

# **Familiarisation and Visualization of Aerosol data with Hands-on-Retrieval using iAOD software**

Akhilesh Kumar  
PhD, UNSW, Sydney  
[akhilesh.kumar@unsw.edu.au](mailto:akhilesh.kumar@unsw.edu.au)

# Operational AOD products

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<b>Satellite-based products</b>	<b>Ground-based measurements</b>
MODIS* (DB, DT, combined, MAIAC)	AERONET*
OMI, GOME, TOMS, MERIS, OCM-2	ARFINET
AVHRR (1 <sup>st</sup> satellite AOD product)	ICARB
POLDER, CALIPSO	EARLINET
Landsat, Sentinel 2 <sup>a</sup>	ACE-1, SAFARI 2000

<sup>a</sup>Kumar, A., & Mehta, M. (2024). Global evaluation of sentinel 2 level 2A Sen2Cor aerosol optical thickness retrievals. *International Journal of Remote Sensing*, 46(2), 728–744. <https://doi.org/10.1080/01431161.2024.2421947>

## **Part I: Products, Access and Visualization**

**MODIS (DBDT & MAIAC), AERONET**

# **MODIS Deep Blue – Dark Target (DB-DT)**

LAADS DAAC

<https://ladsweb.modaps.eosdis.nasa.gov/>

# Access MODIS data (LAADS DAAC)

The screenshot shows the homepage of the LAADS DAAC website. At the top, there's a navigation bar with links to various services like YouTube, Maps, News, Gmail, and Open Source Books. Below the navigation bar, the LAADS DAAC logo is visible, followed by the text "Level-1 and Atmosphere Archive & Distribution System" and "Distributed Active Archive Center". On the right side of the header, there are links for "About LAADS", "Data", "Learn", and "Login". A prominent feature is a large graphic on the left showing a stack of server units and a laptop connected to a cloud, symbolizing data storage and distribution. To the right of this graphic is a callout box with the text "LAADS DAAC Migrates to the Cloud" and a "Learn more." link. A yellow arrow points from this callout towards the "Cloud" icon in the graphic. Below the graphic, the text "Your Source for Level-1 and Atmospheric Data" and "Providing Access to Global Science Data Projects" is displayed, along with "View Data" and "Find Data" buttons. At the bottom, there are six colored boxes representing different data categories: "Missions" (grey), "Level 0 & 1" (dark blue), "Atmosphere" (blue), "Airborne" (teal), "Land" (green), and "Applications" (orange).

ladsweb.modaps.eosdis.nasa.gov

Apps YouTube Maps News Gmail Useful Websites - A... GEOG-422/510 Open Source Books GEOG-414 Email - Akhilesh Ku... Cancer Drug Interac... All Bookmarks

NASA | EARTHDATA Other DAACs Feedback ?

LAADS DAAC

Level-1 and Atmosphere Archive & Distribution System  
Distributed Active Archive Center

About LAADS Data Learn Login

LAADS DAAC Migrates to the Cloud

Learn more.

Your Source for Level-1 and Atmospheric Data

Providing Access to Global Science Data Projects

View Data Find Data

Missions

Level 0 & 1

Atmosphere

Airborne

Land

Applications

# Access MODIS data ...

ladsweb.modaps.eosdis.nasa.gov/search/

No products selected. No date selected. No location selected. No files selected.

All Sensors All Standard Collections

All [531]  
Level-0 / Level-1 [32]  
MODIS Terra, Aqua [12]  
VIIRS Suomi NPP [9]  
OLCI ESA Copernicus Sentinel-3A [2]  
SLSTR ESA Copernicus Sentinel-3A [1]  
OLCI ESA Copernicus Sentinel-3B [2]  
SLSTR ESA Copernicus Sentinel-3B [1]  
MERIS Envisat [5]

Atmosphere [78]  
Aerosol [33]  
Water Vapor [5]  
Cloud Properties [20]  
Atmosphere Profiles [2]  
Cloud Mask [6]  
L2 Joint Atmosphere Product [2]  
L3 Atmosphere Product [8]  
VIIRS+CrlS Fusion [2]  
GEO-LEO Dark Target Aerosol [9]

Airborne [5]

Aerosol

AERDB\_M3\_GEOLEO\_Merged  
MODIS+AHI+ABI+VIIRS/GEO-LEO Merged Deep Blue Aerosol monthly 1x1 degree grid

AERDB\_M3\_VIIRS\_NOAA20  
VIIRS/NOAA20 Deep Blue Level 3 monthly aerosol data, 1x1 degree grid

AERDB\_M3\_VIIRS\_SNPP  
VIIRS/SNPP Deep Blue Level 3 monthly aerosol data, 1x1 degree grid

AERDT\_L2\_VIIRS\_NOAA20  
VIIRS/NOAA20 Dark Target Aerosol 6-Min L2 Swath 6 km

AERDT\_L2\_VIIRS\_SNPP  
VIIRS/SNPP Dark Target Aerosol L2 6-Min Swath 6 km

MOD04\_3K  
MODIS/Terra Aerosol 5-Min L2 Swath 3km

MOD04\_L2  
MODIS/Terra Aerosol 5-Min L2 Swath 10km

MYD04\_3K  
MODIS/Aqua Aerosol 5-Min L2 Swath 3km

MYD04\_L2  
MODIS/Aqua Aerosol 5-Min L2 Swath 10km

XAERDT\_L2\_ABI\_G16  
ABI/GOES-16 Dark Target Aerosol 10-Min L2 Full Disk 10 km

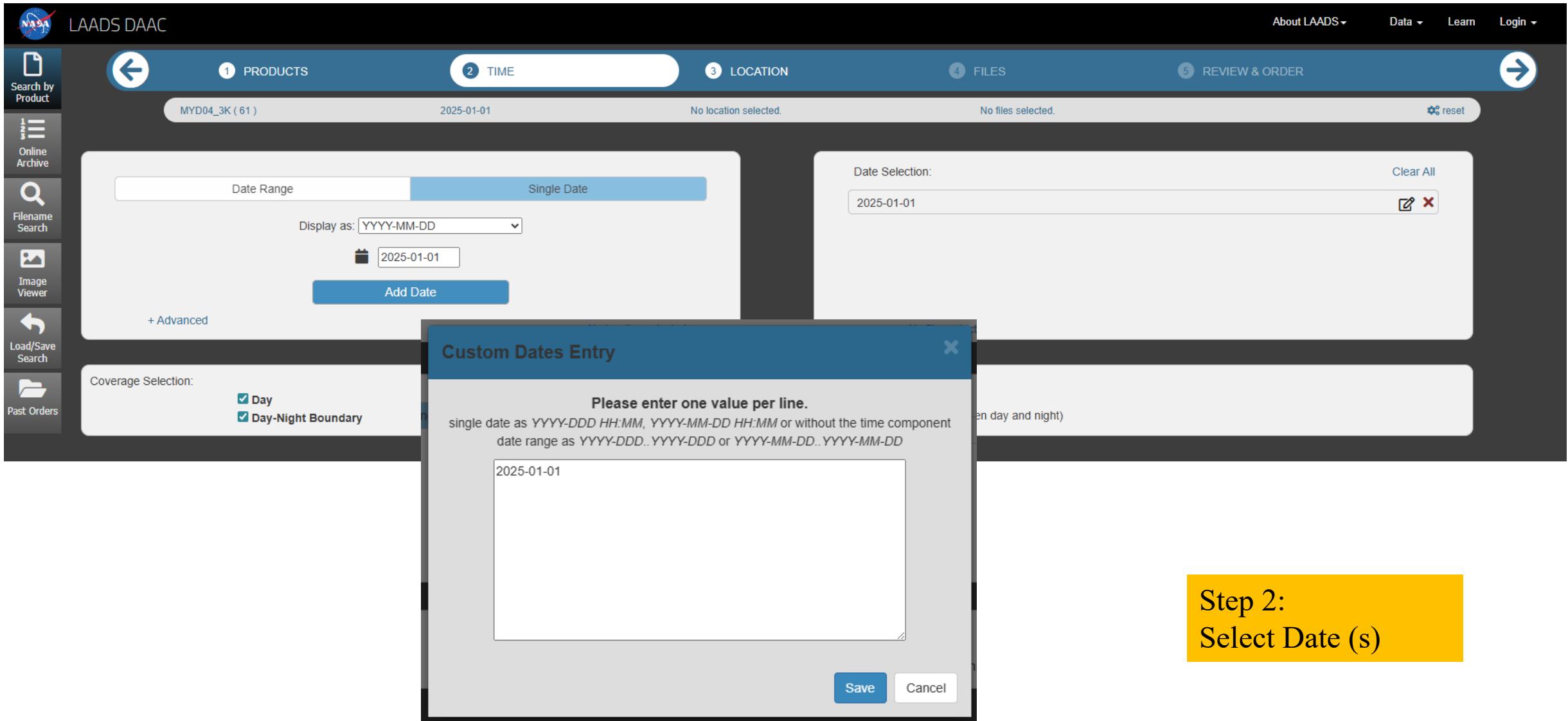
XAERDT\_L2\_ABI\_G17  
ABI/GOES-17 Dark Target Aerosol 10-Min L2 Full Disk 10 km

