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) your question(s).

Question 1: How can I download AERONET data?
Answer 2: AERONET data can be downloaded at https://aeronet.gsfc.nasa.gov/ It's very straightforward - just go to AERONET and download the data by station, all stations together, a specific time period, there are various options. If you look at the ARSET website, there will also be an exercise available:

Question 2: Can AERONET data be available and used by themselves without satellite data. it looks like a nice network by itself
Answer 2: Yes, the AERONET network provides ground-based measurement of Aerosol Optical Depth (AOD). You can always use that and people do use that for many different applications, not just air quality but climate and other applications.

Question 3: Do you know if you can apply the same MODIS AOT models to Landsat-8?
Answer 3: Yes - there have been some attempts. There are some similarities to Landsat 8 and 9 and MODIS channels we use to retrieve AOD. There's been some attempt at research level but there's no operational AOD product from any Landsat satellites. It's very high resolution so there are issues that need to be addressed, and people have started this at the research level.

Question 4: How do you tell apart the biomass burning from haze or dust pollution?
Answer 4: So, the question is - how do you distinguish between different types of aerosols or particles coming from different sources - either from fires, industry, dust. The strength of satellite data is that in the case of MODIS you have 36 different spectral channels. Each of these particles - they respond a little differently to different spectral channels. Once we start looking at the signal in different spectral channels - up to some extent we can distinguish between different particles. It's not always possible to separate them - you can separate biomass burning during a big fire event. But in a mixed environment, it's very, very hard to do alone from satellite measurements. There are other advanced techniques that can help, but we have limited observations of those kinds of measurements but as satellite remote sensing is

advancing, we'll have more capabilities to separate different types of aerosols and identify sources.

Question 5: How can you solve if in your country don't have AOT Stations? In Ecuador, we have recently a station in Quito an AOT station.
Answer 5: So, there are multiple options. Either some countries do have their own Aerosol network (e.g., India, China) there are agencies other than NASA that have their own network that does cover multiple countries. First option: search on the internet for a regional station. If you don't have anything, go to the aeronet website and if you're interested, there's contact information, please contact them and they might have some solution.

Question 6: Why most of the studies are limited to PM2.5 and AOD relationship why not PM10-AOD?
Answer 6: That's a good question - in recent, last 2-3 decades, most health studies have focused on PM2.5, which is a smaller range of particles in the atmosphere. PM2.5 can be more harmful to human health than PM10, which are coarse particles that are difficult to penetrate the body. PM10 are also usually generated through natural process (dust storms, sea salt, e.g.) whereas PM2.5 is more anthropogenic particles and can be toxic in nature. Mostly because of their more severe health impact, people have explored that option. There have been studies for PM10-AOD, specifically for China and some European countries, India - places where PM2.5 is not available people have extracted PM10 from AOD.

Question 7: Which website will be used to download OMI data?
Answer 7: Talk more in Session 2. Earthdata will be used to download OMI data.

Question 8: I have problems acquiring AOD (MODIS) data because the study area is cloudy. The study area is located in the city of Bogota in the country Colombia. What could I do?
Answer 8: There are certain regions around the world where clouds are persistent throughout the year. It might be difficult to pick cloud-free regions. One option is to go through some of those online tools like Worldview that can help you identify clear areas and days over certain locations and pick those dates to download the data. Some active sensors like CALIPSO can provide useful information on vertical distribution but very, very limited coverage.

Question 9: Is it possible that we use Python3.6 instead of 2.7 for this webinar?
Answer 9: Short answer: yes, you can use 3.6, but our codes have been primarily tested in 2.7. Some have been tested in 3.6, but we can't debug during the webinar if you're having trouble. We've tested in 2.7 and know they work. I believe with little modification they should be able to work in 3.6 as well. In session 3, we'll try to show the 3.6 version so you can get an idea of changes to run from 2.7 to 3.6.

