

SAFARI 2000 MAPSS MOD04_L2 Aerosol Summary Data for Southern Africa

Abstract

The MODIS (Moderate Resolution Imaging Spectroradiometer) Atmosphere Group develops remote sensing algorithms for deriving sets of atmospheric parameters from MODIS radiance data. These parameters can be integrated into conceptual and predictive global models. MODIS Atmosphere Products Subset Statistics (MAPSS) are generated over important locations around the world, as one of the ways to increase the scope of application of the MODIS atmospheric parameters. This MAPSS data set contains daily time series of the MODIS MOD04_L2 aerosol product over several SAFARI 2000 ground sites for the period February 26, 2000 through December 31, 2001. Seventeen (17) AERONET sunphotometer measurement sites in Southern Africa were used as the focal points for these spatial statistics.

The MAPSS database was established to provide a means of intercomparison and cross-validation of MODIS atmosphere products with those of other sensors and instruments (ground-based, airborne, or spaceborne) obtained at different locations around the globe. MAPSS data can also be easily used to construct time-series and to conduct various local and regional atmospheric studies, including aerosol climatology, sources and sinks of specific aerosol types (e.g., sulfates and biomass-burning aerosols), interaction of aerosols with clouds, and atmospheric corrections of remotely-sensed surface reflectance over the land.

Background Information

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Project: SAFARI 2000

Data Set Title: SAFARI 2000 MAPSS MOD04_L2 Aerosol Summary Data for Southern Africa

Site: Southern Africa

Westernmost Longitude: -14.415 W

Easternmost Longitude: 32.905 E

Northernmost Latitude: -7.976 S

Southernmost Latitude: -28.248 S

Data Set Citation:

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Web Site: <http://modis-atmos.gsfc.nasa.gov/mapss.html>

Data File Information

This MAPSS data set contains daily statistics of spatial subsets of the MODIS MOD04 L2 aerosol product over SAFARI 2000 ground sites for 2000-2001. Seventeen (17) AERONET sunphotometer measurement sites in Southern Africa were used as focal points for these spatial statistics (Table 1). The process of generating the statistics involves identifying these locations on the MODIS MOD04_L2 product, extracting the values of the pixel corresponding to each coordinate point as well as surrounding pixels falling within a 50 x 50 km box centered on the coordinate point.

Table 1. AERONET Sunphotometer Measurement Sites Used as Focal Points for the MAPSS MOD04_L2 Aerosol Spatial Statistics for SAFARI 2000.

AERONET Sites	Longitude	Latitude
Ascension Island	-14.415	-7.976
Bethlehem, South Africa	28.333	-28.248

Etosha Pan, Namibia	15.914	-19.175
Inhaca, Mozambique	32.905	-26.041
Joberg, South Africa (Johannesburg)	28.029	-26.186
Kaloma, Zambia	24.827	-14.860
Kaoma, Zambia	24.795	-14.793
Maun Tower, Zambia	23.550	-19.900
Mongu, Zambia	23.151	-15.254
Mwinilunga, Zambia	24.431	-11.740
Ndola, Zambia	28.658	-12.995
Pietersburg, South Africa	29.450	-23.883
Senanga, Zambia	23.293	-16.109
Skukuza, South Africa	31.587	-24.992
Solwezi, Zambia	26.363	-12.171
Sua Pan, Botswana	26.067	-20.533
Zambezi, Zambia	23.107	-13.533

The data files are stored as ASCII tables in comma-separated-value (.csv) format. There is one file per site per year for each of the seven variables shown in Table 2.

Table 2. MAPSS MOD04_L2 Aerosol Data Variables.

