CMIP
Coupled Model Intercomparison Project

CMIP7 update

John Dunne (NOAA/GFDL) and Helene Hewitt (Met Office), CMIP Panel Co-chairs
Members of the CMIP Panel and WIP

JSC 45th Session, Monday 27th May 2024 – Lima, Peru

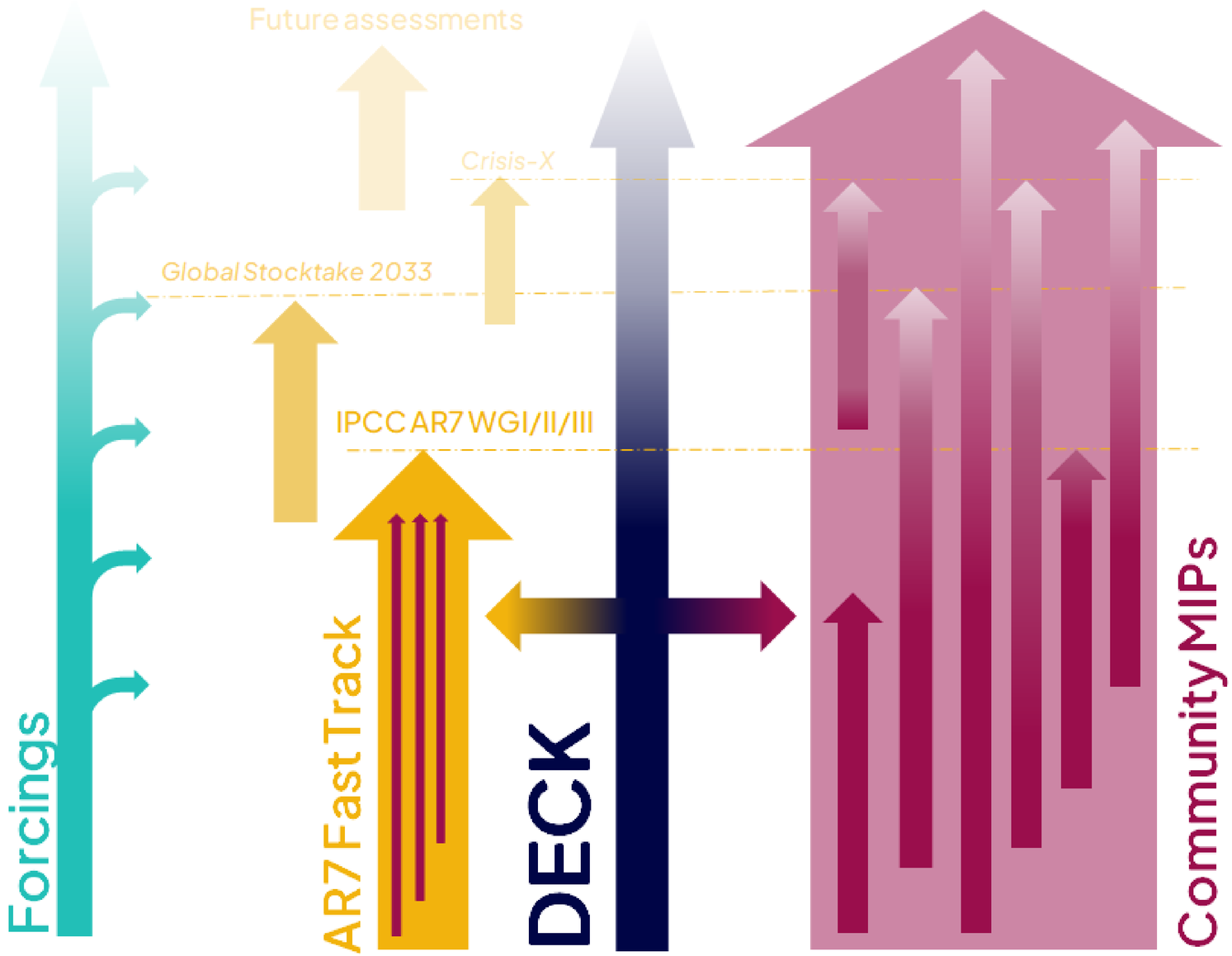
CMIP | WCRP

An evolving CMIP design

A more continuous approach with small targeted “Fast Track” experiment sets. The first will respond to the needs of IPCC AR7.

CMIP infrastructure, standards and tools support ongoing science and assessment activities.

This design reflects extensive feedback from the modelling centres and wider user community.



Climate services supports

AR7 Fast Track service goal to support policy, impacts and adaptation communities (DCPP, ScenarioMIP)

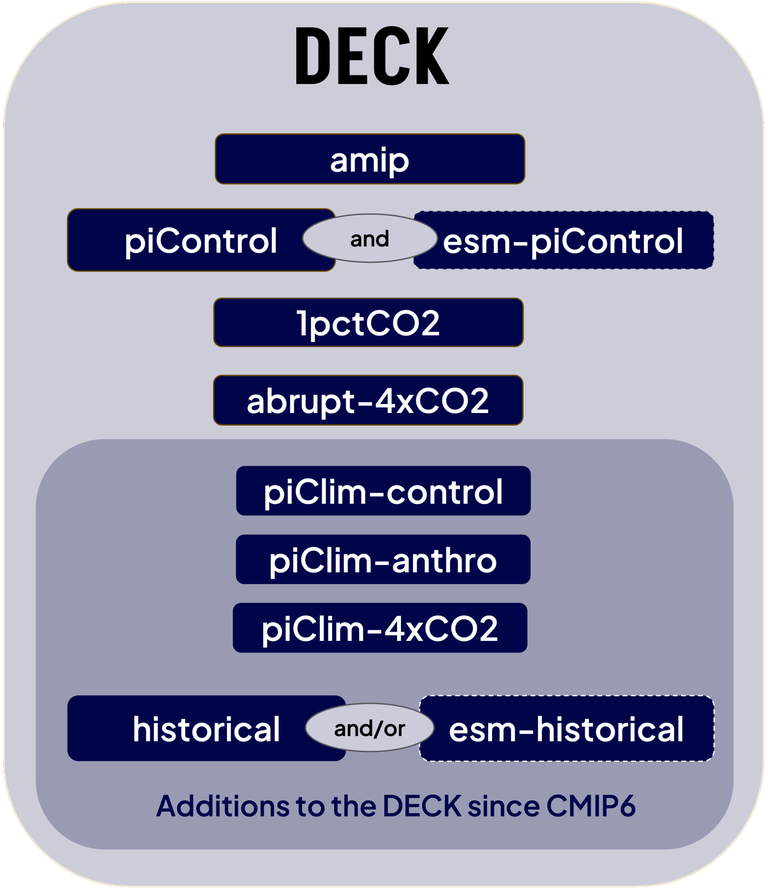
Process understanding supports

CMIP Panel has been discussing the AR7 Fast Track science goals. Not yet confirmed but ongoing themes are:

1. How will tropical ocean temperature patterns co-evolve with higher latitudes? - *link with observations, revised historical forcings, scenarios, model improvements* (DCPP, AerChemMIP, CFMIP, DAMIP, LMIP, PMIP, RFMIP)
2. How will dangerous and impactful weather patterns evolve? - *GWL/ZEC experiments to look at statistics of modes of variability (can be addressed across modelling multiverse).* (AerChemMIP, DAMIP, ScenarioMIP)
3. How will Earth respond to human efforts to manage the carbon cycle? - *emissions driven models, CDR, internally consistent carbon mitigation* (C4MIP)
4. What are the risks of crossing tipping points and triggering irreversible changes across possible climate trajectories? - *overshoot and extended scenarios, offline and coupled ice sheet models/emulators.* (GeoMIP, PMIP)

- Ongoing activities under CMIP6Plus e.g., LESFMIP, CERESMIP, TIPMIP, RAMIP and CMIP7 Community MIPs will also be contributing to addressing these goals.