Question: Trouble with the packages listed in Python.
Answer: Things like calendar, etc. aren't coming up - run the test code. If you run the test code and it runs, you're fine. These frequently come as default and if the code is working without error or complaints, it means those packages are already installed. If you just type the package and import that package and it comes up with no error, it means the package is available. But if the test code is running, don't worry about them.

Question 10: It is possible to combine data obtained by ground monitoring stations with satellite information?
Answer 10: Yes. We'll go through a session 2 exercise to do this.

Question 11: Can MODIS products be accessed by some web service, such as WMS (Web Map Service) and WFS (Web Feature Service)?
Answer 11: So- yes, you can access the MODIS data using various web services. If you're more interested in that, please shoot us an email and we'll provide you with more details. You can search online and find different websites to access WMS and others through which you can access/import the data and display it on your website or integrate it with other applications.

Question 12: Will we be going over, in future training, how to export the data in GeoTIFF for use in GIS applications?
Answer 12: Not in this webinar series - we won't go over that specific aspect. But, if you go through the LAADSWeb exercise we just went through - at the end of the data ordering, there's an option called "Post Processing of the Data." if you go through post processing, you can convert the HDF file into GeoTIFF that you can export into your GIS software.

Question 13: Can we get SO2, PM2.5 data for each day? If there's missing data for some days, do we need to use some interpolation techniques to fill the gaps?
Answer 13: this is very much depends on your application. Yes, you'll see gaps due to clouds, retrieval problems, or the instrument itself might have row anomalies. There are ways to fill the gaps, statistical techniques, interpolation techniques, but it really depends on your application and how you want to use the data.

Question 14: Python install Questions?
Answer 14: **I encourage you to post your email in the Questions box if you are having trouble installing Python. That way a fellow participant may be able to assist.**

Question 15: If we post-process our hdf file which SDS will be appropriate for PM10 applications?
Answer 15: We will talk about that in session 2 when we look into the actual data. At that point we'll describe or talk about different SDS within the HDF files. So tune in to session 2!

Question 16: What are the biggest sources of error in accurately quantifying PM2.5 from aerosol optical depth data from satellite?
Answer 16: This is an interesting question - it really depends on many different parameters. Some are related to the retrieval accuracies of AOD iself and some are related to the composition of PM2.5 in different parts of the world, some are related to the vertical distributions of aerosols or PM2.5 in the atmosphere itself. It depends on where you are, what time frame you're looking at, what kind of aerosols you're looking at - those parameters will vary. It goes back to the fundamental definitions of Pm2.5 - a mass concentration of particles < 2.5 micrometers, AOD represents all particle sizes. If you're in a place and time where other size particles or larger particles are dominating, then you'll have a larger error in your PM2.5 from AOD. Most signals will come from large particles.

If you're in a place/time where there are multiple layers of particles in the atmosphere. You have a surface layer and there are layers at different heights due to long range transport or a specific event, the AOD signal will be contributed to from all those layers, whereas PM2.5 will just represent the surface and you'll have larger error there as well.

If you have aerosols very close - it happens in wintertime - close to the surface, most aerosols are accumulated in the lower-level of the atmosphere - during that time a satellite will have less sensitivity to the aerosol particles, and that can be another source of error.

There are other regions with high humidity, in hydroscopic aerosol environments, you'll see large errors. It varies a lot depending on what you're doing, where, and when.

Question 17: Have you processed images of the Sentinel 5p precursor to measure air quality?
Answer 17: Short answer: no. I believe you're talking about the TROPOMI which has been recently launched. The data hasn't been released from the European agency, so we haven't processed it yet.

Question 18: Can we automate the Data Download process using API?
Answer 18: Yes - there are various options on LAADSweb - there's OpenDAP, HTTP servers, FTP servers to download the data, and you can automate - you can write a script and automate that process easily.

