

2023 TO 2024

CMIP Annual report

July 2024 | CMIP-IPO Publication No.: 01/2024

Acknowledgements

The report was written and edited by the staff of the CMIP International Project Office (IPO), who are hosted by the ESA Climate Office in Harwell, Oxfordshire, UK. We would like to thank all colleagues who contributed to this report.

 CMIP-IPO@esa.int

 CMIP International Project Office
ESA ECSAT, Fermi Avenue,
Harwell Campus, Didcot,
Oxfordshire OX11 0FD,
United Kingdom



Bibliographic information

This report should be cited as: Dingley, B., O'Rourke, E., Turner, B., Ellis, D., CMIP Annual Report 2023–2024.
doi: [10.5281/zenodo.12772973](https://doi.org/10.5281/zenodo.12772973)

Disclaimer

The designations employed in the WCRP Coupled Model Intercomparison Project, or CMIP, publications and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of CMIP, the World Climate Research Programme (WCRP) – including its Sponsor Organizations the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission (IOC) of UNESCO and the International Science Council (ISC) – or the European Space Agency (ESA) in its role as host organisation of the CMIP International Project Office (CMIP-IPO), concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The findings, interpretations and conclusions expressed in CMIP publications with named authors are those of the authors alone and do not necessarily reflect those of CMIP, WCRP, its Sponsor Organizations, ESA or of their Members.

This document is not an official publication of the WCRP and has been issued without formal editing. The views expressed herein do not necessarily have the endorsement of WCRP or its Members.

Any potential mention of specific companies or products does not imply that they are endorsed or recommended in preference to others of a similar nature which are not mentioned or advertised.

Copyright notice

This report is published by the Coupled Model Intercomparison Project (CMIP) under a Creative Commons Attribution 4.0 International License ([CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)) and thereunder made available for reuse for any purpose, subject to the license's terms, including proper attribution.

Authorship and publisher's notice

This report was authored by: Beth Dingley, Eleanor O'Rourke, Daniel Ellis, and Briony Turner with contributions from the CMIP Panel, the WGCM Infrastructure Panel, and Task Team co-leads.



Foreword

The last year has been an incredibly busy time for CMIP with planning for the next phase, CMIP7, ramping up significantly, and discussions regarding the longer-term vision of CMIP evolving.

The CMIP Panel, led by Helene Hewitt (Met Office, UK) and John Dunne (NOAA/GFDL, USA), have driven forward the design of the CMIP7 experimental structure through the development of the AR7 Fast Track, with the help of eight Task Teams. In particular, the Strategic Ensemble Design Task Team helped develop the proposed experiments through initial engagement with MIPs and their stakeholder group. The design has been developed in the most open and collaborative manner yet of any CMIP phase, with multiple invitations to the wider CMIP community to consult and feedback on elements of the Fast Track as they have developed.

In addition to their review of the Fast Track design, many task teams have delivered plans and recommendations for several key components required for CMIP. The Data Request Task Team has designed a large community engagement activity to develop the list of variables assigned to scientific opportunities, expanding the scope and accessibility of the Data Request while retaining and enhancing oversight of complex technical metadata.

The Model Benchmarking Task Team have developed a strategic approach for a Rapid Evaluation Framework. This will allow for evaluation of CMIP data at the time of publication and would represent a huge step forward in evaluation capability. The Model Documentation Task Team have developed a proposed 'Essential Model Documentation' outline, which would require a subset of information about the model to be published alongside the data to improve consistency in the availability of model documentation. The Forcings Task Team are busy coordinating and delivering the CMIP7 DECK forcings suite, ready for modelling centres to run their AR7 Fast Track simulations. The Data Access Task Team are developing a whitepaper with recommendations on how to reduce barriers to CMIP data access, especially for those working in less well-resourced institutions. Finally, the Data Citation Task Team delivered their recommendations on a sustainable data citation service, which enables credit to be given to CMIP data creators, compliance with author guidelines by data referencing and IPCC FAIR Guidelines and facilitates data impact information. With this delivery, the Citation Task Team has completed its objectives and was subsequently closed in March 2024. The Panel would like to thank the co-leads Martina Stockhause (DKRZ, Germany) and Sasha Ames (LLNL, US) and members of the Task Team for their invaluable contribution.



Together, the CMIP Panel, the CMIP IPO, the TTs, and the WIP are working to deliver a suite of papers outlining the work achieved across the next year, as well as the CMIP7 experimental design and protocol paper in 2024, initiating the next phase.

The infrastructure underpinning CMIP6 has continued to evolve through ongoing support and development. One of the numerous highlights is the launching of CMIP6Plus, an infrastructure evolution which enables modelling groups to contribute to projects initiated post-CMIP6, but before the CMIP7 infrastructure becomes available. A whitepaper outlining the objectives and developments of CMIP6Plus is planned for publication during the summer of 2024, realizing the potential for CMIP infrastructure to enable responsive, reactive science.

The IPO provides a key CMIP organisational hub, supporting the scientific and technical experts, and ensuring effective communication throughout our broad and expanding international community.

The Fresh Eyes on CMIP working group of early career researchers, scientists, and practitioners, was established and has spent the past year developing numerous projects to aid users of CMIP data. Their work was featured across many CMIP events in the past year, including prominent sections of the EGU and AOGS Townhalls. The CMIP Panel and WIP are incredibly supportive of all the important work the Fresh Eyes community is performing and are excited to see the outputs benefit CMIP users in the years to come.

We look forward to continuing to work with the community in the year ahead as we facilitate community climate science through CMIP6Plus, finalise the CMIP7 experimental design and plans for supporting infrastructure and make efforts towards operationalising key components of CMIP beyond CMIP7.



The CMIP leadership



John Dunne
CMIP Panel Co-chair



Helene Hewitt
CMIP Panel Co-chair



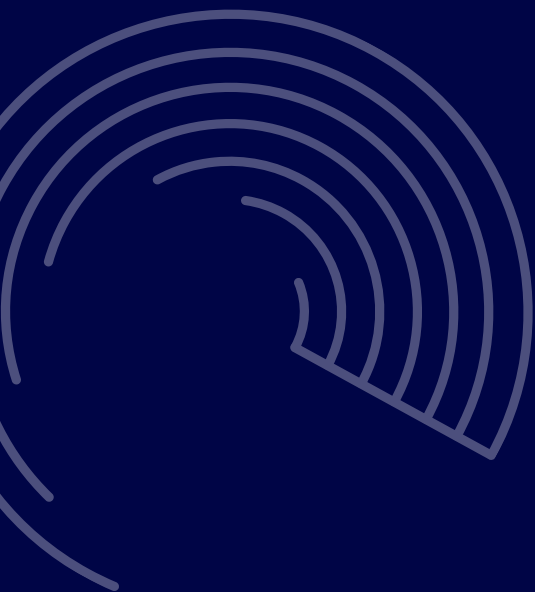
Paul Durack
WIP Co-chair



Matt Mizielski
WIP Co-chair

Contents

1 Governance and Operations	6	2.8 Fresh Eyes on CMIP	39
1.1 The CMIP Panel	6	2.9 New Task Team on CMIP's carbon footprint	41
Spotlight on... AR7 Fast Track	10	2.10 CMIP regular and sustained mode scoping group	41
1.2 The WGCM Infrastructure Panel	14	3 CMIP Scientific Highlights	42
1.3 CMIP International Project Office	16	3.1 Earth beyond six of nine planetary boundaries	43
1.4 Travel support fund	19	3.2 Quantifying the human cost of global warming	44
1.5 Carbon footprint	19	3.3 Indicators of Global Climate Change 2023	45
CMIP across the globe	21	3.4 Aerosols overtake greenhouse gases	46
Our year in numbers	22	4 Events and engagement	47
2 CMIP Community	23	4.1 Events	47
2.1 Data Access Task Team	23	4.2 Consultations with the community	54
2.2 Data Citation Task Team	24		
2.3 Data Request Task Team	25		
Spotlight on... Harmonised thematic variables	26		
2.4 Forcings Task Team	29		
Spotlight on... CMIP7 DECK Forcings datasets	31		
2.5 Model Benchmarking Task Team	34		
Spotlight on... Rapid Evaluation Framework	35		
2.6 Model Documentation Task Team	37		
2.7 Strategic Ensemble Design Task Team	38		






1 Governance and Operations

1.1 The CMIP Panel

The CMIP Panel is a World Climate Research Program (WCRP) Working Group on Coupled Modelling (WGCM) subcommittee charged with overseeing the evolving design of Coupled Model Intercomparison Project (CMIP) and with coordinating the various activities contributing to the science and impact of CMIP. The Panel provides recommendations, proposals, and insight to the WGCM. The Panel works to empower modelling centres to deliver globally coordinated multi-model ensembles to further understanding of the climate system and provide foundations for climate mitigation and adaptation policy. The Panel will promote a transparent and open process to ensure equality of access to the process and of input to requirements and design choices. The CMIP Panel is made up of a Core Panel of up to eight members, who represent the decision-making body, together with an Extended Panel including all the co-leads of active task teams. Ex-officio members provide links to the WGCM Infrastructure Panel (WIP), WGCM, Fresh Eyes on CMIP, ScenarioMIP, CORDEX and VIACS while emeritus members contribute their invaluable knowledge and experience.

After the many co-chair and membership changes in 2022 and 2023, the existing Core Panel membership has remained constant throughout 2023–2025. An exciting development was the addition of two new members recruited through an open call targeted at global regions not represented in the historical or existing Panel membership. Two candidates were selected out of more than 40 high quality applications. Dr Frédéric Bonou, a Senior Researcher and Lecturer at the National University of Sciences, Technologies, Engineering, and Mathematics (UNSTIM) in Benin has accepted the invite to join the Core Panel and has attended his first meeting, and we are awaiting the confirmation of acceptance from the second selected candidate.

With the initiation of the WCRP Earth System Modelling and Observations (ESMO) Core Project, under which the WGCM and CMIP Panel sit, further development of the Panel Terms of Reference has taken place to ensure consistency across ESMO activities and further promote inclusivity and resilience. Additionally, each task team will now have a dedicated CMIP Panel liaison to provide support in raising decision requests and providing recommendations to the Panel.



Over the last year the Panel has been very active, working on: the final development of the CMIP7 experimental design and associated science goals; approval of the AR7 Fast Track experiment selection; drafting of the CMIP7 description paper and commentary; development of community guidance including MIP Best Practice Guidelines and DECK protocol; identifying and securing funding for critical AR7 Fast Track and CMIP7 activities; and driving the initiation of scoping for a sustained mode for CMIP. Panel members have also been integral to the regular active community co-creation and engagement including hosting drop-in sessions and supporting the varied consultations that have taken place during 2023–2024.

Looking forwards there is no rest for our Panel members. The CMIP IPO will be working intensively with the Panel to refine the AR7 Fast Track delivery timeline, with concerted effort on offering the prospect of information to support both IPCC Working Group 1 (WGI) and Working Group 2 (WGII). This will be challenging, requiring the continued enthusiasm and amazing dedication of the CMIP task teams, modelling centres, Model Intercomparison Projects (MIPs) and infrastructure providers. Key priority areas will be supporting finalisation of CMIP7 DECK forcings, a harmonised data request, and Rapid Evaluation Framework (REF) to support the initiation of AR7 Fast Track simulations.



CMIP Core Panel

Name	Affiliation	Country	Term	Role
John Dunne	NOAA-GFDL	USA	2023-	Co-chair
Helene Hewitt	The Met Office	UK	2022-	Co-chair
Julie Arblaster	Monash University	Australia	2020-	Member
Frédéric Bonou	IRHOB/UNSTIM	Benin	2024-	Member
Olivier Boucher	IPSL	France	2023-	Member
Tereza Cavazos	CICESE	Mexico	2024-	Member
Tomoki Miyakawa	University of Tokyo	Japan	2023-	Member
Robert Pincus	LDEO/Columbia University	USA	2020-	Member
Paul Durack	PCMDI/LLNL	USA	2020-	Ex-Officio (WIP)
Matthew Mizielinski	Met Office	UK	2020-	Ex-Officio (WIP)
Gregory Flato	CCCma	Canada	2016-	Ex-Officio (WGCM)
Karl Taylor	PCMDI/LLNL	USA	2008-	Emeritus



Photo by Dmytro VaraviniStock



CMIP Extended Panel

In addition to the CMIP Core Panel members, the following members make up the CMIP Extended Panel.

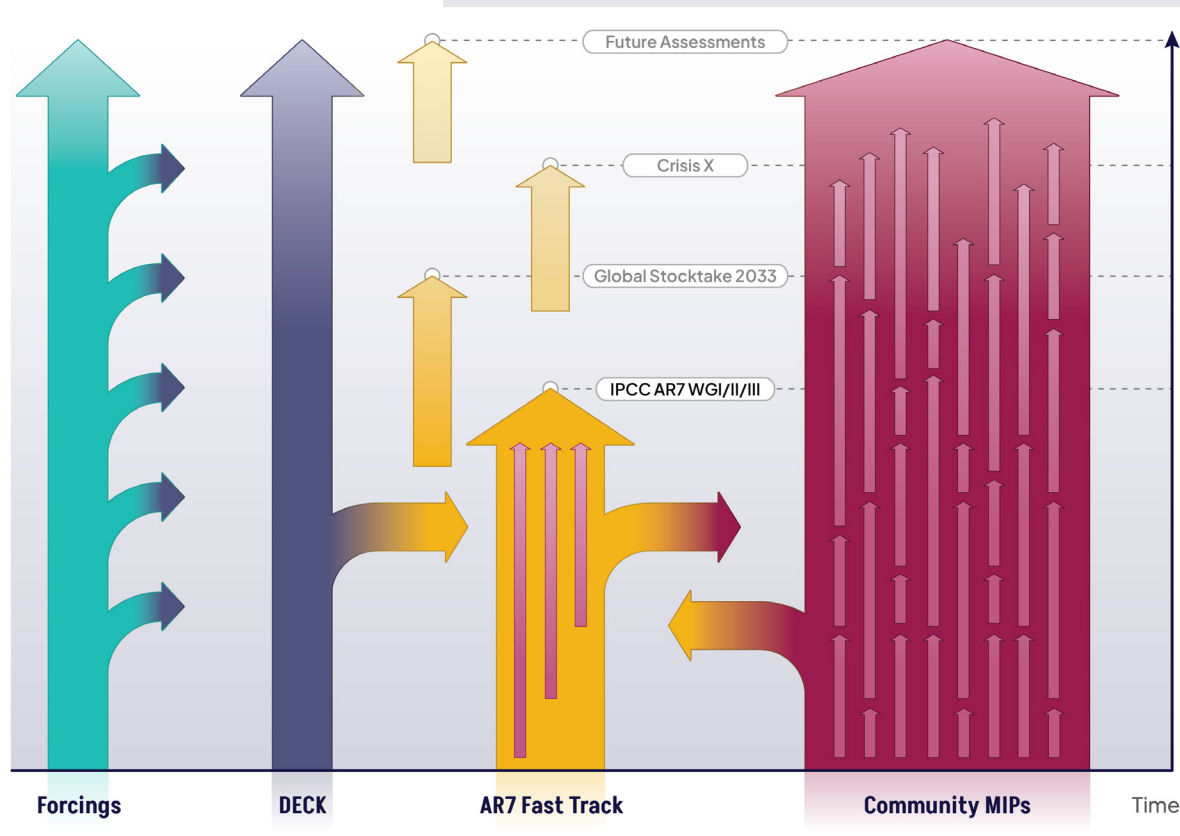
Name	Affiliation	Country	Term	Role
Vaishali Naik	NOAA-GFDL	USA	2022–	Climate Forcings Co-lead
Atef Ben Nassar	IPSL	France	2023–	Data Access Co-lead
James Anstey	CCCma	Canada	2024–	Data Request Co-lead
Martin Jukes	STFC	UK	2022–	Data Request Co-lead
Chloe Mackallah	CSIRO	Australia	2022–	Data Request Co-lead
Birgit Hassler	DLR	Germany	2022–	Model Benchmarking Co-lead
Forrest Hoffman	ORNL	USA	2022–	Model Benchmarking Co-lead
David Hassell	NCAS	UK	2022–	Model Documentation Co-lead
Guillaume Levavasseur	IPSL	France	2022–	Model Documentation Co-lead
Ben Sanderson	CICERO	Norway	2022–	Strategic Ensemble Design Co-lead
Isla Simpson	NSF NCAR	USA	2022–	Strategic Ensemble Design Co-lead
Douglas Rao	NC State	USA	2023–	Fresh Eyes on CMIP Co-lead
Julia Mindlin	Leipzig University	Germany	2023–	Fresh Eyes on CMIP Co-lead
Silvina Solman	University of Buenos Aires	Argentina	2024–	Ex-Officio (CORDEX)
Claas Teichmann	GERICS	Germany	2023–	Ex-Officio (VIACS AB)
Detlef van Vuuren	Utrecht University	Netherlands	2023–	Ex-Officio (ScenarioMIP)



Spotlight on... AR7 Fast Track

Over the course of 2023 and early 2024, the [CMIP Panel](#) and [WIP](#), alongside the [CMIP Task Teams](#), have worked hard to evolve the structure of CMIP to address issues that were faced in [CMIP6](#).

