**README**

This file contains a summary of data and code used in the paper:

M. O. Cuthbert, G. C. Rau, M. Ekström, D. M O’Carroll & A. J. Bates (2022). Global climate-driven trade-offs between the water retention and cooling benefits of urban greening. Nature Communications. <https://doi.org/10.1038/s41467-022-28160-8>

The data is archived under: <https://dx.doi.org/10.6084/m9.figshare.17049806>

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**PLEASE ACKNOWLEDGE WITH A CITATION OF THE PAPER IF YOU USE THESE DATA OR TOOLS (OR DERIVE A VARIATION FROM THEM) - THANK YOU!**

**NetCDF Files**

Outputs are provided for potential evapotranspiration for all scenarios (filename subscript: ALL) as well as the following different urban greening scenarios as follows:

* extensive substrates, 50 mm thick (filename subscript: EXT)
* intensive substrates, 150 mm thick (filename subscript: INT)
* deep substrates, 1000 mm thick (filename subscript: DEEP)
* intensive substrates, plus irrigation at 25% of PET on no-raindays (filename subscript: INT\_25)
* intensive substrates, plus irrigation at 50% of PET on no-raindays (filename subscript: INT\_50)

Values (in 32bit float format) for each scenario are provided in a separate NetCDF file consisting of global distributions, on a 0.25° spatial resolution grid, of the following modelled variables:

* actual evapotranspiration (AET, mm/d)
* retention fraction (RET, -)
* cooling potential (CP, -)

**GeoTIFF** **Files**

For convenience for mapping the outputs, GeoTIFFs are also provided on a 0.25° spatial resolution grid for the global distribution of PET, and for the AET, RET and CP of each scenario (listed above). The filename subscripts are the same as for the NetCDF files.

**Global Surface Summary of the Day (GSOD) Lookup Table**

We have provided a spreadsheet called “urban\_greening\_GSOD\_INT.xlsx”. This is based on using GSOD observations and our global calculation of PET as input for our model to produce the output listed in the table below (see paper for methodological details).

|  |  |
| --- | --- |
| **Column name** | **Description** |
| Precipitation (mm/d) | Mean GSOD precipitation. |
| PET (mm/d) | Potential evapotranspiration estimated from ERA5 daily climate data. |
| Retention\_INT (%) | Average retention estimated from our model using GSOD daily precipitation and our calculated PET for an intensive (150 mm thick) substrate. |
| AET\_INT (mm/d) | Average actual evapotranspiration estimated from our model using GSOD daily precipitation and our calculated PET for an intensive (150 mm thick) substrate. |

**Global Urban Heat Island (UHI) Lookup Table**

To enable quick lookup of our results for RET and CP in any urban area we have provided a spreadsheet called “urban\_greening\_UHI\_INT.xlsx”. The foundation for this is the “Global Urban Heat Island (UHI) Data Set, 2013” (<http://dx.doi.org/10.7927/H4H70CRF>).

We complemented this dataset with results from our global model using ERA5 data for 2000-2017. The latitude and longitude value for each city was matched to the closest grid cell of our model output and the values were then merged into the spreadsheet.

The first columns (A-R) contain unchanged data from the original dataset. The following columns were added in our work:

|  |  |
| --- | --- |
| **Column name** | **Description** |
| PET (mm/d) | Potential evapotranspiration estimated from ERA5 daily climate data. |
| ERA5\_P (mm/d) | Precipitation extracted from ERA5 daily climate data. |
| AET (mm/d) | Actual evapotranspiration estimated from ERA5 daily climate data for an intensive (150 mm thick) substrate using our model. |
| ERA5\_radius (pixels) | Distance (in pixels) of the value from the closest matching cell. A value > 0 shows that no data was available in the closest ERA5 grid cell. |
| ERA5\_RET (mm/d) | Retention calculated as ERA5\_AET/ERA5\_P |
| ERA5\_CP (mm/d) | Cooling potential calculated as ERA5\_AET/ERA5\_PET. |

**Urban Greening Soil Moisture Balance Python Code**

The soil moisture balance model used for the retention and AET calculations in the paper is given in the file:

SMBM.py

A dummy climate input data file is also given as an example of the file format required by the code which includes hypothetical daily time series of precipitation and potential evapotranspiration:

SMBMInputData.xlsx

Running the code should generate the following output file containing calculated values for drainage, actual evaporation, retention and cumulative values of the main variables:

SMBMOutputData.xlsx