



AMS
American Meteorological Society

Supplemental Material

© Copyright 2020 American Meteorological Society (AMS)

For permission to reuse any portion of this work, please contact permissions@ametsoc.org. Any use of material in this work that is determined to be “fair use” under Section 107 of the U.S. Copyright Act (17 USC §107) or that satisfies the conditions specified in Section 108 of the U.S. Copyright Act (17 USC §108) does not require AMS’s permission. Republication, systematic reproduction, posting in electronic form, such as on a website or in a searchable database, or other uses of this material, except as exempted by the above statement, requires written permission or a license from AMS. All AMS journals and monograph publications are registered with the Copyright Clearance Center (<https://www.copyright.com>). Additional details are provided in the AMS Copyright Policy statement, available on the AMS website (<https://www.ametsoc.org/PUBSCopyrightPolicy>).

Supplementary Information for "Elements of the dynamical response to climate change over the Mediterranean"

Alexandre Tuel^{1,*}, Paul A. O’Gorman² and Elfatih A. B. Eltahir¹

October 16, 2020

1 Ralph M. Parsons Laboratory, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology

2 Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology

*e-mail: atuel@mit.edu

Contents

- Tables S1 and S2
- Supplementary references

Name	Resolution		Main reference
	Atmosphere	Ocean	
ACCESS1-0	144 × 192	300 × 360	Bi et al. (2013)
ACCESS1-3	144 × 192	300 × 360	
BCC-CSM1-1-m	160 × 320	232 × 360	Xin et al. (2013)
BNU-ESM	64 × 128	200 × 360	Ji et al. (2014)
CanESM2	64 × 128	192 × 256	Arora et al. (2011)
CCSM4	192 × 288	384 × 320	Gent et al. (2011)
CESM1-CAM5	192 × 288	384 × 320	Neale et al. (2010)
CMCC-CESM	48 × 96	149 × 182	Scoccimarro et al. (2011)
CMCC-CM	240 × 480	149 × 182	
CMCC-CMS	96 × 192	149 × 182	
CNRM-CM5	128 × 256	292 × 362	Voltaire et al. (2013)
CSIRO-Mk3-6-0	96 × 192	189 × 192	Rotstayn et al. (2010)
FGOALS-g2	60 × 128	360 × 196	Li et al. (2013)
GFDL-ESM2G	90 × 144	210 × 360	Dunne et al. (2012)
GFDL-ESM2M	90 × 144	200 × 360	
GISS-E2-R	90 × 144	144 × 90	Miller et al. (2014)
GISS-E2-R-CC	90 × 144	144 × 90	
HadGEM2-AO	144 × 192	216 × 360	Collins et al. (2011)
HadGEM2-ES	144 × 192	216 × 360	
INM-CM4	120 × 180	340 × 360	Volodin et al. (2010)
IPSL-CM54-LR	96 × 96	149 × 182	Marti et al. (2010)
IPSL-CM54-MR	143 × 144	149 × 182	
MIROC-ESM	64 × 128	192 × 256	Watanabe et al. (2010)
MIROC-ESM-CHEM	64 × 128	192 × 256	
MPI-ESM-LR	96 × 192	220 × 256	Zanchettin et al. (2013)
MPI-ESM-MR	96 × 192	404 × 802	
MRI-CGCM3	160 × 320	368 × 360	Yukimoto et al. (2012)
NorESM1-M	96 × 144	384 × 320	Bentsen et al. (2012)
NorESM1-ME	96 × 144	384 × 320	

Table S1: List of CMIP5 models used in this study. Resolution is given by the number of grid boxes in latitude by longitude. The selection was made based on available output at the desired time resolution and scenarios.

Name	Resolution	Run period
CanAM4	64 × 128	1950-2009
CCSM4	192 × 288	1979-2008
CESM1-CAM5	92 × 288	1979-2005
CNRM-CM5	128 × 256	1979-2008
HadGEM2-A	144 × 192	1979-2008
IPSL-CM5A-LR	96 × 96	1979-2009
IPSL-CM5B-LR	96 × 96	1979-2008
MIROC5	128 × 256	1979-2008
MPI-ESM-LR	96 × 192	1979-2008
MPI-ESM-MR	96 × 192	1979-2008
MRI-CGCM3	160 × 320	1979-2010

Table S2: List of AMIP models used in this study. Resolution is given by the number of grid boxes in latitude by longitude. The selection was made based on available output at the desired time resolution and scenarios.