The DECK



The CMIP Core Panel decided on the additions shown here in September 2023.

Further suggestions for the DECK have included:

- ESM-DECK
- OMIP
- LMIP

The CMIP Panel decided not to include these in the DECK for the AR7 Fast Track timeframe but recommended that they will be considered future inclusion.

CMIP | WCRP

DECK

- amip
- piControl and esm-piControl
- 1pctCO2
- abrupt-4xCO2
- piClim-control
- piClim-anthro
- piClim-4xCO2
- historical and/or esm-historical

Additions to the DECK since CMIP6

CMIP AR7 Fast Track

Climate services

DCPP

- Initialised prediction (2025-2036)

ScenarioMIP

- High scenario
- Medium scenario
- Overshoot scenario
- Low scenario
- Very low scenario
- Low overshoot scenario

Process understanding

C4MIP

- 1pctCO2-bgc
- 1pctCO2-rad
- esm-flat10
- esm-flat10-cdr
- esm-flat10-zec

CFMIP

- amip-p4k
- amip-piForcing
- abrupt-2xCO2
- abrupt-0p5CO2

AerChemMIP

- piClim-X
- hist-piSLCF/hist-piAer
- SSPX-SLCF

DAMIP

- hist-nat
- hist-aer
- hist-GHG

GeoMIP

- G7-1.5K-SAI

LMIP

- land-hist

PMIP

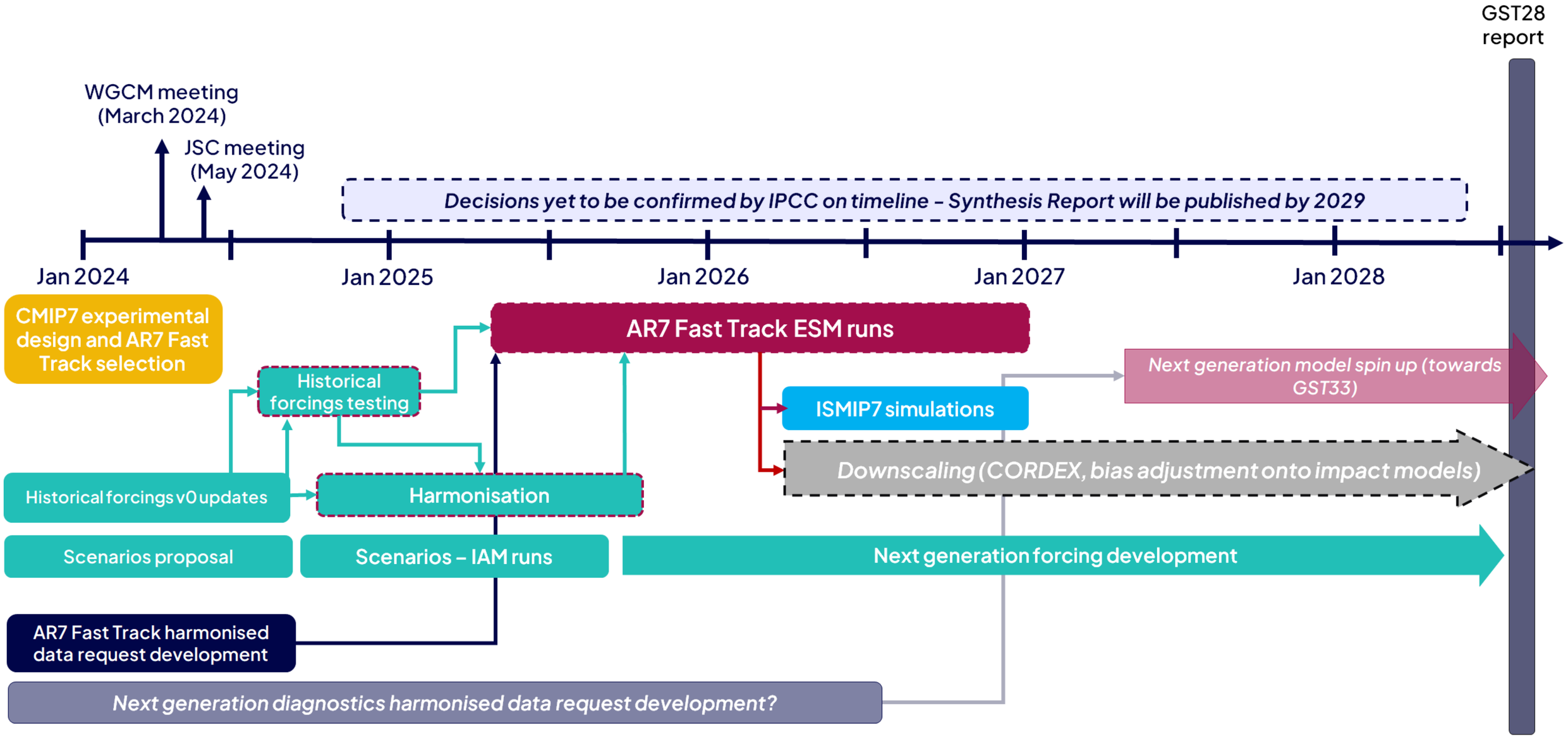
- *LIGabrupt*

RFMIP

- piClim-histaer
- piClim-aer
- piClim-histall

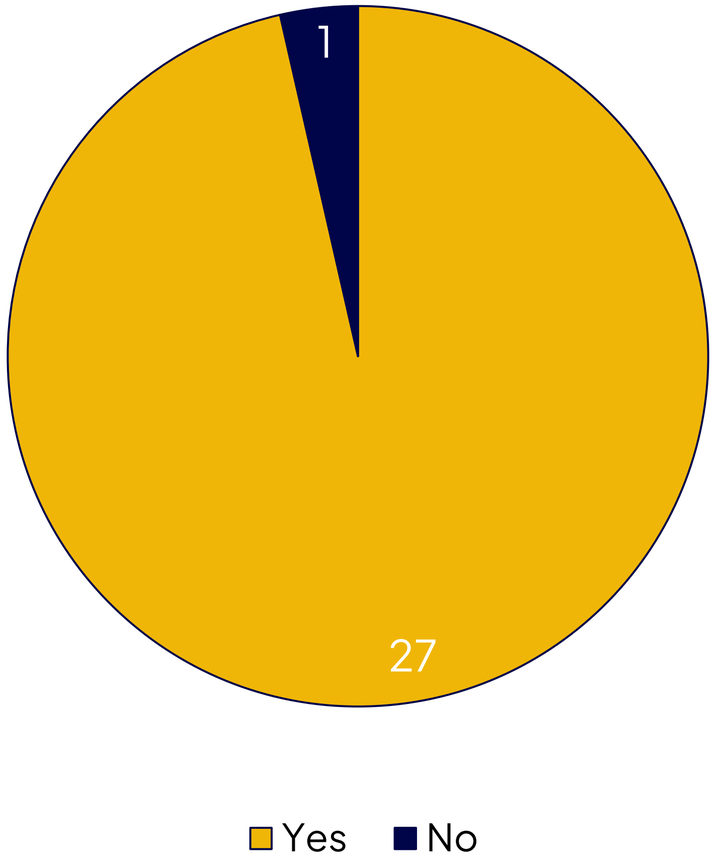
Approved by WGCM in March 2024

AR7 Fast Track timeline estimate (work in progress!)

