



MEMORANDUM FOR: The Record
FROM: Jeff Key, JPSS Cryosphere Team Lead
SUBJECT: Ice Surface Temperature EDR Validated maturity status and public release
DATE: 12/15/2016

Validated maturity status declaration for VIIRS Ice Surface Temperature

Maturity Review Date: 01/08/2014
Effective Date: 10/15/2012
Operational System: IDPS MX6.4

The JPSS Algorithm Maturity Readiness Review Board approved the release of the VIIRS Ice Surface Temperature EDR to the public with a Validated maturity level quality as of 10/15/2012, based on JPSS Validation Maturity Review held on 01/08/2014.

The Validated Maturity stage definition is:

- Product performance is well defined over a range of representative conditions.
- The product is ready for use by the Centrals and in scientific publications.
- There may be later improved versions.
- There are three validation stages. This product was reviewed for Stage 1 Validation, which is defined as: The product performance has been demonstrated to comply with the specification using a small number of independent measurements obtained from selected locations, periods, and associated ground-truth/field program efforts.

The Suomi National Polar-orbiting Partnership (S-NPP) Spacecraft with the Visible Infrared Imaging Radiometer Suite (VIIRS) was successfully launched on October 28, 2011. VIIRS succeeds the NOAA Advanced Very High Resolution Radiometer (AVHRR) and NASA Moderate Resolution Imaging Spectroradiometer (MODIS). With 22 spectral bands covering wavelengths from 0.41 to 12.5 μm , VIIRS provides operational information on the land surface, atmosphere and ocean for weather, climate and other environmental applications. The VIIRS product list includes 22 Environmental Data Records (EDR) along with calibrated and geo-located Sensor Data Records (SDR). The VIIRS Ice Surface Temperature EDR is among a number of cryosphere products generated with VIIRS data.

The VIIRS IST EDR provides surface temperatures over sea ice retrieved at VIIRS moderate resolution, for snow/ice covered oceans, and for both day and night. The ice surface temperature over glacial ice is provided by the VIIRS Land Surface Temperature (LST) EDR. The baseline split window algorithm statistical regression method for the VIIRS IST uses two VIIRS Infrared bands, 10.76 μm (M15) and 12.01 μm (M16) for both day and night and is based on the Advanced Very High Resolution Radiometer (AVHRR) heritage IST algorithm (Yu et al., 1995). IST EDR performance is dependent upon on the quality of the input SDR brightness temperatures, VIIRS Cloud Mask IP cloud confidence, Ice Concentration IP, Aerosol Optical Thickness IP, and regression coefficients derived from matchups between the VIIRS M15 and M16 top-of-atmosphere (TOA) brightness temperatures and surface temperature sources for snow/ice covered ocean surfaces. The MODIS IST product serves as operational heritage for the VIIRS Ice Surface Temperature EDR, although the MODIS algorithm is differs in some respects.

This data product is represented by Collection Short Name (CSN) VIIRS-IST-EDR. There have been no changes since the Beta maturity stage. Product requirements include a measurement uncertainty of 1.0K within a measurement range is 213-275K. The product is clear-sky with a horizontal coverage limited to ice-covered oceans.

The quality of the VIIRS Ice Surface Temperature EDR EDR has been evaluated since the start of product generation in January 2012. We have compared the results of the VIIRS IST to IST derived from MODIS onboard the Terra and Aqua satellites, to NCEP near-surface air temperature, and to ice surface temperature measured from aircraft. Visual analysis of VIIRS false color imagery at a full pixel resolution was also used to qualitatively evaluate the VIIRS IST EDR accuracy (to determine if sea ice exists where IST is defined) and to identify its possible failures. Qualitative analysis of ice surface temperature generated with VIIRS was performed globally, whereas more detailed quantitative evaluation of the product accuracy was conducted over the Northern and Southern Hemispheres as well as for individual granules.

Our preliminary analysis has shown that the VIIRS Ice Surface Temperature EDR accurately prescribes ice surface temperature. However, an examination of the VIIRS IST EDR shows temperatures over false ice retrieved by the Sea Ice Concentration intermediate product (IP). Such errors may be reduced with the MX 8.0 VIIRS Cloud Mask update.

Based on our evaluation, the VIIRS Ice Surface Temperature EDR meets all criteria for the Validated Stage 1 maturity level. No code changes are currently planned for the algorithm.

The Board recommends that users be informed of the following product information and characteristics when evaluating the Ice Surface Temperature EDR:

- The Ice Surface Temperature EDR has been generated since January 2012, however the time series of the derived product are not consistent. Inconsistency occurred due to several modifications that have been introduced to the cloud detection algorithm and hence to the cloud mask during the time period from January 2012 to April 2013.
- Performance of VIIRS Cloud Mask (VCM) remained non-uniform and suboptimal during the monitoring period. This adversely affected the accuracy of the Ice Surface Temperature EDR causing ice surface temperatures to appear where no ice is present. Fixes to the VCM are currently underway and will be reflected in future versions of the IST EDR.
- The conclusion on the realistic representation of ice surface temperature by the VIIRS Ice Surface Temperature EDR and on its accuracy has been made based on the analysis of the product during the time period from January 2012 to July 2013.

Additional information is available in the VIIRS Ice Surface Temperature algorithm theoretical basis document (ATBD) and validation maturity review briefing, which can be accessed at:

<http://www.star.nesdis.noaa.gov/jpss/Docs.php>

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