AEROCENTER Seminar
April 15, 2008

AERONET Data Synergy Tool Exercises

Introduction

The AERONET data synergy tool is a web-based portal providing AERONET data in additional 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/bamgomas_interactive

Aerosol Analysis Exercises (Approx. 30-40 minutes each)

1. **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

2. **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

3. **Examine a dust event over Beijing and XiangHe (China).**
    a. Find aerosol products indicating dust
    b. Identify aerosol source regions
    c. Determine aerosol characteristics supporting primarily dust
    d. Estimate aerosol layer height
    e. Evaluate model results

4. **Examine a high aerosol loading event over Lulin (Taiwan).**
    a. Find the high aerosol loading event over Lulin
    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.

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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).

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Aerosol Training Exercises

Exercise 1:

1. Navigate to the AERONET Data Synergy Tool (http://aeronet.gsfc.nasa.gov/cgi-bin/bamgomas_interactive)
2. Enter Kanpur in the Site Name field.
3. Choose Year: 2005; Month: JUN; Day: 10 in the Master Controls.
4. Choose AOD and Inversions (V2) under AERONET in the Master Controls.
5. Increase the size of the thumbnails using the Large option in the Master Controls.

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

6. Select Level 2.0 (quality-assured) in the AERONET AOD Data Controls and 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.

***** Identify potential aerosol source regions***

9. Deselect AERONET AOD and Inversions and choose MODIS Rapid Response under Satellite Retrievals and Back Trajectory under Model Output; view a larger image by selecting the map plot or zoom the MODIS images using the controls below them.

***** Compare ground-based and satellite observations with model results***

10. Deselect all products in the Master Controls and select GOCART under Model Output.
11. Choose Combined GOCART/AERONET in the GOCART data controls and select the daily image plot to compare these data sets.
12. Choose View Hourly Maps; select Map Region: 20x20 and click on 550nm plot to view a larger image.
13. Select MOVAS (Modis Daily) in the Master Controls; change the product in the MOVAS data controls to “Deep Blue Aerosol Optical Depth”; compare the Aqua satellite retrievals with GOCART output and AERONET measurements interpolated to 550nm.

***** Estimate aerosol composition***

14. Choose 3-Hourly Daily in the GOCART controls to view plots for each available wavelength.

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Exercise 2:

1. Navigate to the AERONET Data Synergy Tool (http://aeronet.gsfc.nasa.gov/cgi-bin/bamgomas_interactive)
2. Enter Gandhi_College in the Site Name field of the Master Controls.

***** Find the high aerosol loading event in 2008 over Gandhi_College***

3. Choose AERONET AOD and select Level 2.0. Note: If not available, you may use Level 1.5, however, these data are not quality-assured.
4. Select 2008 for the year.
5. Analyze the AERONET AOD yearly plot to determine high aerosol loading events in January 2008; change the Month and choose the day (e.g., 31).

***** Analyze prevailing meteorological conditions***

6. Select NOGAPS under Model Output; change the plot type to Temp/Wind Map and set the Map Level to 925, 850, and 700 hPa.

***** Determine aerosol spatial distribution***

7. Select MODIS Rapid Response from the Master Controls; analyze Aqua and Terra images for potential aerosols.
8. Select MOVAS (MODIS Daily) from the Master Controls and analyze the AOD and Deep Blue AOD at 550nm.

***** Identify potential aerosol source regions***

9. Choose the back trajectory analysis from the Master Controls; determine potential source region.
10. Open a new web browser window or tab and navigate to the synergy tool.
11. Using identified source region, use the "Select Map Browser" control at the top-left to select AERONET-AOD; select the Northern India region and choose Kanpur.
12. Set the date to 30 January 2008 (or 1 day prior to Gandhi_College observations).
13. Choose MODIS Rapid Response; analyze aerosols and clouds (red markers indicate detected fires).
14. Choose Ozone (OMI Daily) product from Master Controls; view the UV Aerosol Index; change size to 32x64 to increase map region.
15. Switch back to the Gandhi_College web window.

***** Estimate aerosol size and absorption properties***

16. View the Angstrom parameter in the AERONET AOD product.
17. Choose AERONET Inversion (V2); select Level 2.0; view size distribution, imaginary part of refractive index, and single scattering albedo.

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Exercise 3:

1. Open two windows or tabs; navigate to the AERONET Data Synergy Tool (http://aeronet.gsfc.nasa.gov/cgi-bin/bamgomas_interactive)
2. Enter Beijing in one window and XiangHe in another; set the dates in each window to 29 April 2005

***** Find aerosol products indicating dust***

3. For each site, choose AERONET AOD and Inversions (V2) and select Level 2.0; and choose Ozone (TOMS&OMI Daily) and MOVAS (MODIS Daily).
4. Compare daily AOD plots from each site.
5. Change AERONET AOD to Angstrom data type and compare site plots.
6. Compare size distribution, real part of refractive index, and single scattering albedo plots between sites.
7. Analyze the MODIS AOD and OMI UV Aerosol Index products.

***** Identify aerosol source regions***

8. Deselect all products; and choose the back trajectory analysis for each site.

***** Estimate aerosol layer height***

9. Deselect all products; and choose MPLNET for XiangHe; if available, select 05:55:18 GMT for Level 1.5a product.

***** Evaluate model results***

10. Deselect MPLNET; choose GOCART for both sites; choose daily AERONET/GOCART combined plots and compare between sites.
11. Select 3-Hourly plots and compare between sites.
12. Set Large image size in Master Controls
13. Select View Hourly Maps for Beijing; set Map Region to 20x20; scroll through Map AOD Types (Total to Dust).
14. Compare GOCART maps to MODIS AOD and OMI UV Aerosol Index.

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Exercise 4:

1. Navigate to the AERONET Data Synergy Tool (http://aeronet.gsfc.nasa.gov/cgi-bin/bamgomas_interactive)
2. Enter Lulin in the Site Name field of the Master Controls.

***** Find the high aerosol loading event in 2007 over Lulin***

3. Choose AERONET AOD and select Level 2.0.
4. Select 2007 for the year.
5. Analyze the AERONET AOD yearly plot to determine high aerosol loading events and change the Month (i.e., March).

***** Analyze prevailing meteorological conditions***

6. Set the date to 16 March 2007.
7. Select NOGAPS under Model Output; change the plot type to Temp/Wind Map and set the Map Level to 925 hPa and then 850hPa.

***** Determine aerosol spatial distribution***

8. Select MODIS Rapid Response from the Master Controls; analyze Aqua and Terra images for potential aerosols.
9. Select MOVAS (MODIS Daily) from the Master Controls and analyze the AOD at 550nm.

***** Identify potential aerosol source regions***

10. Choose the back trajectory analysis from the Master Controls; use the 00 UTC image to determine potential source region.
11. Open a new web browser window or tab and navigate to the synergy tool.
12. Using identified source region, use the "Select Map Browser" control at the top-left to select AERONET-AOD; select Southeast Asia and choose Bac_Giang.
13. Set the date to 11 March 2007.
14. Choose AERONET AOD and select Level 2.0.
15. Choose MODIS Rapid Response; analyze fires and aerosols (red markers indicate detected fires).
16. Choose Ozone (OMI Daily) product from Master Controls; view the UV Aerosol Index; change size to 32x64 to increase map region; change day to 14, 15, and 16 to view changes in coverage.
17. Switch back to the Lulin web window.

***** Estimate aerosol size and absorption properties***

18. View the Angstrom parameter in the AERONET AOD product.
19. Choose AERONET Inversion (V2); select Level 2.0; view size distribution, imaginary part of refractive index, and single scattering albedo.