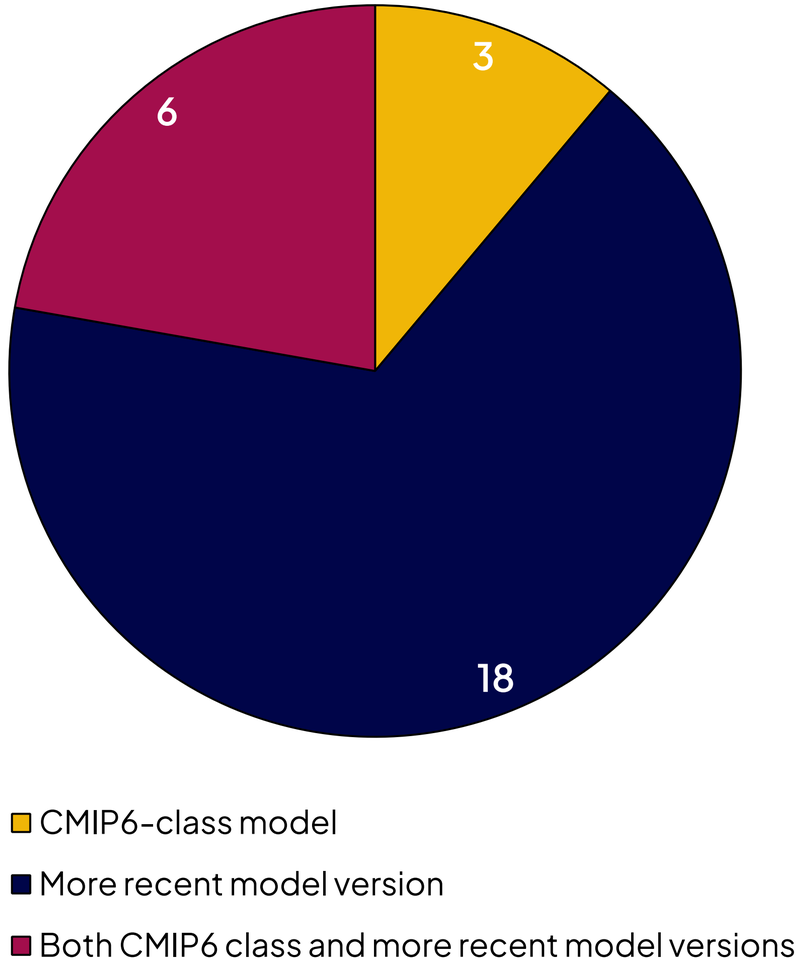


CMIP | WCRP

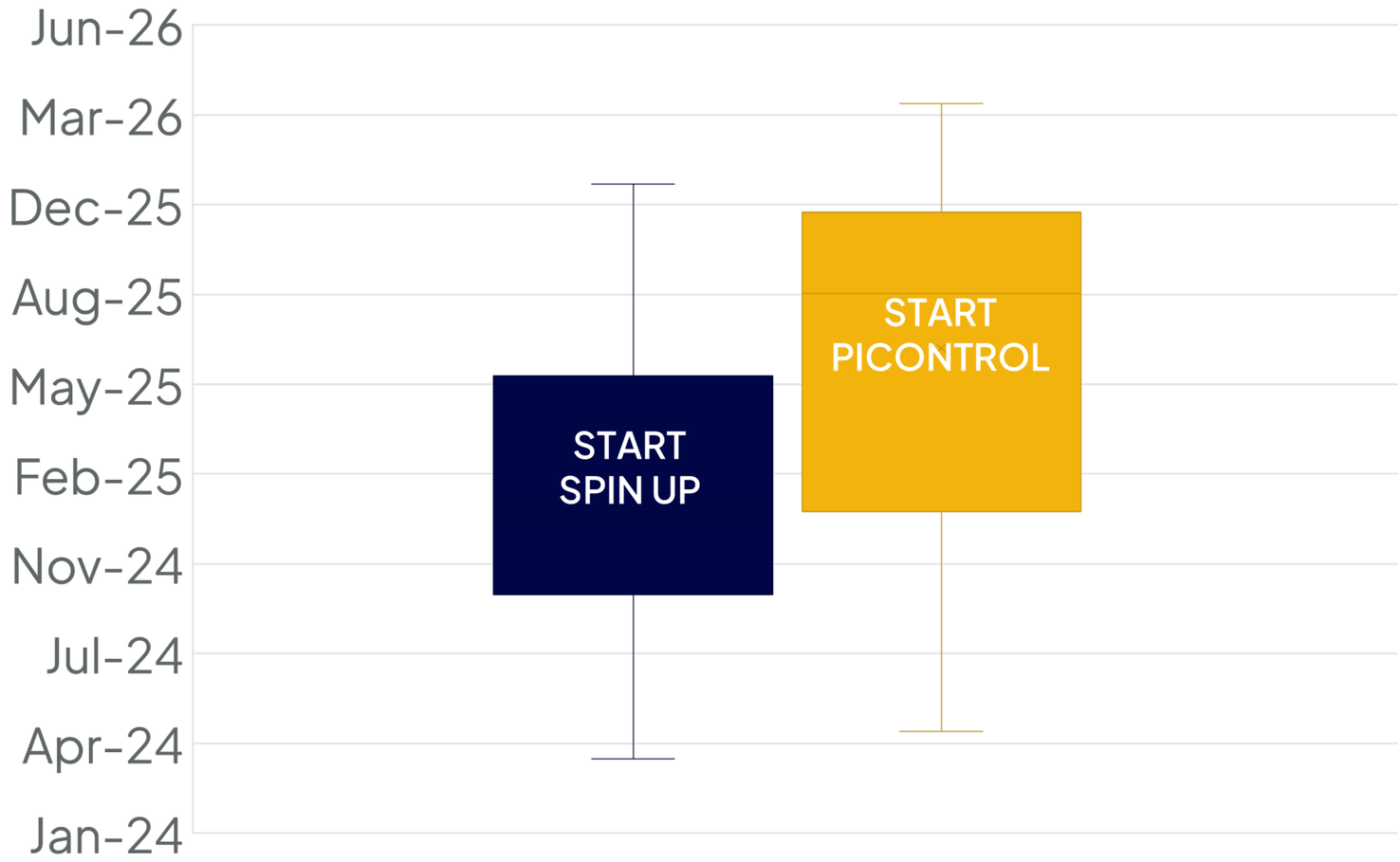
Do you plan to contribute simulations to the CMIP AR7 Fast Track given the timeline outlined (data delivery by end 2026)?



