The Decadal Climate Prediction Project contribution to CMIP7: Component A - Hindcast Experiments

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The aim of DCPP Component A (DCPP-A) is to coordinate the production and retention of a multi-year multi-model collection of initialised climate predictions. Such a dataset, with experiment name *dcppA-hindcasts*, will facilitate research and development of decadal prediction science, as well as underpin the ongoing real-time issuing of multi-year to decadal climate predictions and emerging climate services as part of the World Meteorological Organization Lead Centre Activity on Annual to Decadal Climate Prediction (LC-ADCP).

Broadly the approach parallels DCPP-A in CMIP6 (Boer et al. 2016), but the prioritization is changed in order to lower the minimum requirements of participation. To this end, we introduce the DCPP-A "DECK" as a minimum hindcast set needed to assess skill and produce drift and bias corrections for future predictions. A multi-annual prediction protocol is also explicitly added as an option for participation. The overall structure of DCPP-A in CMIP7 is summarised in Figure 1, which indicates the two separate "routes" through DCPP-A (i.e., Decadal and Multi-annual predictions). The experiments are summarised in Table Aa (for Decadal), Table Ab (for Multi-annual) and Table Ac (for assimilation experiments). The sub-experiments are described below.

The decadal and multi-annual routes each have a distinct DCPP-A-DECK experiment, which is then expanded with additional start dates, hindcast years, or ensemble members. Once the DCPP-A-DECK is complete in one route, modelling groups can tackle the extensions to the core hindcast experiments in any order and as far as they wish. It is important to underline that the Decadal and Multi-annual routes are effectively the same experiment. In other words, they have the same experiment_id and share the same external forcings. The only difference is that the required start dates and run lengths are different. Therefore, it is possible for a prediction system to prioritise one route initially, before transitioning to the other. For example, once experiments A1.1 and A1.2 have been completed in the decadal route (i.e., completing 5-year-long simulations initialised every year from 1980–2024), a modelling group would then have also finished the A2.1 experiment and would be free to continue prioritising the rest of the Multi-annual (MA) route if they wished. Alternatively, for a group who prioritised multi-annual predictions, experiment A2.1 can later be extended to 64 months in length to satisfy, and expand on, the core experiment of the Decadal route (e.g., A1.1).

Although the new protocol allows groups to run a much smaller hindcast dataset than in CMIP6, it is important to emphasise that we strongly recommend that groups contributing to the decadal route of DCPP-A perform the entire experiment in order to provide 10-year hindcasts over the period 1960 onwards (a total of ~6600 simulated years). This will enable, for example, the study of decadal time-scale NAO variability, the predictability of extremes and high-impact weather, and the comparison with CMIP6-era systems.

