HOW TO GENERATE ANNUAL RASTERS OF EVAPOTRANSPIRATION, LAND SURFACE TEMPERATURE, AND PRECIPITATION

*by Yunuen Reygadas, Amazon Borderland Spatial Analysis Team (ABSAT), University of Richmond. September, 2022.

A. Rasters of annual evapotranspiration total

Requirements: ArcGIS license

1. Go to https://earlywarning.usgs.gov/fews/product/460
2. Click on "Download"
3. Under "Select Product", select "Monthly Actual ET"
4. Select the desired date, year and month. Data are available since 2003.
5. Click on "Download Data"
6. Store all rasters in the same folder and do not rename them
7. As this is a global- monthly dataset, to create annual rasters clipped to the desired study area run the "ET_AnnualRasters.py" script (available here: https://github.com/yreygadas/AnnualRastersOf_ET_LST_P/tree/main):
    a. Open the script using a Python Integrated Development Environment (e.g., IDLE ArcGIS pro, PyScripter)
    b. Enter the user-define parameters:

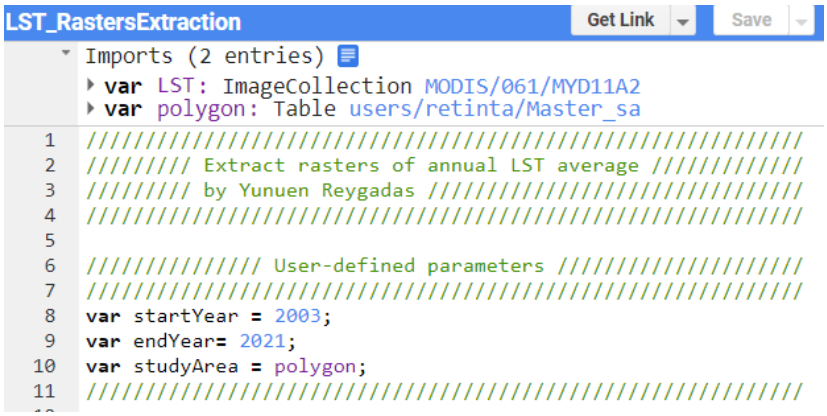
```
################################################################################
# SET BEFORE RUNNING THE SCRIPT
startYear= 2021
endYear= 2021
path =  'D:/Yunuen/6PostDoc/Data/ET/Rasters' #This is the directory in which you have the ET rasters
studyArea= 'D:/Yunuen/6PostDoc/Data/Transfer/Layers/Extended_sa.shp' # This is the study area polygon in .shp format
cellSize = 'D:/Yunuen/6PostDoc/Data/ET/Rasters/m200301_modisSSEBopETv5_actual_mm.tif' # This is any of the ET rasters
################################################################################`
```

        i. startYear= this is the star year of the desired study period.
        ii. endYear= this is the end year of the desired study period.
        iii. path = this the directory where all the global-monthly ET rasters are located.
        iv. studyArea= this is the name and location of the shapefile that delimits the polygon of the desired study area.
        v. cellSize = this is the name and location of any of the global-monthly ET rasters. It serves to set the cell size of the output rasters.
    c. Run the script, the annual rasters should appear in the same folder you have the monthly rasters. They will be named as "ET_YEAR.tif"
8. Be aware of the rasters' metadata:
    a. Source: Operational Simplified Surface Energy Balance (SSEBop) Actual Evapotranspiration Product
    b. Units: mm/year
    c. Spatial resolution: 1-km
    d. Spatial reference: GCS WGS84

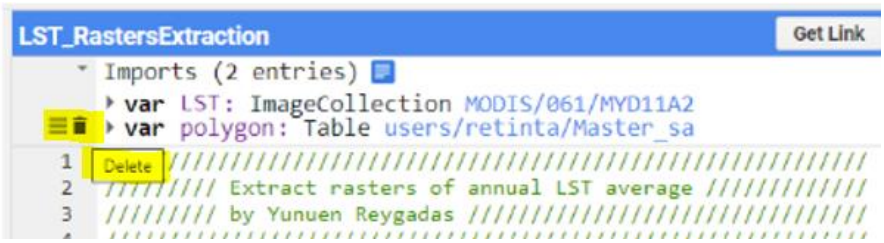
B. Rasters of annual Land Surface Temperature average

Requirements: Google Earth Engine account (go to https://earthengine.google.com/new_signup/ to create an account)

