

CONSTRAIN overview and communication activities

Dr Debbie Rosen, Science and Policy Manager



CONSTRAIN

The 2015 Paris Agreement sets out a global action plan to avoid dangerous climate change by limiting global warming to well below 2°C, whilst pursuing efforts to limit warming to 1.5°C. However, predicting how the climate will change over the next 20-50 years, as well as defining the emissions pathways that will set and keep the world on track, requires a better understanding of how several human and natural factors will affect the climate in coming decades. These include how atmospheric aerosols affect the Earth's radiation budget, and the roles of clouds and oceans in driving climate change.

The EU-funded CONSTRAIN project, a consortium of 14 European partners, is developing a better understanding of these variables, feeding them into climate models to reduce uncertainties, and creating improved climate projections for the next 20-50 years on regional as well as global scales. In doing so, CONSTRAIN will take full advantage of existing knowledge from the Sixth Phase of the Coupled Model Intercomparison Project (CMIP6) as well as other Horizon 2020 and European Research Council projects.



Receive Updates



constrain@leeds.ac.uk



[@constrain_eu](https://twitter.com/constrain_eu)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 820829.

CONSTRAIN PARTNERS

University of Leeds

Météo-France

UK Met Office

Stockholms Universitet

IIASA

ETH Zürich

CICERO

Universität Leipzig

Weizmann Institute of Science

Climate Analytics

Max Planck Institute for Meteorology

TU-Delft

CNRS

Imperial College London



Constraining uncertainty of multi-decadal climate projections

CONSTRAIN runs from July 2019 to June 2023

Our overarching aims are:

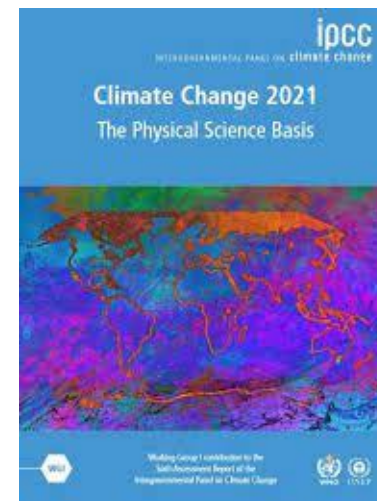
- To improve understanding of **how several human** (e.g. ghg emissions, aerosols) **and natural factors** (e.g. clouds, oceans, aerosols) **will affect the climate** in coming decades (**near-term**).
- To translate this new scientific understanding into improved evidence that can **support international climate policy and decisions** on mitigation and adaptation.

CONSTRAIN

Constraining uncertainty of multi-decadal climate projections

Key policy aims:

- Informing **IPCC AR6** (8 Lead Authors and over 80% of CONSTRAIN papers available to WGI were cited in the report).
- Delivering improved projections of temperature change to the 2023 **UNFCCC Global Stocktake**.



Knowledge Gains: Summary and Implication Reports (briefing papers)

Achieved

- Improved characterisation and understanding of the Effective Radiative Forcing concept
- State-of-the-art understanding of rapid adjustments
- CONSTRAIN's contribution to IPCC AR6
- Climate sensitivity and feedbacks in CMIP model
- The use of climate model emulators in IPCC AR6

Coming up

- How uncertainties affect climate projections for the next 20 to 30 years
- The skill of climate model emulators compared to more complex Earth system models



CONSTRAIN

Constraining uncertainty of multi-decadal climate projections

Key outputs

Stringent mitigation substantially reduces risk of unprecedented near-term warming rates

[Christine M. McKenna](#) , [Amanda C. Maycock](#), [Piers M. Forster](#), [Christopher J. Smith](#) & [Katarzyna B. Tokarska](#)

[Nature Climate Change](#) **11**, 126–131 (2021) | [Cite this article](#)

JGR Atmospheres

Research Article |  Open Access |  

Energy Budget Constraints on the Time History of Aerosol Forcing and Climate Sensitivity

[C. J. Smith](#) , [G. R. Harris](#), [M. D. Palmer](#), [N. Bellouin](#), [W. Collins](#), [G. Myhre](#), [M. Schulz](#), [J.-C. Golaz](#), [M. Ringer](#), [T. Storelvmo](#), [P. M. Forster](#)

Making climate projections conditional on historical observations

[AURÉLIEN RIBES](#) , [SAÏD QASMI](#) , AND [NATHAN P. GILLET](#) 

