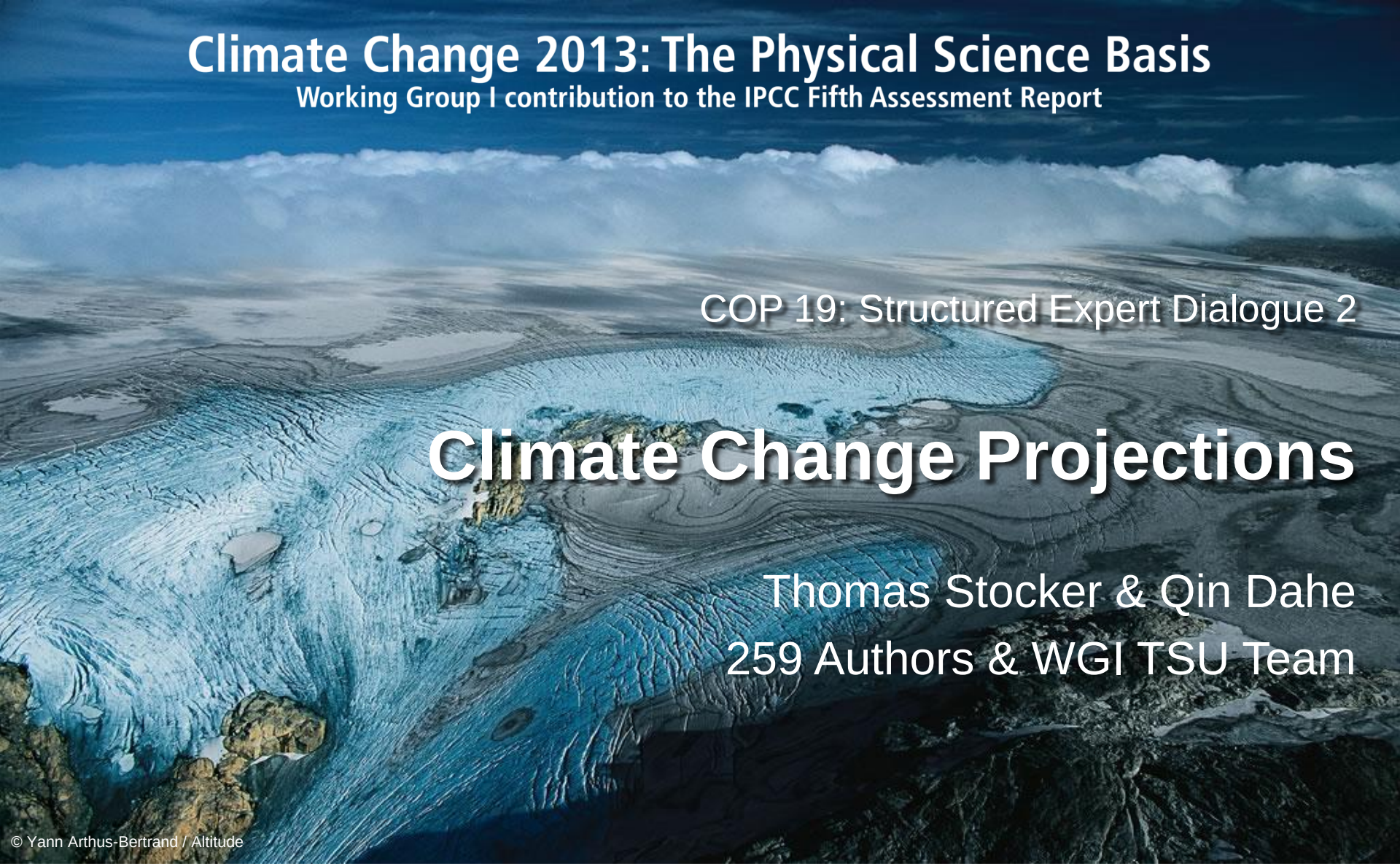
Climate Change 2013: The Physical Science Basis

Working Group I contribution to the IPCC Fifth Assessment Report



COP 19: Structured Expert Dialogue 2

Climate Change Projections

Thomas Stocker & Qin Dahe

259 Authors & WGI TSU Team

© Yann Arthus-Bertrand / Altitude

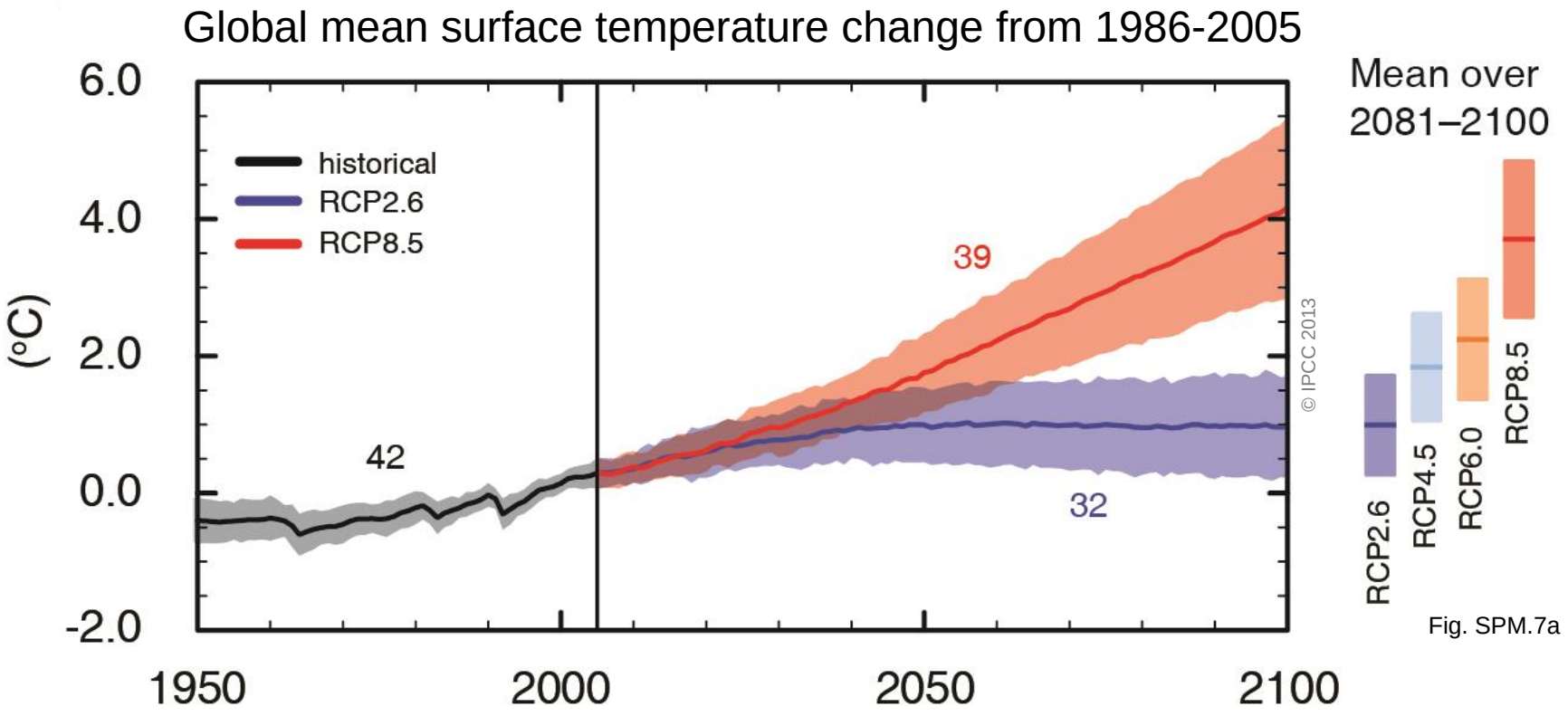


Fig. SPM.7a

Global surface temperature change for the end of the 21st century is *likely* to exceed 1.5°C relative to 1850–1900 for all scenarios except RCP2.6.

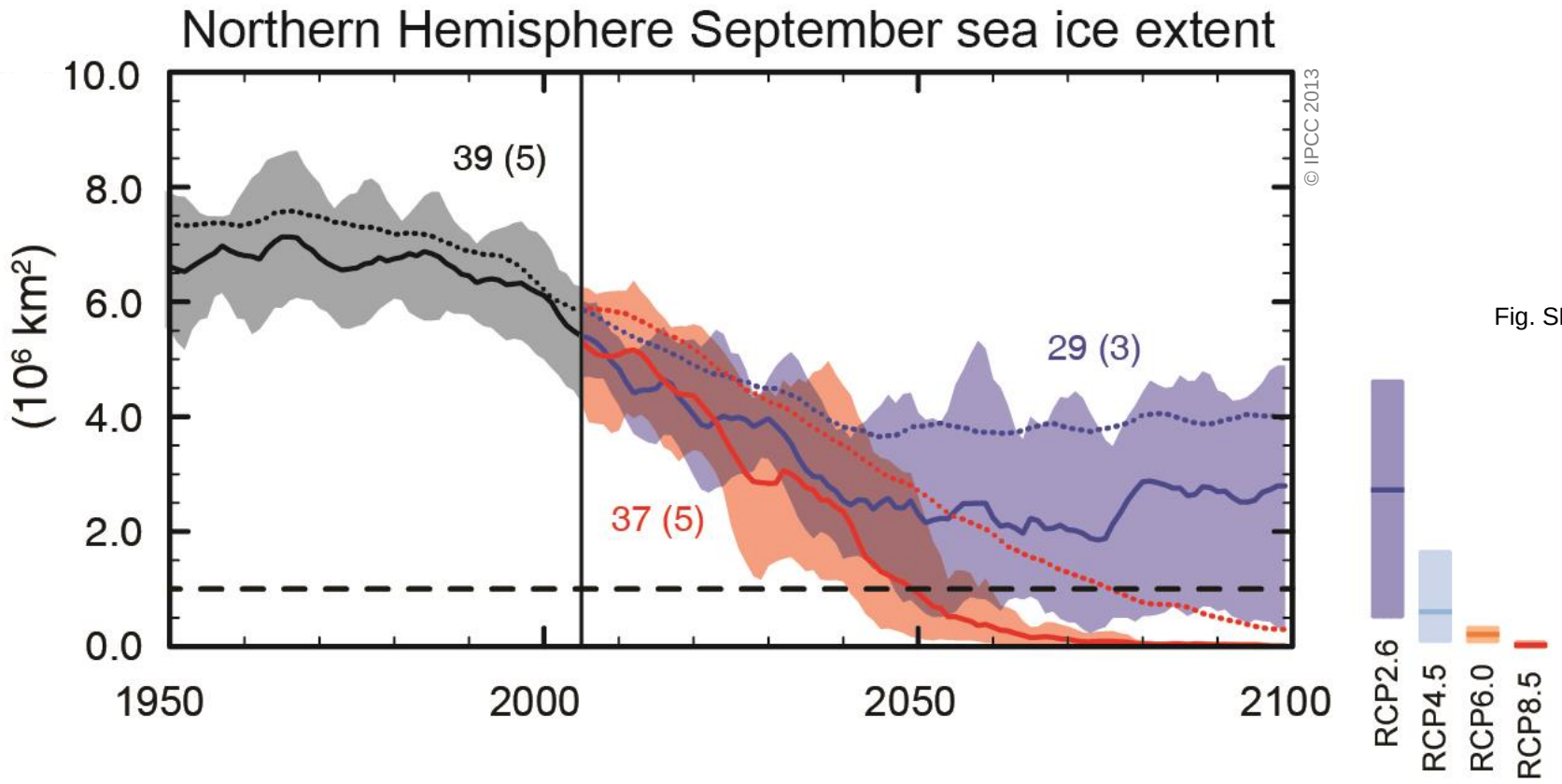
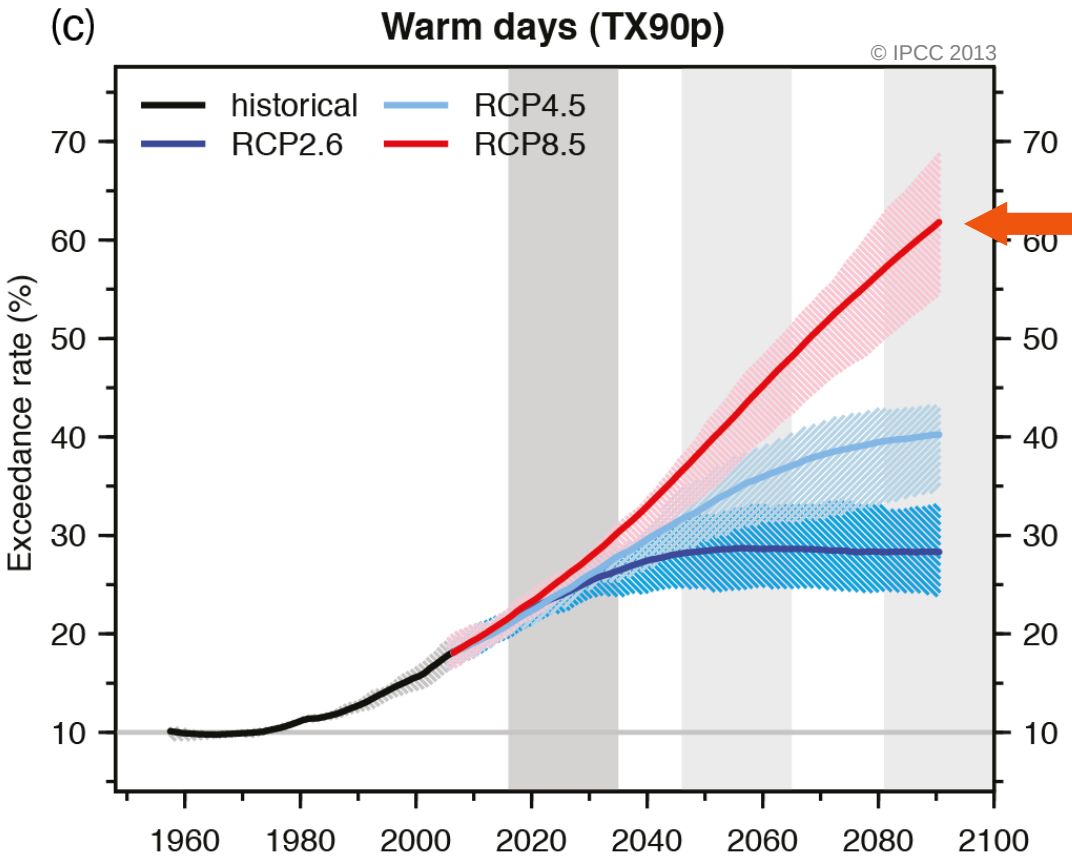


Fig. SPM.7b

[...], a nearly ice-free Arctic Ocean in September before mid-century is *likely* for RCP8.5 (*medium confidence*).



over 6 times more frequent

TS TFE.9, Fig. 1

It is *very likely* that heat waves will occur with higher frequency and duration. Occasional cold winter extremes will continue to occur.