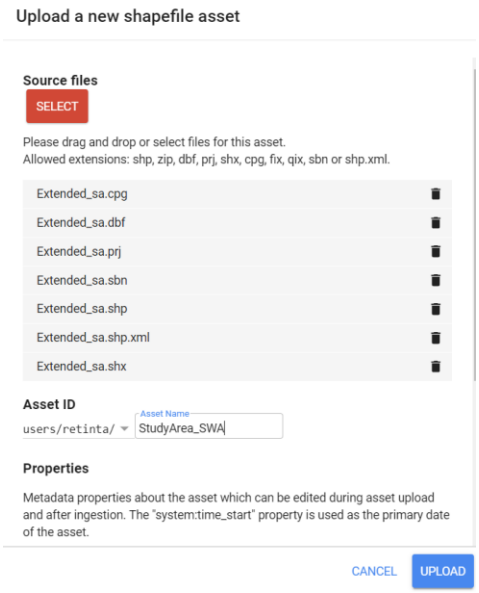
1. Go to https://code.earthengine.google.com/?scriptPath=users%2Fretinta%2FRastersExtraction%3ALST_RastersExtraction
2. Enter the user-defined parameters:

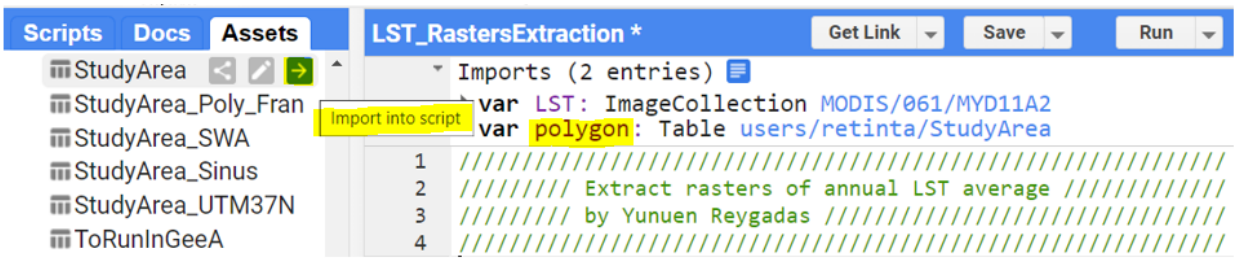


   a. First, delete the current study area.



   b. Then, import yours. To import your study area, go to the "Assets" tab, click on "New" and then on "shape files". A new window will appear, click on "select", navigate to the folder where you have the files associated with the shapefile that delimits your study area, and select the files. Under "Asset ID" enter a location and a name for the asset. Finally, click on "upload". Once your asset is uploaded, place the cursor over the asset, click the "arrow button" to import it into the script, and change its name from "table" to "polygon".





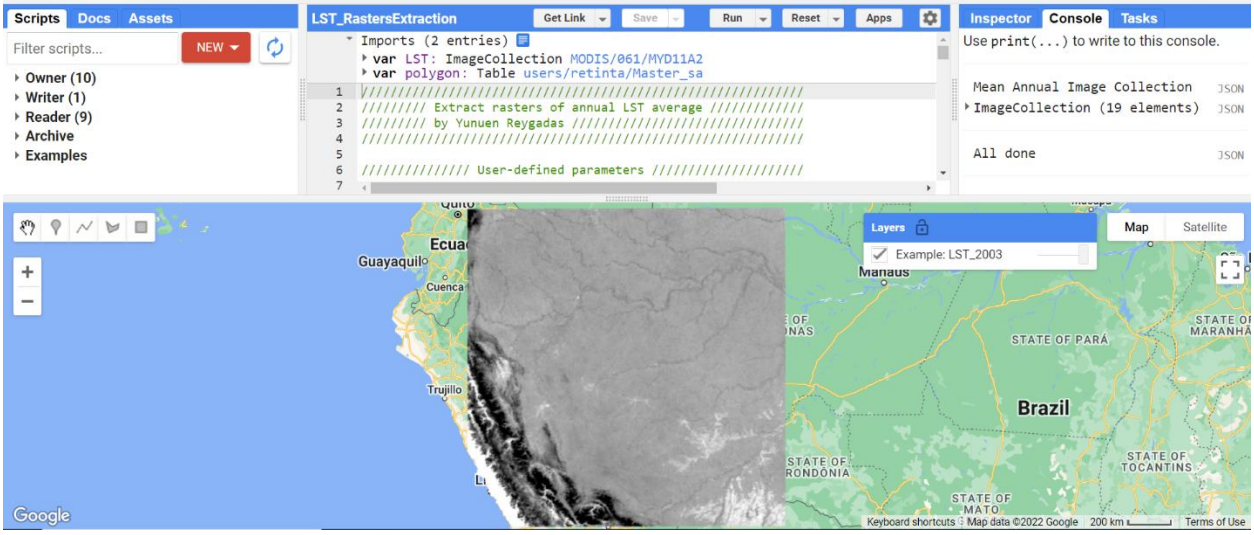
c. Enter the desired start and end year (data are available since 2003).

d. Enter the study area. The name has to be “polygon”.