[SCIENCE ADVANCES](#) • 22 Jan 2021 • Vol 7, Issue 4 • DOI:10.1126/sciadv.abc0671

Current and future global climate impacts resulting from COVID-19

[Piers M. Forster](#) , [Harriet I. Forster](#), [Mat J. Evans](#), [Matthew J. Gidden](#), [Chris D. Jones](#), [Christoph A. Keller](#), [Robin D. Lamboll](#), [Corinne Le Quéré](#), [Joeri Rogelj](#), [Deborah Rosen](#), [Carl-Friedrich Schleussner](#), [Thomas M. Richardson](#), [Christopher J. Smith](#) & [Steven T. Turnock](#)

[Nature Climate Change](#) **10**, 913–919 (2020) | [Cite this article](#)

Past warming trend constrains future warming in CMIP6 models

[KATARZYNA B. TOKARSKA](#) , [MARTIN B. STOLPE](#) , [SEBASTIAN SIPPEL](#) , [ERICH M. FISCHER](#) , [CHRISTOPHER J. SMITH](#) , [FLAVIO LEHNER](#) , AND [RETO KNUTTI](#) 

[SCIENCE ADVANCES](#) • 18 Mar 2020 • Vol 6, Issue 12 • DOI:10.1126/sciadv.abb0408

Earth's Future

Research Article |  Open Access |   

Carbon Cycle Response to Temperature Overshoot Beyond 2°C: An Analysis of CMIP6 Models

[I. Melnikova](#) , [O. Boucher](#), [P. Cadule](#), [P. Claïs](#), [T. Gasser](#), [Y. Quilcaille](#), [H. Shiogama](#), [K. Tachiiri](#), [T. Yokohata](#), [K. Tanaka](#)

Geophysical Research Letters

Research Letter

Observational Evidence of Increasing Global Radiative Forcing

[Ryan J. Kramer](#) , [Haozhe He](#), [Brian J. Soden](#), [Lazaros Oreopoulos](#), [Gunnar Myhre](#), [Piers M. Forster](#), [Christopher J. Smith](#)

Model description paper

Silicone v1.0.0: an open-source Python package for inferring missing emissions data for climate change research

[Robin D. Lamboll](#)¹, [Zebedee R. J. Nicholls](#)^{2,3}, [Jarmo S. Kikstra](#)^{1,4}, [Malte Meinshausen](#)^{2,3}, and [Joeri Rogelj](#)^{1,4}

Reviews of Geophysics

Review Article |  Free Access

An Assessment of Earth's Climate Sensitivity Using Multiple Lines of Evidence

[S. C. Sherwood](#) , [M. J. Webb](#), [J. D. Annan](#), [K. C. Armour](#), [P. M. Forster](#), [J. C. Hargreaves](#), [G. Hegerl](#), [S. A. Klein](#), [K. D. Marvel](#), [E. J. Rohling](#), [M. Watanabe](#), [T. Andrews](#), [P. Braconnot](#), [C. S. Bretherton](#), [G. L. Foster](#), [Z. Hausfather](#), [A. S. von der Heydt](#), [R. Knutti](#), [T. Mauritsen](#), [J. R. Norris](#), [C. Proistosescu](#), [M. Rugenstein](#), [C. A. Schmidt](#), [K. B. Tokarska](#), [M. D. Zelinka](#)

LETTER • OPEN ACCESS

Uncertainty in carbon budget estimates due to internal climate variability

[Katarzyna B Tokarska](#)^{1,8} , [Vivek K Arora](#)², [Nathan P Gillett](#)³ , [Flavio Lehner](#)¹ , [Joeri Rogelj](#)^{1,3,4} , [Carl-Friedrich Schleussner](#)^{5,6} , [Roland Séférian](#)⁷ , and [Reto Knutti](#)¹ 

Published 2 October 2020 • © 2020 The Author(s). Published by IOP Publishing Ltd

[Environmental Research Letters](#), Volume 15, Number 10

CONSTRAIN

Constraining uncertainty of multi-decadal climate projections

Translation into policy: Zero In Report series, launched at UNFCCC COP events



- THE REMAINING CARBON BUDGET
- DECADAL WARMING RATES



- A NEW GENERATION OF CLIMATE MODELS, COVID-19 AND THE PARIS AGREEMENT



- NEAR-TERM WARMING AND OUR CHANCES OF STAYING WITHIN 1.5°C

Unpicking the latest climate science and helping people to understand the Paris Agreement

