**MEMORANDUM FOR:** The Record
**FROM:** Walt Meier and Jeff Key
**SUBJECT:** GCOM-W1 AMSR2 sea ice product maturity status and public release
**DATE:** 05/10/2017

**Validated maturity status declaration for Sea Ice Concentration; Provisional maturity status declaration for Sea Ice Type**
**Maturity Review Date:** **04/20/2017**
**Effective Date:** **04/20/2017**
**Operational System:** **NDE 1.0.10**

The JPSS Algorithm Maturity Readiness Review Board approved the release of the Sea Ice product to the public with a Validated maturity level quality for sea ice concentration and a Provisional maturity level quality for sea ice type/age (multiyear ice concentration) as of 04/20/2017 (effective date), based on JPSS Validation Maturity Review held on 04/20/2017.

1. Validated maturity means:
   - Product performance has been demonstrated over a large and wide range of representative conditions (i.e., global, seasonal).
   - Comprehensive documentation of product performance exists that includes all known product anomalies and their recommended remediation strategies for a full range of retrieval conditions and severity level.
   - Product analyses are sufficient for full qualitative and quantitative determination of product fitness-for-purpose.
   - Product is ready for operational use based on documented validation findings and user feedback.
   - Product validation, quality assurance, and algorithm stewardship continue through the lifetime of the instrument.

   Provisional maturity means:
   - Product performance has been demonstrated through analysis of a large, but still limited (i.e., not necessarily globally or seasonally representative) number of independent measurements obtained from selected locations, time periods, or field campaign efforts.
   - Product analyses are sufficient for qualitative, and limited quantitative, determination of product fitness-for-purpose.
   - Documentation of product performance, testing involving product fixes, identified product performance anomalies, including recommended remediation strategies, exists.
   - Product is recommended for potential operational use (user decision) and in scientific publications after consulting product status documents.
2. Algorithm Description:
   Total sea ice concentration (SIC) is estimated using the NASA Team 2 (NT2) algorithm. It uses a combination of channels and a look-up table (LUT) of values for different atmospheric conditions.

The concentration solution is found iteratively by finding the LUT value that best matches (minimizes cost function) the observed retrievals. A secondary concentration is retrieved using the Bootstrap algorithm; this is an ancillary product to provide data quality information for the primary NT2 retrieval.

A multiyear ice (MYI) concentration estimate is also provided, based on an experimental algorithm developed by Ludovic Brucker (NASA Goddard). The product should be considered Provisional and users should use caution with the MYI product. It is not yet recommended for operational or research use. Several ancillary quality fields are included, as noted in the List of Products below.

Additional information is available in the Sea Ice algorithm theoretical basis document (ATBD) and validation maturity review briefing, which can be accessed at:
http://www.star.nesdis.noaa.gov/jpss/Docs.php

*List of Products:*

| EDR Output | Description | Dynamic Range |
|---|---|---|
| NT2 SIC | Primary sea ice concentration estimate | 0 – 100 % |
| BT SIC | Secondary sea ice concentration estimate (no QC) | 0 – 100 % |
| NT2-BT SIC | Difference between NT2 and BT concentrations | -100 – +100 % |
| SIC Range | Range of NT2 concentration over 24 hours (max – min concentration) | 0 – 100 % |
| Age of observation | Age of observation on which concentration is based | 0 – 1440 minutes |
| MYIC | Multi-year sea ice concentration (provisional) | 0 – 100 % |

*Product requirements/Exclusions (L1RDS):*

| EDR Attribute | Threshold | Objective |
|---|---|---|
| Applicable conditions | Delivered under "all weather" conditions | Delivered under "all weather“ conditions |
| Horizontal cell size | 10 km | 5 km |
| Mapping uncertainty, 3 sigma | 5 km | 3 km |

| | | |
|---|---|---|
| Measurement range | 0 – 100 % | 0 – 100 % |
| Measurement uncertainty | 70% probability of correct typing of ice age class | 90 % |
| Refresh | At least 90% coverage of the globe about every 20 hours (monthly average) | Not Specified |

*Quality flags (bitwise):*

| Flag Value | Description |
|---|---|
| 4 | Ocean SST mask applied |
| 8 | Ice removed by weather filter (threshold exceeded) |
| 16 | Land-spillover corrected (coastal ice removed) |
| 32 | Spatially interpolated (missing grid cells bi-linearly interpolated) |
| 64 | Missing (no valid TBs found) |
| 128 | Land |

*Product evaluation/validation:*
Total sea ice concentration has been evaluated with VIIRS sea ice concentration. Accuracy is generally within 5% and Precision within 10%, which meets the threshold criteria. Higher errors are found near the ice edge and during the summer melt season. Statistics for several days in 2015 are provided in the table below.

The MYI concentration is still undergoing validation and detailed error statistics are not yet available.

*Product availability/reliability:*
EDR data were produced since 03/01/2017.

*Known errors/issues/limitations*:
Total concentration errors are higher near the ice edge due to the dynamic nature of the ice near the ice (growth/melt/advection) and limitations in the algorithm in detecting thin and melting ice. During summer, surface melt water results in the concentration retrievals being biased low. During summer there is also more atmospheric emission, which may result in errors.

Multiyear concentration is retrievable only in the Arctic during winter (~November to April) because surface melt water obscures the multiyear signature.

3. Changes since last maturity stage

None. This is the first maturity stage evaluation.

4. Review board recommendations – as stated above.

5. Path Forward/Future Plan

The main focus over the next several months will be further validation of the multiyear ice product, including statistical comparisons with other multiyear data. The results will be submitted in a manuscript to a peer-reviewed journal.

6. Additional Items to note: None

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