MODIS/Terra Sea Ice Extent 5-Min L2 Swath 1km, Version 61

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Hall, D. K. and G. Riggs. 2021. *MODIS/Terra Sea Ice Extent 5-Min L2 Swath 1km, Version 61*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/MODIS/MOD29.061. [Date Accessed].

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FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/MOD29

National Snow and Ice Data Center

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1 DATA DESCRIPTION

Sea ice is detected using the Normalized Difference Snow Index (NDSI) and ice surface temperature (IST) is estimated using the split-window technique. Snow-covered sea ice typically has a very high reflectance in visible bands and very low reflectance in the shortwave infrared; the NDSI reveals the magnitude of this difference. The MODIS sea ice algorithm calculates NDSI for all ocean pixels in daylight using Terra MODIS visible bands 4 and 6 and IST during both day and night using Terra MODIS thermal bands 31 and 32. The Scientific Data Sets (SDSs) included in this product are listed in Table 1 and a sample image of the data is provided in Figure 1.

The terms "Version 61" and "Collection 6.1" are used interchangeably in reference to this release of MODIS data.

1.1 Parameters

Table 1. SDS Details

Parameter	Description	Values
`Ice_Surface_Temperature`	IST is stored as calibrated data (scaled integers). Use the equation below to convert to K: $IST = scale\_factor * (calibrated\_data - add\_offset)$ where $scale\_factor = 0.01$ and $add\_offset = 0.0$.[1] The valid range for ISTs is 210 K to 313.20 K.	0.0: missing 1.0: no decision 11.0: night 25.0: land 37.0: inland water 39.0: open ocean 50.0: cloud 243-273: expected range of IST calibrated data values 655.35: fill
`Ice_Surface_Temperature_Pixel_QA`	General quality estimate of the IST algorithm output based on MODIS bands 31 and 32.	0: good quality 1: other quality 252: Antarctica mask 253: land mask 254: ocean mask 255: fill

Parameter	Description	Values
`Sea_Ice_by_Reflectance`	Sea ice extent	0: missing 1: no decision 11: night 25: land 37: inland water 39: ocean 50: cloud 100: lake ice 200: sea ice 254: detector saturated 255: fill
`Sea_Ice_by_Reflectance_Pixel_QA`	General quality estimate of the sea Ice algorithm output.	0: good quality 1: other quality 252: Antarctica mask 253: land mask 254: ocean mask 255: fill
`Latitude`	Coarse resolution (5 km) latitudes for geolocating the SDSs.	Values correspond to the pixel center of 5 km x 5 km blocks in the data array.
`Longitude`	Coarse resolution (5 km) longitudes for geolocating the SDSs.	Values correspond to the pixel center of 5 km x 5 km blocks in the data array.

[1] Values for $scale\_factor$ and add_offset are also stored as Local Attributes with the IST SDSs