XAERDT\_L2\_ABI\_H08

**Step 1:  
Select Product (s)**

The screenshot shows the LAADS DAAC search interface. A red box highlights the browser's address bar with the URL 'ladsweb.modaps.eosdis.nasa.gov/search/'. The search interface has five tabs: PRODUCTS (selected), TIME, LOCATION, FILES, and REVIEW & ORDER. On the left, a sidebar lists sensor collections like All Sensors, All Standard Collections, and specific sensors like MODIS, VIIRS, OLCI, SLSTR, and MERIS. The main search results are grouped by sensor. A yellow box labeled 'Step 1: Select Product (s)' highlights the first two entries under the MODIS section: 'MOD04\_3K' and 'MOD04\_L2'. Both of these highlighted items have a red rectangular border around them.

# Access MODIS data ...



The screenshot shows the LAADS DAAC search interface with the 'TIME' step selected. The main interface displays search parameters: MYD04\_3K (61) for products, 2025-01-01 for time, and no location selected. A modal window titled 'Custom Dates Entry' is open, prompting for date input. The date 2025-01-01 is entered in the text area. The 'Save' button is visible at the bottom right of the modal.

LAADS DAAC

1 PRODUCTS    2 TIME    3 LOCATION    4 FILES    5 REVIEW & ORDER

MYD04\_3K ( 61 )    2025-01-01    No location selected.    No files selected.    reset

Date Range    Single Date

Display as: YYYY-MM-DD

2025-01-01

Add Date

+ Advanced

Coverage Selection:

Day

Day-Night Boundary

Custom Dates Entry

Please enter one value per line.

single date as YYYY-DDD HH:MM, YYYY-MM-DD HH:MM or without the time component  
date range as YYYY-DDD..YYYY-DDD or YYYY-MM-DD..YYYY-MM-DD

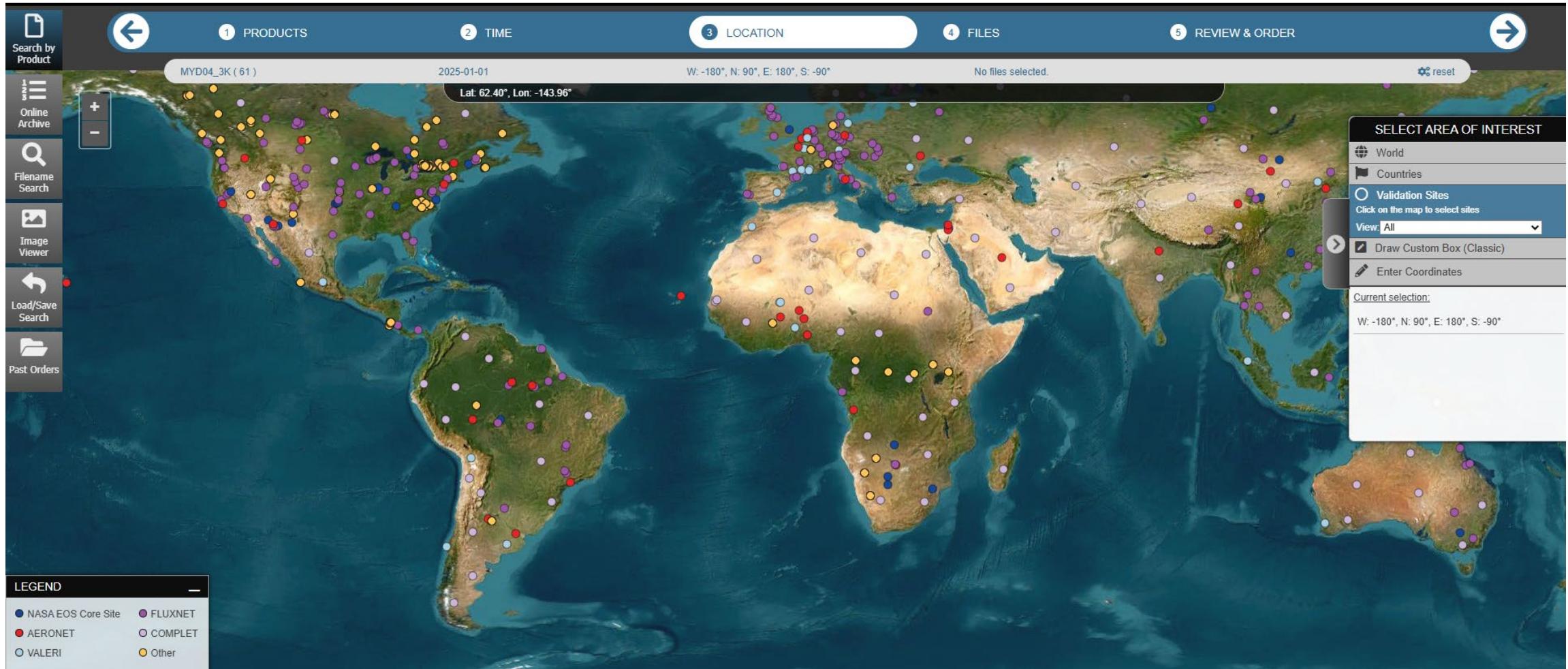
2025-01-01

Save    Cancel

Step 2:  
Select Date (s)

# Access MODIS data ...

## Step 3: Select Location (s) Using Validation Sites



# Access MODIS data ...

Step 3: Select Location (s)  
Using a bounding box

The screenshot shows the LAADS DAAC search interface. The top navigation bar includes the NASA logo, 'LAADS DAAC', and links for 'About LAADS', 'Data', 'Learn', and 'Login'. Below the navigation is a blue header bar with five tabs: 'PRODUCTS', 'TIME', 'LOCATION' (which is highlighted), 'FILES', and 'REVIEW & ORDER'. The main area features a world map with a satellite imagery base. A bounding box is drawn over the Indian subcontinent and parts of Central Asia. On the left, a sidebar contains icons for 'Search by Product', 'Online Archive', 'Filename Search', 'Image Viewer', 'Load/Save Search', and 'Past Orders'. On the right, a 'SELECT AREA OF INTEREST' panel is open, showing options like 'World', 'Countries', 'Validation Sites', and 'Draw Custom Box (Classic)'. The 'Draw Custom Box (Classic)' option is selected, with instructions: 'Draw box on the map. Panning is disabled.' Below it is an 'Enter Coordinates' section and a 'Current selection:' field containing the coordinates: 'W: 64.8°, N: 37.2°, E: 97.5°, S: 4.5°'.

