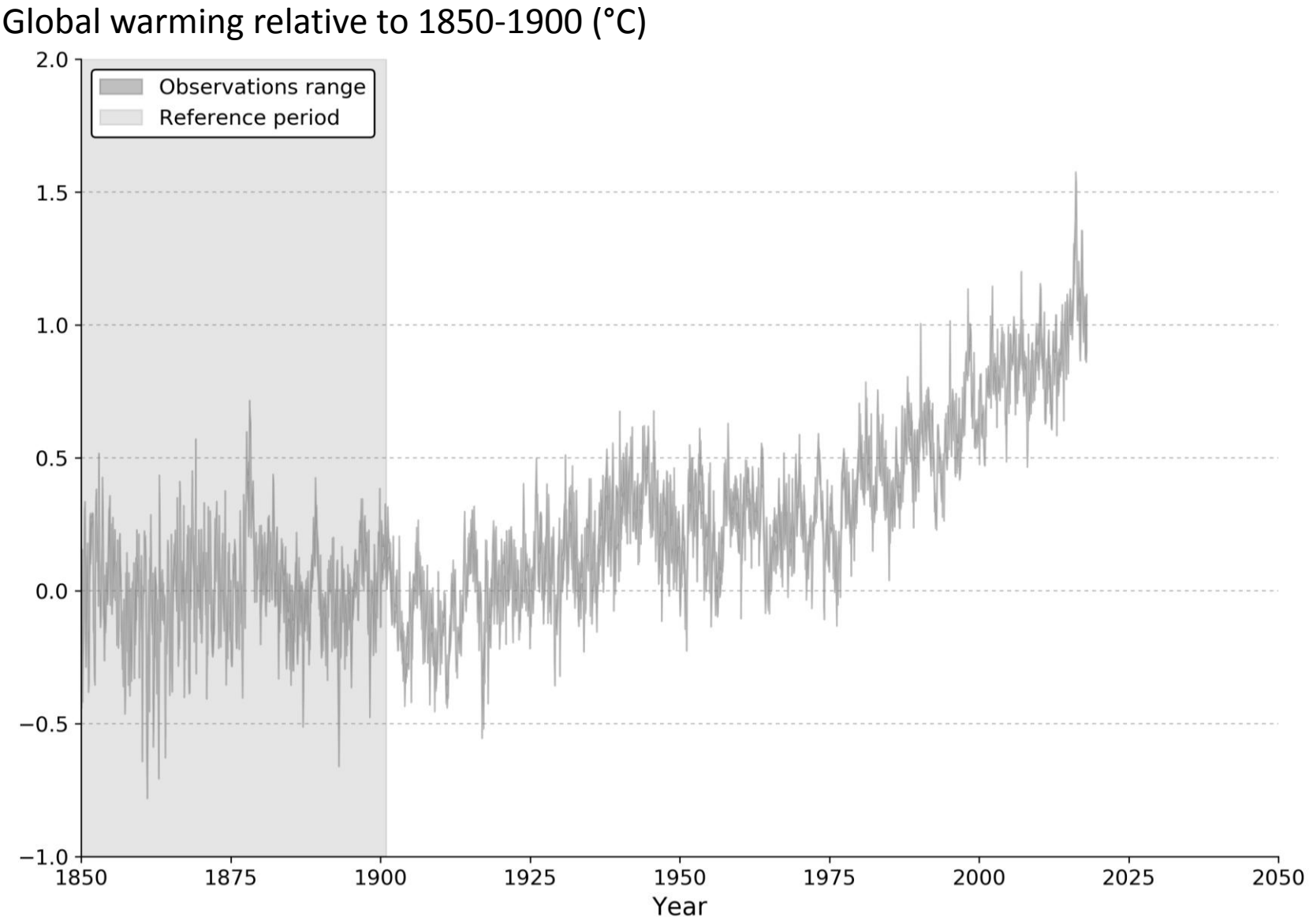
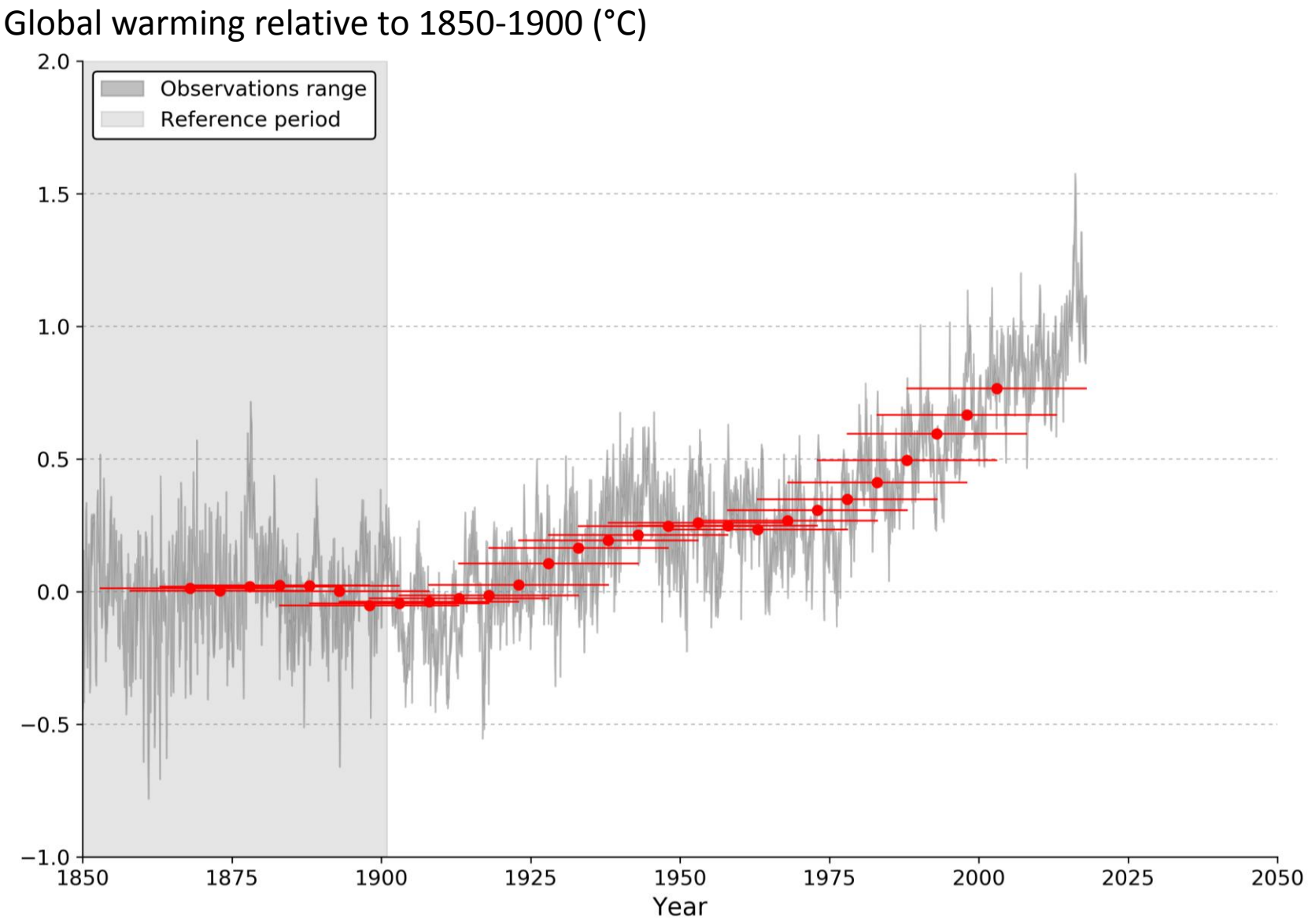


Defining climate as the average over a 30-year period: what is the climate “now”?