1.2 Sample Image

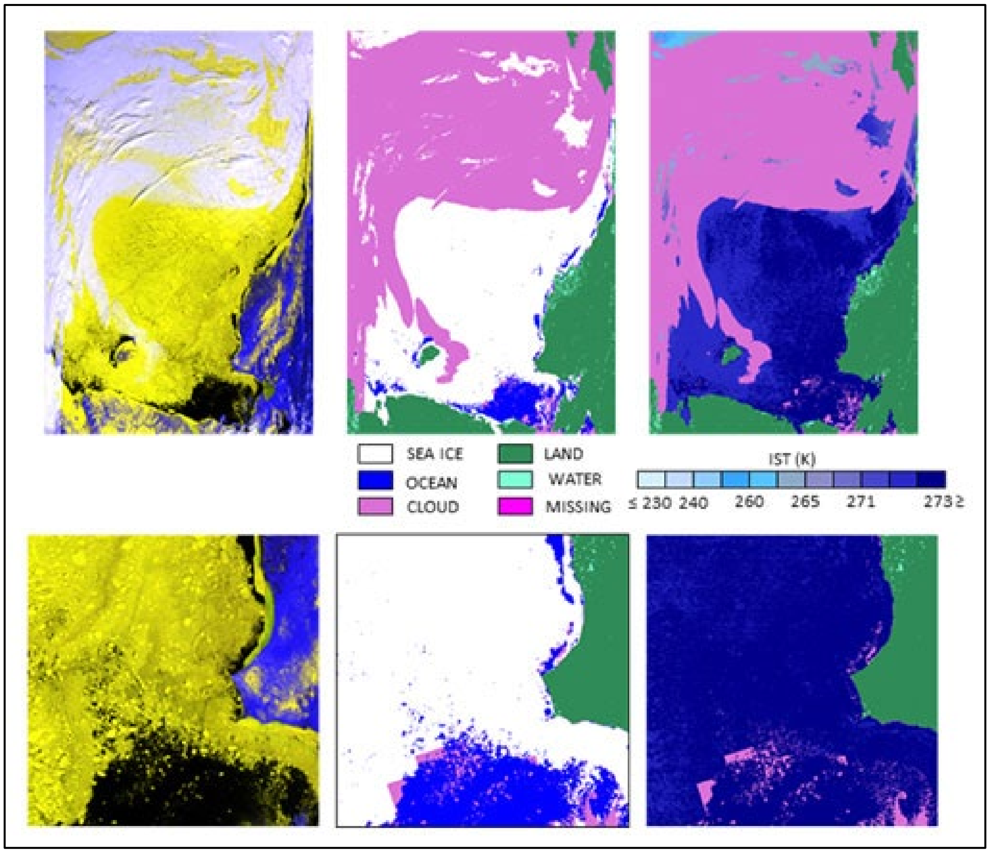

Figure 1. Typical MODIS swath data showing sea ice extent (top center) and IST (top right) from the Arctic Ocean along the Alaska and Russia coasts. The IST interval shown here ranges from 265–273 K. At 1-km resolution, details of sea ice extent can be seen in clear sky conditions. Subset images in the lower row of Chukchi Sea (middle) and Lisburne Peninsula, AK (right) reveal detail in data. Upper/lower left panels show corresponding false color image from MOD021KM to aid interpretation.

1.3 File Information

1.3.1 File Format

Data are provided in HDF-EOS2 format and are stored as 8-bit unsigned integers. For software and more information, visit the HDF-EOS website.

1.3.2 Data File

As shown in Figure 2, each data file includes two data fields (`Sea_Ice_by_Reflectance` and `Ice_Surface_Temperature`), two data quality fields (`Sea_Ice_by_Reflectance _Pixel_QA` and `Ice_Surface_Temperature_Pixel_QA`), and two geolocation data fields (`Latitude` and

`Longitude`). In addition, three file level metadata objects (`CoreMetadata.0`, `ArchiveMetadata.0`, and `StructMetadata.0`) are stored as global attributes in the HDF file.

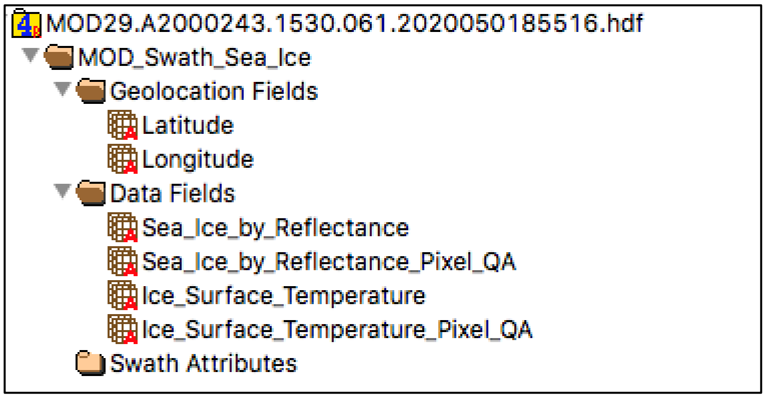

Figure 2. This figure shows the MOD29 fields included in each data file as displayed with HDFView software.

1.3.3 Ancillary Files

A browse image file (`.jpg`) and metadata file (`.xml`) are provided with each data file.

1.3.4 Naming Convention

Files are named according to the following convention and as described in Table 2.