# Access MODIS data ...

## Step 4: Select File (s)

LAADS DAAC

About LAADS ▾ Data ▾ Learn Login ▾

① PRODUCTS ② TIME ③ LOCATION ④ FILES ⑤ REVIEW & ORDER

MYD04\_3K (61) 2025-01-01 W: 66°, N: 37.7°, E: 98°, S: 4.2° 7 files selected

\* Download selected files as json or CSV

Search: Showing 1 to 7 of 7 entries Select All Clear All

Filename	Product (collection)	Date / Time	Download
MYD04_3K.A2025001.1020.061.2025002235307.hdf	MYD04_3K (61)	2025-01-01 10:20:00	14 MB
MYD04_3K.A2025001.0840.061.2025002235451.hdf	MYD04_3K (61)	2025-01-01 08:40:00	9 MB
MYD04_3K.A2025001.1025.061.2025002235221.hdf	MYD04_3K (61)	2025-01-01 10:25:00	8 MB
MYD04_3K.A2025001.0850.061.2025002235524.hdf	MYD04_3K (61)	2025-01-01 08:50:00	4 MB
MYD04_3K.A2025001.0705.061.2025002235525.hdf	MYD04_3K (61)	2025-01-01 07:05:00	9 MB
MYD04_3K.A2025001.0845.061.2025002235508.hdf	MYD04_3K (61)	2025-01-01 08:45:00	15 MB
MYD04_3K.A2025001.0710.061.2025002235925.hdf	MYD04_3K (61)	2025-01-01 07:10:00	6 MB

Query Results Selected (7)

Search by Product Online Archive Filename Search Image Viewer Load/Save Search Back Orders

# Access MODIS data ...

## Step 5: Review and Order

The screenshot shows the LAADS DAAC interface for reviewing and ordering data. The top navigation bar includes the NASA logo, LAADS DAAC, and links for About LAADS, Data, Learn, and Login.

The main interface shows the following steps:

- 1 PRODUCTS:** MYD04\_3K (61)
- 2 TIME:** 2025-01-01
- 3 LOCATION:** W: 66°, N: 37.7°, E: 98°, S: 4.2°
- 4 FILES:** 7 files selected
- 5 REVIEW & ORDER:** A summary box indicates "Total: 7 files" and lists the order details: MYD04\_3K (Collection 61), 2025-01-01 07:05:00 .. 2025-01-01 10:25:00, and "The order will generate 7 files."

**Post-Processing Parameters:**

- Sds
- Geo
- Mosaic
- Reformat
- Reproject
- Control

**Sds Info:**

Please select one or more parameters to be included in the subset order:

Parameters - use Ctrl key to add multiple

- Aerosol\_Cloud\_Fraction\_Land
- Aerosol\_Cloud\_Fraction\_Ocean

**Delivery Method:**

View Delivery Method

Delivery method: HTTP GET

Stage products where I can download them using GNU Wget

**Bottom Status Bar:**

The order may generate as many as 7 files.

**Buttons:**

- Add another search
- Submit Order

# Access MODIS data ...

## Step 6: Download



 v2lads <noreply@nasa.gov>  
to me ▾10:40 AM (0 minutes ago)

Your Export ID is: 502424881

The data you ordered will be staged (in about 10 minutes), and you can retrieve the data through HTTP using GNU wget, as follows

```
wget -e robots=off -m -np -R .html,.tmp -nH --cut-dirs=3  
https://ladsweb.modaps.eosdis.nasa.gov/archive/orders/502424881/  
-header "Authorization: Bearer <YOUR_EDL_TOKEN>" -P <target dir>
```



## Using Command Terminal

Replace the <YOUR\_EDL\_TOKEN> placeholder with your Earthdata Login token. EDL tokens can be created and retrieved by logging into your Earthdata account and selecting "Generate Token" from the menu.

Replace the <target dir> placeholder with the directory where you wish to save the files.

Explanation of additional options used:

- e robots=off : Bypass the robots.txt file, to allow access to all files in the order
- m : Enable mirroring options (-r -N -l inf) for recursive download, timestamping & unlimited depth
- np : Do not recurse into the parent location
- R .html,.tmp : Reject (do not save) any .html or .tmp files (which are extraneous to the order)
- nH : Do not create a subdirectory with the Host name ([ladsweb.modaps.eosdis.nasa.gov](https://ladsweb.modaps.eosdis.nasa.gov))
- cut-dirs=3 : Do not create subdirectories for the first 3 levels (archive/orders/502424881)
- header : Adds the header with your appKey (which is encrypted via SSL)
- P : Specify the directory prefix (may be relative or absolute)

If you do not have wget:

- Windows users can download it at <https://eternallybored.org/misc/wget/>
- Mac OS X users can install it using Homebrew (<https://brew.sh>) using the command `brew install wget`
- Additional information on wget is available at <https://www.gnu.org/software/wget/faq.html>

Alternatively, you can use an HTTP script from

<https://ladsweb.modaps.eosdis.nasa.gov/tools-and-services/data-download-scripts/>