Does your centre/group plan to run the Fast Track with a CMIP6-class model or a more recent version?

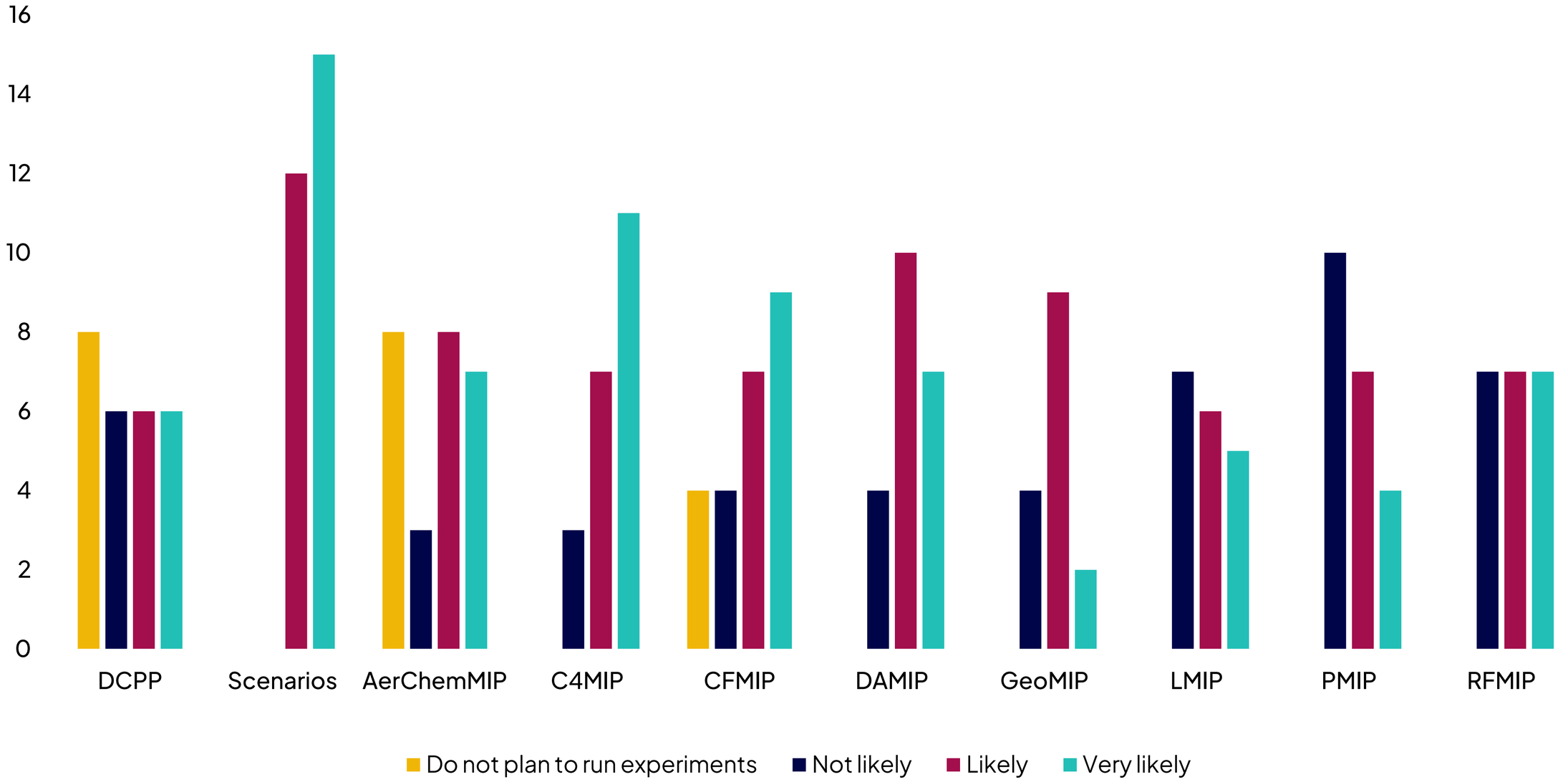


Modelling centre readiness



CMIP | WCRP

Modelling centres overall likelihood of running before end of 2026



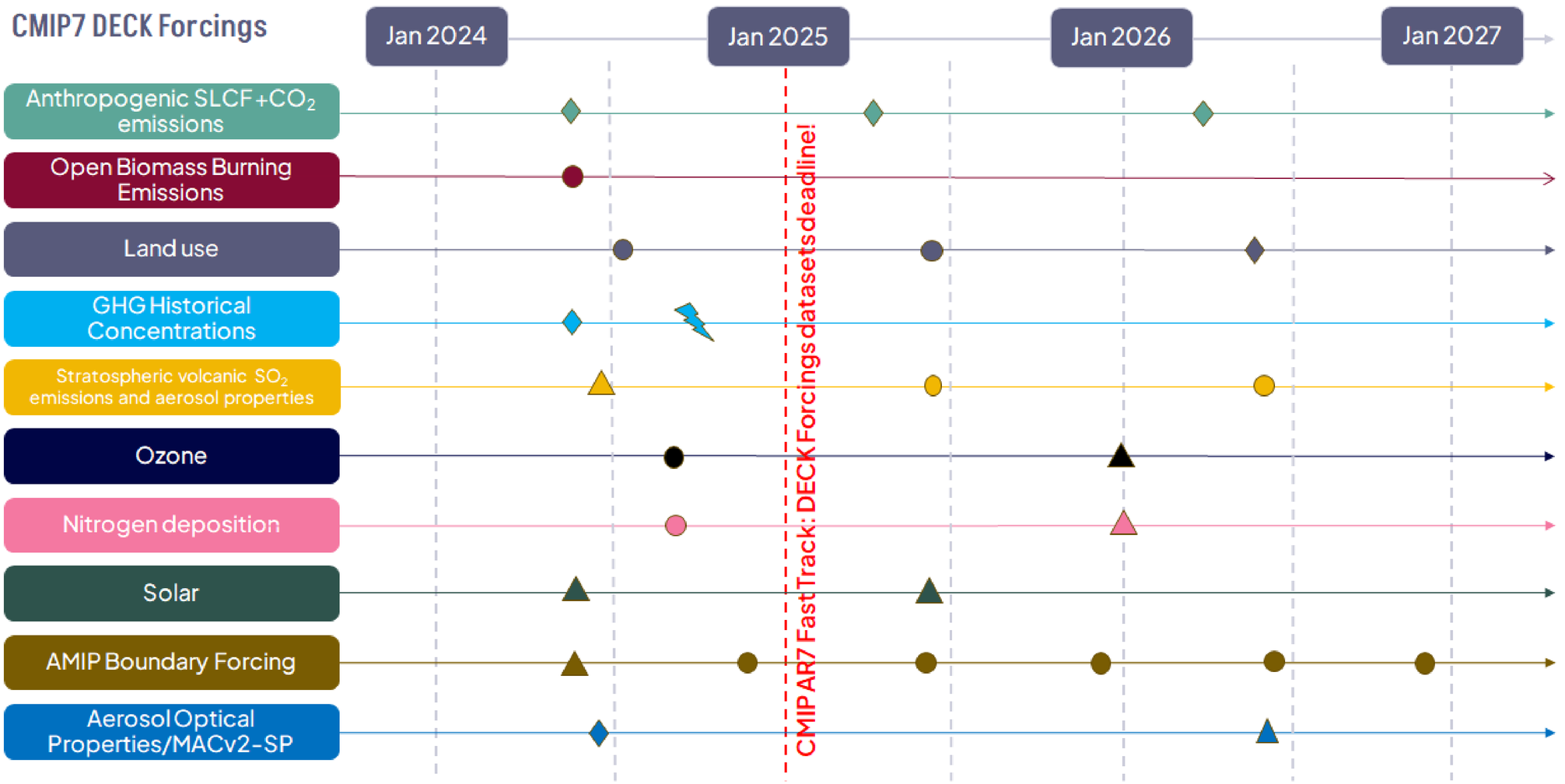
Planned guidance development

- Potential guidance around modelling centre coordination (together with MIPs) to ensure adequate AR7 Fast Track ensemble
  - Strategic Ensemble Design TT
- DECK esm-piControl guidance
  - CMIP Core Panel and Strategic Ensemble Design TT
- Spin up dependency assessment
  - Spin up WG has been established
- Emissions-driven model configuration strategy (for scenarios and wider MIPs e.g. DAMIP)
  - A workshop will be organised.

Historical forcings

- CMIP Forcings Task Team working to resolve known forcing issues for CMIP7 DECK experiments and deliver data updates, **extending until at least December 2021**.
- Pre-release testing versions being generated will be made publicly available through input4MIPs ESGF project mid-2024.
- CMIP7 DECK datasets finalized and **frozen** for wider use in 2025 (these will be different from CMIP6).
- Data available for broader use across AR7 Fast Track experiments; however, MIP activity leads responsible for experiment-specific forcing data requirements not covered by CMIP7 DECK datasets.
- Harmonisation WG established ensuring CMIP7 DECK to ScenarioMIP continuity.
- GMD forcing special issue - evaluation and documentation of CMIP7 forcings.

Historical forcings timeline



♦ **Update** = full timeseries is updated; ● **Extension** = updates from 2014 (or latest release) are appended;
▲ **New** = the full timeseries is based on a new methodology ↯ Operational available

Strategic approach for CMIP data request

CORE

