



# WGCM and CMIP

## 41st Session of the WCRP Joint Scientific Committee

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Online



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# Links to the WCRP Strategic and Implementation Plans

- WGCM and its Panels are well situated within the WCRP structure at the moment, and serve as the primary foci for discussions among modelling centres, data centres, and infrastructure providers on many topics.
- WGCM and CMIP produce some of the most visible and influential outcomes of WCRP, and leverage a huge investment by many countries, institutions and funding agencies.
- Our concerns related to the Strategic Plan continue to relate to maintaining (ideally improving) this visibility and effectiveness.
- We believe that WGCM has played a crucial role in both fundamental model development and coordinated intercomparison projects, providing high-profile input to climate assessments and policy development. These activities should remain core features of the WCRP going forward.



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# Emerging issues

- CMIP has grown into a very large and complex multi-national undertaking. Although it mobilizes a huge (~ \$1B) investment, and its results are essential to a vast array of stakeholders, it is organized by a small group of passionate volunteers in the CMIP Panel and WIP. It is not sustainable in its current form.
  - Recent call for an International CMIP Office will be a helpful step.
  - WGCM will pursue broad consultations in planning the scope and organization of CMIP7.
  - Need to raise the profile and insure ongoing support for vital infrastructure.
- WGCM represents the primary mechanism for interaction and coordination amongst climate (Earth System) modelling centres.
  - This has implications for membership, organizational structure, leadership and future role.
- New scientific priorities such as better understanding modelled climate sensitivity and analyzing/interpreting multi-model ensemble.



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# Additional Slides



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# Progress and achievements

- Model simulations for CMIP6 are progressing rapidly, with community having now designed and implemented 312 distinct CMIP experiments.
- Result being used in IPCC AR6 report in prep.
- Model output now being served by ESGF from 38 institutions (56 models or versions).

[https://pcmdi.llnl.gov/CMIP6/ArchiveStatistics/esgf\\_data\\_holdings/](https://pcmdi.llnl.gov/CMIP6/ArchiveStatistics/esgf_data_holdings/)

## ESGF CMIP6 Data Holdings

[Print-Friendly View](#)

ESGF CMIP6 data holdings as of Friday 17 April 2020 20:55:02

The cells are shaded by how recently their latest datasets were published.

More than 28 days | More than 7 days | Less than 7 days

Click on an activity name at the top of the tables to go to a page for that activity's data holdings.

Number of 'datasets' [variables x (# of simulations)] from each model in support of each CMIP6 activity.

model	# of activities	AerChemMIP	C4MIP	CDRMIP	CFMIP	CMIP	DAMIP	DCPP	FAFMIP	GMMIP	GeoMIP	High
# of models	325	33	16	8	12	56	12	9	7	16	5	29
ACCESS-CM2	4	289				1914			852			
ACCESS-ESM1-5	6	854	2156	1082		3810						
ARTS-2-3	1											
AWI-CM-1-1-MR	4	900				1089						
AWI-ESM-1-1-LR	1					407						
BCC-CSM2-MR	9		512		1112	2164	1481	19488		413		
BCC-ESM1	2	2985				1639						
CAMS-CSM1-0	5	142				725				144		48
CAS-ESM2-0	1					1231						
CESM1-1-CAM5-CMIP5	1							378399				
CESM2	14		1683	136	3332	19253	7049			294		
CESM2-FV2	1					6957						
CESM2-WACCM	5	6738				7206					3322	
CESM2-WACCM-FV2	1					7283						
CIESM	3					387				129		
CMCC-CM2-HR4	2											512
CMCC-CM2-SR5	1											
CMCC-CM2-VHR4	1											513
CMCC-ESM2	2											
CNRM-CM6-1	13	1961			3919	13600	5161	75897		832		5787
CNRM-CM6-1-HR	5	227				1362				107		1181
CNRM-ESM2-1	10	12319	2822			10933				181	2038	
CanESM5	4	4402	536	444	340	2247	4678	22527	272	245	102	



