R version 4.1 and Matlab2016b were used.

To install R, visit https://cran.r-project.org/bin/windows/base/old/4.2.2/.

To install Matlab, visit https://www.mathworks.com/products/matlab.html.

Data format and preprocessing: The data format for eddy covariance measurements is 'CSV'. MATLAB reads the CSV data and conducts initial quality control, ensuring that only measured and high-quality data (QC = 0 or 1) is used. For satellite datasets, the data format is 'nc'. MATLAB reads the NetCDF data and applies quality control following the guidelines specific to each dataset. Daily EF, SM and dLST are saved as ‘mat’ format.

1. Running SM dry-down identification.m to find soil drydowns and save the data; For example, ‘SM dry-down identification.m’ reads in ‘SM\_SCA-V\_2020.mat’ and ‘Delta\_LST\_2020.mat’ files to find soil drydowns for each pixel.

2. Running SM threshold estimation.R to estimate the soil moisture threshold;

3. Running RandomForest recursive feature elimination (RFE) analysis.R and RandomForest Importance and SHAP calculation.R to get the Random Forest results;

4. Running Plot Fig1-5.m to generate the figures in main text.