



Questions & Answers Session 2

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 the average, median and standard deviation of AOD, and # of valid pixels be useful in informing local air quality policy?

Answer 1: This is a difficult question, and the answer depends on what you mean when you say "air quality policy." The average value that 3x3 or 5x5 represent the average concentration of aerosol PM2.5 in that region. Median represents basically similar things, but it's a different statistical parameter to represent the median and takes into account the experience of the data and how it's distributed. Some groups rely more on the median and some on the average - it's going to vary by location and application. The standard deviation will tell you how much variability is there regionally. In terms of how it affects the policy - if the variability is less in a given city, and you want to monitor air quality over a large city and the are ais about 100 km or 10 km and you find the standard deviation is consistently low, over different times, it's telling you the source is homogenous. The source is located through the city and the distributions aren't changing too much. This suggests you might not need many ground measuring stations. But if you see a high variability, this suggests many, different sources and you'll need more ground monitoring stations. It's statistical parameters that are used to evaluate the distribution of aerosols in that region.

Question 2: MODIS 3 km is a resampled product of MODIS 10 km product. What sort of algorithm is used to resample or regrid from 10 km to 3 km? Or is it completely new product?

Answer 2: Not a resampled product - it's the same algorithm that applies to 10 km and is applied to run at 3 km resolution. As you can recall from session 1, the original MODIS resolution is either 250 m resolution, 500 m resolution, or 1 km resolution. Those are the 3 resolutions at which different spectral channels make the radians measurement. When you convert to AOD, you can choose what resolution to make that AOD. You can create at 1 km resolution, but in this case we chose to create at 3 km and 10 km resolution. The algorithm remains the same, but there are a few minor



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changes when it comes to pixel selection and cloud masking. Again, there's a link in the powerpoint called darktarget.gsfc.nasa.gov which should provide more details on the algorithm if you'd like more information.

Question 3: what kind of testing framework does NASA/modis team use in processing modis data? What are good practices/tips for testing satellite data processing and analysis?

Answer 3: I'm not sure what exactly the testing framework means. If you're implying talking about the validation of the datasets, we use aeronet datasets. If you're asking about programming language - different people use different languages. Some use IDEA some use python, some use fortran. I'm not sure what else you mean by testing framework. Shoot me an email and I'll be able to get into it more.

Question 4: I see the map is saved as a .png file. How should we save it as a geotiff (.tif) image so that the image can be manipulated in ArcMap or some other software? Or KML?

Answer 4: In Python, like showed in the code, towards the end there's an option to select an extension, and you can select all the extensions like .tif. In order to save GeoTIFF you have to do a little more - there are other codes available online to convert from HDF to GeoTIFF. In session 1, I mentioned that when you order the data, if you go to post processing, there's options to save the data as GeoTIFF. There you can select that option and the data you receive from NASA will be processed and in geotiff, which you can open in your GIS software.

Question 5: Is anyone else getting "TypeError: 'tuple' object is not callable" ? Should I change the tuple in the code into a list?

Answer 5: As mentioned ,if you reset your python console that error should go away. Sometimes python remembers a value of a variable from a previous run and that can create that problem. Unsure how to fix permanently, but there's way to reset the variable.

Question 6: each pixel has a latitude and longitude data, is that the center of that pixel?

Answer 6: Yes.

Question 7: When saving the map as a PNG, is there a way to increase the resolution? Is there a parameter that lets you set DPI or some other way of making the map larger?



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Answer 7: Yes - so, if you go to the base map part of the code where we're calling `n=` and providing the parameters for `basemap`, there's a key word for the resolution. I believe you can select low/high/medium and give the DPI range there.

Question 8: Is it possible to get some help after the class? It appears I am stuck because I couldn't create the HDF list

Answer 8: One thing we recommend is going over the recording, which we'll post in the next day, go over the powerpoint where we have step-by-step instruction on how to do that, and try yourself. If you still have problems, email us and we'll try and help.

Question 9: In order to get time series AOD data, do we need to download all the MODIS files? Or can we obtain ready-made time series data from the LAAD portal?