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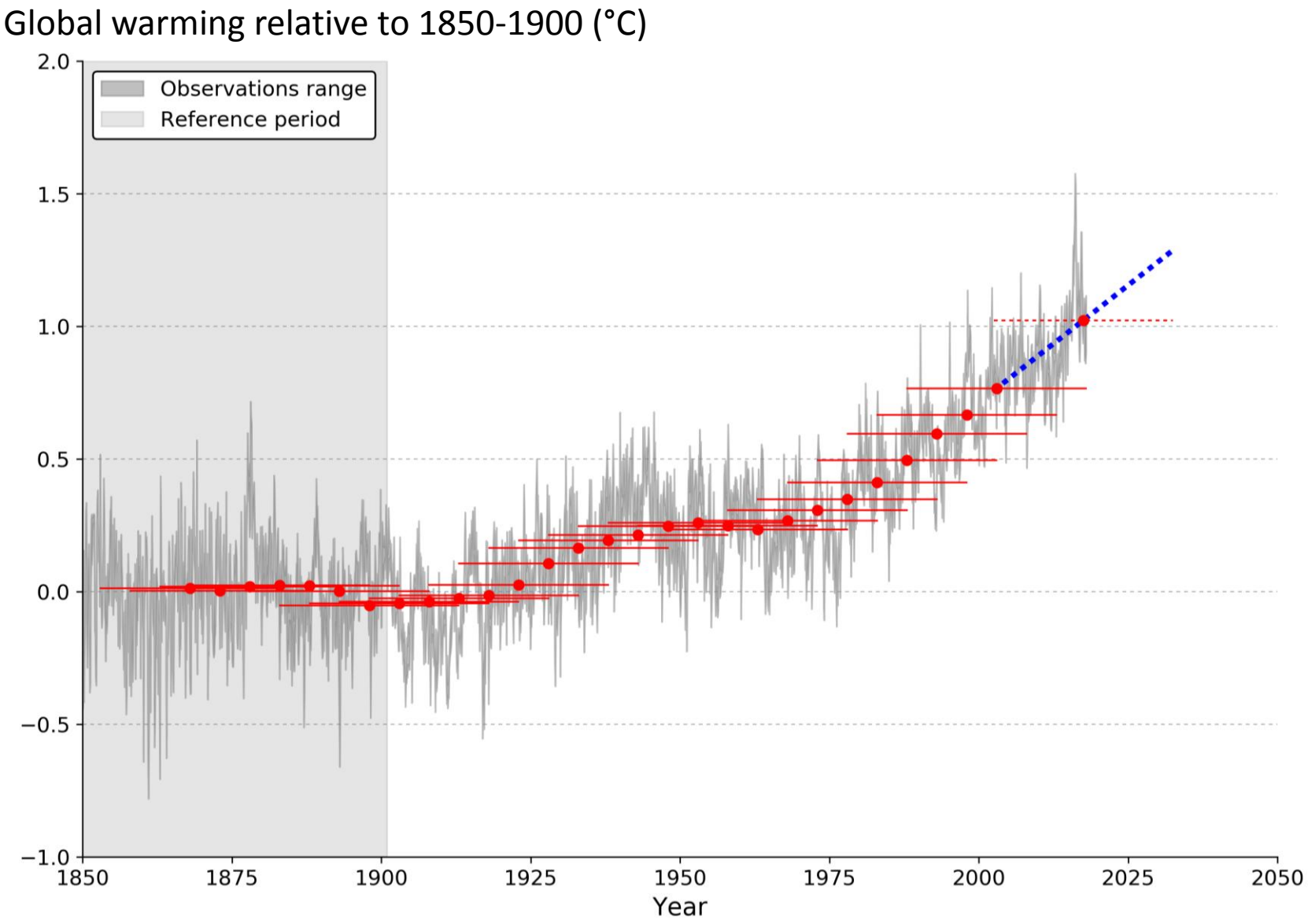
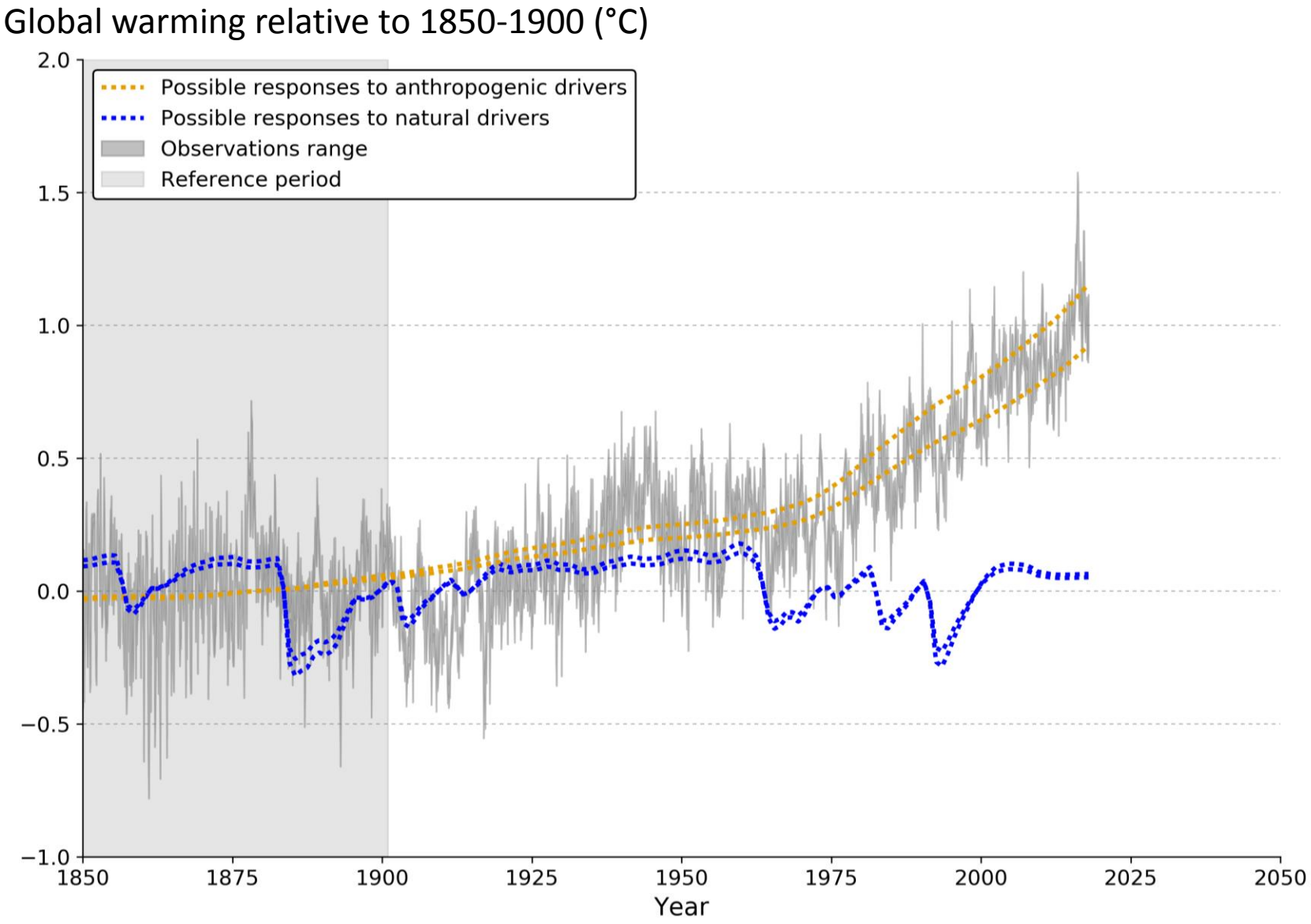
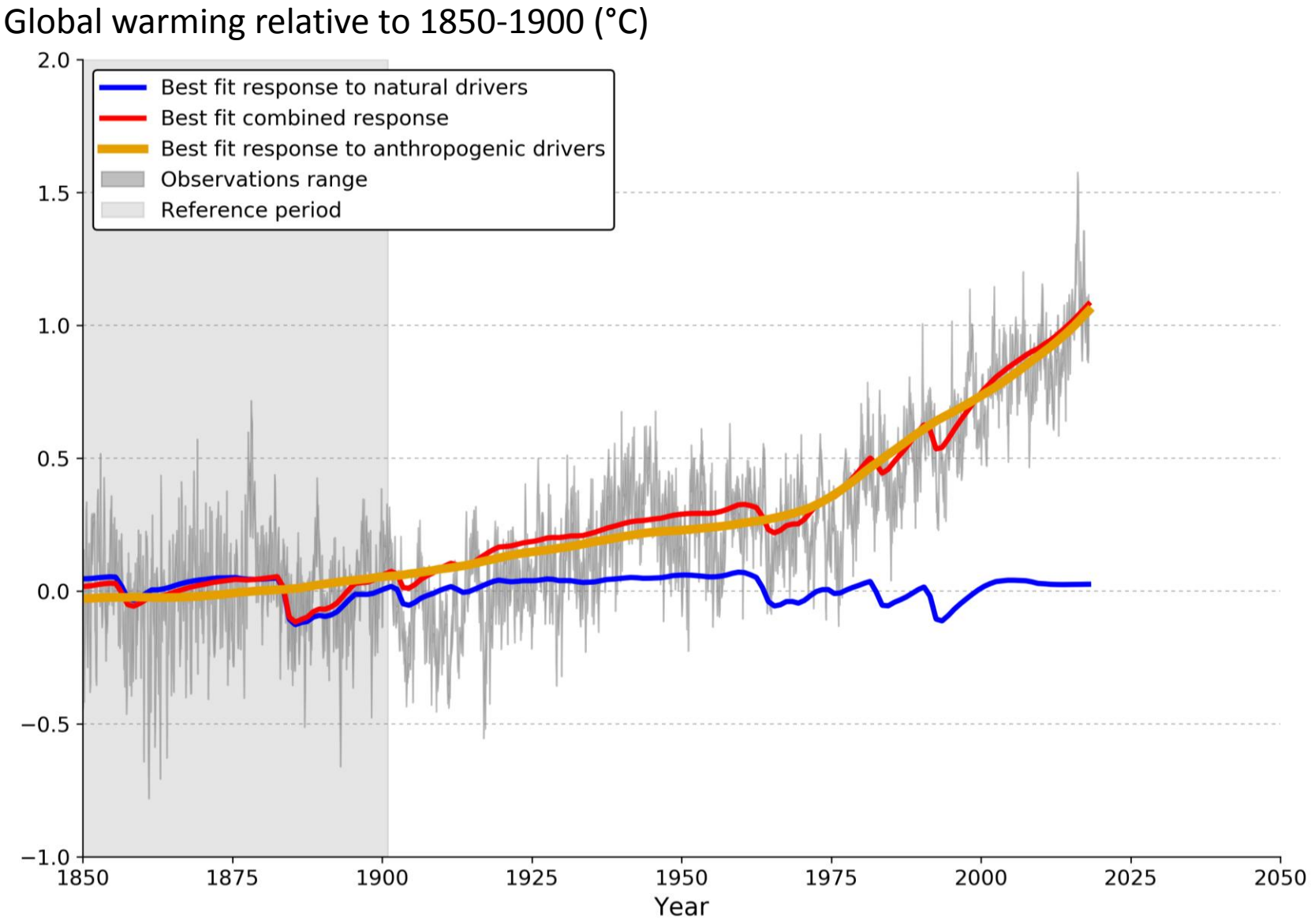


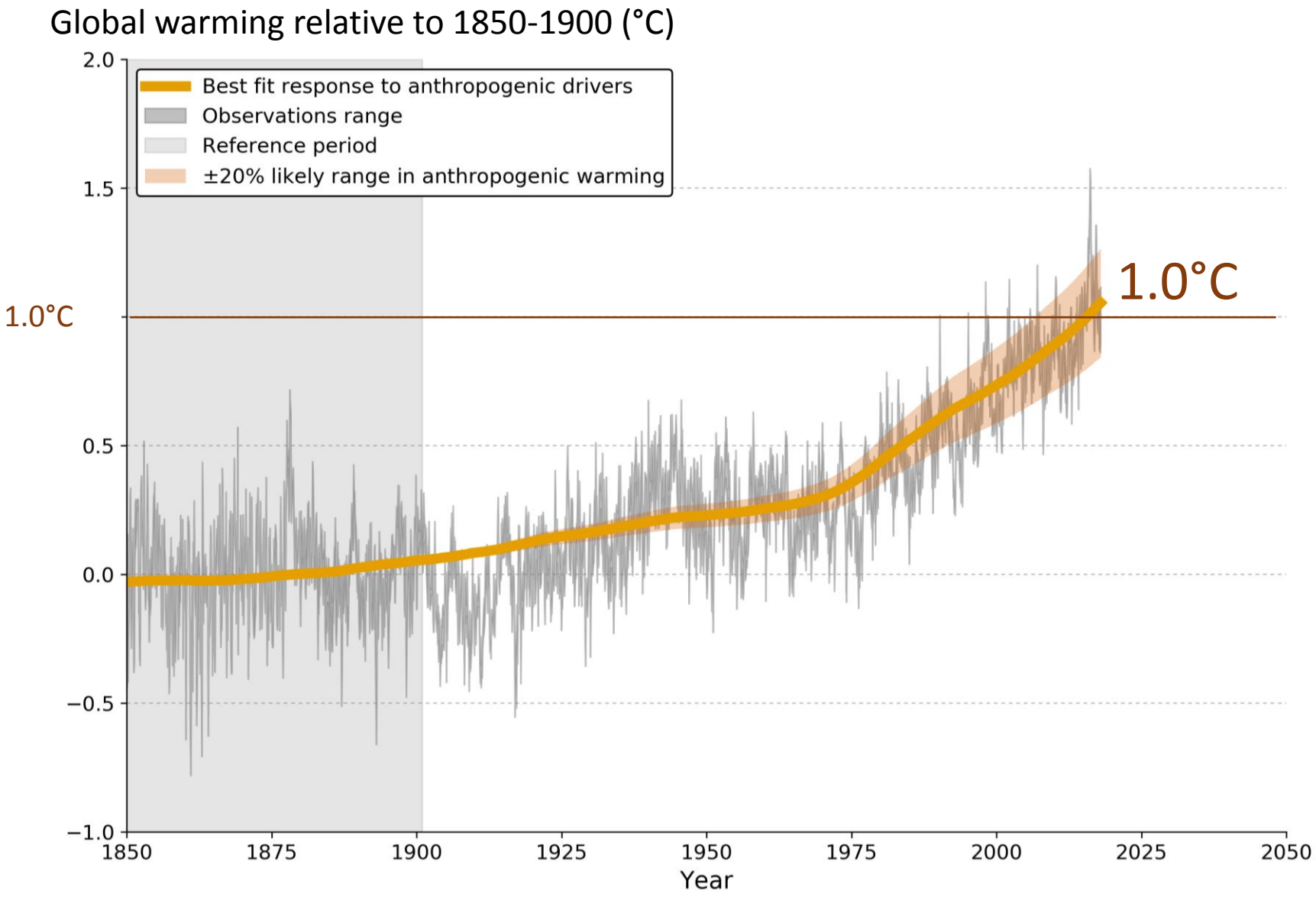
Observed record of **radiative forcing** determines the *timing* of anthropogenic and natural changes in global temperatures