Figure 1: Planned structure of Future CMIP.



A range of [surveys](#) and [events](#) have taken place over the past two years to gather data on the successes and reflections from CMIP6. An often-raised challenge in CMIP6 was the high burden placed on the modelling centres from a large experiment list, frequently changed data request, and delays to historical forcing dataset provision. This high burden led to data issues and substandard documentation of the data.

The CMIP projections are heavily relied upon in the [Intergovernmental Panel on Climate Change \(IPCC\)'s Assessment Reports](#). As such, previous CMIP phases have aligned themselves on the IPCC timelines, to ensure CMIP data and analysis are available for IPCC authors to synthesise in the latest report.

Moving forwards, the CMIP Panel recognised that a change to the experimental design was needed to address the burden placed on modelling centres during CMIP6, while still targeting a data delivery timeline that serves the IPCC and potentially other future climate assessments. Therefore, they have proposed a more continuous approach for model intercomparison along with a targeted [AR7 Fast Track](#) set of experiments designed to set priorities for the running of simulations to align with the needs, and likely ambitious timeline, of the IPCC 7th assessment cycle.

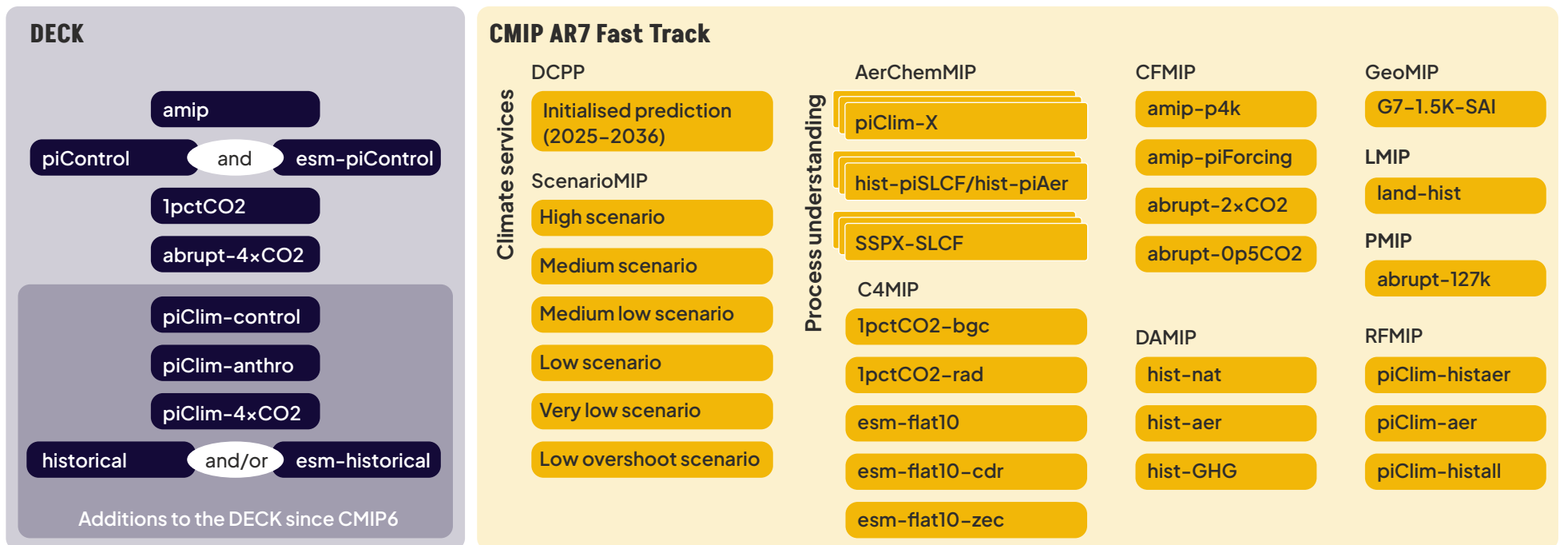
The CMIP AR7 Fast Track proposal

The CMIP fast tracks are designed as a compact set of experiments including the DECK and selected experiments from Community MIPs that will support specific needs. The CMIP AR7 Fast Track is intended to specifically deliver to the IPCC 7th assessment cycle.

This streamlined set of experiments is intended to be performed under a strict timeline aligning with the AR7 requirements. Other experiments, not in the Fast Track, are free to operate on their own timeline, although we understand that some modelling centres / groups may choose to align with the AR7 timeline regardless.

The DECK and Fast Track experiments are governed and designed by the CMIP Panel in close consultation with the community. It is important to emphasise that the Fast Track selection does not reflect scientific prioritisation of experiments on any basis apart from timeline and those experiments that are chosen for prioritisation within this timeline are expected to be those most likely to inform the IPCC AR7. Participation in the Fast Track and Community MIPs is a choice for modelling centres, and participation to the AR7 Fast Track is not a pre-requisite for participation in Community MIPs.

Figure 2: The CMIP AR7 Fast Track experiments.





Designed through community consultation

During 2023, the [Strategic Ensemble Design Task Team](#) developed a list of potential Fast Track experiments through task team discussions and brainstorming, and engagement with their stakeholder group and the MIP chairs. This selection was then presented to the Core Panel in September 2023. After further engagement with the proposing MIPs and CMIP Panel discussion the first version (v1) of the CMIP AR7 Fast Track was released for consultation with the modelling centres/groups in December 2023. A second set of consultation was launched on 14 February 2024, this time inviting any community member to input on the design. Additional, more targeted questions were also sent to the modelling centres during this consultation phase.

Endorsement of the AR7 Fast Track

In March 2028, the CMIP Panel met in person at DKRZ, Hamburg, Germany. An important aim of this meeting was to finalise the proposed experiment selection of the AR7 Fast Track after the extensive consultation with the CMIP community. Reflecting carefully on the input from the modelling centres and wider community, the Panel confirmed their experiment selection, including additions to the DECK, which was presented to and endorsed by the WGCM at their meeting later in the week and presented to the WCRP Joint Scientific Committee.

The final selection of AR7 Fast Track experiments can be seen in Figure 2. An [interactive experiment](#) viewer was also developed by the CMIP IPO to allow interested community members to read about each experiment and why it was selected for the AR7 Fast Track.

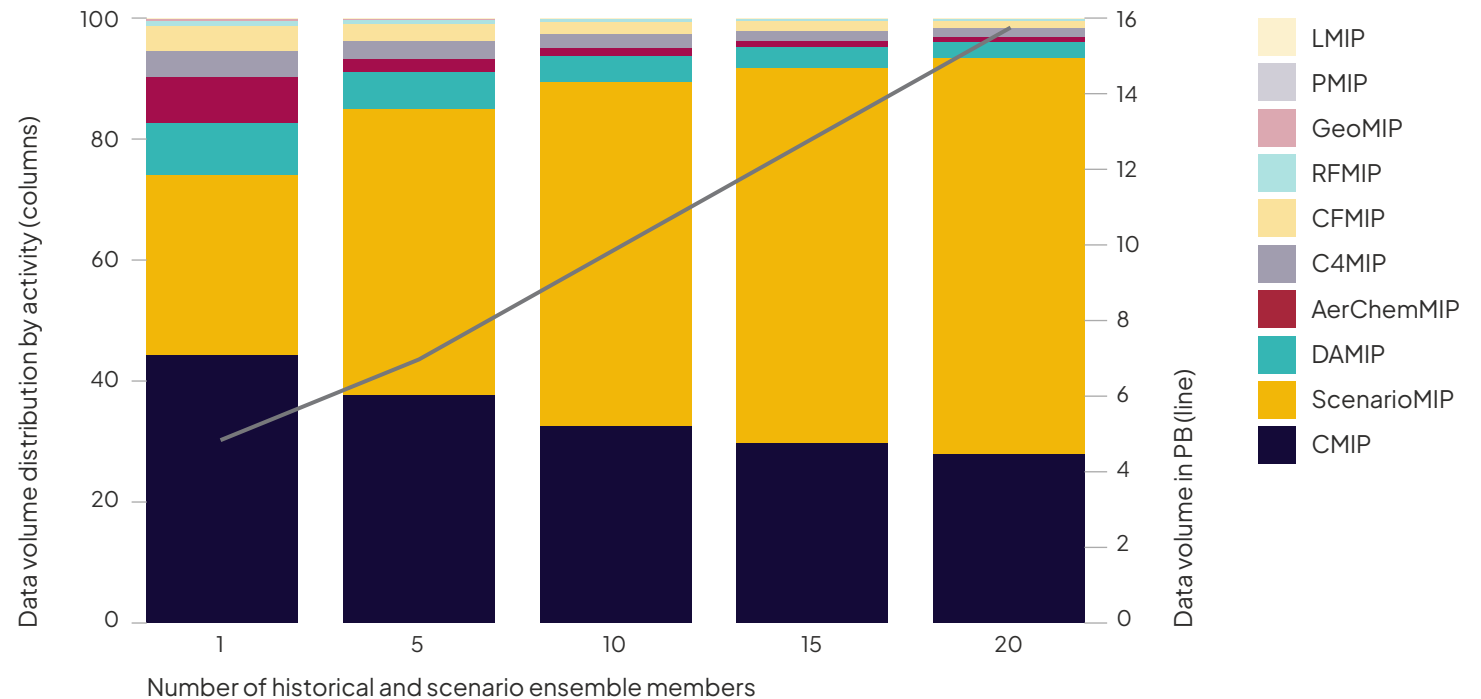
Assessment of the Fast Track's computational load and data volumes

To ensure that the Fast Track achieves its goal of reducing the computational burden on modelling centres, WIP co-chair Matt Mizielski calculated the estimated computational load for modelling centres running the Fast Track. If a modelling centre contributes to all Fast Track MIP experiments, it would require 6998 model years. The analysis is based on running one ensemble member per experiment, except where specified by MIPs (e.g. some experiments within AerChemMIP and DAMIP). Modelling groups are likely to submit more than the minimum number of ensemble members, but this will vary across groups depend on the availability of a resources such as HPC time and data storage facilities.

In addition to the estimation of the minimum number of model years required to deliver the Fast Track experiments, we have produced a crude estimate of the volume of data that would be required. This estimate uses public information from ESGF about data produced during CMIP6 to infer data volume for future runs. The greatest uncertainty is the number of ensemble members that modelling groups will publish, and therefore the analysis has been repeated for ensemble sizes between 1 and 20 members.

An overall estimate of 5–10 PB of data has been made assuming modelling groups will on average produce between one and ten ensemble members. A plot of the total data volumes is shown in Figure 3 along with the breakdown of data volume by activity. The CMIP DECK plus the ScenarioMIP contribution make up the most significant part of the volumes, accounting for 45% and 30% respectively for a single ensemble member, moving to 33% and 57% for 10 ensemble members.

Figure 3: Data volume breakdown by activity and ensemble size.





1.2 The WGCM Infrastructure Panel

The objective of the WGCM Infrastructure Panel (WIP) is to provide guidance and oversee infrastructure development so that it will be fit for its purpose and meet the scientific needs of CMIP and other MIP projects. The mission of the WIP is to promote a robust and sustainable global data infrastructure in support of the scientific mission of the WGCM. The WIP is co-chaired by Dr. Paul Durack (PCMDI/LLNL, USA) and Dr Matthew Mizielinski (Met Office, UK).

In the past year the WIP membership has remained constant. The WIP Terms of Reference are still under discussion and development. ESMO has issued a template Terms of Reference. WIP members require a number of changes to these, which are in progress.

The WIP has initiated implementation of CMIP6Plus, which aims to leverage existing infrastructure, enabling modelling groups to contribute to next-generation climate science with minimal additional investment before the CMIP7 infrastructure and experimental design comes online. CMIP6Plus is now open for submissions and the first data has been published in support of the **Large Ensemble Single Forcing MIP (LESFMIP)**. **A dedicated webpage has been published**, which includes the process for registering new activities, and a whitepaper is being developed for publication. To support CMIP6Plus, work expanding the Controlled Vocabularies (CVs) and MIP tables that define variables continues to be evolved.

The following decisions were approved by the WIP over the past year:

- Mandatory provision of Essential Viable Documentation.
- Recommendations [to ESGF] for a CMIP7 Citation Service including governance and infrastructure development proposals.
- To set up a joint task team with ESGF for enhanced Quality Assurance/Quality Control (QA/QC) of uploaded data.
- To work with the Model Benchmarking Task Team to devise appropriate community standards and guidelines for enhanced QA/QC package(s) to support implementation of the Rapid Evaluation Framework.

WIP members took part in the hybrid Tenth Earth System Grid Federation (ESGF) Conference which took place 23–26 April, in Washington, USA. A roadmap for development and testing activities for ESGF in preparation for CMIP7 was discussed. Key topics relevant to CMIP included improvements to the Errata service, CV's service, minting of DOIs by ESGF publishing nodes and a new structure agreed, the central message queue for publication. Ideas were also explored for allowing streaming access to data, which could be part of the access pathway for the next generation of CMIP and quality control/assurance processes. Whilst aspirations are high, it was acknowledged that resources (including time, people, and financial) are limited.