File naming convention:

```
MOD[PID].A[YYYY][DDD].[HHMM].[VVV].[yyyy][ddd][hhmmss].hdf
```

Table 2. File Name Variables

MOD	MODIS/Terra
PID	Product ID
A	Acquisition date follows
YYYY	Acquisition year
DDD	Acquisition day of year
HHMM	Acquisition hour and minute in GMT
VVV	Version (Collection) number
yyyy	Production year
ddd	Production day of year
hhmmss	Production hour/minute/second in GMT
.hdf	HDF-EOS formatted data file

File name example:

`MOD29.A2000243.1530.061.2020050185516.hdf`

Note: Data files contain important metadata, including global attributes that are assigned to the file and local attributes like coded integer keys that provide details about the data fields. In addition, each HDF-EOS data file has a corresponding XML metadata file (`.xml`), which contains some of the same internal metadata as the HDF-EOS file plus additional information regarding user support, archiving, and granule-specific post-production. For detailed information about MODIS metadata fields and values, see the MODIS Sea Ice User Guide to Collection 6.1 (Riggs et al., 2015).

1.4 Spatial Information

MOD29 data files contain five minutes of swath data, known as a swath scene. Five minutes of MODIS swath data typically comprise 203 full scans of the MODIS instrument and occasionally 204. With an along-track viewing path of 10 km, each scan acquires 10 pixels in the 1 km bands, and thus a scene typically contains 2,030 pixels in the along-track direction and occasionally 2,040. The instrument's ±55 degree scanning pattern yields 1,354 pixels per scene in the cross-track direction. In general, 144 5-minute scenes are acquired during daylight.

1.4.1 Coverage

Coverage is global. Terra's sun-synchronous, near-polar circular orbit is timed to cross the equator from north to south (descending node) at approximately 10:30 A.M. local time. Complete global coverage occurs every one to two days (more frequently near the poles). The following sites offer tools that track and predict Terra's orbital path:

- Daily Terra Orbit Tracks, Space Science and Engineering Center, University of Wisconsin-Madison
- NASA LaRC Satellite Overpass Predictor (includes viewing zenith, solar zenith, and ground track distance to specified lat/lon)

1.4.2 Projection

This data set is not projected. Swaths are georeferenced using the 5 km latitude and longitude array fields, which are based on GPS measurements, and reference the WGS84 datum.

1.4.3 Resolution

1 km (at nadir) for data fields

5 km for geolocation fields

1.4.4 Geolocation

Data in the 5 km 'Latitude' and 'Longitude' SDSs correspond to the center pixel of 5 x 5 blocks of 1 km pixels in the sea ice SDSs. The following section describes how to map the 5 km geolocation SDSs to MODIS 1 km sea ice SDSs.

HDF-EOS formatted data files contain dimension maps that specify how each dimension of each geolocation field relates to the corresponding dimension in each data field. When a data field and a geolocation field share a named dimension, no explicit map is needed. However, for data sets like MOD29/MYD29, in which the resolution of the geolocation dimension (5 km) differs from the resolution of the data dimension (1 km), two values; 'Offset' and 'Increment' are needed to fully define the mapping.

'Offset' specifies the location along the data dimension of the first data point with a corresponding entry along the geolocation dimension. 'Increment' then specifies the number of steps between subsequent data points with corresponding geolocation points. For MOD29/MYD29, 'Offset' = 2 and 'Increment' = 5, thus the first element (0,0) in the 'latitude' and 'longitude' fields corresponds to element (2,2) in the Sea_Ice_by_Reflectance field. Increments of five pixels in the cross track and along track direction correspond to subsequent elements in the geolocation fields as shown in Figure 3.

The dimension map including the 'offset' and 'increment' is stored in the 'StructMetadata' global attribute. For more information about dimension maps and geolocation offsets and increments, see Riggs et al. (2015).

