NASA S-NPP VIIRS Ice Surface Temperature Products Collection 1 (C1) User Guide

Release 1.0

Describes
The Swath Level Product

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Table of Contents

List of Acronyms

ATBD	Algorithm Theoretical Basis Document
BT	Brightness Temperature
CDR	Climate Data Record
CMG	Climate-Modeling Grid
DOI	Digital Object Identifier
EDR	Environmental Data Record
EOSDIS	Earth Observing System Data Information System
ESDT	Earth Science Data Type
HDF5	Hierarchical Data Format 5
IDPS	Interface Data Processing Segment
L1 / L2 / L3	Level 1, Level 2 or Level 3 data product
LSIPS	Land Science Investigator-led Processing System
MOD29	ESDT of the MODIS L2 IST product
MODIS	Moderate-resolution Imaging Spectroradiometer
QA	Quality Assessment
SIN	Sinusoidal Projection
S-NPP	Suomi National Polar-orbiting Partnership
SWIR	Short Wave Infrared
SZA	Solar Zenith Angle
TOA	Top-of-Atmosphere
VIIRS	Visible Infrared Imager Radiometer Suite
VNP30*	ESDT name for the VIIRS Level-2 IST Data Products
VNP30	ESDT name for the VIIRS Level-2 swath-based IST Data Product
VNP30A1	ESDT name for the VIIRS Level-3 tiled IST Data Product
VNP30C1	ESDT name for the VIIRS Level-3 global IST Data Product
VIS	visible

1.0 Overview

The NASA Suomi-National Polar-orbiting Partnership (S-NPP) Visible Infrared Imaging Radiometer Suite (VIIRS) sea ice surface temperature (IST) algorithm and data product are similar to the Moderate Resolution Imaging Spectroradiometer (MODIS) IST algorithm and data product. The overall objective for VIIRS Collection 1 (C1) is to make the NASA VIIRS IST algorithms compatible with the Collection 6 (C6) MODIS Terra and Aqua IST algorithms to ensure continuity of the data products and enable development of a climate-data record (CDR) from the three sensors. Differences between the MODIS C6 and the NASA VIIRS algorithms originate from the physical differences between the MODIS and VIIRS instruments, including spatial resolution and band locations. The NASA VIIRS IST product is produced in the NASA Land Science Investigator-led Processing System (LSIPS). The NASA VIIRS IST data product is somewhat different from the IST product generated in the NOAA- Interface Data Processing Segment (IDPS) system.

This User Guide describes each of the three NASA VIIRS C1 IST products in sequence from Level 2 to Level 3: 1) IST swath, 2) daily IST tiled, and 3) daily climate modeling grid (global). This User Guide is a living document developed in increments for each product as they are scheduled to be released, so it is advisable to check that you are using the latest version. This release (1.0) describes the VIIRS swath level (Level-2) IST product which is the first to be produced by the LSIPS and archived at the NSIDC DAAC. The LSIPS has evolved from the LPEATE which had the task of generating and evaluating algorithms and products generated with IDPS algorithms. The LSIPS is now beginning to produce and distribute the NASA VIIRS data products. The VIIRS IST products are referenced by their Earth Science Data Type (ESDT) root name, VNP30. The ESDTs are produced as a series of products in which data and information are propagated to the higher level products. Details of the data products, Quality Assessment (QA) data content, and commentary on evaluation and interpretation of data are given for each product. The reader is referred to the VIIRS Algorithm Theoretical Basis Document (ATBD) [http://npp.gsfc.nasa.gov/documents.html] [*Tschudi et al*., 2016] and to *Justice et al*. [2013] for further details.

The data product format of the VIIRS IST data products changes with the data product level. The VNP30 product file format is netCDF4/HDF5 and is compliant with the netCDF Climate and Forecast (CF) Metadata Conventions Version 1.6. Information on netCDF4.2 is at www.unidata.ucar.edu/software/netcdf/docs/index.html, information on Hierarchical Data Format 5 (HDF5) may be found at https://www.hdfgroup.org/HDF5/. Either netCDF4 or HDF5 tools should be able to read these data products. The Level-3 products, VNP30A1 and VNP30C1, will be in HDF5-EOS file format. The user should contact the NSIDC DAAC user support group with questions about working with these file formats.

The LSIPS ramp-up to full production of NASA VIIRS data products began with producing the LPEATE versions of IDPS algorithms and products for Level-1B and

Level-2 products to use as inputs to the NASA algorithms and data products as they were being developed and for initial C1 production. Those LPEATE versions of the L1B products will be replaced by the NASA L1B and L2 products when they become available. The difference between those products is calibration and data product format; both contain the same data but are organized in different ways. The current VNP30 uses LPEATE versions of inputs and outputs the VNP30 product. Future version of the VNP30 algorithm code will be revised to use NASA L1B inputs but the IST algorithm will not be changed and the output product will be the same. Data product inputs are listed as global attributes in VNP30 so a user can determine which L1B inputs were used.

