



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 Pawan Gupta (pawan.gupta@nasa.gov), Sarah Strode (sarah.a.strode@nasa.gov) and/or Aaron Naeger (aaron.naeger@nasa.gov).

Question 1: Why is the polar orbiting different in every season? What parameters can be affected by the polar orbiting of satellites?

Answer 1: This might be related to the fact that the same “solar time” can correspond to different “local times” in different seasons. In relation to air quality, aerosol is measured during cloud-free conditions. It is harder to take these measurements during the winter and during monsoon season.

Question 2: Is the reflectivity of dust or smoke influenced by climate? And if so, then what is the best possible geostationary platform to be used to identify it?

Answer 2: The reflectivity of dust and smoke get included in other aerosol particles and have different properties of other aerosols. GOES and GEMS are the best missions to use data to identify smoke and dust, which we will cover in the next parts of this training.

Question 3: What useful things can we get from the geostationary satellites during nighttime?

Answer 3: Night light intensity can be measured, which can provide information about human activities. There is also a nighttime microphysics RGB product. This product helps with the distinction between low clouds and fog.

https://www.star.nesdis.noaa.gov/goes/documents/QuickGuide_GOESR_NtMicroRGB_final.pdf

Question 4: Is there a simple explanation of what an averaging kernel is?

Answer 4: You can think of an averaging kernel as a “weight factor” which describes how sensitive the satellite instrument is to information at different heights in the atmosphere or at different wavelengths (depending on the context). A satellite’s measurement is therefore the weighted average of the true quantity of interest across



all altitudes/wavelengths, where the weight in the average is described by the averaging kernel. We will cover this in more detail during part 3.

Question 5: Is there an archive of GOES images and data somewhere? I want to see dates more than a few weeks old, for example, from 2021.

Answer 5: GOES-16 and -17 imagery from the CONUS and full disk sectors is available in near real-time and archived back to 2019 at NOAA's AerosolWatch website (<https://www.star.nesdis.noaa.gov/smcd/spb/aq/AerosolWatch/>). Imagery includes GeoColor (true color) and aerosol optical depth (AOD). A live demo of the AerosolWatch website will be offered in Part 2 of the training on Oct 18.

Question 6: What is the full range of data observation frequencies from the GOES-R satellites?

Answer 6: The observation frequency depends on the "scan mode" of the satellite. The most common mode is called Mode 6 (M6), the default "flex mode" - this is the mode that Dr. Gupta referred to in the Part 1 presentation (full disk observations every 10 minutes, CONUS every 5 minutes, and two mesoscale sectors every 1 minute). There are other scan modes that occur periodically, which users may encounter - including Mode 4 (M4), the "continuous full disk" mode, with full disk observations every 5 minutes, and no CONUS or mesoscale observations. For more information, and the full list of scan modes, see https://www.star.nesdis.noaa.gov/atmospheric-composition-training/satellite_data_abi_scan_modes.php

Question 7: Is there a cut-off date for historical data in Worldview?

Answer 7: Some of the earliest images in Worldview are likely ~2000/2001 at the beginning of the NASA Earth Observing System (EOS) Program. For example, the Terra satellite was launched in late 1999.

Additional Worldview information can be found here:

<https://www.youtube.com/c/NASAEarthdata/search?query=worldview>

Question 8: I recently made a timelapse of hurricane Ian over Florida with Goes-16 full-disk data. I used the bands as follows:('CMI_C02', 'CMI_GREEN', 'CMI_C01'). What kind of different band composition can I use? When I tried different bands it gave me errors.



Answer 8: You can change the order of RGB and channel and use a different color combination through false color composite. Using the example of land color, you can use a different color to emphasize a feature more.

Question 9: Is there any data source which can give the option to download the data in excel or csv format from Nasa Worldview?

Answer 9: That is feature that is not possible through Worldview. You can only download data in NetCDF and HDF/HDF5 format.

Question 10: If people want to use this data for machine learning models and Data science projects, which data formats should they be familiar with and what tools are needed for python users?

Answer 10: In Part 2 of this training on Oct 18, Dr. Huff will show how to use Python to download, open/read/extract, and map/visualize GOES-R satellites AOD data! In general, satellite data are commonly saved in HDF or NetCDF formats. Some useful python packages for data science and geospatial data analysis include numpy, pandas, scipy, sklearn, and xarray. You can take a look at some of the earlier ARSET trainings, many of which have demonstration codes in python, to get some ideas of what python tools might be useful for you. For example, <https://appliedsciences.nasa.gov/join-mission/training/english/aset-applications-satellite-observations-air-quality-and-health> has a component on using python to read, extract, and map satellite AOD data.

Question 11: Does a Geostationary satellite have NRT wind speed data? If it does, can you provide me with a link to the data?