Answer 9: No, you cannot get radiometric data from LAADs - you have to download the data yourself. Try to look at post processing options when you download. There are some options to combine many HDF files into 1 single file. Maybe that works, but I haven't done it personally so I don't know the details. Look at the post processing option - there are a lot of manipulation options.

Question 10: Is `Optical_Depth_Land_And_Ocean (48.)` already filtered for the quality flags, or do we have to use the `Land_Ocean_Quality_flag` product to filter ourselves?

Answer 10: Yes - this is highest quality data, already filtered. For land `q=3` and ocean `q=123` - this is true for 1 km and 3 km product.

Question 11: I tried to download the data through FTP (Filezilla Client) and I couldn't do it. I know the data is available on the course web, but I would like to know how to do it this way, please. Any suggestions?

Answer 11: For that, I'll strongly recommend following instructions given in the email when you order the data on the LAADsweb website, it'll send you an email that has validated instructions and multiple download options.

Question 12: Should we modify the `read_and_map_mod_aerosol.py` code to show the maps? On showing map: should we modify the code for python 3? I have python 3 and maps are not showing in the console, although question prompt on whether I like to create a map appears. Thank you!

Answer 12: Looks like someone might have added - the `read, aid, map aerosols.py` should create a map for you, you don't have to change anything. If you're using 3.6 it



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should work as is, but it might come up with print error, but it should work. We'll check that next week when we use 3.6 on Monday.

Question 13: How do I know which variables/SDS files are relevant for say, AOD, air quality or other stuff?

Answer 13: This is a really important question. To know which SDS files are relevant, go to darktarget.gsfc.nasa.gov to get that where you'll find details on each SDS for deep blue there is another website called deepblue.gsfc.nasa.gov that provides all details and documentation for recommendations for various applications.

Question 14.1: Do you have any recommended papers to learn more about AOD-PM2.5 relationship? And how satellite data can be used to derive PM 2.5?

Answer 14.1: Yes - we can post some paper recommendations, but there's a nice 2009 paper published in air & waste management by hoff and christopher that's a review paper that provides basic information about Pm2.5 There's also a guidebook published on the ARSET website called air quality user guide by bryan duncan, published freely available to download.

Question 14.2: What kinds of tools do you use to bulk process modis files to derive AOD/PM2.5? Do you do any automated image processing on the generated maps to look for any red flags or interesting patterns?

Answer 14.2: Personally I use IDEA - other people use python. Varies a lot person to person and what they're familiar with.

Question 14.3: Would you mind summarizing again the different uses cases and pros/cons of Deep Blue vs Dark Target derived variables?

Answer 14.3: The dark target algorithm works over dark, vegetated areas. Dark target means surface should be dark enough, over water/vegetated areas/forest/urban areas, dark target is pretty good.

Deep blue works all places, including dark target and bright surfaces. If you're looking for AOD over large cities with minimal vegetation, deep blue might be more accurate. If you're looking at areas where surface is bright, desert areas, western U.S. or Indian/China deserts, dark target may not be available or lower quality.

Question 15: I want to monitor PM10, which SDS name do i have to use?



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Answer 15: You can use optical depth land and ocean but the best quality data from dark target algorithm if your location involves bright surface, you might want to use deep blue optical

Question 16: Is necessary to do atmosphere correction to process the image?

Answer 16: Atmospheric corrections have already been performed on retrieved AOD so you don't have to do that.

Question 17: Is the AOD Data for 10 Km and 3 Km correlated at all the locations? Is 3 km data better?

Answer 17: Like I said earlier, both are processed using the same algorithm. The difference is the resolution and that usually comes with validation studies that show 3 km is lower quality than 10 km. 3 km is good for small-scale pictures, but it comes with more noise. 10 km compares better with aeronet on a global scale.

Question 18: All the HDF files have to be processed one by one. What if you have hundreds of HDF files? Is there a way to batch process all the files at one single time?

Answer 18: Yes - you have to make some minor change in the code, specifically in places it's reading the inputs from the screen. If you can command those and hardwire it should process the command and files in your code, it'll keep running the code and won't ask - it's a minor, small change.