Emissions are currently around 40 Gt CO₂ per year

CONSTRAIN

Constraining uncertainty of multi-decadal climate projections

We estimate that the remaining carbon budget from the start of 2022 = 420 Gt CO₂ for a 50% chance of staying within 1.5°C global temperature rise

Emissions are currently around 40 Gt CO₂ per year

- This **doesn't** mean we only have 10 years to combat climate change:
 - every tonne of CO₂ and every bit of warming counts.
 - more warming means worse climate impacts.
 - if we pass 1.5°C and end up reaching 1.6°C, that's still better than 1.7°C!
- The carbon budget is a really useful framework for assessing whether emissions reductions are on track, but the main things to remember are:
 - the budget is small!
 - every tonne of CO₂ adds to global warming.
 - We need to reach net zero by mid-century to avoid the most dangerous climate change.

CONSTRAIN

Constraining uncertainty of multi-decadal climate projections

Carl-Friedrich Schleussner Retweeted



Joeri Rogelj @JoeriRogelj · May 10

Lots of headlines about the press release by @WMO on the chances that global average temperature will be estimated at 1.5C in one of the next five years (👉)

Unfortunately, many are inaccurate
Here's why (1/n)



marlowehood @marlowehood · May 10

Replying to @marlowehood @JoeriRogelj and 4 others

REUTERS: The world faces a 50% chance of warming of 1.5 degrees Celsius above pre-industrial levels, if only briefly, by 2026, the World Meteorological Organization (WMO) said on Monday.

16

68

125



[Show this thread](#)

Carl-Friedrich Schleussner Retweeted

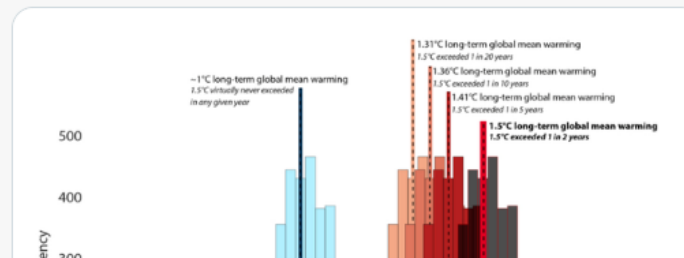


Simon Evans @DrSimEvans · May 10

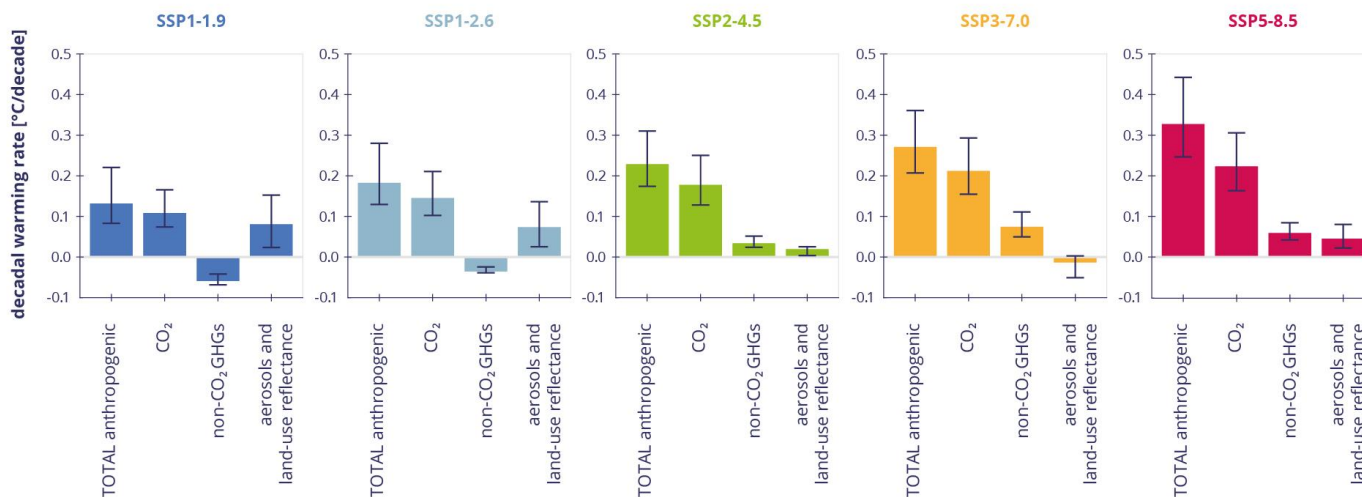
If the world reaches 1.5C in a single year, does that mean we have breached the Paris ambition?

