Questions & Answers Part 2

Please type your questions in the Question Box. We will try our best to get to all your questions. If we don't, feel free to email Gregory Halverson (gregory.h.halverson@jpl.nasa.gov) or Amita Mehta (amita.v.mehta@nasa.gov).

Question 1: Is ECOSTRESS data available on cloud computing platforms such as Google Earth Engine, just like Sentinel-2 and Landsat SR data?
Answer 1: ECOSTRESS isn't available on GEE yet, but we're working on incorporating ECOSTRESS Collection 2 data in GEE and OpenET. ECOSTRESS Collection 2 will be available on LP-CLOUD through HTTP and S3.

Question 2: Can we aerially subset the data product of our interest in AppEEARS using the latitude and longitude of the corner points of the rectangle, similar to Earthdata?
Answer 2: The most precise way to define the spatial area of the AppEEARs request is to create a GeoJSON or shapefile defining the target area and upload that file into the AppEEARs request.

Question 3: Why do we need Mamba? Can't we directly install the required packages using pip or conda? Or directly run the notebook in a browser?
Answer 3: The conda-forge channel of the Anaconda system is the most comprehensive repository for geospatial python packages. The mamba stand-in for the conda command runs much faster than using the conda command itself for installing packages in Anaconda environments.

Question 4: I'm trying to download data for South Africa. I didn't get the drop-down options of data products in appEEARS. Any reasons why this happened? / Is ECOSTRESS only available in the US? South America?
Answer 4: ECOSTRESS is available globally. I just tried drawing a bounding box inside Namibia and searching for ECOSTRESS in the AppEEARs Extract Area page and searched for ECOSTRESS, and I was able to add ECOSTRESS layers to the request.

Question 5: Can we access this script file after this training?
Answer 5: The notebooks are not available now but we're trying to get these notebook files cleared for release. You can use the recording (I tried to go slowly enough) of this demonstration as reference and develop your own notebooks in the meantime.

Question 6: Is Visual Studio Code (VSCode) better than Juptyer notebooks for processing geospatial data?
Answer 6: VScode makes it a bit easier to use Jupyter notebooks than running Jupyter from the command line because it handles operating the Jupyter server and python kernels internally. It also has a better file browser and GitHub integration. It can be used for free, like all software in this demonstration.

Question 7: When we selected the data format, we selected GeoTIFF, and an image for date and variable was downloaded. If we select the NetCDF format, will it download a unique file for each variable?
Answer 7: ECOSTRESS is only available in GeoTIFF format in AppEEARs. There's a NetCDF option in the drop-down box, but it doesn't work when you make a request with it.

Question 8: The ECOSTRESS index was described as AET/PET. Is this PET for a reference grass (i.e. Penman Monteith implemented for a grass using FAO-56 specified parameters)? If it is supposed to be the PET for the actual cover type present, where did this come from (e.g. what cover map was assumed)?
Answer 8: Potential evapotranspiration is calculated using the Priestley Taylor equation, which is defined in Equation 1 of the ECOSTRESS Level 3 ATBD: https://ecostress.jpl.nasa.gov/downloads/atbd/ECOSTRESS_L3_ET_PT-JPL_ATBD_20 180509.pdf. Not exactly the same reference ET. Details on this can be found by contacting Joshua Fisher (email: joshbfisher@gmail.com) to discuss that nuance.

Question 9: Is the climate of Farmington (semi-arid) a reason for the irrigated agriculture sticking out so much? Would you expect similar results in a humid climate?
Answer 9: Farmington, NM was a good candidate visually for making this demonstration because irrigated agriculture surrounded by an arid landscape contrasts both in temperature and evapotranspiration.

Question 10: Is ECOSTRESS data available for northern Mexico? Do these data have the same accuracy as USA information?
Answer 10: ECOSTRESS is available globally (51.6 degrees north-south latitude [orbit of International Space Station]). The ECOSTRESS Collection 1 evapotranspiration product shown here was validated using FLUXNET ground observations.

Question 11: Is it possible (or scientifically acceptable) to compare ECOSTRESS ETp or ETa to Penman based land measurements (ET0 and ETa=kcxET0) for our local area. Flux measurements are difficult to obtain, but climatic data to calculate ET0 comparatively easy to obtain. (For Turkey, et least)
Answer 11: The Priestley Taylor PET used here isn't exactly the same estimate as reference evapotranspiration. You could reach out to Forrest Melton and Joshua Fisher to discuss that nuance. (email: Forrest.S.Melton@nasa.gov, joshbfisher@gmail.com)

Question 12: Is there any limit to downloading data from AppEEARS? Can we request a large time period of the ECOSTRESS dataset, or is it recommended to split our request into small periods?
Answer 12: The AppEEARs system imposes data volume limits on each request. Sometimes you have to break up large requests into several smaller requests. If the larger request is too large you will see a red notice indicating that.

Question 13: Are the results of the ET product in daily values (mm/day?)
Answer 13: The instantaneous ET layers in this demonstration are in watts per square meter. There is also a daily average ET layer in watts per square meter that you can convert to mm per day. ECOSTRESS Collection 2 will have a daily ET layer in mm per day.

Question 14: If we create an AOI with a shapefile or geoJson, what coordinate system/projection do we need to use?
Answer 14: It is best to use WGS84 latitude and longitude. You can reach out to the LP-DAAC for further assistance with AppEEARs.

Question 15: Is it possible to do this process just in the R software?
Answer 15: Yes, the raster package in R and Rasters.jl package in Julia can read and analyze GeoTIFF images. I usually use R for analyzing and plotting tables of data and Python for rasters and other large arrays. Julia seems to be the way of the future.