The WIP continues to engage with the infrastructure providers, in addition to ongoing discussions with the ESGF development community which is primarily split between the US Department of Energy (DoE) and the ENES research infrastructure community in Europe, the latter of which has received funding through the European Commission framework programme IS-ENES projects.



WIP members

Name	Affiliation	Country	Term	Role
Paul Durack	PCMDI/LLNL	USA	2017–	Co-chair, 2021–
Matthew Mizielinski	Met Office	UK	2018–	Co-chair, 2020–
Sasha Ames	LLNL	USA	2019–	Member
Yuqi Bai	Tsinghua University	China	2018–	Member
Katharina Berger	DKRZ	Germany	2021–	Member
David Hassell	NCAS	UK	2019–	Member
Martin Juckes	STFC	UK	2014–	Member
Slava Kharin	CCCma	Canada	2014–	Member
Andrea Lammert	DKRZ	Germany	2021–	Member
Grigory Nikulin	SMHI	Sweden	2021–	Member
Martina Stockhause	DKRZ	Germany	2019–	Member
Karl Taylor	PCMDI/LLNL	USA	2014–	Member

Looking forwards, the WIP's goals for the upcoming year are:

- Revise and update CMIP6 infrastructure (Controlled Vocabularies and MIP tables) in coordination with CMIP technical Task Teams to enable ongoing projects.
- Finalize the CMIP6Plus infrastructure stack, and whitepaper documenting the path for contributions - opening CMIP6Plus for modelling group submissions in late 2023.
- Develop an Infrastructure capable of Integrating with other parts of the MIP universe and be extended to projects beyond CMIP when / If required.
- Coordinate with the Forcing TT and CMIP6Plus contributing modelling groups to publish new simulations testing next generation forcing data to CMIP6Plus.
- Continue to work on building a case for sustainable funding to support ongoing CMIP infrastructure development and support.
- Continue to develop and extend infrastructure to meet the needs of the CMIP7 experimental design and protocol.

1.3 CMIP International Project Office

The CMIP IPO is hosted by ESA's Climate Office at its European Centre for Space Applications and Telecommunications (ECSAT) facility in Oxfordshire, United Kingdom. During the 2023–2024 period there were no further additions to the CMIP IPO team.

“The CMIP-IPO is now almost halfway through their first 5-year tenure and has significantly progressed in the preparations for CMIP7. With a view on enhancing the support to the climate modelling community, CMIP has put in place efficient structures to streamline activities in support of IPCC through the AR7 Fast Track, also working with operational counterparts such as the Copernicus Climate Change Service. The team will continue to grow to provide expert support in key areas such as major community efforts for model validation and verification and CMIP infrastructure coordination. Yet another successful year for CMIP IPO!”

Susanne Mecklenburg, Head of Climate & Long-Term Action Division, ESA

The IPO is run by staff from HE Space Operations under contract to ESA.

“The report concludes a successful second year of HE Space’s staffing of the CMIP IPO. Our staff continue to work hard to deliver a quality service that is required and needed by the CMIP community. With a bigger IPO team than originally foreseen, their second-year achievements include: supporting the development and endorsement of the AR7 Fast Track design; launching of the Data Request Harmonised Thematic Variables engagement process; and spinning-up of the Fresh Eyes on CMIP group. Well done team! After two years the service is fully engaged with the CMIP community. Via our staff, HE Space remains committed to supporting the continued development of CMIP.”

Jason Maroothynaden, UK Managing Director, HE Space Operations Ltd.

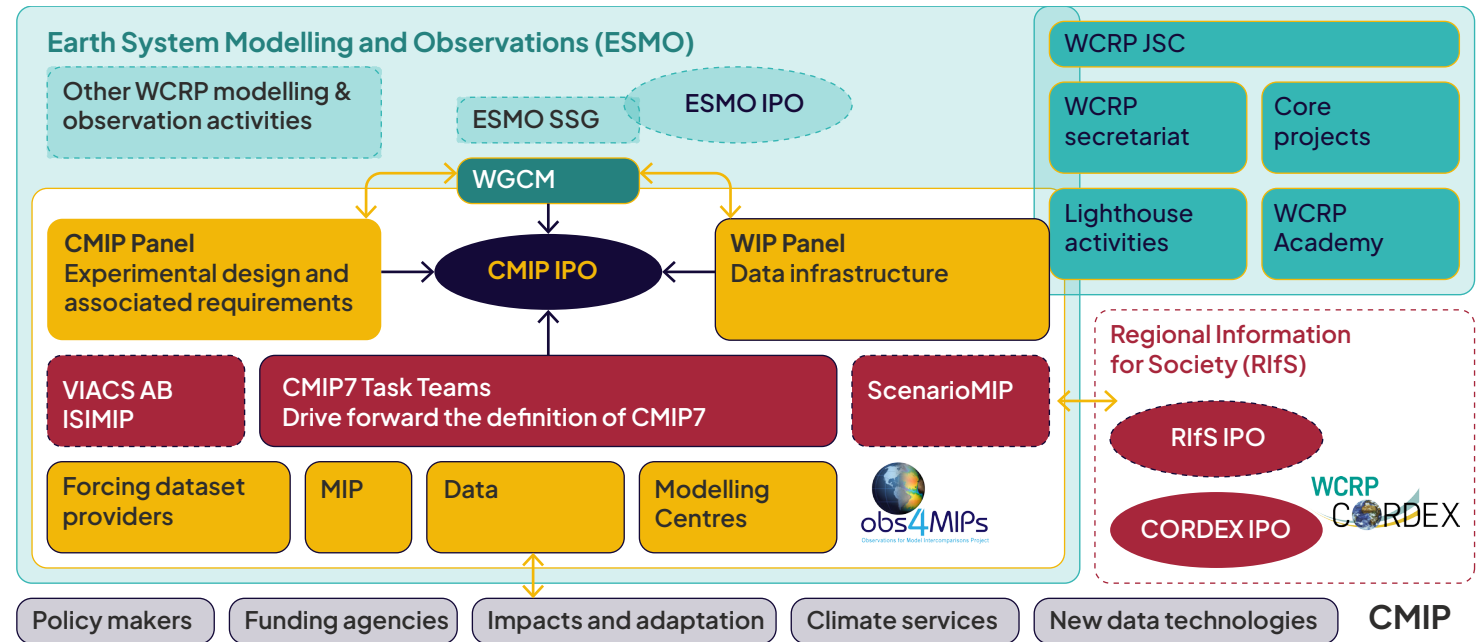
The role of the CMIP IPO is to:

- Provide coordination and organisational support of the activities of the CMIP Panel and WIP, including relevant sessions, meetings, workshops, conferences, and training sessions.
- Support coordination, planning, development, and implementation of the CMIP experimental design, data archiving and dissemination, and associated observational reanalysis, forcings, scenarios and modelling efforts.
- Facilitate international coordination and communication with related WCRP and other international programmes as well as active liaison between the climate observations and modelling communities.
- Identify and scope funding requirements supporting CMIP delivery through regular engagement with current and potential funders, supporting community participation in national and regional funding programmes, and providing direct funding and resource, as available, to support priority workstreams.
- Prepare reports, correspondence, and publications.
- Coordinate CMIP scientific communication, dissemination, and outreach.

The CMIP IPO also collaborates closely with related WCRP, other international programmes, funding agencies and wider stakeholders. Figure 4 shows the CMIP IPO’s position within the broader WCRP landscape.



Figure 4: The CMIP International Project Office within the wider WCRP landscape.



IPO Staff



Eleanor O'Rourke
Director



Briony Turner
Programme Manager



Beth Dingley
Science and
Communications Officer



Daniel Ellis
Technical Officer



Alice Kolesnikov,
Part-time Administrative
Support



Christopher Goddard
Part-time C3S-CMIP
Liaison Officer

1.4 Travel support fund

In August 2023, the CMIP IPO launched the CMIP Travel Support Fund. The Fund is designed to help the CMIP Community attend CMIP-relevant conferences and meetings to boost networking and collaboration. The Travel Support Fund was initially launched exclusively to our Fresh Eyes on CMIP community, to help early career scientists attend meetings which could have a large impact on their future career. The fund was subsequently extended to Task Team members for attendance at Task Team specific meetings, or in other exceptional circumstances. The CMIP IPO reviews applications on a rolling basis as they arrive and accepts / rejects based on availability of funds.

Since its launch, the Travel Support Fund has supported 19 members of the community across seven different events, including AGU, EGU, AOGS, and the WCRP Open Science Conference. CMIP has an ongoing mission to widen participation and encourage diversity across the community. In line with this, of the 19 recipients of the fund, 18 are early career scientists, eight are women, and seven are working in the Global South.

1.5 Carbon footprint

CMIP is an accumulation of international scientific effort. This includes a multitude of activities that have an emissions footprint, such as from computing and meeting travel. The science of CMIP is important, but we must be conscious of the carbon footprint this work is associated with. WCRP has committed to reducing its carbon footprint across all activities. Within the CMIP community, we are focusing on four key areas of reduction:

- eliminate unnecessary data duplication,
- network and data transmission optimisation,
- intentional decision making on CMIP design (experiments, computation, and storage),
- activities of the CMIP community (Scope 3 emissions).

Work is ongoing to determine the computational carbon footprint from CMIP6. There has been some work through the EU Horizon 2020 project, IS-ENES3, which has revealed that the CMIP6 experiments at a range of modelling centres in Europe were between 24 and 868 tonnes of CO₂. To put this in perspective, a return flight London to New York is just under a tonne of CO₂. This work is continuing, and we will develop a more robust estimate which will be used as a benchmark on which a monitoring and action plan for CMIP7 can be developed.



Photo by Elcova Lana

Additionally, the CMIP IPO records an estimate of carbon emissions from all travel that is either:

1. Funded by the CMIP IPO (including IPO staff and community members receiving funding via the Travel Support Fund),
2. CMIP Community members attending a conference / meeting on behalf of their CMIP affiliation (e.g. a CMIP Panel member attending a meeting to represent the CMIP Panel),
3. Attendance at a CMIP IPO organised/facilitated event.

Between July 2023 and July 2024, the total carbon emissions from CMIP travel were 93,811 kgCO₂e. Of this, the emissions from IPO funded travel (including IPO staff travel) 65,068 kgCO₂e. IPO staff travel accounted for 20,663 kgCO₂e.

CMIP across the globe



Our year in numbers



2 New CMIP Panel members selected



5 IPO staff members



8 Task Teams



12 Events facilitated by our IPO across different meetings / conferences



38 countries

Where we have CMIP Activity members

28 countries

Have contributed to modelling or data infrastructure



€68,000

To support CMIP Community attend conferences and meetings

20% to support members from the Global South

20% to support the CMIP Core Panel members to represent CMIP at events



93,811 kgCO₂e

Emissions from **35** Community members across **14** different meetings / conferences



This is equivalent to **87** transatlantic return flights between London and New York



10 consultations

On the design of CMIP7 components



16

YouTube videos published



340%

Increase in LinkedIn followers

16,921

Post impressions on LinkedIn



1359

Members on the CMIP Community News newsletter



3 seminars

Held in our new CMIP Seminar series



19 publications

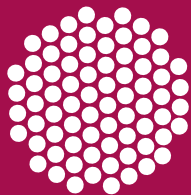
On CMIP Zenodo Community

558,593 datasets

Published to CMIP6 on ESGF

8283 datasets

Published to CMIP6Plus



330

CMIP Activity members



2 CMIP Community

The CMIP Community is a thriving, diverse community which continuously drives forward the innovation, design, and impact of CMIP. The CMIP Community is comprised of task teams, working groups, and the Fresh Eyes on CMIP early career scientists' initiative. Members of these communities represent academia, government, and the private sector to ensure that CMIP's outputs serve all industries and uses who need them.


The overarching objectives the CMIP Community work towards are to:

1. Increase CMIP's scientific and societal relevance,
2. Improve accessibility and widen participation,
3. Support the design, scope, and definition of the next phase of CMIP,
4. Support the evolution of CMIP infrastructure and future operationalisation.

2.1 Data Access Task Team

The [Data Access Task Team](#) seeks to identify barriers to provisioning and using CMIP-related data and to gather ideas for lowering those barriers where possible. To this end, the task team is broadly constituted of members with expertise in data provisioning, data distribution, and data use; membership is drawn from academia, research, NGOs, and the commercial sector. The task team has two associated stakeholder groups, one focused on data provisioning and one on data distribution, whose purpose is to represent the wider community.

In the past twelve months, the Task Team has gathered information on barriers to access and provisioning of CMIP data from a wide range of stakeholders. In addition to regular meetings to learn about and discuss barriers, members of the Task Team organised a side event at the WCRP Open Science Conference. The [Equitable access to climate modelling data](#) event was co-chaired by four members, Lincoln Alves, Nana Klutse, Muhammad Amjad, and Luciana Prado. The event was highly interactive, with excellent feedback provided by participants on the barriers they experience when accessing CMIP data. A large emphasis was placed on the need for improved community training and better data documentation to make data access easier.



A few participants also raised that the ability to subset data before downloading would help address the bandwidth and storage restrictions they can face.

The Task Team are currently working on synthesising the gathered information into a whitepaper, which should be published in 2024. The whitepaper will be invaluable when evaluating future opportunities for improving access and use of CMIP data.

The Data Access Task Team is co-led by Robert Pincus (Columbia University, USA) and Atef Ben Nasser (ISPL, France). Full Task Team membership is available on their website: wcrp-cmip.org/cmip7-task-teams/data-access/.

2.2 Data Citation Task Team

The Data Citation Task Team was tasked with identifying how the existing data citation service could be transformed into a sustainable, scalable and better-integrated service for CMIP7 with the option to offer it for WCRP projects beyond CMIP7. The current data citation service is a one-person effort, which cannot be continued into CMIP7. The objectives of the TT were:

- to define options for a future citation service with information on functionality, advice on federated implementation, costs/risks and benefits as basis for attracting partners willing to contribute to the future citation service; and
- to define a governance structure overseeing the implementation and the compliance to standards and functionality.

The Task Team fulfilled its objectives when they submitted a proposal for a sustainable citation service to the CMIP Panel and the WIP. Both Panels approved their recommendations, and on 12 March 2024, the CMIP Panel voted to close the Task Team. A whitepaper summarising the findings and recommendations of the Task Team will be published in late 2024.

The Data Citation Task Team was co-led by Martina Stockhause (DKRZ, Germany) and Sasha Ames (LLNL, USA). Full Task Team membership is available on their website: wcrp-cmip.org/cmip7-task-teams/data-citation/.