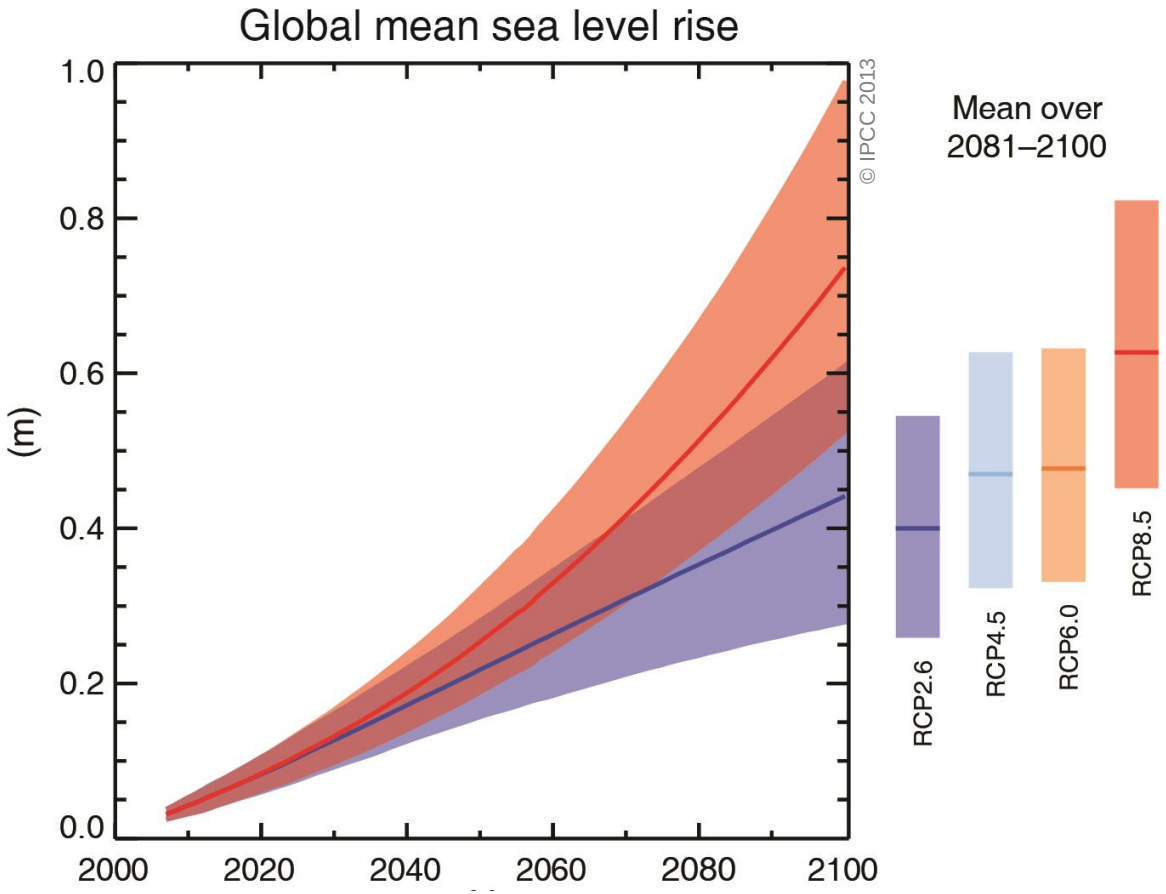


Fig. SPM.9

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

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

* *likely* range

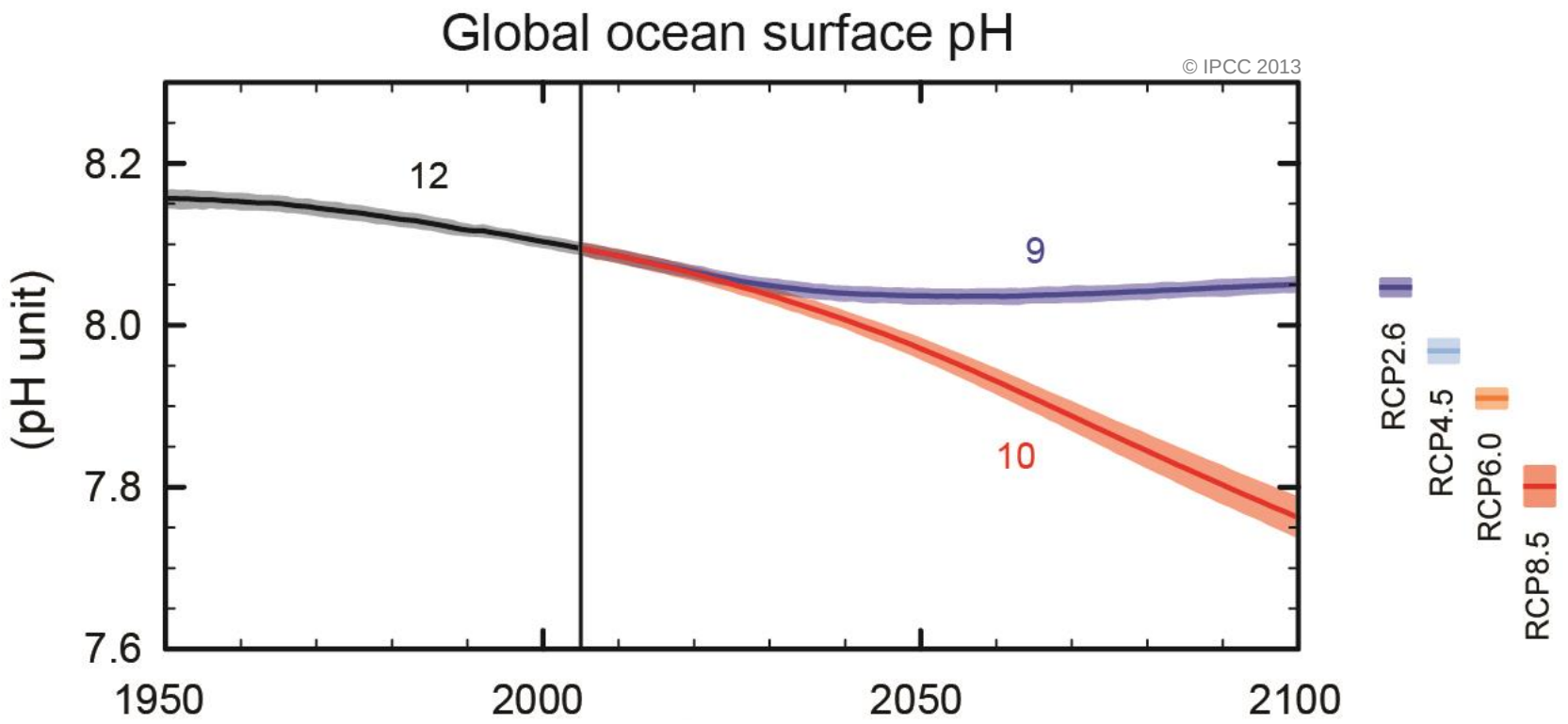


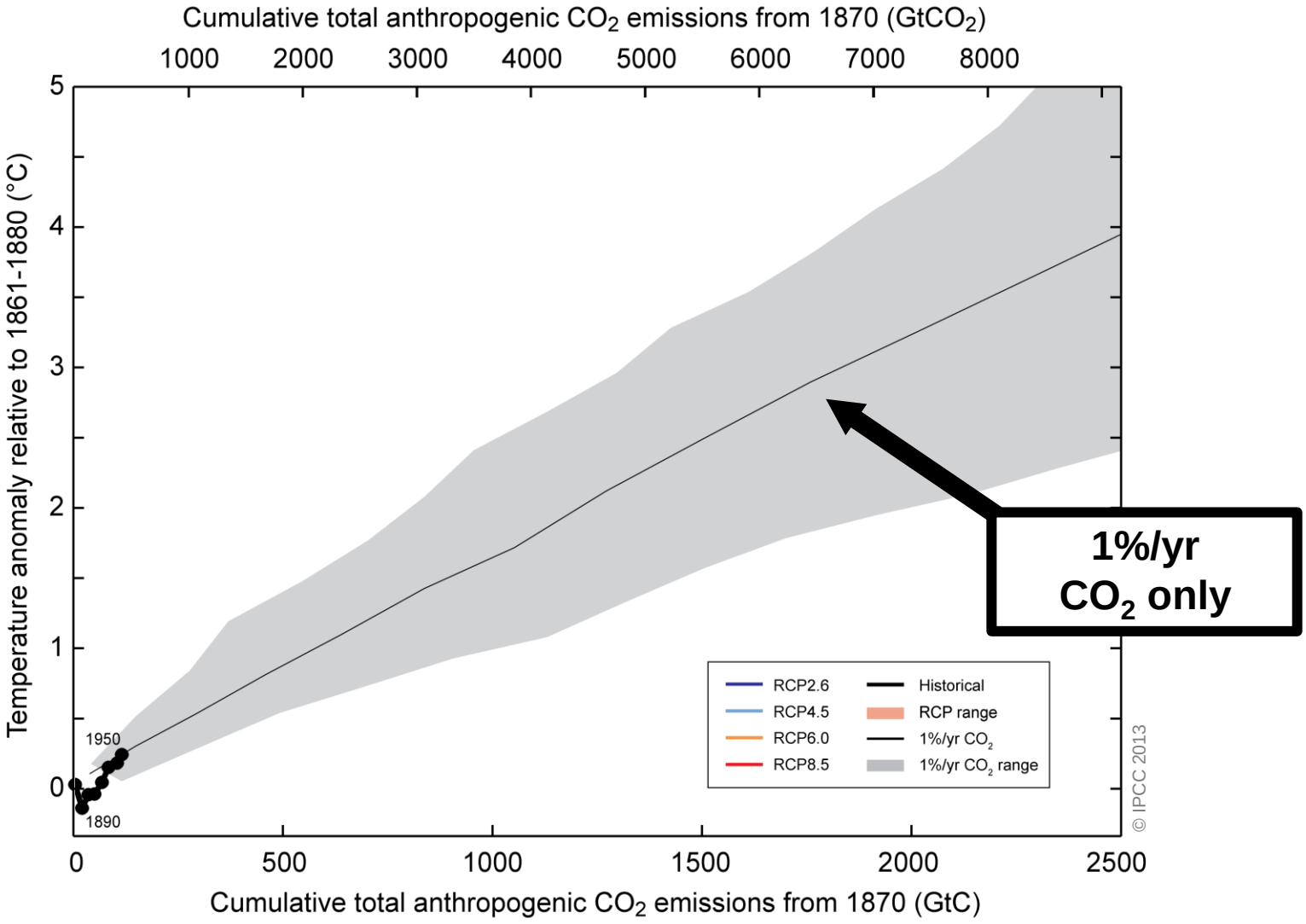
Fig. SPM.7

RCP2.6 (2081−2100): −0.06 to −0.07 *

RCP8.5 (2081−2100): −0.30 to −0.32 *

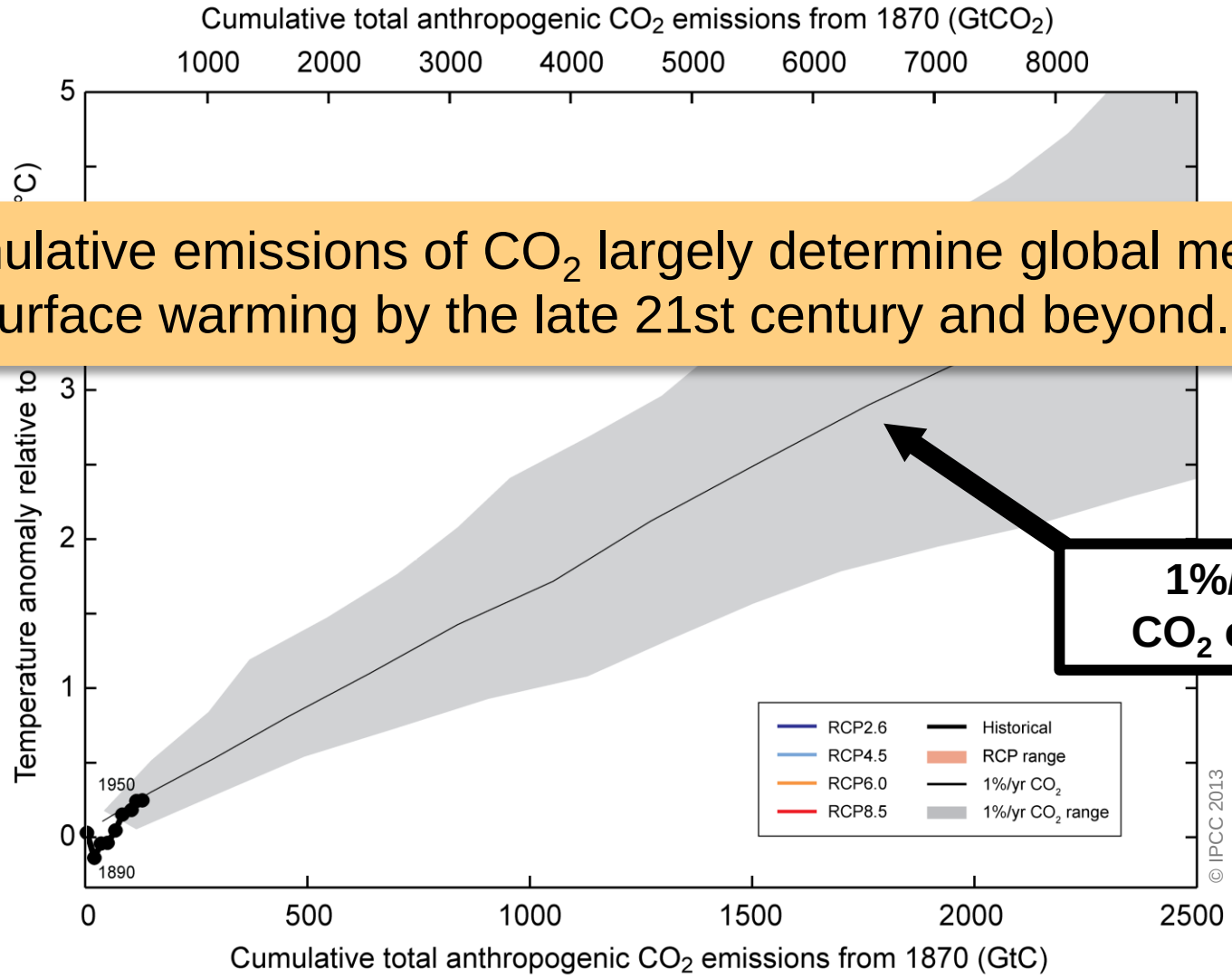
* CMIP5 model spread

Warming caused by cumulative carbon emissions to 1950



Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 1960

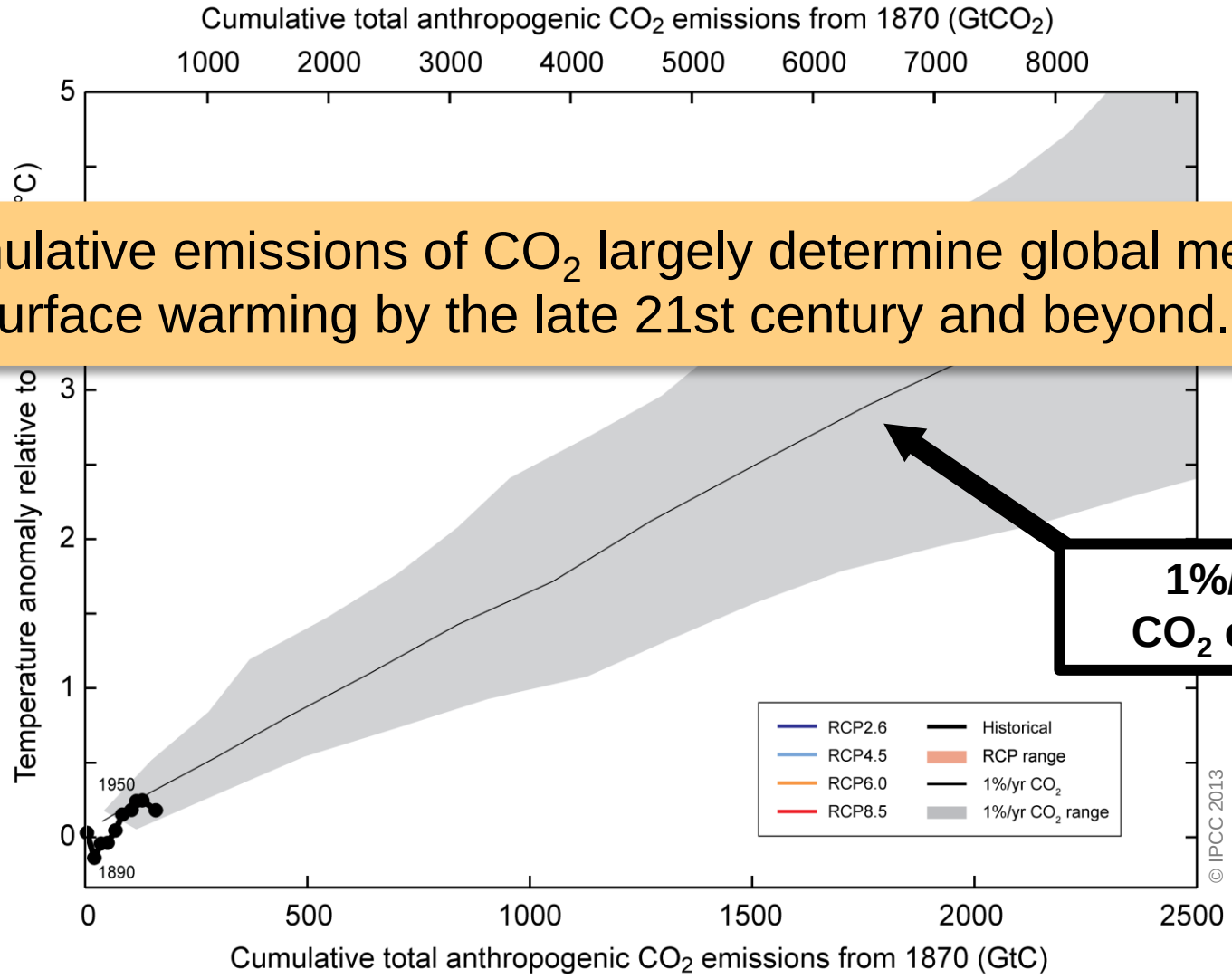