Note: The User Guide is developed in increments for each product as they are scheduled to be released so check that you have the latest version of the guide.

2.0 NASA VIIRS IST Data Products

The NASA VIIRS sea ice surface temperature (IST) data products are listed in Table 1. IST products are produced in sequence beginning with a swath at a nominal pixel spatial resolution of 750 m with nominal swath coverage of 3200 pixels (across track) by 3248 pixels (along track), consisting of 6 minutes of VIIRS scans. Products in EOSDIS are labeled as ESDT and have their heritage in the MODIS production system [*Wolfe and Ramapriyan*, 2010]. The ESDT also indicates what spatial and temporal processing has been applied to the data product. Data product levels are briefly described here, Level 1B (L1B) is a swath (scene) of VIIRS data in latitude and longitude orientation. A Level 2 (L2) product is a geophysical product that remains in latitude and longitude orientation of L1B. A Level 2 gridded (L2G) product is in a gridded format of the sinusoidal projection for VIIRS land products. At L2G the data products are referred to as tiles, each tile being 10° x 10° area of the global map projection. L2 data products are gridded into L2G tiles by mapping the L2 pixels into cells of a tile in the map projection grid. The L2G algorithm creates a gridded product necessary for the Level 3 (L3) products. An L3 product is a geophysical product that has been temporally and or spatially manipulated, and is in a gridded map projection format and comes as a tile of the global grid. The VIIRS L3 IST products are in the EASE-Grid 2 polar projection (VNP30A1 and VNP30C1).

The series of NASA VIIRS IST products to be produced in C1 is listed in Table 1. A description of each product, synopsis of the algorithm and commentary on IST detection, quality assessment, accuracy and errors is given in the following sections.

Attributes (metadata) describing the time of acquisition of the swath, input products, geographic location of swath, production of the data product, provenance and Digital Object Identifier (DOI) of the product are attached to the root group (the file). Those attributes are listed in Appendix A; they are not described further in this user guide.

Table 1: Summary of sea ice IST products produced at the Land Science Investigator-led Processing System (LSIPS).

Products	ESDT	Description
IST (L2 Daily Swath product)	VNP30	VIIRS/NPP IST 6-Min Swath 750 m
IST (L3 Daily Tiled product)	VNP30A1	VIIRS/NPP IST Map Daily L3 Global 750 m EASE-Grid2 Day
IST (L3 CMG Product)	VNP30C1	VIIRS/NPP Daily IST L3 Global EASE-Grid2climate-modeling grid (CMG)

3.0 VNP30

Sea ice surface temperature over sea ice is computed using a split-window technique as is performed in the MODIS C6 IST algorithms [*Tschudi et al*., 2016; *Yu et al*., 1995 and b]. The IST product contains four datasets; 1) IST map with cloud mask and other masks applied, 2) IST not masked for clouds, 3) basic Quality assurance (QA), and 4) algorithm bit flags. The IST is calculated for day and night time data. A mask of night data is applied in the basic QA dataset. The algorithm bit flags are not set in the first version of VNP30 released..Those flags are set to a fill value as a place holder for future version that will set the algorithm bit flags A detailed explanation for providing the IST is given in the NASA VIIRS IST ATBD [*Tschudi et al*., 2016] [http://npp.gsfc.nasa.gov/documents.html].

The NASA VIIRS IST swath product, VNP30, contains dimension-scale datasets, a geolocation datagroup an IST data group with datasets and attributes, and file level attributes. Contents of VNP30 are given in List 1.

List 1. File level description of the contents of the VNP30 product.
dimensions:
    number_of_lines = 3232 ;
    number_of_pixels = 3200 ;
global attributes:
group: Geolocation_Data

group: IST_Data

3.1 Geolocation Data

The latitude and longitude data for each pixel in a swath are stored as coordinate datasets in the GeolocationData group in the VNP30. The coordinate variables, attributes and datasets use the netCDF CF conventions for georeference. Software tools that work with the netCDF or HDF5 data formats should be able to work with the VNP30 product. Description of the GeolocationData group is given in List 2.

List 2. Description of the Geolocation_Data group and attributes in VNP30

```
group: Geolocation_Data {
  variables:
        float latitude(number_of_lines, number_of_pixels) ;
              latitude:long_name = "Latitude data" ;
              latitude:units = "degrees_north" ;
              latitude:_FillValue = -999.9f ;
              latitude:valid_range = -90.f, 90.f ;
              latitude:standard_name = "latitude" ;
        float longitude(number_of_lines, number_of_pixels) ;
              longitude:long_name = "Longitude data" ;
              longitude:units = "degrees_east" ;
              longitude:_FillValue = -999.9f ;
              longitude:valid_range = -180.f, 180.f ;
              longitude:standard_name = "longitude" ;
  } // group Geolocation_Data
```

3.2 IST Data Group

The VNP30 product has the following datasets in the IST_Data datagroup; IST, IST_Map, IST_Basic_QA, and QA_Flags, each with local attributes describing the data. Descriptions of the IS_ Data group datasets and attributes are given in List 3 and in Section 3.2 subsections and images of the datasets are shown in Figure1.