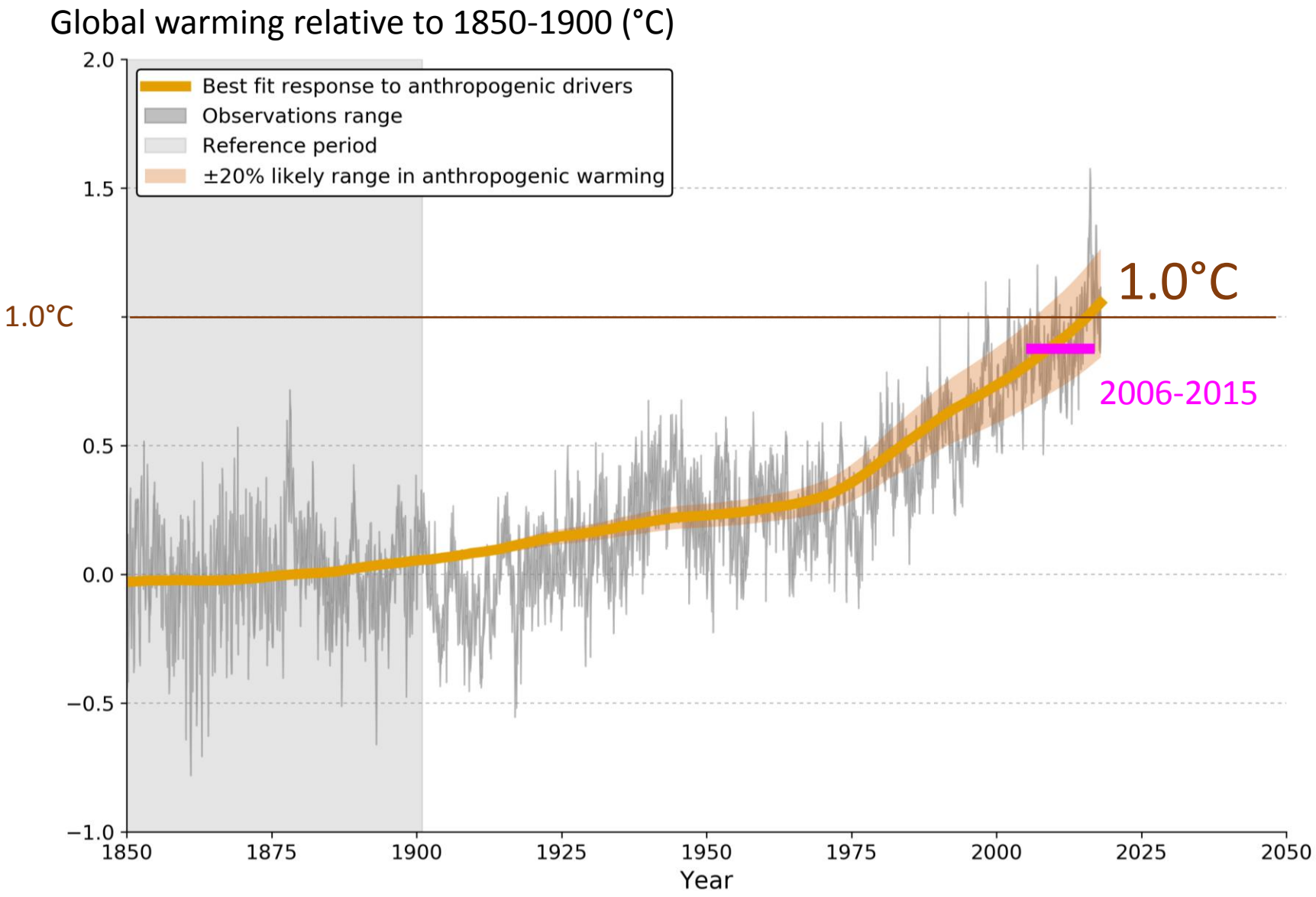
Observed record of **warming** is used to estimate the *magnitude* of anthropogenic and natural changes in global temperatures



Anthropogenic global warming has reached 1°C, with a *likely* range of 0.8 to 1.2°C, and is increasing at 0.2°C per decade



Consistent with the observed warming of 0.87°C (±0.12°C) between the periods 1850-1900 and 2006-2015



The importance of the definition of global temperature: blended sea-surface and land surface air temperature versus pure SAT

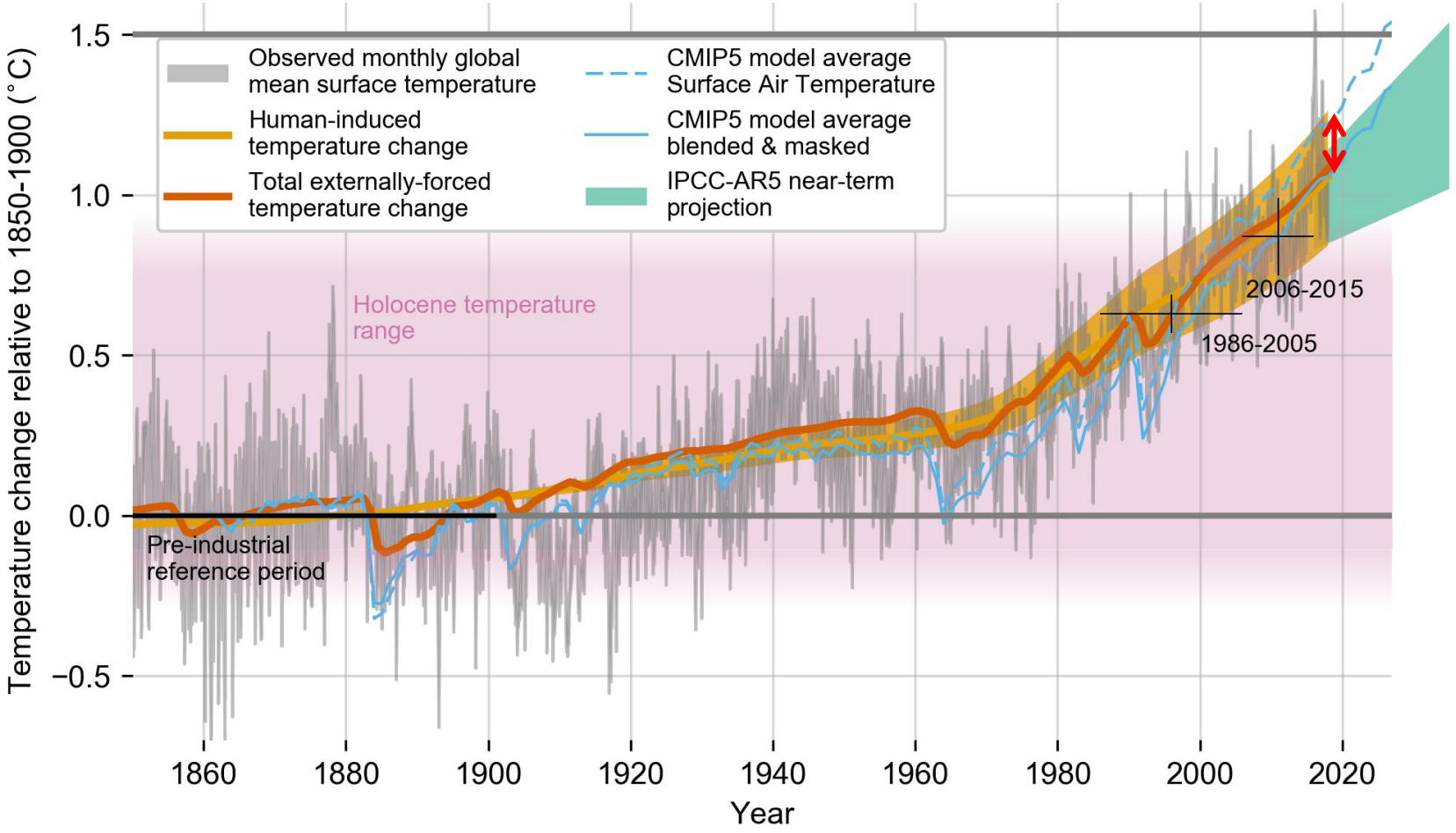


Figure 1.2, Chapter 1

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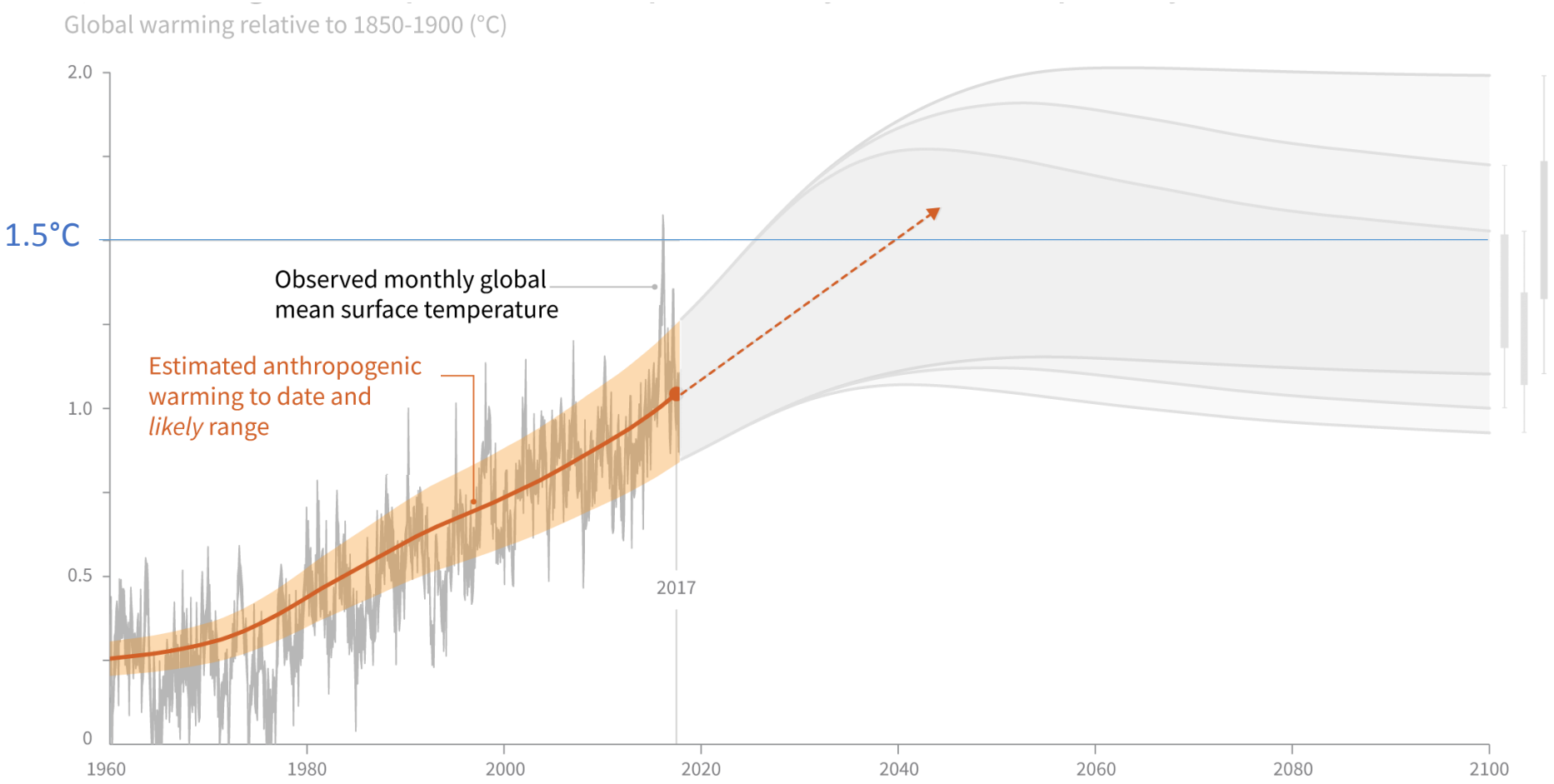
Global warming is *likely* to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate



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“Anthropogenic emissions from the pre-industrial period to the present … alone are *unlikely* to cause global warming of 1.5°C.”

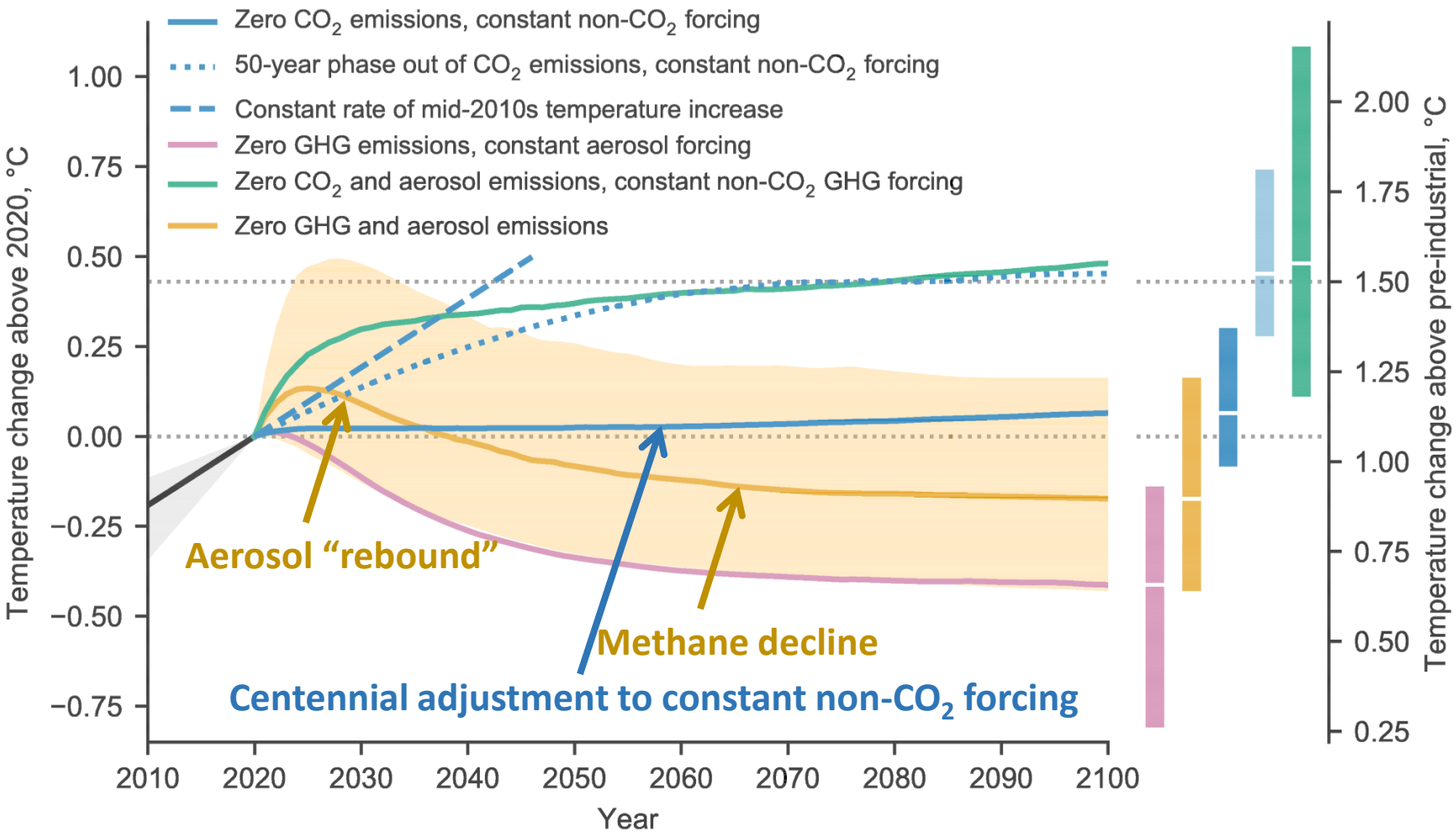

Figure 1.5, Chapter 1, & Smith et al, 2018

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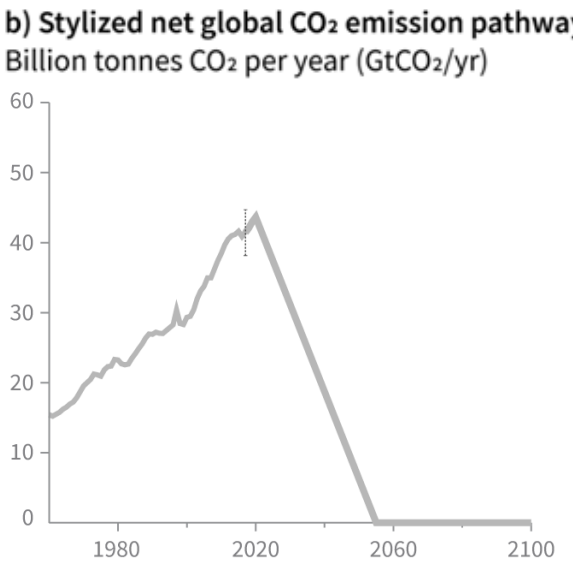
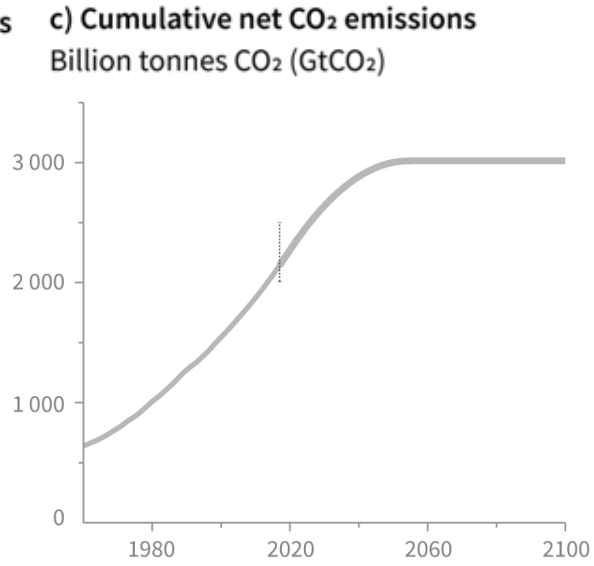
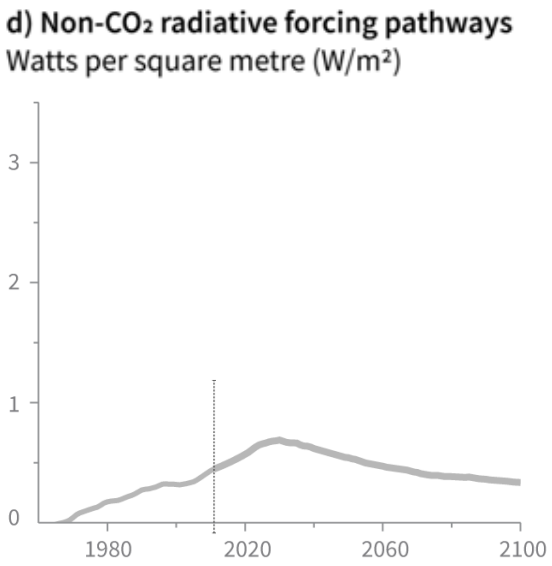
Exploring what is required to limit warming to 1.5°C using stylized pathways of net global CO_2 emissions and other radiative forcing