Definitely not, explain @JoeriRogelj @CarlSchleussner in this 2017 guest post for @CarbonBrief

carbonbrief.org/guest-post-int...



Average decadal warming over the next 20 years (2021-2040)



Average decadal warming rates over the next 20 years (2021-2040) by groups of anthropogenic drivers for the five IPCC AR6 WGI emissions scenarios

21st century peak temperature probabilities



“Climate wheels” showing the probabilities of staying below 1.5°C (and other temperatures) with different climate sensitivities, aerosol forcing strengths, and permafrost feedbacks with the same emissions reductions

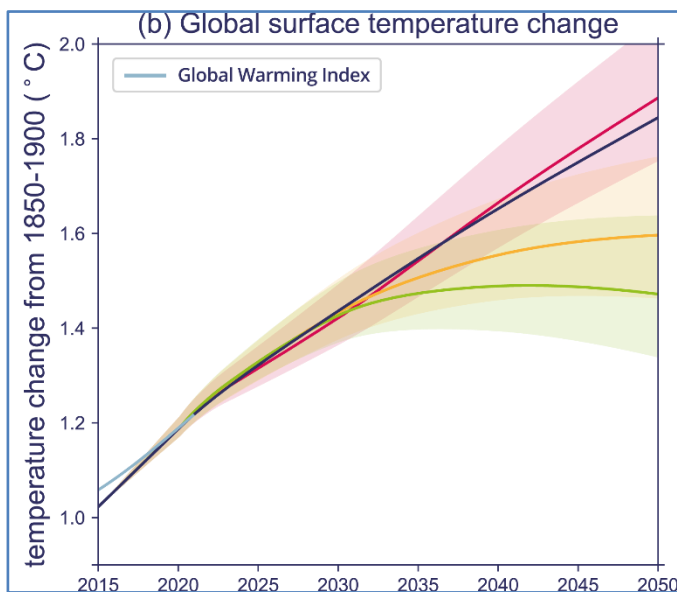
CONSTRAIN

Constraining uncertainty of multi-decadal climate projections



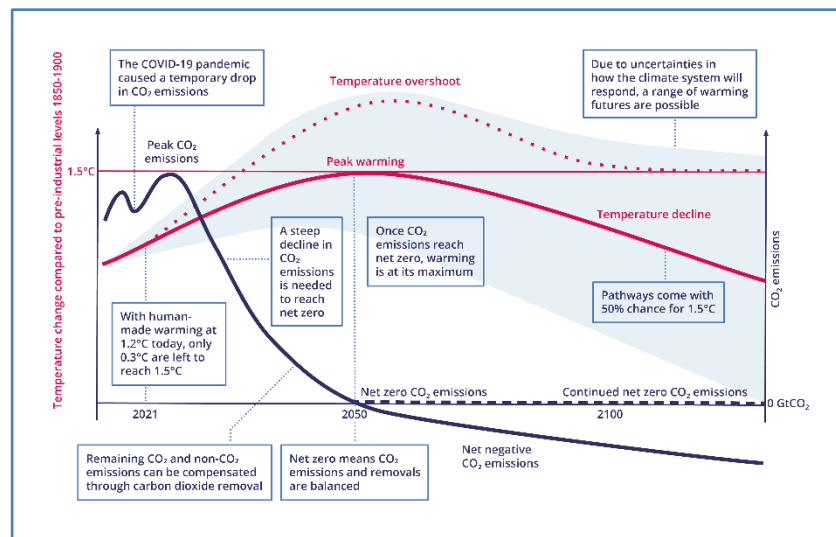
PRE-COP26 BRIEFING NOTE

HOW LIKELY ARE WE TO REACH 1.5°C IN THE NEAR FUTURE?



PRE-COP26 BRIEFING NOTE

WHAT EXACTLY IS A “1.5°C PATHWAY”?



