

# Consultation: CMIP AR7 Fast Track v1

This document provides background information to support the completion of the consultation survey for the CMIP AR7 Fast Track v1 proposal. Please **read carefully** before completing the survey on behalf of your modelling centre/group – **a single consolidated response** from each modelling centre/group is required.

The [CMIP Panel](#) and [WGCM Infrastructure Panel \(WIP\)](#) continue to shape the future CMIP structure and delivery plans in close coordination with the [CMIP Task Teams](#) and through regular engagement with WCRP and the wider community. Reflecting concerns about the burden CMIP6 placed on modelling centres/groups, the CMIP Panel have proposed a more continuous approach for model intercomparison along with a targeted “Fast Track” set of experiments designed to set priorities for the running of simulations to align with the needs of IPCC 7th assessment cycle.

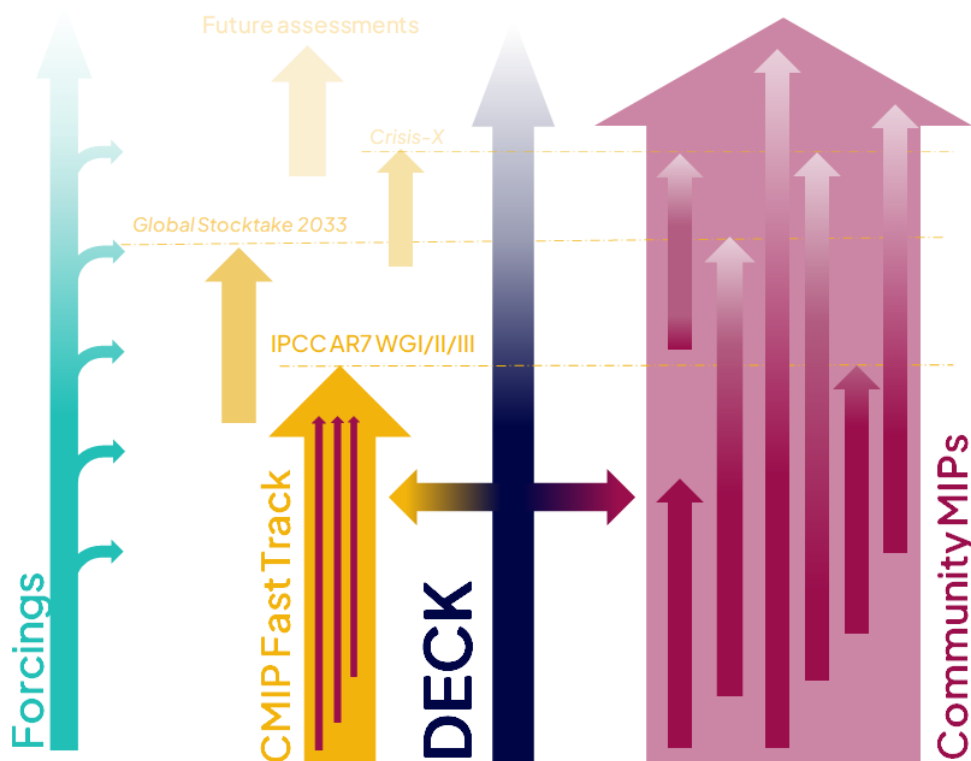


Figure 1: Schematic representing the evolving CMIP experiment structure.

## What is the CMIP Fast Track?

The Fast Track is 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, need not align with such a strict timeline,

although we understand that some modelling centres/groups may choose to align with the AR7 timeline regardless.

The DECK (CMIP “entry card”) 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. Participation in the Fast Track and Community MIPs is a choice for modelling centres and participation to the Fast Track is not a pre-requisite for participation to Community MIPs.

## Is the DECK changing?

Running the DECK will remain the “entry card” for CMIP, including the Fast Track. Community feedback on potential changes to the DECK have been received by the Panel. In September 2023, the CMIP Core Panel confirmed the DECK will now include (in addition to amip, abrupt4xCO2, piControl, esm-piControl (for ESMs only), and 1pctCO2) the following experiments:

- historical
- esm-hist (for ESMs only)
- piClim-control
- piClim-anthro
- piClim-4xCO2

The historical was already identified in CMIP6 as an “entry card” simulation and therefore the Panel concluded it should become part of the DECK. The piClim runs (as described in [Pincus et al, 2016](#)) have also been included as they characterise the forcing, are well proven and tested, and have a minimal computational requirement.