List 3. Description of IST_Data group datasets and attributes in VNP30

```
group: IST_Data {
  variables:
        ushort IST(number_of_lines, number_of_pixels) ;
              IST:coordinates = "latitude longitude" ;
              IST:long_name = "Ice Surface Temperature" ;
              IST:units = "K" ;
              IST:valid_range = 21000US, 31300US ;
              IST:scale_factor = 0.01f ;
              IST:_FillValue = 65535US ;
              IST:mask_values = 0US, 1US, 11US, 25US, 37US, 39US ;
```

IST:mask_meanings = "0-missing, 1-no_decision, 11-night, 25-land, 37-inland_water, 39-open_ocean" ;
ubyte IST_Basic_QA(number_of_lines, number_of_pixels) ;
IST_Basic_QA:coordinates = "latitude longitude" ;
IST_Basic_QA:long_name = "Basic QA of Ice Surface Temperature" ;
IST_Basic_QA:valid_range = 0UB, 6UB ;
IST_Basic_QA:QA_value_meanings = "0-best, 1-day_good, 2-day_cloud, 3-night_good, 4-night_cloud, 5-other,6-poor" ;
IST_Basic_QA:mask_values = 237UB, 253UB, 254UB ;
IST_Basic_QA:mask_meanings = "237-inland_water, 253-land_mask, 254-bowtie_trim" ;
IST_Basic_QA:_FillValue = 255UB ;
ushort IST_map(number_of_lines, number_of_pixels) ;
IST_map:scale_factor = 0.01f ;
IST_map:units = "K" ;
IST_map:coordinates = "latitude longitude" ;
IST_map:long_name = "Ice Surface Temperature with masks" ;
IST_map:valid_range = 21000US, 31300US ;
IST_map:mask_values = 0US, 1US, 11US, 25US, 37US, 39US, 50US ;
IST_map:mask_meanings = "0-missing, 1-no_decision, 11-night, 25-land, 37-inland_water, 39-open_ocean, 50-cloud" ;
IST_map:_FillValue = 65535US ;
ubyte QA_Flags(number_of_lines, number_of_pixels) ;
QA_Flags:coordinates = "latitude longitude" ;
QA_Flags:long_name = "Algorithm QA Flags for IST" ;
QA_Flags:comment = "No QA bit flags are set in this version, the dataset is place holder for future version that will have QA bit flags set" ;

// group attributes:
:IST_coefficient_source = "Liu, Y.; Key, J.; Tschudi, M.; Dworak, R.; Mahoney, R.; Baldwin, D. Validation of the Suomi NPP VIIRS Ice Surface Temperature Environmental Data Record. Remote Sens. 2015, 7, 17258-17271." ;
:IST_coefficients_LT_240K = -7.335613, 1.030383, 1.264255, -0.438851 ;
:IST_coefficients_240-260K = -8.606919, 1.03532, 0.641668, 1.83879 ;
:IST_coefficients_GT_260K = -6.629177, 1.027197, 1.082237, 2.159417 ;
} // group IST_Data
}

3.2.1 IST

The IST dataset, Fig.1 upper left, is the sea ice surface temperature generated by the algorithm. IST is represented by values in the range of 237 – 253K in each pixel, as was done in the MODIS data products [*Hall et al*., 2004; *Riggs et al*., 2016). The IST is given for day and night pixels and does not have the cloud mask applied. The cloud mask is not applied so that a user has access to IST for all pixels regardless of cloud cover. The cloud mask is applied to the IST_Map, and in the Basic_QA datasets. Providing the data in this way allows a user access to IST for all ocean pixels in a swath and allows them to determine or interpret cloud cover from the QA data or an

independent cloud data product. The onboard bowtie trim fill data is retained in the dataset. An example of the IST dataset with a colorized range is shown in Figure 1. Attributes are attached to the dataset.

3.2.2 IST _map

To give a view of cloud conditions in the scene, the cloud mask is overlaid on the IST data to make the IST_Map, Fig.1 upper right.