or manually download all files from

<https://ladsweb.modaps.eosdis.nasa.gov/archive/orders/502424881/>

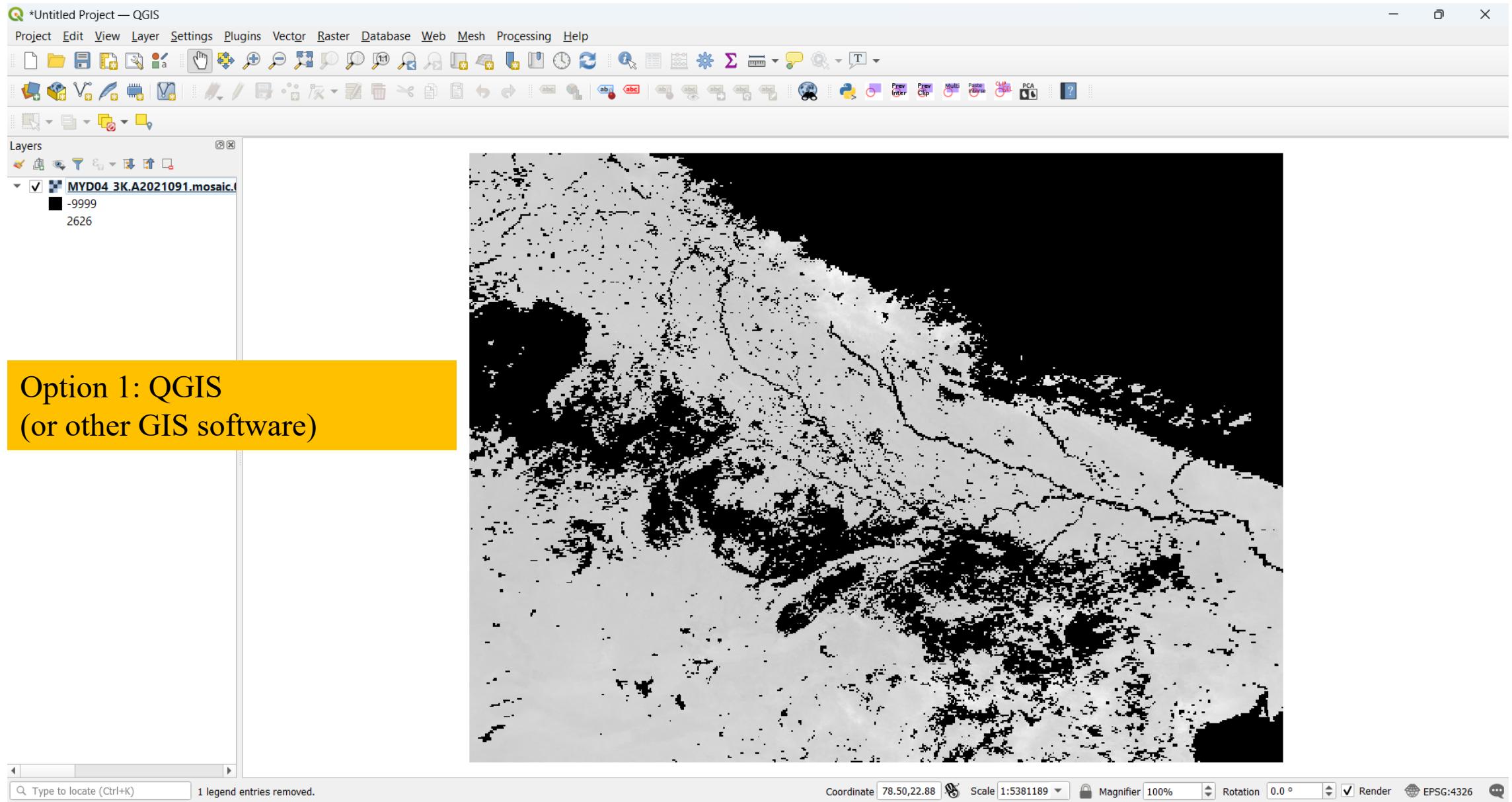


## Using HTTP scripts (site crawl)



## Manual

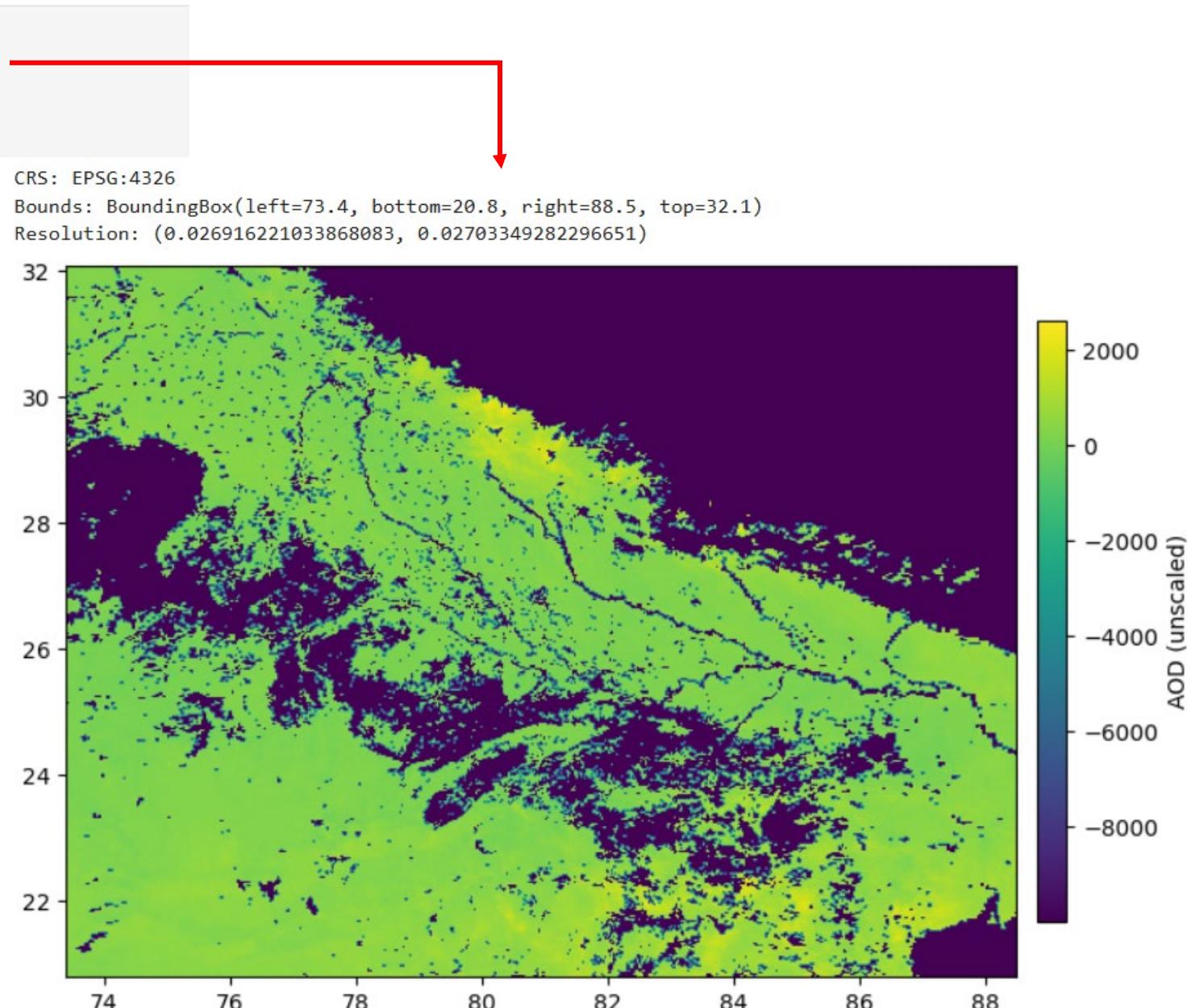
# Visualizing MODIS data



# Visualizing MODIS data ...

```
1 import rasterio
2 from rasterio.plot import show
3 import matplotlib.pyplot as plt
4
5 def display_geotiff(path):
6
7     with rasterio.open(geotiff_path) as src:
8         data = src.read(1) # first band
9         print("CRS:", src.crs)
10        print("Bounds:", src.bounds)
11        print("Resolution:", src.res)
12
13    fig, ax = plt.subplots(figsize=(8, 8))
14    img = show(data, transform=src.transform, ax=ax, cmap="viridis")
15
16    cbar = plt.colorbar(img.get_images()[0], ax=ax, fraction=0.04)
17    cbar.set_label("AOD (unscaled)") # label for legend
18    plt.show()
19
20
21 # Example
22 geotiff_path = r"D:\Aerosol Modelling\Validation_Data\MYD04_3K\MYD04_3K.tif"
23 display_geotiff(geotiff_path)
```

Option 2: Programming Language  
(Python (shown above), R, etc.)



# **Multi-angle Implementation of Atmospheric Correction (MAIAC)**

Google Earth Engine

[https://developers.google.com/earth-  
engine/datasets/catalog/MODIS\\_061\\_MCD19A2\\_GRANULES](https://developers.google.com/earth-engine/datasets/catalog/MODIS_061_MCD19A2_GRANULES)

# Access MAIAC data ...

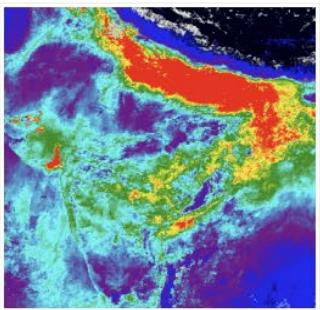
ata Catalog

Search /

All datasets All tags Landsat MODIS Sentinel Publisher Community API Docs Dataset status

## MCD19A2.061: Terra & Aqua MAIAC Land Aerosol Optical Depth Daily 1km

### ◆ AI-generated Key Takeaways



#### Dataset Availability

2000-02-24T00:00:00Z–2025-11-20T23:55:00Z

#### Dataset Provider

NASA LP DAAC at the USGS EROS Center

#### Earth Engine Snippet

```
ee.ImageCollection("MODIS/061/MCD19A2_GRANULES")
```

#### Cadence

1 Day

#### Tags

aerosol  
usgs

```
1 import ee
2
3 if not ee.data._credentials:
4     ee.Authenticate()
5 if not ee.data._initialized:
6     ee.Initialize(project='[REDACTED]')
7
8 bbox = ee.Geometry.BBox(73.4, 20.8, 88.5, 32.1)
9 collection = (ee.ImageCollection("MODIS/061/MCD19A2_GRANULES")
10     .filterBounds(bbox)
11     .filterDate("2023-01-01", "2023-01-31"))
12
13 image = collection.first()
14 image = image.select("Optical_Depth_055") # Optical depth at 550nm
15
16 image_clipped = image.clip(bbox)
17
18 # Download locally via URL
19 print("Generating download URL...")
20 url = image_clipped.getDownloadURL({"scale": 1000, # MODIS native resolution ~1km
21                                     "crs": "EPSG:4326", "region": bbox})
22
23 print("Download link: ", url)
```

Generating download URL...