Answer 11: The GOES-R satellites have a Level 2 Derived Motion Winds (DMW) product. Here is a link to the product documentation: https://www.star.nesdis.noaa.gov/GOES/documents/QuickGuide_BaselineDerivedMotionWinds.pdf

Here is the link to the GOES-16 product Read-Me for Data Users: <https://www.star.nesdis.noaa.gov/GOES/conus.php?sat=G16>

Here is the link to the GOES-17 product Read-Me for Data users: https://www.ncei.noaa.gov/sites/default/files/2021-08/GOES-17_ABI_L2_DerivedMotionWinds_Provisional_ReadMe.pdf



Near real-time imagery is available from NOAA's GOES Image Viewer website, here is the link to GOES-East (GOES-16) imagery; Derived Motion Winds is the 5th option:
<https://www.star.nesdis.noaa.gov/GOES/conus.php?sat=G16>

Dr. Huff will demonstrate how to download GOES-R satellites Level 2 data files using Python in the Part 2 training on Oct 18, including Derived Motion Winds data files. Although the training will not cover how to work directly with the files, you will learn how to open files and read the metadata - users can apply that knowledge, along with information about the Derived Motion Winds data product from the product Read-Me for Data Users - to work with the data on their own.

Question 12: What does 'Z' mean? (This was asked when the volcano gif was being created)

Answer 12: A lot of scientific observations use a standard 24-hour time called 'Zulu time'. Another name is Coordinated Universal Time (UTC). 'Z' is an abbreviation for this.

Question 13: How can you measure the coverage, for example, of that volcano, either width or depth etc...?

Answer 13: If you want to measure the vertical profile of the volcano, you would need a sensor to measure the vertical profile since imagery alone will not be able to capture it. Also using the physical parameters of the volcano (area) and its subsequent changes are also another way of measuring it.

Question 14: How do I activate the time hours and minutes on the Worldview? I only see year, month and day.

Answer 14: The hour/minute option should appear once you add a geostationary layer. For example, go to 'Add Layers' and type 'GOES' into the search bar to locate GOES layers.

<https://www.youtube.com/c/NASAEarthdata/search?query=worldview>."

Question 15: For TEMPO, will averaging kernels be necessary and if so will they be included amongst the data products?

Answer 15: The averaging kernel information will already be in the product and other pertinent variables.



Question 16: For TEMPO, will the chemistry products be available in units of mixing ratio (ppmv, ppbv, etc...)?

Answer 16: Those measurements will be made available in molecules per centimeter squared. TEMPO ozone observations will be available in Dobson Units (DU).

Question 17: Does TEMPO cover other parts of the world?

Answer 17: No, TEMPO only covers greater Northern America. Future missions, such as the European Sentinel-4 mission, and the GEMS mission (discussed in Part 3 of this training) cover (and will cover) different regions of the globe.

Question 18: Why is the resolution different for ozone profile and aerosol?

Answer 18: For the ozone profile, it is a noisy retrieval when done with the TEMPO nominal footprint. To combat this, we do co-adding to decrease the signal to noise ratio to provide more accurate data. Aerosol is a similar concept, but will have greater accuracy. We are still working on this.

Question 19: Can I detect the emissions of NO_x from TEMPO?

Answer 19: Yes. TEMPO will provide tropospheric data on NO_x emissions.

Question 20: Can we monitor and analyze hydrometeorological hazards using geostationary datasets?

Answer 20: Yes we can. It is a primary use for geostationary data.

Question 21: How is the pre-launch data generated for TEMPO? Are those actual measurements or simulated data?

Answer 21: We use model input information from the GEOS Nature Run simulation. We will provide a link with more information about pre-launch product generation.

Question 22: How can I get the Level 2 and level 3 data from a geostationary satellite?

Answer 22: We will go into more detail in Part 2!

Question 23: Can organic and non-organic aerosols be identified and differentiated based on geostationary satellite data?



Accessing and Analyzing Air Quality Data from Geostationary Satellites October 11-25, 2022

Answer 23: Geostationary satellite data products don't give information about aerosol composition. You can take a look at MAIA, an upcoming non-geostationary satellite mission which will provide information on aerosol composition in several target cities around the world: <https://maia.jpl.nasa.gov/>

Question 24: Can you explain the effect of the seasons on the concentration of pollutants in the air?

Answer 24: This is a very complex topic; you can take a look at Part 1 of this earlier ARSET training on air quality to get a basic overview:

<https://appliedsciences.nasa.gov/join-mission/training/english/arset-introduction-and-access-global-air-quality-forecasting-data-and>

Question 25: The examples given in the presentation were focused on areas with latitudes closer to the equator, where the satellite is orbiting. What about quality in other latitudes, like the northern US and Canada?

Answer 25: At higher latitudes, polar-orbiting satellites can give better information about air quality. However, data availability might still be limited due to low-light conditions in different parts of the year.

Question 26: Can we safely say that geostationary satellites can give 'better' datasets for AI usage ?

Answer 26: It is difficult to say whether they are "better", but they may be more suitable for different applications. For example, with a geostationary satellite giving consistent information from the same "view" of the earth during different times of day, the dataset from a geostationary satellite may be more temporally complete for its target area, and that might translate to a better training dataset for certain AI applications. On the other hand, if you wanted to train an AI algorithm that would work anywhere in the world, you'd need to combine data from several different geostationary satellites to get better global coverage for your dataset.