## Recommendation for running the DECK experiments

**UPDATE (08/12/23):** The CMIP Panel would like to recommend that **all** centres/groups should run CO<sub>2</sub> concentration driven experiments for amip, abrupt-4xCO<sub>2</sub>, 1pctCO<sub>2</sub>, piClim-control, piClim-anthro, piClim-4xCO<sub>2</sub> and piControl **plus** the esm-hist and esm-piControl, for those prioritising CO<sub>2</sub> emissions-driven comparisons, **and/or** historical (if prioritising CO<sub>2</sub> concentration-driven comparisons).

## Will there be an ESM DECK?

Proposals for an ESM-DECK were also considered, and the rationale that the current DECK does not allow for characterisation of ESMs was appreciated. However, members of the Core Panel expressed concern that many ESMs do not have a stable piControl and concluded that the experiments require further testing to ensure they are well proven before potential inclusion of an ESM-DECK in the CMIP experimental design.

**UPDATE (08/12/23):** Ben Sanderson, Strategic Ensemble Design TT co-lead, and the C4MIP Scientific Steering Committee are working to develop an ESM-DECK proposal based on testing completed by several modelling centres. A full set of results is expected in early January, which can then be considered by the CMIP Core Panel, during the development of the Fast Track v2 proposal.

## DECK-lite?

Additionally, there will be no DECK-lite for high resolution. The Panel will instead work with HighResMIP2 on synergy between some of their proposed experiments and the DECK.

## What about all the other MIPs?

The CMIP Community MIPs are the heart of the CMIP effort, addressing key climate science questions that require tailored simulations, including long simulations, large ensembles, and representation of comprehensive earth system processes. CMIP infrastructure, standards and tools will continue to support these ongoing science and assessment activities, but MIPs can run on a timeline determined by their own needs, which may or may not align to AR7 timelines.

Unlike in CMIP6, the CMIP Panel will not endorse specific MIPs in this cycle but will provide best practice guidelines, which are currently under development. The Panel encourages collaboration across MIPs to identify and reduce any potential duplication while also considering their carbon footprint. Requests for Panel feedback and CMIP International Project Office (IPO) support can be submitted when registering. So far 27 MIPs have registered and can be found on the [CMIP website](#). MIPs can share further information/news with the CMIP community by emailing [cmip-ipo@esa.int](mailto:cmip-ipo@esa.int).

## What is the timeline for the Fast Track/CMIP7?

For the DECK and CMIP AR7 Fast Track experiments aimed at aligning with the IPCC there can be no definitive timeline developed until the new IPCC leadership has confirmed the AR7 format and timelines. Ahead of information being received from IPCC after the Sixtieth Session of the IPCC (IPCC-60) in January 2024, a best estimate for CMIP Fast Track data delivery, based on previous cycles, would be the end of 2026 at the earliest. The CMIP Panel is engaging with the IPCC Bureau to get more information and guidance as it becomes available.

As the CMIP Panel wants the climate modelling community to be as prepared as possible for when the IPCC timeline emerges, we are in the process of determining readiness. Current estimates suggest:

- **Historical forcings:** Updates are expected, with data extending until at least December 2021, as pre-release versions for testing in mid-2024 and for wider use by early 2025. The longer-term aim is to move towards quasi-operational annual delivery of forcings. The detailed timeline can be found [here](#).
- **Scenario forcings:** The ScenarioMIP working timeline currently suggests scenario availability and harmonisation in late 2025/early 2026 (link to [ScenarioMIP pages](#))
- **Data request:** Initial production versions expected by mid-2025, with regular updates thereafter.
- **ESGF nodes:** The ESGF is required to collate and serve the CMIP data. Ongoing discussions led by the WIP and ESGF community are determining capacity and resource requirements and respective timeline.
- **Future CMIP description paper:** Intention for submission in 2024.

Below is an expected timeline for the Fast Track consultation process.