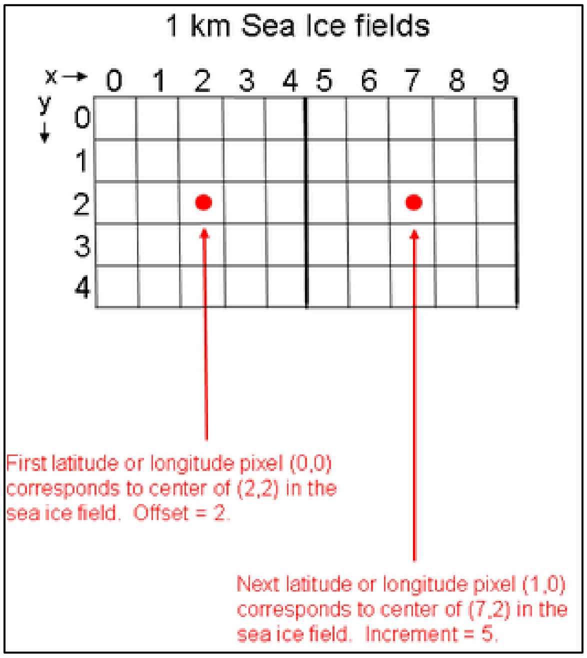

Figure 3. This figure shows how MOD29/MYD29 1 km data fields map to 5 km latitude and longitude geolocation fields.

1.5 Temporal Information

1.5.1 Coverage

MODIS Terra data are available from 24 February 2000 to present. However, because the NDSI depends on visible light, data are not produced when viewing conditions are too dark. In addition, anomalies over the course of the Terra mission have resulted in minor data outages. If you cannot locate data for a particular date or time, check the MODIS/Terra Data Outages web page.

1.5.2 Resolution

Each data file contains five minutes of swath data (one scene).

2 DATA ACQUISITION AND PROCESSING

2.1 Background

The content of MODIS sea ice data files differs between day and night because visible data are not acquired when Earth's surface is dark. However, thermal data are acquired during both day and night. Users should be aware that swath data acquired during daylight, or during a mix of day and night mode, contain variables for both sea ice extent and ice surface temperature, while swath data acquired completely in night mode contain only the ice surface temperature variables. Thus, daily sea ice data sets are split into separate files for day and night.

Note: The DayNightFlag object, a metadata value stored with the CoreMetadata.0 global attribute, indicates whether the entire swath was acquired during daylight (day), darkness (night), or a mix of day and night (both).

2.2 Acquisition

MODIS scans the entire globe every one to two days. As such, most locations on Earth are imaged at least once per day and more frequently where swaths overlap (e.g. near the poles). Terra's sun-synchronous, near-circular polar orbit is timed to cross the equator from north to south (descending node) at approximately 10:30 A.M. local time.

Ongoing changes in the Terra orbit

The Terra flight operations team conducted Terra’s last inclination adjust maneuver to maintain Terra’s orbit in February 2020. The inclination adjust maneuvers were used to control the platform’s 10:30 AM mean local time (MLT) equator crossing. Terra will continue to drift and is expected to reach a 10:15 AM MLT in October 2022. At that time, the flight operations team will have Terra exit the Earth Sciences Constellation and lower Terra to an altitude of 694 km by performing two retrograde maneuvers. MLT will continue to drift after these maneuvers, reaching 9:00 AM around December 2025. Terra MODIS will remain operational and generate the full suite of products until the end of the mission in December 2025.

Earlier crossing times for a morning platform like Terra mean lower solar elevations leading to more prevalent shadows. This decrease in orbit altitude alters the spatial coverage of the sensor including possible gaps in spatial sampling, decreased spatial coverage, and higher spatial resolution. Products are mostly expected to be science quality except for reduced grid size (from lower altitude) and without a strict 16-day repeat of observations (from drift and changing orbit).

Details on the impact of the Constellation Exit on the quality of the product are being compiled and will be posted when available.

2.3 Sources

Table 3 lists the MODIS C61 products that are used as inputs to the MODIS sea ice algorithm. For a detailed description of the MODIS sea ice detection algorithm, see the Algorithm Theoretical Basis Document (Hall et al., 2001).

Table 3. Inputs to the MODIS sea ice algorithm

Product ID	Long Name	Data Used
MOD021KM	MODIS Level 1B Calibrated and Geolocated Radiances	Band: 1 (0.645 µm); Band: 2 (0.865 µm); Band: 4 (0.555 µm); Band: 6 (1.640 µm); Band: 31 (11.03 µm); Band: 32 (12.02 µm)
MOD03	MODIS Geolocation	Land/Water Mask; Solar Zenith Angle; Latitude; Longitude; Geoid Height
MOD35_L2	MODIS Cloud Mask	Unobstructed Field of View Flag; Day/Night Flag

2.4 Processing

The MODIS sea ice algorithm identifies ice-covered oceans by reflectance characteristics and IST using the split-window technique. A processing description for the sea ice, IST, and quality assurance (QA) parameters are described in the sections below, and a flow diagram for the MODIS sea ice algorithm is shown in Figure 4.