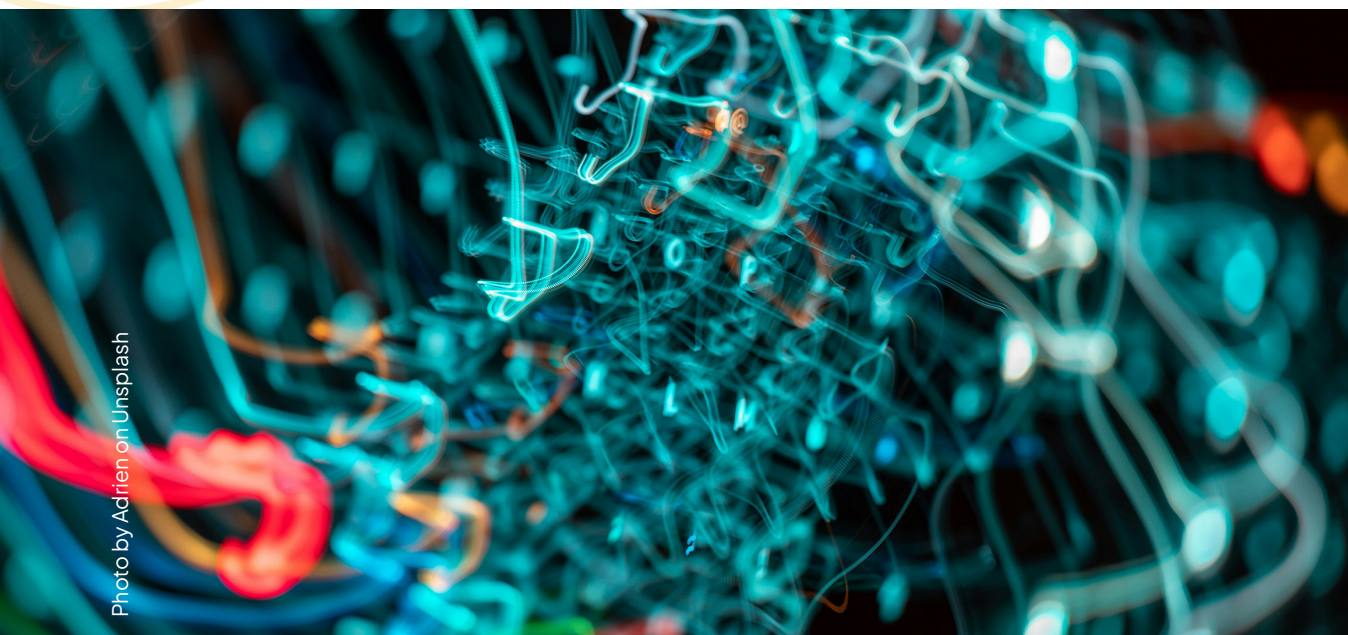


Photo by Adrien on Unsplash

2.3 Data Request Task Team

The focus of the Data Request Task Team is to oversee the creation of the CMIP7 Data Request. The Data Request will provide participating modelling centres with full details of CMIP7 output requirements from participating science teams, helping to ensure that the CMIP7 output requirements accurately reflect the ambition of the science teams, the constraints of the data managing services, and the resources of the modelling centres.

Throughout that past year, the Task Team have further developed their strategic approach for the CMIP7 Data Request, which was approved by both the WIP and CMIP Panel in July 2023, with the implementation of a public engagement activity to develop the variables list further approved in June 2024.

For the engagement activity, the Task Team have developed an approach that works with community representatives to devise a controlled list of high priority variables that facilitate the majority of user needs. They proposed a new Data Request structure consisting of three parts: the Core, Harmonised, and Unharmonised request. Five thematic author teams have been established to develop the controlled list of high priority variables through an IPO-supported and Data Request Task Team coordinated paper writing process, with co-authors representing key stakeholders within each theme.

Read more about this activity, known as the Harmonised Thematic Variables process, in its dedicated Spotlight On... section below.

During the development of the Harmonised Thematic Variables process, the Task Team held a MIP drop-in event in June 2024 to communicate to MIPs how they could contribute to the CMIP7 Data Request and ensure their variables would be included.

The Data Request Task Team was co-led by Martin Jukes (STFC, UK) and Chloe Mackallah (CSIRO, Australia) alone through to June 2024. Due to changing job responsibilities for the Co-leads and the expanded work of the Task Team, a third Co-lead was added in June 2024. James Anstey, a member of the Task Team since its formation, is a modelling centre representative from CCCma in Canada. He is also helping co-chairing a new Data Request Technical Subgroup, alongside Marie-Pierre Moine (CERFACS). Full Task Team membership is available on their website: wcrp-cmip.org/cmip7-task-teams/data-request/.

Spotlight on... Harmonised thematic variables

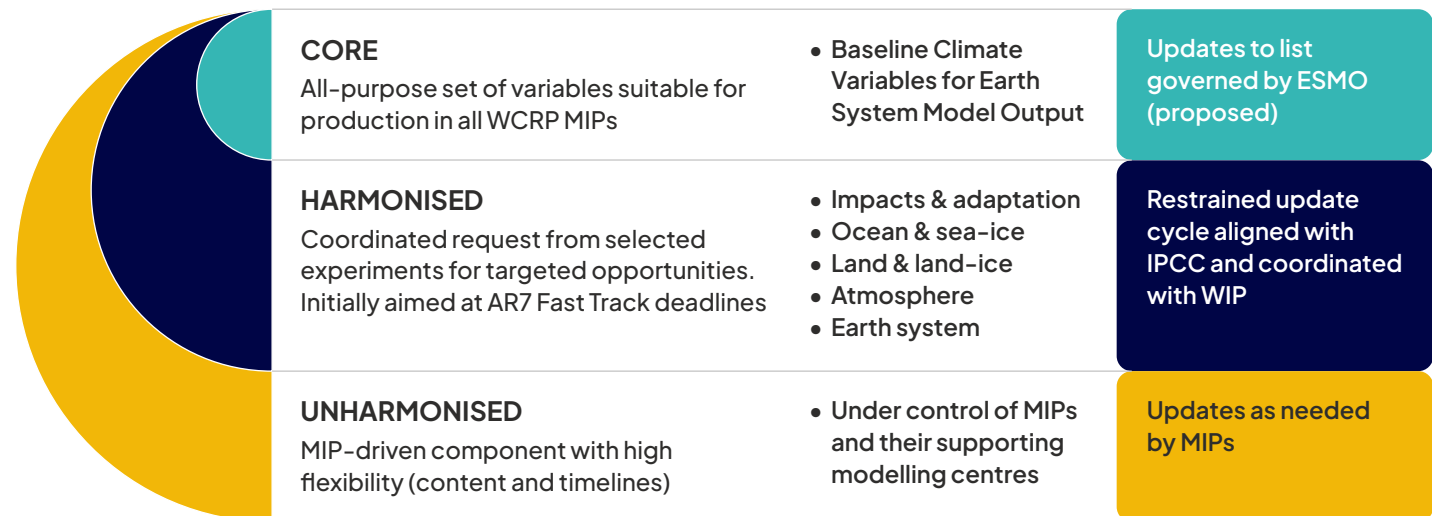
In an analysis of the [CMIP6 Survey](#), most users found the CMIP6 Data Request to be too complex with too little documentation. However, the value in a consistent Data Request was also commonly reported. The survey also found significant tensions, including:

- Data users wanting more variables but data producers struggling with the size of request, and
- Those wanting fewer updates to the Data Request with others wanting more regular version releases.

A new structure for the CMIP7 Data Request

The [Data Request Task Team](#) have developed an activity that works with community representatives to devise a controlled list of high priority variables that facilitate the majority of user needs. They proposed the following structure of the next Data Request to the CMIP Panel and WGCM Infrastructure Panel (WIP). The [Panel and WIP both approved the structure](#).

Figure 5: The new Data Request structure consisting of three parts: the Core, Harmonised, and Unharmonised request.





CORE

The Baseline Climate Variables list. These variables will be requested as standard across all of CMIP7, forming a base of fundamental variables that are ideally produced by all models for all experiments. A paper outlining the variables, and the process followed to identify the variables will be published in GMD soon.

HARMONISED

A controlled list of high priority variables that facilitate the majority of user needs, while keeping the request as small as possible. This component complements the Core by providing a consistent list of variables across five thematic areas (ocean & sea-ice, land & land-ice, atmosphere, earth system, and impacts & adaptation), which can be mapped onto specific groups of experiments according to the scientific objectives and downstream needs of each case. Five thematic author teams have been set up to develop the controlled list of high priority variables through an IPO-supported and Data Request Task Team coordinated paper writing process similar to that undertaken for the Core list, with co-authors representing major stakeholders of each theme.


UNHARMONISED

This is the component of the CMIP7 Data Request that allows MIPs and other community activities to exploit data request services without being restricted by the deadlines and engagement requirements of the harmonisation process.

Harmonised Thematic Variables process and author teams

Papers across the identified five themes will define a collection of harmonised variables to support the high impact analysis of climate model output and provide a consistent and robust set of parameters on which to build the CMIP7 archive. Each will be a collaboration between the CMIP Data Request Task Team and the MIPs and communities relevant to each theme.

The Data Request will include variable definitions and the mapping of variables against the justification for the request expressed in terms of the opportunities that the data will generate. This will take the form of a controlled list of high priority variables that serve both the majority of user needs and create a harmonised set of data requests which balance scientific demand for data against modelling centre and infrastructure capacity.



The [AR7 Fast Track](#) experiments include a range of dual use experiments which will both provide input for AR7 and serve a wider role a control experiments for a wide range of investigations by community MIPs, many of them running on independent time lines. The Data Request will include data requirements covering both use cases so that those modelling centres wishing to support community MIPs can generate the data that they request efficiently.

This process for developing the Data Request is designed to enable a more transparent and effective approach to variable and request harmonisation and prioritisation. The planned timeline for this process is in Figure 2.

Author teams

An open call was conducted for authors and reviewers for the thematic papers:

- [Impacts & adaptation](#) (call closed on 30 November 2023)
- [Ocean & sea-ice](#) (call closed on 01 March 2024)
- [Atmosphere](#) (call closed on 08 March 2024)
- [Earth system](#) (call closed on 08 March 2024)
- [Land & land-ice](#) (call closed on 08 March 2024)

Appointed authors can be [viewed on Airtable](#).

Public consultation

In addition to the author teams' work, there will also be three phases of consultation:

- **Phase 1:** Building the data request – community members can engage directly with author teams, as well as directly comment on proposed opportunities, variable groups and experiment groups as they evolve. In this *in real time* consultation community members with input are advised to do so as early as possible.
- **Phase 2:** Review of the first version of the controlled list of high priority variables.
- **Phase 3:** Review of the refined version of the controlled list of high priority variables

2.4 Forcings Task Team

The Forcings Task Team (Forcings TT) has grown over 2023–2024 to now include two co-leads, 15 members, and seven stakeholders. In addition, the Fresh Eyes on CMIP Forcings subgroups has 14 members.

The TT has been progressing against all four of their **core goals** over the last year with a clear focus on the timely delivery of the **CMIP7 DECK forcings** suite to support the AR7 Fast Track simulation and wider CMIP7 activities. Further details on the CMIP7 DECK forcings suite delivery and future of forcing dataset delivery can be found in the Forcings Spotlight.

The custom forcing datasets required by the wider AR7 Fast Track experiments are the responsibility of the relevant MIPs. However, the Task Team are keen to support publication of this data into the **input4MIPs ESGF project**, provide access to relevant tools, and ensure links to the data and associated documentation are made clearly available on the CMIP website. They further welcome contributions of forcing datasets required by community MIP experiments, and prototype or alternative datasets not currently included in the standard CMIP DECK forcing suite, provided they conform to CMIP data formats. The collation of alternative datasets to sample uncertainty and spread is a team priority.

Looking forward towards 2025, the Task Team established a Harmonisation Working Group in early 2024. This group is comprised of TT members and representatives from the scenarios community with the aim of initiating planning, and ensuring resource availability, for the harmonisation of historical datasets and future scenarios.

The Forcings Task Team has been very active in engaging with the wider community over the last year with dedicated science sessions and involvement in CMIP townhalls at AGU23 and EGU24 including:

- AGU Fall Meeting 2023 session **Climate forcing: quantifying the roles and responses of anthropogenic and natural climate drivers** co-convened by Paul Durack, Vaishali Naik and Stephanie Fiedler.
- EGU Meeting 2024 session **Addressing and understanding climate forcing and uncertainties in CMIP: Key insights and future directions** co-convened by Thomas Aubry, Michaela Hegglin and Camilla Mathison.

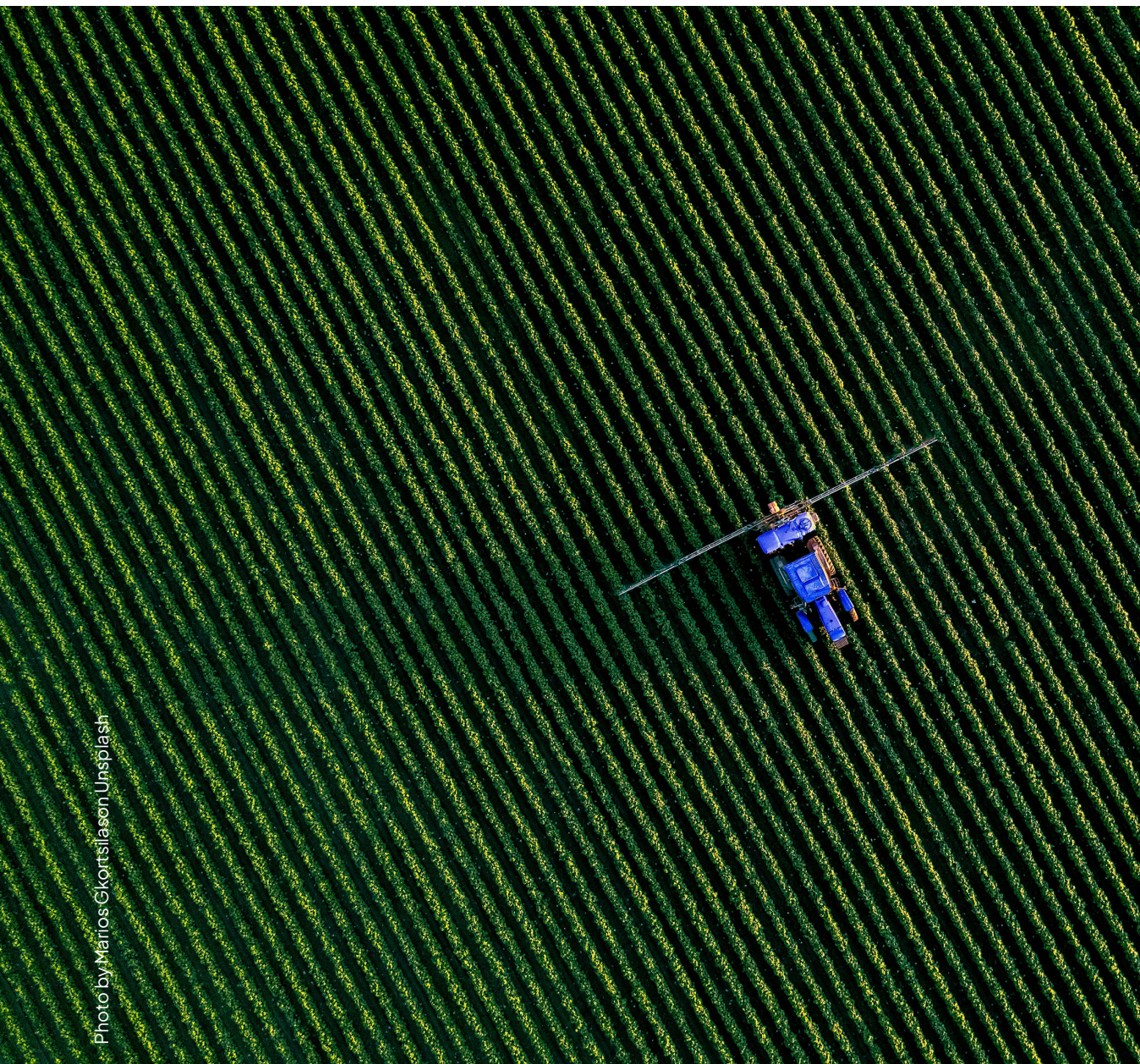


Photo by Marios Gkortsilason Unsplash

The team members have also presented to interested institutions and projects throughout the year sharing the latest developments and plans for the CMIP7 forcing dataset delivery. The [Forcings TT webpage](#) is regularly updated, publications can be found at the [Zenodo WCRP-CMIP Community](#), a [CMIP7 forcings and inputs – development, documentation, and evaluation](#) Geoscientific Model Development Special Issue has been established, and community drop-in sessions are in planning for September 2024 and early 2025.