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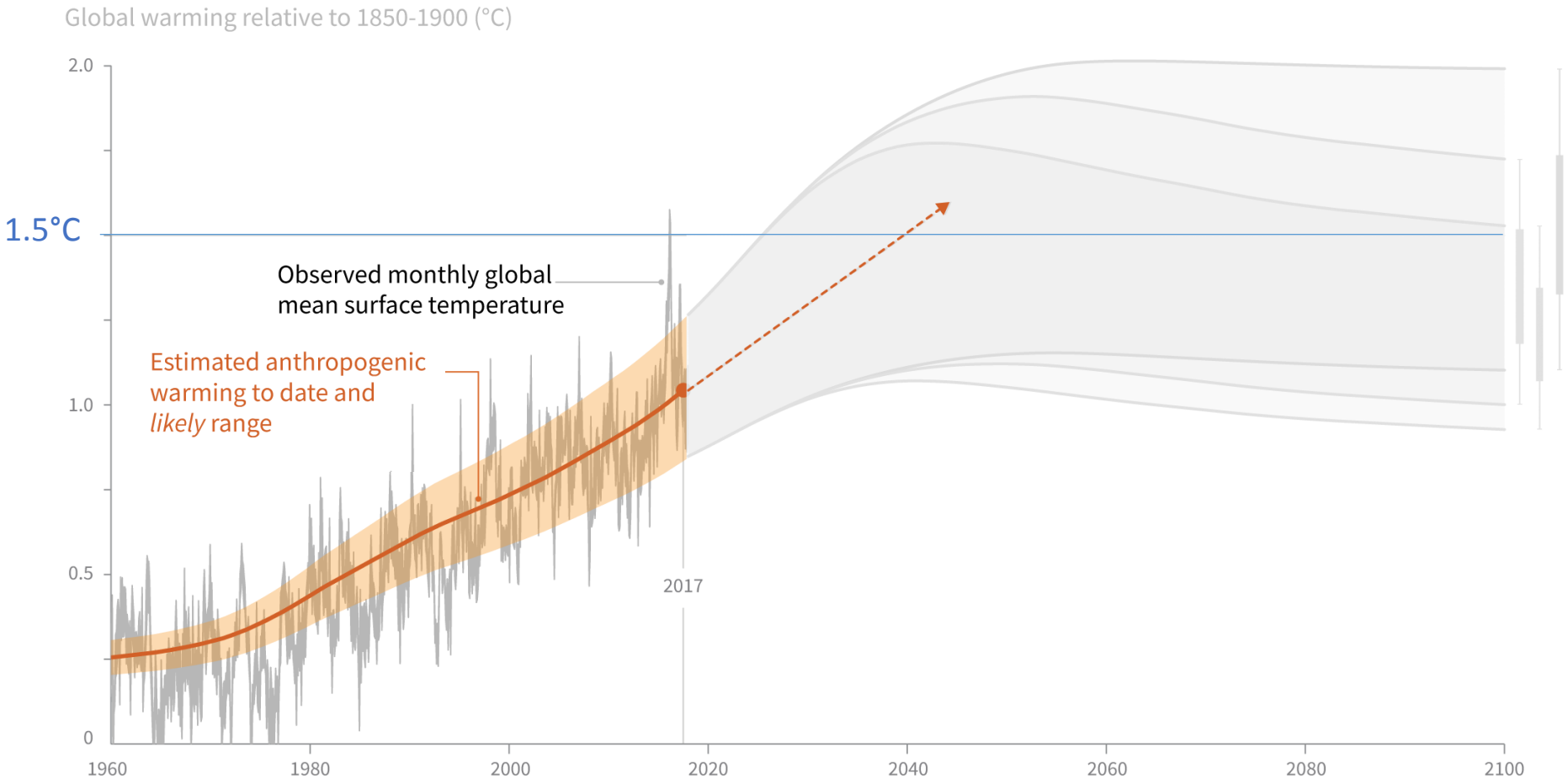
Warming response to stylized pathway: CO_2 emissions reach net zero in 2055, non-CO_2 forcing decline after 2030



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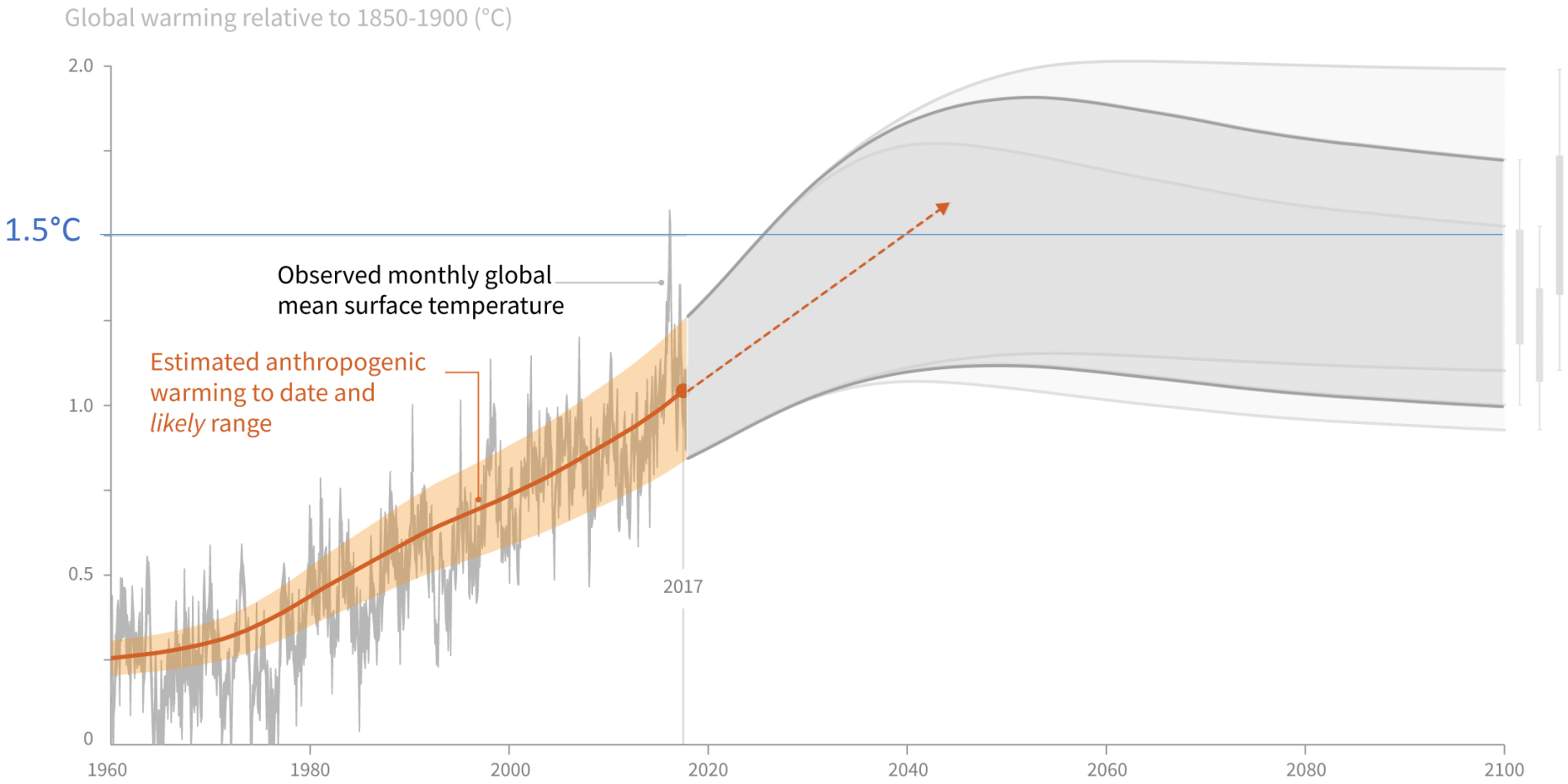

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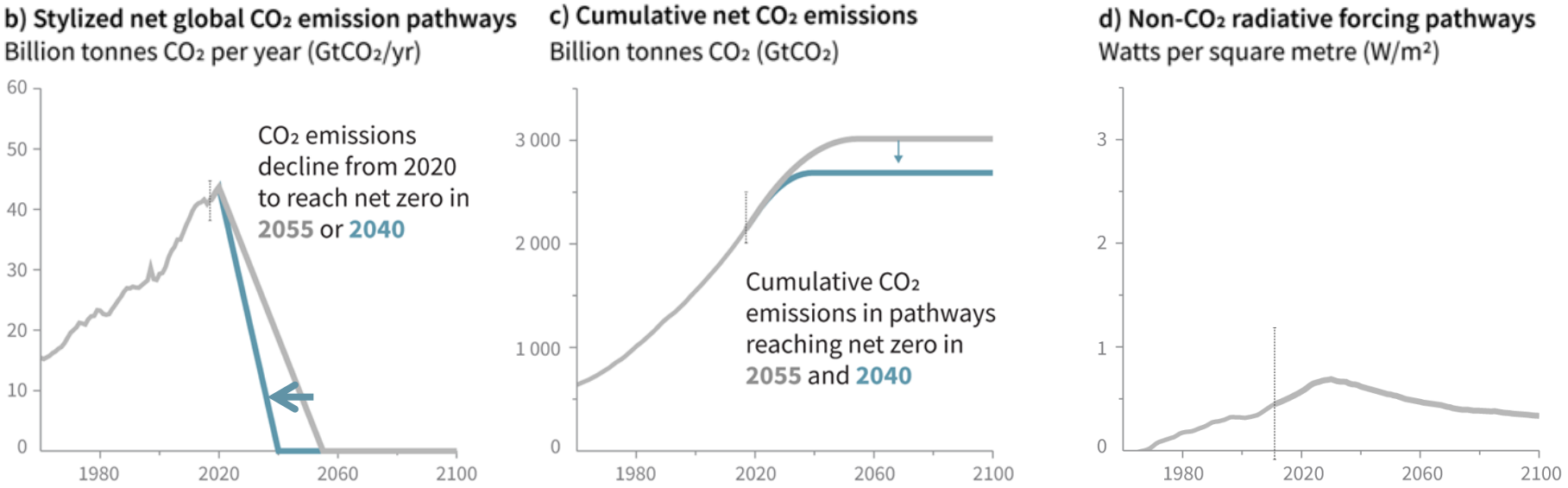
Faster immediate CO_2 reductions, reaching net zero in 2040, reduce total cumulative CO_2 emissions



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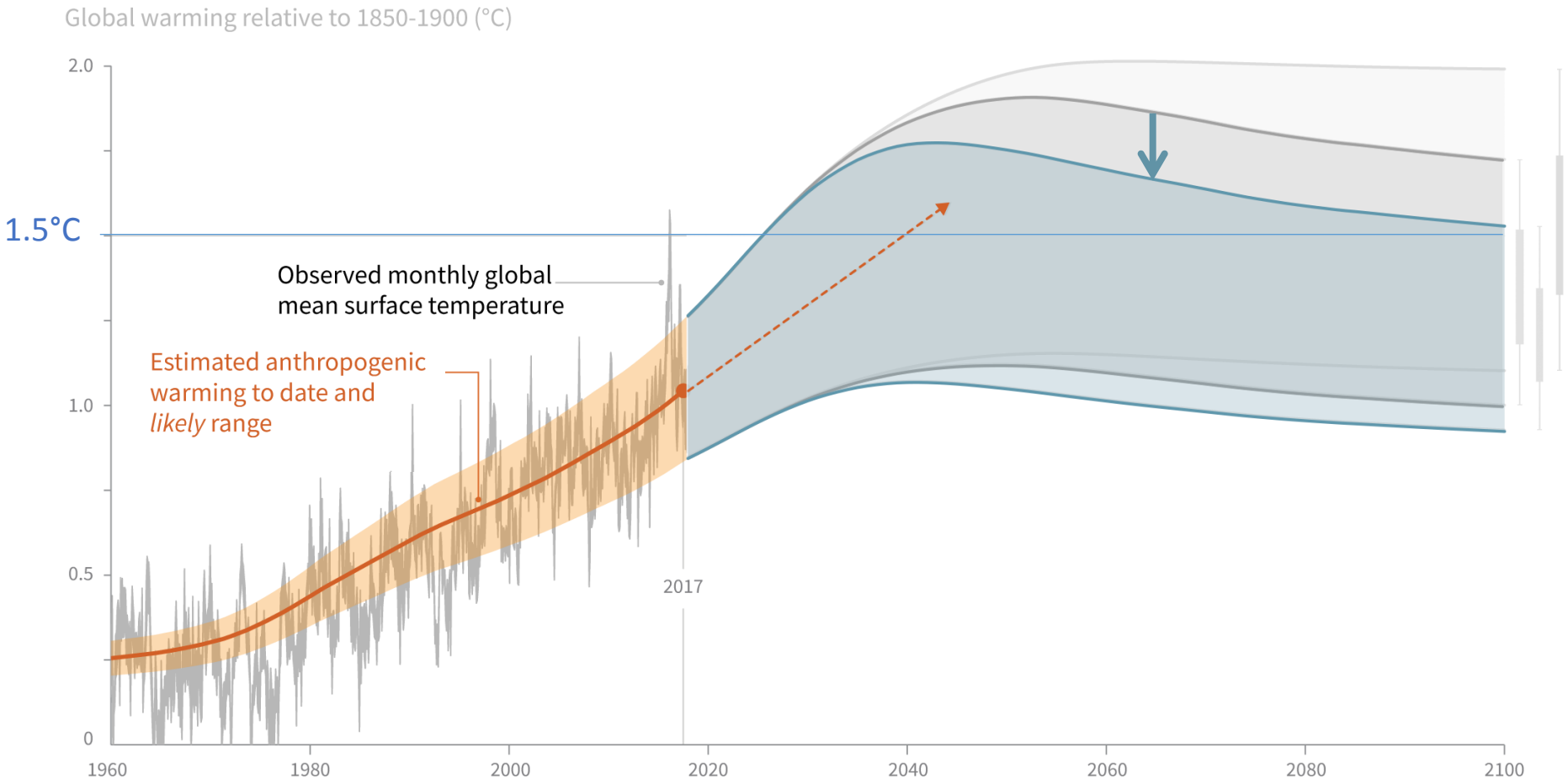
Faster immediate CO_2 reductions, reaching net zero in 2040, reduce the probability of global warming exceeding 1.5°C



