Persistent Urban Heat

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**Section 1: performing the analysis related to the control simulation in the paper.**

1, put all CESM outputs, urban fraction per grid cell (pct\_urban\_0.9x1.25\_global.nc), and surface input data (surfdata\_0.9x1.25\_16pfts\_Irrig\_CMIP6\_simyr2000\_c170824.nc) into a folder. Below is my folder:

/projectnb/urbanclimate/public/CLM\_output/urban\_I2000Clm50Sp\_f09\_g17\_regular\_roof/lnd/hist2/

2, run readin\_data.m. This will produce data1.mat

3, run compute\_mask.m. This is to find out the urban grid cells and land grid cells and will produce mask\_urban\_and\_rural.mat.

4, run compute\_mu.m. This is for computing the urban thermal inertia and will produce mu\_data.mat.

5, run do\_T2.m, which will do the following:

compute\_detrending (This will produce data2.mat)

compute\_autocorrelation (This will produce autocorrelation.mat)

compute\_spectra (This will produce spectra\_data.mat)

compute\_gamma (This will produce gamma.mat)

6, run do\_TS.m, which will do the following:

compute\_detrending\_Ts (This will produce data2\_Ts.mat)

compute\_autocorrelation\_Ts (This will produce autocorrelation\_Ts.mat)

compute\_spectra\_Ts (This will produce spectra\_data\_Ts.mat)

compute\_gamma\_Ts (This will produce gamma\_Ts.mat)

7, run do\_seasonal.m which will perform the following.

compute\_autocorrelation\_spring (This will produce autocorrelation\_spring.mat)

compute\_gamma\_spring (This will produce gamma\_spring.mat)

compute\_autocorrelation\_summer (This will produce autocorrelation\_summer.mat)

compute\_gamma\_summer (This will produce gamma\_summer.mat)

compute\_autocorrelation\_autumn (This will produce autocorrelation\_autumn.mat)

compute\_gamma\_autumn (This will produce gamma\_autumn.mat)

compute\_autocorrelation\_winter (This will produce autocorrelation\_winter.mat)

compute\_gamma\_winter (This will produce gamma\_ winter.mat)

8, run compute\_To.m. This will produce To.mat, which is the integral time scale free of the red noise assumption.

9, run do\_plot.m, which will perform the following

plot\_autocorrelation\_example\_final (This will produce Figure 1 A, B, C and Figure S1 A)

plot\_autocorrelation\_example\_Ts\_final (This will produce Figure 1 D, E, F and Figure S1 B)

plot\_autocorrelation\_map (This will produce Figure 2A)

plot\_autocorrelation\_map\_Ts (This will produce Figure 2B)

plot\_autocorrelation\_map\_spring (This will produce Figure S2A).

plot\_autocorrelation\_map\_summer (This will produce Figure S2B).

plot\_autocorrelation\_map\_autumn (This will produce Figure S2C).

plot\_autocorrelation\_map\_winter (This will produce Figure S2D).

plot\_mu\_map (This will produce Figure 2C and Figure S3)

plot\_persistence\_inertia (This will produce Figure 2D)

plot\_compare\_To\_AR1 (This will produce Figure S4).

**Section 2: performing the analysis related to the uniform simulations in the paper**

13, run readin\_data\_uniform.m. The required CESM outputs are similar to those in the control run. Also required is the surfdata. The 6 runs are named as follows:

A close-up of a code

Description automatically generated

14, run plot\_uniform.m (This will produce Figure 3).