Part 3 Questions & Answers Session A

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 Amita Mehta (amita.v.mehta@nasa.gov) or Sean McCartney (sean.mccartney@nasa.gov).

Question 1: How do you calculate the temperatures in 1750?
Answer 1: Based on a number of paleo climate observations (e.g., tree rings).

Question 2: Is there a glossary available for these abbreviations and terminologies?
Answer 2: Most of the acronyms are defined in the presentation but this link can be helpful for climate related glossary: https://apps.ipcc.ch/glossary/.

Question 3: (Around Slide 22 – NEX_GDDP_CMIP6) Can this dataset be used to calculate wet bulb temperature? I know there are a lot of uncertainties with the results as it's a model.
Answer 3: NEX-GDDP models do have downscaled specific and relative humidity and surface winds – so estimation of wet bulb T would be possible.

Question 4: Is Climate change impact uniform across the globe or does its intensity vary from the North to the South pole?
Answer 4: No, climate change impacts are not uniform. Impacts depend on regional/local conditions, that is why downscaled data are used for regional/local impact assessment.

Question 5: Is downscaling only done in the temporal component, and not in the spatial one? Will there be downscaling below 1 km^2?
Answer 5: NEX-GDDP does spatial downscaling. Currently climate models have spatial resolutions of 1° to 2.5°. NEX-GDDP downscales these data at 0.25° resolution. Currently there is no data at 1 km^2 resolution – high resolution observations would be required for downscaling at that scale.

Question 6: Doesn't NEX-CMIP6 also use CDF to bias-correct? Why are both correction methods used and what is the specific purpose of each?
Answer 6: NEX-GDDP uses CDF for bias correction and uses spatial desegregation for downscaling (BCSD scheme is used). More information can be found in this document and references therein.

Question 7: The NEX-GDDP-CMIP6 model can be used worldwide? In a latitudinal range? On a continent? Or in a specific climatic region?
Answer 7: Yes, the model can be used worldwide - these are global data.

Question 8: Is the result code just showing the map, or can we get a .csv file of daily temperature or precipitation in these years of scenarios?
Answer 8: A time series can be downloaded as a csv file from the console window. This is shown in the demonstration. For maps, we used GeoTIff to export data in the demonstration as the files were large. Here is a code sample that describes how to save images (rasters) as csv files.

Question 9: Are there any examples or case studies whereby this analysis was used for decision-making by an organization or a country?
Answer 9: This is a very good question! We do not have any specific examples, but online search suggests that there are several studies where NEX-GDDP data are used for studying local impacts, e.g for hydrology, Urbanization.

Question 10: Is the GEE data bias-corrected or downscaled for further analysis?
Answer 10: The GDDP data are biased-corrected. GEE does not do any additional processing.

Question 11: Can you provide training material to download the GRACE data (from the new platform), downscale the data to 0.25º by 0.25º and compute groundwater storage anomaly?
Answer 11: Information about the GRACE data access and download are available from NASA-JPL-GRACE portal. For higher resolution ground water data at 1x1 degree and 0.25x0.25 degree resolutions you may want to use Global Land Data Assimilation System (GLDAS) data. These data are available in GEE.

Question 12: Can you provide the code for Celsius degrees please?

Answer 12: You can subtract 273.15 from the temperatures in Kelvin.

Here is the modified code link:

https://code.earthengine.google.com/92362f960f87f95be1ca93e36fe0a7f2

Question 13: How can we get the final product of the precipitation scenario in NetCDF?

Answer 13: Go to the original data service and it is in NetCDF. In GEE, you can download data as GeoTiff and then convert to NetCDF using python or gdal.

Question 14: How is data accuracy ensured in Earth Engine scenario modeling? Or, are calibration procedures implemented in Earth Engine to enhance the reliability of scenario outputs?

Answer 14: GEE is not adding anything. It is making the data available through the cloud.

Question 15: How can I apply the code to calculate environmental variables such as the Normalized Difference Vegetation Index (NDVI), albedo (α), and evapotranspiration?

Answer 15: This code can not calculate NDVI, Albedo, and ET. Go to https://developers.google.com/earth-engine/datasets and search for these products, they are available from GEE.

Question 16: Are there any training resources available on soil moisture prediction/estimation?

Answer 16: ARSET has a few training resources related to soil moisture:

- Application of NASA SPoRT-Land Information System (SPoRT-LIS) Soil Moisture Data for Drought
- Applications of Remote Sensing to Soil Moisture and Evapotranspiration

Question 18: Can we select more than one model and get an ensemble to get more accurate results?

Answer 18: Yes. Ensemble mean may be more accurate. In the code, when defining 'dataset' if you delete line 123 (.filter(ee.Filter.eq('model', 'GISS-E2-1-G')) then instead

of the selected model, the data set will include all the models. However, it is also important to look at individual models to check which is best for your region of interest.

Question 20: How do you downscale the CMIP6 data using ground data?
Answer 20: Downscaling is an ongoing topic for research. Different methodologies have been used. For example, please see:
https://carbonplan.org/research/cmip6-downscaling-explainer

Question 21: These models have some area preferences or are they good for every part of the world?
Answer 21: It is well-known that GCMs have area preferences. Different models can work better in different areas.

Question 22: So the GDDP in GEE uses BCSD in addition to CDF?
Answer 22: GDDP uses BCSD. GEE does not add any analysis to it, just makes the data available through their platform.

Question 23: How can I unite two countries that share a border on GEE?
Answer 23: You can draw a polygon covering both the countries or merge shapefiles and use them as one.

Question 24: How can I use this code to compute the SPEI index?
Answer 24: This code cannot be used for this purpose. You will need to add that segment.