Download link: [https://earthengine.googleapis.com/v1alpha/projects/\[REDACTED\]/thumbnails/f5be9506:getPixels](https://earthengine.googleapis.com/v1alpha/projects/[REDACTED]/thumbnails/f5be9506:getPixels)

Data on: Google Earth Engine  
Access: Python (earthengine-api)

# Visualizing MAIAC data ...

```
import ee
import folium
import geemap

if not ee.data._credentials:
    ee.Authenticate()
if not ee.data._initialized:
    ee.Initialize(project='[REDACTED]')

bbox = ee.Geometry.BBox(73.4, 20.8, 88.5, 32.1)

collection = (ee.ImageCollection("MODIS/061/MCD19A2_GRANULES")
    .filterDate("2023-05-01", "2023-05-15")
    .filterBounds(bbox))

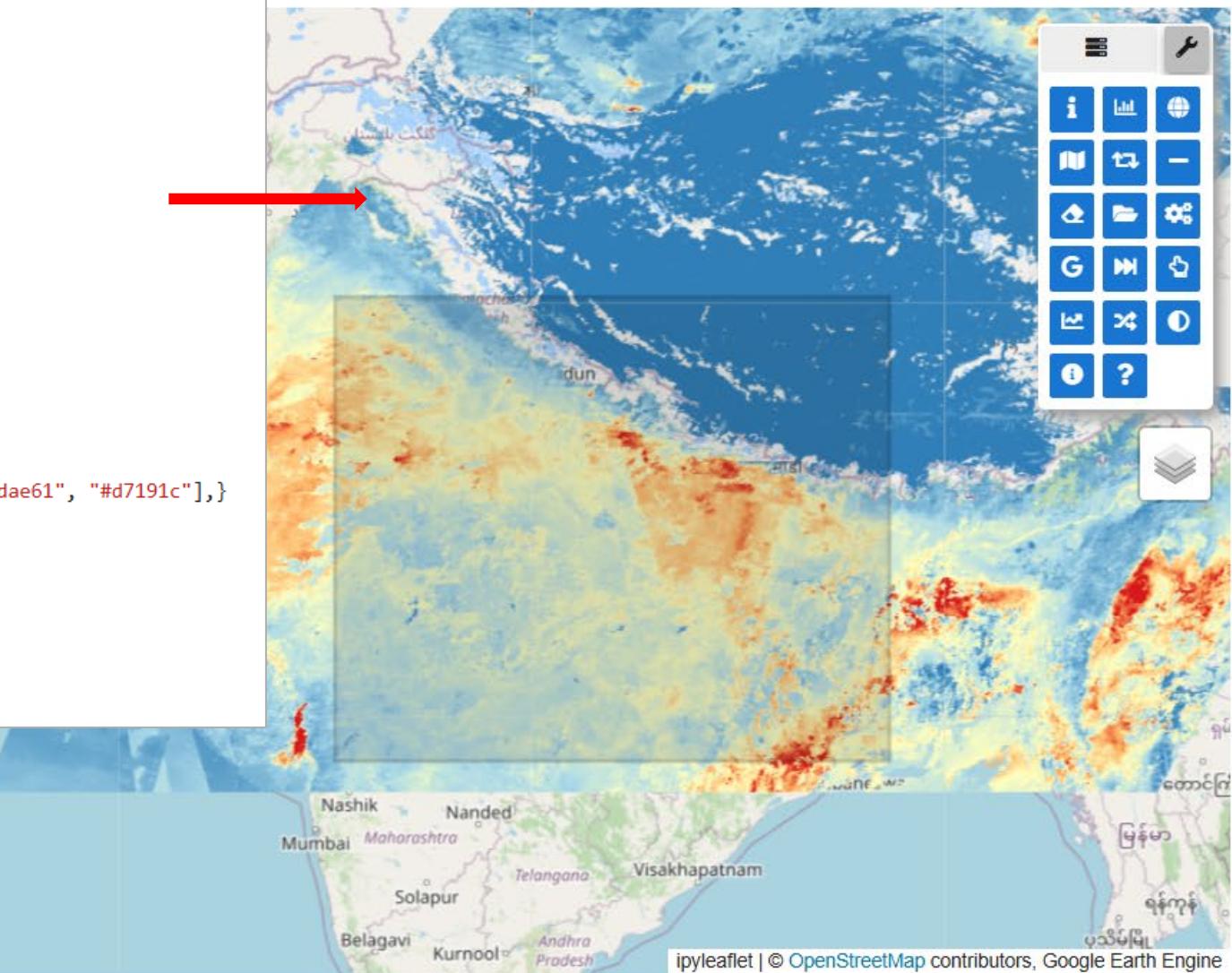
mosaic = collection.mosaic()
aod = mosaic.select("Optical_Depth_055").multiply(0.001)

vis_params = {"min": 0, "max": 1.5, "palette": ["#2c7bb6", "#abd9e9", "#ffffbf", "#fdae61", "#d7191c"],}
m = geemap.Map(center=[26.5, 80], zoom=5)
m.addLayer(aod, vis_params, "MCD19A2_GRANULES AOD Mosaic")

bbox_fc = ee.FeatureCollection([ee.Feature(bbox)])
m.addLayer(bbox_fc, {"color": "black"}, "Bounding Box")

m.addLayerControl()
m
```

Python (earthengine-api, geemap)



ipyleaflet | © OpenStreetMap contributors, Google Earth Engine

# **Aerosol Robotic Network (AERONET)**

NASA AERONET

<https://aeronet.gsfc.nasa.gov/>

# Access AERONET data (website)

The screenshot shows the AERONET website homepage. At the top, the title "AERONET" and "AEROSOL ROBOTIC NETWORK" is displayed above a photograph of a sun-photometer mounted on a pole. Below the title, there are five navigation links: "+ AEROSOL OPTICAL DEPTH", "+ AEROSOL INVERSIONS", "+ SOLAR FLUX", "+ OCEAN COLOR", and "+ MARITIME AEROSOL". A yellow banner below these links contains the text: "For receiving updates on AERONET - subscribe to the mailing list by sending an email to [aeronet-join@lists.nasa.gov](mailto:aeronet-join@lists.nasa.gov)". On the left side, a vertical sidebar menu lists various categories: "-Home", "Home", "+ AEROSOL/FLUX NETWORKS", "+ CAMPAIGNS", "+ COLLABORATORS", "+ DATA", "+ LOGISTICS", "+ NASA PROJECTS", "+ OPERATIONS", "+ PUBLICATIONS", "+ SITE INFORMATION", "+ STAFF", and "+ SYSTEM DESCRIPTION". Below this, under "AERONET DATA ACCESS", there are links for "DATA VISUALIZATION" (including "+ Synergy Tool", "+ Map Explorer", "+ Air Quality", and "+ Diurnal Analysis") and "AEROSOL OPTICAL DEPTH (V3)-SOLAR" (including "+ Data Display" and "+ Download Tool"). The "+ Download Tool" link is highlighted with a red border. To the right of the sidebar, a world map shows the locations of AERONET sensors, with green dots indicating active sites and other colors for historical data. Below the map, the text "2025-11-28" is displayed. Further down, the "About AERONET" section provides a detailed description of the program's history and international collaboration.

