

GENERAL INFORMATION

1. Title of Dataset: Supporting data for McHugh et al. 2023, "Using Large Ensembles to Examine Historical and Projected Changes in Record-Breaking Summertime Temperatures over the Contiguous United States."

2. Creators/Author list Information (author list on paper? Different order?)

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3. Date of data collection (single date, range, approximate date) 2017, 2020-2021:

4. Geographic location of data collection: The Geophysical Fluid Dynamics Laboratory (GFDL) of the National Oceanic and Atmospheric Administration (NOAA) in Princeton, NJ.

5. Information about funding sources that supported the collection of the data: N/A

SHARING/ACCESS INFORMATION

1. Licenses/restrictions placed on the data:

These data were produced by NOAA and are not subject to copyright protection in the United States. NOAA waives any potential copyright and related rights in these data worldwide through the Creative Commons Zero 1.0 Universal Public Domain Dedication (CC0-1.0).

2. Links to publications that were used as references, or that cite or use the data:

Delworth, T. L., Cooke, W. F., Adcroft, A., Bushuk, M., Chen, J.-H., Dunne, K. A., et al. (2020). SPEAR: The Next Generation GFDL Modeling System for Seasonal to Multidecadal Prediction and Projection. *Journal of Advances in Modeling Earth Systems*, 12(3), e2019MS001895. <https://doi.org/10.1029/2019MS001895>

Vecchi, G. A., Delworth, T., Gudgel, R., Kapnick, S., Rosati, A., Wittenberg, A. T., et al. (2014). On the Seasonal Forecasting of Regional Tropical Cyclone Activity. *Journal of Climate*, 27(21), 7994–8016. <https://doi.org/10.1175/JCLI-D-14-00158.1>

3. Links to other publicly accessible locations of the data: N/A

4. Links/relationships to ancillary data sets: N/A

5. Was data derived from another source? No

6. Recommended citation for this dataset: Colleen E. McHugh, Thomas L. Delworth, William Cooke, Liwei Jia (2023). Supporting data for McHugh et al., 2023 [Data set]. Geophysical Fluid Dynamics Laboratory, November, 2023.

DATA & FILE OVERVIEW

1. File List:

The directory contains a list of individual compressed tar.gz files organized by file name consisting of the model, experiment, model component, frequency, and variable as follows for the GFDL FLOR and SPEAR models:

flor.experiment.component_frequency.variable.tar.gz

spear.experiment.component_frequency.variable.tar.gz

Each tar.gz file consists of individual NetCDF files for ensembles 1-30 organized by file name consisting of the model, experiment, ensemble member, component, frequency, time period, and variable. The daily data is available from June 1 to August 31 for each year listed below over the CONUS geographical region.

Natural: 1991-2100

Historical: 1991-2020

RCP85, SSP245, SSP534OS, SSP585: 2021-2100

An example file name for the flor historical ensemble member 1 data is:

flor.historical.ens_01.atmos_daily.1991-2020.jja.conus.t_ref_max.nc

Each tar.gz file also contains static variables for the land and lake fields. The file `atmos_daily.static.nc` contains the land mask variable, `land_mask`. The file `land.static.nc` contains the lake mask variable, `frac_lake`.

flor.historical.atmos_daily.t_ref_max.tar.gz

flor.rcp85.atmos_daily.t_ref_max.tar.gz

spear.historical.atmos_daily.t_ref_max.tar.gz

spear.natural.atmos_daily.t_ref_max.tar.gz

spear.ssp245.atmos_daily.t_ref_max.tar.gz

spear.ssp534os.atmos_daily.t_ref_max.tar.gz

spear.ssp585.atmos_daily.t_ref_max.tar.gz

2. Relationship between files, if important: N/A

3. Additional related data collected that was not included in the current data package: N/A

4. Are there multiple versions of the dataset? No

METHODOLOGICAL INFORMATION

1. Description of methods used for collection/generation of data:

This dataset contains model output from the coupled global climate models SPEAR and FLOR, both developed at GFDL. For more information on the model designs, see Delworth et al. (2020) and Vecchi et al. (2014) for SPEAR and FLOR respectively.

