**MODIS Dust Mask Algorithm**

**External Users Manual**



**Version 1.0**

**June, 2012**

**TABLE OF CONTENTS**

Page

LIST OF TABLES AND FIGURES 6

1. PRODUCTS 7

1.1. Product Overview 7

1.1.1. Product Requirements 7

1.1.2. Product Team 7

1.1.3. Product Description 7

1.2. Product History 7

1.3. Product Access 8

2. ALGORITHM 9

2.1. Algorithm Overview 9

2.2. Input Satellite Data 9

2.2.1. Satellite Instrument Overview 9

2.2.2. Satellite Data Preprocessing Overview 9

2.3. Input Ancillary Data 9

3. PERFORMANCE 10

3.1. Product Testing 10

3.1.1. Test Data Description 10

3.1.2. Unit Test Plans 10

3.2. Product Accuracy 10

3.2.1. Test Results 10

3.2.2. Product Accuracy 10

3.3. Product Quality Output 11

3.4. External Product Tools 11

4. PRODUCT STATUS 12

4.1. Operations Documentation 12

4.2. Maintenance History 12

# PRODUCTS

## Product Overview

### Product Requirements

SPSRB user request # 1009-0016 from NWS/NCEP

NWS/NCEP is preparing for an operational implementation of HYSPLIT dust forecast modeling system. There is a need for in situ or satellite data to verify the forecasts in near real time. NWS is requesting NESDIS to develop a satellite-based dust aerosol concentration product.

Environmental parameter: Dust mask, dust aerosol optical depth, dust aerosol concentration

### Product Team

IPT Lead: S. Kondragunta (STAR)

IPT Backup Lead: Liqun Ma(OSPO)

NESDIS team:

STAR: S. Kondragunta

OSPO: L. Ma

OSD: Tom Schott

Data Center: Alan Hall (NCDC)

Others: Liang Chen(OSPO-GST), M. Ruminski (OSPO), P. Ciren (STAR-IMSG), J. Zeng

(STAR-ERT), Paul Haggerty (OSPO/IPD)

User team

Lead: P. Davidson (NWS)

Others: I. Stajner (NWS), J. McQueen (NWS)

Oversight Panel lead: AC POP

Other OPs involved: ICAPOP

### Product Description

The MODIS dust mask algorithm is responsible for dust detection for all MODIS pixels for the granules over the United States during daytime. Due to the relatively weak aerosol signal and large uncertainties associated with bright surface, the performance of the current algorithm is expected to be better for heavy dust events. The algorithm output is written in HDF4 format for dust flags with values: 0 (no dust) and 1 (dust). The algorithm also produces two bytes of quality control output which includes: Day/Night flag; Land/Ocean flag; Sunglint flag; and Cloud flags.

## Product History

Algorithm has been tested and implemented to run on STAR computers on a routine basis since 2010. Originally developed for MODIS by University of Wisconsin but substantially enhanced/modified by STAR scientists to adapt it for GOES-R ABI using MODIS as proxy data set.

## Product Access

MODIS Dust Mask Algorithm will be running on NESDIS/OSDPD/OSPO operational servers and be monitored 24x7. Its output will be put on ESPC DDS (Data Distribution Server) server ‘satepsdist1’. Any user who needs to obtain the near real time (NRT) MODIS Dust Mask data need contact ESPC DDS administrator Donna Mcnamara ([Donna.Mcnamara@noaa.gov](mailto:Donna.Mcnamara@noaa.gov)). She will provide an ‘ESPC Data Access Request Form’ and detail information about how to access MODIS Dust Mask data on ESPC DDS.

MODIS Dust Mask algorithm generates two sets of hourly output files: hourly GRIB

File and hourly netCDF file(compressed). Only netCDF file will be archived. File naming convention for these two sets of output files are:

MYDdust.aod\_conc.v6.3.4.yyyymmdd.hrhh.grib(590KB)

MODIS\_DUST.yyyymmdd.hh.nc.gz(90KB,max)

Where,

yyyy is the year

mm is the month

dd is the day

hh is the hour

Examples are:

MYDdust.aod\_conc.v6.3.4.20120428.hr17.grib

MODIS\_DUST.20120507.22.nc.gz

The content of these two files are:

netcdf MODIS\_DUST.20120505.17 {

dimensions:

x = 601 ;

y = 251 ;

variables:

float combaod(y, x) ;

combaod:long\_name = "DUST AOD" ;

combaod:unit = "none" ;

combaod:NoAODRetrievals = "-1" ;

combaod:NoDust = "-2" ;

combaod:NoGranuleCoverage = "-99999" ;

float combconc(y, x) ;

combconc:long\_name = "DUST Column Concentration Density" ;

combconc:unit = "Kg/m^3" ;

combconc:Cloud = "-1" ;

combconc:Sunglint = "-2" ;

combconc:NoGranuleCoverage = "-3" ;

combconc:NoData = "-9999" ;

// global attributes:

:Title = "MODIS DUST " ;

:Platform = "MODIS/Aqua" ;

:DataType = "LatLonGrid" ;

:NorthWestConnerLat = "50.0f" ;

:NorthWestConnerLon = "125.0f" ;

:LatGridSpacing = "0.1f" ;

:LonGridSpacing = "0.1f" ;

:Year = "2012" ;

:Month = "05" ;

:Day = "05" ;

:Hour = "17" ;

}

# ALGORITHM

## Algorithm Overview

Uses spectral contrast and variability tests for different channels ranging from visible to IR to determine the presence of dust in MODIS/VIIRS granules.