<https://aeronet.gsfc.nasa.gov/>

AERONET Data Access

Aerosol Optical Depth (V3) - Solar

Download Tool

The AERONET (Aerosol RObotic NETwork) program is a federation of ground-based remote sensing aerosol networks established by [NASA](#) and [PHOTONS](#) (PHOtométrie pour le Traitement Opérationnel de Normalisation Satellitaire; Univ. of Lille 1, CNES, and CNRS-INSU) and is greatly expanded by networks, calibration centers, and collaborators (e.g., [RIMA](#), [AeroSpan](#), [APAC](#), [AEROCAN](#), [AEROSPAIN](#), [NEON](#), and [CARSNET](#)) from national agencies, institutes, universities, individual scientists, and partners. For more than 25 years, the project has provided long-term, continuous, and readily accessible public domain database of aerosol optical, microphysical and radiative properties for aerosol research and characterization, validation of satellite retrievals, and synergism with other databases. The network imposes standardization of [instruments](#), [calibration](#), [processing](#) and [distribution](#).

AERONET collaboration provides globally distributed observations of spectral aerosol optical depth (AOD), inversion products, and precipitable water in diverse aerosol regimes. Version 3 AOD data are computed for three data quality levels: Level 1.0 (unscreened), Level 1.5 (cloud-screened and quality-controlled), and Level 2.0 (quality-assured). Inversions, precipitable water, and other AOD-dependent products are derived from these levels and may implement additional quality checks.

The AERONET - Ocean Color (AERONET-OC) is another component of the AERONET program, provides the additional capability of measuring the radiance emerging from the sea (i.e., normalized water-leaving radiance) with sun-photometers installed on offshore platforms like lighthouses, oceanographic and oil towers. Similarly, the Maritime Aerosol Network (MAN) component of the AERONET program provides ship-borne aerosol optical depth measurements from the Microtops II

# Access AERONET data ....

Step 1: Select site

Step 2:  
Select date & product (s)

+Home

**Aerosol Optical Depth**

+ AEROSOL/FLUX NETWORKS

+ CAMPAIGNS

+ COLLABORATORS

**- DATA**

+ LOGISTICS

+ NASA PROJECTS

+ OPERATIONS

+ PUBLICATIONS

+ SITE INFORMATION

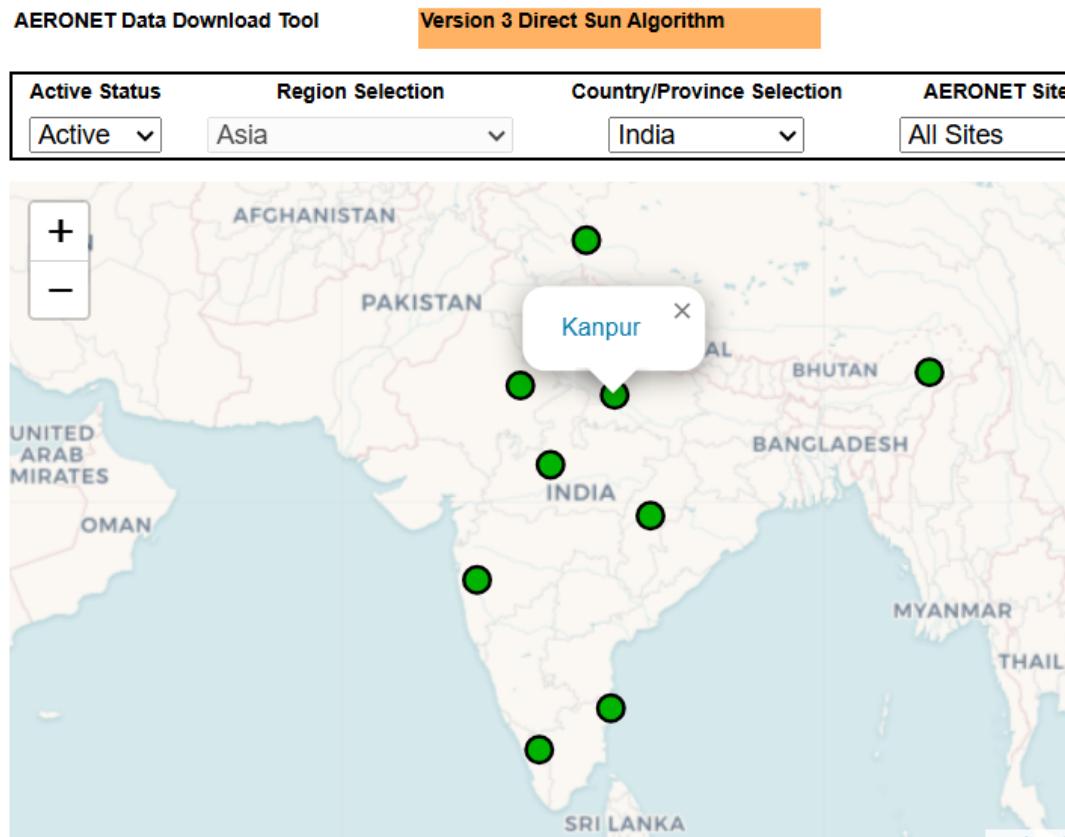
+ STAFF

+ SYSTEM DESCRIPTION

**AERONET DATA ACCESS**

**DATA VISUALIZATION**

+ Synergy Tool



AERONET Data Download Tool      Version 3 Direct Sun Algorithm

Click Geographic Region, Country/State or AERONET Site to change site selection:

**Geographic Region**      **Country/State**      **AERONET Site**

Asia      India      Kanpur

**Download Data for Kanpur**

Select the start and end time of the data download period:

START: Day/Month/Year      END: Day/Month/Year

1 JAN 2025      30 JAN 2025

Data Descriptions      Data Units

**Note:** Data are not available if the data type is *italicized*

Select the data type(s) using the corresponding check box:

Direct Sun Products		Select
Aerosol Optical Depth (AOD) with Precipitable Water and Angstrom Parameter		<input type="checkbox"/> Level 1.0 <input checked="" type="checkbox"/> Level 1.5 <input type="checkbox"/> Level 2.0
Total Optical Depth based on AOD Level*		<input type="checkbox"/> Level 1.0 <input checked="" type="checkbox"/> Level 1.5 <input type="checkbox"/> Level 2.0
Spectral Deconvolution Algorithm (SDA) Retrievals -- Fine Mode AOD, Coarse Mode AOD, and Fine Mode Fraction		<input type="checkbox"/> Level 1.0 <input type="checkbox"/> Level 1.5 <input type="checkbox"/> Level 2.0

**Data Format**

All Points    Daily Averages    Monthly Averages

Download

\*All Points Format Only

# Process AERONET data (manual)

File Home Insert Draw Page Layout Formulas Data Review View Help Tell me what you want to do

Get Data From Text/CSV From Web From Table/ Range Recent Sources Existing Connections Refresh All Properties Workbook Links Sort Advanced Filter Reapply Advanced

Text to Columns Flash Fill Remove Duplicates Data Validation Consolidate Data Model What-If Analysis Forecast Sheet Group Ungroup Subtotal Outline Automation

