Questions & Answers Session 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 Pawan Gupta (pawan.gupta@nasa.gov) or Melanie Follette-Cook (melanie.cook@nasa.gov).

Question 1: Can you explain the variables that are in the dataset like it has flags and others...if you could explain all of those that we see.
Answer 1: As you can see from when I showed the subset, there are a lot of different variables. For descriptions of every variable, you can refer to the documentation, but I tried to highlight the most important variables if you wanted to filter the data yourself. Those were terrain reflectivity, cloud radiance fraction, and solar zenith angle. Terrain reflectivity - just to go over it - it's a measure of how reflective the surface of the earth is. Cloud radiance fraction indicates the amount of clouds - clouds can interfere with retrieval. Solar zenith angle is the measure between the point directly above and the center of the sun's disk. For specifics about other flags within the data, you can refer to the documentation:
https://disc.gsfc.nasa.gov/datasets/OMNO2_V003/summary?keywords=omno2
Click on Documentation → "File Specification Document"

Question 2: Can you also share the resource that talks about how data are polled creating gridded data like L3d
Answer 2: As far as filtering the criteria, I just described what's used to filter the L2 data to create the L3. As far as the specific area weighting that goes into calculating the L3 fields, that can be found in the OMNO2 readme file:
https://disc.gsfc.nasa.gov/datasets/OMNO2_V003/summary?keywords=omno2
Click on Documentation → "README Document"

Question 3: OMI detected NO2 change detection map..which variable you are using?
Answer 3:For the gif where I showed the decreases in NO2 shown over the U.S. - those are decreases in tropospheric column NO2.

Question 4: (If i remember the figure clearly- annual NO2), i noticed that the NO2 hotspot over the Pacific coast (i guess that's California) has not reduced that much as compared to the eastern US in spite of stringent AQ regulation. Any explanation?
Answer 4: Not sure which figure you're referencing - let me take a quick look. If this is referencing trends, I am looking through figures - 1 moment. I think this is referencing the annual trend figure. There are still large amounts of NO2 in the LA region - that's partly a feature of terrain.

Question 5: One question: can I correlate the OMI information with the MODIS information (Terra/Aqua) for wildfire applications?
Answer 5: OMI flies on the Aura satellite, which has a similar overpass time as the Aqua satellite. They have - for MODIS info for wildfire applications, I'm assuming you're referencing fire detection, burned area, or AOD. These are on very different spatial resolutions. So in a qualitative sense, yes. If you're going to be quantitative, you're going to have to map one to the other swath.

Question 6: Sentinel-5 is an ESA product from Copernicus mission, isn't it? It's available also under NASA platform?
Answer 6: Yes - and yes. We're very fortunate to be able to distribute the TROPOMI data through GESDISC.

Question 7: I had an issue downloading Dataset 4. Is there another way to get this data? When I click dataset 4, the site shows like,
The page you requested does not exist or is no longer available. You may also contact us for assistance.
Answer 7: The correct link in now on the training webpage:
https://arset.gsfc.nasa.gov/airquality/webinars/advanced-NO2-2019

Question 8: Any way to analyse data without GUI like tool i.e. panoply and with a CLI tool or script? (Command line interface)
Answer 8: I apologize - I don't know what a CLI tool or script is. Pawan: not familiar, but we'll do panoply tool in Part 2 and analyze some of these datasets. Melanie: if it references python - absolutely. There are many libraries in Python and IDL and we're going to share some python scripts.

Question 9: How can we process multiple HDF files?

Answer 9: If you're referring to within the scripts we're going to provide, we'll show you ways. We're going to process one file at a time, but we'll show you where to modify the scripts to process multiple files.

Question 10: do we treat satellite data as primary or secondary data in our own research?
Answer 10: Not sure I understand that question. Satellite data, as we said, record top of the atmosphere radiance. But we - a huge part of making satellite measurements is establishing ground truth. Measurements made from the surface to validate earth satellite measurements. I'm not sure what you mean by primary or secondary data.

Question 11: There are studies of movement of pollutants, for example NO2? if they exist in which platform we can analyze them? Would it help us to know the source of the contamination (NO2) and if it moves globally, could a temporary analysis be done?
Answer 11: I'm not exactly sure what this q is asking- for a species like NO2 it has a short lifetime. NO2 itself would not have - if you had a contamination - you would not see that globally, in other words you wouldn't see a global signal. But there has been research on NO2 plumes. But, as I said before, it's a good quantity to measure by satellite because it has such a short lifetime and such high spatial gradiance.