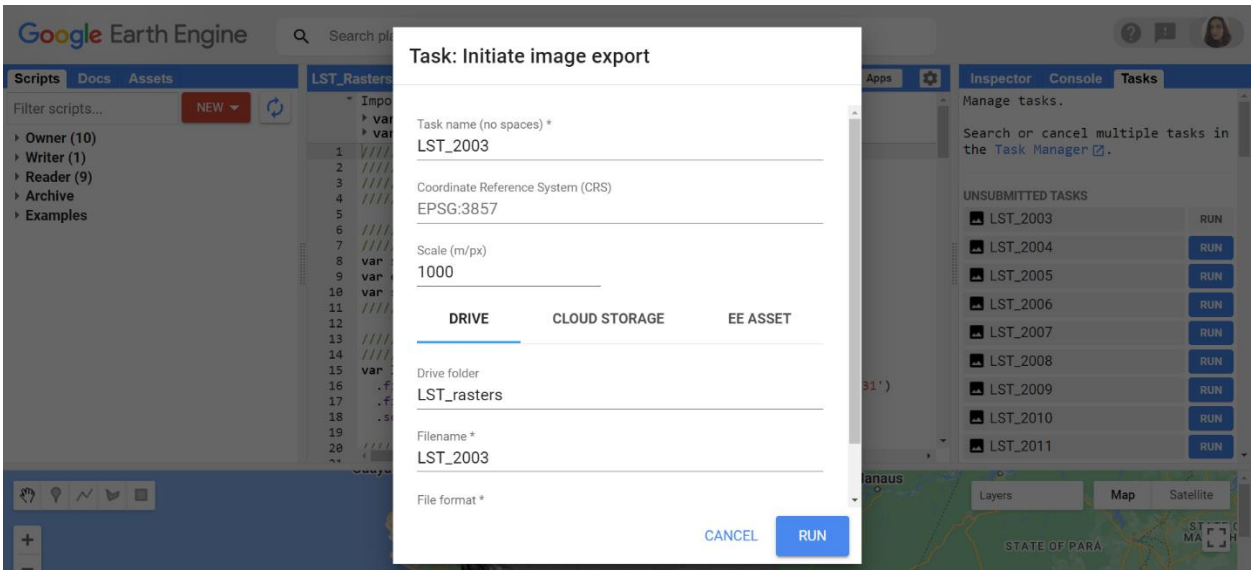
3. Run the script

4. Review the results and download them to google drive

a. In the map, see an example (the earliest year) of the annual maps generated



b. In the “Tasks” tab, click run on each of the annual maps, a new window will appear, click run again. Repeat this step for each of the annual maps. All maps will be downloaded to google drive within a folder called “LST_rasters”.

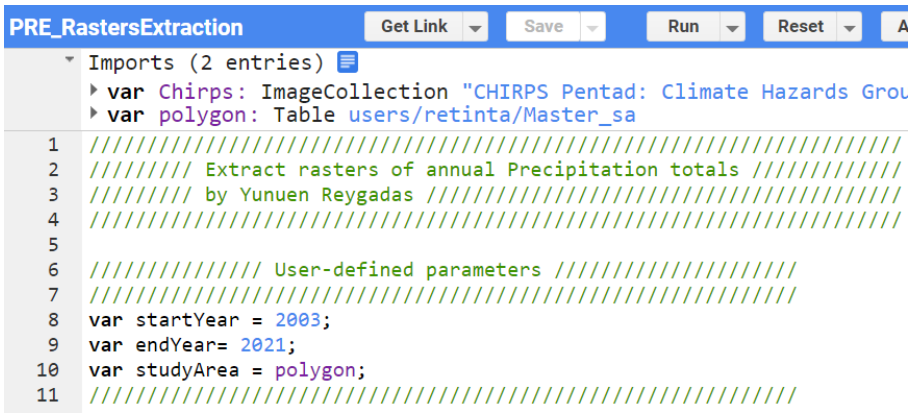


5. Be aware of the rasters' metadata:
    a. Source: MYD11A2.061 Aqua Land Surface Temperature and Emissivity 8-Day Global 1km
    b. Units: ^{o}C/year
    c. Spatial resolution: 1-km
    d. Spatial reference: GCS WGS84
    e. Extension: Acre-Brazil and Loreto, Madre de Dios, and Ucayali-Peru