A1 AERONET Version 3

1 AERONET Version 3  
2 Kanpur  
3 Version 3: AOD Level 1.5  
4 The following data are cloud cleared and quality controls have been applied but these data may not have final calibration applied  
5 Contact: PI=S.\_N.\_Tripathi\_and\_Pawan\_Gupta\_and\_Elena\_Lind; PI Email=snt@iitk.ac.in\_and\_pawan.gupta@nasa.gov\_and\_elena.lind@iitk.ac.in  
6 All Points UNITS can be found at [https://aeronet.gsfc.nasa.gov/new\\_web/units.html](https://aeronet.gsfc.nasa.gov/new_web/units.html)  
7 Date(dd:mm:yy) Time(hh:mm) Day\_of\_Year Day\_of\_Year AOD\_1640 AOD\_1020 AOD\_870n AOD\_865n AOD\_779n AOD\_675n AOD\_667n /  
8 24:01:2025 04:46:51 24 24.1992 0.0807 0.160587 0.210441 -999 -999 0.311822 -999  
9 24:01:2025 05:00:49 24 24.2089 0.078039 0.154063 0.200244 -999 -999 0.29743 -999  
10 24:01:2025 05:10:14 24 24.21544 0.082186 0.161216 0.209523 -999 -999 0.30933 -999  
11 24:01:2025 05:16:51 24 24.22004 0.080435 0.154406 0.202058 -999 -999 0.299056 -999  
12 24:01:2025 05:21:51 24 24.22351 0.075478 0.142722 0.187494 -999 -999 0.278726 -999  
13 24:01:2025 05:26:51 24 24.22698 0.07465 0.143218 0.18868 -999 -999 0.281241 -999  
14 24:01:2025 05:31:51 24 24.23045 0.077483 0.146994 0.19149 -999 -999 0.282397 -999  
15 24:01:2025 05:36:51 24 24.23192 0.074772 0.140252 0.184663 -999 -999 0.274579 -999  
16 24:01:2025 05:41:51 24 24.23174 0.080364 0.15143 0.198434 -999 -999 0.293266 -999  
17 24:01:2025 05:51:51 24 24.24134 0.082629 0.156618 0.206234 -999 -999 0.305074 -999  
18 24:01:2025 06:10:09 24 24.25105 0.072284 0.134662 0.177354 -999 -999 0.263507 -999  
19 24:01:2025 06:15:51 24 24.2617 0.077222 0.142566 0.185974 -999 -999 0.274556 -999  
20 24:01:2025 06:20:51 24 24.27147 0.072284 0.134662 0.180556 -999 -999 0.284198 -999  
21 24:01:2025 06:25:51 24 24.28106 0.071749 0.126831 0.180966 -999 -999 0.268487 -999  
22 24:01:2025 06:30:51 24 24.29174 0.071749 0.126831 0.190315 -999 -999 0.284118 -999  
23 24:01:2025 06:35:51 24 24.30142 0.071749 0.126831 0.190736 -999 -999 0.283499 -999  
24 24:01:2025 07:21:51 24 24.30684 0.074255 0.133386 0.175602 -999 -999 0.261927 -999  
25 24:01:2025 07:26:51 24 24.31031 0.071749 0.126831 0.167782 -999 -999 0.251554 -999  
26 24:01:2025 07:46:51 24 24.3242 0.074711 0.129616 0.168578 -999 -999 0.250175 -999  
27 24:01:2025 07:51:51 24 24.32767 0.072293 0.124841 0.165728 -999 -999 0.247226 -999  
28 24:01:2025 08:00:53 24 24.33395 0.067972 0.111719 0.150812 -999 -999 0.223298 -999  
29 24:01:2025 08:10:18 24 24.34049 0.067956 0.115417 0.150049 -999 -999 0.222378 -999  
20250101\_20250130\_Kanpur

Convert Text to Columns Wizard - Step 2 of 3

This screen lets you set the delimiters your data contains. You can see how your text is affected in the preview below.

Delimiters

Tab  
 Semicolon  
 Comma  
 Space  
 Other:   
 Treat consecutive delimiters as one  
Text qualifier: "

Data preview

AERONET Version 3  
Kanpur  
Version 3: AOD Level 1.5  
The following data are cloud cleared and quality controls have been applied but these data may not have final calibration applied  
Contact: PI=S.\_N.\_Tripathi\_and\_Pawan\_Gupta\_and\_Elena\_Lind; PI Email=snt@iitk.ac.in\_and\_pawan.gupta@nasa.gov\_and\_elena.lind@iitk.ac.in  
All Points

Step 1:  
Load & Format

Step 2:  
Temporal averaging

Time taken: ~ 15-20 mins per site per date

# Download & Process AERONET data (iAOD)

AERONET Extraction Module

**AERONET Extraction**

Year: 2025 Satellite Overpass Time: 24-01-2025 05:15:29

Temporal Scale [For averaging, in minutes]: 60 Wavelength (in nm): 550

AERONET Data Level: 1.5

Raster File [for extracting extent]: Browse D:/Aerosol Modelling/Aerosol/Scripts/GUI/Landsat 8

Destination Folder [to save downloaded files]: Browse D:/Aerosol Modelling/Aerosol/Scripts/GUI/Landsat 8

**Extract AERONET AOD** **View Result** **Calculate Angstrom AOD**

**Output console:**

```
|   | Site_Name      | lon | lat | Elevation(meters) |
|---+-----+-----+-----+-----+
| 340 | Amity_Univ_Gurgaon | 76.916 | 28.3173 | 285
| 416 | IIT_Delhi       | 77.1926 | 28.545  | 15
+---+-----+-----+-----+-----+
Processing: Fetching and averaging AERONET Level1.5 values at ±60min

File downloaded successfully from https://aeronet.gsfc.nasa.gov/cgi-bin/print_web_data_v3?site=Amity_Univ_Gurgaon&year=2025&month=1&day=24&hour=5&year2=2025&month2=1&day2=24&hour2=6&AOD15=1&AVG=10

File downloaded successfully from https://aeronet.gsfc.nasa.gov/cgi-bin/print_web_data_v3?site=IIT_Delhi&year=2025&month=1&day=24&hour=5&year2=2025&month2=1&day2=24&hour2=6&AOD15=1&AVG=10
+---+-----+-----+-----+
|   | Site Name      | AOD_440nm | AOD_1020nm | AOD_550.0nm |
|---+-----+-----+-----+-----+
| 0 | Amity_Univ_Gurgaon | 0.375297 | 0.16821  | 0.303303
| 1 | IIT_Delhi       | 0.338077 | 0.101567 | 0.245701
+---+-----+-----+-----+
```

**About**

Checking the availability, downloading, cleaning and pre-processing AERONET data for each station is a time consuming process. Using this module, data for all the available AERONET sites within a raster extent can be downloaded, cleaned, and averaged in less than a minute or two.

Since most AOD retrieval studies focus on temporal averaging within ± 30-60 minutes of satellite overpass time, an option has been provided to set a temporal averaging time too (default is 60 min). Satellite overpass time must be provided by the user. It is generally available in the metadata file. By default, AERONET site for year 2021 is accessed but it can be changed by the user as per their needs.

In the output file, the 'hour' value is the median time of the temporal averaging scale and is generally equal to the satellite overpass time. Since AERONET AOD is only available at certain wavelengths, once AERONET AOD has been extracted, use 'Calculate Angstrom AOD' to calculate AOD at the required wavelength.

