

MEMORANDUM FOR: The JPSS Program Record
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SUBJECT: GOSAT-GW AMSR3 Snowfall Rate Product Provisional maturity status and public release
DATE: TBD

Provisional maturity status declaration for GOSAT-GW AMSR3 Snowfall Rate

Maturity Review Date: 08/03/2026
Effective Date: TBD
Operational System: Snowfall Rate, Version 4.0

The JPSS Algorithm Maturity Readiness Review Board approved the release of the GOSAT-GW AMSR3 Snowfall Rate to the public with a Provisional maturity level quality as of TBD (effective date), based on JPSS Provisional Maturity Review held on 08/03/2026 Materials sent on 07/31/2026 ([link to review artifacts](#)).

1. **Maturity stage definition** (reference to the AMM webpage for maturity definition: <http://www.star.nesdis.noaa.gov/jpss/AlgorithmMaturity.php>)

Provisional maturity stage definition:

- 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 select locations, periods, and associated ground truth or field campaign efforts.
- Product analysis is sufficient to communicate product performance to users relative to expectations (Performance Baseline).
- Documentation of product performance exists that includes recommended remediation strategies for all anomalies and weaknesses. Any algorithm changes associated with severe anomalies have been documented, implemented, tested, and shared with the user community.
- Product is ready for operational use and for use in comprehensive cal/val activities and product optimization.

2. **Algorithm Description:**

The GOSAT-GW AMSR3 Snowfall Rate (SFR) product is a water equivalent snowfall rate derived from AMSR3 measurements at a set of window and water vapor sounding channels. The algorithm is composed of two independent components: a machine learning (ML) Snowfall Detection (SD) algorithm and a physically based SFR algorithm. The ML SD algorithm was trained using ground observations from NOAA ISD and GHCN database and ECMWF ERA5 reanalysis data. The SFR algorithm is based on a 1D variational (1D-Var) model that retrieves cloud properties from AMSR3 measurements. SFR is derived from the retrieved cloud properties and calculated ice

particle terminal velocity. The SFR product is a two-dimensional array with the same field-of-view size as the AMSR3 water vapor sounding channels at 183.31GHz, i.e. 5km. The Provisional level AMSR3 SFR algorithm was developed using a hybrid dataset that consists of both AMSR3 observations and proxy GPM GMI observations.

List of Products (Collection Short Name (CSN))

GOSAT-GW AMSR3 Snowfall Rate (SFR)

Product requirements/Exclusions (DPS)

The SFR requirements are documented in the [Joint Polar Satellite System \(JPSS\) Ground Segment Data Product Specification \(GSegDPS\)](#). Specifically, there are two product requirements:

DPS-1756: The algorithm shall produce a SFR product that has a measurement precision of: 1.0 mm/hr.

DPS-1757: The algorithm shall produce a SFR product that has a measurement accuracy of: ± 0.3 mm/hr.

The GOSAT-GW AMSR3 SFR product meets all the DPS requirements.

Quality flags (Table)

There is one quality flag (32 bit) in the SFR file that specifies two quality variables:

Quality Flag Bit	Meaning	Value
0	1DVAR convergence	0: Convergent 1: Non convergent
1	SFR threshold	0: SFR above threshold, value unchanged 1: SFR below threshold, set to 0

Product evaluation/validation

The Provisional GOSAT-GW AMSR3 SFR algorithms to generate the SFR product was developed using a hybrid dataset that consists of both AMSR3 observations and proxy GPM GMI observations. 8 months of AMSR3 observations were collocated with ground reference dataset including NOAA GHCN ground observation, NCEP Stage IV radar and gauge combined hourly precipitation analyses and ECMWF ERA5 total snowfall rate product. The hybrid training dataset was carefully designed to ensure at least 50% of the training data is from the AMSR3 observations, so that the trained snowfall detection (SD) and SFR algorithms capture the characteristics of the real AMSR3 observation. The rest of the training dataset came from multi-year GPM GMI proxy data to provide enough information on climatology and seasonal variation, as the 8-month AMSR3 observation is insufficient to provide such information in the training dataset. The SD and SFR algorithms were first validated using an independent testing dataset generated from the hybrid database. The SD algorithm was validated against ground observations from NOAA ISD and GHCN database over land, and against ECMWF ERA5 precipitation type products over ocean. The SFR algorithm was validated using the NCEP Stage IV radar and gauge combined hourly precipitation analyses and ECMWF ERA5 snowfall rate product. The validation results show good agreement between GOSAT-GW AMSR3 SFR and the validation dataset with the performance statistics meeting the DPS requirements. The Provisional SFR algorithm was also validated using 1-month AMSR3 observations in April 2026 which is outside the time frame of our hybrid training

database to better validate the algorithms when applied to future data. The validation was performed against NCEP Stage IV radar and gauge combined hourly precipitation analyses, ECMWF ERA5 total snowfall rate product and the validated matured operational GPM GMI SFR product. This validation also shows good agreement between AMSR3 SFR and reference datasets. The Beta version of the AMSR3 SFR algorithm was developed before launch using GPM GMI proxy data. The algorithm showed degraded performance in the polar regions (latitudes $> 69.3^{\circ}$ N/S) because of the limited spatial coverage of GMI data. The Provisional AMSR3 SFR algorithm improved performance in the polar regions and completely removed the artifacts in Antarctica that were present in the Beta version.

Product availability/reliability

The Beta maturity AMSR3 SFR is currently in the Integration and Testing stage. After reaching Provisional maturity, the updated algorithm is scheduled for delivery to OCS as part of the SFR v4.0 package in August 2026. The AMSR3 SFR data will become available in CLASS once SFR v4.0 becomes operational in NESDIS NCCF.

Algorithm performance dependence

The performance of the GOSAT-GW AMSR3 SFR product depends on the quality of the GOSAT-GW AMSR3 L1 data and the NOAA GFS model forecasts.

Known errors/issues/limitations

The Provisional GOSAT-GW AMSR3 SFR algorithm is applicable globally, however, validation shows performance degradation in snowfall detection under cold conditions ($T_{2m} < -15^{\circ}\text{C}$). The algorithm may miss some snowfall under such conditions. Additional AMSR3 training data is expected to enhance SFR performance in the future.

3. Changes since last maturity stage

- Collocated 8 months AMSR3 observations with “ground truth” references data to create hybrid training dataset for snowfall detection and SFR algorithms.
- Trained AMSR3 Snowfall Detection ML XGB model over land and ocean using the hybrid training dataset.
- Trained AMSR3 1DVAR initialization ML NN model and SFR bias correction ML NN model using the hybrid training dataset.
- Updated AMSR3 coefficient files
- Updated AMSR3 data reader for remapped L1R data.

4. Review board recommendations

TBD

5. Path Forward/Future Plan

- 1) Collecting more AMSR3 observations to create comprehensive training dataset that reflects global seasonal variations.
- 2) Update machine learning (ML) snowfall detection model with new dataset.
- 3) Update ice water path ML initialization model with new dataset.



Read-me for Data Users

- 4) Update ML SFR bias correction model with new dataset
- 5) Conduct cal/val and reach validated maturity.

6. Additional Items to note

Additional information on the SFR algorithm is available in the Snowfall Rate (SFR) 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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