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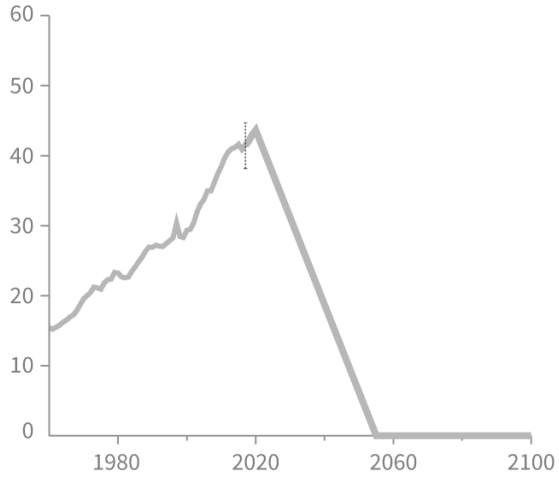
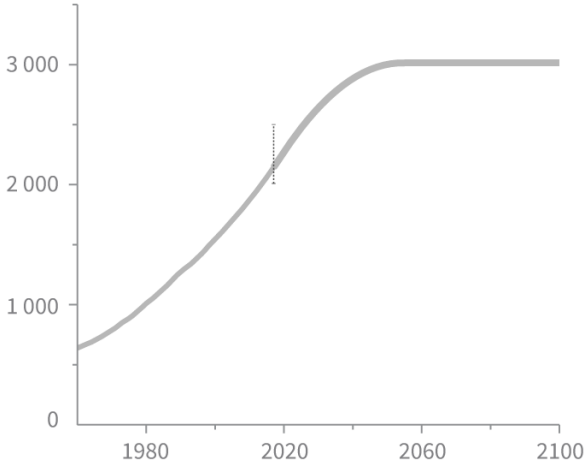
Future temperatures are also affected by radiative forcing due to methane, aerosols, nitrous oxide and other forcing agents

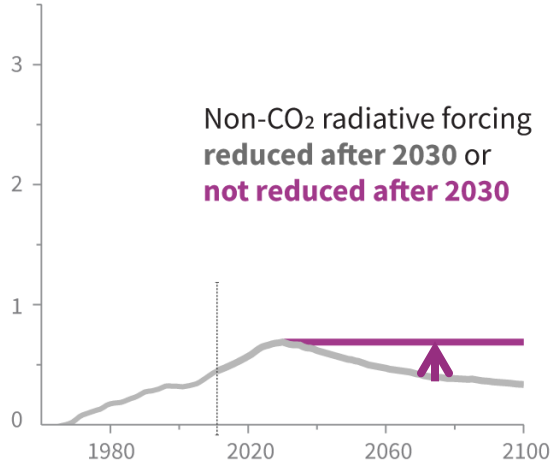
b) Stylized global CO_2 emission pathways
Billion tonnes CO_2 per year (Gt/y)



c) Total cumulative CO_2 emissions
Billion tonnes CO_2 (Gt)



d) Non-CO_2 radiative forcing pathways
Watts per square metre (W/m^2)



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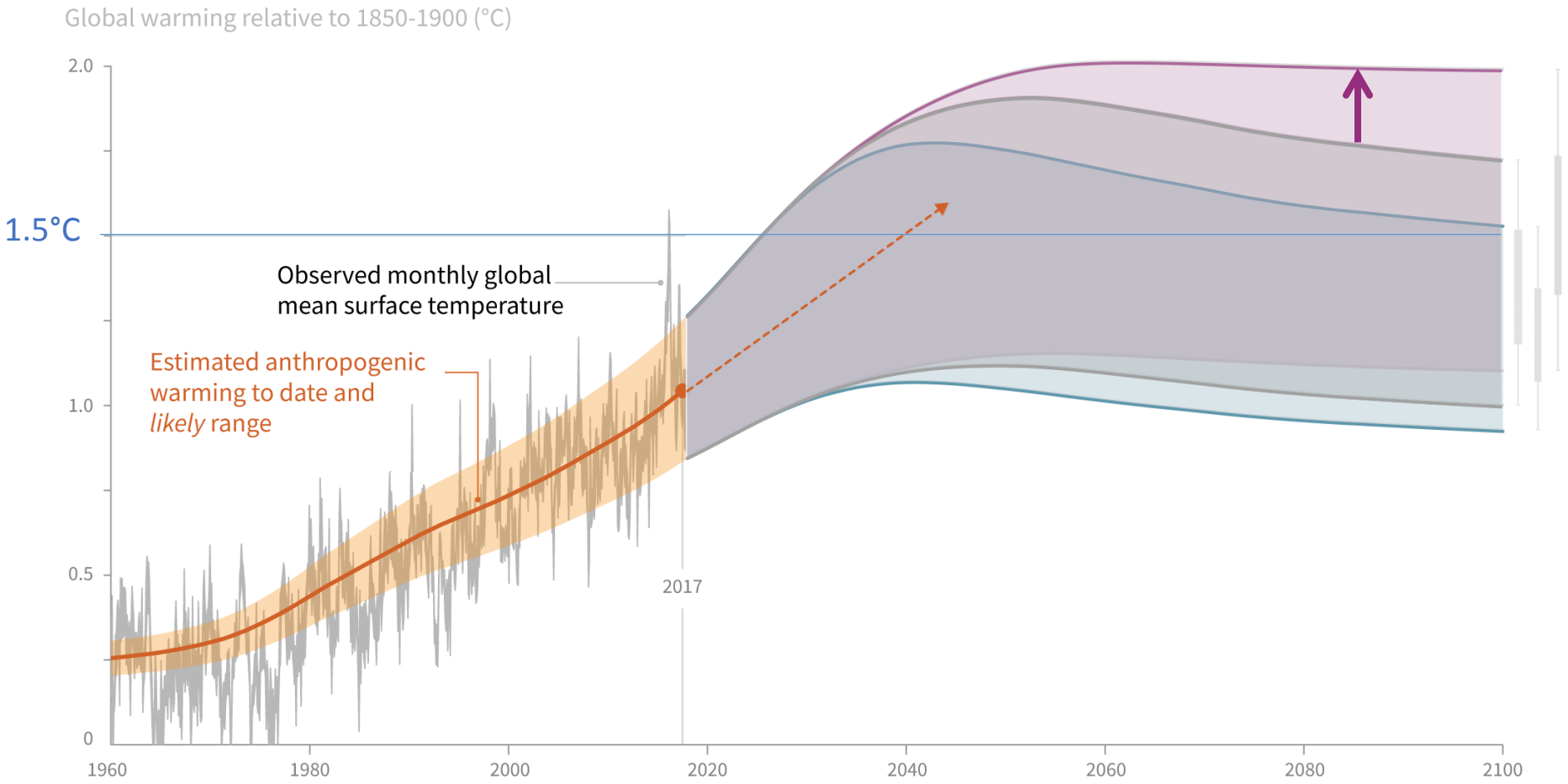
No reduction of non-CO_2 radiative forcing after 2030 results in a lower probability of limiting warming to 1.5°C



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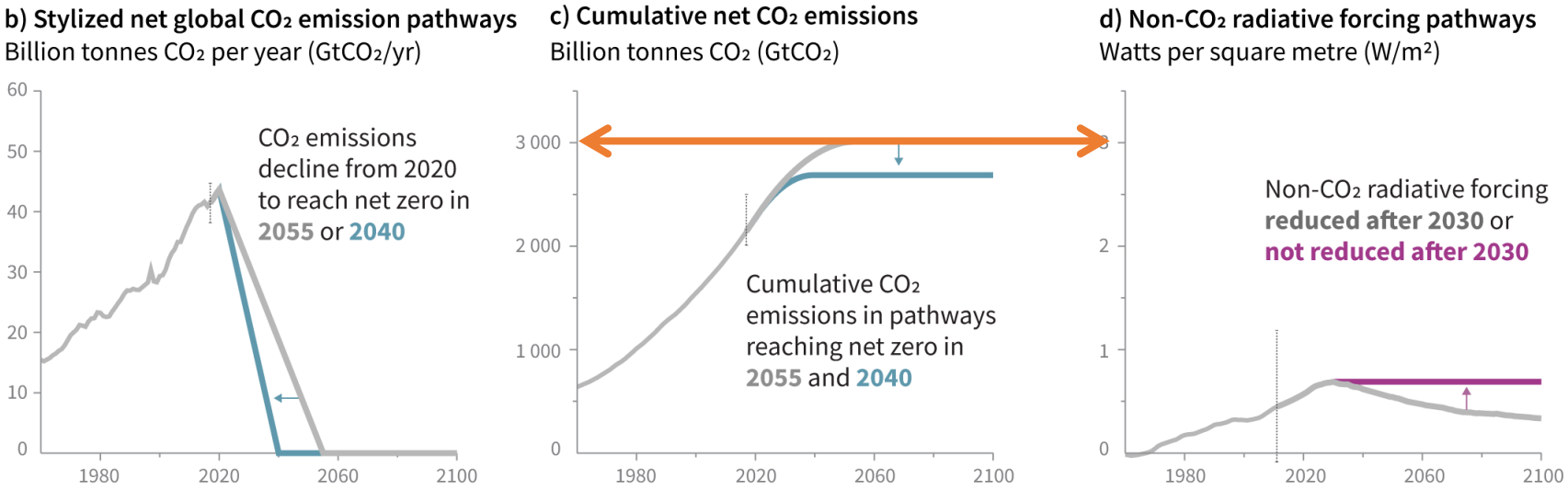
“Vertical axes in panels c and d are scaled to represent approximately equal effects on GMST”



Faster immediate CO_2 emission reductions limit cumulative CO_2 emissions shown in panel **(c)**.

Maximum temperature rise is determined by cumulative net CO_2 emissions and net non-CO_2 radiative forcing due to methane, nitrous oxide, aerosols and other anthropogenic forcing agents.