Cumulative emissions of CO_2 largely determine global mean surface warming by the late 21st century and beyond.

1%/yr CO_2 only

Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 1970

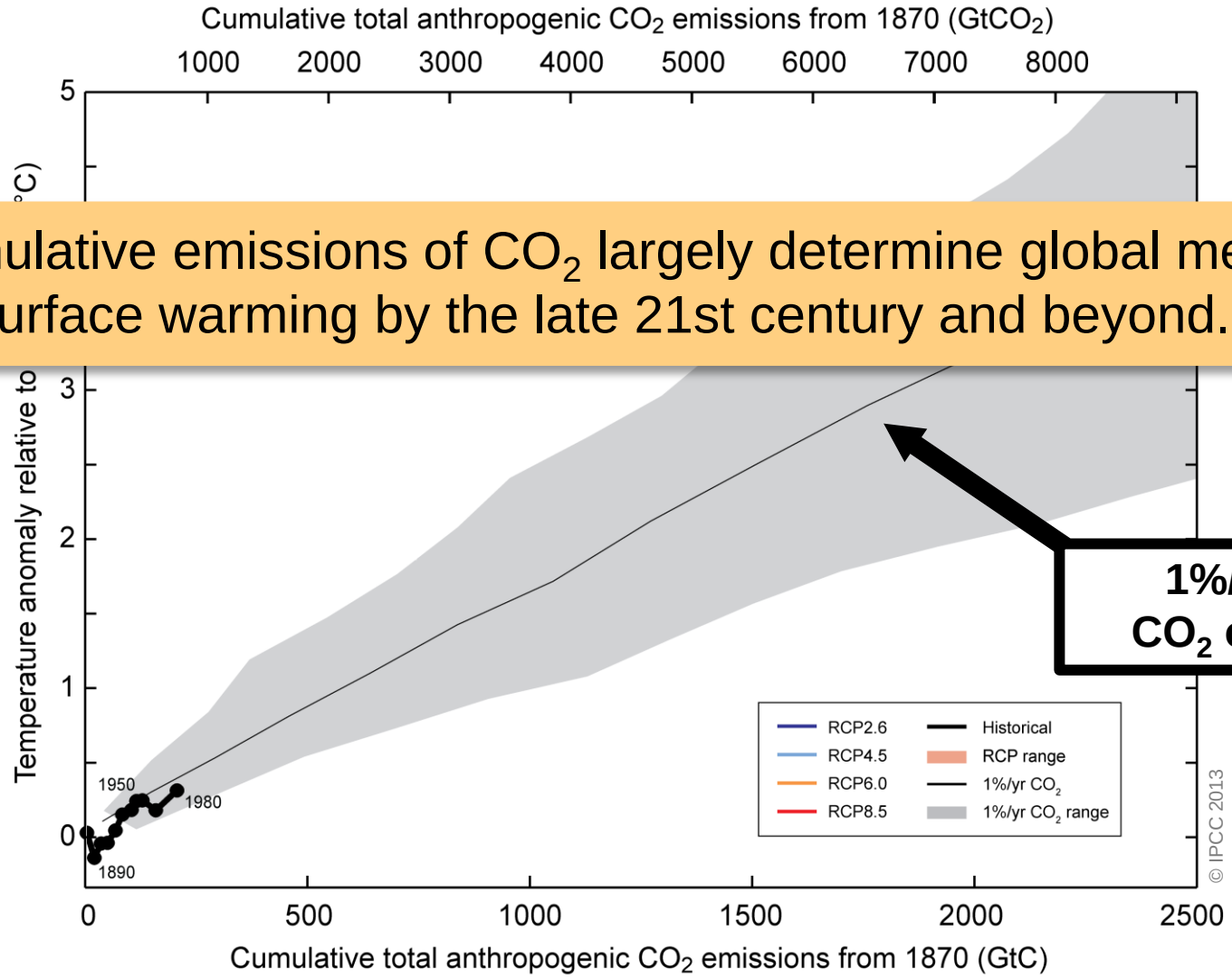


Cumulative emissions of CO_2 largely determine global mean surface warming by the late 21st century and beyond.

1%/yr CO_2 only

Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 1980

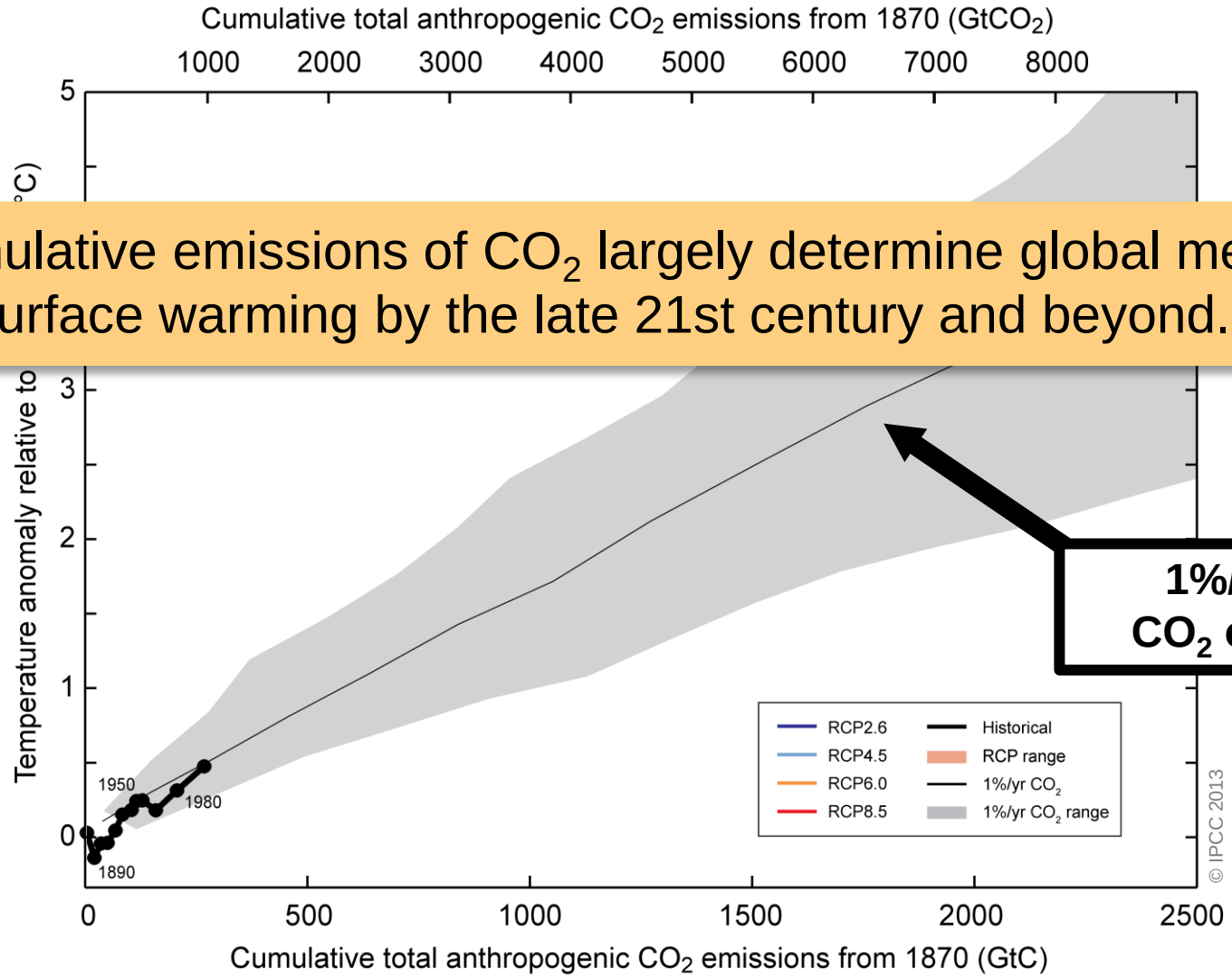


Cumulative emissions of CO_2 largely determine global mean surface warming by the late 21st century and beyond.