Supplementary References

- [1] Arora, V. K., Scinocca, J. F., Boer, G. J., Christian, J. R., Denman, K. L., Flato, G. M., Kharin, V. V., Lee, W. G., and Merryfield, W. J. (2011) Carbon emission limits required to satisfy future representative concentration pathways of greenhouse gases, *Geophys. Res. Lett.* 38: L05805.
- [2] Bentsen, M., Bethke, I., Debernard, J., Iversen, T., Kirkevåg, A., Seland, O., Drange, H., Roelandt, C., Seierstad, I., Hoose, C., and Kristjaánnsson, J. (2012), The Norwegian earth system model, NorESM1-M – Part 1: Description and basic evaluation, *Geosci. Model Dev. Discuss.* 5(3): 2843–2931.
- [3] Bi, D., Dix, M., Marsland, S. J., O’Farrell, S., Rashid, H. A., Uotila, P., Hirst, A. C., Kowalczyk, E., Golebiewski, M., Sullivan, A., Yan, H., Hannah, N., Franklin, C., Sun, Z., Vohralik, P., Watterson, I., Zhou, X., Fiedler, R., Collier, M., Ma, Y., Noonan, J., Stevens, L., Uhe, P., Zhu, H., Griffies, S. M., Hill, R., Harris, C., and Puri, K. (2013) The ACCESS coupled model: description, control climate and evaluation, *Austr. Meteorol. Oceanogr. J.* 63: 41–64.
- [4] Collins, W. J., Bellouin, N., Doutriaux-Boucher, M., Gedney, N., Halloran, P., Hinton, T., Hughes, J., Jones, C. D., Joshi, M., Liddicoat, S., Martin, G., O’Connor, F., Rae, J., Senior, C., Sitch, S., Totterdell, I., Wiltshire, A., and Woodward, S. (2011) Development and evaluation of an earth-system model – HadGEM2, *Geosci. Model Dev.* 4: 1051–1075.
- [5] Dunne, J., John, J., Adcroft, A., Griffies, S., Hallberg, R., Shevliakova, E., Stouffer, R., Cooke, W., Dunne, K., Harrison, M., Krasting, J., Malyshev, S., Milly, P., Phillips, P., Sentman, L., Samuels, B., Spelman, M., Winton, M., Wittenberg, A., and Zadeh, N. (2012) GFDL’s ESM2 global coupled climate–carbon earth system models. Part I: physical formulation and baseline simulation characteristics, *J. Clim.* 25(19): 6646–6665.
- [6] Gent, P. R., Danabasoglu, G., Donner, L. J., Holland, M. M., Hunke, E. C., Jayne, S. R., Lawrence, D. M., Neale, R. B., Rasch, P. J., Vertenstein, M., Worley, P. H., Yang, Z., and Zhang, M. (2011) The Community Climate System Model Version 4, *J. Clim.* 24: 4973–4991.
- [7] Ji, D., Wang, L., Feng, J., Wu, Q., Cheng, H., Zhang, Q., Yang, J., Dong, W., Dai, Y., Gong, D., Zhang, R., Wang, X., Liu, J., Moore, J., Chen, D., and Zhou, M. (2014) Description and basic evaluation of Beijing Normal University earth system model (BNU-ESM) version 1, *Geosci. Model Dev.* 7(5): 2039–2064.
- [8] Li, L., Lin, P., Yu, Y., Wang, B., Zhou, T., Liu, L., Liu, J., Bao, Q., Xu, S., Huang, W., Xia, K., Pu, Y., Dong, L., Shen, S., Liu, Y., Hu, N., Liu, M., Sun, W., Shi, X., Zheng, W., Wu, B., Song, M., Liu, H., Zhang, X., Wu, G., Xue, W., Huang, X., Yang, G., Song, Z., and Qiao, F. (2013) The flexible global ocean-atmosphere-land system model, grid-point version 2: FGOALS-g2, *Adv. Atmos. Sci.* 30(3): 543–560.
- [9] Marti, O., Braconnot, P., Dufresne, J. L., Bellier, J., Benshila, R., Bony, S., Brockmann, P., Cadule, P., Caubel, A., Codron, F., de Noblet, N., Denvil, S., Fairhead, L., Fichet, T., Foujols, M. A., Friedlingstein, P., Goosse, H., Grandpeix, J. Y., Guilyardi, E., Hourdin, F., Krinner, G., Lévy, C., Madec, G., Mignot, J., Musat, I., Swingedouw, D. J., and Talandier, C. (2010) Key features of the IPSL ocean atmosphere model and its sensitivity to atmospheric resolution. *Clim. Dyn.* 34: 1–26.

