

Consultation: CMIP AR7 Fast Track v2

This document provides background information to support the completion of the consultation survey for the CMIP AR7 Fast Track v2 proposal. Please **read carefully** before completing [the survey](#) on behalf of your organisation - **a single consolidated and representative response** from each modelling centre/group is requested by Wednesday 6th March. All consultation materials can be found [here](#) including a [summary of the analysis of the Fast Track v1 consultation](#) is available.

Evolving CMIP

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.

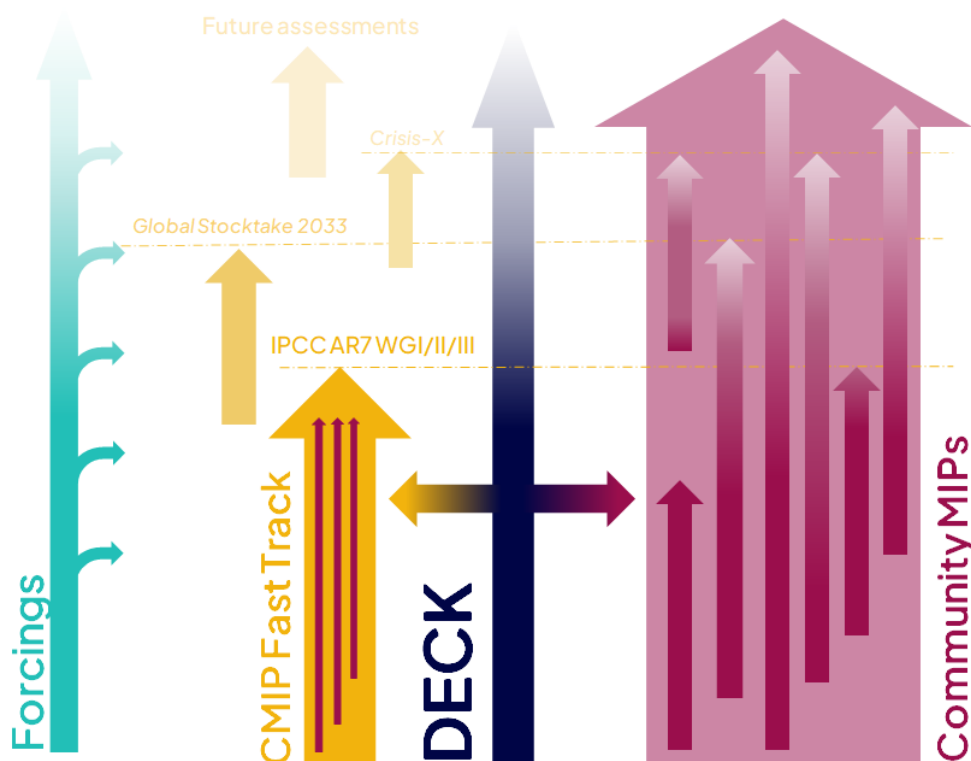


Figure 1: Schematic representing the evolving CMIP experiment structure.

What is the CMIP AR7 Fast Track?

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 (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 AR7 Fast Track is not a pre-requisite for participation in Community MIPs.

What is the timeline for the AR7 Fast Track?

The Sixtieth Session of the IPCC (IPCC-60) in January 2024 ([press release](#)) concluded that the IPCC would deliver its Synthesis Report in 2029. There was no consensus on a second Special Report targeting the GST28, so no implications for earlier delivery of CMIP7 results. Unfortunately, detailed scheduling of the WG timelines will not be available until after the next Plenary in July. Only at this point will each WG present a detailed month-by-month plan, including tentative dates for Lead Author meetings, data delivery and literature cutoff.

However, the CMIP community must start working towards a timeline as soon as possible. Informed estimates would suggest AR7 Fast Track delivery will be required by the second half of 2026. The open community v2 consultation, together with this follow up consultation with the modelling centres, will support the determination of what the CMIP community is realistically able to deliver in this time frame and priorities for both data providers and users. Following this v2 consultation, the CMIP Panel will finalise the AR7 Fast Track proposal to be discussed and presented for approval at the Working Group on Coupled Modelling (WGCM) meeting on 20-21 March 2024 in Hamburg.

The timeline below provides indications of current estimates for: delivery of updated forcing datasets; scenario delivery and harmonisation; and development of AR7 Fast Track harmonised data request.