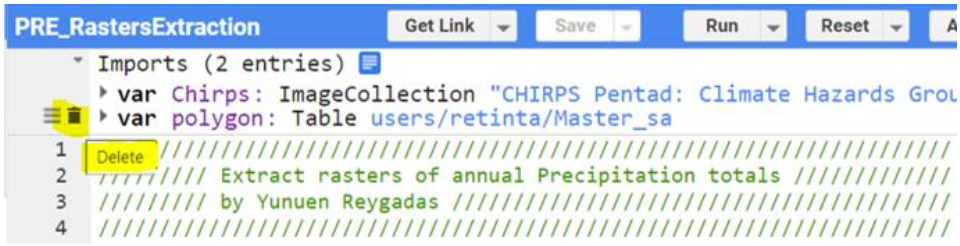
C. Rasters of annual precipitation total

Requirements: Google Earth Engine account (go to https://earthengine.google.com/new_signup/ to create an account)

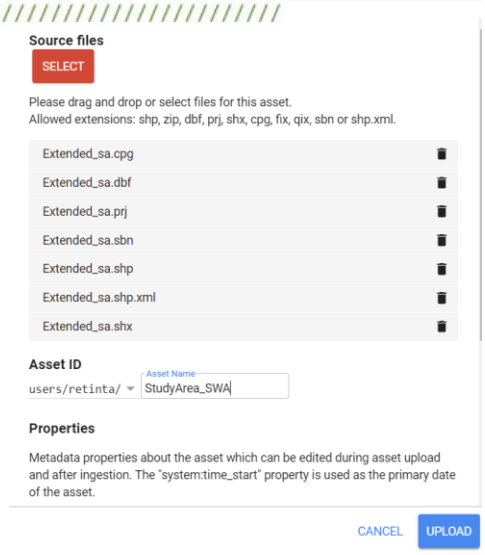
1. Go to https://code.earthengine.google.com/?scriptPath=users%2Fretinta%2FRastersExtraction%3APRE_RastersExtraction
2. Enter the user-defined parameters:

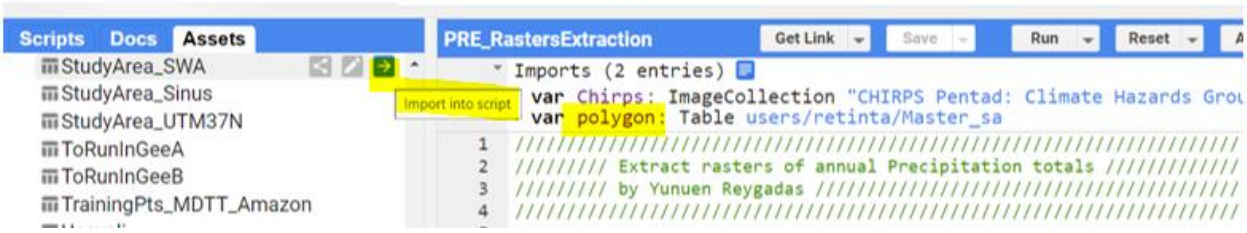


   a. First, delete the current study area.