All-purpose set of variables suitable for production in all WCRP MIPs

- Baseline Climate Variables for Earth System Model Output

Updates to list governed by ESMO (proposed)

HARMONISED

Community-driven review of priority variables in themed categories. Suitable for Fast Track & AR7 deadlines

- Impacts & adaptation
- Ocean & sea-ice
- Land & land-ice
- Atmosphere,
- Earth system

Restrained update cycle aligned with IPCC and coordinated with WIP

UNHARMONISED

MIP-driven component with high flexibility (content and timelines)

- Under control of MIPs and their supporting modelling centres

Updates as needed by MIPs

Harmonised Thematic Variables

The CMIP Data Request Task Team are seeking to work with community representative leads and engage with the wider community to devise a controlled list of high priority variables that facilitate the majority of user needs, while keeping the request as small as possible.

- Impacts theme: author team underway.
- Atmosphere, Ocean/Sea Ice, Land/Land Ice, and Earth System themes – applications closed, Steering committees being formed.
- Common process in development: key milestones, quarterly cross-theme papers and Fast Track harmonisation sprint in September have been set up.
- Guide on scope: around 200 variables per theme.

Key risks for AR7 Fast Track delivery

The timeline!

Some potential areas of concern include:

- Delivery of forcing datasets from unfunded providers (situation has improved since CMIP6).
- The ScenarioMIP timeline appears very ambitious.
- Capacity of modelling centres.
- Ongoing uncertainty around the IPCC AR7 timeline.
- Current aspiration to deliver CMIP7-ready infrastructure has uncertain funding support.

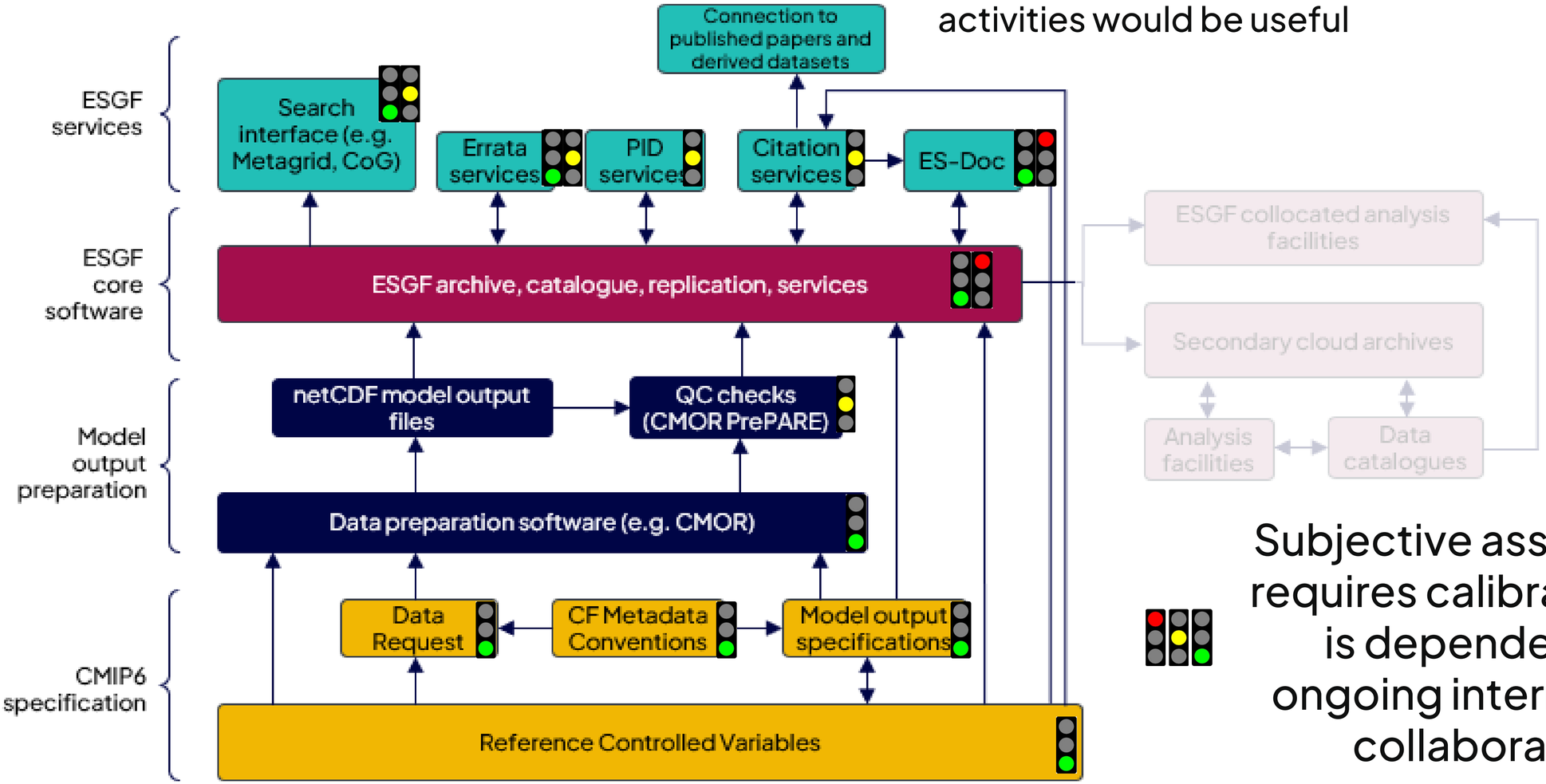
CMIP WIP | WCRP
Coupled Model Intercomparison Project

