

GOES-16 ABI L2+ Ice Age and Thickness (AITAF)

Full Data Quality

May 14, 2024

Read-Me for Data Users

GOES-R Advance Baseline Imager (ABI) L2+ products will achieve Full Validation maturity by default after two years of Provisional and Operational use with no major anomalies reported (minor product improvements may still be occurring). As a result, GOES-16 Ice Age and Thickness is considered Full Validation maturity as of January 21, 2023.

The ABI L2+ Ice Age and Thickness (AITAF) product includes sea and lake ice thickness and age categories for any pixel covered with ice. It includes associated data quality flags, mean, maximum, minimum, and standard deviation. Ice-free areas are distinguished from first-year ice and older ice areas.

The GOES-R ABI daytime and nighttime Ice Age and Thickness product is generated using other L2 ABI products, including the cloud mask, snow depth, ice surface temperature, and thermal and radiative fluxes. The algorithm will use parameterizations of some input variables if they are not otherwise available. The retrieval is available for each clear and ice-covered pixel.

The Ice Age and Thickness product requirements are:

- *Measurement range:* ice free, first-year ice, and older ice for ice age
- *Temporal coverage:* Day and night, ice-covered waters under clear sky conditions. Solar Zenith Angle less than 67 degrees for daytime
- *Refresh:* 3 hours
- *Spatial coverage:* Full Disk (FD). Retrievals to 67-degree local zenith angle (LZA)
- *Spatial resolution:* 3 km
- *Quality:* 80% correct classification

While not a requirement, the product includes ice thickness. The required ice age categories – ice free, first-year ice, and older ice – are based on ice thickness. The product also contains a more extensive set of ice age categories: new, grey, grey-white, first-year thin, first-year medium, first-year thick, and older ice.

A full description and format of the ice age and thickness product can be found in the Product Definition and User's Guide (PUG) Volume 5: Level 2+ Products, located on OSPO's GOES-R documents webpage: <https://www.ospo.noaa.gov/Organization/Documents/goes-r.html>. The algorithm used to derive the ice age and thickness product from GOES-16 ABI observations is described in detail in the "Algorithm Theoretical Basis Document For Ice Thickness and Age from VIIRS, ABI, and METImage", located on STAR's GOES-R ATBD webpage: https://www.star.nesdis.noaa.gov/goesr/documentation_ATBDs.php.

Full maturity, by definition, means that:

- Validation, quality assurance, and anomaly resolution activities are ongoing.
- Incremental product improvements may still be occurring.
- Users are engaged and user feedback is assessed.
- Product performance for all products is defined and documented over a wide range of representative conditions via ongoing ground-truth and validation efforts.
- Products are operationally optimized, as necessary, considering mission parameters of cost, schedule, and technical competence as compared to user expectations.
- All known product anomalies are documented and shared with the user community.
- Product is operational.

Users bear all responsibility for inspecting the data prior to use and for the manner in which the data are utilized. Persons desiring to use the GOES-16 ABI Full maturity ice age and thickness product for any reason, including but not limited to scientific and technical investigations, are encouraged to consult the NOAA algorithm working group (AWG) scientists for feasibility of the planned applications. This product is sensitive to upstream processing, notably the cloud mask and ice surface temperature. Of the two, errors in the cloud mask have a greater impact on the ice products.

The status of the GOES-16 ice age and thickness product and any remaining known issues that are being resolved are:

1. Summary of the measured performance of the AITAF product as measured against reference data:
 - a. Accuracy specifications for FD and CONUS products are met in general based on inferred validation results with respect to retrievals from ice charts, aircraft field campaigns, and ice thickness products from other satellite instruments.
 - b. Precision specifications are also met in general based on inferred validation results with respect to retrievals from aircraft and other satellite-based instruments.
2. Missing ice or false ice are often due to errors in the cloud mask. Cloudy pixels that are incorrectly identified as clear generally result in errors in ice thickness, which may then cause errors in ice age. Though the overall impact is small, errors can be large on the local scale.
3. Any changes to ABI calibration or spectral response functions will not influence day or night AITAF retrievals directly, but may have an indirect impact through upstream products such as the cloud mask and ice surface temperature.

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