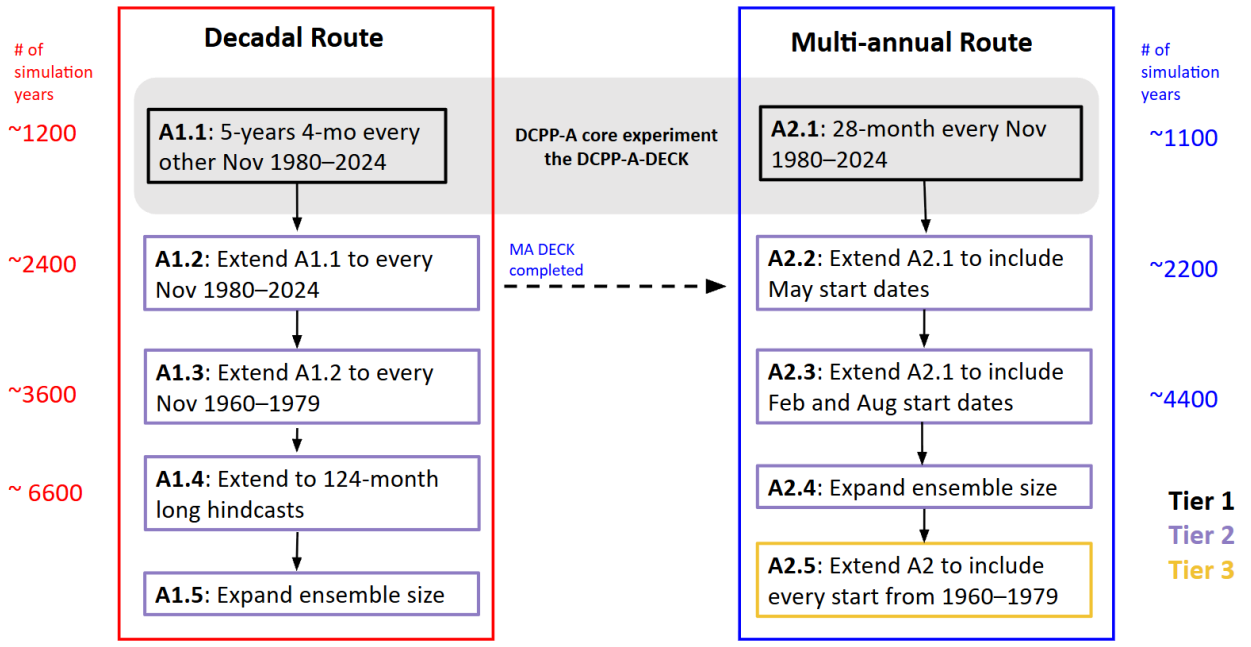

Figure 1: An overview of the structure of DCPP-A in CMIP7. Both Decadal and Multi-annual retrospective prediction (or hindcast) experiments have a core component (the DCPP-A-DECK), which is then expanded to include additional simulations that extend the number of start-years (both decadal and multi-annual) or the length of the simulations (decadal). Minimum ensemble size of all tiers is 10 members.

Experimental description

Decadal Route

- The core (tier 1) experiment of the DCPP-A decadal hindcasts, *dcppA-hindcasts*, is the DCPP-A-DECK (A1.1), which is 10-member, 5-year and 4-month (64-month) long predictions initialised from 1 November every other year covering the period 1980–2024 (i.e., they cover 6 full DJF seasons). The first initialisation is 1 November 1980, and the first full forecast year is 1981. This is the minimum experiment required for groups to take part in DCPP-B, i.e., to provide drift correction and calibration. The minimum ensemble size is 10 members.
- The tier 2 contributions are various extensions to the November decadal start dates. Performing tier 2 of *dcppA-hindcasts* thus recreates the DCPP-A hindcasts in CMIP6 and allows the most complete comparison of performance between CMIP6 and CMIP7. Therefore, it is strongly recommended that groups complete both tier 1 and tier 2. The extensions include:
    - Expand the DCPP-A-DECK to include all start years from 1980 until 2024 (i.e., 5-year 4-month predictions for the remaining years such as 1981, 1983,…) (A1.2) - *Note that once A1.1 and A1.2 have been completed, then the core experiment of the Multi-annual hindcast route (A2.1) has also been fulfilled*.
    - Extend start dates backward in time to 1960 onwards (A1.3)
    - Extension of hindcasts to 10 years (124-months) (A1.4).

- Provide additional ensemble members to A1 experiments (A1.5).

Multi-annual Route

- The core (tier 1) experiment for the DCPP-A Multi-Annual hindcasts, also *dcppA-hindcasts*, are 28-month long hindcasts initialised every November over start dates 1980-2024. This is the minimum experiment needed in order to contribute multi-annual predictions to DCPP-B. The minimum ensemble size is 10 members.
- The tier 2 extension includes:
  - 28-month hindcasts initialised every May over 1980-2024
  - 28-month hindcasts initialised every February and August over 1980-2024
  - An increase in ensemble members.
- The tier 3 extension extends start dates backward in time to 1960 onwards.