Use the dust mask pixels to tag the independently derived MODIS aerosol optical depth (AOD) product in those pixels as “dust AOD”.

Converts dust AOD to dust concentration using mass extinction efficiency and the assumption that the dust aerosols are present in the lowest 5 km.

Detail info is described in ATBD.

## Input Satellite Data

MODIS Dust Mask requires MODIS level1 and level2 data that include MOD021KM, MOD03, MOD04\_L2, MOD07\_L2 and MOD35\_L2.

### Satellite Instrument Overview

All input data for this product are from MODIS Aqua. Detail information for MODIS Aqua can be find at :http://modis.gsfc.nasa.gov/

### 2.2.2. Input Satellite Data Description

MODIS/Aqua Calibrated radiances-1km(MOD21KM) - HDF4

## Input Ancillary Data

MODIS/Aqua Aerosol Product(MOD04) - HDF4

MODIS/Aqua Cloud Mask(MOD35) – HDF4

MODIS/Aqua Atmospheric Profiles product (MOD07) – HDF4

MODIS/Aqua Geolocation Data Set(MOD03) - HDF4

MODIS/Aqua snow/ice mask – HDF4

MODIS/Aqua sunglint mask – HDF4

MODIS/Aqua day/night flag – HDF4

# PERFORMANCE

## Product Testing

### Test Data Description

Test data is from NASA MODIS website: ladsweb.nascom.nasa.

The specific data sets are:

MOD021KM.P2012071.1725.hdf

MOD021KM.P2012071.1730.hdf

MOD021KM.P2012071.1905.hdf

MOD021KM.P2012071.1910.hdf

MOD021KM.P2012071.2040.hdf

MOD021KM.P2012071.2045.hdf

MOD021KM.P2012071.2050.hdf

MOD03.P2012071.1725.hdf

MOD03.P2012071.1730.hdf

MOD03.P2012071.1905.hdf

MOD03.P2012071.1910.hdf

MOD03.P2012071.2040.hdf

MOD03.P2012071.2045.hdf

MOD03.P2012071.2050.hdf

MOD04\_L2.P2012071.1725.hdf

MOD04\_L2.P2012071.1730.hdf

MOD04\_L2.P2012071.1905.hdf

MOD04\_L2.P2012071.1910.hdf

MOD04\_L2.P2012071.2040.hdf

MOD04\_L2.P2012071.2045.hdf

MOD04\_L2.P2012071.2050.hdf

MOD35\_L2.P2012071.1725.hdf

MOD35\_L2.P2012071.1730.hdf

MOD35\_L2.P2012071.1905.hdf

MOD35\_L2.P2012071.1910.hdf

MOD35\_L2.P2012071.2040.hdf

MOD35\_L2.P2012071.2045.hdf

MOD35\_L2.P2012071.2050.hdf

MYDdustaod.v6.3.4.P20120311.hr17.png

MYDdustaod.v6.3.4.P20120311.hr19.png

MYDdustaod.v6.3.4.P20120311.hr20.png

MYDdustconc.v6.3.4.P20120311.hr17.png

MYDdustconc.v6.3.4.P20120311.hr19.png

### Unit Test Plans

Detailed information is located in ‘Implementation and Test Plans for MODIS Dust Mask Product’

## Product Accuracy

### Test Results

Test results are reviewed by developer and installation programmer. Test data also put on ESPC anonymous ftp site ‘satepsanone’ for user to test.

### Product Accuracy

Accuracy of products, as measured by V&V testing, and compared to accuracy requirements. Refer to relevant test reports. (Document Object 39da website) this is on the S in the System Maintenance Manual Guideliness)

Accuracy of this product is determined by comparing to CALIPS vertical feature mask(VFM) product that identifies dust in different layers of the atmosphere.

Accuracy: 67.59

Probability of Detection(DOd): 54.23%

## Product Quality Output

Describe the quality flags that are included in the output product files. *(Document Object 38da website) this is on the S in the System Maintenance Manual Guideliness)*

## External Product Tool

‘wgrib’ can be used to quick look at MODIS Dust Mask GRIB file.

‘ncdump’ and HDFView can be used to quick look at MODIS Dust Mask NetCDF file.

# PRODUCT STATUS

MODIS Dust Mask product is a brand new product installed and maintained by ESPC since July 2012.

## Operations Documentation

ATBD

External Users Manual

SystemMaintenance Manual

Operational procedure(for ESPC help desk use only)

Operational log (for ESPC maintenance use only)

## Maintenance History

Excerpts and/or references to maintenance documentation deemed of value to product users (e.g., relevant sections of maintenance reports). *(Document Object 58da website) this is on the S in the System Maintenance Manual Guideliness)*

END OF DOCUMENT