Infrastructure readiness

Funding situation

- ESGF 2.0 in US funded
- EU and AUS ESGF funding uncertain

JSC letter defining CMIP7 plans calling on countries/institutions to support planned activities would be useful



Subjective assessment requires calibration and is dependent on ongoing international collaboration

CMIP suggestions to the JSC

Lack of structural agreement with ESGF

Given the tight timeline of the AR7 Fast Track, the growing demand for CMIP output, and rapid evolution of data technologies and user expectations, the CMIP/WIP Panels have concerns regarding the lack of a structural agreement with the ESGF consortium and lack of clarity in responsibilities/governance across the WIP and ESGF Executive and Steering Committees. Funding uncertainty makes navigating this terrain complex.

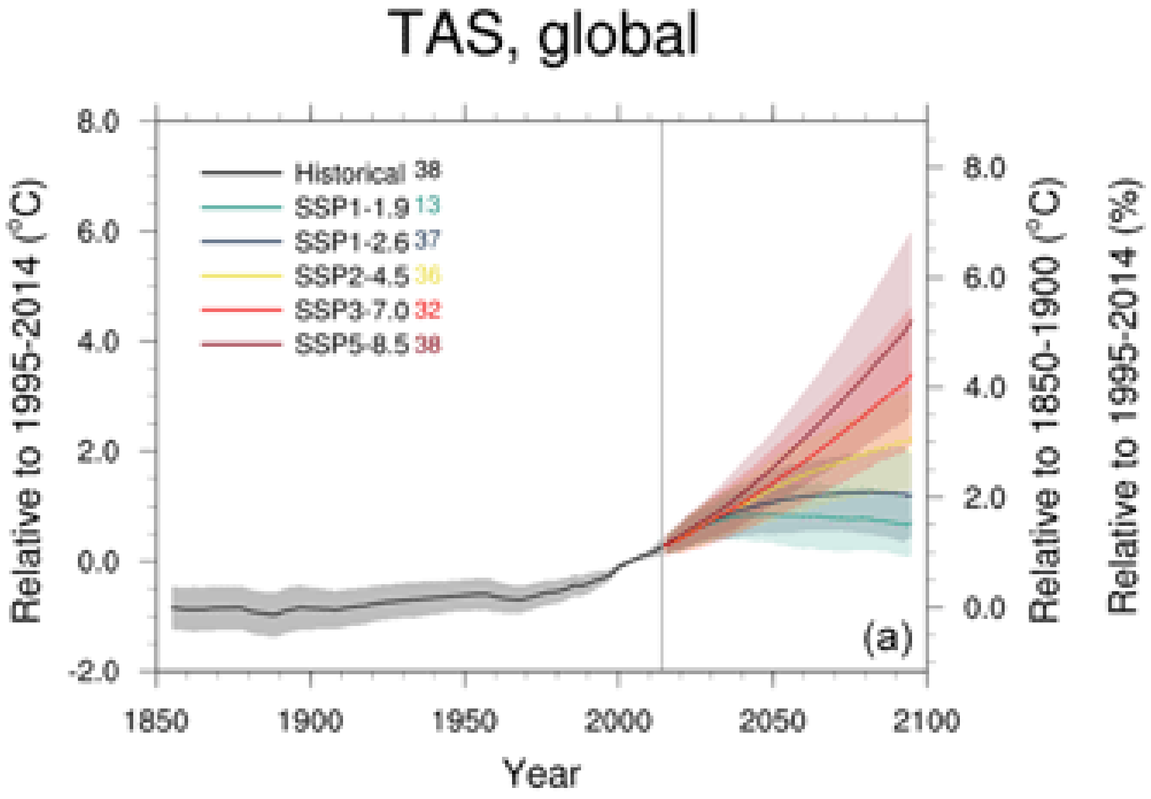
Need for a dedicated scenarios activity within WCRP

Given the increased profile and importance of scenario development to climate policy assessments we feel greater visibility within WCRP may be beneficial to ensure timely delivery, adequate structural support, and establishing a closer connection with the Integrated Assessment Modelling community.

ScenarioMIP

ScenarioMIP

Exploration of climate consequences of evolution of a set drivers of climate change over plausible values – covering a wide range of possible outcomes.



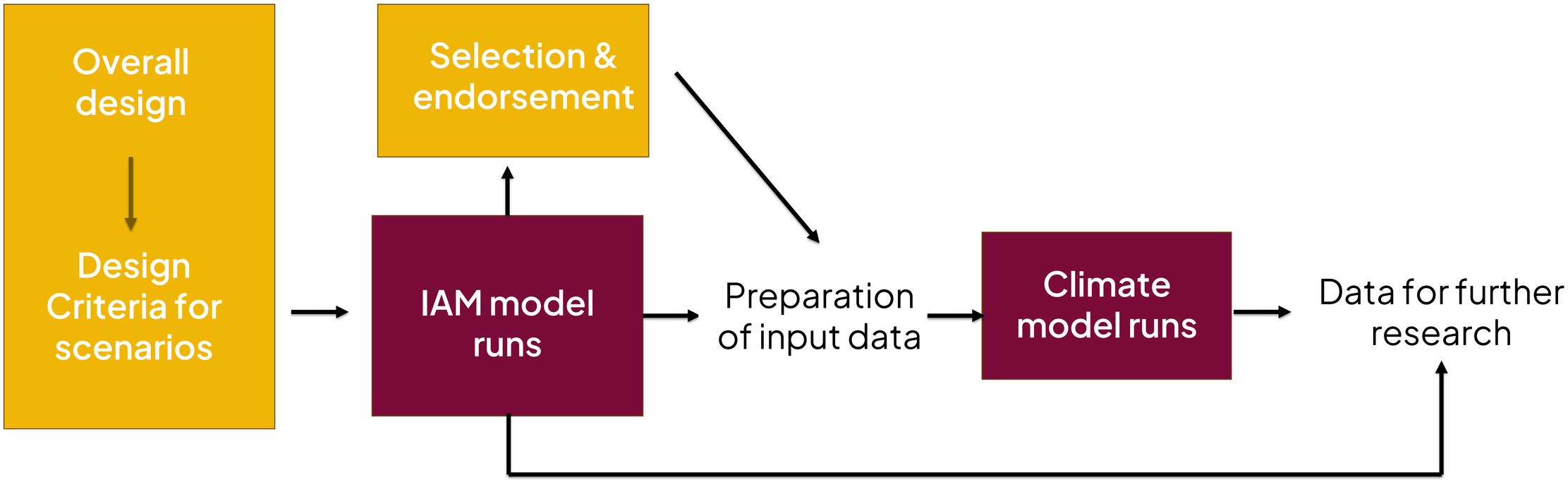
Rationale

- *Service:* Develop a set of community scenarios that can link different climate research communities
- *Science:* Study and understand climate processes, in relation to different, plausible trajectories of direct and indirect forcing
- *Policy:* Providing information that helps support climate policy development

