Questions & Answers Session 2

Please type your questions in the Question Box. We will try our best to get to all of your questions. If we don't, feel free to email Pawan Gupta (pawan.gupta@nasa.gov).

Question 1: Hi, you mentioned that AOD is adimensional. Is the scale bounded to a specific interval (ex: 0-1)?
Answer 1: Yes, the scale is typically bounded to a specific interval. The range depends on how the AOD data are visualized and where you are in the world. Typically in the U.S., AOD ranges from 0-1. That's the scale for AOD displayed on the NOAA AerosolWatch (ABI and VIIRS AOD) and JSTAR Mapper (VIIRS AOD) webpages. In more polluted parts of the world, AOD can be >1. An example is the winter haze that occurs in northern India. During these episodes, and in very thick smoke plumes, AOD can range up to 5. The scale for AOD displayed on the NASA Worldview website (MODIS AOD) ranges from 0-5, since it shows global AOD.

Question 2: Is the daily PM AQI map derived from air quality forecast model?
Answer 2: The Air Quality Index (AQI) is a dimensionless, color-coded scale (0-500) developed by the U.S. EPA to communicate both current and forecasted ambient air quality to the public. It's not tied to a forecast model. Instead, it's based on the concentration of a specific pollutant, such as PM2.5, and it's tied to the health standard for that pollutant (called the National Ambient Air Quality Standard or NAAQS). The AQI has 6 categories, with increasing severity of air quality: Code Green (Good), Code Yellow (Moderate), Code Orange (Unhealthy for Sensitive Groups or USG), Code Red (Unhealthy), Code Purple (Very Unhealthy), and Code Maroon (Hazardous). In the U.S., air quality of Code Orange or higher typically violates the NAAQS for a given pollutant, and triggers an Air Quality Alert.

Question 3: How does the U.S. EPA use satellite data in conjunction with their ambient air monitoring network and data?
Answer 3: U.S. EPA uses satellite data in conjunction with their ambient air monitoring network in several key ways. U.S. EPA, in conjunction with NASA and NOAA, has a project called the AirNow Satellite Data Processor (ASDP), in which they fuse satellite AOD data with ground-based PM2.5 monitor observations to fill in gaps in the national monitor network. Since ground-based monitors are clustered in urban and suburban areas, where most people live, there are large gaps in the network in rural areas. So the EPA has this fused product to try and address areas where surface monitor network

is sparse. Also, the EPA, in partnership with NOAA, runs operational air quality models - for ozone and PM2.5 predictions - and also predictions of dust and smoke. The team at NOAA NCEP that runs the numerical modeling program uses satellite data as part of the assimilation process, and they use AOD data to verify the model output as well.

Question 4: On AerosolWatch, will you likely have the option to overlay GOES-16 and -17 to make one composite image?
Answer 4: We will definitely display the GOES-17 data, once the satellite becomes operational, presumably in late 2018 or early 2019. At first, we will have separate layers on AerosolWatch to view the GOES-16 and -17 imagery. If the users ask for it, we can create a composite of the imagery from both satellites.

Question 5: With the ABI Dust Mask, might it be possible to track dust plumes across the Pacific Ocean using GOES West?
Answer 5: Yes - absolutely. GOES-17 is expected to become GOES-West in late 2018 or early 2019. At that point, the GOES-17 ABI dust mask and dust RGB imagery will be available on AerosolWatch. The dust mask will be useful to track dust plumes across the Pacific Ocean, but the dust RGB might even be more useful since it is available during the nighttime, while the dust mask is only available during daylight hours.

Question 6: How can we verify that the atmospheric dust in the atmosphere or after deposition over the ocean is not interfering with the chlorophyll remote sensing?
Answer 6: I am not an expert in chlorophyll remote sensing, so I can't answer that specifically. I can tell you that the ABI dust RGB and dust mask products have a turbidity test, so if the coastal waters are turbid, then the dust RGB and dust mask aren't retrieved. So there is no interference in the atmospheric dust measurements by chlorophyll in coastal waters.