Question 12: Are we able to do this analysis in ArcGIS platform? Have you tried this?
Answer 12: I'm not familiar, personally, with doing it in ArcGIS. But I believe you can - I think the downloads are only available in HDF or NetCDF from GESDISC. I don't know if Arc can handle NetCDF (it can) but I don't have knowledge on how to do that.

Question 13: Can we use Python or Panoply to extract point data values?
Answer 13: Not sure about panoply, but for Python, yes. That will be one of the scripts we demonstrate in Part 3.

Question 14: How consistent are the OMI derived spectral AOD and SSA retrievals when compared to ground / other satellite retrievals?
Answer 14: OMI retrieves AOD in UV. Which, I believe, has been evaluated against aeronet measurements. I don't have knowledge about the errors. But I can look for some documentation or a paper on OMI AOD and link it here
Update:
Comparison of OMI SSA with AERONET inversion:

https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014JD021672

Assessment of OMI AOD over land:

https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2013JD020188

Question 15: for Tropospheric NO2 column, can you recommend a minimum column value that is above uncertainty threshold?

Answer 15: That's a very good question. I don't have an exact answer, so I'm going to look that up. And I'll update that answer here once I have more certain information. Update: In general, a tropospheric column amount shouldn't be a larger negative number than the stratospheric column. (A typical stratospheric column amount is $\sim 2\times10^{15}$ molec/cm^2)

Question 16: Which is the lower extension we can use OMI data? Is it the spatial resolution (24 x 13 km)?

Answer 16: If this question is asking what's the finest resolution of OMI data, that is it. As far as a gridded product, the .1x.1 degree product is the finest gridded product we currently offer.

Question 17: Can we obtain average data for one month of level 2 No2 data?

Answer 17: The short answer is no. But you can use the - if you want to use L2 - you can potentially use OMNO2G to see what swaths overlap a potential location over the course of a month

Question 18: Can NO2 data from OMI be combined with data from other sensors to improve resolution?

Answer 18: Don't think it's typically used with other sensors, but there are techniques for OMI downscaling using either high res chemical transport models or very high res land use regression models. Some work has been done with these techniques. With the intro of TROPOMI, we have much higher resolution available. It doesn't help for past measurements, but for the future.

Question 19: Have you thought about the workflow that is template and can used for the real time analytics of the work what you showed; say you just picked one time but how about we can process the time series on the fly and if we can share those results or workflow as web services?

Answer 19: I'm assuming you're talking about downloading the data. If you noticed, when I was doing the data download, there was an opendap link for the OMI data. That's something you can pick up potentially in near real-time. I'm not sure about subsetting it, though. That might need to be something that happens on your machine rather than automating that on the end of the GESDISC.

Question 20: There is version Python 3.7 available in the website. But, you referred 3.6.5. Should I install the 3.7 version? Will it work for this course?
Answer 20: I think 3.7 should be fine. Pawan: Strictly recommend 3.6.5 because the codes we created will work on that, and we're hoping they run on 3.7, but we can't guarantee that. So download 3.6.5. Melanie: So we can guarantee you can walk through the exercises with us.

Question 21: Is there any source of data for ethane measurements?
Answer 21: For satellites - no, there's no standard product.

Question 22: Do you know how the tropospheric ozone column product from TROPOMI compare to OMI?
Answer 22: I do not. As far as data quality - I'm not sure. As far as magnitudes, I don't think you're going to see big changes in the tropospheric ozone column with increasing resolution as you will with NO2/SO2, i.e. species with short lifetimes and high spatial gradients.

Question 23: Can we access the data using an API?
Answer 23: I'm not sure - but I think the fastest way to get it would be on the opendap server it's on. But I don't have a terrible amount of knowledge about APIs

Question 24: How is OMI NO2 L3 data obtained considering that there may be a potential difference of 90. minutes between granules?
Answer 24: Yeah - there is a difference of 90 minutes. Because of the nature of the orbit, it's overpassing every location at about the same time of day. So the overpass time for OMI is about 1:30/1:45 in the afternoon. They are 90 min apart, but it's sampling each location at the same time.

Question 25: Is the available OMI data suitable for daily assessment of regional NO2 concentration in sub-tropical areas with up to 60% cloud cover and high relative humidity?

Answer 25: For daily assessments - you might find the data to be noisy because of the cloud cover. As far as regional NO2 concentrations, again, it's going to depend on the sort of chemistry in the area how high your suburban or rural backgrounds are going to be. If a cloud is covering your urban center, and a suburban or rural region is in view, I'm not sure what conclusions you'd be able to draw from one to another.

Question 26: Can we use level 3 gridded data for scientific research?

Answer 26: Yes! Definitely. Level 3 gridded data can be very useful. It's definitely the easiest to use, so if you're a new user, Level 3 data is a good way to get introduced to using satellite data.