1%/yr CO_2 only

Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 1990

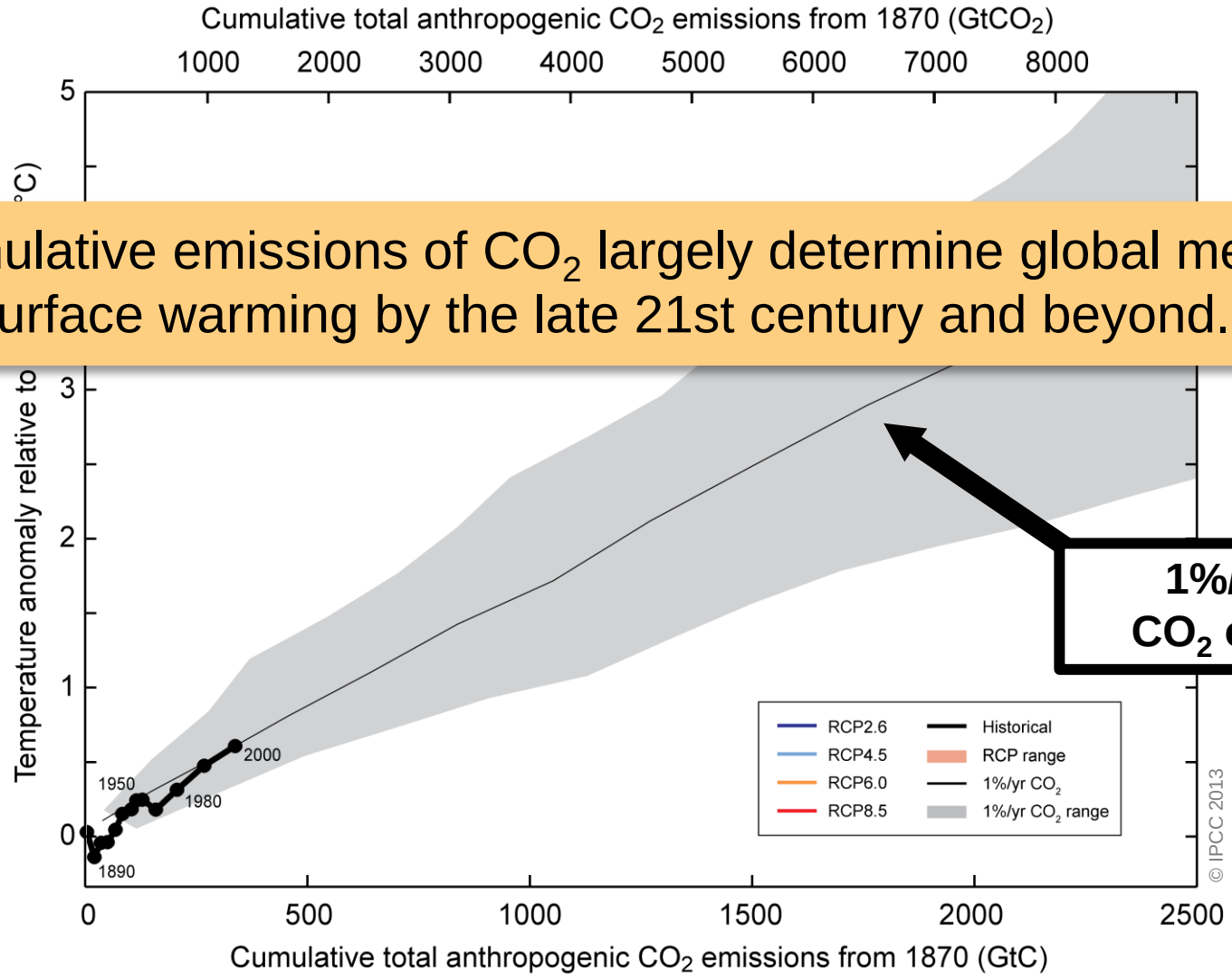


Cumulative emissions of CO_2 largely determine global mean surface warming by the late 21st century and beyond.

1%/yr CO_2 only

Animation courtesy Myles Allen (Oxford University)

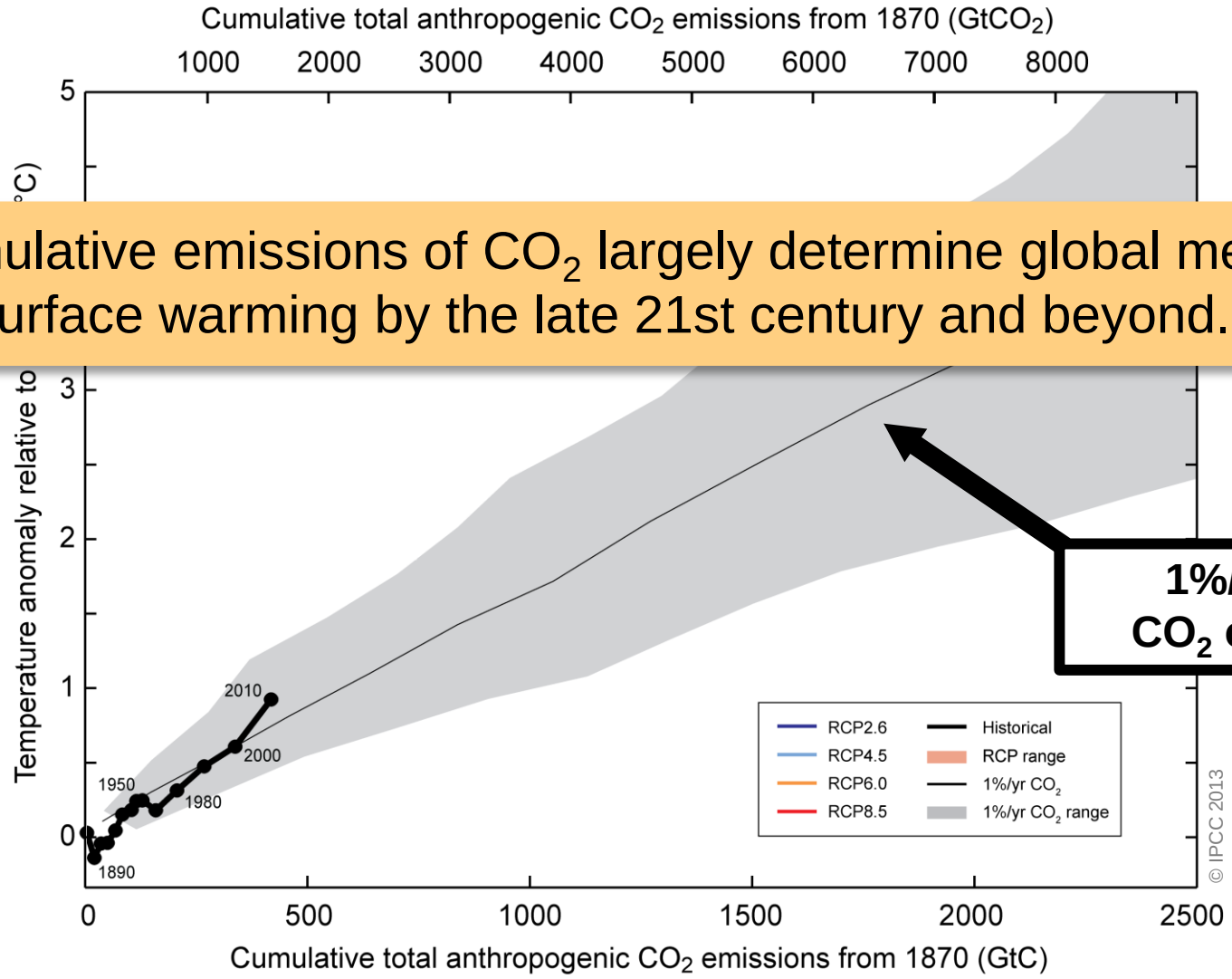
Warming caused by cumulative carbon emissions to 2000



Cumulative emissions of CO_2 largely determine global mean surface warming by the late 21st century and beyond.

Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 2010

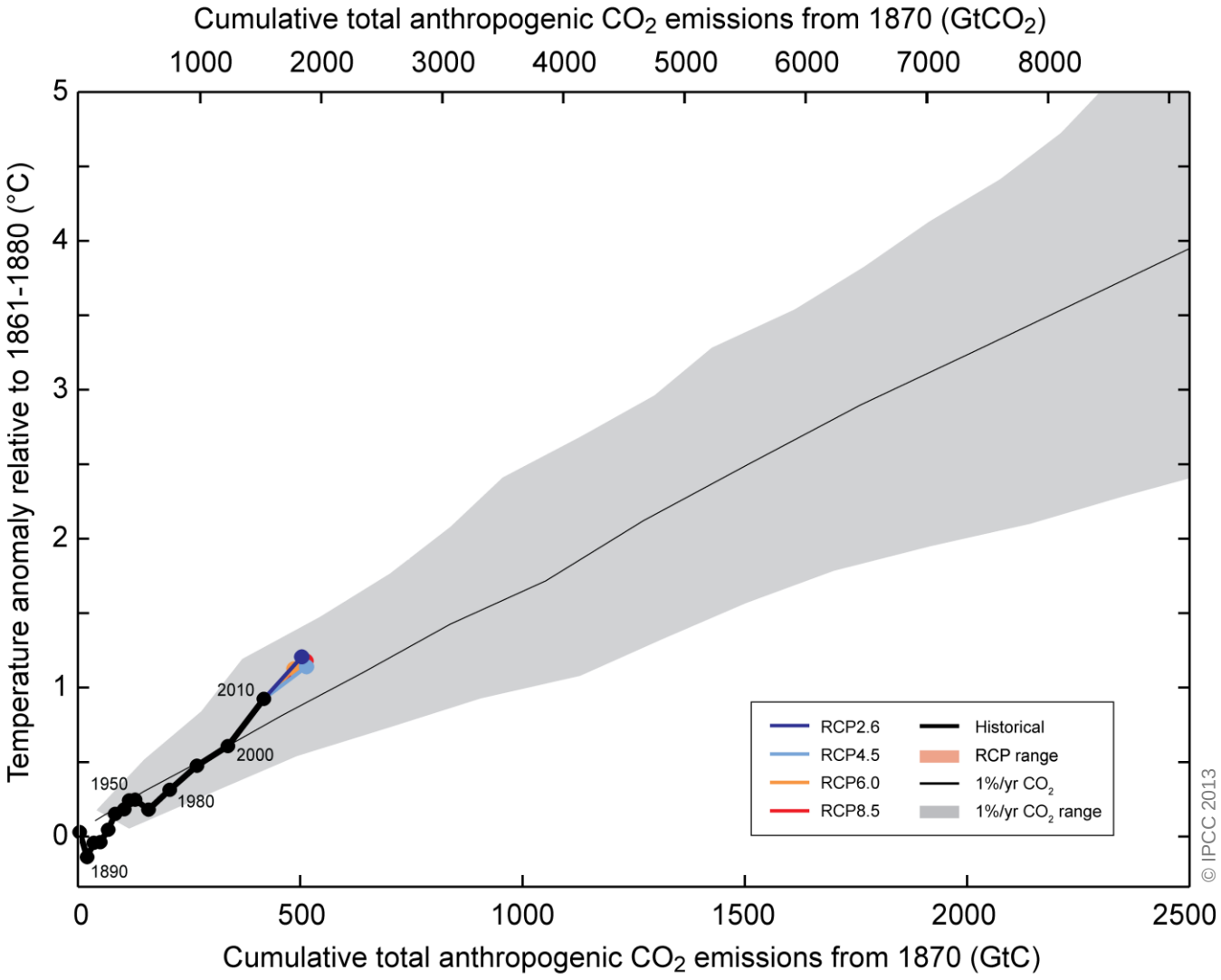


Cumulative emissions of CO_2 largely determine global mean surface warming by the late 21st century and beyond.

1%/yr CO_2 only

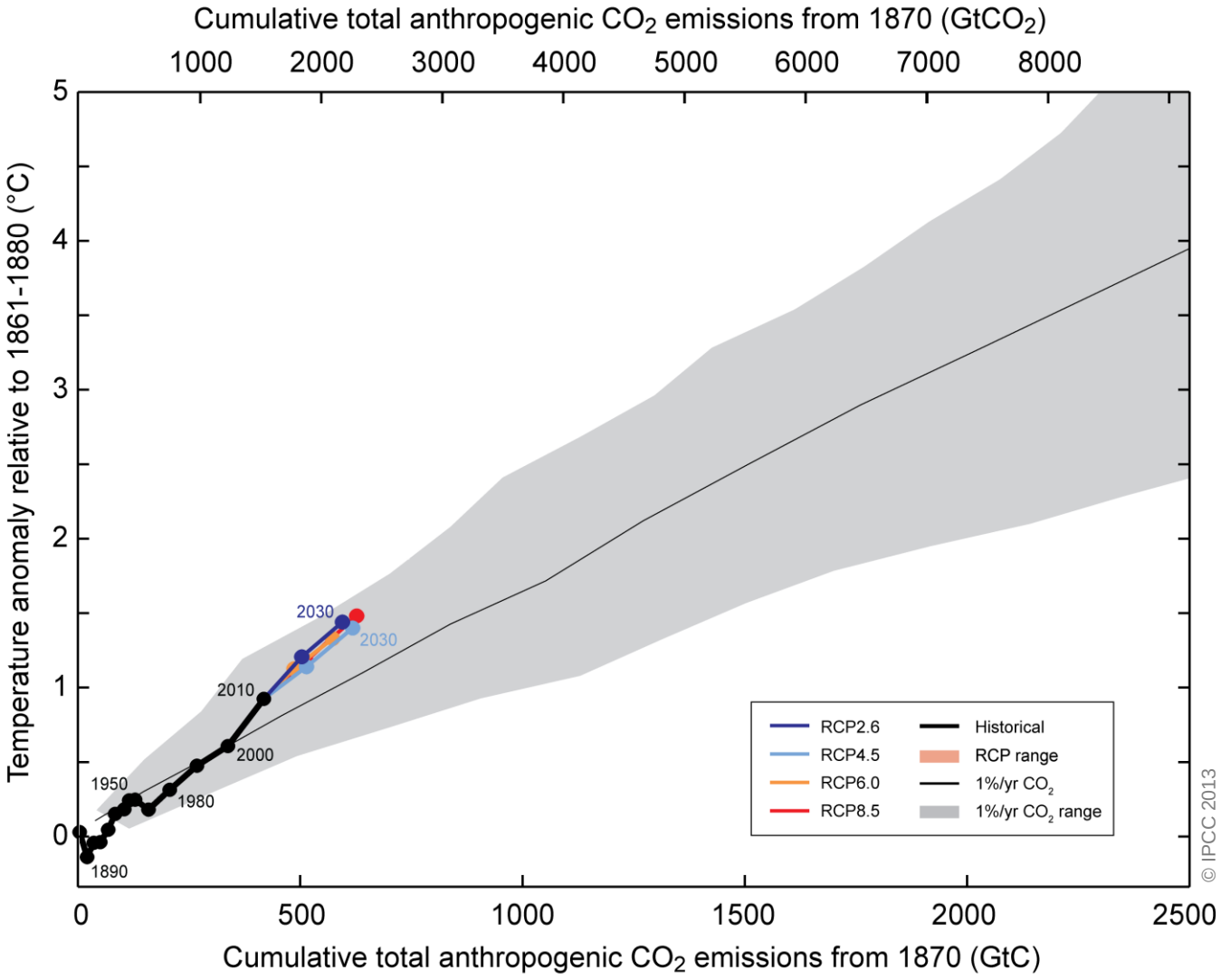
Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 2020