- Wide and plausible range for different forcing variables, including outcomes consistent with current climate targets
- Relevant in different research domains (physics, impacts, mitigation/adaptation)
- Provide insights into uncertainty

CMIP | WCRP

Overall process



Process and transparency

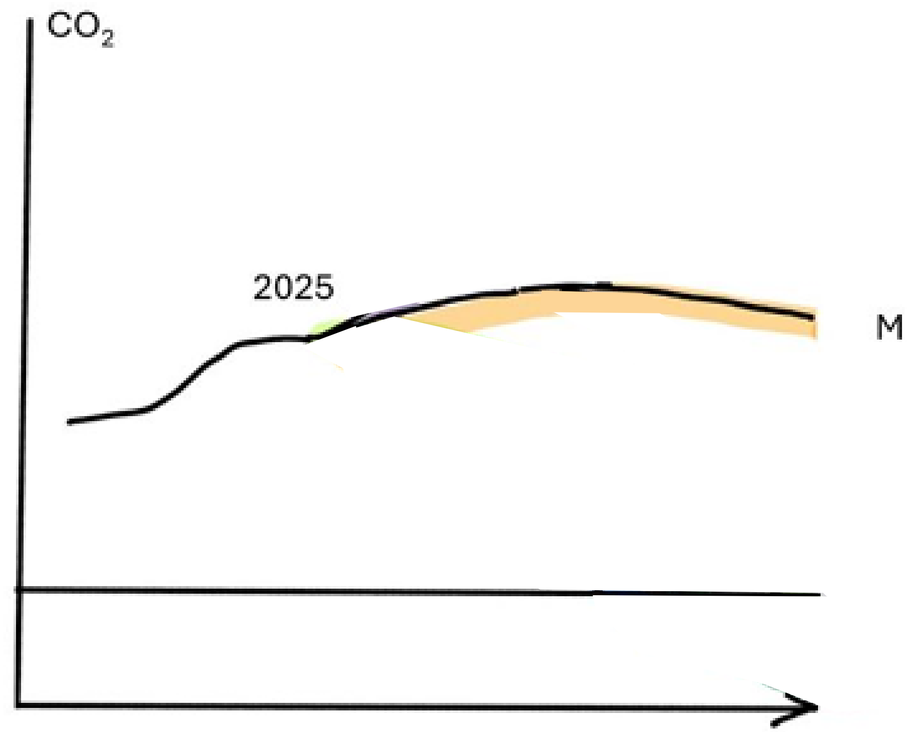
- 20 member steering committee: Govindasamy Bala (India), Louise Parsons Chini (USA), Veronika Eyring (Germany), Pierre Friedlingstein (UK), Katja Frieler (Germany), Tomoko Hasegawa (Japan), Reto Knutti (Switserland), Elmar Kriegler (Germany), Chris Lennard (South Africa), Jason Lowe (UK), Shahbaz Mehmood (Pakistan), Swapna Panickal (India), Luciana Prado (Brazil), Keywan Riahi (Austria), Alex Ruane (USA), Ben Sanderson (Norway), Anna Sörensson (Argentina), Qiang Zhang (China), Detlef van Vuuren (Netherlands), Brian O'Neill (USA), Claudia Tebaldi (USA)
- >70 member Advisory Board
- Various forms of interaction with community:
  - 70+ member meeting in Reading (Kick-off)
  - Presentation at various occasions (including webinar)
  - Review of proposal in Advisory Board and open review
  - SSC and Advisory Board selected on the basis of open consultation

Design criteria for scenarios

- Concentration driven
- Full range

Design criteria for scenarios

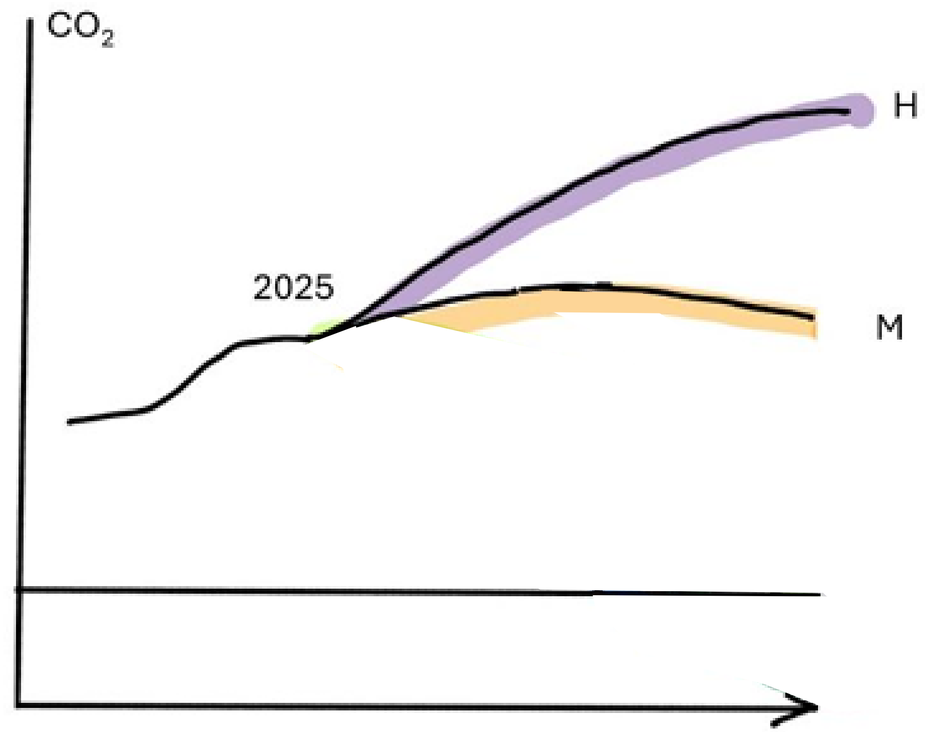
- Concentration driven
- Full range



Scenario consistent with current policies (2.5-3°C in 2100)

Design criteria for scenarios

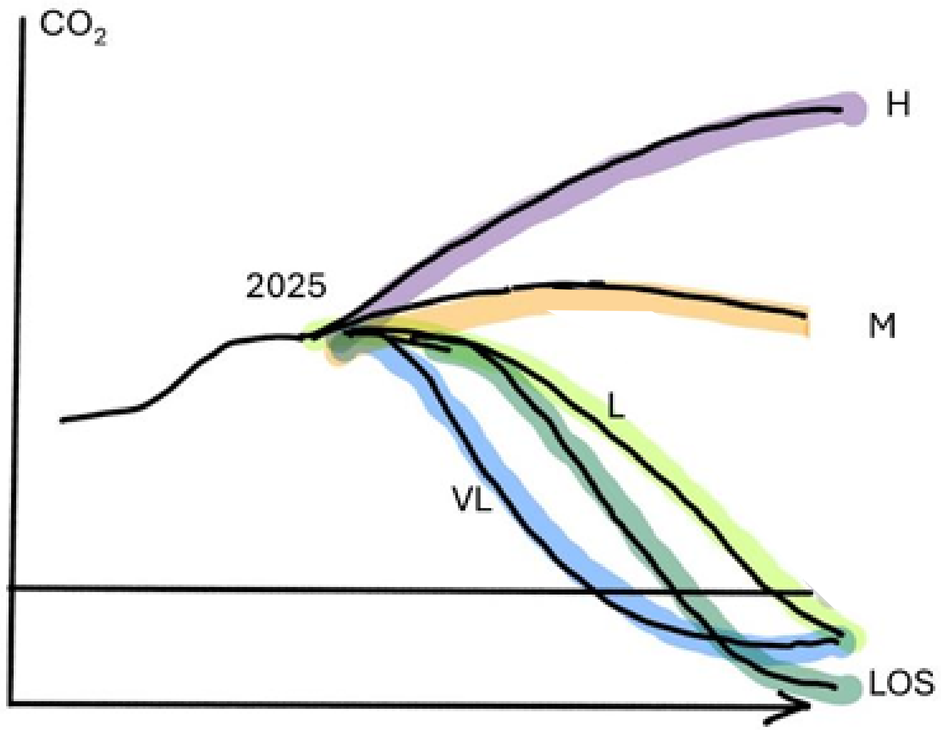
- Concentration driven
- Full range



Scenario indicating policy failure + high forcing (~7 W/m2??)

Design criteria for scenarios

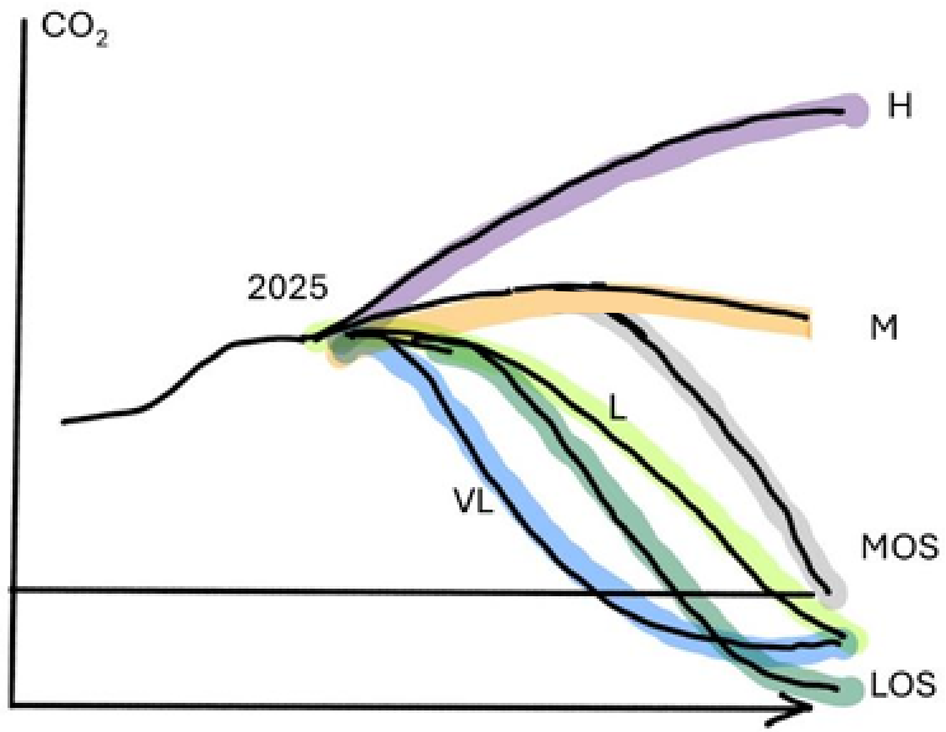
- Concentration driven
- Full range



Three scenarios exploring range relevant for Paris (C1-C3 range); one as low as plausible; one with clear overshoot

Design criteria for scenarios

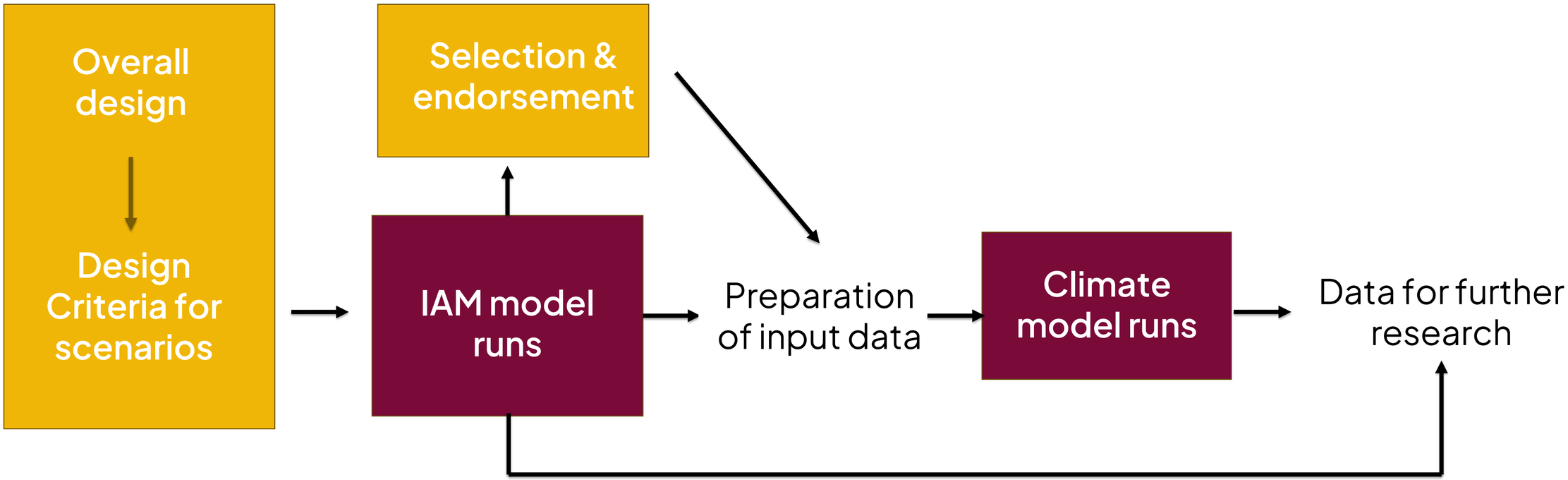
- Concentration driven
- Full range



Scenario that departs from medium later

CMIP | WCRP

Overall process and timeline



June'23–
June'24

June'24–
Early'25

Until
Autumn '25

CMIP | WCRP

Thank You


@wcrpcmip


wcrp-cmip


cmip-ipo@esa.int