Part 2 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 Andrea Molod (andrea.m.molod@nasa.gov).

Question 1: Will the GEOS-S2S-3's hindcast climatology spanning 1991 to 2020 also be released in August?
Answer 1: Yes, we are still working out the mechanism for this though. Most likely we will host them on our "dataportal" and give out a URL for access.

Question 2: How long will GEOS-S2S version 2 be available after the release of version 3?
Answer 2: Our plans are to keep GEOS-S2S-2 running until the end of 2024.

Question 3: What are the possible ways to get the ensemble to look good if it is not?
Answer 3: There are several methods for "calibration" of ensemble forecasts being developed. We currently calibrate my subtracting off a "drift" or systematic error to provide an unbiased anomaly. Other methods include adjustment of the ensemble variance, and there are MANY machine-learning based methods out there as well.

Question 4: Is GEOS-S2S an open access model? Can I use it for Kazakhstan?
Answer 4: GEOS-S2S-2 is an "open access" model in the sense that anyone can download the code (we have a few different ways to do this). However, in a practical sense, the need for parallel computing and auxiliary data make it quite difficult to run anywhere other than on NASA computing. We are also not a "community model" in the sense that a user could ask for assistance to download and run our model.

Question 5: Can the GEOS-S2S models be applied to local scale (small scale) studies? What is the spatial resolution of its outputs?
Answer 5: We run our model and provide output at 50 km atmospheric resolution and 25 km ocean resolution. A "downscaling" exercise would be needed to obtain

resolution at smaller scales. We don't presently have a recommendation on how to do that.

Question 6: Are S2S-2.1 maps available for download as GEOTIFFs?
Answer 6: Not as of now. There are a limited number of .png images on our website that could be downloaded.

Question 7: How do you check for Africa?
Answer 7: Our model is global, so when data are downloaded the fields will include Africa.

Question 8: Can they be viewed using panoply since it is in NetCDF?
Answer 8: I would imagine the answer is "yes", though I have not done this.

Question 9: Is there a Python notebook you could recommend for this exercise for people not expert with QGIS?
Answer 9: Not that I know of. ARSET may consider a train of S2S using Pythob notebook in future.

Question 10: It is very interesting to me that the forecast predictions are listed as ensembles. This leads me to ask this specific question. What specific 'motifs' or 'patterns' are within this forecast prediction that exist across North America for landslides?
Answer 10: There is a group in GSFC's Earth Sciences division that is (or was at some point) using our output for this application. I cannot remember which group offhand but could inquire. I do not know the answer to your question but they probably would. We will update before we post. NASA/GSFC Code 613 Staff.

Question 11: What are some examples of custom data requests that get uploaded to FTP?
Answer 11: We have users that only want a subset of fields, others that ask for interpolations to coarser grids, others ask for us to provide a field we calculate from other outputs we have. An example of the latter is "integrated moisture transport" that we calculate based on model moisture and momentum (winds).

Question 12: One question related to the seasonal forecast: is there any long term (30-years or longer) daily dataset of historical variables like air temperature and precipitation?
Answer 12: As the model forecast runs we produce 3-hourly fields of 2-meter temperature and precipitation, and average them later for seasonal forecasts. At the request of a user we could provide these 3-hourly forecast fields for each (of 40) ensemble members in a month for the first 45 days of the forecast. We have these fields available from “near-real time” (new) forecasts as well as from our entire suite of retrospective forecasts (1991-2020).

Question 13: In the anomaly layer shown for July for precipitation, there are some areas/countries in South Africa and the Middle Eastern countries that were white, which represents zero anomaly. What is the reason for that? I do not think not having a deficit would be the reason!
Answer 13: I cannot see the specific plot you are referring to, but a zero anomaly (relative to the contour interval of the plot) is certainly a possibility. This means that the expected rainfall is the “usual” or climatological amount. This “usual amount” is actually the number in the drift files.

Question 14: It was a little bit too fast to follow the calculation – was it PR2_Jul24 * 3600 * 24?
Answer 14: Yes that number is seconds per day. That is to convert from Kg/m2/s to mn/day

Question 15: Do you only produce precipitation and temperature data under GEOS-S2S?
Answer 15: GEOS-S2S provides an extensive list of output fields. The document in: https://gmao.gsfc.nasa.gov/pubs/docs/Nakada1033.pdf provides the options for GEOS-S2S-2. A document similar to this is being prepared for GEOS-S2S-3, with an even more extensive list of fields.

Question 16: While performing the Part 1 Exercise, I encountered some errors in GEE. Can someone guide who I can contact to correct those errors?
Answer 16: Please email nasa.arset@gmail.com.

Question 17: As the forecast provides data on the anomalies, how do you use that data for calculating drought indices like the SPI?
Answer 17: It would be possible of course to compute the SPI based on “raw” output (not calibrated), or compute an SPI anomaly, or there may be a few other options. This would be a matter to be discussed with members of our group in GMAO. We would look for the most skillful option of course.

