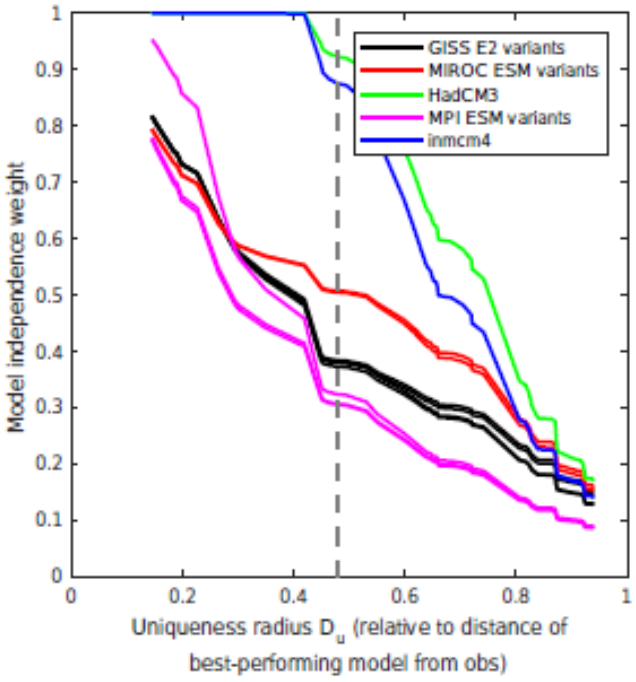
Multi-Model Ensembles -- G. Flato 16/Dec/2020

- 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.
- How does one optimally combine models?
- It seems to me there may be 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.
- One obstacle is the documentation of models in a way that would allow rigorous identification of differences, similarities, lineage, etc.

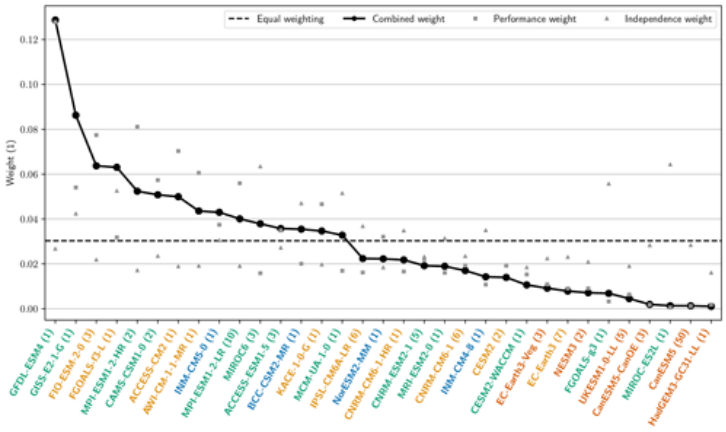
‘uniqueness’



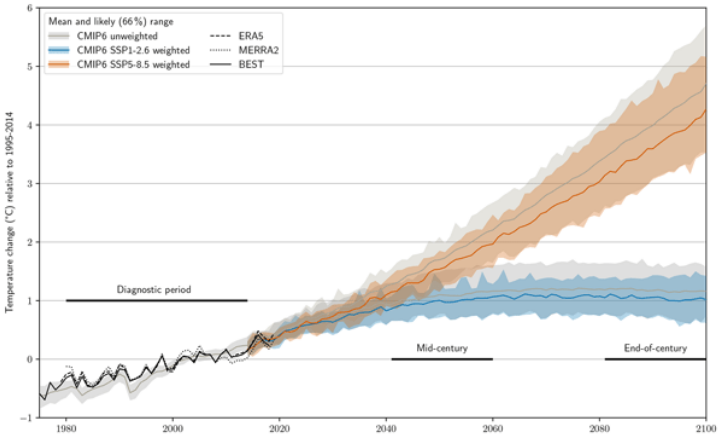
Sanderson et al., 2017
https://doi.org/10.5194/gmd-10-2379-2017