Question 7: What other quantitative parameters can be derived using the current remote sensing technologies? For example: any concentrations of PM or gaseous pollutants?
Answer 7: AOD is a quantitative measure of PM2.5. There is a very active area of research on relating AOD measurements from different satellite instruments to surface PM2.5 measurements in different parts of the world, since AOD and PM2.5 vary by season and location. There is an ARSET webinar on this topic (.https://arset.gsfc.nasa.gov/airquality/webinars/advanced-AOD-PM). Using satellites to quantitatively derive surface concentrations of gaseous pollutants is more difficult. Satellite measurements of SO2, NO2, and CO are available and useful for a variety of

applications, such as using satellite SO2 to monitor volcanic eruptions and the impacts on aviation. For ozone, it's essentially impossible to quantitatively measure the ambient ozone in the troposphere (near the surface) since most of the ozone in the atmosphere (90%) is in the stratosphere. Satellites just can't "see" through all of the ozone in the stratosphere to resolve what's at the surface, at least not on daily or even weekly time scales. There are some new satellites on the horizon, such as TEMPO and GEO-CAPE, that have promise to resolve some of the gaseous pollutants - like ozone and NO2.

Question 8: Can we obtain the ABI Aerosol product in real-time ?
Answer 8: Yes - near real-time and archived imagery are on AerosolWatch website. When you open the site, a selection box will open, and you can select which of near real-time data you want to visualize. The latency is about 20 minutes (so there is a delay of about 20 min between the satellite observation, and when the imagery is available on AerosolWatch). During the training, when I demoed AerosolWatch at 12:55 pm, what I showed was the near real-time data, the latest of which was from 12:30 pm.

Question 9: What is spatial coverage? Is it available for Asia?
Answer 9: No, ABI observations are not available for Asia. Since GOES-16 and GOES-17 are geostationary satellites, they only have hemispheric coverage. On slide 4 of the training, I showed the coverage of GOES-East (GOES-16) and GOES-West (soon to be GOES-17). The Himawari-8 and Himawari-9 satellites have an instrument called the Advanced Himawari Imager (AHI) that is analogous to the ABI, however, that does provide coverage of Asia.

Question 10: Is there a way to know the size of particles from the AOD measurement? Is there a suggested algorithm?
Answer 10: Yes, this a very active area of research, relating satellite AOD to surface PM2.5 (or PM10) measurements. The algorithm depends on location, time of year, and the satellite instruments. To learn more, there is an ARSET webinar on this topic (https://arset.gsfc.nasa.gov/airquality/webinars/advanced-AOD-PM). Since the ABI AOD are still only provisional maturity, NOAA hasn't - yet - established the relationship to relate ABI AOD to surface PM2.5 in the U.S., but they will once the ABI data reach full maturity.

Question 11: Does the AerosolWatch cover every part of the globe?
Answer 11: AerosoWatch displays ABI imagery from the GOES-16 (and soon GOES-17) satellites. The GOES are geostationary, so they only cover the Western Hemisphere (see the answer to question 9).

Question 12: What is the difference between AOD and AOT?
Answer 12: They are essentially synonyms: Aerosol Optical Depth (AOD) and Aerosol Optical Thickness (AOT).

Question 13: Can there be a negative AOD value?
Answer 13: Yes, sometimes you will see negative AOD values. Since AOD is defined as the scattering and absorption of visible light by aerosols, if there are a lot of highly absorbing aerosols, like black carbon, then AOD can be negative. Sometimes you will see AOD scales to go down to -0.5 to reflect this. But typically, AOD values are positive.

Question 14: From what time period AOD data is available?
Answer 14: GOES-16 launched in November 2016. It takes several months after launch to calibrate the satellite and do instrument checks. For a product like AOD, which uses many channels of the ABI in a complex algorithm, it takes even longer for the data to be available. So we have what's called beta-maturity (preliminary data) ABI AOD from GOES-16 from as early as September 2017, but you can't use those data for scientific purposes. The ABI AOD attained what's called provisional maturity in July 2018. Provisional maturity isn't the final level of maturity, but it means that the data can be used for scientific purposes. So on AerosolWatch, you will see the AOD available beginning in late July 2018.

Question 15: Can I download the AOD information in the South America region? to integrate with a GIS software?
Answer 15: You want the data files (not imagery) for that application. You will need to download the ABI AOD from NOAA's CLASS website. However, since the AOD data are only recently provisional maturity (as of July 24, 2018), they aren't available from CLASS yet, but they will be in a few months.

Question 16: which data repository does the GOES ABI data reside? I am looking for L2/L3 type data.
Answer 16: See the answer to question 15.