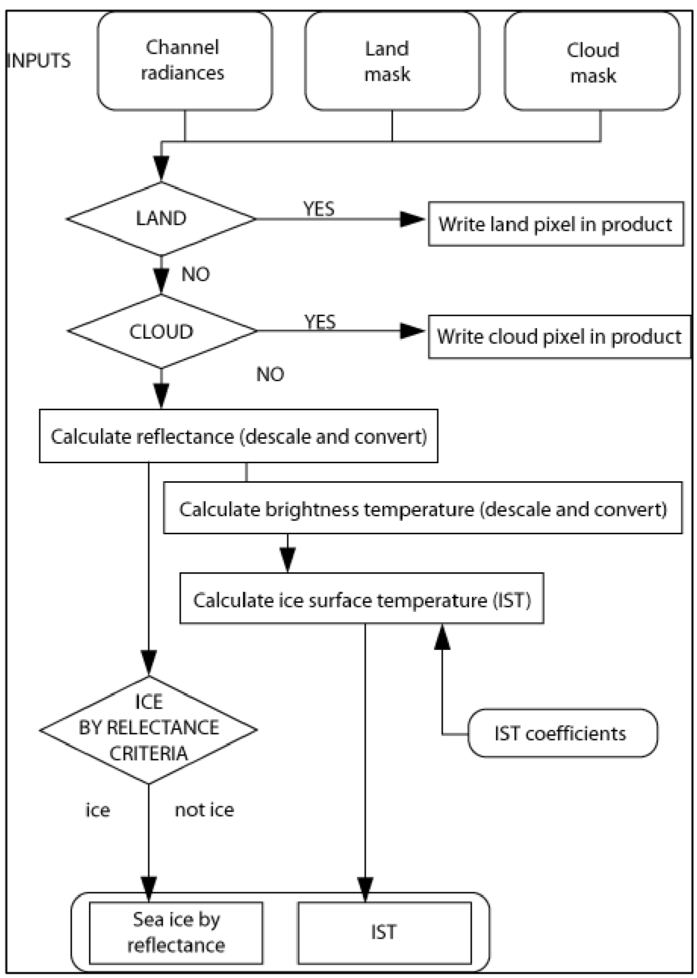

Figure 4. Flowchart showing the MOD29 and MYD29 sea ice algorithm

2.4.1 Sea Ice

Sea ice analysis is constrained to daylight ocean pixels that have visible reflectance greater than 10 percent and are not obstructed by clouds. The MOD03 land/water mask is used to guide processing on oceans. The mask's three ocean categories: deep, moderate, and shallow, are all processed as ocean with no distinction between the categories.

Top-of-the-atmosphere (TOA) reflectance is read from MOD021KM and screened for missing and unusable data. Unusable data results from processing at L1B when the sensor radiance data fails to meet acceptable criteria. The algorithm maps missing MOD021KM data as 'missing' in the output. No action is taken in the algorithm to analyze missing data. If other anomalous conditions are encountered in the input data, the algorithm sets 'no decision' for that pixel, except for a few cases where a value indicating the source of the anomaly is written.

Land and inland water bodies are masked using the land/water mask in MOD03. Clouds are masked using the MODIS Cloud Mask (MOD35_L2) 'unobstructed field-of-view' flag. If the flag is set to 'certain cloud', the pixel is set to 'cloud.' If the cloud flag is set to 'clear', or any level of possible cloud, the pixel is interpreted as 'clear.' That logic is used to increase the number of retrievals balanced against the cloud conservative nature of the cloud mask and accepts potential ice/cloud confusion and cloud contamination in IST.