The Forcings Task Team is co-led by Paul Durack (PCMDI/LLNL, USA) and Vaishali Naik (GFDL/NOAA, USA). Full Task Team membership is available on their website: wcrp-cmip.org/cmip7-task-teams/forcings/.



Spotlight on... CMIP7 DECK Forcings datasets

Climate forcings are key in defining exogenous drivers of ongoing climate change and variability. As such, they are an integral part of defining historical, future scenarios, and idealised model experiments. Up-to-date, accurate, and well-documented forcing datasets are needed to build confidence in model simulations, attribution of historical changes, and projections of future climate change. The Climate Forcings Task Team is focused on identifying, developing, documenting, and delivering an updated and expanded forcing dataset collection for [CMIP7](#) and beyond.

The CMIP7 DECK forcing suite

Responding to the feedback on delayed forcing data provision during CMIP6, the Climate Forcings Task Team has been working hard to ensure timely delivery of well tested and evaluated suite of datasets to support the AR7 Fast Track and wider CMIP7 activities. The task team is focused on the DECK experiments that require forcing providing the ten datasets outlined in the list below:

1. Anthropogenic short-lived climate forcer (SLCF) and CO₂ emissions
2. Open biomass burning emissions
3. Land use
4. Greenhouse gas historical concentrations
5. Stratospheric volcanic SO₂ emissions and aerosol optical properties
6. Ozone concentrations
7. Nitrogen deposition
8. Solar
9. AMIP sea surface and sea ice boundary forcing
10. Aerosol optical properties/MACv2-SP

The first versions (v0) of the ten datasets are being made available as they are being finalized and the full suite of primary datasets will likely become available during September 2024. The CMIP website ([Forcings TT webpage](#)) provides the latest information, documentation, and download links. When available, planned for early 2025, the future CMIP7 version 1 data will be identified for modelling groups to begin their CMIP7 AR7 Fast Track simulations.



Testing and evaluating the datasets

Further improving on the CMIP6 experience the task team will share the v0 datasets, published on the [input4MIPs ESGF Project](#) with the wider community to:

- Identify peculiar or unexplained dataset issues including problems in units, spatial and temporal distribution.
- Allow for testing within volunteering modelling centres.
- Evaluate the data and compare to previous CMIP forcing datasets – this work will be led by the Fresh Eyes on CMIP forcings group.
- Allow the wider community to access and evaluate the datasets (e.g., FireMIP, VolMIP, PMIP etc).
- Support the dataset providers to provide temporal extensions past December 2022 if available or possible.
- Receive community feedback through the [dedicated Github discussion](#) particularly from those who have tested the datasets in models or compared against datasets in previous CMIP phases or other sources.

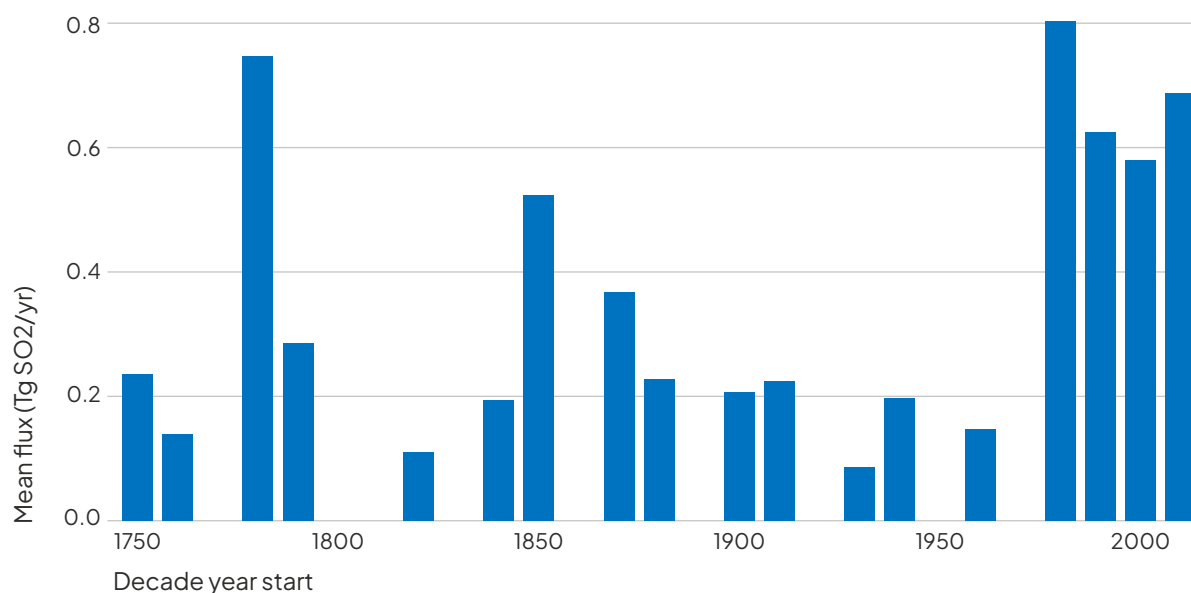
Science highlight: new stratospheric volcanic SO₂ emissions and aerosol optical properties dataset

Timely and reliable delivery of forcing dataset updates is a priority for CMIP7 but key science challenges also remain to be addressed across the forcings.

This included in the development of the new stratospheric volcanic SO₂ emissions and aerosol optical properties datasets by new providers, Thomas Aubry (University of Exeter), Anja Schmidt (DLR) and Mahesh Kovalikam (NASA). This dataset will support both the increasing number of models able to simulate volcanic sulfate aerosols and their optical properties driven by volcanic sulphur dioxide (SO₂) emissions and those that do not have that capability and therefore require aerosol optical properties to represent volcanic eruptions.

A priority challenge for the team is to address the pre-satellite emission bias in the v1 dataset supporting the AR7 Fast Track simulations. Small-medium eruptions (< 3 Tg SO₂) are under-recorded in ice-core archive used to constrain volcanic emission in the pre-satellite era (Figure 6). These relatively small but frequent eruptions contribute on average 50% of volcanic radiative forcing and their inclusion in Earth System Model simulations has a small but significant effect on key climate metrics such as global mean surface temperature or sea level.

Figure 6: Recorded 1-year mean SO₂ emissions by small-magnitude (< 3 Tg SO₂) eruptions, expressed as an average flux in (Tg of SO₂ per year. Data plotted is v0 of the CMIP7 volcanic emission dataset, in which a solution to correct the pre-satellite era bias is yet to be implemented before delivery of v1 for CMIP7 FastTrack.



The v0 version of the dataset does include this strong bias in small-magnitude eruption emissions prior to the satellite era. For the v1 dataset supporting the AR7 Fast Track simulations, they plan to incorporate new high-resolution ice-core datasets and geological volcanic eruption record to mitigate this bias. As with all the datasets, development of the datasets will continue with wide community engagement planned.

Looking to the future

In discussions around a potential sustained mode or “operational” element of CMIP, forcings has been identified as high priority for moving to a regular and importantly, sustained, delivery of updated and improved forcings. Indeed, one of the TT goals is to “Work with teams to identify, develop, document and deliver an updated and expanded forcing collection to near real time”. There is strong agreement around this ambition; however, the reality of implementation is complex, particularly because the development of some key and uncertain forcing datasets still involves research and knowledge advances.

During 2023–2024 steps have been made with the TT Identifying format and standardisation updates to facilitate “operational” use by modelling groups and leveraging and extending community tools to generate and evaluate datasets. However, the funding landscape remains fragmented and user needs remain to be clearly defined and elaborated. A “Pathway to regular and sustained delivery of climate forcing datasets” workshop will take place in October 2024 to further discuss the challenges, and importantly, define a roadmap to the vision for future forcings provision to support not just the CMIP but wider communities and users



2.5 Model Benchmarking Task Team

The objectives of the Model Benchmarking TT are to identify and understand multi-model evaluation, model-data intercomparison, and benchmarking activities that were successful in CMIP6 and other modelling activities.

The past year has been extremely busy and productive for the Task Team. Activities have focussed on the preparation of four papers, three of which are in active development. The first is an invited paper in Reviews of Geophysics which reviews model benchmarking and evaluation tools and highlights the progress the community has made developing these approaches over the past decade. In the paper, the Task Team also provide definitions of the four terms: validation, verification, evaluation, and benchmarking as they can be used in the climate model evaluation community, because there is quite some confusion about their use across the community. Finally, the paper outlines developments required to unlock new benchmarking capabilities for CMIP7 and beyond. This paper is planned for submission in late summer 2024.

Another paper in preparation for submission in late 2024 is summarising the observational requirements for effective model benchmarking. In addition, the Task Team continues to consider their goals for a paper outlining new perspectives for model benchmarking.

Finally, the last paper describes their new ambitious vision to develop a Rapid Evaluation Framework (REF) for CMIP7.

The REF is a new framework which will allow for model simulations to be rapidly evaluated by a range of existing climate metrics as the data is uploaded to ESGF. Evaluating climate models in this way allows for modelling centres to validate their model and allows users to assess and investigate the CMIP data. Overall, this leads to a better scientific understanding of the data that is being produced for CMIP and increases the integrity of its associated science. The Task Team's strategic approach for the REF was approved by the CMIP Panel in July 2024. The Task Team continues to work with the WIP on the best way to implement quality assurance/quality control packages for CMIP data on ESGF. Read more about the REF in its dedicated Spotlight on... section below. This is planned to be initially published as a whitepaper in early 2025, with a journal submission planned once some testing of the REF has been completed.

Work on all four papers was advanced in May 2024 at their dedicated workshop, hosted by Birgit Hassler at DLR, Germany. Members of the Task Team and members of the Fresh Eyes on CMIP Model Evaluation subgroup were invited to attend either in-person or remotely. It was during this meeting that the Task Team finalised the scope of the REF.

The Model Benchmarking Task Team is co-led by Birgit Hassler (DLR, Germany) and Forrest Hoffman (ORNL, USA). Full Task Team membership is available on their website: wcrp-cmip.org/cmip7-task-teams/model-benchmarking/.



Spotlight on... Rapid Evaluation Framework

The CMIP Panel approved the concept for a new Rapid Evaluation Framework (REF) on 18 June 2024, proposed by the [Model Benchmarking Task Team](#), for the [CMIP AR7 Fast Track](#) focused on supporting the next IPCC Assessment Report 7 (AR7) cycle.

The REF is a new framework which will allow for model simulations to be rapidly evaluated by a range of existing metrics as the data is uploaded to ESGF. Evaluating climate models in this way allows for modelling centres to validate their model and allows users to assess and investigate the CMIP data.

Overall, this leads to a better scientific understanding of the data that is being produced for CMIP and increases the integrity of its associated science.

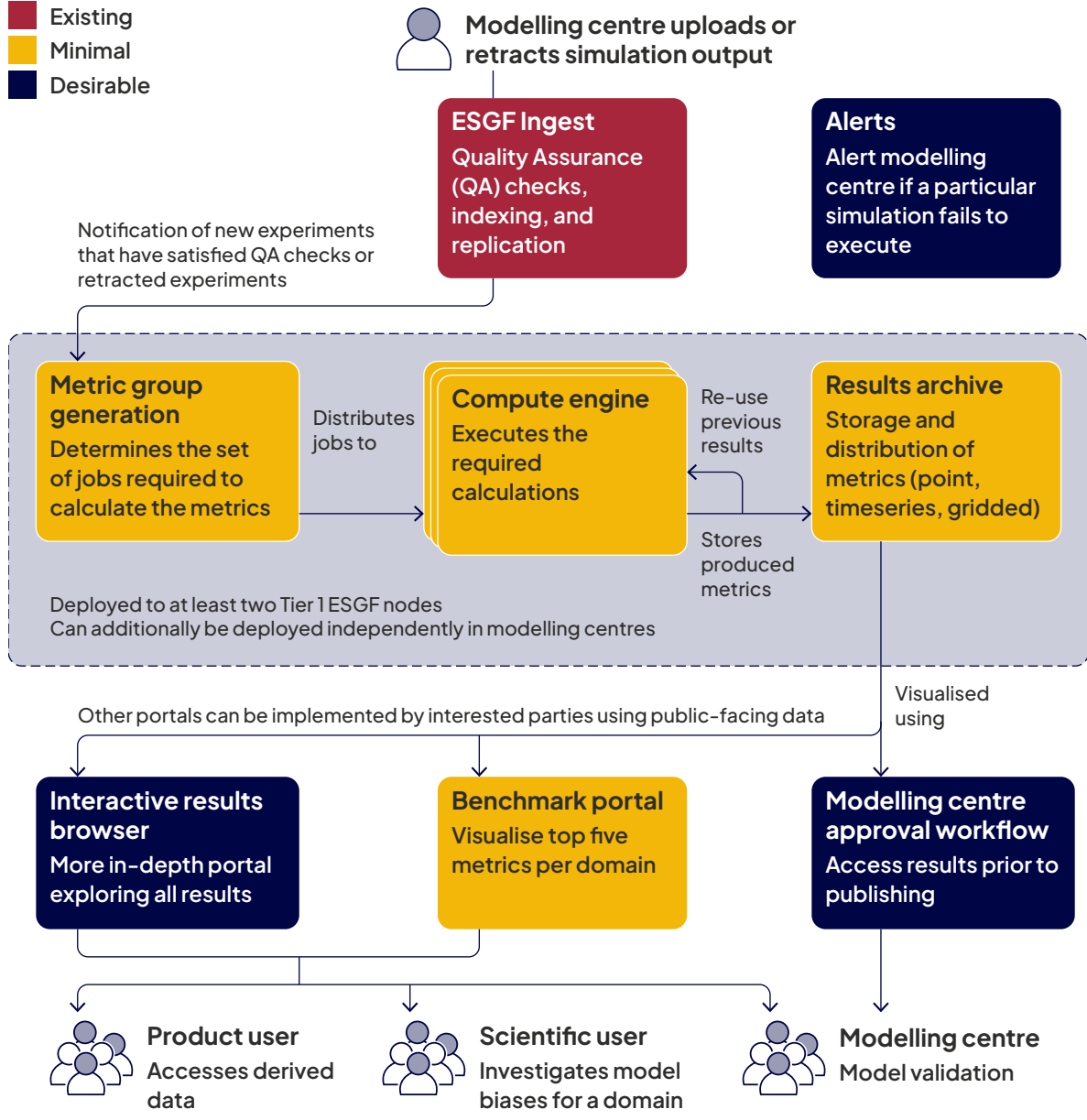
The members of the Model Benchmarking Task Team have developed an outline of the framework (see Figure 8), which is designed to be open source and modular, with immediate focus on delivery of a rapid evaluation for the AR7 simulations but envisaged to build upon existing community evaluation packages.