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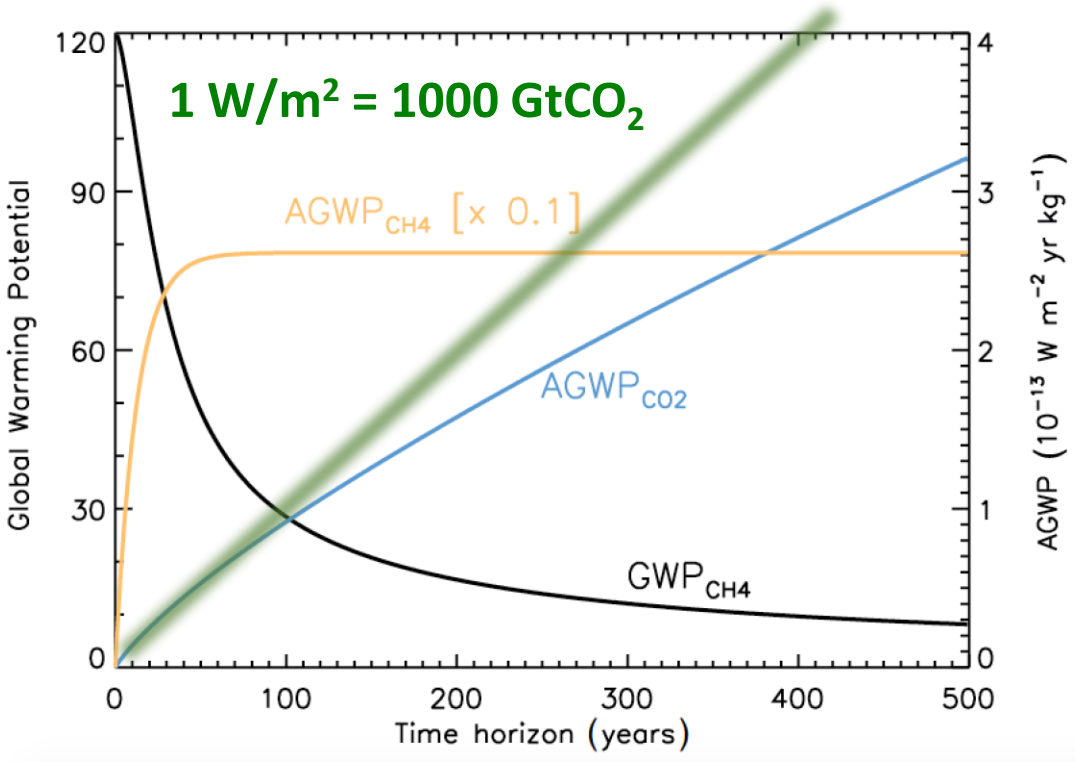
Two definitions of Absolute Global Warming Potential for a time-horizon *H*: $AGWP_H$

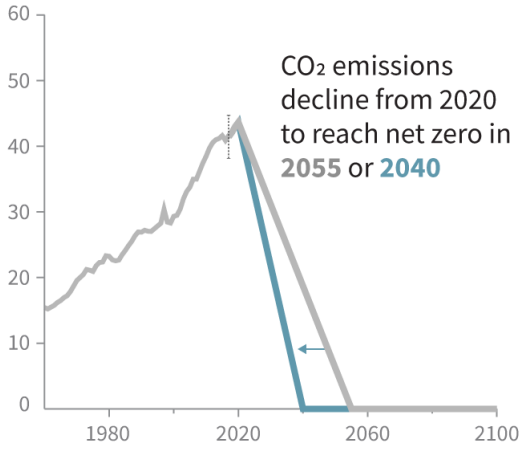


- Integrated radiative forcing over *H* years following a 1kg emission.
- Instantaneous radiative forcing resulting from a continuous emission of 1kg/year over the preceding *H* years.

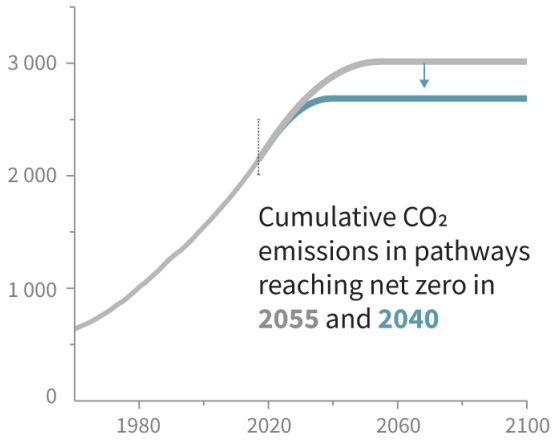
AR5 $AGWP_{100}$:
9.17×10^{-14} W m^{-2} yr kg^{-1}
Corresponds to $H/AGWP_H$
= 1090 $GtCO_2$ / (W m^{-2})

How do these pathways relate to the outstanding carbon budget for 1.5°C?

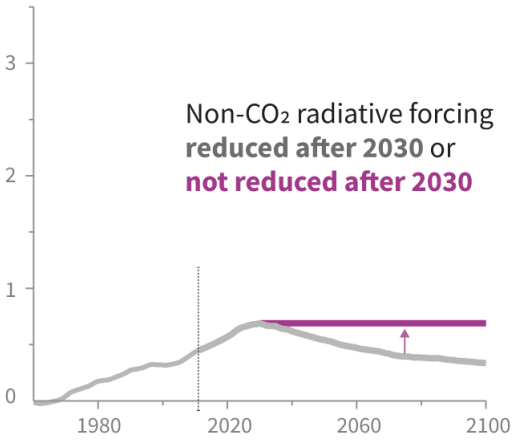
b) Stylized net global CO_2 emission pathways
Billion tonnes CO_2 per year ($GtCO_2$/yr)



c) Cumulative net CO_2 emissions
Billion tonnes CO_2 ($GtCO_2$)



d) Non-CO_2 radiative forcing pathways
Watts per square metre (W/m^2)



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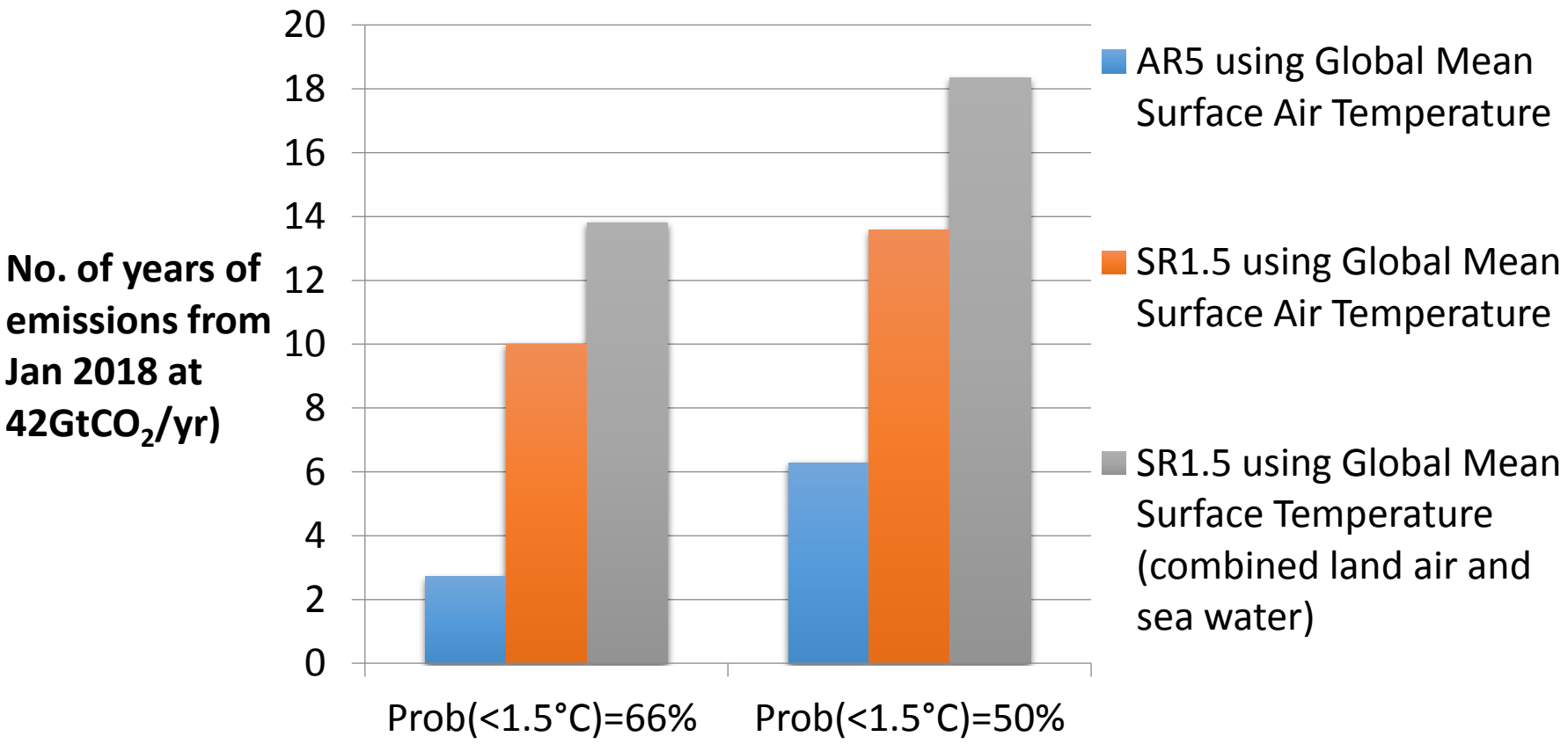
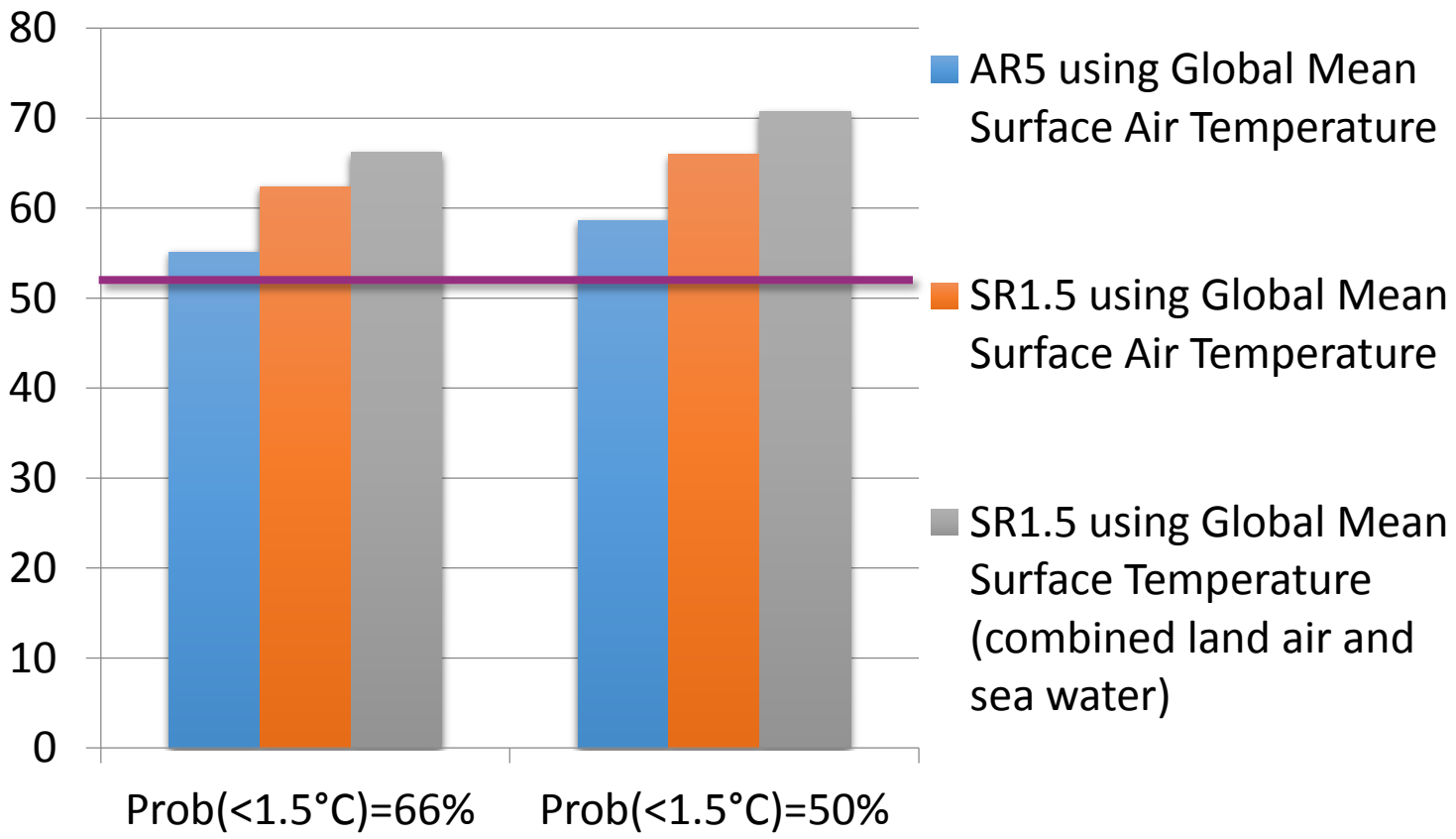
Revised estimates of remaining “carbon budget” depend on choice of how to measure “global temperature” and probability of remaining below 1.5°C