Question 25: How do you run the code using all available models?
Answer 25: You have to extract data from each model if you want to look at each model output individually. If you want ensemble mean of model then please refer to Question

Question 26: Is it possible to save the results in NetCDF files locally?
Answer 26: GEE exports raster data as GeoTiff. You can use python or gdal to convert GeoTiff to NetCDF.

Question 27: How can I save the modified GEE Code?

Answer 27: There is a save button towards the top menu bar next to run.

Question 28: When I execute the code using profiler, the entire code runs. Can I execute a part of the code?
Answer 28: Yes, you can comment out the sections you do not want to execute // is used comment out a line or cab comment a block of line [/*   line1, line2, —-- */].

Question 29: I am receiving an error for the time series chart "response size exceeds limit".
Answer 29: Depending on the size of the area, internet speed, and bandwidth this could happen. The same code may run some other time if you try again.

Question 30: How can these scenarios be used for a small area of interest such as a county or a subbasin?
Answer 30: You create your own shapefile and upload that as your area of interest.

Question 31: We are limited ultimately by the resolution. How much higher can the resolution of CMIP6 go before we should just use Landsat or Sentinel?
Answer 31: Ultimate limitation for downscaling is availability of observations at finer scales similar to Landsat and Sentinel. Dynamical downscaling may be used for high resolutions but it would not be possible to assess uncertainties in the downscaled products if there are no high resolution observations available.

Part 3 Questions & Answers Session B

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 Amita Mehta (amita.v.mehta@nasa.gov) or Sean McCartney (sean.mccartney@nasa.gov).

Question 1: Do the many (climate) models agree on some or all variables?
Answer 1: There is a range of values for parameters coming from various models. CMIP is set up to understand this spread in outputs.

Question 2: How can I predict agricultural drought? What are the data or indices needed, what methods I can use to predict, and what software is available?
Answer 2: Agricultural droughts need soil moisture prediction – ideally at surface and root zone depth. Predictions of precipitation, temperatures, and soil moisture can be used to estimate vegetation/crop yields using statistical methodology and/or models based on past observations. Soil and Water Assessment (SWAT) model.

Question 3: Do you know when a new version of projections (CMIP7) together with new SSPs will be released?
Answer 3: We don't have that information.

Question 4: Is there a map of where each country is within this SSP ranking scale?
Answer 4: We have not seen such a map but here is a link to the SSP Literature Database that can provide some information:
https://sedac.ciesin.columbia.edu/data/set/ssp-ssp-literature-db-v1.

Question 5: Can we downscale climate projections in GEE for a smaller region, like a district or state?
Answer 5: Downscaled data are available at 0.25º x 0.25º resolution from GDDP – you can select a region of your interest by uploading shapefile of the region and saving as the AIO in the code.

Question 6: How do I upload the new project if I cannot find it on my computer?

Answer 6: Go to https://earthengine.google.com/ → Platform → Code Editor to start a new script.

Question 7: In the GEE script you explain data for 2020, 2050 and 2100 years. Can you take another year like 2020, 2025, 2030, etc.. Is it possible to do?
Answer 7: Yes, it is. Just change 2050 to 2025, 2100 to 2030. You can copy the segment of the code and copy for years you prefer.

Question 8: In GEE, can we download the 50th percentile of all model projections instead of some individual models? Or do we have to download all and do the analysis ourselves?
Answer 8: If you do not filter for a specific model (see Question 18 in Part A), all the models are included in the image collection. You can export this image collection, download and do your own analysis.

Question 9: When we do such analysis, is the data already available for the area of interest in the dataset? How does it work?
Answer 9: Yes, it is global data.

Question 10: For you, what are the best ways to present/report uncertainties for both spatial and time series data? Like ensemble mean +/- standard deviation for time series?
Answer 10: Yes, this is a good way to start.

Question 11: I downloaded my shapefile but it doesn't appear on the screen.
Answer 11: Once you upload it in the code, your aoi should be that shapefile. Name it myaoi and comment out the lines in the code.

Question 12: Is it possible to generate seasonal averages instead of annual averages, such as June-September?
Answer 12: Yes, there is a way. Specify your filter setting to month.

Question 13: My maps have been generated. Can you please explain again how we can save the time series from the console window?

Answer 13: Screenshot is fine. You can also save the time series as a csv file. Click on the arrow at the right of the chart. This will open a new window with the timeseries, on top you will see the option to download the data as a csv file.

Question 14: Is it useful to look at annual vulnerability to droughts by getting data of potential evapotranspiration (PET) and subtract it by precipitation (P) through GEE? With this, can we get an idea of precipitation PET-P that represents annual hydric deficit? Is this a valid approach for drought vulnerability?

Answer 14: This is one way of looking at it. Please see the following site for more information how Evaporative Stress Index can be used for assessing droughts.
https://www.drought.gov/data-maps-tools/evaporative-stress-index-esi

Question 15: How to address an error for response size exceeds limit for time series?

Answer 15: You can look at a smaller portion of your area of interest. Also, depending on the internet speed and bandwidth the code may run if you try some other time!

Question 16: I have noticed that more NASA data is available through AWS. Is there a long-term goal of doing this for all data? Will the DAACs continue as the primary data repositories?

Answer 16: For now DAACs will have all the data.

Question 17: Is GEE able to train historical climate data by applying ML approaches or must we use a NASA pre-trained model?

Answer 17: You can apply your own code to historical climate data depending on the application.

Question 18: Is it possible to modify your code to get precipitation time series and visualize it by modifying your existing code for annual time series?

Answer 18: Yes. Go to line 380 and use the variable PR instead of AirT. You will have to change visualization options for the time series by changing min and max values.