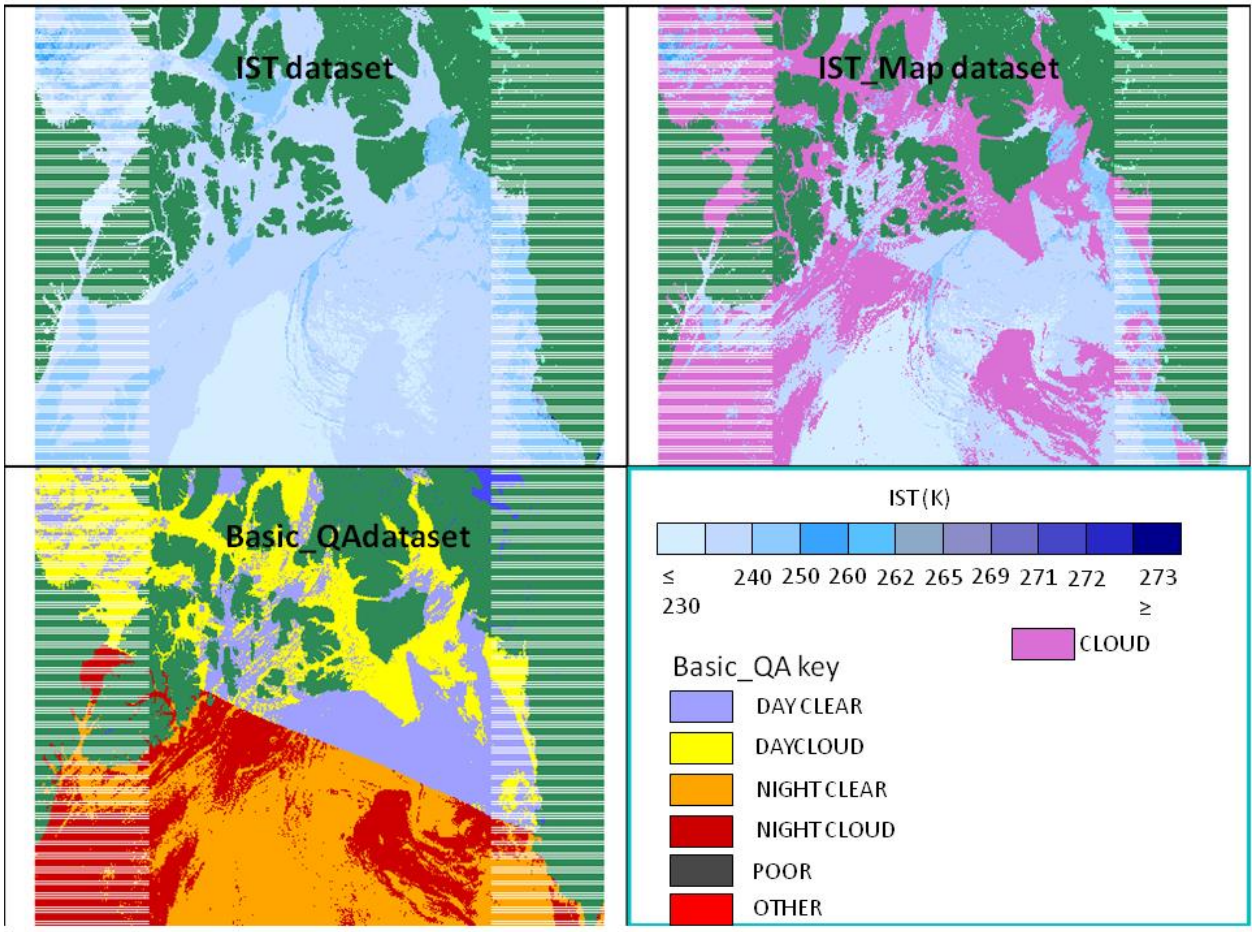

Figure 1. VNP30.A2014074.2055 datasets. This swath has both day and night observations which are delineated in the Basic_QA dataset, lower left.

3.2.3 Algorithm_Flags

Currently this dataset is set to the fill value as a place holder for a future version which will have bit flags set. Algorithm-specific bit flags will be set in this dataset for the data screens that are applied in the algorithm and other conditions. Multiple bit flags may be set for a pixel. Some of the bit flags will identify an uncertain IST result. See Section 3.3 for a description of bit flags. Local attributes describing the bit flags will be included.

3.2.4 IST_Basic_QA

A general quality value is given for pixels processed for sea ice surface temperature. Setting of basic QA value is similar to the approach used for the MODIS IST products

[*Riggs et al*., 2016]. However the setting of basic QA has been revised to include setting values for day and night pixels, and cloud cover, Fig.1 lower left. This is a basic quality value used to indicate quality ranging from best to poor to provide a user with a convenient value for initial quality assessment of the data. Local attributes describing the data are included. The IST basic QA is defined as: IST_Basic_QA: QA_value_meanings = "0-best, 1-day good, 2-day cloud, 3-night good, 4-night cloud, 5-other, 6-poor". And with mask values of; IST_Basic_QA: mask_meanings = "237-inland_water, 253-land_mask, 254-bowtie_trim"

3.3 Ice Surface Temperature Algorithm

A brief description of the algorithm approach is provided to explain the flow of the algorithm and the basic technique used to detect sea ice surface temperature. A detailed description of the algorithm can be found in the NASA VIIRS ATBD [*Tschudi et al*., 2016].