The framework scope includes an application programming interface (API) for executing metrics generation from those community evaluation packages, across the globe. Tool developers and providers are encouraged to enter the details of their packages into the [Model Benchmarking and Evaluation Tools database](#). This will be used for early consultation to ensure compatibility and ease of integration.

The framework will improve the availability of, and global access to, evaluated simulations as well as supporting community efforts to reduce the carbon footprint. Certain emergent characteristics – such as climate sensitivity, equilibrium climate sensitivity (ECS), transient climate response to cumulative emissions (TCRE), and others – could be pre-computed in a standardised manner supporting users including IPCC author teams.

The framework will support analysts to select models and simulations suitable for their research before downloading data or starting their own assessment. The task team will work with the community to identify critical diagnostics for AR7 Fast Track simulations and expect to expand the framework and add new visualisation and analysis capabilities for future model intercomparison activities.

- Existing
- Minimal
- Desirable



The CMIP Panel are currently looking to the global community to resource and implement this ambitious vision. With an ambitious timeline announced at the IPCC-61 Plenary in July, dedicated funding and resources are required to ensure timely delivery of a robust and reliable framework. It is anticipated it will be required to be fully operational by May 2025 and ready in time for publication of the first AR7 Fast Track data. Over the next year, the CMIP Panel will look to gather funding commitments alongside technical and scientific resources to make this ambitious goal a reality.

Figure 7: Outline of the Model Benchmarking Task Team’s vision for the Rapid Evaluation Framework (REF). Red boxes represent components which already exist, yellow boxes are components required for the minimal implementation of the REF, blue boxes are additional desirable components.

2.6 Model Documentation Task Team

Following the straw man proposals and discussions of the previous year, the Model Documentation Task Team have refined the scope of their work to focus on identifying areas of experiment documentation which are most likely to be used by the CMIP community.

Following the business idea of a 'minimum viable product' the Task Team set out to determine the most fundamental documentation questions that were required for any model simulations to be usable in literature, academia and public understanding.

The concept of Minimum Viable Documentation (MVD) was then presented to CMIP panel and the WIP for comment and approval. It was generally well received and deemed appropriate considering the need outlined from previous community engagement.

Great care was taken with regards to the method of gathering data, inputting and the question content as not to repeat some of the issues presented with ESDoc (namely modelling centres/groups struggling to complete the data). The team also focused on how to encourage people to supply additional information, and discussed the current limitations, addressing concerns of why people have previously not provided complete information.

In addition to this, exploration of future developments in the modelling world, and emerging technologies were discussed. The idea of this task was to build a robust documentation framework that can continue to function past CMIP7 whilst also accurately describing the experiments which have been previously run. Some ideas here include better methods to describe grids and adding versioning information for model components (as each generation often has the same name).

Care was also taken in discussing the format in which information is provided, should new categories be registered beforehand, use of tags or labels (and what the difference is) to better index information, connecting documentation to publications, and adding free text for additional information should someone want to provide it. With an emphasis on reducing the burden of modelling centres, the concept of pre-populating many of the fields, and reusing existing information was also discussed and generally considered a good idea as it reflects current practice as demonstrated in the community.

In collating this information an outline for "Essential Model Documentation" (since this is the minimum requirement to accurately describe a model) was developed and presented to the panels for comment. The next stage will be to send out a survey to the MIPs asking if any information critical to their work may have been missed.

The Model Documentation Task Team is co-led by David Hassell (NCAS, UK) and Guillaume Levavasseur (IPSL, France). Full Task Team membership is available on their website: wcrp-cmip.org/cmip7-task-teams/model-documentation/.

2.7 Strategic Ensemble Design Task Team

The priority for the Strategic Ensemble Design Task Team (SED TT) during the latter part of 2023 and early 2024 was on providing a final recommendation to the CMIP Panel on the AR7 Fast Track experiment selection ahead of WGCM endorsement in March 2024. The team developed the initial selection through early brainstorming of the TT members followed by wider engagement of the community MIPs, selected stakeholders, and then two cycles of consultation with modelling centres together with a public, open consultation. Full details on the AR7 Fast Track can be found in the Fast Track Spotlight below.

Further TT discussions have been focused on meeting the needs for community guidance around the following topics:

- The DECK protocol – ensuring the needs of emissions-driven were met without increasing the computational burden for modelling centres/groups. The final guidance will be included in the CMIP7 description paper.
- Implementation of emissions-driven scenarios and Integrated Assessment Modelling (IAM) coupling including Carbon Dioxide Removal (CDR) implementation, land use specification and treatment of non-emissions-driven models. A perspective piece led by task team co-lead Ben Sanderson motivation the need for emissions driven simulations is currently under review (doi.org/10.5194/egusphere-2023-2127) and a virtual workshop on this topic is planned for late 2024.
- Documenting models spin-up strategies and identifying priority spin-up metrics – a Spin-up Working Group was established and has engaged with modelling centres/groups around appetite and capacity for providing spin up relevant data and its integration into model documentation and benchmarking activities.



Flat10MIP

The SED TT led an initiative to develop a set of emissions-driven diagnostic experiments for the fast-track. This design was proposed in the emissions-driven perspective piece, and has since been piloted in a trial MIP, with nine participating Earth System Models and three Simple Climate models. A paper (in preparation) documents the results of this MIP exercise, comparing results with existing simulations in the CMIP6 DECK, C4MIP and ZECMIP.

The Strategic Ensemble Design Task Team is co-led by Ben Sanderson (CICERO, Norway) and Isla Simpson (NSF NCAR, USA). Full Task Team membership is available on their website: wcrp-cmip.org/cmip7-task-teams/ensemble-design/.

2.8 Fresh Eyes on CMIP

[Fresh Eyes on CMIP](#) is a working group integrating the voices of early career researchers, scientists and practitioners in CMIP. Researchers, scientists and practitioners early in their career provide a unique insight into climate science. Coming into the system more recently enables ECRs to have a fresh perspective on CMIP. ECRs regularly undertake the often time-consuming task of generating, downloading, processing, and analysing data from CMIP and as such, have a unique, working insight into the successes and flaws of CMIP phases. Fresh Eyes on CMIP sits alongside the CMIP7 Task Teams.

Invitations to join the first cohort of Fresh Eyes were sent to successful applicants on 8 July 2023. The original structure of the group comprised a Steering Group with a representative from the six major world regions, and seven subgroups relating to seven key areas of CMIP: Infrastructure; Data Access; Data Analysis; Data Request; Documentation; Forcings; and Model Evaluation. The kick-off meeting for Fresh Eyes was held in September 2023 for all members of the Wider Steering Group (members of the Steering Group plus all subgroup co-leads).

Fresh Eyes members were invited to meet with their groups and determine a/several projects they wanted to work on together. Additionally, a project proposal on the Responsible Use of CMIP Data was brought to the Steering Group, who subsequently decided to launch a cross-subgroup project on the topic.





Over the past year, many exciting and innovative projects have been developed by the Fresh Eyes subgroups including:

1. Assessing the impact and use of CMIP data
2. Testing Forcing datasets ready for CMIP7
3. Introduction to CMIP for first timers
4. Responsible use of CMIP data
5. Data analysis tools and recipes repository
6. Model evaluation requirements and recommendations

In response to the developing ways of working within the Fresh Eyes on CMIP group and feedback from members, a new structure was developed in collaboration with the co-leads, Douglas Rao and Julia Mindlin, CMIP Panel co-chairs, Helene Hewitt and John Dunne, and the CMIP IPO. The new structure retains many of the features of the original set-up, but allows for a more open membership to Fresh Eyes, members to commit to projects based on their own interests and time commitments, and more freedom for members of Fresh Eyes, the Task Teams, and CMIP Governance to propose projects.

Over the past twelve months, members of Fresh Eyes have also been involved in the organisation of multiple conference events. The Fresh Eyes Wider Steering Group developed a session proposal, which was submitted to EGU, AGU, and AOGS titled 'Addressing and understanding uncertainties in CMIP: Key insights and future directions'. The session has been successfully co-convened by a number of different Fresh Eyes members across the different conferences and has already been submitted again for AGU in 2024. In addition, a team of nine Fresh Eyes alongside the IPO organised a workshop which was held at AOGS in June 2024 in South Korea. The workshop was titled **Making the most of CMIP data: access, analysis, and tools** and covered an introduction to

1. CMIP experimental structure and MIPs.
2. Scientific limitations of CMIP data.
3. Different methods for accessing CMIP data, and their advantages and limitations.
4. Analysis and evaluation tools.

2.9 New Task Team on CMIP's carbon footprint

Limiting the carbon impact of CMIP7 has been considered across all aspects of delivery over the past year with the implementation of travel emissions reporting for CMIP meetings, events, IPO and supported guest travel plus ongoing assessment of compute time during the AR7 Fast Track development. However, careful planning for the monitoring and measurement of AR7 Fast Track and wider CMIP7 activities impact is required, and discussions have initiated with the ENES HPC Task Force regarding the collection of computational (CPMIP) and wider metrics. To drive this discussion, and implementation, CMIP will join forces with the ENES HPC Task Force in a joint CMIP7 Carbon Footprint Task Team. An open call for members is expected in October 2024.

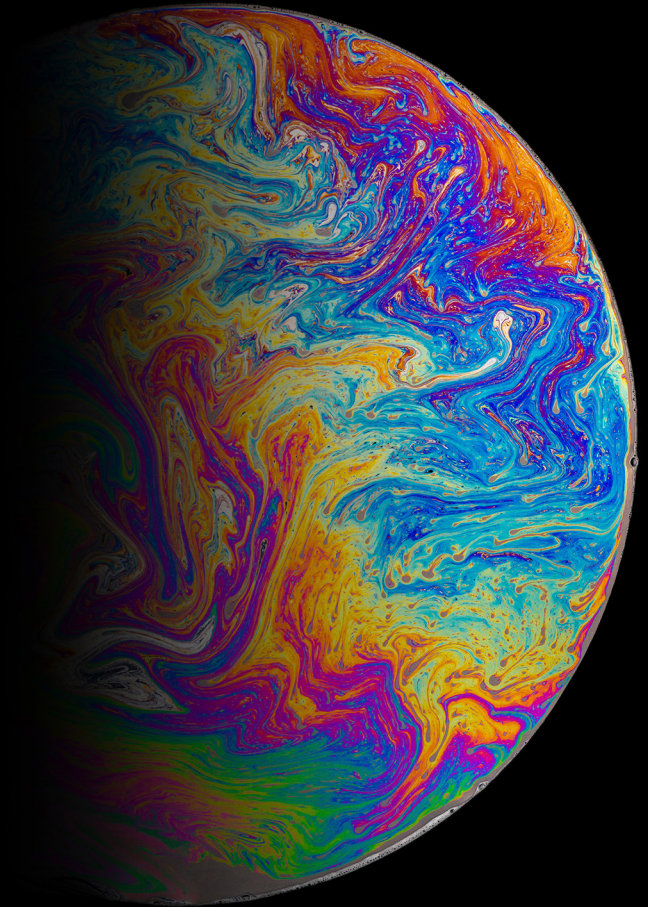
2.10 CMIP regular and sustained mode scoping group

The evolution of CMIP and its increased relevance in supporting a wide range of climate services has provoked discussions on the need, for a regular, sustained mode within CMIP. Historical forcings, scenarios, historical and future climate simulations and quality control measures have been highlighted as priority for such potential “operationalisation” due to their broad application. However, a move to a regular and sustained mode for these critical CMIP activities, will require funding, governance and technical infrastructure issues to be resolved. Additionally, the cultural shift that would be required to move from research to sustained delivery mode will also require significant consideration.

To move the discussion forward, an outcome of the ESMO meeting in March 2023 was the establishment of a group formed from ESMO sub-panel chairs to scope the feasibility of a regular, sustained mode for CMIP chaired by Helene Hewitt (CMIP Panel Co-Chair) and Greg Flato (WGCM Co-Chair). The group will produce an initial report by early 2025 identifying the next steps and further scoping requirements.

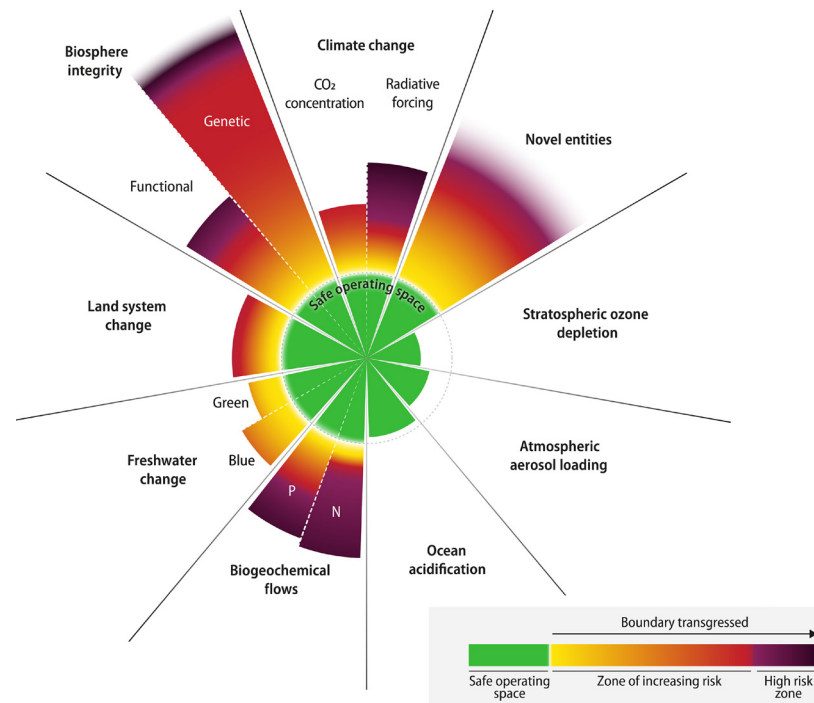
3 CMIP Scientific Highlights

The data from existing CMIP phases continues to be heavily used throughout the community. CMIP6 data publication began in 2019 and much of the data publication was completed in 2022. Below are selected highlights by the CMIP IPO's Science and Communications Officer, from high-impact science journals which have made use of the CMIP data.



3.1 Earth beyond six of nine planetary boundaries

This study investigates current status of the nine Planet Earth Boundaries. The boundaries are defined as those which are critical for maintaining stability and resilience of the Earth System as a whole. In the original 2009 paper to define these planetary boundaries, the Rockström et al., define that “Transgressing one or more planetary boundaries may be deleterious or even catastrophic due to the risk of crossing thresholds that will trigger non-linear, abrupt environmental change within continental- to planetary-scale systems”.