Question 19: Can we use MODIS AOD or AERONET data to validate WRF/Chem aerosol simulations?
Answer 19: Short answer: you can use the AERONET data to validate. MODIS data can be used to compare - MODIS data isn't considered as "ground truth" but AERONET is. When we talk about validation, we compare with something *true*. But you can compare MODIS to get the feeling of overall performance and consistency.

Question 20: What could be the threshold of correlation between AOD and PM2.5 for validating the AOD product?
Answer 20: If you want to validate the AOD product, you have to use another AOD product. When you validate the AOD product, you use the same parameter. What you're asking is what is the threshold of correlation to get a good estimate of PM2.5 from AOD. It depends on how much tolerance you can sustain in PM2.5 Sometimes correlation of .5 can do the job, sometimes .9 - it depends on your tolerance level. Is it 5% accuracy you want, 40%? It depends on your application. There's no one answer for that estimation.

Question 21: Can you tell us the importance or applications of air quality monitoring on the ocean?

Answer 21: As you know, over oceans there are many different sources of pollution of aerosol particles. One major one is sea salt particles, which comes from the ocean as wind blows over the ocean surface. THere's other transport from dust, biomass burning, pollution from industry, that transport over the ocean. There's other sources like smoke from big ships, gas & oil drilling in the ocean that puts out a lot of pollution, there are aircraft emissions. If certain agencies require monitoring the level of pollution over the ocean, most of the time they are near the land boundaries. Most monitor aerosols over ocean related to climate applications.

Question 22: Is it possible to transport PM2.5 MODIS data to SMOKE to process it to use in CMAQ?

Answer 22: I think the SMOKE is the model within CMAQ - that comes with emission datasets. Short answer: yes, but I don't know all the details of how to do it.

Question 23: Fog is a special cloud (on the ground) that is highly affected by aerosols close to the surface. i am interested in identify and analyze the presence, occurrence and dynamics of fog in the tropical Andes. Is there any algorithm/product from NASA focus on this fog issues?

Answer 23: So, NASA, I believe, does not have any fog product - operational fog product. But there have been research studies people have published and there are methods people have developed based on the spectral thresholds of different MODIS channels that can be used to monitor, detect fog over different locations. If you're really interested in more, write an email to Pawan and he can suggest reference papers where people have demonstrated those techniques. Unsure if GOES has something? Please check the NOAA GOES-East - it might have a U.S. fog product.

Question 24: If we post-process our hdf file which SDS will be appropriate for PM10 applications?

Answer 24: Same as used for PM2.5. SDS with AODs.

Question 25: What is the difference between Normalized Difference Aerosol Index & PM2.5? Any correlation in these variables?

Answer 25: Not sure what normalized difference aerosol index is - unfamiliar with it.
There's a NOAA product - something like that, but not 100% sure. It might be from
VIIRS?

Question 26: Can we directly use modis or omi data without any corrections?
Answer 26: Short answer: yes, all the data is corrected for any correction needed. But
it depends on your applications and how accurate your data needs to be. If you need
very accurate data, you might need to do more corrections. If you can tolerate lower
accuracy, you can use as is. We'll go over some of this - there are products that come
with a quality flag that tells about uncertainty levels, and we'll talk about that in
sessions 2 & 3.

Question 27: Is MODIS data for PM2.5 available for 1-km resolution? i would like to use
it to evaluate CMAQ results for PM2.5 in 1-km resolution over western US.
Answer 27: There is a dataset available at 1 km spatial resolution. It's not a NASA
product, it's from Dalhousie university called atmosphere chemistry group led by
Randall Martin. They have a 1 km product and its Annual Mean Number. It is not an
official NASA product, but they use NASA satellite data to create that product.

Question 28: Can we work on regional scale for eg. Nagpur city, Maharashtra to extract
AOD over the city using satellite data?
Answer: Yes - and we will do that exercise in session 2

Question 29: Is PM2.5 has an impact on Occurrence of Western Disturbance Dynamics
Activity in Western Himalaya?
Answer 29: Not really sure what that means, so we'll say I don't know.