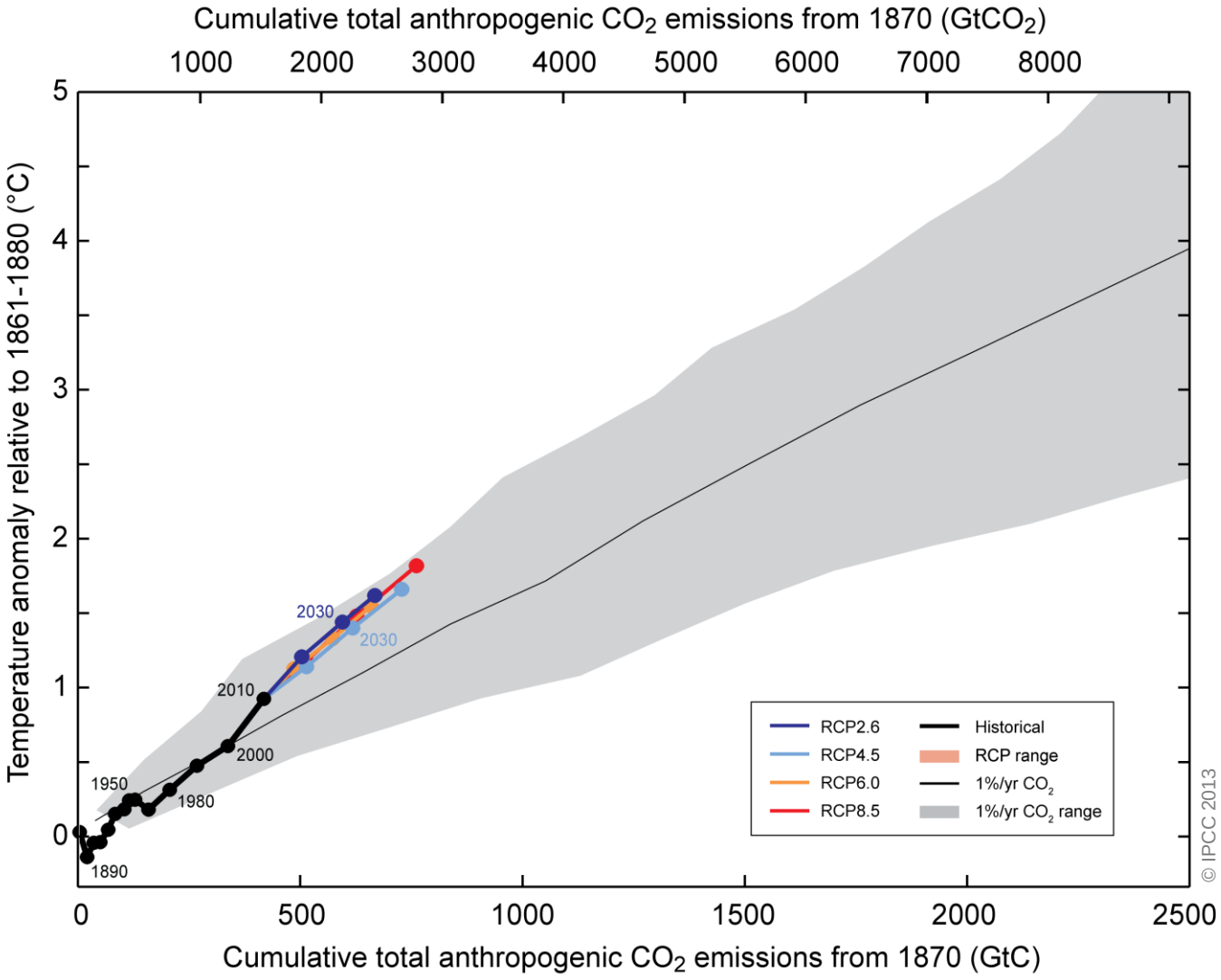
Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 2030



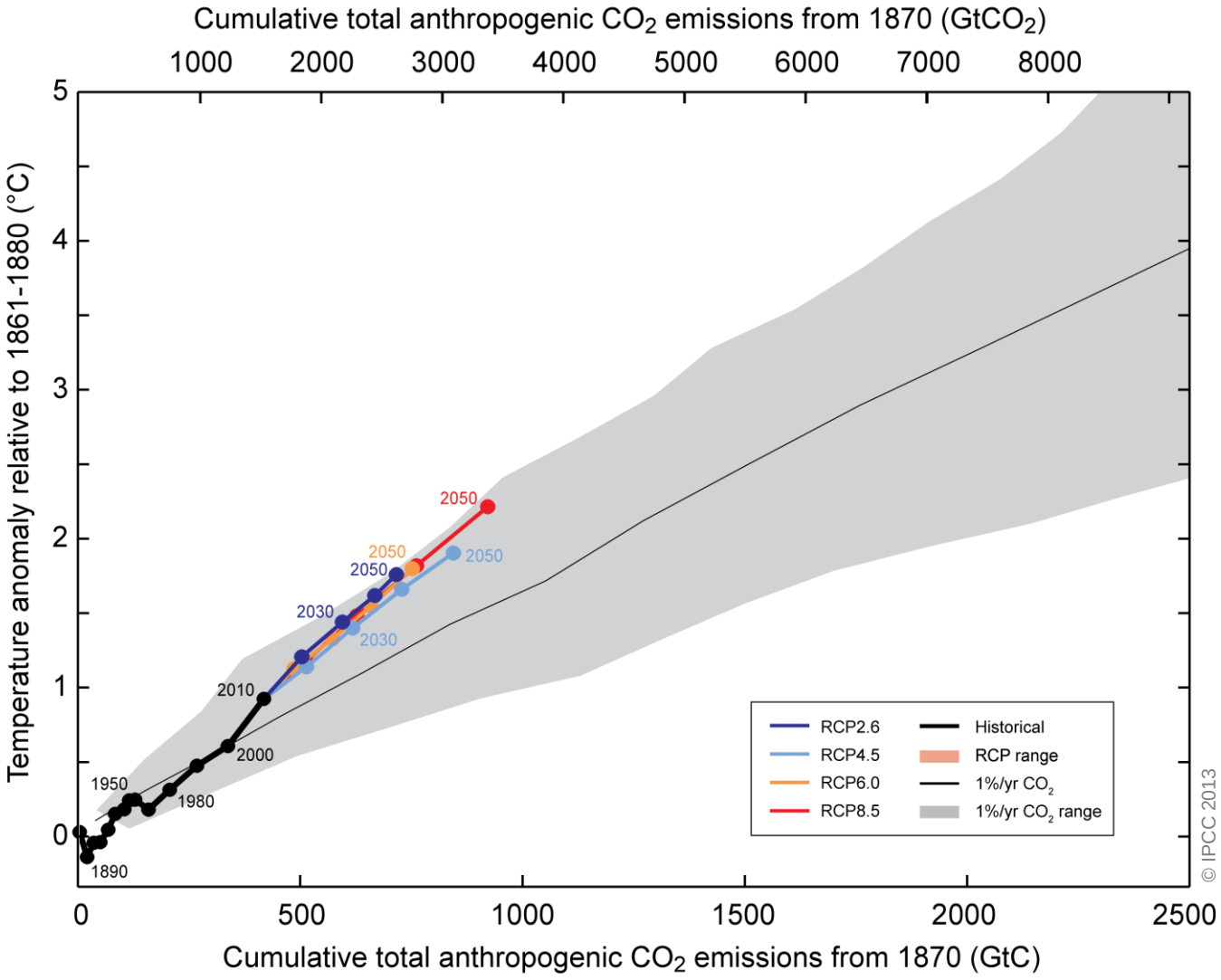
Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 2040



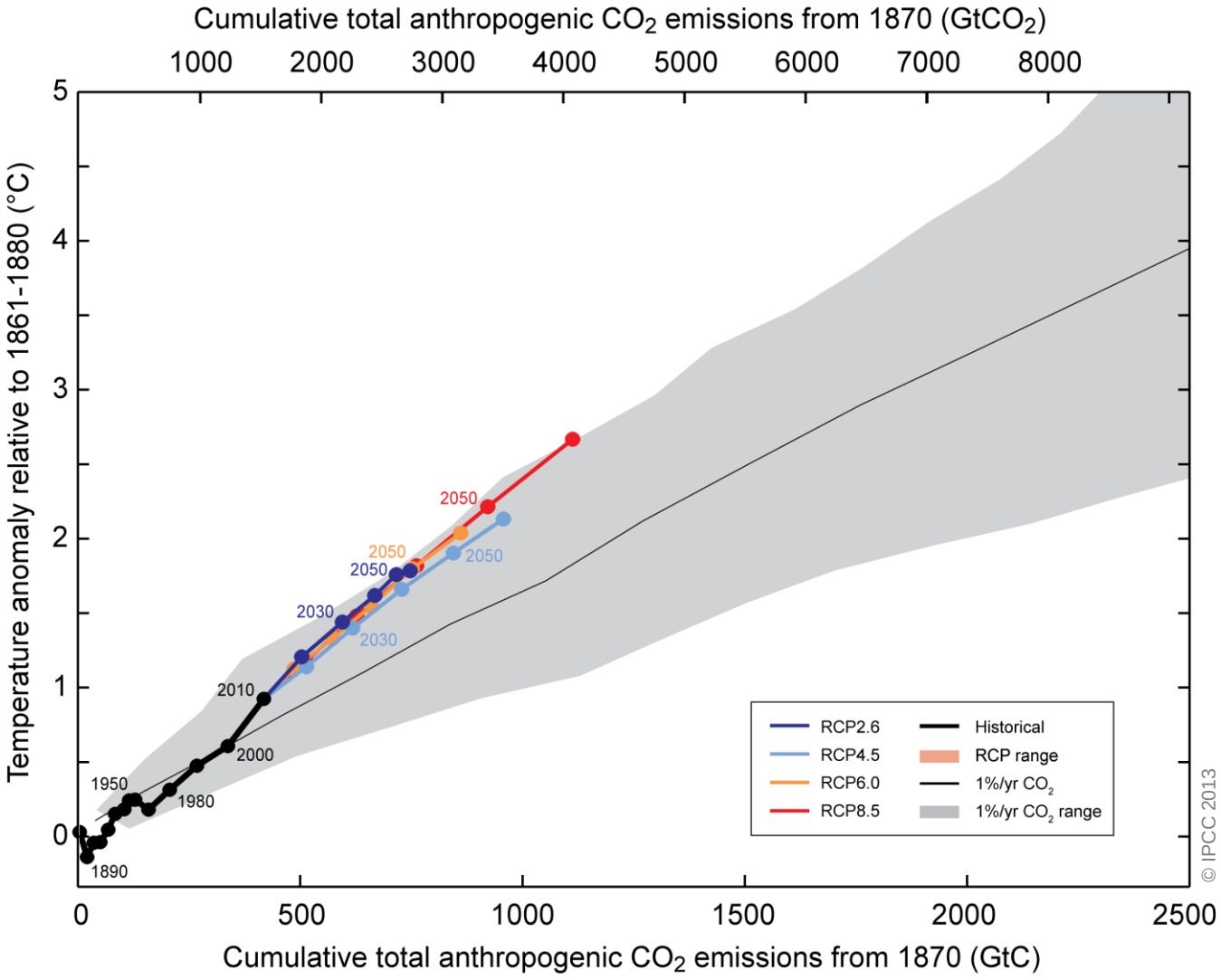
Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 2050