- [10] Miller, R., Schmidt, G., Nazarenko, L., Tausnev, N., Bauer, S., DelGenio, A., Kelley, M., Lo, K., Ruedy, R., Shindell, D., Aleinov, I., Bauer, M., Bleck, R., Canuto, V., Chen, Y., Cheng, Y., Clune, T., Faluvegi, G., Hansen, J., Healy, R., Kiang, N., Koch, D., Lacis, A., LeGrande, A., Lerner, J., Menon, S., Oinas, V., Pérez García-Pando, C., Perlwitz, J., Puma, M., Rind, D., Romanou, A., Russell, G., Sato, M., Sun, S., Tsigaridis, K., Unger, N., Voulgarakis, A., Yao, M., and Zhang, J. (2014) CMIP5 historical simulations (1850-2012) with GISS Model E2, *J. Adv. Model. Earth Syst.* 6(2): 441–478.
- [11] Neale, R. B., Richter, J. H., Conley, A. J., Park, S., Lauritzen, P. H., Gettelman, A., and Williamson, D. L. (2010) Description of the NCAR Community Atmosphere Model (CAM5.0), NCAR Tech. Rep. NCAR/TN-486+STR, 268 pp.
- [12] Rotstayn, L. D., Collier, M. A., Dix, M. R., Feng, Y., Gordon, H., O’Farrell, S., Smith, I., and Syktus, J. (2010) Improved simulation of Australian climate and ENSO-related rainfall variability in a global climate model with an interactive aerosol treatment, *Int. J. Climatol.* 30: 1067–1088.
- [13] Scoccimarro, E., Gualdi, S., Bellucci, A., Sanna, A., Giuseppe Fogli, P., Manzini, E., Vichi, M., Oddo, P., and Navarra, A. (2011) Effects of tropical cyclones on ocean heat transport in a high-resolution coupled general circulation model, *J. Clim.* 24(16): 4368–4384.
- [14] Voldoire, A., Sanchez-Gomez, E., Salas y Mélia, D., Decharme, B., Cassou, C., Sénési, S., Valcke, S., Beau, I., Alias, A., Chevallier, M., Déqué, M., Deshayes, J., Douville, H., Fernandez, E., Madec, G., Maisonnave, E., Moine, M., Planton, S., Saint-Martin, D., Szopa, S., Tyteca, S., Alkama, R., Belamari, S., Braun, A., Coquart, L., and Chauvin, F. (2013) The CNRM-CM5.1 global climate model: description and basic evaluation, *Clim. Dyn.* 40: 2091–2121.
- [15] Volodin, E. M., Diansky, N. A., and Gusev, A. V. (2010) Simulating present-day climate with the INMCM4.0 coupled model of the atmospheric and oceanic general circulations, *Izvestiya Atmos. Ocean. Phys.* 46: 414–431.
- [16] Watanabe, M., Suzuki, T., O’ishi, R., Komuro, Y., Watanabe, S., Emori, S., Takemura, T., Chikira, M., Ogura, T., Sekiguchi, M., Takata, K., Yamazaki, D., Yokohata, T., Nozawa, T., Hasumi, H., Tatebe, H., and Kimoto, M. (2010) Improved climate simulation by MIROC5: mean states, variability, and climate sensitivity, *J. Clim.* 23: 6312–6335.
- [17] Xin, X., Wu, T., and Zhang, J. (2013) Introduction of CMIP5 experiments carried out with the climate system models of Beijing climate center, *Adv. Clim. Change Res.* 4: 41–49.
- [18] Yukimoto, S., Adachi, Y., Hosaka, M., Sakami, T., Yoshimura, H., Hirabara, M., Tanaka, T., Shindo, E., Tsujino, H., Deushi, M., Mizuta, R., Yabu, S., Obata, A., Nakano, H., Koshiro, T., and Ose, T. A. (2012) A new global climate model of the meteorological research institute: MRI-CGCM3 – model description and basic performance, *J. Meteorol. Soc. Jpn.* 90A: 23–64.
- [19] Zanchettin, D., Rubino, A., Matei, D., Bothe, O., and Jungclaus, J. (2013) Multidecadal-to-centennial SST variability in the MPI-ESM simulation ensemble for the last millennium, *Clim. Dyn.* 40: 1301–1318.