CONSTRAIN

Constraining uncertainty of multi-decadal climate projections



CONSTRAIN

The Global Carbon Budget 2019

Wednesday 4
December
16:45-18:15 CET
UNFCCC Pavilion
Room 5

TAKING YOUR QUESTIONS ON:

- the latest global carbon budget figures
- the remaining carbon budget
- what this means for the Paris Agreement

And livestreamed
via the
COP 25
side events
webcast page

Speakers: **Glen Peters** (CICERO Center for International Climate Research, Norway), **Matt Jones** (University of East Anglia), **Joeri Roelofs** (Imperial College London) alongside an expert discussion panel



UNFCCC Climate Dialogues Special Event
Wednesday 2 December 4-5pm CET

A new generation of climate models, COVID-19
and the Paris Agreement:
Introducing the second CONSTRAIN Zero In Report

Register @
<https://bit.ly/3qOnRRf>

More info @
<https://bit.ly/2Jazogp>

CONSTRAIN
CONSTRAINING UNCERTAINTY OF MULTI-DECADE CLIMATE PROJECTIONS

This project has received funding
from the European Union's
Horizon 2020 research and
innovation programme under grant
820829



1.5°C: Where are we now,
where are we headed,
what are the risks?

UNIVERSITY OF EXETER GLOBAL CARBON PROJECT UNIVERSITY OF LEEDS University of Reading CONSTRAIN °CICERO Walker Institute Met Office

