

# **MODIS Level-1 Science Processing Algorithm (MODISL1DB\_SPA) User's Guide**

**Version 1.9**

July 2021



---

**GODDARD SPACE FLIGHT CENTER  
GREENBELT, MARYLAND**

## **MODIS Level-1 Science Processing Algorithm**

### **MODISL1DB\_SPA**

#### **General**

The NASA Goddard Space Flight Center's (GSFC) Direct Readout Laboratory (DRL), Code 619.0 developed this software for the International Planetary Observation Processing Package (IPOP). The IPOP package maximizes the utility of Earth science data for making real-time decisions by giving fast access to instrument data and derivative products from the NOAA-20 [Joint Polar Satellite System (JPSS)], Suomi National Polar-orbiting Partnership (SNPP), Aqua, and Terra missions.

Users must agree to all terms and conditions in the Software Usage Agreement on the DRL Web Portal before downloading this software.

Software and documentation published on the DRL Web Portal may occasionally be updated or modified. The most current versions of DRL software are available at the DRL Web Portal:

<https://directreadout.sci.gsfc.nasa.gov/?id=software>

Questions relating to the contents or status of this software and its documentation should be addressed to the DRL via the Contact DRL mechanism at the DRL Web Portal:

<https://directreadout.sci.gsfc.nasa.gov/?id=dspContent&cid=66>

#### **Algorithm Wrapper Concept**

The DRL has developed an algorithm wrapper to provide a common command and execution interface to encapsulate multi-discipline, multi-mission science processing algorithms. The wrapper also provides a structured, standardized technique for packaging new or updated algorithms with minimal effort.

A Science Processing Algorithm (SPA) is defined as a wrapper and its contained algorithm. SPAs will function within IPOP to serve the needs of the broad Direct Readout community. Detailed information about SPAs and other DRL technologies is available at the DRL Web Portal.

#### **Software Description**

This software package contains the MODIS Level 1 Direct Broadcast SPA (MODISL1DB\_SPA). It processes Level 0 MODIS data into Level 1A (MOD01/MYD01) and Geolocation (MOD03/MYD03) products. It also processes Level 1A and Geolocation products into MODIS Level 1B 1km (MOD021KM/MYD021KM), half km (MOD02HKM/MYD02QKM), and quarter km (MOD02QKM/MYD02QKM) data products.

#### **Software Version**

Version 1.2 of the DRL algorithm wrapper was used to package the SPA described in this document. This package contains the MODIS Level 1 Direct Broadcast software.

Enhancements to Version 1.9 of the MODISL1DB\_SPA include:

- Updating the MODIS Terra and Aqua L1A and Geolocation modules to the latest version. These modules were ported from the SeaDAS Data Processing Component (SeaDAS-OCSSW, direct broadcast bundle, tag: V2021.2).

This software will execute on a 64-bit computer. This software has been tested on a computer with 32GB of RAM and a CentOS Linux 7 X86\_64 operating system.

Copyright 1999-2007, United States Government as represented by the Administrator for the National Aeronautics and Space Administration. All Rights Reserved.

## **Credits**

The algorithm was enhanced by the Ocean Biology Processing Group (OBPG) at NASA/GSFC; the Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin; and the DRL at NASA/GSFC.

## **Prerequisites**

To run this package, you must have the Java Development Kit (JDK) or Java Runtime Engine (JRE) (Java 1.6.0\_25 or higher) installed on your computer, and the bin directory of your Java installation in your PATH environment variable. You must also have the following installed on your computer:

- Python 2.7;
- Python 3.6 or later;
- Python requests package v2.18.0 or later;
- A .netrc file containing NASA EarthData Portal credentials installed in your home directory. Users must be registered with the NASA EarthData Portal. Instructions for establishing EarthData login credentials are provided on page 3 of this User Guide.

If you need to upgrade Python, go to: <http://www.python.org/download/releases>.

## **Program Inputs and Outputs**

The SPA processes Level 0 MODIS PDS data to produce Level 1A (MOD01/MYD01) and Geolocation (MOD03/MYD03) data products. The Level 0 to Level 1A processing uses leapsec, utcpole, ephemeris and attitude files as input ancillaries. The SPA also processes Level 1A and Geolocation products to produce MODIS Level 1B 1km (MOD021KM/MYD021KM), half km (MOD02HKM/MYD02QKM), and quarter km (MOD02QKM/MYD02QKM) data products. The Level 1A to Level 1B processing uses using Reflective, Emissive and QA LUTs as input ancillaries.

The following table describes the SPA outputs.