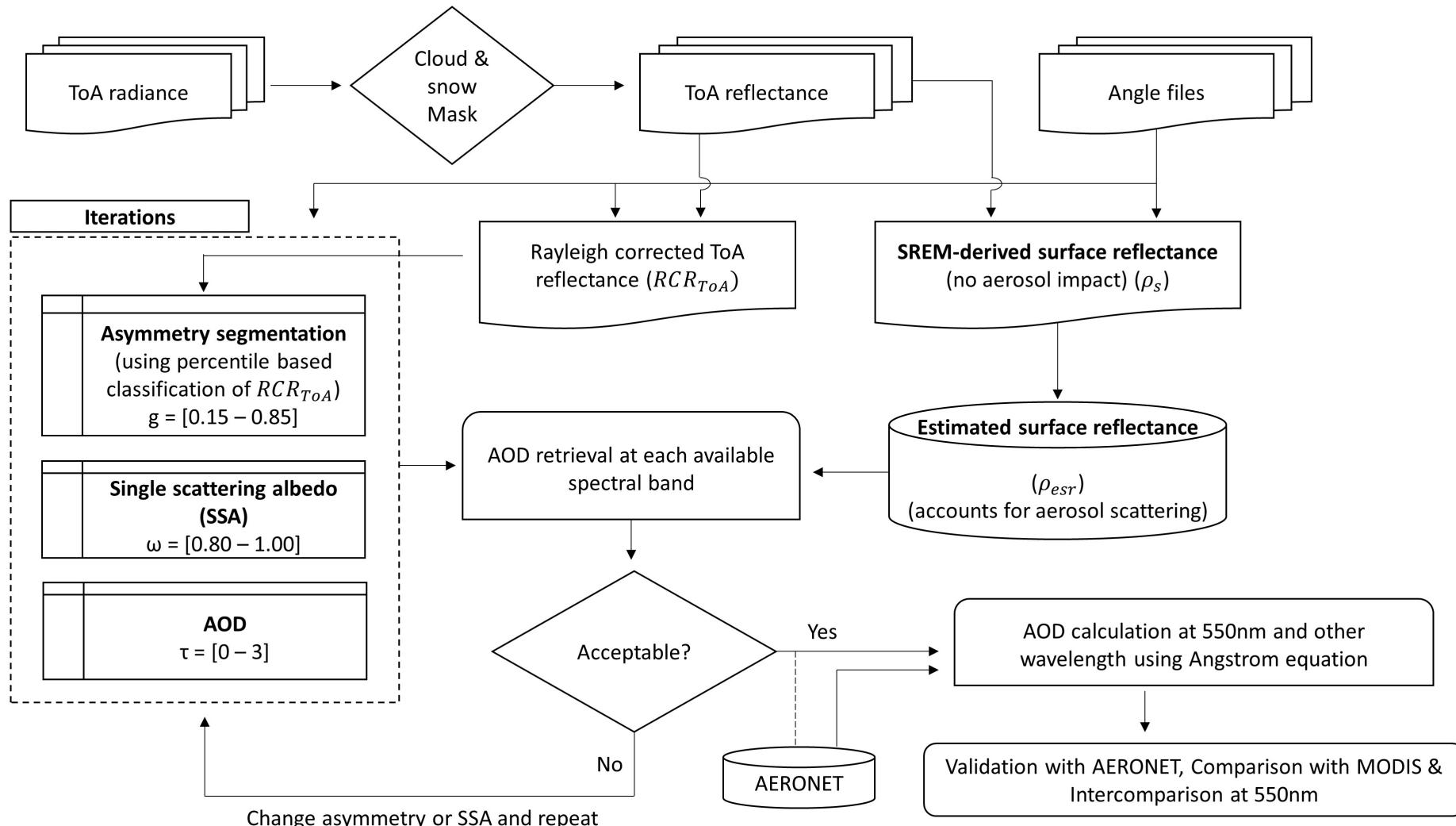
**Extract AERONET AOD – Retrieve, Clean, and preprocess AERONET data**

**Calculate Angstrom AOD – AOD @ 550nm using AOD at 443 nm & 865 nm**

**Time taken: ~ 10-30 sec**

## **Part 2: iAOD Demonstration**

# iAOD Methodology (Kumar & Mehta, 2023)



Automated in  
iAOD software

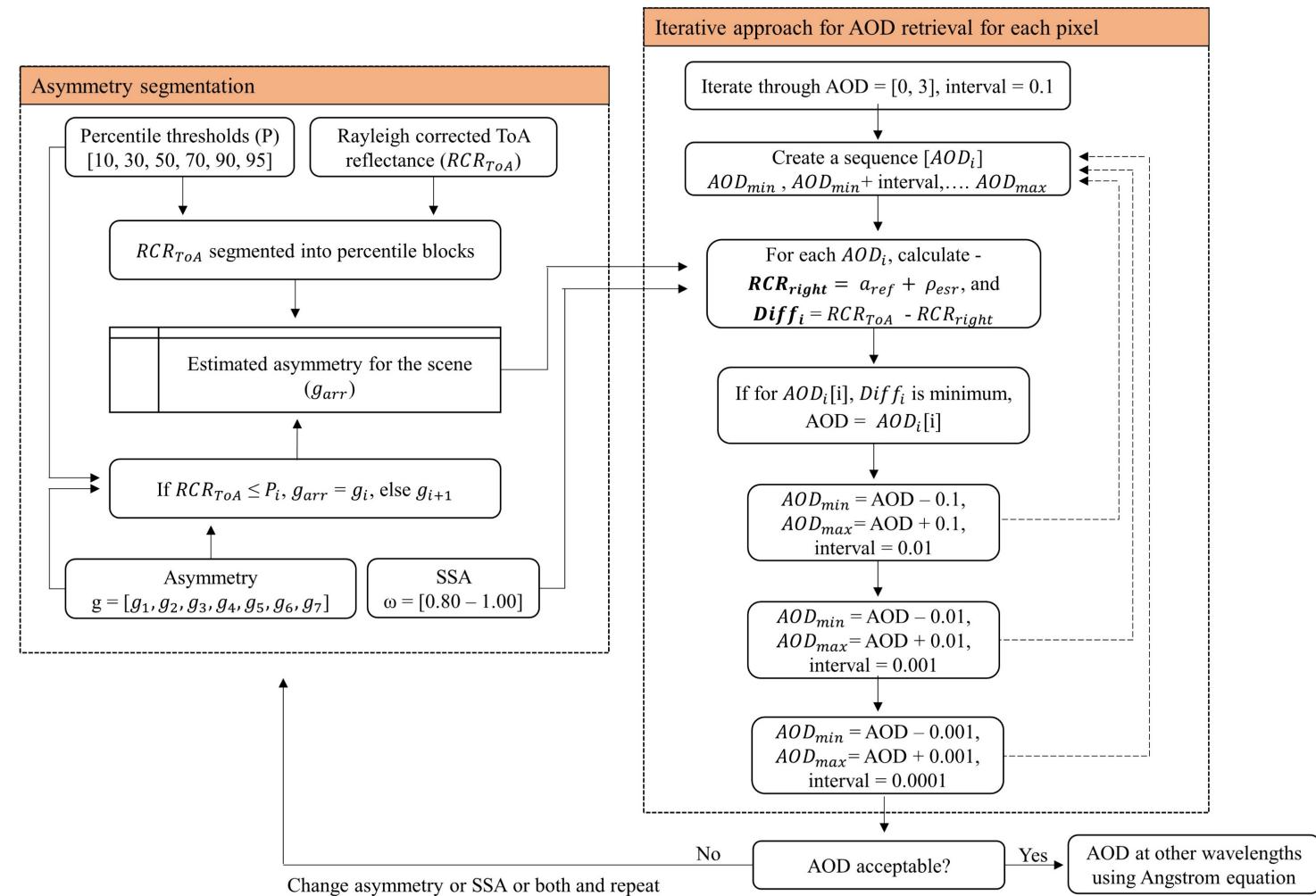
User intervention

# iAOD Methodology<sup>b</sup> (cont.)

Percentile segmentation of Rayleigh corrected reflectance image

Asymmetry assignment to each segment

Single scattering albedo (SSA) assignment



<sup>b</sup>Kumar, A., & Mehta, M. (2023). Investigating the applicability of a simple iterative approach for aerosol optical depth (AOD) retrieval over diverse land surface types from Landsat 8 and Sentinel 2 using visible and near-infrared (VNIR) spectral bands. *Atmospheric Environment*, 314, 120082.

## Input parameters

## Sensor      Operations

Select

Select

Spectral Band

Select

Check availability

Save and Next

## Output/Log Console

Save and Clear Output

This is output console. It shows up all entries and relevant outputs.  
This space can also be used to write or keep note of something.  
Use "F" key to toggle between fullscreen and minimize.  
The log file could also be saved as a text file after execution.

Web Connect: No



# Thank you!

Reach me at:  
[akhilesh.kumar@unsw.edu.au](mailto:akhilesh.kumar@unsw.edu.au)

Missed presentation?  
Scan QR for access