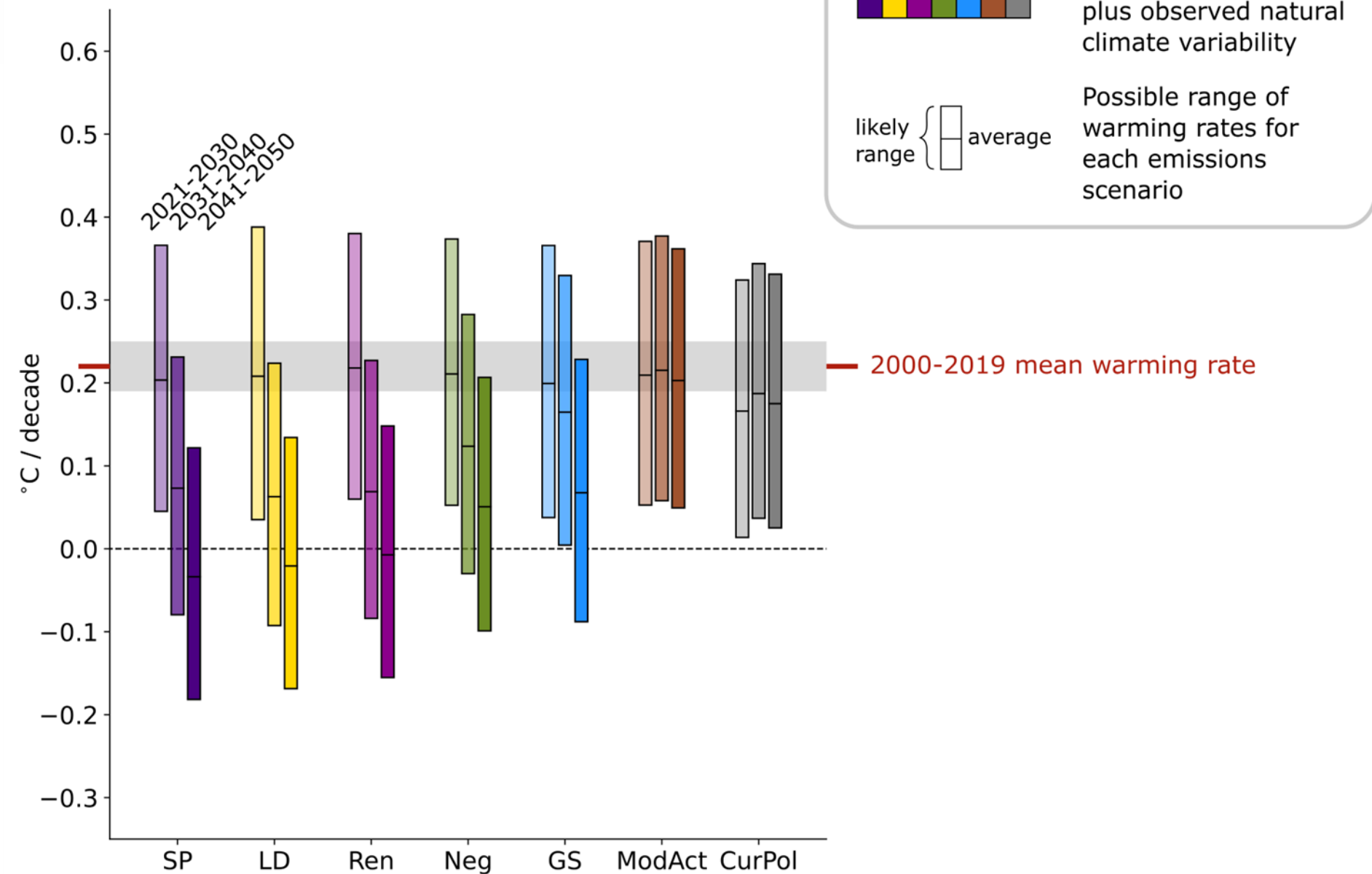




Constraining uncertainty of multi-decadal climate projections

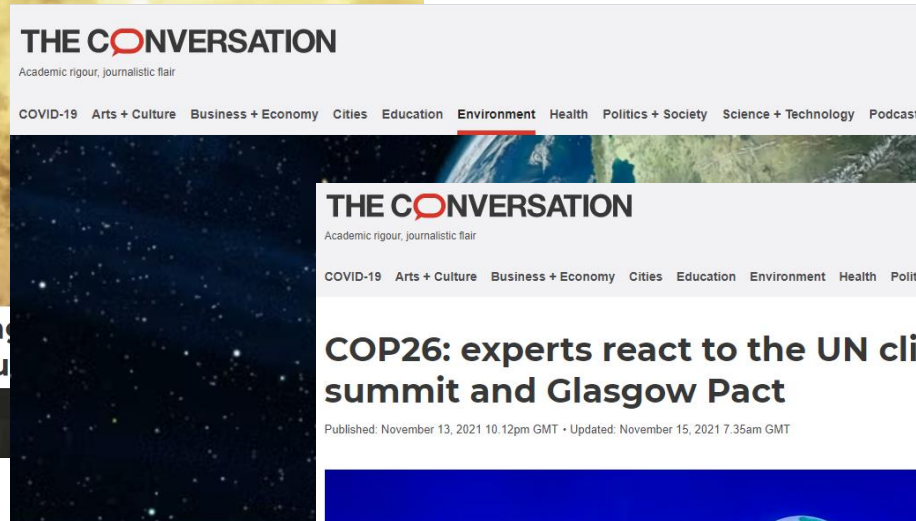


Rate of global warming



CONSTRAIN

Constraining uncertainty of multi-decadal climate projections

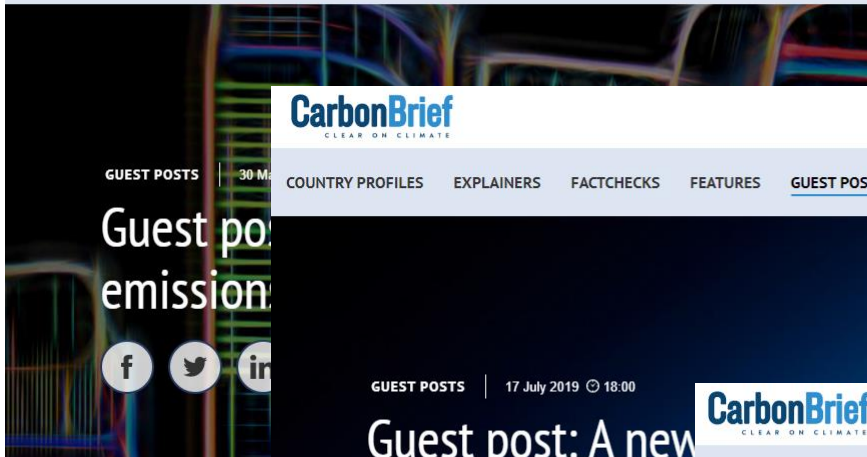


CONSTRAIN

Constraining uncertainty of multi-decadal climate projections

CarbonBrief
CLEAR ON CLIMATE

COUNTRY PROFILES EXPLAINERS FACTCHECKS FEATURES GUEST POSTS INFOGRAPHICS INTERVIEWS



CarbonBrief
CLEAR ON CLIMATE

CHINA POLICY EU POLICY INTERNATIONAL POLICY REST OF WORLD POLICY UK POLICY UN CLIMATE TALKS

COP26 GLASGOW | 2 November 2021 © 14:57

Guest post: The Global Methane Pledge needs to go further to help limit warming to 1.5C





Constraining uncertainty of multi-decadal climate projections

Thank you!

<http://constrain-eu.org>

@constrain_eu

