

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

Supplemental Materials for

“Defining the Internal Component of Atlantic Multidecadal Variability in a Changing Climate”

Clara Deser* and Adam S. Phillips

National Center for Atmospheric Research, Boulder, CO

Submitted to *Geophys. Res. Lett.*

17 April 2021

* Corresponding author: Clara Deser (cdeser@ucar.edu)

Contents

This document contains one Table (Table S1) and a list of references.

16 **References**

17 Delworth, T. L., Cooke, W. F., Adcroft, A., Bushuk, M., Chen, J.-H., Dunne, K. A., et al. (2020).
18 SPEAR: The next generation GFDL modeling system for seasonal to multidecadal prediction and
19 projection. *Journal of Advances in Modeling Earth Systems*, 12,
20 e2019MS001895. <https://doi.org/10.1029/2019MS001895>.

21
22 Deser, C., F. Lehner, K. B. Rodgers, T. Ault, T. L. Delworth, P. N. DiNezio, A. Fiore, C.
23 Frankignoul, J. C. Fyfe, D. E. Horton, J. E. Kay, R. Knutti, N. S. Lovenduski, J. Marotzke, K. A.
24 McKinnon, S. Minobe, J. Randerson, J. A. Screen, I. R. Simpson and M. Ting, 2020: Insights from
25 earth system model initial-condition large ensembles and future prospects. *Nat. Clim. Change*, doi:
26 10.1038/s41558-020-0731-2.

27
28 Jeffrey, S. et al., 2013: Australia's CMIP5 submission using the CSIRO-Mk3.6 model. *Aust.*
29 *Meteorol. Ocean.* 63, 1–13.

30
31 Kay, J. E., C. Deser, A. Phillips, A. Mai, C. Hannay, G. Strand, J. Arblaster, S. Bates, G.
32 Danabasoglu, J. Edwards, M. Holland, P. Kushner, J. -F. Lamarque, D. Lawrence, K. Lindsay, A.
33 Middleton, E. Munoz, R. Neale, K. Oleson, L. Polvani, and M. Vertenstein, 2015: The Community
34 Earth System Model (CESM) Large Ensemble Project: A community resource for studying climate
35 change in the presence of internal climate variability. *Bull. Amer. Met. Soc.*, **96**, 1333–1349, doi:
36 10.1175/BAMS-D-13-00255.1.

37

38 Kirchmeier-Young, M. C., Zwiers, F. W. and Gillett, N. P. , 2017: Attribution of extreme events
39 in Arctic Sea ice extent. *J. Climate* 30, 553–571.
40

41 Maher, N., Milinski, S., Suarez-Gutierrez, L., Botzet, M., Dobrynin, M., Kornblueh, L., et al.
42 (2019). The Max Planck Institute Grand Ensemble: Enabling the exploration of climate system
43 variability. *J. Adv. Mod. Earth Sys.*, 11, 2050– 2069. <https://doi.org/10.1029/2019MS001639>
44

45 Rodgers, K. B., Lin, J. & Frölicher, T. L. Emergence of multiple ocean ecosystem drivers in a
46 large ensemble suite with an Earth system model. *Biogeosciences* 12, 3301–3320 (2015).
47

48 Sun, L., Alexander, M. and Deser, C. , 2018: Evolution of the global coupled climate response to
49 Arctic sea ice loss during 1990–2090 and its contribution to climate change. *J. Climate* 31, 7823–
50 7843.
51

52 Swart, N. C., Cole, J. N. S., Kharin, V. V., Lazare, M., Scinocca, J. F., Gillett, N. P., Anstey, J.,
53 Arora, V., Christian, J. R., Hanna, S., Jiao, Y., Lee, W. G., Majaess, F., Saenko, O. A., Seiler, C.,
54 Seinen, C., Shao, A., Sigmond, M., Solheim, L., von Salzen, K., Yang, D., and Winter, B.: The
55 Canadian Earth System Model version 5 (CanESM5.0.3), *Geosci. Model Dev.*, 12, 4823–
56 4873, <https://doi.org/10.5194/gmd-12-4823-2019>, 2019.
57

58 Tatebe, H., Ogura, T., Nitta, T., Komuro, Y., Ogochi, K., Takemura, T., Sudo, K., Sekiguchi, M.,
59 Abe, M., Saito, F., Chikira, M., Watanabe, S., Mori, M., Hirota, N., Kawatani, Y., Mochizuki, T.,
60 Yoshimura, K., Takata, K., O'Ishi, R., ... Kimoto, M. (2019). Description and basic evaluation of

61 simulated mean state, internal variability, and climate sensitivity in MIROC6. *Geoscientific Model*
62 *Development*, 12(7), 2727-2765. <https://doi.org/10.5194/gmd-12-2727-2019>.

63

64
65
66
67
68

Table S1. Summary of the salient characteristics of the 8 model initial-condition Large Ensembles used in this study. “Macro” refers to different coupled initial states; “Micro” refers to different atmospheric initial states (see Deser et al., 2020).

Modeling Center	Model Version	Model Resolution (atm/ocn)	Years	Initialization Method	Number of Members	Forcing	Reference
CCCma	CanESM2	~2.8°x2.8°/ ~1.4°x0.9°	1950-2100	Macro and Micro	50	historical, rcp85	Kirchmeier-Young et al. (2017)
CSIRO	MK3.6	~1.9°x1.9°/ ~1.9°x1.0°	1850-2100	Macro	30	historical, rcp85	Jeffrey et al. (2013)
GFDL	ESM2M	~2.0°x2.5°/ ~1.0°x0.9°	1950-2100	Macro	30	historical, rcp85	Rodgers et al. (2015)
MPI	MPI-ESM-LR	~1.9°x1.9°/ nominal 1.5°	1850-2100	Macro	100	historical, rcp26, rcp45, rcp85	Maher et al. (2019)
NCAR	CESM1-CAM5	~1.3°x0.9°/ nominal 1.0°	1920-2100	Micro	40	historical, rcp85	Kay et al. (2015)
CCCma	CanESM5	~2.8°x2.8°/ ~1.4°x0.9°	1850-2100	Macro	50	historical, ssp5-8.5	Swart et al. (2019)
GFDL	SPEAR_MED	50km/ nominal 1°	1921-2100	Macro	30	historical, ssp5-8.5	Delworth et al. (2020)
MIROC	MIROC6	~1.4°x1.4°/ nominal 1°	1850-2014	Macro	50	historical, ssp5-8.5	Tatebe et al. (2019)

69