Various papers by Knutti and others …

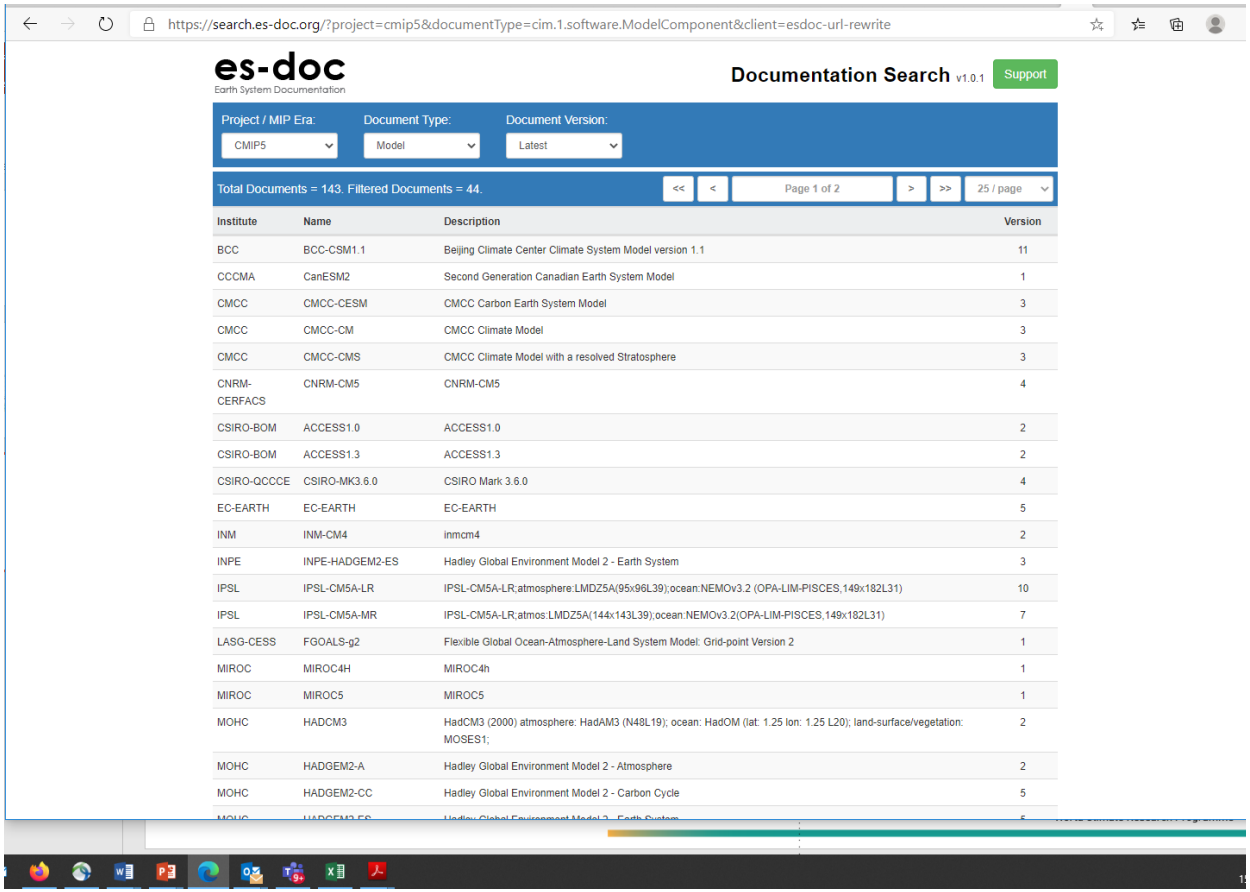
weighting



weighted results



Brunner et al., 2020
https://doi.org/10.5194/esd-11-995-2020



https://search.es-doc.org/?project=cmip5&documentType=cim.1.software.ModelComponent&client=esdoc-url-rewrite