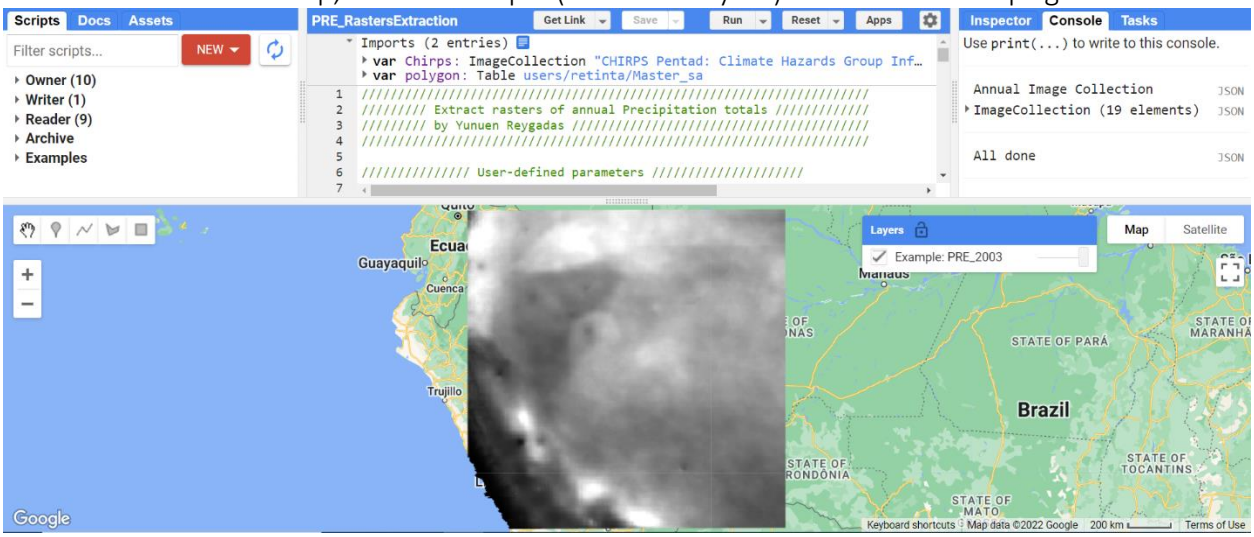
   b. Then, import yours. To import your study area, go to the "Assets" tab, click on "New" and then on "shape files". A new window will appear, click on "select", navigate to the folder where you have the files associated with the shapefile that delimits your study area, and select the files. Under "Asset ID" enter a location and a name for the asset. Finally, click on "upload". Once your asset is uploaded, place the cursor over the asset, click the "arrow button" to import it into the script, and change its name from "table" to "polygon".



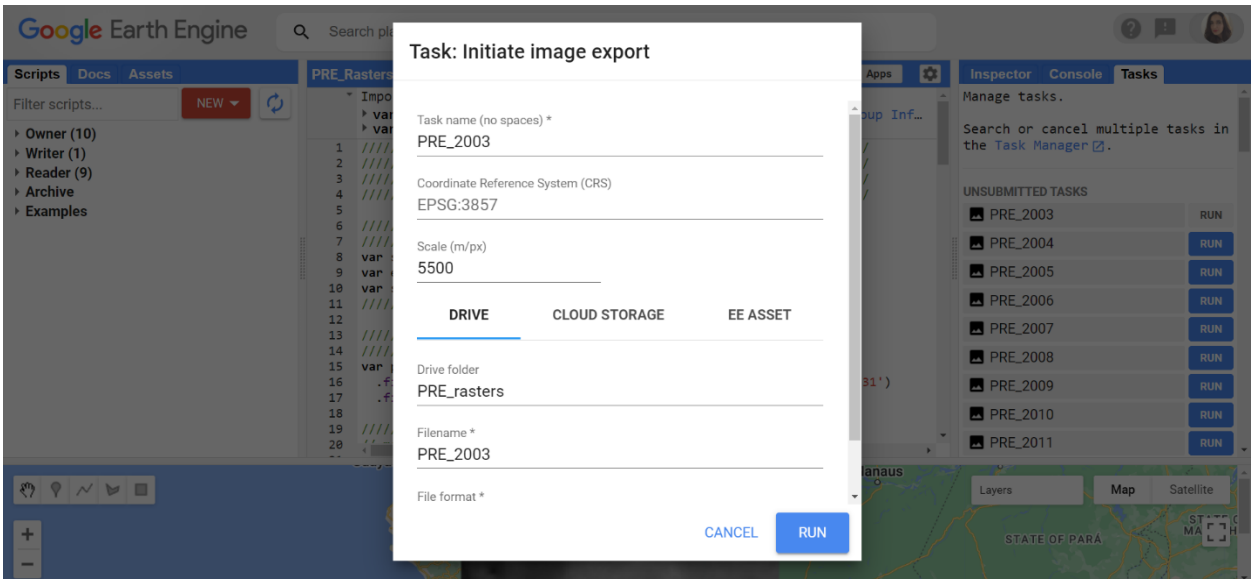


c. Enter the desired start and end year (data are available since 2003).
d. Enter the study area. The name has to be “polygon”.

3. Run the script
4. Review the results and download them to google drive
    a. In the map, see an example (the earliest year) of the annual maps generated



b. In the “Tasks” tab, click run on each of the annual maps, a new window will appear, click run again. Repeat this step for each of the annual maps. All maps will be downloaded to google drive within a folder called “PRE_rasters”.



5. Be aware of the rasters' metadata:
    a. Source: CHIRPS Pentad: Climate Hazards Group InfraRed Precipitation With Station Data (Version 2.0 Final)
    b. Units: mm/year
    c. Spatial resolution: 0.05° (~5-km)
    d. Spatial reference: GCS WGS84