The simulations use forcings described in Riahi et al., 2011, O'Neill et al., 2016, van Vuuren et al., 2014.

Delworth, T. L., Cooke, W. F., Adcroft, A., Bushuk, M., Chen, J.-H., Dunne, K. A., et al. (2020). SPEAR: The Next Generation GFDL Modeling System for Seasonal to Multidecadal Prediction and Projection. *Journal of Advances in Modeling Earth Systems*, 12(3), e2019MS001895. <https://doi.org/10.1029/2019MS001895>

O'Neill, B. C., Tebaldi, C., van Vuuren, D. P., Eyring, V., Friedlingstein, P., Hurtt, G., et al. (2016). The Scenario Model Intercomparison Project (ScenarioMIP) for CMIP6. *Geoscientific Model Development*, 9(9), 3461–3482. <https://doi.org/10.5194/gmd-9-3461-2016>

Riahi, K., Rao, S., Krey, V., Cho, C., Chirkov, V., Fischer, G., et al. (2011). RCP 8.5—A scenario of comparatively high greenhouse gas emissions. *Climatic Change*, 109(1), 33. <https://doi.org/10.1007/s10584-011-0149-y>

Vecchi, G. A., Delworth, T., Gudgel, R., Kapnick, S., Rosati, A., Wittenberg, A. T., et al. (2014). On the Seasonal Forecasting of Regional Tropical Cyclone Activity. *Journal of Climate*, 27(21), 7994–8016. <https://doi.org/10.1175/JCLI-D-14-00158.1>

van Vuuren, D. P., Kriegler, E., O'Neill, B. C., Ebi, K. L., Riahi, K., Carter, T. R., et al. (2014). A new scenario framework for Climate Change Research: scenario matrix architecture. *Climatic Change*, 122(3), 373–386. <https://doi.org/10.1007/s10584-013-0906-1>

2. Methods for processing the data:

The simulations were performed on the GAEA supercomputer at Oak Ridge National Laboratory (ORNL), Oak Ridge, TN. Raw model output was post-processed at NOAA GFDL using the FMS Runtime Environment (FRE).

A subset of the post-processed model output daily maximum temperature (`t_ref_max`) data over the time period 1921-2100 was taken for June 1 to August 31 over the CONUS geographical area using Climate Data Operators (`cdo`) and NetCDF Operators (`nco`) tools.

3. Instrument- or software-specific information needed to interpret the data:

Any software that interprets NetCDF dataset can be used to read this data.

4. Standards and calibration information, if appropriate: Metadata are as-is from the GFDL post-processing workflow and may have internal naming conventions.

5. Environmental/experimental conditions:

6. Describe any quality-assurance procedures performed on the data: N/A

7. People involved with sample collection, processing, analysis and/or submission:

Co-authors listed on this dataset: Colleen E. McHugh, Thomas L. Delworth, William Cooke, Liwei Jia

Modeling Workflow: GFDL Modeling Systems Division

DATA-SPECIFIC INFORMATION FOR: NetCDF files in tar.gz files

1. Number of variables: 1

2. Number of cases/rows: N/A

3. Variable List:

`t_ref_max`; maximum temperature; K

4. Missing data codes: N/A

5. Specialized formats or other abbreviations used: N/A

DATA-SPECIFIC INFORMATION FOR: atmos_daily.static.nc

1. Number of variables: 1

2. Number of cases/rows: N/A

3. Variable List:

land_mask; land mask

4. Missing data codes: N/A

5. Specialized formats or other abbreviations used: N/A

DATA-SPECIFIC INFORMATION FOR: land.static.nc

1. Number of variables: 1

2. Number of cases/rows: N/A

3. Variable List:

frac_lake; land fraction

4. Missing data codes: N/A

5. Specialized formats or other abbreviations used: N/A