MOD04 Aerosol Data		
File Name	Data Column Abbreviations	Definition
cld_frc_lan	cfrac-l	cloud fraction land
cld_frc_ocn	cfrac-o	cloud fraction ocean
eff_rad_ocn	effr0550b-a, effr0550b-o	effective radius ocean
opt_dp_l-o	AOT0550	optical depth land and ocean

opt_dp_lan_c	AOT0470corr-l, AOT0550corr-l, AOT0660corr-l	optical depth land, corrected
opt_dp_ocn_e	AOT0470ea-o, AOT0550ea-o, AOT0660ea-o, AOT0870ea-o, AOT1200ea-o, AOT1600ea-o, AOT2100ea-o	optical depth ocean, effective average
opt_dp_s_ocn	rAOTse0550a, rAOTse0550b	optical depth ratio small ocean

The data files contain the following columns:

In the data files, column names representing the above statistics are prefixed by: pval_, mean_, sdev_, slop_, slaz_, and mcoc_, respectively. These prefixes are followed by a short acronym to designating the aerosol product. If numbers or number ranges are included in these acronyms, they represent wavelength in nanometers. If the acronym ends with a "-l", this indicates that the product covers only land surfaces, but if it ends with a "-o" the product covers only ocean surfaces. Otherwise, it can potentially cover any type of surface.

These statistical parameters were calculated for the MODIS MOD04_L2 aerosol product for SAFARI 2000 for the period February 26, 2000 through December 31, 2001. There may be some data gaps, however, resulting from non-retrieval of the MODIS images due to some unfavorable factors such as cloud cover in the reflective wavebands.

NOTE: It is possible for the data columns to change part way through a file as parameters were added or removed from the extraction process. Instead of reprocessing the entire file, such changes were marked by the insertion of a new list of column headings at the start of the new column arrangement.

Column Label	Description/format (example)
Date	2002-01-02
Time	11:15
Dayfrac	0.46875000

HDFfile	MOD05_L2. A2002002.1115.003.2002007010715. hdf
Location	Ascension_Island
Longitude	decimal degrees (-14.415)
Latitude	decimal degrees (-7.976)
SolarZenith	degrees
SolarAzimuth	degrees
SensorZenith	degrees
SensorAzimuth	degrees
ScatteringAngle	degrees
boxsize	Square km
nchan	Number of channels
pval_*	Value of the central pixel, units given in file header
npix_*	Number of pixels in subset
mean_*	Mean of the subset, units given in file header
sdev_*	Standard deviation of the subset, units given in file header
slop_*	Slope of a plane fitted to the subset
slaz_*	Azimuth (direction, degrees from true north) of the slope
mcoc_*	Multiple Correlation Coefficient

* See "Data Column Abbreviations" in previous table.

Example data files: ascension_2000_cld_frc_lan.csv

TITLE : MODIS Aerosol Products Subset Statistics (MAPSS)
PGE Type : MOD04_L2
SDS name : Cloud_Fraction_Land
SDS description : "Cloud fraction (%)"
SDS no.of layers : 1
SDS units of measure : None
Contact person : Charles Ichoku (ichoku@climate.gsfc.nasa.gov)
Pr. Investigator(s) : Yoram Kaufman (kaufman@climate.gsfc.nasa.gov)
Lorraine Remer (remer@climate.gsfc.nasa.gov)

Date,Time,Dayfrac,HDFfile,Location,Longitude,Latitude,SolarZenith,SensorZenith,ScatteringAngle,
boxsize,nchan,pval_cfrac-l,npix_cfrac-l,mean_cfrac-l,sdev_cfrac-l,slop_cfrac-l,slaz_cfrac-l,mcoc_cfrac-l
2000-02-28,11:40,0.48611113,MOD04_L2.A2000059.1140.002.2000062220536.hdf,Ascension_Island,-
14.415,-7.976,22.090,7.830,157.840,3,1,,0,,,,,
2000-03-01,11:25,0.47569445,MOD04_L2.A2000061.1125.002.2000067110824.hdf,Ascension_Island,-
14.415,-7.976,25.040,21.140,149.920,3,1,,0,,,,,
2000-03-02,12:10,0.50694448,MOD04_L2.A2000062.1210.002.2000069055534.hdf,Ascension_Island,-
14.415,-7.976,14.340,58.460,122.240,3,1,,0,,,,,
2000-03-05,11:00,0.45833334,MOD04_L2.A2000065.1100.002.2000070072347.hdf,Ascension_Island,-
14.415,-7.976,31.080,58.090,123.540,3,1,,0,,,,,