In this study, Richardson et al., find that six of the nine boundaries have now been transgressed suggesting that “Earth is now beyond the safe operating space for humanity”. The nine boundaries each represent components of the Earth System which are affected by anthropogenic climate change. A number of studies analysing CMIP data went into the analysis for the boundaries. Particular use was made of the CMIP6 aerosol emission inventories, analyses of climate responses to aerosol forcings, and analyses of biogeochemistry in the ocean. The status of the nine boundaries can be viewed in Figure 8.

This paper was ranked fifth on Carbon Brief’s The climate papers most featured in the media in 2023 and was mentioned 589 news stories by 384 outlets around the world, including the Guardian, World Economic Forum and The Conversation.

Figure 8: Current status of control variables for all nine planetary boundaries. (Paper Figure 1).

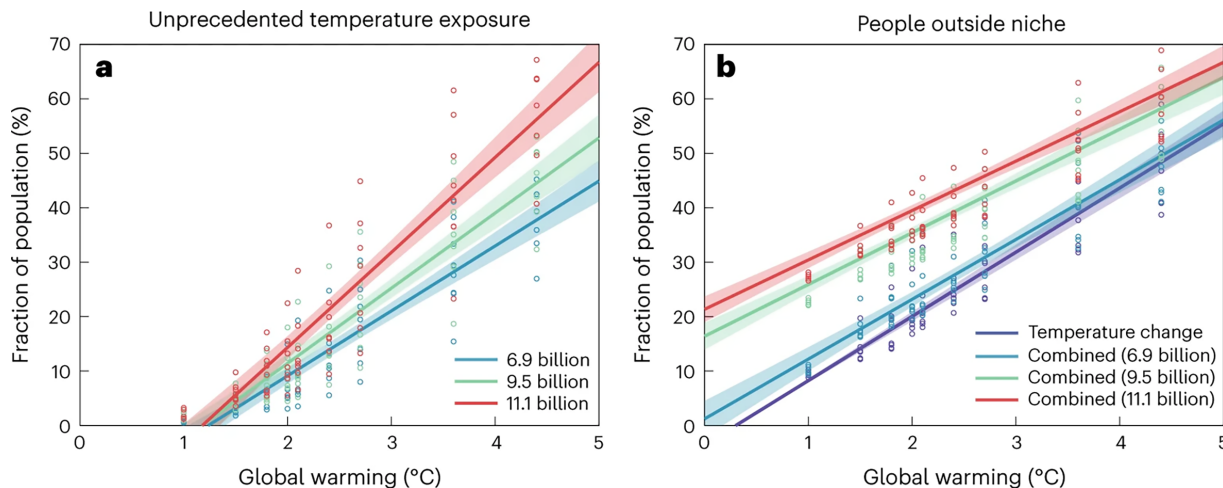
Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S.E., Donges, J.F., Drüke, M., Fetzer, I., Bala, G., Von Bloh, W. and Feulner, G., 2023. Earth beyond six of nine planetary boundaries. *Science advances*, 9(37), p. eadh2458.

doi.org/10.1126/sciadv.adh2458

3.2 Quantifying the human cost of global warming

In this paper, Lenton et al., analyse the costs associated with climate change. But instead of measuring this cost in financial terms as is typically done, the authors estimate the cost in terms of “number of people left outside the human climate niche - defined as the historically highly conserved distribution of relative human population density with respect to mean annual temperature.” In other words, how many people around the world live outside of favourable climate conditions.

In the paper, the authors find that climate change has already pushed 9% of the world’s population outside of the “climate niche”, and policies which push us to 2.7°C could leave 22–39% of the population outside of the niche.

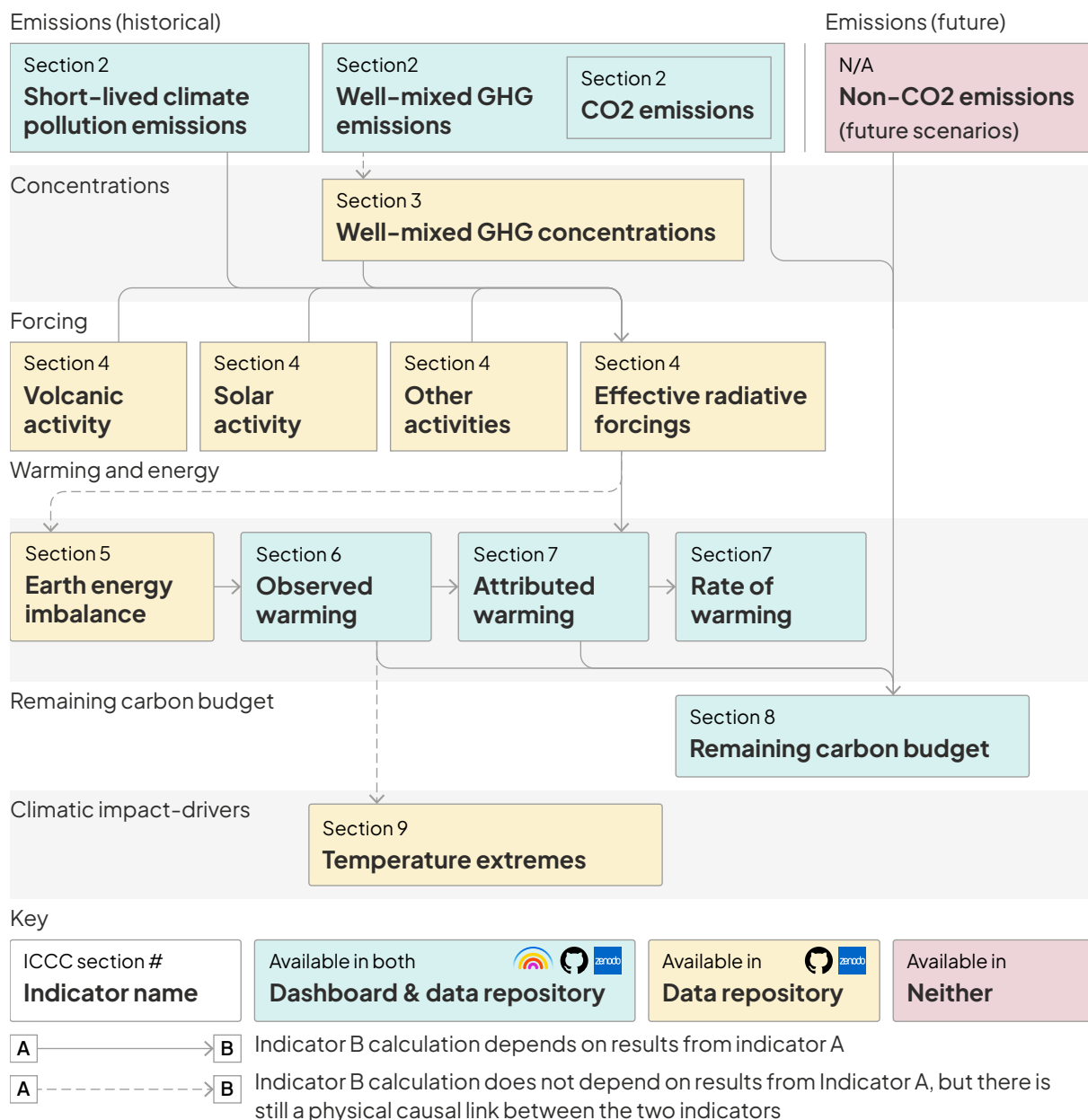


This paper utilises a number of CMIP-derived datasets. Firstly, they use data from six different CMIP6 models to calculate the wet bulb temperature between 2000–2020. They also used downscaled future projection data from eight CMIP6 models, from the WorldClim v2.0 dataset. Finally, mean global warming levels from the CMIP6 model ensemble were used as a metric for selecting SSP intervals for emulators.

This paper was ranked eighth on Carbon Brief’s The climate papers most featured in the media in 2023 and was mentioned in 318 news stories from 218 outlets – including the Guardian, TIME and The Conversation.

Figure 9: Relationships between global warming and population exposed outside the temperature niche for different fixed population distributions (Figure 3 in paper). a) Population (%) exposed to unprecedented heat (MAT $\geq 29^\circ\text{C}$) for the different population distributions. b) Population (%) exposed outside the temperature niche due to temperature change only (purple), and due to the combined effects of temperature change and demographic change, for different fixed population distributions (blue, green, red).

Lenton, T.M., Xu, C., Abrams, J.F., Ghadiali, A., Loriani, S., Sakschewski, B., Zimm, C., Ebi, K.L., Dunn, R.R., Svenning, J.C. and Scheffer, M., 2023. Quantifying the human cost of global warming. *Nature Sustainability*, 6(10), pp.1237–1247. doi.org/10.1038/s41893-023-01132-6



3.3 Indicators of Global Climate Change 2023

Annual update of key indicators of the state of the climate system and human influence

Whilst the IPCC reports are the trusted source of evidence used for climate negotiations, the reports are published every 5–10 years, creating the potential for information gaps between reports. In this paper, Forster et al., follow IPCC methods to update a number of the key climate indicators on the state of the climate using the latest evidence and data available. In the paper, the authors also outline an effort to update these indicators and make them publicly available annually.

A range of CMIP datasets were utilised in the calculation of the climate indicators, including the CMIP6 scenarios and the biomass burning datasets.

Figure 10: The flow chart of data production from emissions to human-induced warming and the remaining carbon budget, illustrating both the rationale and workflow within the paper production. (Paper Figure 1).

Forster, P.M., Smith, C., Walsh, T., Lamb, W.F., Lamboll, R., Hall, B., Hauser, M., Ribes, A., Rosen, D., Gillett, N.P. and Palmer, M.D., 2024. Indicators of Global Climate Change 2023: annual update of key indicators of the state of the climate system and human influence. *Earth System Science Data*, 16(6), pp.2625–2658. doi.org/10.5194/essd-16-2625-2024

3.4 Aerosols overtake greenhouse gases

A warmer climate and more weather extremes toward carbon neutrality

In this paper, the Wang et al., assess the global impacts of changing greenhouse gases (GHGs), aerosols, and tropospheric ozone (O₃) following a carbon neutrality pathway on climate and extreme weather events. A carbon neutrality pathway is a pathway on which carbon neutrality can be achieved. There are many different feasible pathways for this.

Whilst carbon dioxide and other greenhouse gases contribute to warming the climate, aerosols have been previously shown to have a cooling effect. Reducing the amount of aerosol in the atmosphere could therefore have an overall warming effect. In this paper, the Wang et al., find that aerosols significantly climate warming and the frequency and intensity of climate extremes towards carbon neutrality. They show that these effects outweigh the impacts of carbon dioxide and other greenhouse gases.

This paper makes use of data from the DAMIP experiments alongside the CMIP6 scenario datasets.

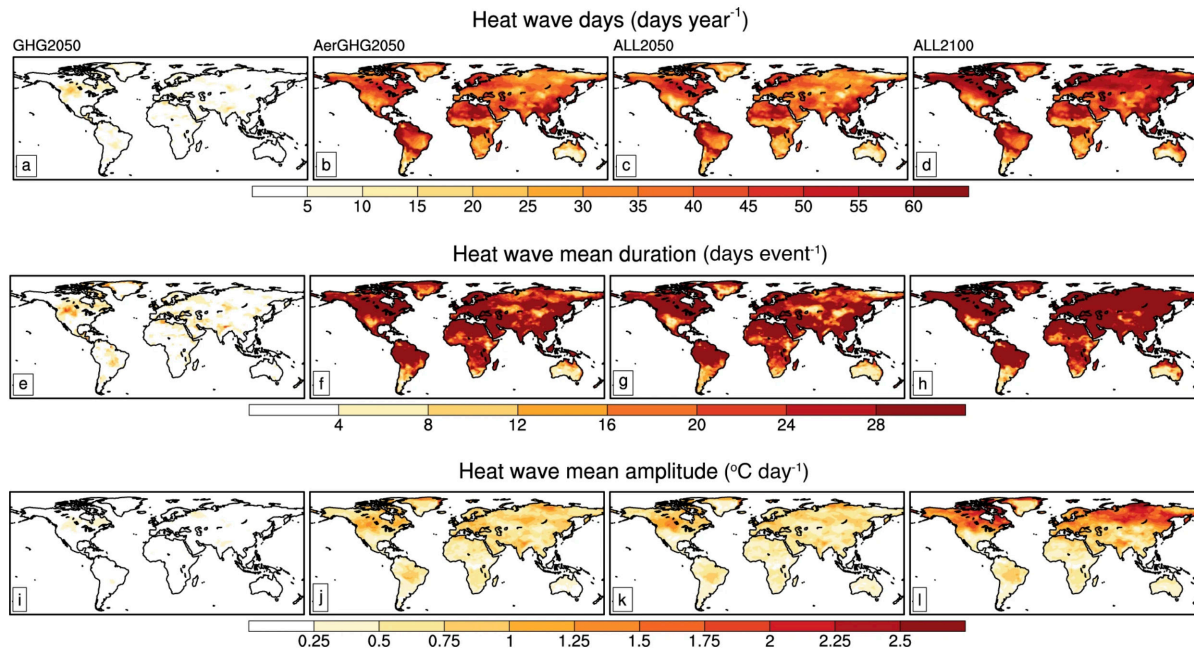


Figure 11: Global maps of heat wave indices. (Paper Figure 3). Heat wave days (days/year), mean duration (days/event) and amplitude (°C/day) in GHG2050 (a, e, i), AerGHG2050 (b, f, j), ALL2050 (c, g, k), and ALL2100 (d, h, l) simulations.

Wang, P., Yang, Y., Xue, D., Ren, L., Tang, J., Leung, L.R. and Liao, H., 2023. Aerosols overtake greenhouse gases causing a warmer climate and more weather extremes toward carbon neutrality. *Nature Communications*, 14(1), p.7257. doi.org/10.1038/s41467-023-42891-2



4 Events and engagement

4.1 Events

WCRP Open Science Conference 2023

The [World Climate Research Programme's \(WCRP\) Open Science Conference \(OSC\)](#) was held in Kigali, Rwanda in October 2023. This once in a decade event welcomed more than 1400 scientists, practitioners, policy makers, and intergovernmental agency workers, over half of which attended in-person in Kigali, with a significant and welcomed representation from African scientists.

The five-day conference saw dozens of presentations across daily plenaries and 40 parallel sessions covering the three conference themes: Advances in Climate Research; Human Interactions with Climate; and Co-produced Climate Services and Solutions. The conference was opened by the Rwandan Minister of Environment Jeanne d'Arc Mujawamariya, who highlighted Rwanda's commitment to climate research and action during the opening ceremony.

The CMIP community was well represented across the conference. Julie Arblaster and Robert Pincus, two members of the CMIP Core Panel, attended the conference in-person to give an update on CMIP to the WCRP community, alongside CMIP7 Task Team co-leads Birgit Hassler, Forrest Hoffman, and Isla Simpson. In addition, three members of the CMIP International Project Office (IPO) and dozens of Task Team and Fresh Eyes on CMIP members attended the conference.

The CMIP IPO organised three exciting side events during the OSC and co-organised a side event with the CORDEX IPO.

[Equitable access to climate modelling data](#)

This event was run by four members of the [CMIP7 Data Access Task Team](#). This event was highly interactive, with excellent feedback given by the participants on the barriers they experience when accessing CMIP data. A large emphasis was placed on the need for improved community training and better data documentation to make data access easier. A few participants also raised that the ability to subset data before downloading would also address the bandwidth and storage restrictions they can face.

