

AERONET Data Synergy Tool

Introduction

The AERONET data synergy tool is a web-based portal providing AERONET data in addition to other ground-based, satellite, and model data sets. Products include data from ground-based networks (e.g., AERONET and MPLNET), satellite instruments (e.g., MODIS, TOMS, and OMI) and model products (e.g., back trajectory analyses, GOCART, and NOGAPS). In addition to images, data plots and maps, most data products provide digital data that may be downloaded for further analysis. The availability of aerosol-related Earth Science data sets at one web page provides the analyst with the ability to produce an aerosol analysis in a short period of time.

AERONET Data Synergy Tool: http://aeronet.gsfc.nasa.gov/cgi-bin/bamgomax_interactive
Aerosol Analysis Exercises (Approx. 30-40 minutes each)

1. **Air quality event for your workshop**
 - a. Examine AOD levels for the month and day of your air quality event
 - b. Examine the back trajectory image and download the associated KML file.
 - c. Find and download the associated MODIS images for the day of your study
 - d. Estimate aerosol size and absorption properties.

These additional activities are available on the word version of this document which can be downloaded from the ARSET website.

2. **Examine a high aerosol loading event over Kanpur (India).**
 - a. Determine aerosol concentration, size, and contribution to the aerosol optical depth by fine and coarse mode particles
 - b. Identify potential aerosol source regions
 - c. Compare ground-based and satellite observations with model results
 - d. Estimate the aerosol composition
3. **Examine a high aerosol loading event over Gandhi_College (India).**
 - a. Find the high aerosol loading event over Gandhi_College
 - b. Analyze prevailing meteorological conditions
 - c. Determine aerosol spatial distribution
 - d. Identify potential aerosol source regions
 - e. Estimate aerosol size and absorption properties

See the AERONET Data Synergy Tool Product Description below for more information.

AERONET Data Synergy Tool Product Description

1. **AERONET Direct Sun Data Products**
 - a. Aerosol Optical Depth (AOD): Provides the columnar optical depth due to aerosols.
 - b. Angstrom: Provides a general interpretation of the small and large size particles in the column (values near 2 indicate fine and near 0 coarse).
 - c. Water Vapor: Provides the columnar water vapor (precipitable water).

- d. Levels: Level 1.0 (unscreened); Level 1.5 (cloud-screened); Level 2.0 (quality-assured)
2. **AERONET Inversion Data Products**
 - a. Size Distribution: Provide the aerosol volume size distribution and determines fine and coarse modes.
 - b. Refractive Index – Imaginary Part: Provides an indication of the amount of absorption
 - c. Single Scattering Albedo: Provides the spectral absorption characteristics
3. **MODIS Rapid Response Images**: True color images with fire detection indicated as red marks.
4. **MPLNET**
 - a. Level 1.0 Normalized Relative Backscatter: A raw product indicating aerosol and cloud layers
 - b. Level 1.5a Extinction: an extinction profile derived from the synergism of AERONET aerosol optical depth and lidar parameters to determine the aerosol layer heights; this product will not be generated when a cloud is detected immediately above the lidar.
5. **Back Trajectory Analyses**: Kinematic back trajectory analyzes are generated for 7-days back from the observation time; this product provides an indication of potential source regions.
6. **GOCART**
 - a. 3-Hourly: Provides AOD every three hours for 450, 550, and 900nm wavelengths and plotted for each component: organic matter, black carbon, sea salt, sulfates, and dust.
 - b. Maps: Provides the same as 3-Hourly above except drawn on a map.
 - c. Combined AERONET/GOCART: Provides AOD from AERONET Level 2.0 and GOCART to compare on the same plot.
7. **GIOVANNI**
 - a. MOVAS MODIS Daily: Provides aerosol and cloud products
 - b. Ozone (TOMS&OMI): Provides OMI and/or TOMS UV aerosol index, ozone, and effective surface reflectivity products.
8. **NOGAPS**
 - a. Surface Map: Provides mean sea-level pressure, precipitation (>.25cm) and 1000-500hPa thickness.
 - b. Temp/Wind Map: Provide the temperature and wind for designated pressure surface.
 - c. Sounding: Provide the model sounding (i.e., vertical temperature, dew point and wind profiles).

Aerosol Training Exercises

Exercise 1:

1. Navigate to the AERONET Data Synergy Tool (http://aeronet.gsfc.nasa.gov/cgi-bin/bamgomas_interactive)
2. Enter Univ_of_Houston in the Site Name field.
3. Choose Year: 2012; Month: June; Day: 27 in the Master Controls.
4. Choose AOD, Inversions (V2) and SDA retrievals under AERONET in the Master Controls.
5. Increase the size of the thumbnails using the Large option or click in the Master Controls or click on the small thumbnails to open a larger pop-up image

**** Determine aerosol microphysical and radiative properties**

6. Under the calendars on the left side of the page select Level 2 in the AERONET AOD Data Controls, and SDA retrievals. Select Level 1.5 for the Inversion (V2) data controls.
7. Choose Angstrom in the Data Type field of the AERONET AOD data controls Choose Water Vapor in the Data Type field of the AERONET AOD data controls.
8. View the Inversions (V2) product volume size distribution (shows aerosol modes); change the data product to Single Scattering Albedo.

Record your estimate of the average value for each of the following:

AOD:

Angstrom Exponent:

Single Scattering Albedo (estimate for 550 nm):

Fine AOD: _____ Coarse AOD: _____

Fine Mode Fraction: _____ Water Vapor: _____

Does there seem to be any relationship between the AOD, Angstrom Exponent, Single Scattering Albedo and Water Vapor? If so describe this relationship:

**** Identify potential aerosol source regions**

9. Select Trajectory and HySplit Trajectory under Model Output; For the HySplit Trajectory select 500 M, 1500 M and 3000 M End Heights.
10. Download a KMZ or an image file of the back trajectories for one or both satellites.
What could be the aerosol source regions for your site on this day?

**** Compare ground-based and satellite observations.**

11. Select “Modis Daily” and MISR daily in the Master Controls. Switch to June 26 as your date.

How do the AOD values for the three sensors compare to each other?

(Make sure you click on the thumbnail images and check the AOD scales before you answer this question.)

How do the satellite values compare to the AERONET AOD values for the same or similar time of day?

Change the product in the MOVAS data controls to “Deep Blue Aerosol Optical Depth.” How is this different than the default dark target value?

Investigate Meteorological Effect

12. Change the date back to June 27. Select “NOGAPS” under Model Output. Look at the surface map, temperature and wind maps for different levels and the sounding.

Are there any meteorological effects that could explain changes in AOD or aerosol properties throughout the day?

Obtain a true color image for this day in KMZ format.

13. Go to the MODIS today site. <http://ge.ssec.wisc.edu/modis-today/>

Select “Show All Available Images.” Use the calendar to navigate to June 27, 2012.

Select Aqua. Click the “Open in Google Earth” link at the top.

14. Repeat this analysis for August 7, 2013