Sea ice detection is achieved by using grouped criteria tests for sea ice reflectance characteristics in the visible and near-infrared regions. The algorithm assumes that sea ice is snow-covered and that the NDSI can be used to detect sea ice. The NDSI is computed from MODIS band 4 (0.55 µm) and band 6 (1.6 µm) as follows:

$$NDSI = \frac{(band4 - band6)}{(band4 + band6)}$$

Pixels that pass all of the following criteria tests are identified as sea ice and passed through for additional tests:

- NDSI > 0.4
- Band 2 (visible) reflectance > 0.11
- Band 1 reflectance > 0.10

The algorithm also conducts intermediate checks based on theoretical bounds of 0 to 1 for reflectance and -1.0 to +1.0 for the NDSI. However, the sea ice test is performed regardless of violations of these limits and the QA data is set to indicate an unusual condition with low quality result.

2.4.2 IST

The IST algorithm is constrained to ocean pixels that are not obstructed by clouds and is run for daytime and nighttime data. The MOD03 land/water mask is used to guide processing on oceans. The mask's three ocean categories: deep, moderate and shallow, are all processed as ocean with no distinction between the categories.

Radiance data for bands 31 and 32 are read from MOD021KM and converted to brightness temperatures using a version of the Plank function:

$$T = {c_2 v} \Big/ \ln\left(1 + \left(\frac{e c_1 v^3}{E}\right)\right)$$

where:

T = brightness temperature (K)
c_1 = 1.1910659 × 10^{-5} m W·m^{-2}·sr·cm^{-4}
c_2 = 1.438833 cm K
v = central wavelength in cm^{-1}
E = radiance from sensor in m W·m^{-2}·sr·cm^{-4}
e = emissivity

ISTs are estimated using a split-window technique and a version of Key's equation for the Advanced Very High Resolution Radiometer (AVHRR) that was adapted for use with MODIS Channels 31 and 32 (Key et al., 1997):

$$IST = a + bT_{31} + c(T_{31} - T_{32}) + d\big((T_{31} - T_{32})(\sec(q) - 1)\big)$$

where:

T_{31} = brightness temperature of MODIS channel 31 (11 µm)
T_{32} = brightness temperature of MODIS channel 32 (12 µm)
q = sensor scan angle from nadir
a, b, c, and d are coefficients determined by a multilinear regression of brightness temperatures to estimated surface temperatures.

Coefficients for the IST equation were derived using MODIS spectral response functions and radiative transfer calculations. Different coefficients sets are used for each of three temperature ranges in the Northern and Southern Hemispheres as shown in Table 4:

Table 4. N. and S. Hemisphere IST Coefficient Sets

T (K)	Coef.	N. Hemisphere	S. Hemisphere
< 240	a	-1.5711228087	-0.1594802497
	b	1.0054774067	0.9999256454
	c	1.8532794923	1.3903881106
	d	-0.7905176303	-0.4135749071
240 to 260	a	-2.3726968515	-3.3294560023
	b	1.0086040702	0.9999256454
	c	1.6948238801	1.2145725772
	d	-0.2052523236	0.1310171301
> 260	a	-4.2953046345	-5.207360416
	b	1.0150179031	1.0194285947
	c	1.9495254583	1.5102495616
	d	0.197132579	0.2603553496

The MOD021KM data is screened for missing data and for unusable data. Unusable data result from the processing at L1B when the sensor radiance data fails to meet acceptable criteria. MODIS data may be unusable for several reasons. Specifics of L1B processing and criteria can be found at the MODIS Characterization Support Team (MCST) web page and in supporting documentation. In the case of missing data, the algorithm maps the data as 'missing' in the output product. No action is taken in the algorithm to make an analysis for missing data. If other anomalous conditions occur with the input data, the algorithm makes no decision for that pixel, except for a few anomalous conditions where a value indicating the source of the anomaly is written.

Quality checks are applied to the input data and at intermediate processing steps. If intermediate checks are failed, the quality value is lowered and the final quality value associated with a pixel is output. Clouds are masked using the MODIS Cloud Mask data product (MOD35_L2) 'unobstructed field-of-view' flag for both daytime and nighttime data. If the cloud flag is set to 'clear' or any level of possible cloud, the pixel is interpreted as 'clear'. That logic is used to increase the number of retrievals balanced against the cloud conservative nature of the cloud mask and accepts potential ice/cloud confusion and cloud contamination in IST.