Assimilation and initial conditions

Groups are free to produce initial conditions for their prediction systems using the method that they deem most appropriate. However, to produce the initial conditions for the dcppA-*hindcast* experiment, it is assumed that most groups will produce an assimilation run – e.g., a simulation or simulations that are used to generate initial conditions for the coupled model. The term assimilation is used here very broadly to mean a simulation that incorporates observational data in some form, rather than directly assimilating such data in a formal framework. Such information on the initial conditions is useful from the point of view of understanding prediction system performance and especially model drift. In recognition of this utility, we make the provision of such a *dcppA-assim* (A3.1) as a *tier 1* requirement of DCPP-A in CMIP7.

External forcing

Coupled models that are either driven in concentration or emissions mode can be used for DCPP-A in CMIP7. Over the period 1960-2021, *dcppA-hindcasts* should use the external forcings specified for the CMIP7 *historical* or *esm-historical* experiments, depending on whether the model that forms the basis of the prediction system is concentrations or emissions driven, respectively. These forcings / emissions are given in table 2 of Dunne et al. (2025). From 2022 onwards, *dcppA-hindcasts* should use the "medium" scenario from ScenarioMIP, which is designed to be "consistent with current policies" (Van Vuuren et al. 2026).

Table Aa - Decadal route through DCPP-A in CMIP7

	Exp	**experiment_id**	**Dec Tier**	**Years**	**Description**
Component A: Decadal Hindcasts	A1.1	dcppA-hindcast	**1**	~1200	64 month (i.e., 5-year 4-month) long hindcasts initialised from November **every other year** from 1980 until 2024. 10 ensemble members minimum.

	A1.2		2	~1200	Extend A1.1 to 64-month hindcasts **every year** from 1980 to 2024.
	A1.3		2	1070	Extend A1.1 to include 64-month hindcasts initialised every year from 1960-1979.
	A1.4		2	1110-3150	Extend all starts performed in A1.1, A1.2, and A1.3 to 124 months (10 years).
	A1.5		2	(120-670)*m	Extend the ensemble size of A1 experiments by m

Table Ab - Multi-annual route through DCPP-A in CMIP7

	Exp	**experiment_id**	**MA Tier**	**Years**	**Description**
Component A: Multi-annual Hindcasts	A2.1	dcppA-hindcast	**1**	1050	28-month simulations initialised 1 November every year from 1980–2024. 10 ensemble members minimum.
	A2.2		2	1050	28-month simulations initialised from 1 May for every year over 1980-2024.
	A2.3		2	2100	28-month predictions initialised from 1 February and 1 August every year over 1980-2024
	A2.4		2	105*ma	Extend ensemble size of A2 experiments by ma, targeting at least 20.
	A2.5		3	460-1900	Extend start dates back to include 1960-1979

Table Ac - DCPP-A assimilation experiments.

	Exp	**experiment_id**	**Tier**	**Years**	**Description**
Component A: Assimilation runs	A3.1	dcppA-assim	1	45+	“assimilation runs” if available

References

Boer, G. J., and Coauthors, 2016: The Decadal Climate Prediction Project (DCPP) contribution to CMIP6. *Geosci Model Dev*, **9**, 3751–3777, https://doi.org/10.5194/gmd-9-3751-2016.

Dunne, J. P., and Coauthors, 2025: An evolving Coupled Model Intercomparison Project phase 7 (CMIP7) and Fast Track in support of future climate assessment. *Geosci. Model Dev.*, **18**, 6671–6700, https://doi.org/10.5194/gmd-18-6671-2025.

Van Vuuren, D. P., and Coauthors, 2026: The Scenario Model Intercomparison Project for CMIP7 (ScenarioMIP-CMIP7). *Geosci. Model Dev.*, **19**, 2627–2656, https://doi.org/10.5194/gmd-19-2627-2026.