Question 16: Is it possible to apply an example where there is rainfall distribution without irrigation? Can we use ECOSTRESS for longterm ET projections?
Answer 16: If you are looking at seasonal or annual aggregates of ET, that could be useful to compare to precipitation in hydrology. You could use these aggregates as input to projection models. ECOSTRESS ET is an estimation in hindsight.

Question 17: Follow up to 9. Is there any additional masking required when the contrast between irrigated and non irrigated land cover is not as great. i.e. humid southeastern United States?
Answer 17: We do not include flags that would let you distinguish irrigated vs non-irrigated lands. In humid regions PET would be high as well. ET Stress you may be able to distinguish between.

Question 18: What is the resolution of the PET product?
Answer 18: All the products are 70 meters spatial resolution.

Question 19: Why does the water in ET appear as NA?
Answer 19: ECOSTRESS Collection 1 does not estimate water surface evaporation, but ECOSTRESS Collection 2 will.

Question 20: Are all the images in a certain time of day window?
Answer 20: ECOSTRESS has varying time of observations as it is on the ISS. It observes at different times of day depending on the location.

Question 21: Can we access this script file after this training?
Answer 21: The notebooks are not available now but we're trying to get these notebook files cleared for release. You can use the recording (I tried to go slowly enough) of this demonstration as reference and develop your own notebooks in the meantime.

Question 22:
a) Is the ESIavg defined as ETinst/PET?
b) If one wanted to use ETdaily instead of ETinst, would the same definition hold?
c) Is it a straightforward conversion from ETinst or ETdaily to PET i.e is PET = ETdaily/ESIavg?

Answer 22: The ESI product is the instantaneous ratio of actual to potential ET at the time of ISS overpass. If you want to assume that that is the same ratio as daily actual to potential ET, then you would estimate that daily potential ET by dividing the daily actual ET by ESI.

Question 23: Is the ET from ECOSTRESS Actual ET?
Answer 23: PT-JPL estimates transpiration, soil moisture evaporation, and interception evaporation, and then adds them up to actual ET.

Question 24: Question about comparing NLDAS Evapotranspiration values with ECOSTRESS values: The NLDAS hourly potential evapotranspiration is reported in kg/m2, while the ECOSTRESS values are in W/m2. Is there a direct conversion from one to the other? I applied a factor of 24500/36 to the NLDAS hourly values based on the footnotes in the PT-JPL ATBD and this document: https://www.fao.org/3/x0490e/x0490e04.htm#reference%20crop%20evapotranspiration%20(eto). Is this correct?
Answer 24: To convert watts per square meter to mm per time period or kg per time period, multiply by the number of seconds in the time period (3600 seconds in an hour) and divide by latent heat of vaporatization (2,450,000 Joules to evaporate on kg of water).

Question 25: Is there any study on the accuracy assessment of ET from ECOSTRESS? Is there any study that focuses on the validation of ET ecostress data with eddy covariance data?
Answer 25: Yes, the Fisher et al 2020 validated the ECOSTRESS Collection 1 ET product with an accuracy of 6%.
https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019WR026058

Question 26: Is it more difficult than GEE?
Answer 26: GEE makes remote sensing analysis easier by handling spatial operations in the background and giving you server-side access to a large volume of data without having to download it. OpenET is powered by GEE. ECOSTRESS Collection 1 is not available on GEE. We're working on incorporating ECOSTRESS Collection 2 data in GEE and OpenET. ECOSTRESS Collection 2 will be available on LP-CLOUD through HTTP and S3.

Question 27: Which of the different multispectral high-spatial resolution satellite images is the most appropriate to determine ET in the Amazon?
Answer 27: Landsat 5/7/8/9 provides 30 m NDVI and albedo coincident to ~100 m surface temperature over a 35+ year record and can be used to calculate ET using the methods employed by OpenET and ECOSTRESS.

Question 28: Are there any codes that could guide us to derive ET from ECOSTRESS LST using PT-JPL?
Answer 28: There are a variety of ET models, including PT-JPL, that are becoming public-knowledge through the OpenET project.

Question 29: How many thermal bands are on the ECOSTRESS sensor? How is LST obtained from them?
Answer 29: The ECOSTRESS sensor includes five thermal radiance bands, but the majority of scenes that have been produced by ECOSTRESS use three of those bands. Surface temperature is estimated from the thermal radiance bands using the Temperature and Emissivity Separation (TES) algorithm. Please contact Glynn Hulley and Simon Hook for further details on TES.

Question 30: When stacking the median-averaged rasters for each year, how sure are we of the geolocation for each median raster? i.e, do the rasters always fall on the same grid?
Answer 30: ECOSTRESS Collection 1 is distributed in swath format with the original sensor geolocation provided in arrays of latitude and longitude. AppEEARs grids the ECOSTRESS Collection 1 product on the fly using a dynamic geographic cell size that best fits 70 m, so the ECOSTRESS Collection 1 GeoTIFFs obtained through AppEEARs are not on a consistent grid. The upcoming ECOSTRESS Collection 2 will be distributed in Sentinel tile format, with each tile being a consistent 70 m UTM grid.

Question 31: What is the temporal resolution and revisit frequency of ECOSTRESS, and how can I practically implement the data on a daily basis? For example if we are going to mark a specific agriculture zone that needs more irrigation or water.
Answer 31: The ISS passes over every 3-5 days. ECOSTRESS Collection 1 includes a daily up-sampled product. The upcoming ECOSTRESS Collection 2 will have a daily ET layer in mm per day. Please contact Forrest Melton and Justin Huntington for best practices in utilizing real-time ET estimates for agriculture management.

Question 32: Why is the surface temperature data not provided as already cloud masked data?
Answer 32: The surface temperature product retains cloud-top temperature, but ET is cloud-masked because ET is only valid on land surfaces.