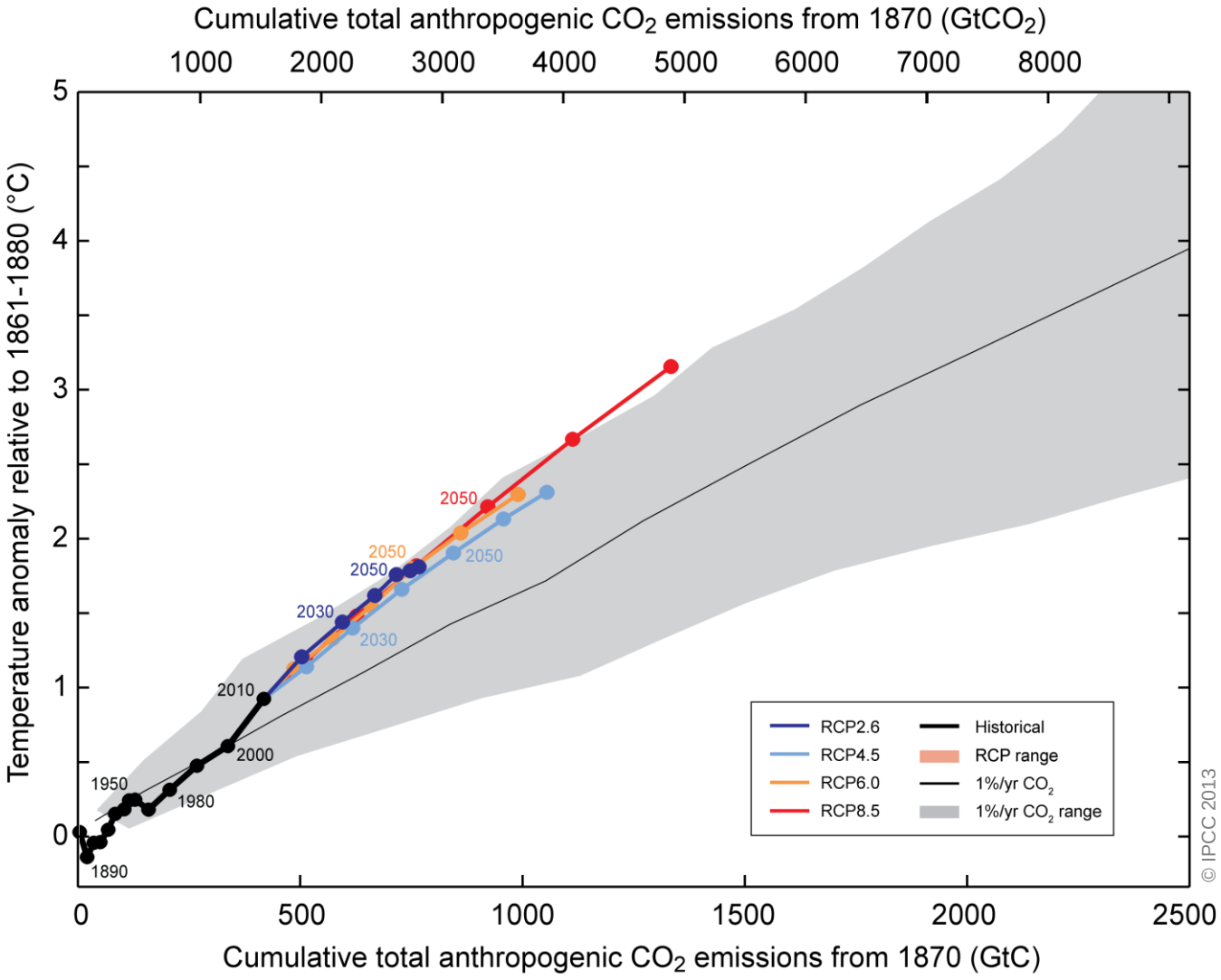
Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 2060



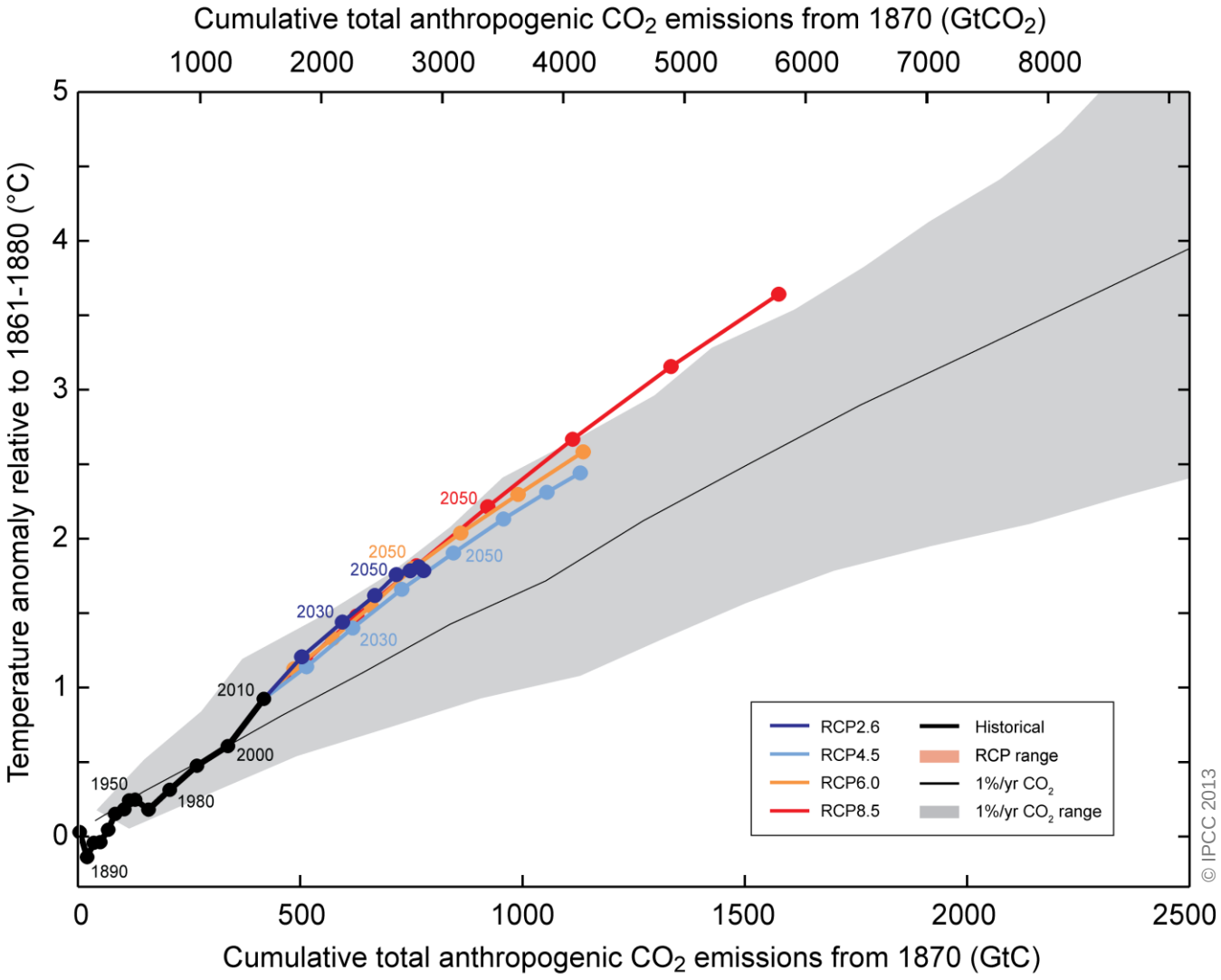
Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 2070



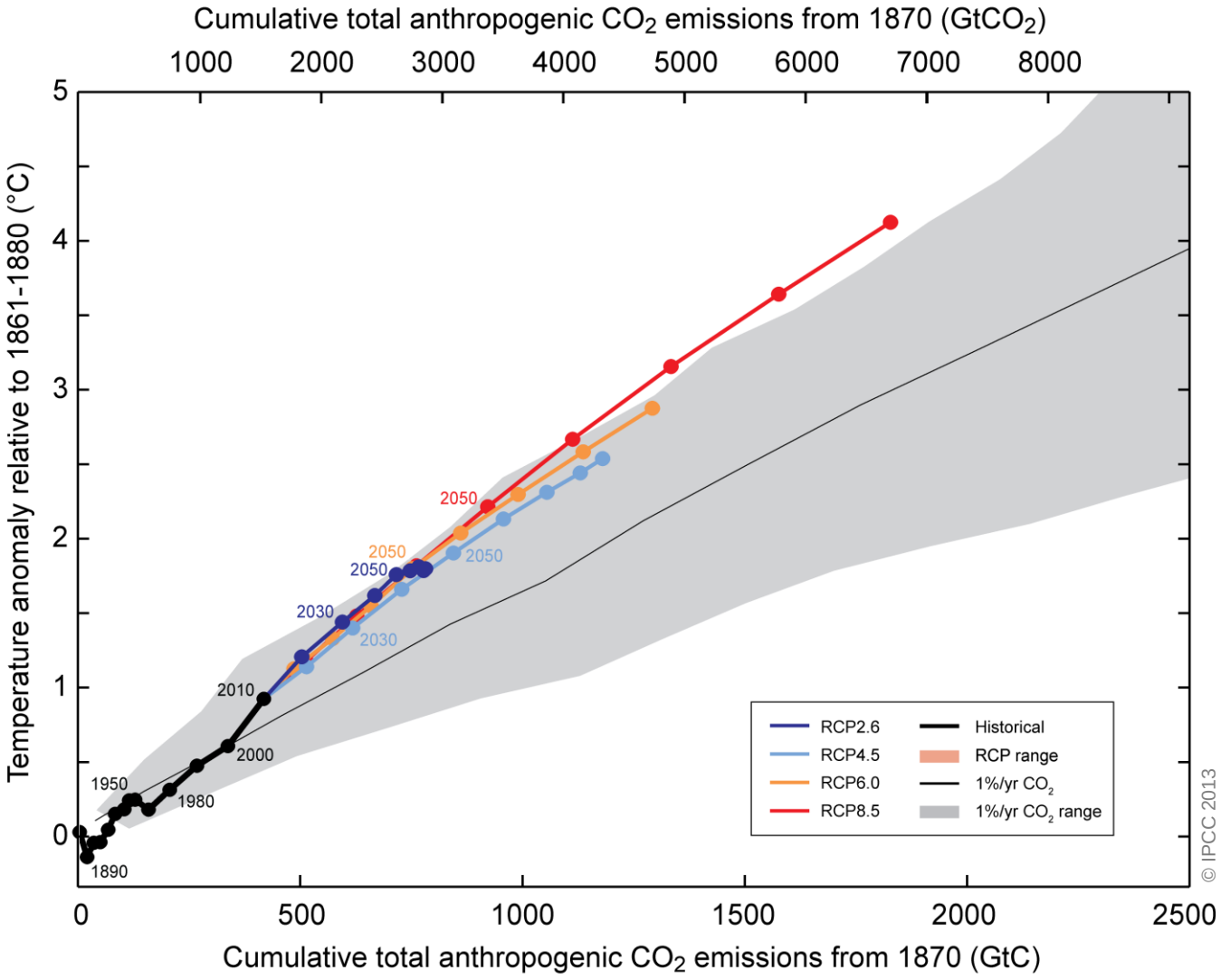
Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 2080



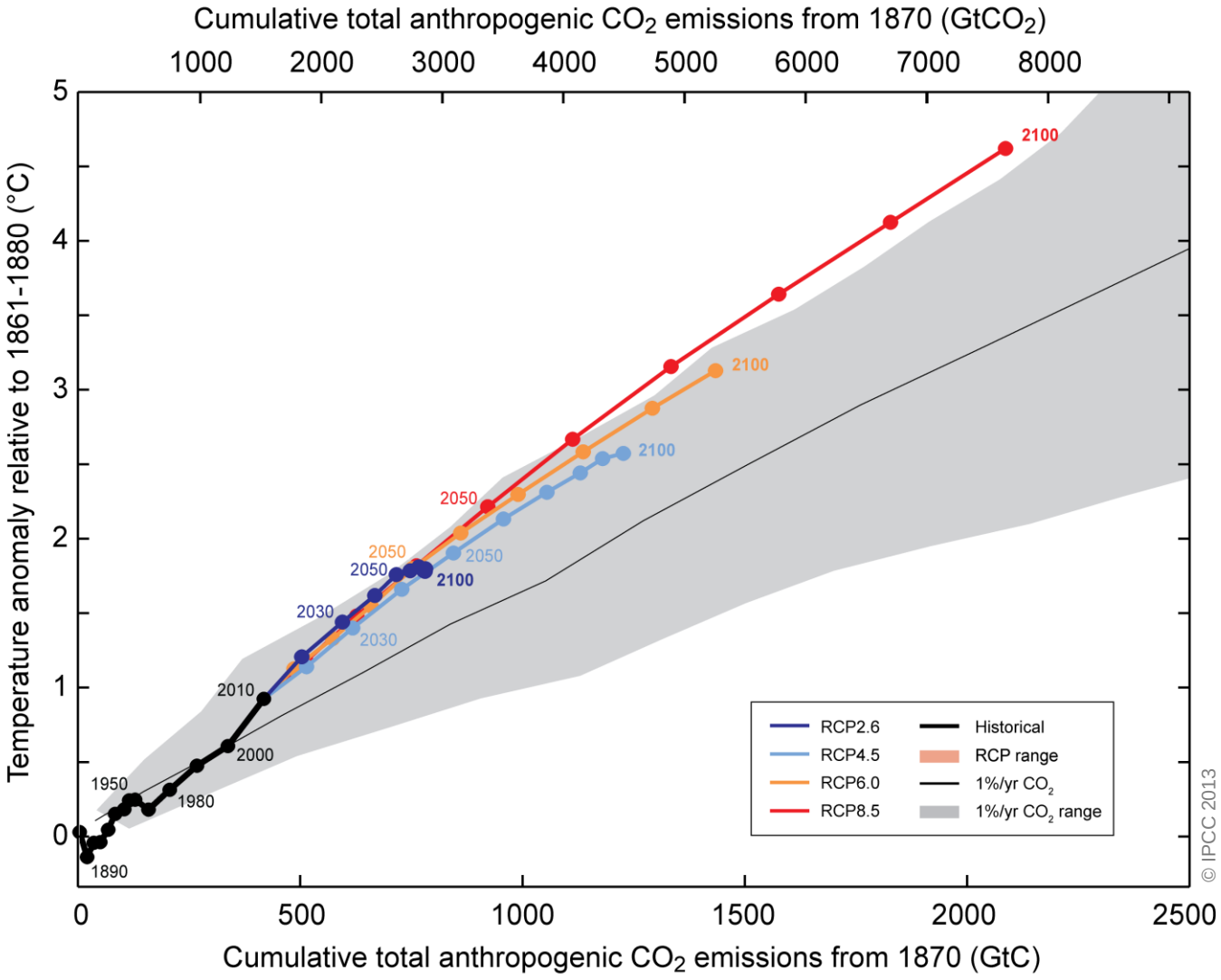
Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 2090