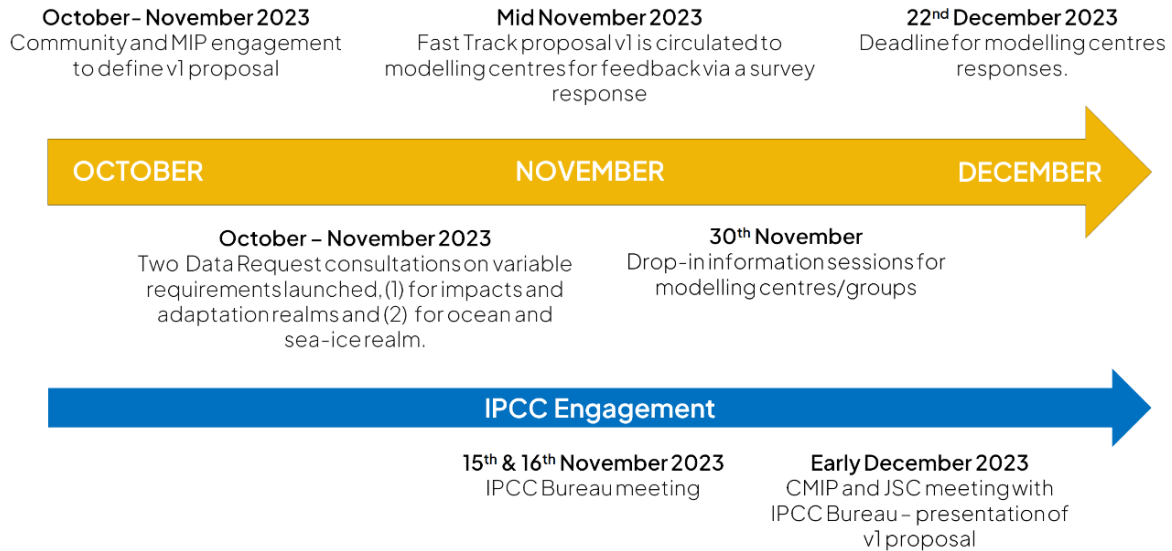


Figure 1a: Fast Track development timeline (October to December 2023)

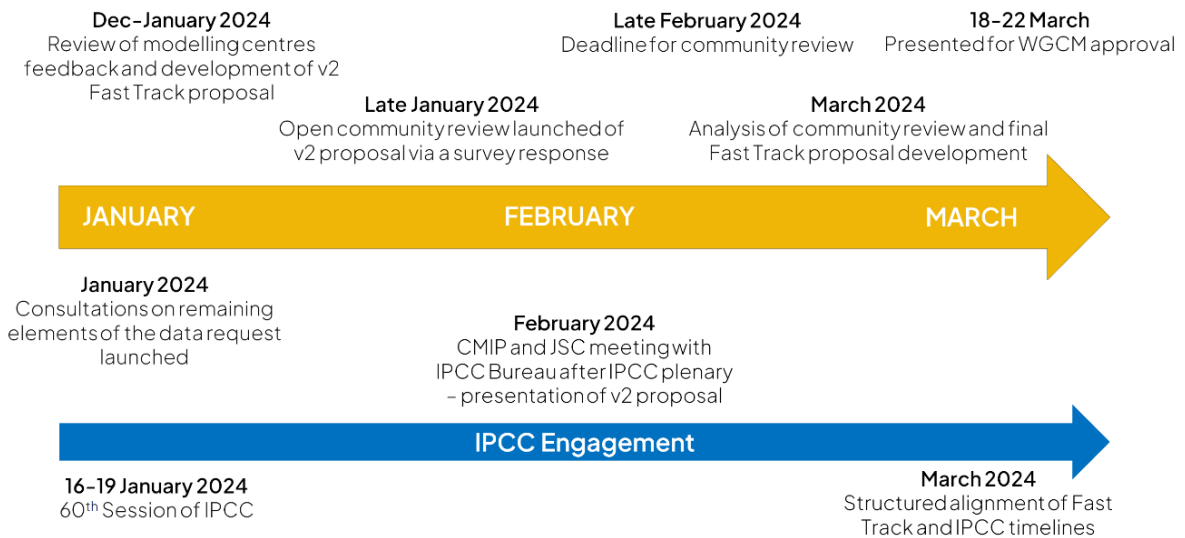


Figure 2b: Fast Track development timeline (January to March 2024)

## The CMIP AR7 Fast Track v1 draft proposal

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 is presented below for your review and comment through the survey form.

**UPDATE (08/12/23):** The CMIP Panel is keen to promote, where there is capacity, emissions-driven simulations to resolve carbon cycle and CDR uncertainties and define scenarios in terms of activity pathways (emissions and land use) rather than concentrations – see [Sanderson et al paper](#) for further information.

This is intended to be a co-production process – your centre/group’s input is very important. As outlined in the timeline above, the feedback received from modelling centres/groups will be analysed and will guide the iteration of the second version (v2), which will then be published for open community review in early 2024. The IPCC Bureau will also be engaged in consultation on the proposals.

**UPDATE (08/12/23):** You may wish to refer to the list of [CMIP6 Experiment IDs](#) for more detailed information when reviewing the experiment list below. Relationships between experiments are highlighted under the “parent\_experiment\_id” column in [CMIP6 Experiment IDs](#). Further detail on the proposed experiments, supplied by the proposing MIPs, is hyperlinked under the relevant MIP name in the table below.