The basis of the NASA VIIRS IST algorithm is the work of *Key et al*. [1997], who state that the demonstrated accuracy of the algorithm is sufficient for most climate process studies. The major caveat with the algorithm is that it is applicable only to clear-sky conditions. Inadequate cloud masking may result in significant error in estimating the IST. The heritage of the VIIRS IST algorithm is *Key and Haefliger* [1992] with substantiation of robustness and accuracy by later work [*Key et al.*, 2013, 1994; *Yu et al*., 1995; *Lindsay and Rothrock*, 1994; *Massom and Comiso*, 1994).

The IST is computed from VIIRS band M15 and M16 brightness temperature data using the split-window method of *Yu et al*. [1995], updated for VIIRS M15 and M16 bands.

The IST is calculated for all polar ocean water bodies in daylight and nighttime (Fig.1). Screening for clouds is accomplished by applying the VIIRS Cloud Mask (VCM) data product [*Godin*, 2014]. The VCM Cloud Detection Results & Confidence Indicator flag is used to mask cloud and cloud contamination from pixels. If that flag is set to “confident cloudy” or “probably cloudy,” then the pixel is labeled as cloud obscured in the sea ice map.

Data product inputs to the NASA VIIRS IST algorithm are listed in Table 2, currently using the LPEATE version of inputs. The LISPS ESDT names are listed in parentheses and italicized. The basic processing flow is depicted in Figure 2. The processing flow for a pixel is determined based on the land/water mask read from the NPP_CMIP data product. All ocean pixels in daylight and nighttime processed for IST VIIRS radiance data are checked for nominal quality and converted to top-of-atmosphere (TOA) reflectance.

Table 2. VIIRS data product inputs to the VNP30 algorithm.

ESDT	Data array names	Nominal spatial resolution	Descriptor
NPP_VMAES_L1	BrightnessTemperature_M15	750 m	BT
	QF1_VIIRSMBANDSDR_M15		Poor quality flag
	BrightnessTemperature_M16	750 m	BT
	QF1_VIIRSMBANDSDR_M16		Poor quality flag
	SolarZenithAngle	750 m	Solar zenith angle
	SatelliteZenithAngle	750 m	Satellite zenith angle
VNP35_L2	QF1_VIIRSCMIP (bits 2-3)	750 m	Cloud mask confidence
	QF2_VIIRSCMIP (bits 0-2)	750 m	Land/water mask

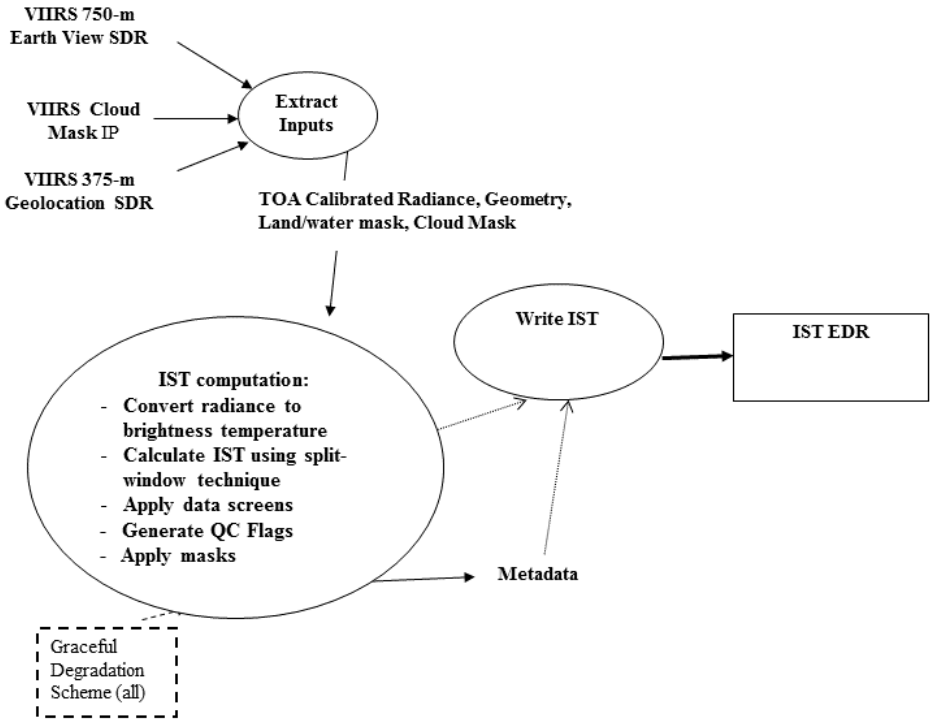

Figure 2. IST Environmental Data Record (EDR) processing architecture.