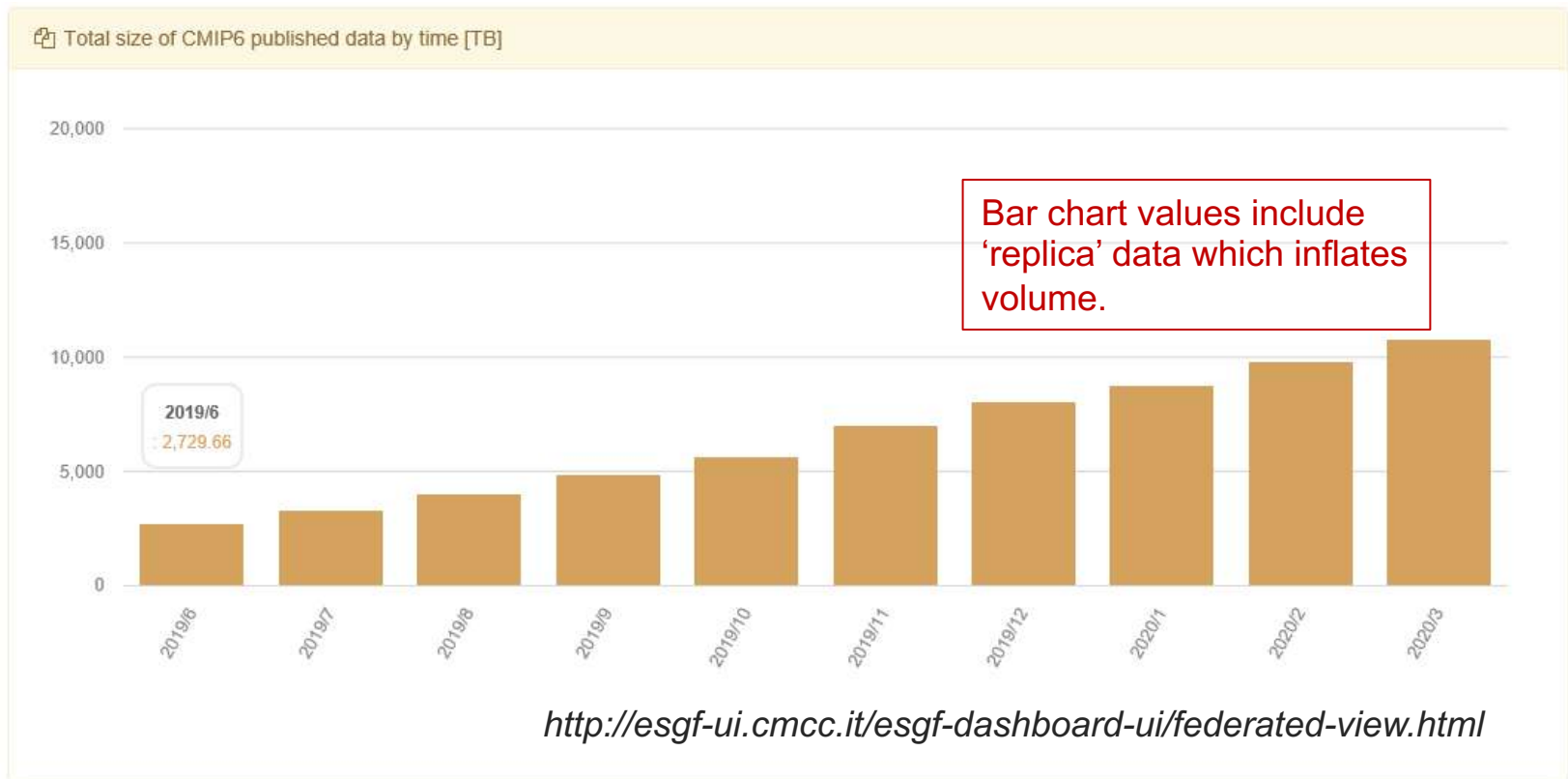
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# Progress and achievements

Model results continually being added to archive.