The colour coding and font in the table of experiments below denotes the following:

Only relevant for ESMs
<i>Descriptive rather than CMIP standardised (<a href="#">CMIP6 Experiment IDs</a> experiment) name – new experiments for CMIP7.</i>

Experiment	MIP	Required model components	Justification
<b>CLIMATE SERVICES</b>			
Initialised prediction (2025-2026)	DCPP <a href="#">Summary slide</a>	AOGCM	A 10-year initialized prediction starting as close to the IPCC deadline as possible to provide a multi-model outlook. Likely done with CMIP6-era systems. A pre-requisite is a hindcast with the same model.
Scenarios x5	ScenarioMIP <a href="#">ScenarioMIP workshop report</a>	AOGCM	Five scenarios are under development by the ScenarioMIP community – please refer to their <a href="#">June 2023 workshop report</a> for further information. They will be providing both emissions and concentration driven scenarios.
<b>PROCESS UNDERSTANDING</b>			
piClim-X	AerChemMIP <a href="#">Summary slide</a>	AGCM	Present-day ERF for single forcings (17 experiments proposed) piClim-X experiments were essential in AR6 of the IPCC for quantifying individual SLCF ERF and biogeochemical feedbacks of individual atmospheric composition changes.

hist-piSLCF	<a href="#">Further detail</a>	AGCMAER	Designed to reduce uncertainty in the role of heterogeneous short-lived forcings in global and regional water cycle changes observed over the historical period (3 members)
hist-piAer			
SSPX-SLCF			
1pctCO2-bgc	C4MIP  <a href="#">Summary slide</a>	AOGCMBGC	Designed to isolate carbon-concentration and carbon-climate elements of the global carbon feedbacks. Will enable calibration of climate emulators.  TCRE required to inform carbon budget estimates and calibrate climate emulators. *emissions-driven “flat10” alternative discussion ongoing - <a href="https://benmsanderson.github.io/esm-deck/flat10_protocol.pdf">https://benmsanderson.github.io/esm-deck/flat10_protocol.pdf</a> .  ZEC required to inform carbon budget estimates *flat10 discussion ongoing - <a href="https://benmsanderson.github.io/esm-deck/flat10_protocol.pdf">https://benmsanderson.github.io/esm-deck/flat10_protocol.pdf</a> .
1pctCO2-rad			
(For TCRE 1% or flat10*)			
esm-1pct-brch-1000PgC (or flat10-zec*)			
amip-p4k	CFMIP  <a href="#">Further detail</a>	AGCM	Experiments to diagnose historical feedbacks and the SST pattern effect.  Climate feedbacks and sensitivity have been found to be quite different in 2x versus 4xCO2 simulations, and this fed into the WCRP assessment of climate sensitivity (Sherwood et al. 2020). This is particularly relevant for high-mitigation scenarios.
amip-piForcing			
abrupt-2xCO2			
hist-nat	DAMIP  <a href="#">Summary slide</a>	AOGCM	Necessary for attributing historical changes to climate forcings. All are widely used in IPCC. (Concentration driven simulations will be a priority on Fast Track timeline, but DAMIP will be considering emissions driven simulations as well)
hist-aer			
hist-GHG			
NewGeoMIP	GeoMIP  <a href="#">Summary slide</a>	AGCM	Equivalent to SSP2-4.5, anchored to the global mean surface air temperature average of 2020-2039 using stratospheric aerosol injection. Policy relevant. Process understanding of response to stratospheric aerosols and carbon cycle interactions. Growing interest from several bodies (UNEP, IPCC, EC, ...).

land-hist	LMIP	AOGCM	Benchmark land surface scheme of CMIP models and allow investigation of long-term variability of energy-water-carbon cycle.
<i>LIGabrupt</i> <a href="#">Proposal document</a>	PMIP <a href="#">Summary slide</a> <a href="#">Further detail</a>	AOGCM	A paleoclimate simulation starting from piControl then abruptly and perpetually imposing the insolation distribution and greenhouse gases that occurred 127,000 years ago. This short experiment will focus on exploring whether models can capture the lack of summer sea ice reconstructed in the Arctic and provide insight into polar amplification.
piClim-aer	RFMIP <a href="#">Summary slide</a> <a href="#">Further detail</a>	AGCM	Present-day aerosol forcing is one of the largest uncertainties in contemporary climate science. It is a very important contributor to committed future warming and is expected to continue to be important for sensitivity assessment.
piClim-histaer			Required for emulator calibration. Also pairs with the DAMIP hist-aer to diagnose the ERF in the historical simulation.
piClim-histall			Diagnose forcing feedbacks and pattern effects in coupled runs.