3.3.1 Data Screens

The M15 and M16 quality flag (QF) data is checked. If the QF data flag is set to other than good data the basic QA value is set to poor and the IST is calculated. IST is represented in Kelvins, with values in the expected range of 213-275K for each pixel.

In next version of the algorithm other data screens will be added and bit flags will be set for screens applied in the algorithm.

3.3.2 Cloud Masking

The cloud confidence flag from VNP35_L2 is used to mask clouds. The cloud confidence flag gives four levels of confidence: confident cloudy, probably cloudy, confident clear, and probably clear. If the cloud mask flags "confident cloudy then the pixel is masked as "cloud." If the cloud mask flag is set "confident clear" or "probably clear" or "probably cloudy", it is interpreted as "clear" to make the IST_map dataset.

3.3.3 Quality Assessment (QA)

Two QA datasets are output: 1) the IST_Basic_QA which gives a simple value, and 2) the QA_Flags which reports results of data screens as bit flags. The basic QA value is a qualitative estimate of the algorithm result for a pixel. The basic QA value is initialized to the best value and is then set based on the quality of the L1B input data, the day/night flag and the cloud mask.

In a future version the QA_Flags dataset will contain bit flags set for data screens that applied in the algorithm. More than one bit flag may be set because all data screens are applied to a pixel. By examining the bit flags a user would be able to determine if an IST pixel has certain screens set to "on" indicative of an uncertain IST estimate. The screens and bit flags identify where IST detection was "uncertain." More than one data screen could be "on" for uncertain IST detection.

3.4 Interpretation of IST Detection Accuracy, Uncertainty and Errors

The accuracy of the IST algorithm for the IDPS VIIRS IST product is approximately 1K [*Key et al*., 2013]. The NASA VIIRS IST accuracy is approximately 1K and continues to be assessed via comparisons with the NASA MODIS IST product [*Hall et al*., 2004] and validated with NASA Operation IceBridge airborne IST measurements [*Krabill and Buzay*, 2012]. An example of autumn freeze up and formation of ice in the Beaufort Sea by the VIIRS IST is shown in Figure 3. A comparison of those IST datasets from a IceBridge flight is shown in Figure 4. The VIIRS IST was found to be within ± 1K of the airborne IST measurements.

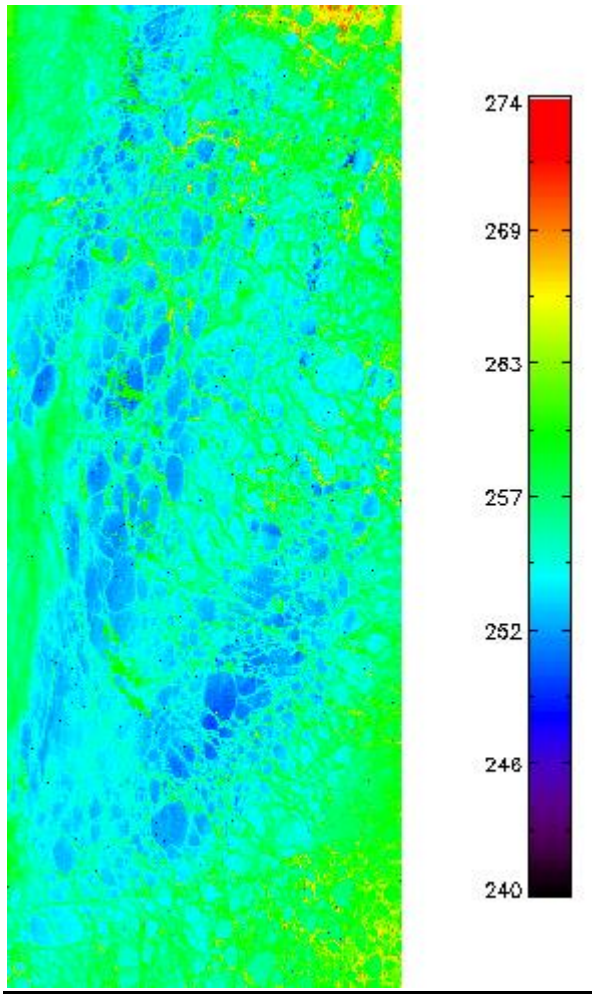

Figure 3. VNP30.A2014255.2110, 2110 UTC, 12 September 2014. IST map during fall freeze-up in the Beaufort Sea.