ascension_2000_eff_rad_ocn.csv

TITLE : MODIS Aerosol Products Subset Statistics (MAPSS)
PGE Type : MOD04_L2
SDS name : Effective_Radius_Ocean
SDS description : "Effective_Radius at 0.55 micron of both solutions"
SDS no.of layers : 2
SDS units of measure : micron
Contact person : Charles Ichoku (ichoku@climate.gsfc.nasa.gov)
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Date,Time,Dayfrac,HDFfile,Location,Longitude,Latitude,SolarZenith,SensorZenith,ScatteringAngle,
boxsize,nchan,pval_effr0550b-o,npix_effr0550b-o,mean_effr0550b-o,sdev_effr0550b-o,slop_effr0550b-o,
slaz_effr0550b-o,mcoc_effr0550b-o,pval_effr0550a-o,npix_effr0550a-o,mean_effr0550a-o,sdev_effr0550a-
o,slop_effr0550a-o,slaz_effr0550a-o,mcoc_effr0550a-o
2000-02-28,11:40,0.48611113,MOD04_L2.A2000059.1140.002.2000062220536.hdf,Ascension_Island,-
14.415,-7.976,22.090,7.830,157.840,3,2,,0,,,,,0,,,,,
2000-03-01,11:25,0.47569445,MOD04_L2.A2000061.1125.002.2000067110824.hdf,Ascension_Island,-
14.415,-7.976,25.040,21.140,149.920,3,2,,0,,,,,0,,,,,
2000-03-02,12:10,0.50694448,MOD04_L2.A2000062.1210.002.2000069055534.hdf,Ascension_Island,-
14.415,-
7.976,14.340,58.460,122.240,3,2,,4,0.633,0.550,65.426,123.469,1.000,,4,1.121,0.092,42.253,166.752,0.909
2000-03-05,11:00,0.45833334,MOD04_L2.A2000065.1100.002.2000070072347.hdf,Ascension_Island,-
14.415,-7.976,31.080,58.090,123.540,3,2,,0,,,,,0,,,,,

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MOD04 Aerosol Data

The MODIS Aerosol Product monitors the ambient aerosol optical thickness over the oceans globally and over a portion of the continents. Further, the aerosol size distribution is derived over the oceans, and the aerosol type is derived over the continents. Daily Level 2 data are produced at the spatial resolution of a 10 x 10 1 km (at nadir) pixel array. There are two MODIS Aerosol data product files: MOD04_L2, containing data collected from the Terra platform; and MYD04_L2, containing data collected from the Aqua platform. This data set provides statistics derived from MOD04_L2.

Aerosols are one of the greatest sources of uncertainty in climate modeling. Aerosols modify cloud microphysics by acting as cloud condensation nuclei (CCN), and, as a result, impact cloud radiative properties and climate. Aerosols scatter back to space and absorb solar radiation. The MODIS aerosol product can be used to study aerosol climatology, sources and sinks of specific aerosol types (e.g., sulfates and biomass-burning aerosols), interaction of aerosols with clouds, and atmospheric corrections of remotely-sensed surface reflectance over the land.

Additional Sources of Information

For more information about MAPSS, please refer to: <http://modis-atmos.gsfc.nasa.gov/mapss.html>

For more information about MOD04 Level 2, please refer to: http://modis-atmos.gsfc.nasa.gov/MOD04_L2/index.html

Algorithm Theoretical Basis Document (ATBD): Algorithm for Remote Sensing of Tropospheric Aerosol from MODIS:

http://ftpwww.gsfc.nasa.gov/MODIS-Atmosphere/docs/atbd_mod02.pdf

References

Kaufman, Y. J. and D. Tanré. 1998. Algorithm for Remote Sensing of Tropospheric Aerosol from MODIS Products: MOD04_L2, MOD08_D3, MOD08_E3, MOD08_M3. ATBD Reference Number: ATBD-MOD-02. [http://modis.gsfc.nasa.gov/data/atbd/atbd_mod02.pdf]

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