### Potential computational load

We are strongly aware of concerns around the experiment burden on modelling centres and have therefore calculated estimates of model years for the proposed experiments below (**UPDATED 08/12/23**). As a comparison, the Met Office Hadley Centre contributed 60 000 model years across their full CMIP6 contribution. The figures in parenthesis represent a minimal option including only one ensemble member.

Activity	Coupled	Atmosphere only	Land only	Activity total
DECK <sup>1</sup>	1475	136		1611
DCPP	100			100
ScenarioMIP	695			695
AerChemMIP	1400 <sup>2</sup> (350)	825(615)		2225(965)

<sup>1</sup> COUPLED - piControl 500yrs, esm-piControl 500 yrs, 1pctCO2 150yrs, abrupt-4xCO2 150yrs (CFMIP double request), "historical" 175yrs (1850-2025): ATMOS - amip 36yrs (1979-2025), piClim-control 30yrs, piClim-anthro 30yrs, piClim-4xCO2 30yrs

<sup>2</sup> Includes two additional DECK historical ensemble members to provide initial conditions for sspYYY-SLCF

C4MIP	850			850
CFMIP	300	201		501
DAMIP	1575 <sup>3</sup> (525)			1573 (525)
GeoMIP	50			50
LMIP			175	175
PMIP	100			100
RFMIP		456		456
<b>Grand Total</b>	<b>6545 (4345)</b>	<b>1618 (1408)</b>	<b>175</b>	<b>8338 (6028)</b>

**UPDATE (08/12/23):** The figures above assume that both an emissions driven and concentration driven pre-industrial control are required with 500 years for each. For concentration driven models, for which the emissions driven experiment is not relevant, deduct 500 years from the DECK coupled numbers above and the corresponding totals.

### Potential data production workload

To avoid divergence between the planning and decision making for experiment selection and variable selection, the Data Request Task Team has now become integrated into the Fast Track development process. The Data Request is being developed through a consultation process involving around five thematic papers, the first of which, on impacts and adaptation data requirements, was [launched in October 2023](#). Modelling centres/groups should also consider the following:

- The CMIP6 Data Request (~2000 variables) is too large for this purpose.
- A baseline list of 140 variables has been developed and will be requested for all experiments.
- Additional variables will be added to the request through a community consultation process that is developing thematic variable lists and mapping them onto objectives.
- Active participation of modelling centres in the consultation is being sought to ensure that the resulting data production workload is appropriate given the restraints on time and resources.

### Model documentation and errata developing requirements

In the CMIP6 Community Survey and subsequent feedback from the community the issue of documentation has been regularly raised. Modelling centres/groups felt the model documentation requirements were too time consuming and there was insufficient resource to support it, resulting in low completion levels. However, for users this information is important, and they report having to directly contact modelling centres/groups, which is particularly challenging for downstream users who are increasingly seeking to utilise CMIP data.

Therefore, the Model Documentation Task Team are proposing a mandatory Minimum Viable Documentation that will be required before publication to the ESGF. The details of this requirement are

<sup>3</sup> Assumes three ensemble members for each of the single forcing experiments.



being developed by the task team currently with the goal of a maximum time requirement per modelling centre of 4 hours.

The Errata system, searchable via <https://errata.es-doc.org>, currently allows issues and changes in published datasets to be documented. This includes issues with individual data sets or simulations (such as retractions or documentation of known problems) and the extension of other data sets. In the future, the intention is to link these issues to the ESGF indexes and to allow user submitted issues to be included, with modelling groups given a limited window to respond before these are made public. Modelling centres will be kept abreast of these developments.

## How will the Fast Track experiments be described/documentated?

**UPDATE (08/12/23):** During the drop-in sessions the responsibility for, and format of, Fast Track experiments description and documentation was raised. A Fast Track experiment documentation peer-reviewed paper was suggested, potentially supported by CMIP website information. This will be considered by the CMIP Panel, and a proposal included in the Fast Track v2 proposal consultation documentation.

## The survey and drop-in session documentation

Thank you for taking the time to read this information. Please now [complete the survey here](#) – **ONLY one consolidated response should be submitted per modelling centre/group.**

**UPDATE (08/12/23):** Two drop-in sessions took place on Thursday 30<sup>th</sup> November at 05:00–06:00 UTC and 17:00–18:00 UTC to accommodate global time zones. The slides and Q&A from the sessions plus all v1 documentation can be found on the [CMIP AR7 Fast Track v1 consultation webpage](#). The Panel appreciate the questions, comments and feedback received during these sessions that, together with the survey responses, will support the development of the CMIP AR7 Fast Track v2 proposal that will be published for open community review in January/February 2024