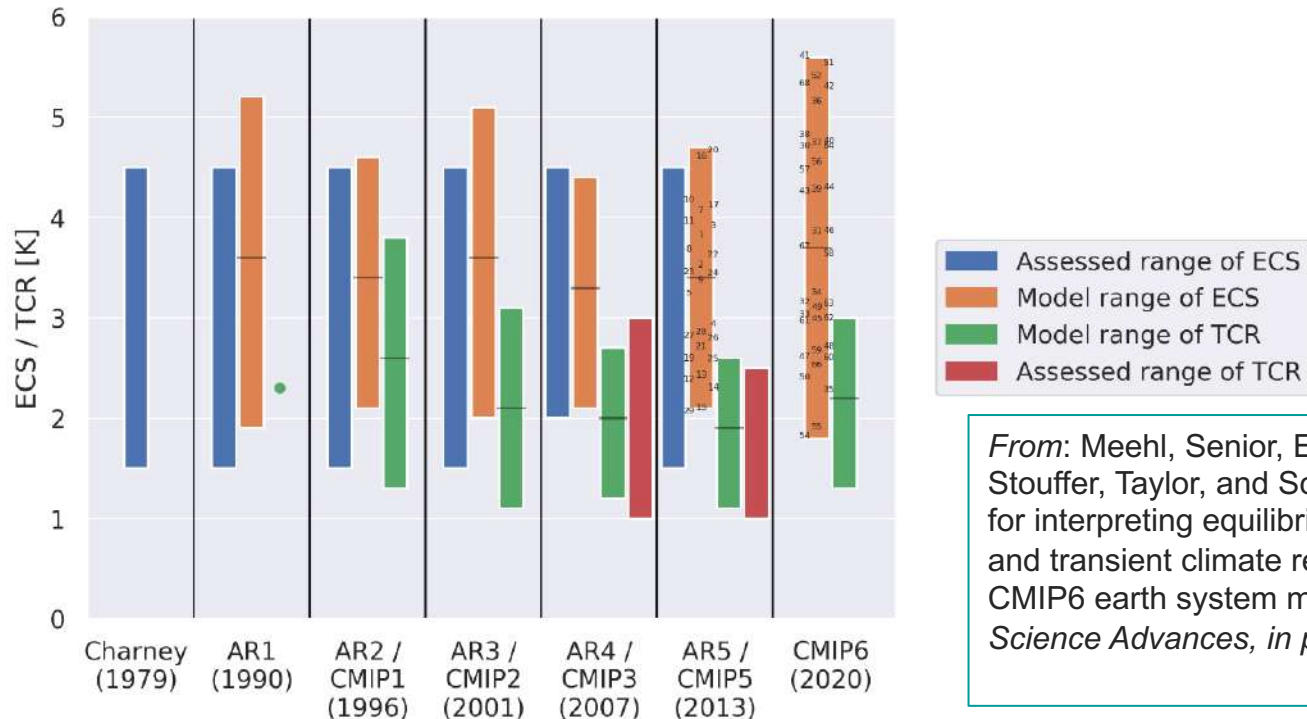
- currently 7.5 PB of data and climbing (compared to 1.7 PB total in CMIP5)



# Progress and achievements

- As a follow-up to the Barcelona CMIP workshop, held in March, 2019, former WGCM co-Chair, Jerry Meehl, has led the development and submission of a paper laying out the history of quantifying climate sensitivity and comparing the CMIP6 multi-model ensemble sensitivity to previous results.

Equilibrium Climate Sensitivity (Gregory method) and Transient Climate Response

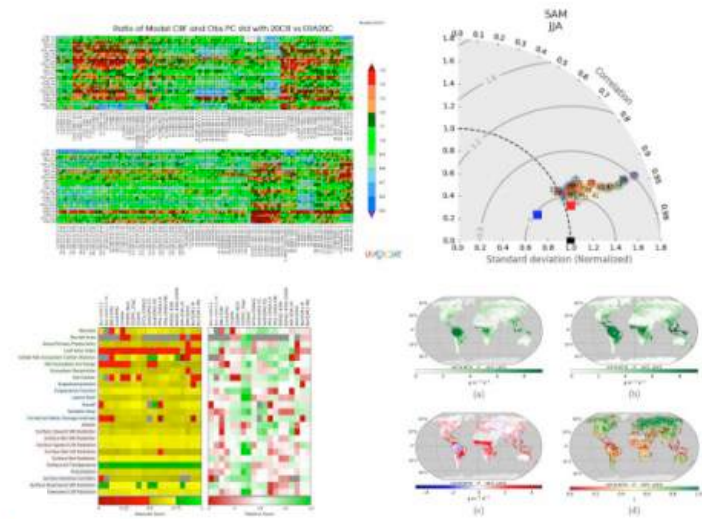
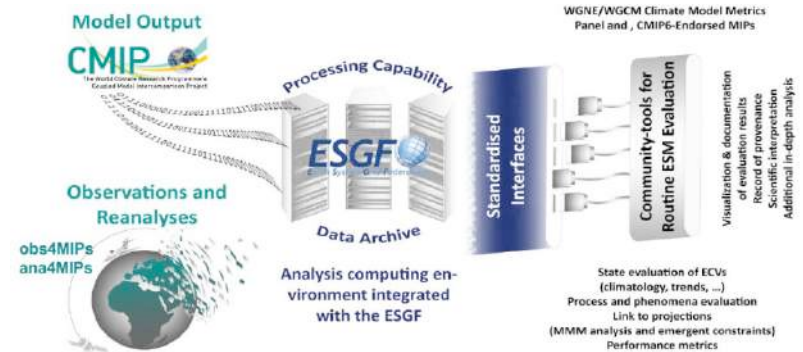


From: Meehl, Senior, Eyring, Flato, Lamarque, Stouffer, Taylor, and Schlund, 2020. Context for interpreting equilibrium climate sensitivity and transient climate response from the CMIP6 earth system models; *Science Advances*, in press.