Question 18: I was wondering if there is any package in R that allows us to download GMAO S2S data?
Answer 18: There is no R package for S2S that we know of.

Question 19: Do we need to perform the raster calculation (i.e., raster file*[360*24]) on all the raster files?
Answer 19: You can use the files as is. Units are already converted for the exercise. If you download data from the S2S ftp site then you will have check the units.

Question 20: I can’t download the anomalies (https://gmao.gsfc.nasa.gov/cgi-bin/products/climateforecasts/geos5/S2S_2/current/anom_atm.cgi?var=T2M&type=monthly&reg=glb).
Answer 20: These are not digital data. Only png images are available.

Question 21: What is the best scale to work with this dataset in the forecast?
Answer 21: Forecasts available for 9 months and are updated every month. Though daily data are available, they should not be interpreted as weather forecast.

Question 22: Where can I get VPD data for 2000 to 2020?
Answer 22: It would have to be calculated from temperature and humidity.

Question 23: What's the chronological arrangement of the layers in Exercise 2?
Answer 24: For the QGIS exercise, you can arrange the layers in any order you prefer.

Question 25: Are there any further recommendations to consider when modeling seasonal drought, such as parameters, scales, and data?
Answer 25: GMAO S2S data include surface temperature, precipitation, soil moisture. And evapotranspiration. These can be used from weekly to seasonal time scales to

form anomalies or define percentile value threshold for meteorological and agricultural drought.

Question 26: How can S2S outputs be used for statistical downscaling, for instance using the Climate Predictability Tool, given that it is provided at coarse resolution?
Answer 26: Downscaling is a big issue. You may review this information here.

Question 27: Is evapotranspiration data available on products generated by GEO-S2S?
Answer 27: Yes. It is further broken down in evaporation and transpiration.

Part 2 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 Andrea Molod (andrea.m.molod@nasa.gov).

Question 1: Which models and data should be used in the MENA region if we are considering confidence?
Answer 1: As of next month or the one after, we are switching to GEOS-S2S-3. This is what will be available for all regions. We can provide retrospective skill estimates (we will post images for several fields online).

Question 2: What does L720x361 in the collection name mean?
Answer 2: "L" says lat/lon grid, 720x360 are the dimensions in lon (720, ½ degree resolution) and lat (361, ½ degree resolution).

Question 3: Will GEOS-S2S-3 seasonal forecasts (9 month) have a bias correction approach incorporated for any products?
Answer 3: We generally provide the uncalibrated forecast along with the "drift" to use for calibration. Upon request we could provide calibrated fields. A note here: "calibration" is not a bias correction relative to observations. We do not perform that step and I view it as a "dangerous game" to play, in particular in a rapidly changing climate.

Question 4: Is it possible to use artificial intelligence and machine learning in drought prediction? Is there any drought dataset (training data)? oriented to test machine learning algorithms?
Answer 4: Yes! Frankly our retrospective forecasts provide an ideal training dataset for an ML based prediction of precipitation, say. The "predictors" can be obtained from our forecasts (for example the temperature or winds or radiation at the ground or soil moisture), and an ML based prediction can be trained against observed precipitation. This kind of work is under way at GMAO and elsewhere.

Question 5: Is there an option to have an API that links forecast ensemble atmospheric data (temperature and precipitation) with other dashboards and applications?
Answer 5: Our forecast data as of now is only available in NetCDF files. I do not anticipate a change in that.

Question 6: What is the definition of precipitation here? If I want to get the predictions for January to April in Canada, does the precipitation include snow and rain together, only snow, or only rain?
Answer 6: Precipitation is snow and rain together. Our estimates of Rain and Snow separately are also available.

Question 7: How can I get these raster data?
Answer 7: The raster data for our forecast maps are not currently available. I do not think we will supply them in the future.

Question 8: Can you describe more the statistical approach used by GEOS-S2S to calculate the predictions of precipitation and temperature? How can we evaluate the viability of the predictions?
Answer 8: We use our retrospective forecasts to evaluate our skill. These skill plots for GEOS-S2S-3 will be posted on our website for selected fields, others can be made available.

Question 9: Is the data updated or will it take some time to give me information?
Answer 9: New seasonal forecasts are available on approximately the 5th or 6th of each month. We CAN retain a limited number of previous months' forecasts on the ftp site.

Question 10: What statistical analysis was used? Did you use different methods for different regions?
Answer 10: We are typically evaluating anomaly correlation and bias of our retrospective forecasts. The same calculation is performed all over the globe.

Question 11: Is S2S only used for anomalies? Can one get the temperature and precipitation data from S2S?

Answer 11: We CAN provide these data as well, and we do. These are not as “reliable” as the anomalies so we advocate the use of the calibrated forecast. Some users who are taking forecast output to “drive” another model (pest, crops, primary productivity) find that they can take our forecast fields and use those for their specific purpose.