es-doc
Earth System Documentation

Documentation Search v1.0.1 Support

Project / MIP Era: CMIP5 | Document Type: Model | Document Version: Latest

Total Documents = 143. Filtered Documents = 44. << < Page 1 of 2 > >> 25 / page

Institute	Name	Description	Version
BCC	BCC-CSM1.1	Beijing Climate Center Climate System Model version 1.1	11
CCCMA	CanESM2	Second Generation Canadian Earth System Model	1
CMCC	CMCC-CESM	CMCC Carbon Earth System Model	3
CMCC	CMCC-CM	CMCC Climate Model	3
CMCC	CMCC-CMS	CMCC Climate Model with a resolved Stratosphere	3
CNRM-CERFACS	CNRM-CM5	CNRM-CM5	4
CSIRO-BOM	ACCESS1.0	ACCESS1.0	2
CSIRO-BOM	ACCESS1.3	ACCESS1.3	2
CSIRO-QCCCE	CSIRO-MK3.6.0	CSIRO Mark 3.6.0	4
EC-EARTH	EC-EARTH	EC-EARTH	5
INM	INM-CM4	inmcm4	2
INPE	INPE-HADGEM2-ES	Hadley Global Environment Model 2 - Earth System	3
IPSL	IPSL-CM5A-LR	IPSL-CM5A-LR;atmosphere:LMDZ5A(95x96L39);ocean:NEMOv3.2 (OPA-LIM-PISCES,149x182L31)	10
IPSL	IPSL-CM5A-MR	IPSL-CM5A-LR;atmos:LMDZ5A(144x143L39);ocean:NEMOv3.2(OPA-LIM-PISCES,149x182L31)	7
LASG-CESS	FGOALS-g2	Flexible Global Ocean-Atmosphere-Land System Model: Grid-point Version 2	1
MIROC	MIROC4H	MIROC4h	1
MIROC	MIROC5	MIROC5	1
MOHC	HADCM3	HadCM3 (2000) atmosphere: HadAM3 (N48L19); ocean: HadOM (lat: 1.25 lon: 1.25 L20); land-surface/vegetation: MOSES1;	2
MOHC	HADGEM2-A	Hadley Global Environment Model 2 - Atmosphere	2
MOHC	HADGEM2-CC	Hadley Global Environment Model 2 - Carbon Cycle	5

https://doi.org/10.5194/gmd-2019-177
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Geoscientific Model Development Discussions

The Canadian Earth System Model version 5 (CanESM5.0.3)

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Abstract. The Canadian Earth System Model version 5 (CanESM5) is a global model developed to simulate historical climate change and variability, to make centennial scale projections of future climate, and to produce initialized seasonal and decadal predictions. This paper describes the model components and their coupling, as well as various aspects of model development, including tuning, optimization and a reproducibility strategy. We also document the stability of the model using a long control simulation, quantify the model's ability to reproduce large scale features of the historical climate, and evaluate the response of the model to external forcing. CanESM5 is comprised of three dimensional atmosphere (T63 spectral resolution / 2.8°) and ocean (nominally 1°) general circulation models, a sea ice model, a land surface scheme, and explicit land and ocean carbon cycle models. The model features relatively coarse resolution and high throughput, which facilitates the production of large ensembles. CanESM5 has a notably higher equilibrium climate sensitivity (5.7 K) than its predecessor CanESM2 (3.8 K), which we briefly discuss, along with simulated changes over the historical period. CanESM5 simulations are contributing to the Coupled Model Intercomparison Project Phase 6 (CMIP6), and will be employed for climate science and service applications in Canada.

Questions

- Would there be value and interest in having WGCM promote or organize targeted research in the analysis of multi-model ensembles, their statistical properties, etc? If so, how can we be most effective?

- Would there be value and interest in developing a project on 'bottom-up' analysis of independence, rather than diagnostic approaches? What would be the best approach?

- How can WGCM promote clear and comprehensive model documentation in a way that satisfies publication requirements, can be updated, and minimizes pain for modelling centres? Should we promote some 'standards'? Should we engage with Journal Editors to identify (and overcome) barriers?