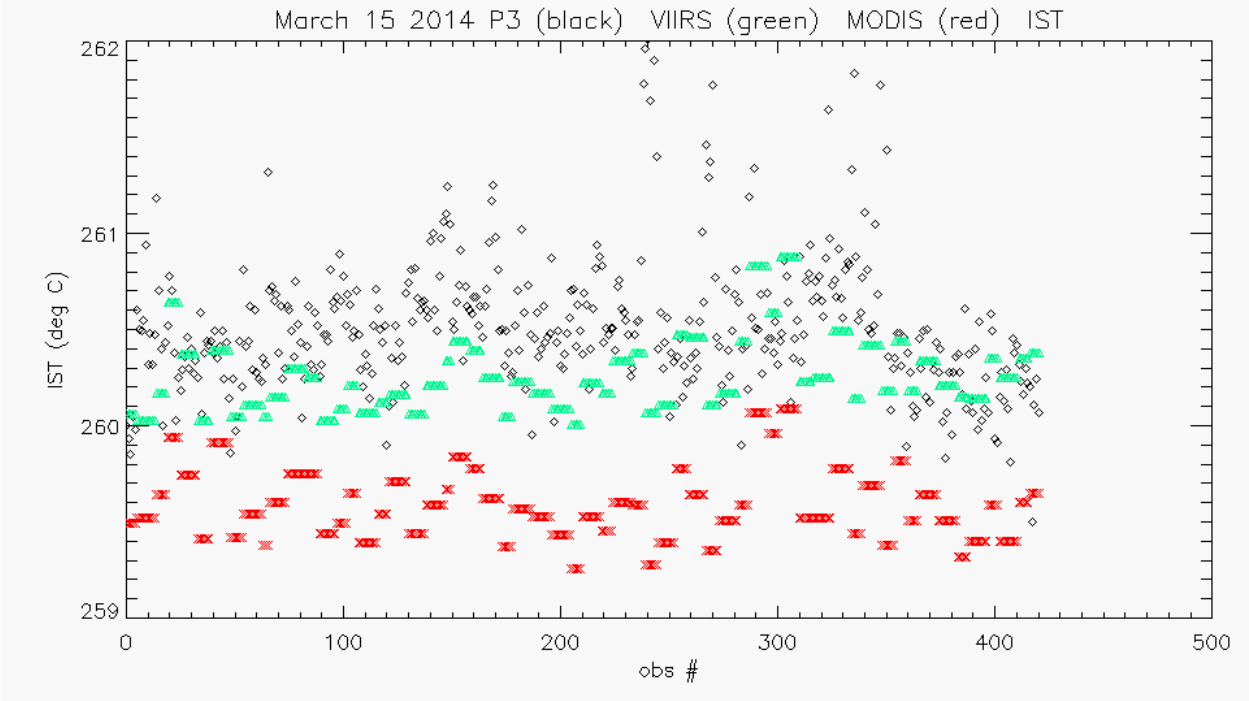

Figure 4. Validation of VIIRS IST. Valiation of VIIRS IST (green) with Operation IceBridge flight P3 K19 sensor data (black); P3 IST mean 260.523K, std dev 0.379906K; VIIRS IST mean 260.261K, std dev 0.192122K; MODIS IST (red) 259.593K std dev 0.186308K.

Coefficients obtained from *J. Key* and *Y. Liu* et al., (2015) are used in the NASA VIIRS IST algorithm. The coefficients are based on VIIRS-specific calculations they performed. Further analysis of NASA VIIRS IST evaluations will be done to ensure accuracy of the IST data.

3.4.1 Uncertainty Estimate

Because sea ice can vary in concentration from near zero to 100 percent in a 750 m pixel, the IST can vary within a scene, due to mixed-pixel effects. The presence of melt ponds and leads in the summer months will affect the emissivity of the surface and therefore the calculation of ice surface temperature.

The targeted uncertainty of the NASA VIIRS IST product is ±1K over a measurement range of 213-275K. Previous estimation of the IDPS VIIRS IST uncertainty with comparisons to the NASA MODIS IST Product approach this uncertainty overall, but show a greater uncertainty (2-3K) for warmer IST (>250K) [*Key et al*., 2013], with the VIIRS IST cooler than MODIS. Measurement uncertainty is defined as the root-mean-square of the measurement errors.

3.4.2 Land/water mask

In this version of the algorithm the land/water mask is extracted from the VNP35_L2 and use to mask land and inland water bodies from processing. When the NASA L1B products become available the algorithm will change to using the land/water mask in the NASA VIIRS geolocation product. That is the MODIS C6 land/water mask which was

derived from the UMD 250m MODIS Water Mask data product (UMD Global Land Cover Facility http://glcf.umd.edu/data/) [*Carroll et al*., 2009]. The UMD 250 m Water Mask was converted to a 500 m seven class land/water mask for use in the production of MODIS products in C6 to maintain continuity with the land/water mask used in C5. The new land/water mask more accurately provides the location of water bodies [http://landweb.nascom.nasa.gov/QA_WWW/forPage/MODIS_C6_Water_Mask_v3.pdf . Thus LSIPS adapted the MODIS land/water mask to create the VIIRS land/water mask in the geolocation product.

