Questions & Answers Part 1

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 Melanie Follette-Cook (melanie.cook@nasa.gov), Pawan Gupta (pawan.gupta@nasa.gov), or Xiaohua Pan (xiaohua.pan@nasa.gov).

Question 1: Which global ground air quality data are used to develop AQI forecast products?
Answer 1: The Air Quality Index (AQI) is a quantity used by the US EPA to communicate the potential for exposure to poor air quality and possible health impacts. To issue AQI forecasts, the EPA uses US ground reference monitors measuring criteria pollutants such as PM2.5 and ozone (O3), along with weather forecast models and satellite observations. More about AQI:
https://www.airnow.gov/aqi/aqi-basics/using-air-quality-index/
Other countries have different air pollution indices (in other words, they use different equations to generate their own AQI).

Question 2: Is the unit right? kg/m^3?
Answer 2: The unit for PM2.5 is kg/m^3 from the original output of MERRA2. In the Giovanni demo, the minimum monthly PM2.5 of the spatial map for August 2021 is about 1.8 e-9 kg/m^3, so it is 1.8 microgram /m^3. You can use a conversion factor of 1e-9 kg/m^3 = 1 microgram/m^3.

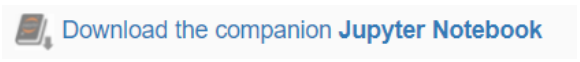
Question 3: Can we plot MODIS AOD products having 3km and 10km resolution in Giovanni?
Answer 3: No, GIOVANNI only provides gridded AOD data from MODIS which are at 1x1 deg resolution. For high resolution MODIS data, refer to our previous advanced training and check out this link
https://ladsweb.modaps.eosdis.nasa.gov/tools-and-services/

Question 4: Why is there a low value in 2019?
Answer 4: Good observation! This is an interesting question worthy to investigate more. In wikipedia, I don't see large wildfires in 2019.
https://en.wikipedia.org/wiki/List_of_California_wildfires. In addition, remember that we are plotting over California only, instead of the entire western US.

Question 5: How do I download Giovanni PM2.5 data in CSV or tabular format?
Answer 5: To download data in CSV through Giovanni, you need to use one of the Giovanni "time series" functions, run through your query, and you can download your data in CSV (located on the left hand side of “History” Downloads button)

Question 6: Is it possible to use MATLAB instead of Python?
Answer 6: Many different programming languages can be used to analyze data (MATLAB is definitely one of them). At NASA, we try to provide open-source (no-cost) tools, and MATLAB requires a license to use.

Question 7: Where do you get that script from? I did not read it anywhere?
Answer 7: Please find it at this link https://drive.google.com/drive/folders/1qelu0JPMsemR9kJPSL6axiW7gXb8EeIh.

Question 8: I couldn't find the JupyterLab/google collab notebook - "How to use the web services API for subsetting MERRA 2 DATA PM2.5" - where can the participants download this module?
Answer 8: Please find it at this link https://drive.google.com/drive/folders/1qelu0JPMsemR9kJPSL6axiW7gXb8EeIh. If you want to see a general How-to (not the one demonstrated) for additional information, you can get the Jupyter Notebook HowTo here: GES DISC How-To's: How to Use the Web Services API for Subsetting MERRA-2 Data (nasa.gov). Download the Jupyter Notebook by clicking 

icon on top left corner and upload the script into your own Google Colab space.

Question 9: After we calculate the surface concentration of PM2.5/1/10, what is the unit of the PM?
Answer 9: It is kg/m3 from the original output. See response to Q2 as well.

Question 10: Can we use the air quality on landsat imagery using Google earth engine?
Answer 10: Yes, GEE has Landsat data, but no air quality parameters and as such, you would have to derive those parameters yourself. Other air quality relevant datasets are on GEE, such as MODIS and TROPOMI. We are also in the process of adding GEOS model output into GEE. Please note that not all NASA earthdata are curated in GEE, i.e., GEE may not have the most recent version of NASA datasets.

Question 11: Do all three techniques give the same result when we plot the data?
Answer 11: Yes, the subsetted data are the same from three demos given the same subsetting configurations (e.g., spatial coverage over North America). You can plot data without having to download it and calculate the total PM2.5 for the first demonstration (Giovanni). For the second (web-based subsetter) and third demonstration (Python API), you need to download the five aerosol components and calculate the total PM2.5.

Question 12: Is there in any plan to lower the spatial resolution to a meter scale in the future?
Answer 12: When we increase the spatial resolution in these models, we also increase the computational power needed to process the higher resolution. So very high spatial resolution simulations are typically run over short time periods. We don't anticipate the forecasts shown here to reach the meter scale. Higher resolution model runs also need higher resolution inputs such as emissions which are not typically available everywhere at those resolutions.

Question 13: Hello, I have heard MERRA2 data has a major limitation over polar oceans and in tropical latitude. Is that correct?
Answer 13: MERRA-2 represents a merger of many satellite observations, in situ observations, and model forecasts, and while providing a reasonable representation of the global observed state at any given time, it also accumulates and weighs the uncertainties of all the assimilated observations and model forecasts (Gelaro et al., 2017). Without more information on the specific nature of the mentioned limitations, we cannot answer the question with more detail. Please feel free to reach out to the trainers if you have a follow-up question.

If the question is in reference to the grid used, GEOS simulations are run on a cubed-sphere grid and are then output on a standard latitude longitude grid. A cubed sphere grid is used to ensure even grid spacing at all latitudes and avoids singularities that can occur using other grids. For more information, please see session 2 of our previous webinar, Introduction and Access to Global Air Quality Forecasting Data and Tools.

Question 14: Is the GEOS-Chem CF output different from the GEOS-Chem basic model? If so, what is the difference between the two? I see the basic model gives PM2.5 composition data.
Answer 14: The basic, downloadable version of GEOS-Chem is a chemistry transport model that uses GEOS meteorological fields. GEOS-CF runs a version of GEOS-Chem

that has been configured to run within GEOS, and outputs a subset of the available variables within GEOS-Chem.

Question 15: Why does GEOS CF use replay technique instead of data assimilation technique? What is the advantage of replay technique?
Answer 15: Since CF is relatively new, the replay against FP-IT was chosen because it is a frozen model version. The unchanging model version allows the replay fields to be used as a continuous composition archive that could be used for analyses and evaluation of the model performance. Future versions of GEOS-CF will include data assimilation of trace gases.

Question 16: Is there a way to access GEOS-Chem basic composition data?
Answer 16: If this is in reference to the composition of aerosols, the CF output does contain the mass of each aerosol component as well as PM2.5. Refer to the file specification document and the chm_tavg_1hr_g1440x721_v1 collection.
https://gmao.gsfc.nasa.gov/GMAO_products/NRT_products.php
(scroll to GEOS-CF)

Question 17: How do you deal with cloud cover esp in tropics area./no data?
Answer 17: Within the model output, all fields are available regardless of cloud cover. Cloud information is contained in cloud variables such as cloud fraction or cloud optical depth. With respect to satellite observations used in the data assimilation, pixels that have cloud contaminations are typically filtered out, and thus the model output dominates the analysis.

Question 18: Performance wise, is GEOS CF better than GEOS FP for the same species?
Answer 18: There has not been a published comparison between CF and FP aerosol output. An evaluation of CF can be found in the Keller et al. paper referenced in session.
https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020MS002413