2.4.3 Sea Ice QA

The sea ice QA SDS provides an indication of the quality of the sea ice by reflectance algorithm output for each pixel. QA performed within the algorithm checks that the input data and calculated intermediate values lie within theoretical or expected ranges. The default QA value is good (0); if any of the data checks fail, the value is set to 'other' (1). If the algorithm was not applied, for example to a land pixel, then the mask value is output. Unless the input data is unusable or missing, the data quality will usually be set to good.

2.4.4 IST QA

The IST QA SDS provides an indication of the quality of the output data. The algorithm checks that the input data and calculated intermediate values lie within theoretical or expected ranges. The default QA value is good (0); if any of the data checks fail, the value is set to 'other' (1). If the algorithm was not applied, for example to a land pixel, then the mask value is output. Unless the input data is unusable or missing, the data quality will usually be set to good.

2.5 Quality Information

2.5.1 Sea Ice Extent

Sea ice extent has been evaluated by visual comparison with MODIS radiance imagery and comparative analysis with sea ice products and maps from other sources. Although the MODIS Science Team is not aware of any definitive quantitative evaluations, qualitative comparisons suggest that the sea ice extent maps can be very accurate under clear sky conditions, showing ice details at 1 km resolution. However, the extensive and frequent cloud cover in the Arctic factors against the use of MODIS data for monitoring sea ice conditions.

2.5.2 IST

For the IST product, the algorithm is applied to all ocean pixels without pre-screening for the possible occurrence of sea ice. The IST algorithm is not a sea surface temperature algorithm and should not be used as one. ISTs in this data set are only relevant in the context of oceans and seas where sea ice occurs.

Water vapor and the presence of any clouds potentially degrades the accuracy of the ISTs. Under ideal conditions (clear skies and low water vapor), IST accuracy is estimated at 1-3 K (Hall et al., 2004, Scambos et al., 2006, Shuman et al., 2014, and Hall et al., 2015).

The IST algorithm utilizes the MODIS scan angle range of 55 degrees in the IST calculation. The science team has compared this convention with using the MODIS sensor zenith angle, which includes the surface curvature effect, and found that both geometries yield accurate ISTs; in general within 1 K of each other. The science team continues to evaluate the practice of using the fixed sensor scan angle to calculate ISTs.

2.5.3 Sea Ice and IST

For both the sea ice and IST data sets, discriminating between clouds and sea ice is challenging. Clouds are masked using the MOD35_L2 cloud mask, and thus the accuracy and error of that product's algorithm propagates into MOD29/MYD29. Furthermore, the cloud conservative nature of MOD35_L2 tends to report sea ice as cloud under certain conditions. Users should also be aware that an artifact from the cloud mask product appears in MODIS sea ice data sets. In order to initialize the sea ice background flag, the cloud mask algorithm uses ancillary data with a relatively coarse spatial resolution: 25 km compared with the 1 km cloud mask resolution. This difference in the resolution of the background map sometimes creates artifacts in which cloud edges in the cloud mask have straight lines or 90 degree corners.

2.5.4 Geolocation

Geolocation accuracy is 50 m or less. Geolocation uncertainty is not evident in MODIS Level-2 products when viewed independently. However, when mapped to projections or to other maps, feature mismatches may occur (Lin et al., 2019).

2.5.5 Validation

MODIS sea ice data sets are considered validated at stage 2, meaning that accuracy has been assessed via comparisons with in situ data and other satellite sensors. See the MODIS Land Team: Validation web page for details. In addition, the NASA Goddard Space Flight Center: MODIS/VIIRS Land Product Quality Assessment website provides updated quality information for all MODIS land products.

2.6 Errors

Anomalies in the input data can propagate to the output. Refer to Table 3 for a list of the MODIS products that are input to the MOD29 algorithm.

2.7 Instrumentation

2.7.1 Description

The MODIS instrument provides 12-bit radiometric sensitivity in 36 spectral bands ranging in wavelength from 0.4 µm to 14.4 µm. Two bands are imaged at a nominal resolution of 250 m at nadir, five bands at 500 m, and the remaining bands at 1000 m. A ±55 degree scanning pattern at an altitude of 705 km achieves a 2330 km swath with global coverage every one to two days.