Description	Output Format Description
Aqua/Terra MODIS Level 1A	Please refer to: <a href="https://ladsweb.modaps.eosdis.nasa.gov/missions-and-measurements/science-domain/modis-L0L1/">https://ladsweb.modaps.eosdis.nasa.gov/missions-and-measurements/science-domain/modis-L0L1/</a>
Aqua/Terra MODIS Geolocation	
Aqua/Terra MODIS L1B 1km	
Aqua/Terra MODIS L1B 500m (daytime only)	
Aqua/Terra MODIS L1B 250m (daytime only)	

## Installation and Configuration

SPAs will be automatically executed by the IPOPP processing framework. IPOPP will autonomously:

- discover and register raw sensor data;
- retrieve ancillaries from the DRL's real-time and archived ancillary repositories;
- register ancillaries in its Ancillary File Cache;
- schedule SPA executions;
- fulfill science data/ancillary requests from SPAs;
- generate science data products; and
- manage the IPOPP file system.

**Installing into an IPOPP Framework:** The SPA must be installed dynamically into an IPOPP framework to automate production of Aqua/Terra MODIS L1A, Geolocation and L1B data products. The SPA installation process will install its SPA service(s) into IPOPP. An SPA service is an IPOPP agent that provides the mechanism necessary for running an SPA automatically within the IPOPP framework.

Download the MODISL1DB\_1.9\_SPA\_1.2.tar.gz and follow the instructions as contained in the IPOPP User's Guide (available on the DRL Web Portal) for installing an SPA.

**Establishing EarthData Login Credentials:** The geolocation module as ported from SeaDAS OCSSW requires access to additional ephemeris and attitude ancillary files during processing. These files will be automatically retrieved using EarthData portal login credentials. Users must register with the NASA EarthData portal if they do not already have an account. To set up, copy the sample ".netrc" from the SPA/modisl1db/algorithm/DRLshellscripts/ directory to the home directory of your ipopp account.

```
$ cp $HOME/drl/SPA/modisl1db/algorithm/DRLshellscripts/sample.netrc $HOME/.netrc
```

Next edit the \$HOME/.netrc file to replace “yourlogin” and “yourpassword” with your EarthData portal credentials.

**Running the SPA in the IPOPP Framework:** Once this SPA is installed, users must enable the SPA service(s) corresponding to this SPA along with any other prerequisite SPA service(s). Furthermore, users who wish to generate image products from the data products generated by this SPA will need to enable the downstream image-generating SPA services. Please refer to the IPOPP User’s Guide for instructions on how to enable the SPA services. Table 1 lists the SPA services available in this SPA. Table 2 and Table 3 list the prerequisite and the image-generating SPA services respectively. The SPAs containing the prerequisite and the image-generating SPA services listed in Tables 2 and 3 can be downloaded from the DRL Web Portal, in case they are not already available in your IPOPP installation. Details about these other SPAs are available in the respective SPA User’s Guides.

**Table 1. SPA Services**

SPA services for this SPA	Data products produced	
MODISL1DB I011terra	<b>Product name</b>	<b>Destination (when installed in IPOPP)</b>
	Terra MODIS Level 1A	\$HOME/drl/data/pub/gsfcddata/terra/modis/level1/MOD01.yyDDDHHMMSS.hdf <sup>1</sup>
	Terra MODIS Geolocation	\$HOME/drl/data/pub/gsfcddata/terra/modis/level1/MOD03.yyDDDHHMMSS.hdf <sup>1</sup>
MODISL1DB I011aqua	<b>Product name</b>	<b>Destination (when installed in IPOPP)</b>
	Aqua MODIS Level 1A	\$HOME/drl/data/pub/gsfcddata/aqua/modis/level1/MYD01.yyDDDHHMMSS.hdf <sup>1</sup>
	Aqua MODIS Geolocation	\$HOME/drl/data/pub/gsfcddata/aqua/modis/level1/MYD03.yyDDDHHMMSS.hdf <sup>1</sup>
MODISL1DB I1atob	<b>Product name</b>	<b>Destination (when installed in IPOPP)</b>
	Aqua/Terra MODIS L1B 1km	\$HOME/drl/data/pub/gsfcddata/<aqua terra>/modis/level1/M<Y O>D021KM.yyDDDHHMMSS.hdf <sup>1</sup>
	Aqua/Terra MODIS L1B 500m (daytime only)	\$HOME/drl/data/pub/gsfcddata/<aqua terra>/modis/level1/M<Y O>D02HKM.yyDDDHHMMSS.hdf <sup>1</sup>
	Aqua/Terra MODIS L1B 250m (daytime only)	\$HOME/drl/data/pub/gsfcddata/<aqua terra>/modis/level1/M<Y O>D02QKM.yyDDDHHMMSS.hdf <sup>1</sup>

<sup>1</sup> Where *yy*, *DDD*, *HH*, *MM*, *SS* represents the 2-digit year, day-of-year, hour, minutes, seconds for start of swath.

**Table 2. Prerequisite SPA Services**

Prerequisite SPA services	SPA in which they are available
gbad	GBAD_SPA

**NOTE:** The gbad SPA service is a prerequisite for the I0I1aqua SPA service.

**Table 3. Image-generating SPA services**

Image-generating SPA services	SPA in which they are available
N/A	N/A