CMIP and CORDEX evaluation and analysis tools

This event was jointly run by the CMIP IPO and the CORDEX IPO. This event had excellent attendance with participants looking to learn about and watch demonstrations for different available tools which might be useful for their work. Beth Dingley (CMIP IPO) and Grisha Nikulin (SMHI) started the event with overviews on CMIP and CORDEX data, followed by an overview from the recent Climate Resilient Development for Africa (CRD4Africa) meeting by Nana Klutse. A number of different tools then gave a short pitch to participants to encourage them to come to their demo table later in the session. We were lucky to have in-person demonstrations from ESMValTool, Climate and Agriculture Risk Visualization and Assessment (CAVA), the CMIP6 for CORDEX Toolkit, the IPCC WGI Interactive Atlas, Copernicus Climate Change Service (C3S), the Climate Information Portal as well as three online presentations from Pangeo, XMIP, and NOAA's Model Diagnostics Task Force Framework.

Addressing barriers to a diverse and inclusive climate modelling community

The third side-event was a fascinating panel discussion titled featuring Julie Arblaster as chair of the discussion, with WMO Secretary General elect Celeste Saulo (WMO), Brazilian climate modeller Paolo Nobre (INPE), regional climate modelling expert Masilin Gudoshava (IGAD), extreme weather modeller Izidine Pinto (KNMI), and idealised climate modeller Adrian Tompkins (ICTP) joining the panel.

Discussions were varied, but focussed on whether the community has become more diverse in the past decade and what those in well-resourced institutions can do to drive progress. Speakers also shared their inspirational career paths which have allowed them to rise to their current positions.

How to strengthen the observational-modelling interface to meet emerging scientific needs critical to our understanding of climate change

The final side event of the week was held on Wednesday lunchtime. This world café event followed on from a similar event held at GCOS 2022, where a provisional roadmap of practical actions was curated. Outputs from this session will be summarised in a roadmap, due to be published before the end of 2023. Fresh Eyes on CMIP Model Evaluation subgroup co-lead Alicia Hou attended this event and wrote a [summary report](#), which is available on the event page.



During the CMIP and CORDEX tools event, we also launched our new [Climate Data Tools database](#) and a more detailed model evaluation and benchmarking tools gallery. This is a new community-driven, online tools database to help anyone who uses climate data to find tools, tutorials, and data access platforms. In the database users will find different tools, coding languages, and other softwares which might be useful when working with climate data. The CMIP7 Model Benchmarking Task Team have also compiled more detailed information on a number of tools used for model benchmarking and evaluation. The CMIP IPO worked together with the ESMValTool and PCMDI Metrics Package (PMP) teams to develop videos introducing the tools. All of these resources were launched during the OSC, receiving very positive feedback from participants.

[AGU23](#)

During December every year, over 20,000 people convene both in-person and online at the [American Geophysical Union \(AGU\) Annual Fall Meeting](#). In 2023, San Francisco hosted the meeting at the Moscone Centre between 11–15 December, covering themes from across the geosciences domain. The tagline for this year's meeting was 'Wide. Open. Science.', with a number of sessions focussing on open data and diversity and inclusion initiatives throughout the geosciences.

Many members of the CMIP Panel attended the conference, including CMIP Panel co-chair John Dunne (NOAA GFDL) and WIP co-chair and Forcings Task Team (TT) co-lead Paul Durack (PCMDI/LLNL). Other wider panel members in attendance include emeritus member of the CMIP Panel Karl

Taylor (PCMDI/LLNL), Data Citation TT co-leads Martina Stockhause (DKRZ) and Sasha Ames (LLNL), Strategic Ensemble Design TT co-lead Isla Simpson (NCAR), Model Documentation TT co-lead David Hassel (NCAS), Model Benchmarking TT co-lead Forrest Hoffman (ORNL), and Fresh Eyes on CMIP co-lead Douglas Rao (NC State).

Having such a variety of CMIP experts at AGU allowed for our Townhall event [Co-creating the future of CMIP](#) to cover a wide range of the latest CMIP updates. The Townhall was chaired by John Dunne, with additional presentations from the Forcings TT, Model Benchmarking TT, Fresh Eyes on CMIP, as well as invited presentations from [ScenarioMIP](#) by co-chair Brian O'Neill (JGCRI/PNNL) and [HighresMIP2](#) by Paul Ullrich (UC Davis). Isla Simpson presented the proposed CMIP AR7 Fast Track experimental design. This proposal represents a shift away from the burdensome design of CMIP6, with all experiments needing to be delivered on the same timeline, and instead moves towards fast tracking a specified set of experiments from Community MIPs to be ready for the next IPCC Assessment Report. Other experiments from MIPs can be requested on their own timeline, based on scientific need.

After the Townhall, John Dunne commented,

“ I was proud that the CMIP Townhall had broad participation with a great introduction of new faces and energy stimulating ongoing community discussions on how to most effectively move forward in this new phase. ”

John Dunne, CMIP Panel co-chair

Paul Durack added,

“ The Townhall attracted a diverse array of contributors and stakeholders. We received targeted feedback for the ongoing CMIP7 planning, with many following up with panel and task team members during ongoing discussions after the session. ”

Paul Durack, WIP co-chair

EGU24

The [European Geophysical Union’s General Assembly in 2024](#) (EGU24) took place in Vienna in April. EGU24 welcomed over 18,000 in-person attendees from 116 countries with over 2500 people also joining online. Two members of the International Project Office (IPO) were also able to attend.

The IPO was delighted to host two Townhalls during the week, four informal lightning talks, and a poster summarising the plans for the CMIP AR7 Fast Track.

The first Townhall – [Co-creating the future CMIP](#) – included a presentation on the experiments chosen for the AR7 Fast Track, as well as discussion on the scientific opportunities that could be investigated with CMIP7. The Townhall also featured updates on the next phase of scenarios, forcing datasets, model evaluation and benchmarking plans, and an update from the Fresh Eyes on CMIP group.

The second Townhall was organised in collaborating with the [CORDEX](#) and [Rifs](#) IPOs. The Townhall was designed to understand the challenges of producing information for society based on climate science. This included topics ranging from data access to the treatment of uncertainty and expert judgement over what constitutes robust, decision-ready information. A report summarising the discussions during the Townhall can be [read on Zenodo](#).

ESGF10

The 10th Earth System Grid Federation (ESGF) meeting was held in Washington DC in April 2024. The meeting was designed to facilitate collaborative interactions across ESGF contributing members and create a roadmap for ESGF development activities, aimed at developing the next generation ESGF (ESGF-NG) for delivering AR7 Fast Track and wider CMIP7 simulation data. The meeting was hybrid, with online contributors invited to join both the plenary and discussion sessions.

A key outcome of the meeting was a roadmap and timeline, which ESGF contributors will use to plan the work they hope to deliver in advance of the AR7 Fast Track data starting to be delivered. A primary goal was to further discussions on index and search capabilities and significant progress was made on integrating the US and European approaches. Participants of the meeting highlighted the considerable benefit of this week of face-to-face discussions, being the first in person ESGF meeting since 2019. The progress made during the week is continuing with potential plans for a further in-person meeting in late 2024.

AOGS 24

The Asia Oceania Geosciences Society's (AOGS) Annual Meeting was held in Pyeongchang, South Korea at the end of June 2024. The CMIP Community was well represented across the conference, with CMIP Core Panel member Tomoki Miyakawa attending, alongside Model Benchmarking co-leads Forrest Hoffman and Fresh Eyes on CMIP co-lead Douglas Rao.

CMIP hosted a Townhall at the conference titled **Co-creating the Future CMIP**. This session featured a presentation of the AR7 Fast Track development process, experiment selection as well as the science goals more widely for CMIP7. During the Townhall, Forrest Hoffman also presented an update on model benchmarking plans for CMIP7, including their **Tools Gallery** and plans for a **Rapid Evaluation Framework**. Douglas Rao also introduced the Fresh Eyes on CMIP group, before he and two other Fresh Eyes members (Yiwen Li and Alexander Winkler) presented work from three active projects: Responsible Use of CMIP Data, Model Evaluation Survey, and Measuring the Impact of CMIP Data respectively.

Nine Fresh Eyes on CMIP members and the IPO also organised a workshop for AOGS attendees titled **Making the most of CMIP data: access, analysis, and tools**. The workshop provided an overview of ways to access CMIP data and present some useful analysis tools and methods to help with using it. The key topics covered in the workshop were:



1. CMIP experimental structure and MIPs.
2. Scientific limitations of CMIP data.
3. Different methods for accessing CMIP data, and their advantages and limitations.
4. Analysis and evaluation tools.

Materials from the workshop, including slides and code are freely available online and can be accessed from the [workshop webpage](#).

Drop-in sessions

Following the success of the Drop-in series launched in early 2023, two more sessions were held in the past year. The drop-in sessions provide a chance for the climate community to actively input into key elements of the CMIP7 design. These sessions are facilitated by the CMIP IPO, in collaboration with Task Teams and governance, and are open to all with attendance by modelling centre and MIP representatives strongly encouraged. Each drop-in session is held at two different times to enable participation from those in all time zones across the world.

AR7 Fast Track drop-in

To support the v1 AR7 Fast Track consultation with modelling centres in late 2023, two drop-in sessions were held providing an overview of the evolving CMIP structure and development of the CMIP AR7 Fast Track, an update on the timeline, and an opportunity to ask questions and raise concerns. Sessions were run at 05:00 UTC and 17:00 UTC on 30 November, to ensure all centres/groups could attend at a convenient time in their location, with members of the CMIP Panel and relevant task teams available to answer questions. All questions and answers were collected and made available on the [CMIP Community FAQ](#) under the **AR7 Fast Track** topic tag. A further drop-in session was planned to support the open community v2 consultation but did not go ahead due to very low registration, suggesting the supporting information made available was sufficient.

Data request drop-in

Following the announcement of the new Data Request structure and the harmonised thematic variables community engagement process, the Data Request Task Team held two drop-in sessions to inform MIPs about the developments and answer any questions they had. The drop-in sessions were held at two different time-zones at 15:00 UTC on 5 June, and 08:00 UTC on 6 June 2024. Martin Juckes chaired the first session, and Chloe Mackallah chaired the second.

The aims of the sessions were to present planned changes from the CMIP6 Data Request and to outline the harmonised thematic variables engagement process for MIPs and modelling centres / groups, but all members of the community were welcome to register and attend.

During the community drop-in session, the chairs presented the process for MIP engagement in development of the harmonised variable list for the AR7 Fast Track experiments. The sessions then opened into interactive question and answer session.

CMIP Seminars

Science is at the heart of CMIP. To promote the breadth of excellent science being done that utilises CMIP data, a **monthly seminar series** was launched in March 2024, with the first session held on 24 April 2024. Seminars are held on the final Wednesday of each month at alternating times of 08:00 UTC and 15:30 UTC to allow for presenters and audience members across all time zones. Each seminar features three speakers and allows time for both presentations and questions. Many of the presentations are **uploaded to YouTube** afterwards, to allow for anyone to watch and learn about science which makes use of CMIP data. The seminars have proved to be very popular, with over 300 people registered to receive joining details.

An additional Special Seminar was also held on 24 July 2024 at 15:30 UTC to celebrate the career of retired CMIP alumnus Cath Senior, titled **A perspective on WCRP and CMIP and future challenges**. Cath was co-chair of the WGCM from 2015–2022. She was also interim co-chair and lead author of the scientific strategy ESMO and remained a member of the ESMO Scientific Steering Committee and the Extended CMIP Panel until her retirement in July 2024. The whole CMIP community thanks Cath for her incredible service and wishes her well in her retirement!



4.2 Consultations with the community

AR7 Fast Track consultation

Throughout the development of the AR7 Fast Track design and experiment selection, engagement with the modelling centres/groups, wider CMIP community and downstream users has been prioritised.

The initial experiment selection recommendation from the [Strategic Ensemble Design Task Team](#) involved communication with all CMIP6 and registered MIPs offering the opportunity to nominate experiments to be considered for inclusion, plus request for input from other WCRP activities. The proposal was discussed by the CMIP Panel before the first of two phases of consultation, with modelling centres / groups invited to comment on the v1 proposal in late 2023. The feedback received was carefully considered and further discussions with proposing MIPs took place before a v2 proposal was released. This consultation took the form of a further focused engagement with modelling centres / groups plus an open community consultation. The summaries of the AR7 Fast Track v1 and consultation responses can be [found on Zenodo](#).

Following the endorsement of the AR7 Fast Track experiment selection by the WGCM and ESMO in March 2024 further consultation with the community has taken place regarding Essential Model Documentation, spin up metrics, ocean regridding, representation of bioenergy combined with carbon capture and storage (BECCS), and the developing CMIP7 Rapid Evaluation Framework. Close engagement and consultation with the community will continue as the CMIP community moves to implementation and delivery.

ScenarioMIP CMIP7 design consultation

Over the past year, the [ScenarioMIP](#) co-chairs Brian O'Neill, Claudia Tebaldi, and Detlef van Vuuren worked alongside the ScenarioMIP [Scientific Steering Committee](#) (SSC) to develop the proposal for a new generation of climate scenarios for CMIP7.

On June 20–22, 2023, the [first meeting of the ScenarioMIP project under CMIP7](#) was held in Reading, UK. Participants were primarily members of scenario-related MIPs, including the ScenarioMIP SSC, as well as relevant scientific experts identified by the MIPs, representatives of ESM modelling centres, and leadership of CMIP. [A report](#) was published following the meeting, summarising discussions and early plans for the next generation of scenarios.






Following a series of engagements with the ScenarioMIP SSC, Advisory Board, CMIP Panel, WCRP Joint Steering Committee, and the wider community, ScenarioMIP released their proposal for the CMIP7 scenarios and **invited the wider community to consult** and provide feedback in advance of the planned submission to GMD this year.

MIP Best Practice Guidance

Responding to feedback given in the **CMIP6 Community Survey**, the CMIP Panel have elected to not endorse MIPs in CMIP7, as was done in CMIP6. It was identified that requiring all MIPs to conform to the same timeline added additional burden to the modelling centres needing to produce large amounts of data, and reduced the ability for MIPs to respond to scientific questions as and when they arose.

Despite no longer endorsing MIPs moving forwards, CMIP's long experience in coordinating model intercomparisons has helped identify a set of practices that allow broad participation and efficient use of resources. In January, the CMIP Panel published a summary of these in the **MIP Best Practice Guidance document**.

The document includes guidance on MIP development, design, and documentation. There is also helpful information given for MIPs who wish to take advantage of the data standards and infrastructure that support CMIP.



Coupled Model Intercomparison Project (CMIP)

CMIP is a project of the World Climate Research Programme (WCRP) providing climate projections to understand past, present, and future climate changes. CMIP and its associated data infrastructure have become essential to the Intergovernmental Panel on Climate Change (IPCC) and other international and national climate assessments.

 [CMIP – Coupled Model Intercomparison Project](#)

 [@wcrpcmip](#)

 [wcrp-cmip.org](#)

 [wcrp-cmip.org/get-involved/](#)

 [ipo@wcrp-cmip.org](#)