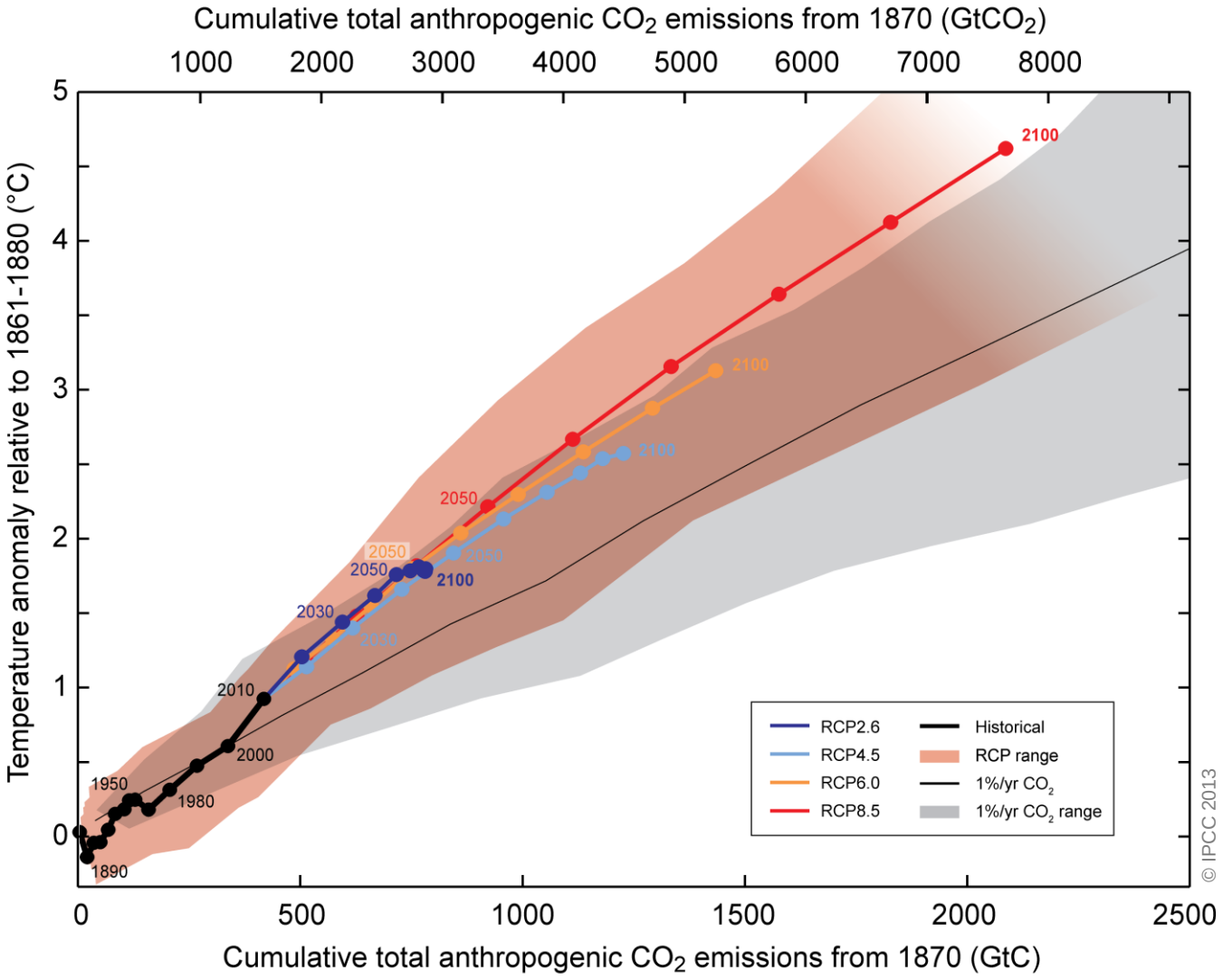
Animation courtesy Myles Allen (Oxford University)

Warming caused by cumulative carbon emissions to 2100

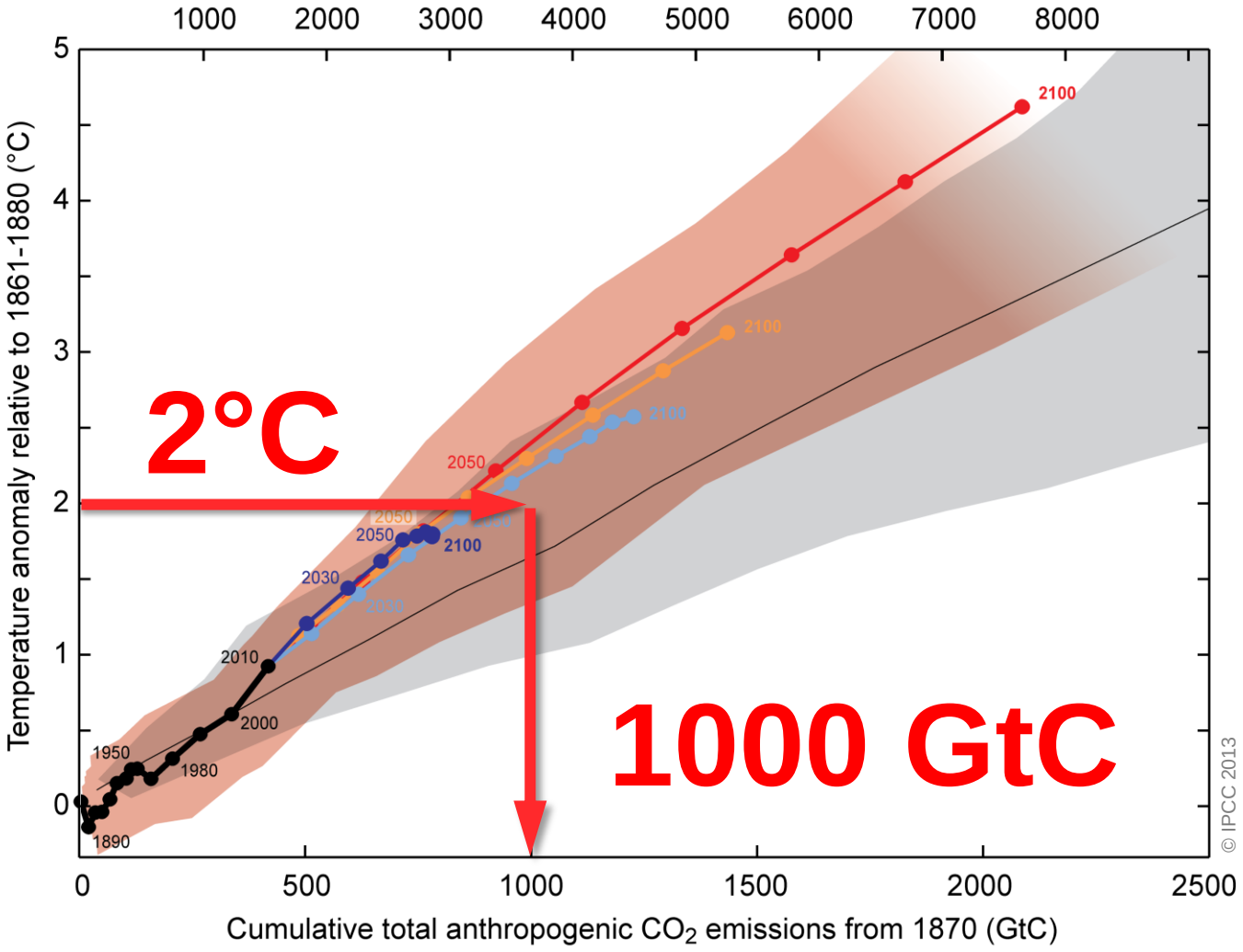


Animation courtesy Myles Allen (Oxford University)

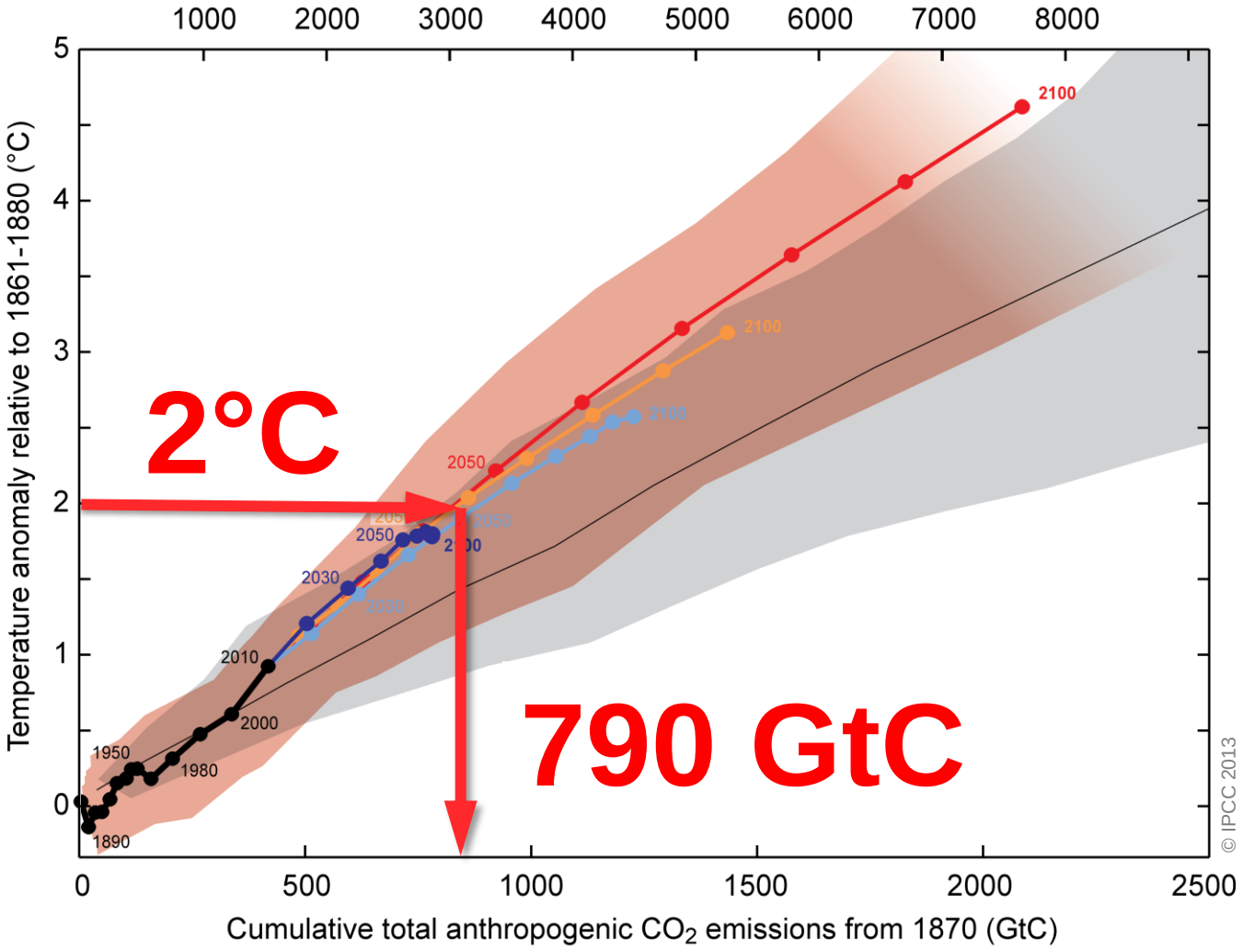
Warming caused by cumulative carbon emissions to 2100



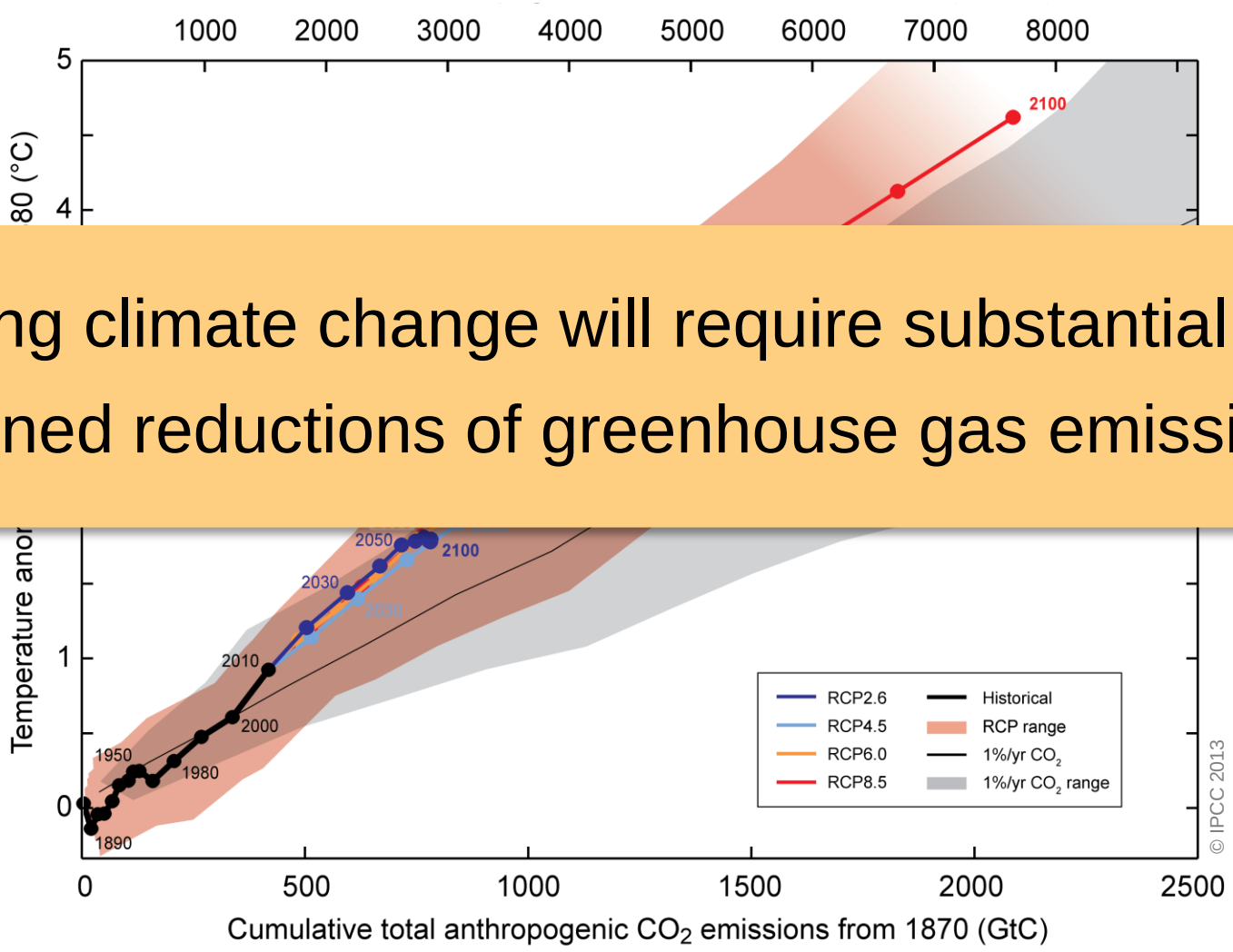
To limit **CO_2-induced warming** to *likely* < 2°C, cumulative CO_2 emissions must be limited to about **1000 GtC**.