# Progress and achievements

## Routine Evaluation in CMIP

- A range of sophisticated evaluation tools have been developed to allow streamlined access to the CMIP data archived on the ESGF.
- These tools are being extensively used by the climate research community, and by several IPCC AR6 chapter teams to undertake analysis and produce figures.



Right et al, GMD, 2020 and Eyring et al., GMD, 2020

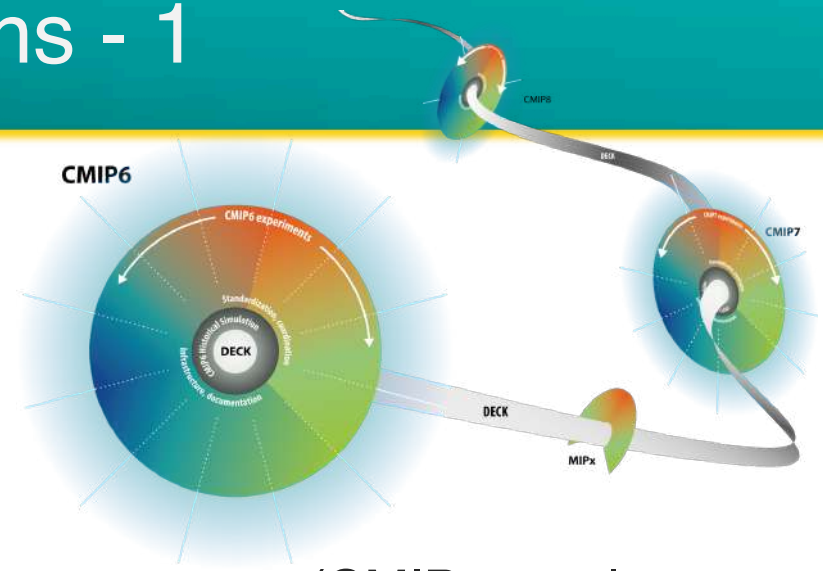




# Future Plans - 1

## CMIP Future

- CMIP6 was very ambitious!
- 23 endorsed MIPs; >300 experiments.
- Results will fuel climate research for years to come (CMIP5 results continue to be used; > 1100 publications self-reported at <https://cmip-publications.llnl.gov/> which is certainly an underestimate.
- CMIP results also fuel a vast range of derived climate information products and services.
- However, logistics of organizing and delivering this massive effort is straining the capabilities of the CMIP Panel and WIP (currently with no dedicated project office). CMIP is at risk and is not sustainable as is.



- CMIP essential infrastructure is currently delivered by volunteers, by the WGCM members, the CMIP Panel, the WGCM Infrastructure Panel (WIP), and the individual scientists and their institutions, in often unfunded efforts.
- Infrastructure includes;
  - ‘forcing data’ for climate model simulations
  - development of data formats and standards
  - documentation and software to contribute model output to the ESGF and allows users from around the world to access this massive multi-model data set.
  - The distributed but integrated hardware that permits archival and dissemination of CMIP model output to the wide community.

- WGCM, CMIP Panel, and WIP will undertake a substantive consultation in the coming year involving the climate science community, modelling centres, data centres, and other stakeholders to develop plans for CMIP7.
  - There are currently range of views on the way forward.
  - We will need to maintain consistency with ongoing WCRP Implementation planning.
- Considerations will necessarily include modelling centre capacity and ongoing interest, issues around forcing data, output archival and dissemination, scientific goals and other stakeholder needs, etc..
- Call for CMIP International Office is currently out, and interest in hosting such an office has already been expressed.
  - This will be a huge help.



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# Future Plans - 2

## Multi-Model Ensembles

- An increasingly important research problem involves the analysis of, and extraction of information from, large multi-model ensembles (MMEs) like that produced by CMIP.
- Many of the models share components. Some are largely independent whereas others are modest variations. All have errors/biases of different kinds, in different variables and in different regions.
- There is a need to motivate and perhaps coordinate enhanced research on the analysis of MMEs and LMEs (large individual model ensembles) so as to better quantify confidence/uncertainty in the results of these ensembles and the assessments and products derived from them.



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