3.4.3 Geolocation accuracy

Geolocation accuracy in NASA VIIRS is very high, providing consistent high accuracy in mapping of the VIIRS data products [https://viirsland.gsfc.nasa.gov/Products/Geolocation.html]. The small errors in geolocation are negligible in the L2 products, however, geolocation error may be observed in the daily gridded products as a shifting of features, e.g., changes in the location of a shoreline in cells from day to day.

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4.0 Related Web Sites

Suomi-NPP
http://npp.gsfc.nasa.gov/suomi.html

VIIRS
VIIRS Land: http://viirsland.gsfc.nasa.gov/
MODIS Snow/Ice Global Mapping Project:
https://modis-snow-ice.gsfc.nasa.gov

Imagery and Data Product Viewing
Worldview: https://worldview.earthdata.nasa.gov
LANCE: https://wiki.earthdata.nasa.gov/display/GIBS/2015/12/10/VIIRS+is+Here
https://earthdata.nasa.gov

NSIDC Data Ordering & User Services
National Snow and Ice Data Center: http://nsidc.org/data/viirs

HDF5
The HDF Group: https://www.hdfgroup.org/HDF5/

NetCDF4
www.unidata.ucar.edu/software/netcdf/docs/index.html

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Appendix A

Listing of global attributes in VNP30

```
// global attributes:
                :identifier_product_doi_authority = "http://dx.doi.org" ;
                :InputPointer =
"VNP35_L2.A2015183.2112.001.2017170160345.hdf,NPP_VMAES_L1.A2015183.2112.001.201710221
2340.hdf" ;
                :WestBoundingCoord = -180.f ;
                :StartTime = "2012-01-26 07:25:00.000" ;
                :publisher_email = "modis-ops@lists.nasa.gov" ;
                :RangeBeginningTime = "07:25:00.000000" ;
                :ProcessingCenter = "MODAPS-NASA" ;
                :PGE_EndTime = "2012-01-26 07:30:00.000" ;
                :RangeEndingDate = "2012-01-26" ;
                :keywords_vocabulary = "NASA Global Change Master Directory (GCMD) Science
Keywords" ;
                :LSIPS_AlgorithmVersion = "NPP_PR30 2.2.3" ;
                :PGE_StartTime = "2012-01-26 07:25:00.000" ;
                :LongName = "VIIRS/NPP Ice Surface Temperature 6-Min L2 Swath 750m" ;
                :AlgorithmType = "OPS" ;
                :LocalGranuleID = "VNP30.A2015183.2112.001.2017170192325.nc" ;
                :Conventions = "CF-1.6" ;
                :ShortName = "VNP30" ;
                :stdname_vocabulary = "NetCDF Climate and Forecast (CF) Metadata Convention" ;
                :DayNightFlag = "Day" ;
                :title = "VIIRS Ice Surface Temperature" ;
                :PGE_Name = "PGE505" ;
                :ProcessingEnvironment = "Linux npp1 3.10.0-514.10.2.el7.x86_64 #1 SMP Fri Mar 3
00:04:05 UTC 2017 x86_64 x86_64 x86_64 GNU/Linux" ;
                :naming_authority = "gov.nasa.gsfc.VIIRSland" ;
                :publisher_name = "LAADS" ;
                :creator_email = "modis-ops@lists.nasa.gov" ;
                :RangeEndingTime = "07:30:00.000000" ;
                :project = "VIIRS Land SIPS Ice Surface Temperature Project" ;
                :publisher_url = "http://ladsweb.nascom.nasa.gov" ;
                :creator_name = "VIIRS Land SIPS Processing Group" ;
                :EndTime = "2012-01-26 07:30:00.000" ;
                :GRingLatitude = 70.6383, 60.6274, 67.3207, 84.2676 ;
                :ProductionTime = "2017-06-19 19:23:25.000" ;
                :identifier_product_doi = "10.5067/VIIRS/VNP30.001" ;
                :license = "http://science.nasa.gov/earth-science/earth-science-data/data-information-
policy/" ;
                :PGEVersion = "P1.1.1" ;
                :creator_url = "http://ladsweb.nascom.nasa.gov" ;
                :institution = "NASA Goddard Space Flight Center" ;
                :SouthBoundingCoord = 60.6274f ;
                :VersionID = "001" ;
                :SatelliteInstrument = "NPP_OPS" ;
                :RangeBeginningDate = "2012-01-26" ;
                :GRingLongitude = -98.2296, -165.582, 146.95, -4.30614 ;
                :processing_level = "Level 2" ;
                :cdm_data_type = "swath" ;
                :EastBoundingCoord = 180.f ;
                :NorthBoundingCoord = 90.f ;
```