Anthropogenic forcing has increased the risk of longer-traveling and slower-moving large contiguous heatwaves

1. Codes information

1.1 Contiguous heatwaves-Figure.2.py:

Code to analyze the spatial distribution of the contiguous heatwaves. The code includes five sections: Functions, Plot of the distribution of the centroids of the contiguous heatwaves, Plot of the changes in the accumulated area and intensity with latitude, Plot of the distribution of the movement of the contiguous heatwaves, Plot of the rose diagram of the directional distribution of the moving distance of the contiguous heatwaves.

1.2 Contiguous heatwaves-Figure.3.py:

Code to analyze the observed temporal changes of contiguous heatwaves during 1979–2020 based on the ERA5, MERRA2, and NCEP2 datasets. The code includes three sections: Functions, Calculate the long-term trends of contiguous heatwaves and plot the temporal changes in the heatwave metrics, Plot the temporal changes in the eddy kinetic energy (EKE) and zonal wind (U) at the 500 hPa level.

1.3 Contiguous heatwaves-Figure.4.py:

Code to analyze the simulated temporal changes of the contiguous heatwaves during 1979–2020. The contiguous heatwaves are tracked based on the CMIP6 simulations under hist-GHG, hist-ALL, and hist-NAT forcings. The code includes three sections: Functions, Calculate the long-term trends of contiguous heatwaves and plot the temporal changes in the heatwave metrics, Plot the temporal changes in the eddy kinetic energy (EKE) and zonal wind (U) at the 500 hPa level.

2. Data information

2.1 Contiguous heatwave events

See Methods section of the paper for a detailed description about how to track the contiguous heatwaves. The tracked contiguous heatwave events are saved as the PICKLE format, which are publicly available in the "Data" folder at https://github.com/sjwu9407/Contiguous_heatwaves/. The data can be used directly for analysis in the paper and results obtained.

2.2 EKE and zonal wind

Eddy kinetic energy (EKE) and zonal wind (U) at the 500 hPa level are calculated to understand the dynamic evolution properties including the moving distance and speed of contiguous heatwaves. The data of EKE and U at the 500 hPa level are publicly available at https://doi.org/10.5281/zenodo.8385167. The data can be used directly for analysis in the paper and results obtained.

2.3 Original raw datasets

Due to size of the original raw datasets used in this paper, we only provide the URLs to download these datasets. Data analyzed in the paper is publicly available from the following sources:

a) The ERA5 data are downloaded from https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-single-levels?tab=overview.

b) The MERRA2 data are available from https://disc.gsfc.nasa.gov/datasets/M2T1NXSLV_5.12.4/summary.

c) The NCEP2 data are available through https://psl.noaa.gov/data/gridded/data.ncep.reanalysis2.html.

d) The CMIP6 model simulations are available from https://esgf-node.llnl.gov/search/cmip6/.