

UK Modelling Contribution to CMIP7

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The UK continues to play a key role in [Coupled Model Intercomparison Project](#) (CMIP), through hosting the CMIP international project office (IPO), leadership of CMIP panels and wide engagement across the CMIP task teams. CMIP6 results underpinned the IPCC Sixth Assessment Report. CMIP7 activities will be a collaboration between the Met Office Hadley Centre and NERC partners facilitated by the UK National Climate Science Partnership (UKNCSP).

We would like to raise awareness throughout the UK climate modelling community of the status of plans for delivery of results from UK models to CMIP7. We hope that the broad climate community will be interested in this activity. We specifically would like to engage and connect anyone who might be planning or wanting to contribute to CMIP7 by way of performing model simulations especially through the Community MIPs. For more information, please see the document attached and join us in May for the CMIP7 Webinar.

Webinar

We are hosting a more detailed Webinar on **8th May 2025 at 10:00-11:30am**, where we will provide the latest information on model configurations and progress towards a UK CMIP7 Fast Track Delivery. Please register and find more details [via the link](#).

Introduction

CMIP7 is the latest phase of the [Coupled Model Intercomparison Project](#) (CMIP) and is an evolution from CMIP6. CMIP6 was a huge endeavour by the international climate modelling community and has a legacy of almost 25 TB of data available for analysis. CMIP6 results underpinned the IPCC Sixth Assessment Report. Following consultation with the international community, the CMIP panel have identified a set of experiments which are considered critical for the delivery of the IPCC AR7 reports. This set of experiments are referred to as the **CMIP AR7 Fast Track**. It is hoped that most modelling centres will prioritise the Fast Track experiments during 2025-2026. The full set of experiments chosen for the Fast Track and the experiment design details can be found in the CMIP7 documentation paper as part of the CMIP7 special issue of Geoscientific Model Development [here](#) (currently in discussion).

The expectation is that to be assessed by authors of the IPCC AR7 Working Group I report, model data from the Fast Track simulations will need to be submitted to the Earth System Grid Federation data archive by the end of 2026 (Figure 1). This tight deadline limits which UK model configurations will be available for use in Fast Track.

On longer timescales, community MIPs can contribute to CMIP7 by delivering new science in their own time without IPCC deadlines but taking advantage of the CMIP7 infrastructure. The CMIP panel will not be endorsing MIPs for this phase of CMIP, however they have released a [MIP Best Practice guidance note](#).

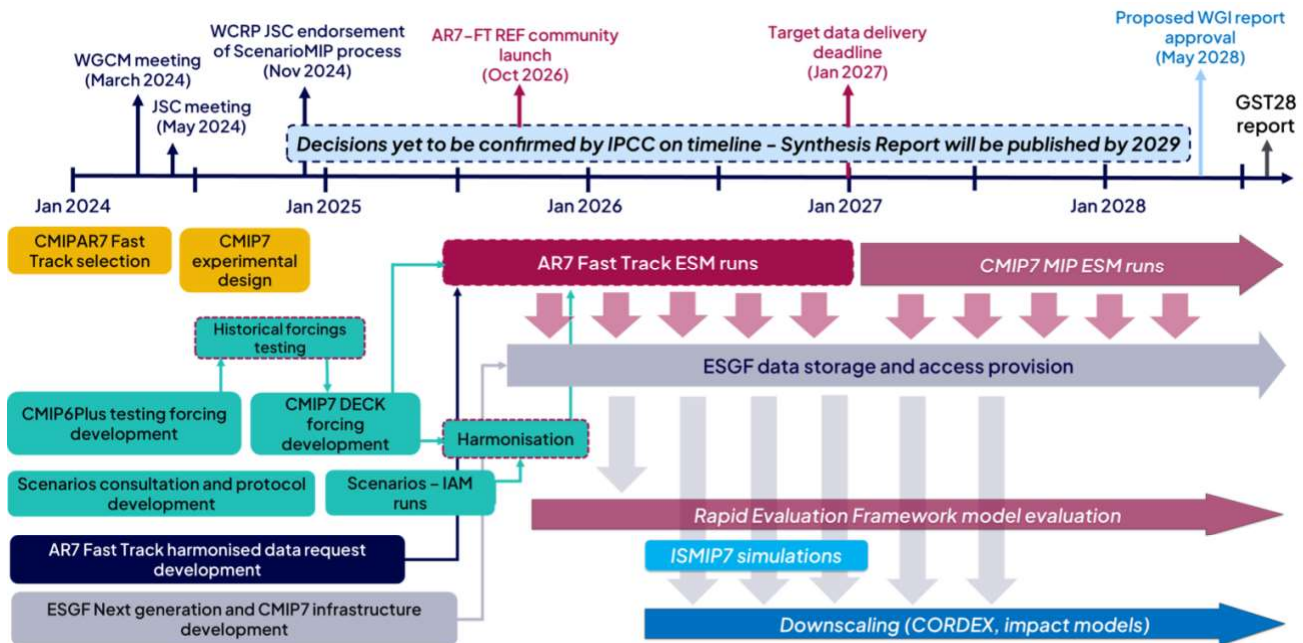


Figure 1. Timeline for CMIP AR7 Fast Track. Noting that IPCC timelines are not yet confirmed. This figure taken from: <https://wcrp-cmip.org/cmip7/>