To limit **anthropogenic warming** to *likely* < 2°C, cumulative CO_2 emissions must be limited to about **790 GtC**.



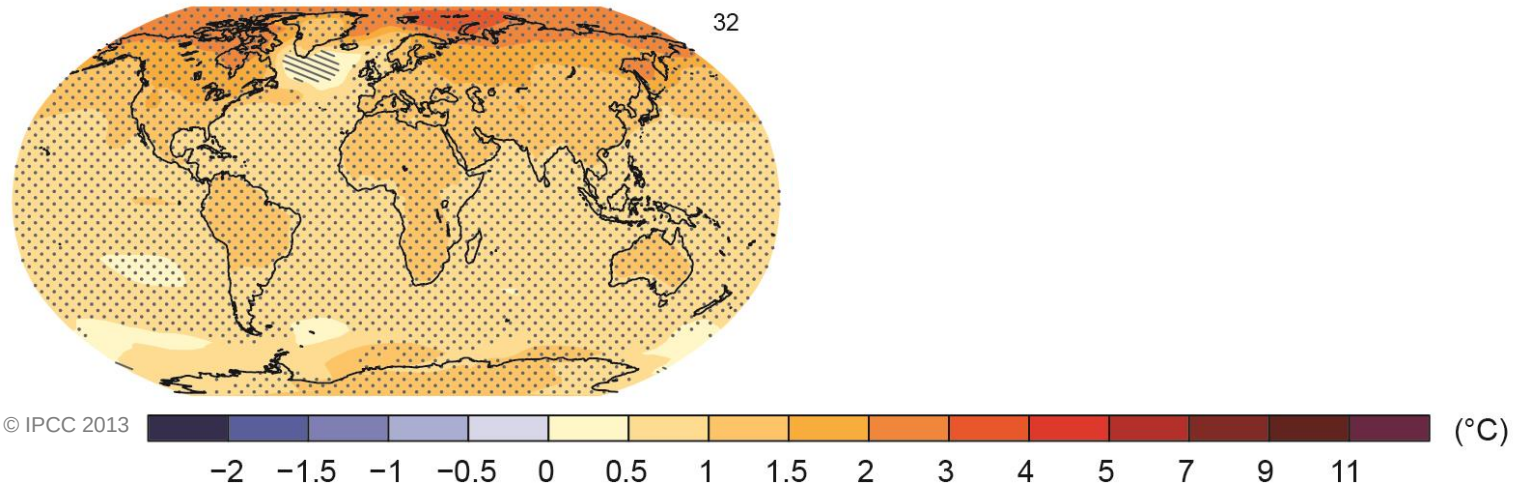
Cumulative CO_2 emissions to date: 515 [445 to 585] GtC.



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

RCP2.6
CO_{2eq} = 475 ppm

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



Change in average precipitation (1986−2005 to 2081−2100)

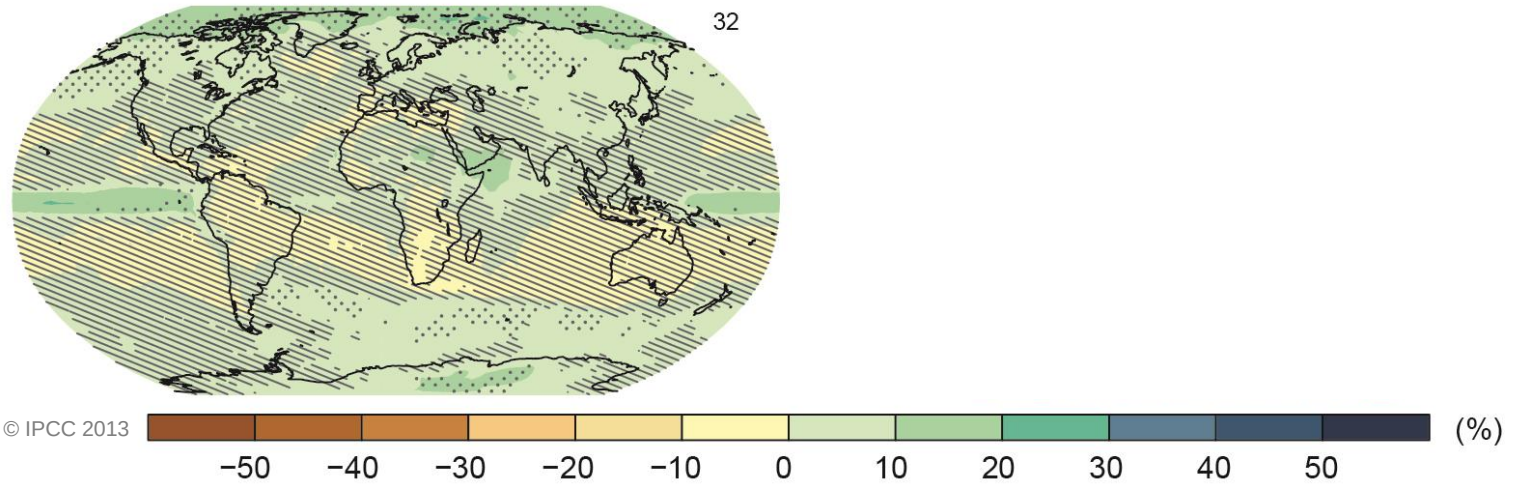


Fig. SPM.8

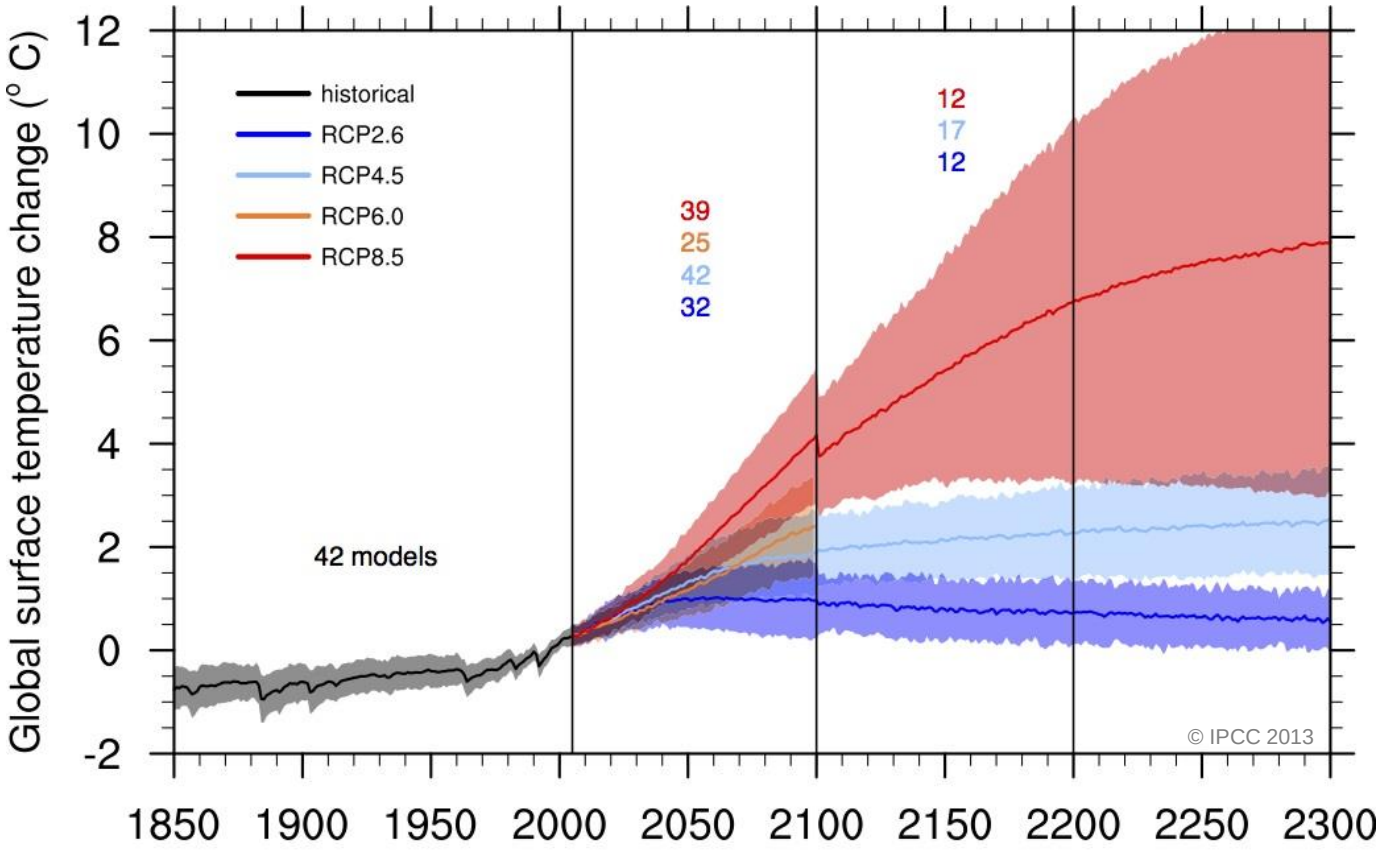


Fig. 12.5

Most aspects of climate change will persist for many centuries even if emissions of CO_2 are stopped.

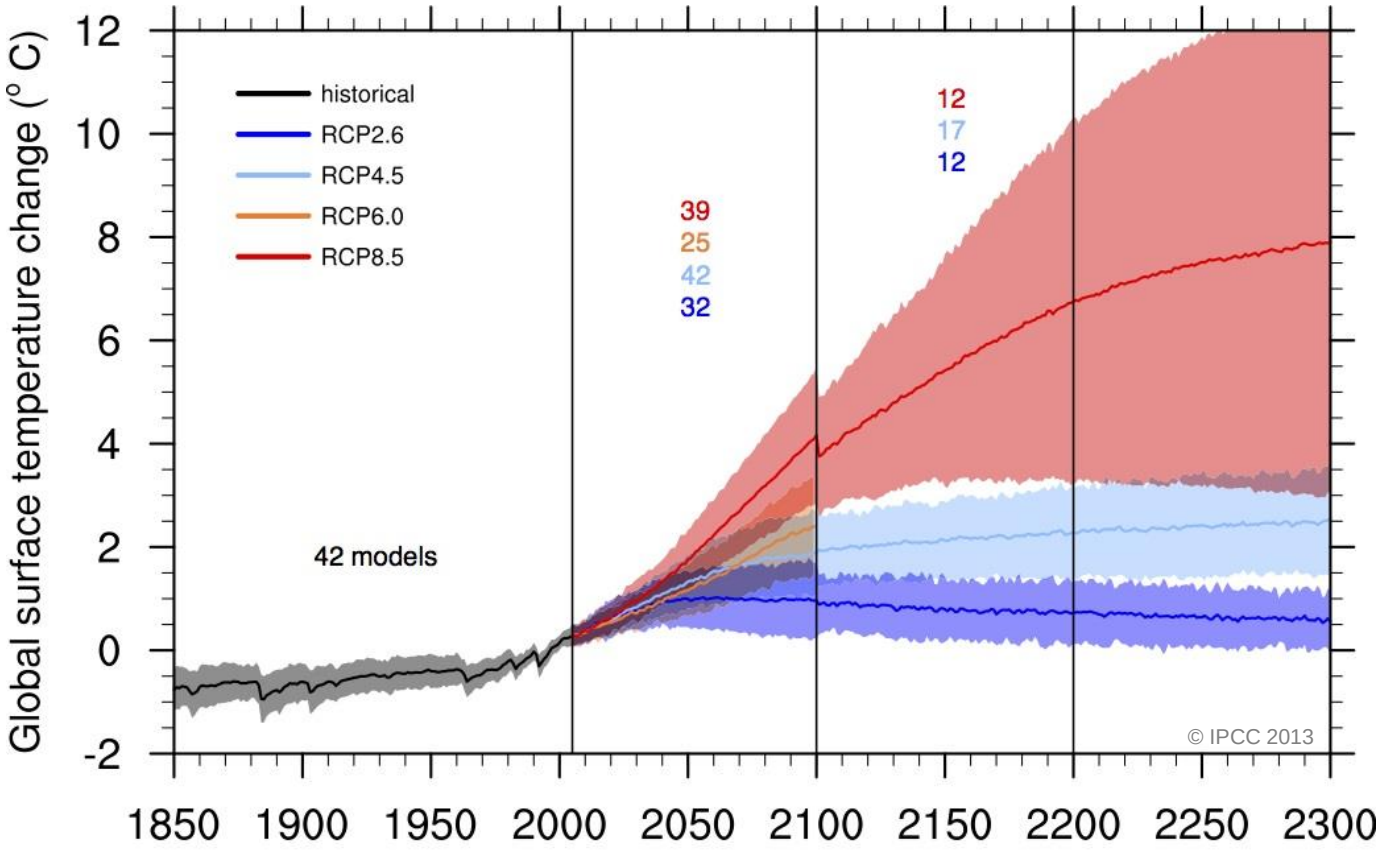


Fig. 12.5

This represents a substantial multi-century climate change commitment created by past, present and future emissions of CO_2.

Climate Change 2013: The Physical Science Basis

Working Group I contribution to the IPCC Fifth Assessment Report

Further Information

www.climatechange2013.org

© Yann Arthus-Bertrand / Altitude

ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP