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

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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 RUNING THE SCRIPT
startYear= 2022
endYear= 2022
path = arcpy.env.workspace = 'D:/Yunuen/6PostDoc/Data/ET/Rasters' #This is the directory in which you have the ET rasters
arcpy.env.mask = 'D:/Yunuen/6PostDoc/Data/Transfer/Layers/Extended_sa.shp' # This is the study area polygon
arcpy.env.cellSize = 'D:/Yunuen/6PostDoc/Data/ET/Rasters/m200301_modisSSEBopETv5_actual_mm.tif' # This is any of the ET rasters
arcpy.env.snapRaster = 'D:/Yunuen/6PostDoc/Data/ET/Rasters/m200301_modisSSEBopETv5_actual_mm.tif' # This is any of the ET rasters
################################################################################`
```
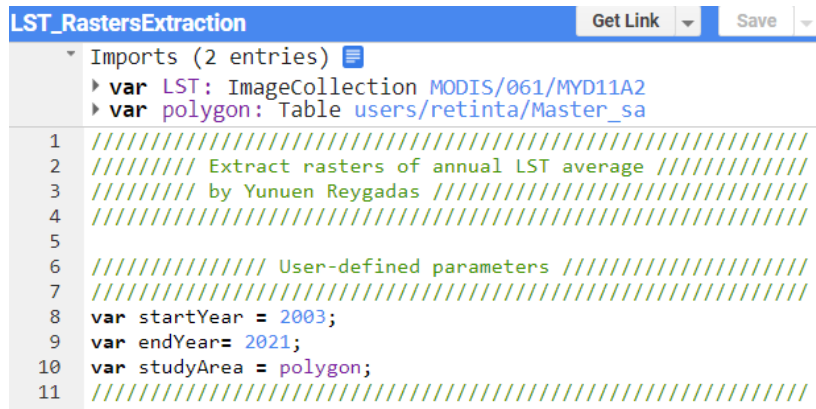
   Make sure you have all global-monthly rasters in the same folder.
   c. Run the script, the annual rasters should appear in the same folder you have the monthly rasters. They will be named as "ET_YEAR.tif"
8. Be aware of the rasters' metadata:
   a. Source: Operational Simplified Surface Energy Balance (SSEBop) Actual Evapotranspiration Product
   b. Units: mm/year
   c. Spatial resolution: 1-km
   d. Spatial reference: GCS WGS84
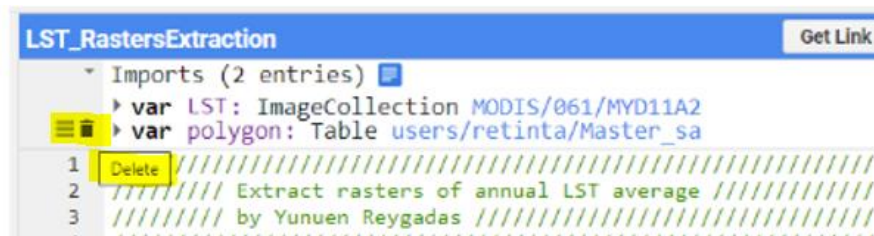
B. Rasters of annual Land Surface Temperature average

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
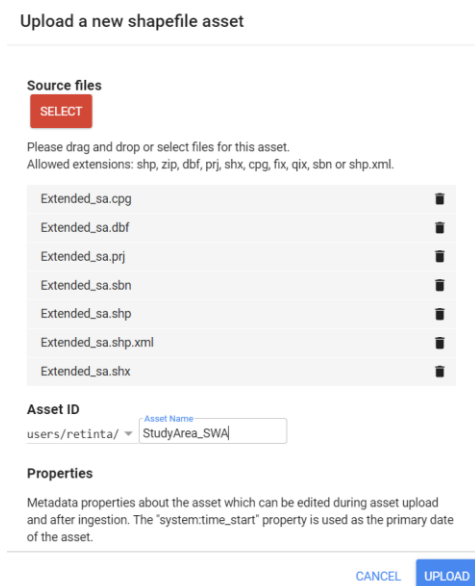
2. Enter the user-defined parameters:

   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.
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
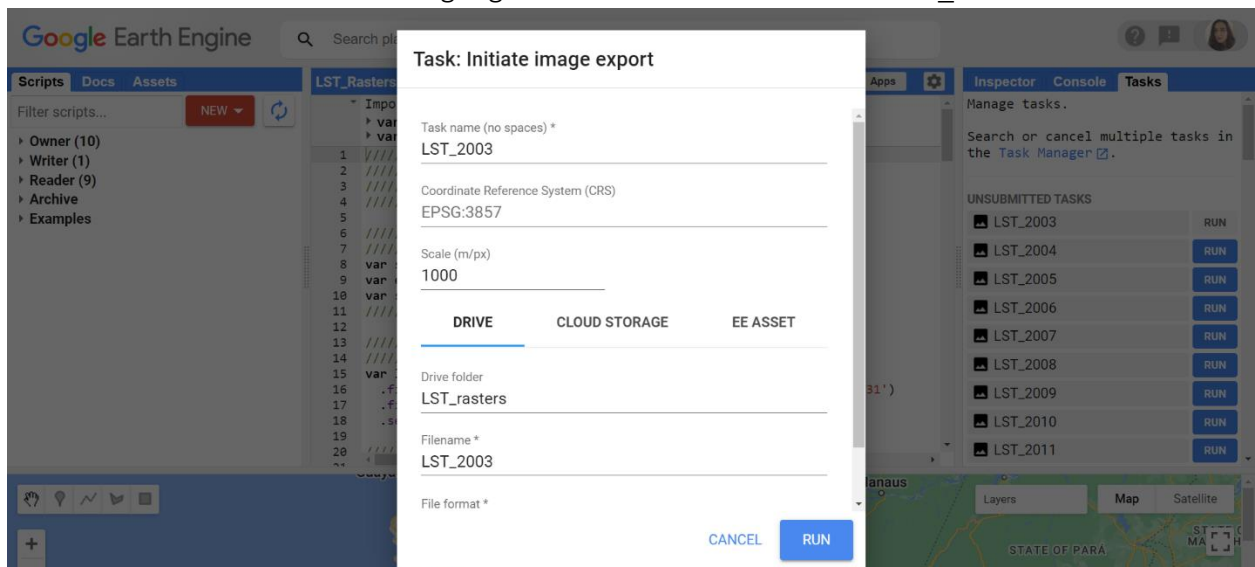

b. In the "Tasks" tab, click run on each of the annual maps, a new window will appear, click run again. Repeat this step for each of the annual maps. All maps will be downloaded to google drive within a folder called "LST_rasters".

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:


```
PRE_RastersExtraction        Get Link  ▾    Save  ▾      Run  ▾     Reset  ▾   A
    ▾ Imports (2 entries) ▤
        ▸ var Chirps: ImageCollection "CHIRPS Pentad: Climate Hazards Grou
        ▸ var polygon: Table users/retinta/Master_sa
   1  //////////////////////////////////////////////////////////////
   2  ///////// Extract rasters of annual Precipitation totals //////////////
   3  ///////// by Yunuen Reygadas //////////////////////////////////////
   4  //////////////////////////////////////////////////////////////
   5
   6  /////////////// User-defined parameters ///////////////////////
   7  //////////////////////////////////////////////////////////////
   8  var startYear = 2003;
   9  var endYear= 2021;
  10  var studyArea = polygon;
  11  //////////////////////////////////////////////////////////////
```

   a. First, delete the current study area.


```
PRE_RastersExtraction        Get Link  ▾    Save  ▾      Run  ▾     Reset  ▾   A
    ▾ Imports (2 entries) ▤
        ▸ var Chirps: ImageCollection "CHIRPS Pentad: Climate Hazards Grou
≡🗑  ▸ var polygon: Table users/retinta/Master_sa
   1  Delete //////////////////////////////////////////////////////////////
   2  ////////// Extract rasters of annual Precipitation totals //////////////
   3  ///////// by Yunuen Reygadas //////////////////////////////////////
   4  //////////////////////////////////////////////////////////////
```

   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".

Source files

SELECT

Please drag and drop or select files for this asset.
Allowed extensions: shp, zip, dbf, prj, shx, cpg, fix, qix, sbn or shp.xml.

Extended_sa.cpg   🗑
Extended_sa.dbf   🗑
Extended_sa.prj   🗑
Extended_sa.sbn   🗑
Extended_sa.shp   🗑
Extended_sa.shp.xml   🗑
Extended_sa.shx   🗑

Asset ID

users/retinta/ ▾   Asset Name: StudyArea_SWA|

Properties

Metadata properties about the asset which can be edited during asset upload and after ingestion. The "system:time_start" property is used as the primary date of the asset.

CANCEL   UPLOAD

c. Enter the desired start and end year. Data are available since 2003.

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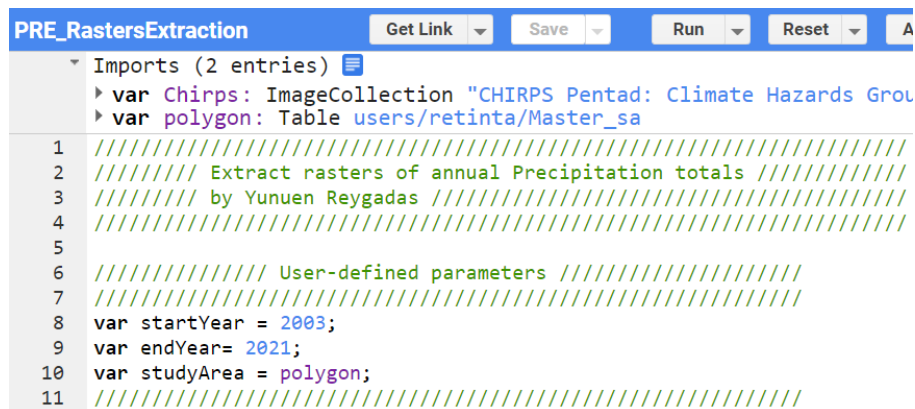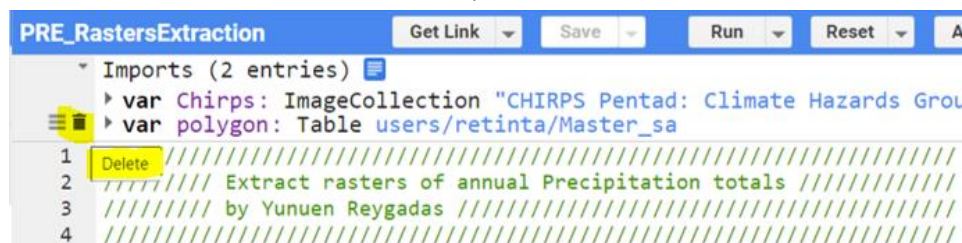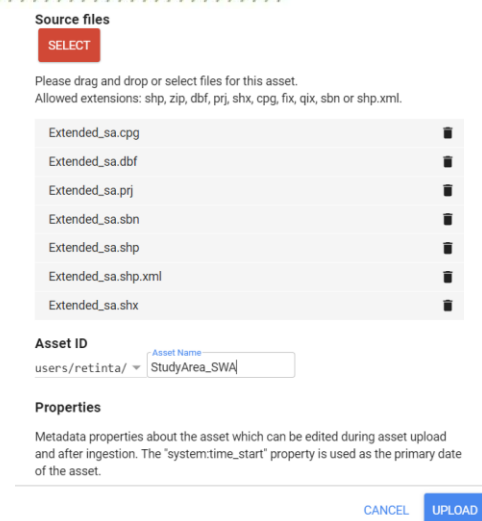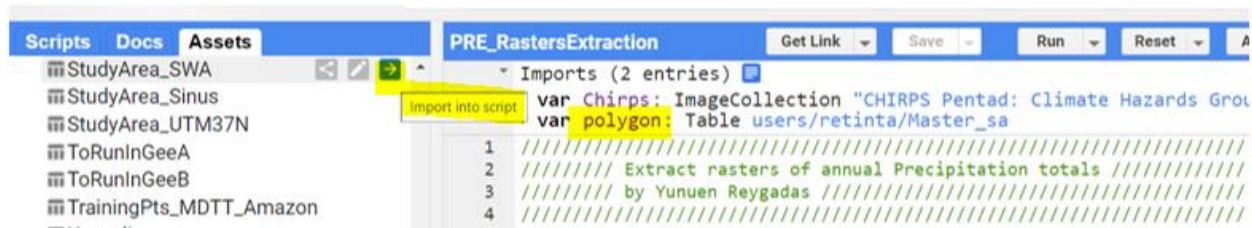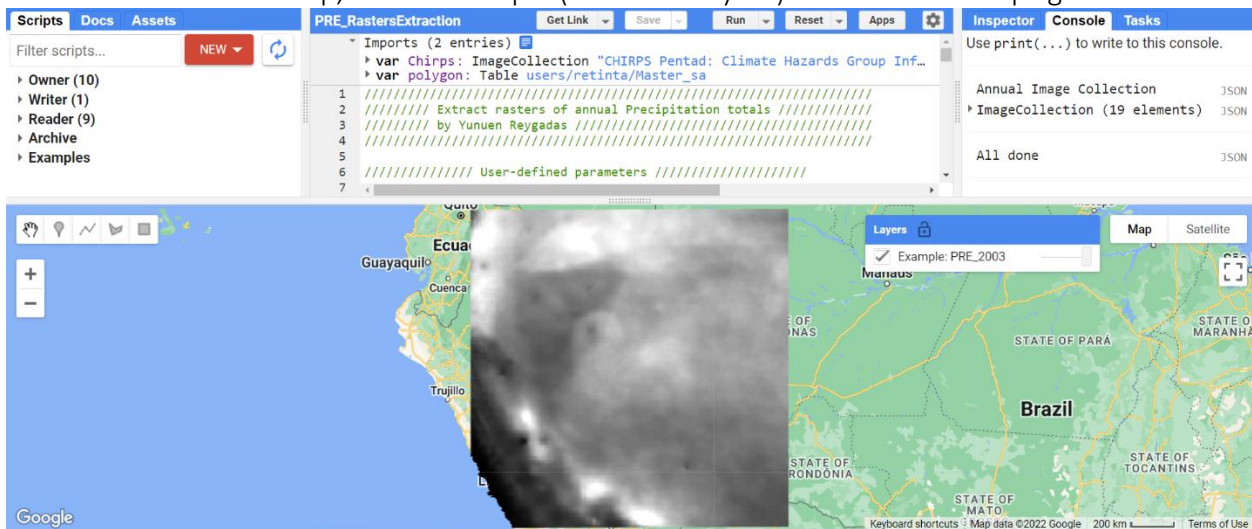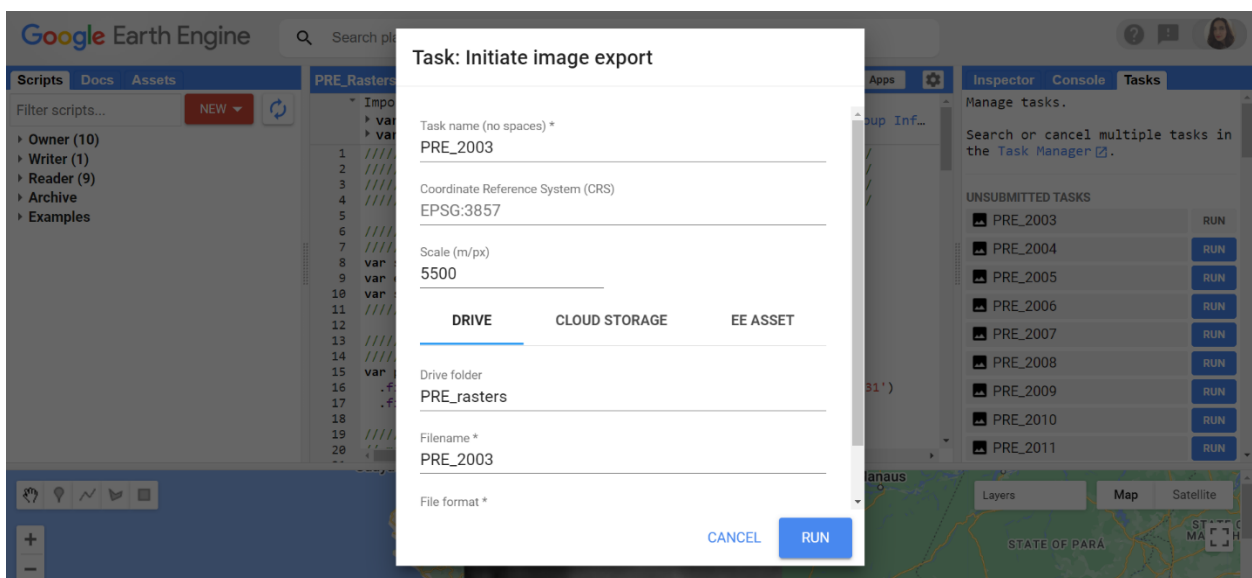
5. Be aware of the rasters' metadata:
   a. Source: CHIRPS Pentad: Climate Hazards Group InfraRed Precipitation With Station Data (Version 2.0 Final)
   b. Units: mm/year
   c. Spatial resolution: 0.05° (~5-km)
   d. Spatial reference: GCS WGS84