UK contribution to CMIP

CMIP6

For CMIP6, the UK contributed many simulations to a wide range of MIPs from HadGEM3-GC31-LL, HadGEM3-GC31-MM and UKESM1-0-LL models. This huge effort resulted in nearly half a million output files on the CEDA ESGF node from these models. Outputs from the UK models have been used extensively in papers and IPCC chapters. The activity represented a very successful community collaboration between NERC and Met Office partners.

CMIP AR7 Fast Track

Resources available to deliver the UK contribution to CMIP7 are significantly reduced compared to CMIP6. We are nevertheless committed to making a substantial world-leading contribution to CMIP7, running DECK simulations and a significant part of the Fast Track.

Planned Model Configurations:

For Fast Track, we hope to contribute an Earth system model and two resolutions of the latest physical model configuration, HadGEM3-GC5.

UKESM

The next flagship UKESM configuration, UKESM2, will not be ready in time for the Fast Track. We are therefore prioritizing a contribution from UKESM1.3 while also continuing development of UKESM2 for use in CMIP7

community MIP activities beyond the Fast Track. UKESM1.3 is an extension of the CMIP6+ model, UKESM1.1 (Mulcahy et al. 2023) and offers novel, world-leading capability in the form of interactive ice sheet models for Greenland and Antarctica and closed cycles for both carbon dioxide (CO₂) and methane (CH₄). While a number of global ESMs will likely run with emission-driven CO₂ in the Fast Track, UKESM1.3 will likely be unique in including the CH₄ emission-driven capability.

GC5-climate

The latest HadGEM3 physical global coupled climate model configuration is GC5 (Xavier et al., in preparation). The development of the standard GC5 configuration (GC5.0) followed a bottom-up approach that does not constrain emergent properties. A perturbed parameter ensemble approach was used to develop a GC5 configuration with improved historical performance and an Effective Climate Sensitivity (EffCS) within the IPCC AR6 very likely range while limiting the degradation of wider climate metrics. The resulting GC5 climate configuration has an EffCS of approximately 4K. Contribution of this model configuration is contingent on the outcomes of an ongoing detailed evaluation.

Pushing the boundaries of resolution

Additionally, we anticipate running a subset of the Fast Track with a high-resolution configuration also based on GC5 (currently named GC5-EERIE) but with some notable modifications including using the CoMorphA9 atmospheric convection scheme. This configuration – N640-ORCA12 (approximately 20km in the atmosphere and 8km in the ocean) – is very likely to be the highest resolution model contributing to CMIP AR7 Fast Track. The computational cost of this configuration means successful delivery is contingent on timely availability of CMIP7 forcing data and the new HPC at the Met Office.

Configuration	Resolution	Modelling Components
UKESM1.3	N96 ORCA1.0	HadGEM3-GC3.1 plus: MEDUSA (ocean bgc) TRIFFID (dynamic vegetation) UKCA (chemistry and aerosol) UNICICLES (ice sheet model) Emission-driven for CO ₂ /CH ₄
GC5-climate	N96 ORCA1.0	Retuned configuration of HadGEM3-GC5.0
GC5-EERIE	N640 ORCA12	Variant of HadGEM3-GC5.0 with CoMorphA9 convection scheme

Table 1: Summary of proposed UK model configurations for CMIP AR7 Fast Track

Technical Infrastructure

Other ongoing activities as we prepare for the Fast Track include updating software to process the CMIP7 forcing data in ancillary files used by the models. Significant developments have also been made to the Climate Data Dissemination System (CDDS) which is the system used to convert and deliver UK model data to the ESGF.

Beyond AR7 Fast Track

The next state-of-art flagship UKESM model will be UKESM2.0. This model is currently under development, and we expect to have a release configuration for use within the community by mid-2026. UKESM2 will be built on the GC5 Fast Track configuration and will have a number of scientific enhancements compared to UKESM1 model, including interactive fire, nitrate aerosol and permafrost. UKESM2 will be run in emission-driven mode for both CO₂ and CH₄ as standard. Subject to funding we have the ambition to rerun the DECK and a subset of future projections. We anticipate and encourage the use of UKESM2 for new science in community MIPs beyond the Fast Track and anticipate that it will be made available and supported for community use.

Please join us for more detailed information and updates at [the Webinar](#) in May.

Please contact [Jane Mulcahy](#) or [Chris Jones](#) if you have any further questions on the UK CMIP7 modelling project.

Please contact [Wendy Tsai](#) if you have any queries about upcoming Webinar.