The scan mirror assembly uses a continuously rotating, double-sided scan mirror to scan ±55 degrees and is driven by a motor encoder built to operate 100 percent of the time throughout the six-year instrument design life. The optical system consists of a two-mirror, off-axis afocal telescope which directs energy to five refractive objective assemblies, one each for the visible, near-infrared, shortwave infrared, middle-wavelength infrared, and long-wavelength infrared spectral regions.

The MODIS instruments on the Terra and Aqua space vehicles were built to NASA specifications by Santa Barbara Remote Sensing, a division of Raytheon Electronics Systems. Table 5 contains the instruments' technical specifications:

Table 5. MODIS Technical Specifications

Variable	Description
Orbit	705 km altitude, 10:30 A.M. descending node (Terra), sun-synchronous, near-polar, circular
Scan Rate	20.3 rpm, cross track
Swath Dimensions	2330 km (cross track) by 10 km (along track at nadir)
Telescope	17.78 cm diameter off-axis, afocal (collimated) with intermediate field stop
Size	1.0 m x 1.6 m x 1.0 m
Weight	228.7 kg
Power	162.5 W (single orbit average)
Data Rate	10.6 Mbps (peak daytime); 6.1 Mbps (orbital average)
Quantization	12 bits
Spatial Resolution	250 m (bands 1-2) 500 m (bands 3-7) 1000 m (bands (8-36)
Design Life	6 years

2.7.2 Calibration

MODIS has a series of on-board calibrators that provide radiometric, spectral, and spatial calibration of the MODIS instrument. The blackbody calibrator is the primary calibration source for thermal bands between 3.5 µm and 14.4 µm, while the Solar Diffuser (SD) provides a diffuse, solar-illuminated calibration source for visible, near-infrared, and short wave infrared bands. The Solar Diffuser Stability Monitor tracks changes in the reflectance of the SD with reference to the sun so that potential instrument changes are not incorrectly attributed to changes in this calibration source. The Spectroradiometric Calibration Assembly provides additional spectral, radiometric, and spatial calibration.

MODIS uses the moon as an additional calibration technique and for tracking degradation of the SD by referencing the illumination of the moon since the moon's brightness is approximately the same as that of the Earth. Finally, MODIS deep space views provide a photon input signal of zero, which is used as a point of reference for calibration.

For additional details about the MODIS instruments, see NASA's MODIS | About Web page.

3 SOFTWARE AND TOOLS

The following sites can help you identify the right MODIS data for your study:

- NASA's Earth Observing System Data and Information System | Near Real-Time Data
- NASA Goddard Space Flight Center | MODIS Land Global Browse Images
- MODIS Land Discipline Group (MODLAND) Tile Calculator
- Tile Bounding Coordinates for the MODIS Sinusoidal Grid

The following resources are available to help users work with MODIS data:

- The HDF-EOS to GeoTIFF Conversion Tool (HEG) can reformat, re-project, and perform stitching/mosaicing and subsetting operations on HDF-EOS objects.
- HDFView is a simple, visual interface for opening, inspecting, and editing HDF files. Users can view file hierarchy in a tree structure, modify the contents of a data set, add, delete and modify attributes, and create new files.
- What is HDF-EOS? an NSIDC FAQ
- The MODIS Conversion Toolkit (MCTK) plug-in for ENVI can ingest, process, and georeference every known MODIS data set, including products distributed with EASE-Grid projections. The toolkit includes support for swath projection and grid reprojection and comes with an API for large batch processing jobs.

4 RELATED WEBSITES

The following resources provide additional information about MODIS Version 6.1 data, including known problems, production schedules, and future plans:

- The MODIS Snow and Sea Ice Global Mapping Project
- NASA LDOPE | MODIS/VIIRS Land Product Quality Assessment
- MODIS Land Team Validation | Status for Snow Cover/Sea Ice (MOD10/29)

5 CONTACTS AND ACKNOWLEDGMENTS

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7 DOCUMENT INFORMATION

7.1 Publication Date

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7.2 Date Last Updated

December 2021