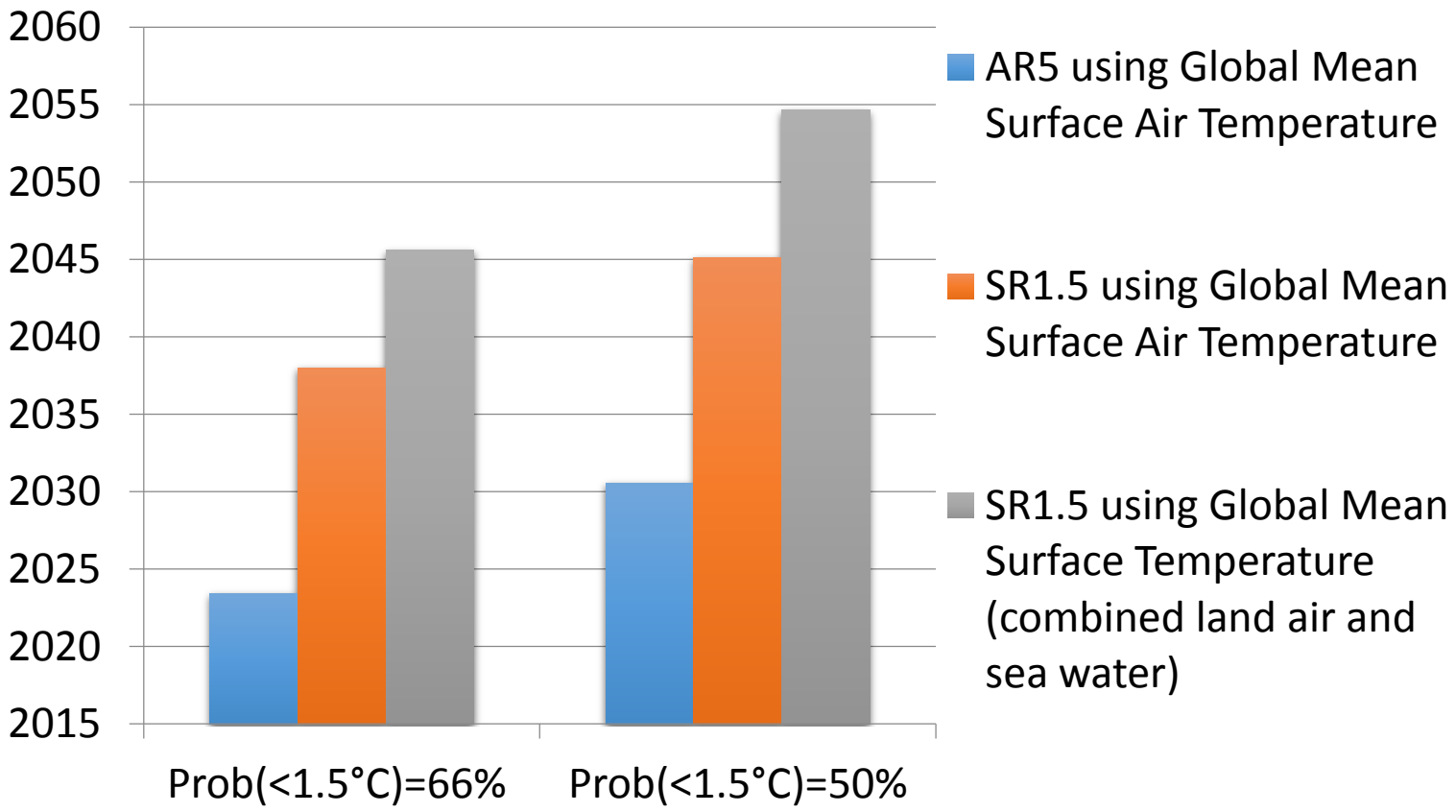


Revised estimates of remaining “carbon budget” in context: adding observed historical emissions

No. of years of emissions from Jan 2018 at 42GtCO$_2$/yr plus 2200GtCO$_2$ historical emissions



Revised estimates of remaining “carbon budget” in context: year that emissions must reach zero if reductions begin now



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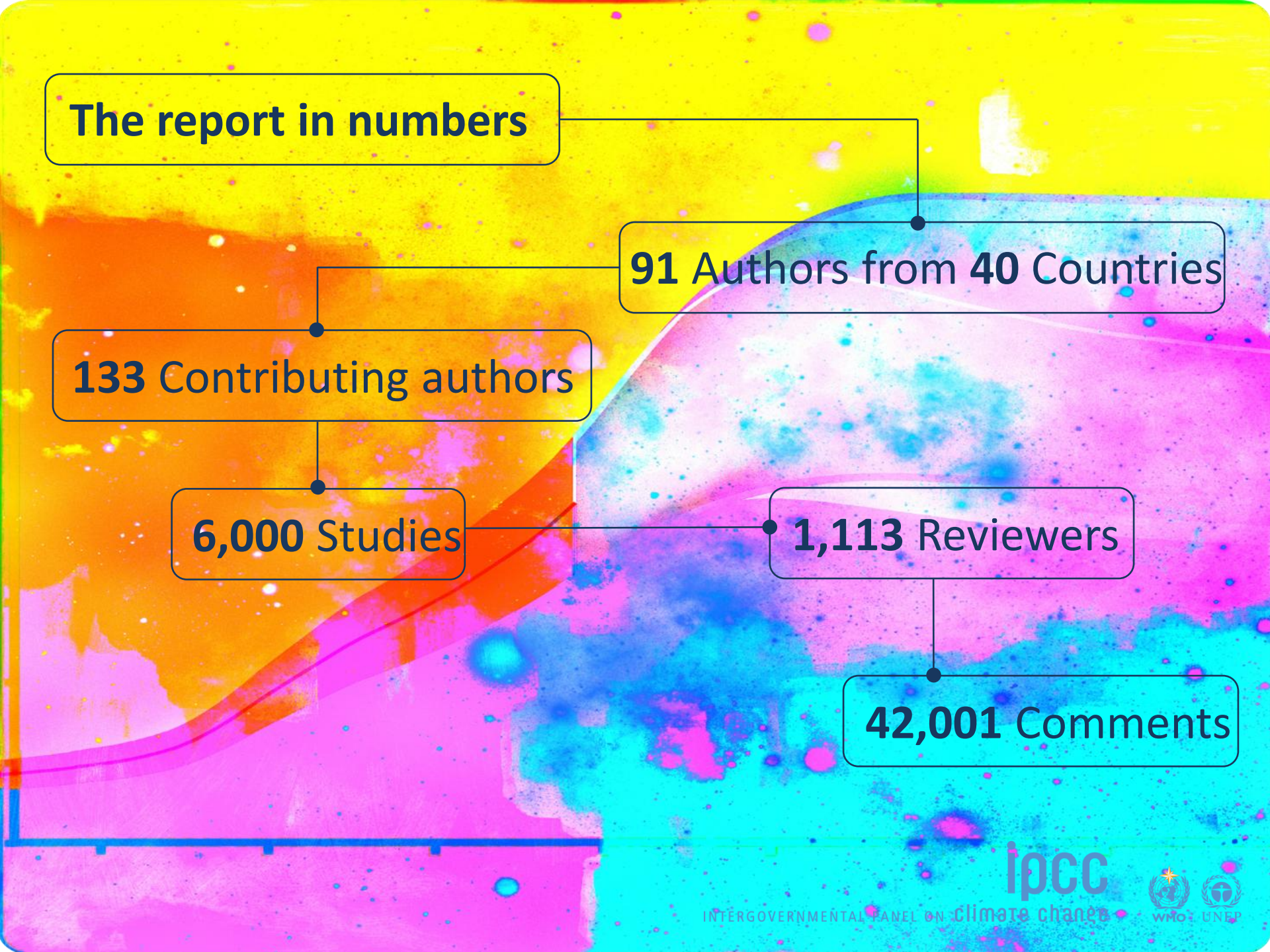
The report in numbers
91 Authors from 40 Countries
133 Contributing authors
6,000 Studies
1,113 Reviewers
42,001 Comments
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Some surprisingly hard-hitting sentences…

Approved SPM – copyedit pending IPCC SR1.5

B6. Most adaptation needs will be lower for global warming of 1.5°C compared to 2°C (*high confidence*). There are a wide range of adaptation options that can reduce the risks of climate change (*high confidence*). There are limits to adaptation and adaptive capacity for some human and natural systems at global warming of 1.5°C, with associated losses (*medium confidence*). The number and availability of adaptation options vary by sector (*medium confidence*). {Table 3.5, 4.3, 4.5, Cross-Chapter Box 9 in Chapter 4, Cross-Chapter Box 12 in Chapter 5}

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