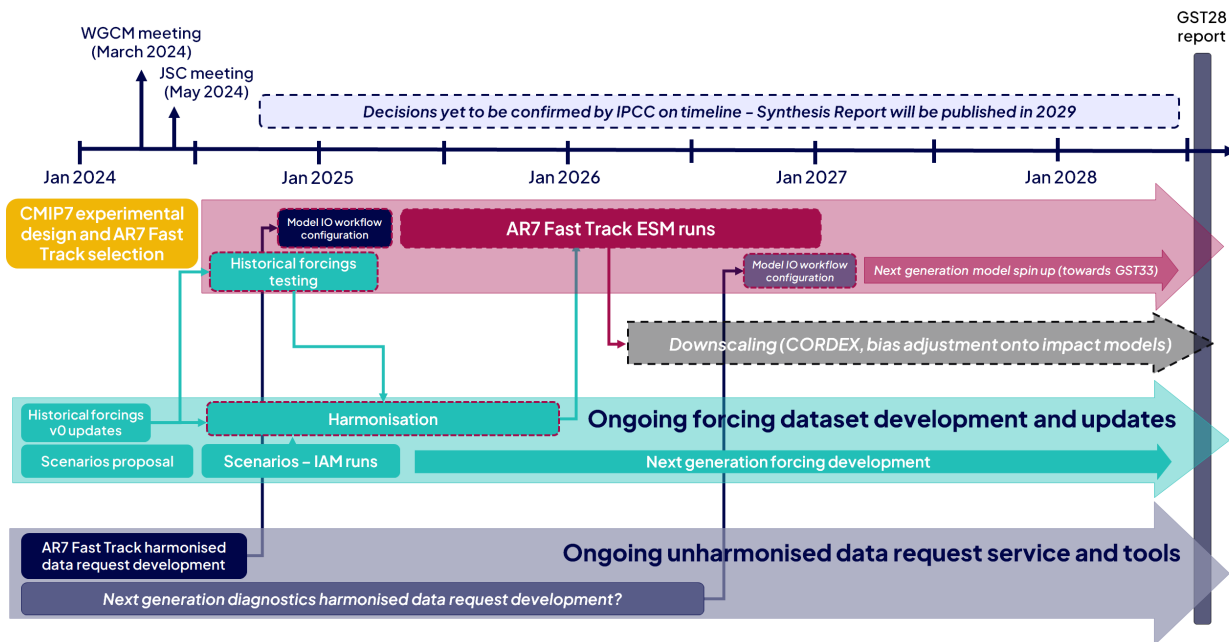


Figure 2: A best guess working timeline for CMIP AR7 Fast Track delivery. The IPCC timeline is not confirmed.

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.

Proposed: 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. The Panel have re-confirmed this decision promoting instead the inclusion of relevant experiments within the C4MIP Fast Track experiment group.

Proposed: DECK-lite

There will be no DECK-lite for high resolution or other model categories (e.g. CCMI). The Panel will work with HighResMIP2 and others on synergy between some of their proposed experiments and the DECK.

Proposed: OMIP and LMIP inclusion in the DECK

The v1 consultation responses included requests for inclusion of OMIP in the Fast Track. The CMIP Panel discussed that this experiment, being akin to AMIP, may belong in the DECK and will likely be run by most modelling centres. Further discussion with the OMIP leadership supported this approach. However, given the challenges raised by the termination of JRA55-do and need for new protocol development, it would be challenging for the OMIP community to meet the timeline requirements of the Fast Track or consideration for DECK inclusion at this point. The Panel considers it is likely a proposal for DECK inclusion will happen at some point in the future and is open to this.

LMIP is computationally very lightweight and is also a key experiment within the Global Carbon Project TRENDY experiments that are run every year. An issue facing the land-hist experiments is the need to move to a new atmospheric forcing dataset and work is under way with a fallback option available. Given this challenge, and some concerns around the resolution of the diurnal cycle, the Panel concluded they would like LMIP to remain within the Fast Track experiments with future opportunity to be considered for inclusion in 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 the AR7 timelines.

Unlike in CMIP6, the CMIP Panel will no longer endorse specific MIPs but have developed [best practice guidance](#) to support MIP leads. 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 28 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.

The CMIP AR7 Fast Track v2 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 was released for consultation with the modelling centres/groups in December 2023.

The second, open consultation is intended to be a co-production process - your organisation's input is very important. All respondents are being asked to consider the financial, human and infrastructure constraints of the CMIP community who will deliver the Fast Track and further output as part of the Community MIPs, who may or may not decide to align with the final IPCC AR7 WGI deadlines.

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.

Changes from v1 proposal

Based on the feedback received from the AR7 Fast Track v1 consultation and in discussion with several MIPs, the following changes have been made:

AerChemMIP	AerChemMIP has suggested some refinement of proposed experiments with an aim to reduce the computational burden.
C4MIP	The C4MIP community has provided some refinement of the experiments proposed in v1 and now include a Joos pulse.
abrupt-0p5CO2	A suggested addition from v1 feedback supported by both CFMIP and PMIP, which the Panel has agreed to include in the v2 proposal.
WhatIfMIP	This set of experiments was recently proposed by the WhatIfMIP community. The Panel feel the experiment definition is not mature enough to consider as part of the v2 proposal but welcomes community feedback on the proposals.

The v2 experiment list

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](#).

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

Only relevant for ESMs
<i>Descriptive rather than CMIP standardised (CMIP6 Experiment IDs experiment) name – new experiments for AR7 Fast Track.</i>
Newly proposed experiments for v2

Experiment	MIP	Required model components	Justification
CLIMATE SERVICES			
<i>Initialised prediction (2025–2026)</i>	DCPP	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 prerequisite is a hindcast with the same model.
<i>Scenarios x 5</i>	ScenarioMIP	AOGCM	Five scenarios are under development by the ScenarioMIP community – please refer to their June 2023 workshop report for further information. They will be providing both emissions and concentration driven scenarios.
PROCESS UNDERSTANDING			
piClim-X	AerChemMIP Summary slide Further detail	AGCM	Present-day ERF for six single forcings (where X = aer, CH ₄ , NO _x , SO ₂ , HC, N ₂ O). piClim-X experiments were essential in AR6 of the IPCC for quantifying individual SLCF ERF and biogeochemical feedbacks of individual atmospheric composition changes.
<i>hist-piSLCF (hist-piAer for models without interactive chemistry)</i>		AGCM AER	All but one protocol. 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)
SSPX-SLCF			Alternative variant of 1 scenario (3 members)
1pctCO ₂ -bgc	C4MIP	AOGCM BGC	

1pctCO2-rad	Summary slide		Designed to isolate carbon-concentration and carbon-climate elements of the global carbon feedbacks. Will enable calibration of climate emulators.
flat10-cdr			Gradual reduction in emissions: 100 years of +10 PgC, 100 years gradual ramp-down to -10 PgC, 100 years of -10 PgC. Total cumulative emissions=0 by the end.
Joos pulse			Details to be confirmed, but as place-holder cite Joos et al (2013): https://acp.copernicus.org/articles/13/2793/2013/acp-13-2793-2013.html) with a desire to update their results.
flat10-zec			ZEC required to inform carbon budget estimates *flat10 discussion ongoing - https://benmsanderson.github.io/esm-deck/flat10_protocol.pdf .
amip-p4k	CFMIP	AGCM	Experiments to diagnose historical feedbacks and the SST pattern effect.
amip-piForcing	Further detail		
abrupt-2xCO2	CFMIP are advocating for extending abrupt runs to 300 years, to provide more information on the timescale-dependence of the climate response, and better estimates of the equilibrium response.		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.
abrupt-0p5CO2			For a high ECS model to be able to match LGM conditions there would need to be a strong asymmetry between warming and cooling (i.e. that the large forcing at the LGM would need to be far less effective than 2 or 4xCO2). This could be captured much more easily with abrupt0.5xCO2 - the degree of asymmetry would then be a useful component in the assessment of the plausibility of any model's ECS and physics.
hist-nat	DAMIP	AOGCM	Necessary for attributing historical changes to climate forcings. All are widely used in IPCC. (<i>Concentration driven simulations will be a priority on Fast Track timeline, but DAMIP will be considering emissions driven simulations as Tier 2 experiments</i>)
hist-aer	Summary slide		
hist-GHG	Further detail		
NewGeoMIP	GeoMIP Summary slide Experimental design preprint	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 Summary slide	AOGCM	Benchmark land surface scheme of CMIP models and allow investigation of long-term variability of energy-water-carbon cycle.

LIGabrupt	PMIP Summary slide Proposal document Response to v1 consultation feedback	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. ISMIP have expressed interest in this experiment and further discussions on joint effort to further study ice sheet - climate interactions for this period have been initiated, during which sea level was 5 to 10 m higher than today.
piClim-aer	RFMIP Summary slide Further detail	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. For some models same experiment could be used for both AerChemMIP and RFMIP.
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.

Additional experiments

The following experiments, part of the WhatIfMIP developing under the WCRP Safe Landing Climates Lighthouse activities, have been suggested and the Panel would like to gather community feedback, particularly given that it was confirmed at IPCC-60 that there will be no tipping points Special Report in the AR7 cycle. The WhatIfMIP team are also keen to determine which of the CMIP7 generation models will run with dynamic vegetation and may be interested in running the WhatIfMIP experiments.

Global Warming Level (GWL) simulations	WhatIfMIP Further detail	AOGCM	GWL simulations using the flat10 or 0.2C/decade protocols to be added to the FastTrack with 2°C and 4°C being sufficient.
Boreal Forest – Northern Expansion and Southern Dieback			Branch off 4°C stabilization, run for 100 years. Designed to look at a northward expansion of boreal forest (where shrubification is already detected) and a southern dieback at 4°C stabilization (i.e., this tipping element has happened). Policy relevant for assessing regional adaptation and vulnerability associated with its impacts on permafrost and temperature-related drought as well biodiversity, people and fauna who live there. Its influence on Arctic sea ice, the carbon cycle, and wildfire aerosols would have global impacts.
Sahel Greening			Branch off 3°C stabilization, run for 200 years.

			Designed to look at Sahel greening at 4°C stabilization (this tipping element crossed due to climate change and afforestation projects). Policy relevant for assessing Sahelian-Saharan vulnerability and adaptation associated with its regional impact on water recycling and monsoons and far-field impacts on ENSO variability, tropical cyclone activity, and ocean productivity.
Tropical Rainforests			Branch off 2°C stabilization, run for 100 years. Designed to look at Amazon rainforest deforestation at 2°C stabilization (this tipping element crossed due to deforestation and its interaction with climate change). Policy relevant for assessing regional adaptations and vulnerability associated with its impact on atmosphere and circulation patterns, both within and outside the tropics. It also represents a large component of the carbon cycle.

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. As a comparison, the Met Office Hadley Centre contributed 60 000 model years across their full CMIP6 contribution.

Activity	Coupled	Atmosphere only	Land only	Activity total
DECK ¹	1475	136		1611
ScenarioMIP	695			695
AerChemMIP	875 ²	495		1320
C4MIP	900			900
CFMIP	300	201		501
DAMIP	1620 ³			1620
GeoMIP	50			50
LMIP			175	175
PMIP	100			100
RFMIP		456		456
Grand Total	6015	1288	175	7478

¹ COUPLED - piControl 500yrs, 1pctCO2 150yrs, abrupt-4xCO2 150yrs, "historical" 175yrs (1850-2025): ATMOS - amip 46yrs (1979-2025), piClim-control 30yrs, piClim-anthro 30yrs, piClim-4xCO2 30yrs

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

³ Assumes three ensemble members for each of the single forcing experiments.

CMIP forcings

Many delays in starting CMIP6 DECK simulations centred around forcings provision. After receiving considerable community feedback, the [CMIP Forcings Task Team](#) (Forcings TT) is working to resolve known forcing issues for CMIP7 DECK experiments (1pctCO2, abrupt-4xCO2, amip, *historical, *piControl, piClim-Control, piClim-anthro, and piClim-4xCO2, and maybe *-0p5xCO2) and deliver forcing data updates, extending until at least December 2021. Pre-release versions for testing are being generated and will be made publicly available through the [input4MIPs ESGF project](#) in mid-2024. After receiving community feedback on these prototype data (Forcings TT, Fresh Eyes on CMIP and engaged modelling groups), CMIP7 DECK datasets will be finalized and frozen for wider use in 2025. The Forcings TT are engaged in a harmonization activity to ensure CMIP7 DECK to ScenarioMIP continuity. All Forcings TT data will be available for broader use across AR7 Fast Track experiments; However, MIP leads of these activities are responsible for any experiment-specific forcing data requirements not covered in the CMIP7 DECK datasets. There is a longer-term aspiration for more continuous/annual updates to DECK forcings, however, realizing this requires support that is not presently identified ([CMIP Forcings timeline – current status](#)).

Data request

The Fast Track data request is likely to be limited to supporting the immediate needs of AR7. Modelling work, and associated data requirements, for the investigation of new ESM capabilities is likely to occur later in the CMIP cycle supported by an expanded harmonised data request later in the CMIP7 cycle, approximately two years after the Fast Track data request.

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, further information can be found [here](#). 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 v1 consultation the Model Documentation Task Team proposed a mandatory Minimum Viable Documentation (MVD), estimated to take around four hours for centres/groups to produce, that will be required before publication to the ESGF. Most of the responding centres/groups, 23 out of 25, supported the proposal. The Model Documentation Task Team is currently finalising the MVD proposal for approval by the WIP and CMIP Panel.

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.

Guidance for modelling centres

Recommendation for running the DECK experiments

As stated previously the CMIP Panel is keen to promote emissions-driven runs. With regard to the DECK, the Panel would like to recommend that all centres/groups should run CO₂ concentration driven experiments for amip, abrupt-4xCO₂, 1pctCO₂, piClim-control, piClim-anthro, piClim-4xCO₂ and piControl plus the esm-hist and esm-piControl, for those prioritising CO₂ emissions-driven comparisons, and/or historical (if prioritising CO₂ concentration-driven comparisons).

Recommendation for spin up and branching

A new CMIP Spin up Working Group has been established to develop spin up/equilibration and branching guidance potentially including documentation of spin up, defining metrics that can be used to compare spin ups, or providing targets for residual drifts. The group is aware there is a need for any guidance to be developed in a timely manner given the tight timelines.

The survey and further information

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

If you require any further information or have any questions, please contact cmip-ipo@esa.int or submit via the [Q&A forum](#).