

MIRS Delivery Memorandum Version 11.9

Date of Release:

August 12th 2022

Purpose of Delivery:

This delivery constitutes the official MIRS delivery algorithm package (DAP11.9) to NOAA/NESDIS/OSPO and STAR ASSISTT from NOAA/NESDIS/STAR.

Brief Description of the Package:

This MIRS package contains all source codes, scripts, makefiles, data, coefficients, etc. needed to run the MIRS package for the following operational satellites: NOAA-18, NOAA-19, METOP-A, METOP-B, METOP-C, DMSP-F17, DMSP-F18, S-NPP, GPM, NOAA-20, JPSS-2 (final pre-launch version), and Metop-SG-A1 (preliminary). Note that the variational retrieval is sensor-independent and could be run for any other microwave sensor. The same observation applies to the forward operator and other sensor-independent applications. The testing was performed under a Linux environment using both ifort and gfortran Fortran compilers.

The package also contains more limited (research) capability to process the following satellites/sensors: TRMM/TMI, GCOM-W1/AMSR2, and AQUA/AMSR-E. **However, the retrieval products from these sensors have not been subjected to extensive validation, are not officially operational, and should be used for research purposes only. Please contact the MiRS team with any questions concerning the processing of these data, or before presenting any results to the community.**

List of Delivery Contents:

- (1) Source codes, (2) Scripts, (3) Configuration files, (4) Makefiles, (5) Coefficients, (6) Sample data, (7) Documentation, (8) Version 2.1.1 of the CRTM forward model package, (9) Benchmark files for verification, (10) GUI-based tool to control MIRS execution, (11) A complete *readme* file

Version Number

The MiRS algorithm version and serial number of this delivery are contained in the name of the DAP tar file.

Officially Delivered Products

MiRS produces all core and derived products by design. However, depending on the information content of the particular sensor measurements, only certain retrieved products, resulting from either the core retrieval or the post-processing algorithm, may be of operational quality. The officially delivered products with this delivery are the following:

For Suomi-NPP, NOAA-18, NOAA-19, METOP-A, METOP-B, METOP-C, NOAA-20**, JPSS-2 (NOAA-21), METOP-SG-A1:

- Temperature profile over open water ocean
- Humidity profile over open water ocean
- Humidity Profile over non-coastal Land
- Total Precipitable Water (TPW) over open water ocean
- Total Precipitable Water over non-coastal land
- Land surface temperature
- Surface Emissivity over land and snow
- Surface Type Classification
- Snow Water Equivalent (SWE)
- Sea Ice Concentration (SIC)
- Snow Cover Extent (SCE), based on the SWE

- Vertically-Integrated Non-precipitating Cloud Liquid Water (CLW) over open water ocean
- Vertically-Integrated Ice Water Path (IWP)
- Vertically-Integrated Rain Water Path (RWP)
- Rainfall Rate (RR) over open water ocean and non-coastal, non-snow-covered land surface types
- Effective grain size of snow (over snow-covered land surface)*
- Multi-Year (MY) Type Sea Ice Concentration*
- First-Year (FY) Type Sea Ice Concentration*
- Snow fall rate (SFR)***

*Note that FY and MY Sea Ice Concentration, as well as Snow Grain Size are not officially operational, but preliminary products, which is a higher maturity level than experimental status.

**Note that all retrieval products from NOAA-20 are at full validated maturity level.

***Note that snowfall rate is not produced for NOAA-18 and Metop-SG-A1.

The following products are also produced experimentally for NOAA-18, NOAA-19, Metop-A, Metop-B, Metop-C, Suomi-NPP, and NOAA-20. Note that they lack a thorough validation due to the absence of reliable ground truth measurements. These are made available to users for the purpose of evaluating their usefulness.

- Cloud Liquid Water Profile (CLWP) over ocean.
- Surface Temperature (skin) extended to snow-covered land surface type
- Surface Temperature (skin) extended to open ocean water

For DMSP-F17 and DMSP-F18:

- Temperature profile over open water ocean
- Humidity profile over open water ocean
- Total Precipitable Water (TPW) over open water ocean
- Total Precipitable Water over non-coastal land
- Land surface temperature
- Surface Emissivity over land and snow
- Surface Type Classification
- Snow Water Equivalent (SWE)
- Sea Ice Concentration (SIC)
- Snow Cover Extent (SCE), based on the SWE
- Vertically-Integrated Non-precipitating Cloud Liquid Water (CLW) over open water ocean
- Vertically-Integrated Ice Water Path (IWP)
- Vertically-Integrated Rain Water Path (RWP)
- Rainfall Rate (RR) over open water ocean and non-coastal, non-snow-covered land surface types
- Effective grain size of snow (over snow-covered land surface)*
- Multi-Year (MY) Type Sea Ice Concentration*
- First-Year (FY) Type Sea Ice Concentration*

*Note that FY and MY Sea Ice Concentration, as well as Snow Grain Size are not officially operational, but preliminary products, which is a higher maturity level than experimental status.

The following products are also produced experimentally for SSMI/S. These are made available to users for the purpose of evaluating their usefulness.

- Cloud Liquid Water Profile (CLWP) over ocean

For GPM:

- Total Precipitable Water (TPW) over open water ocean
- Total Precipitable Water over non-coastal land
- Surface Type Classification
- Snow Water Equivalent (SWE)
- Snow Cover Extent (SCE), based on the SWE
- Vertically-Integrated Non-precipitating Cloud Liquid Water (CLW) over open water ocean
- Vertically-Integrated Ice Water Path (IWP)
- Vertically-Integrated Rain Water Path (RWP)

- Rainfall Rate (RR) over open water ocean and non-coastal, non-snow-covered land surface types

For Megha-Tropics/SAPHIR:

- Humidity profile over open water ocean
- Humidity Profile over non-coastal Land
- Total Precipitable Water (TPW) over open water ocean
- Total Precipitable Water over non-coastal land
- Rainfall Rate (RR) over open water ocean and non-coastal, non-snow-covered land surface types. Please note that RR should be considered as a reduced-quality product relative to RR derived from conventional imager/sounder instruments. Known limitations include low or poor detection of rain from liquid water hydrometeors, and possible saturation (loss of sensitivity) for higher rain rates greater than approximately 10 mm/h.

Summary of Changes Made since Last Delivery:

The list below is an overview of all technical, scientific and other changes made to MIRS since the last official delivery (DAP11.8) which occurred in July 2021.

Scientific changes:

- Updates to the snowfall rate (SFR) algorithm software including (1) Extreme Gradient Boosting (XGB) machine learning Snowfall Detection algorithms for JPSS-2/NOAA-21, NOAA-20, S-NPP, NOAA-19, Metop-C and Metop-B, (2) updated Neural Network machine learning Ice Water Path initialization and SFR bias correction for JPSS-2/NOAA-21, NOAA-20, S-NPP, NOAA-19, Metop-C and Metop-B, (3) new SFR low limit set at 0.05 mm/h and high limit at 6 mm/h, and (4) Metop-A processing removed.
- Implementation of a new and up to date higher-resolution (0.05 degree lat/lon) land/water surface type database derived from global VIIRS data. The surface type at each satellite observation location also accounts for the satellite field of view (FOV) size. This replaces the previous and out of date 1/6th degree resolution database.

Technical changes:

- None.

Technical note:

- When compiling the SFR algorithm using gfortran v4.8.5, the resulting executable may produce minor differences in retrieved SFR between multiple runs with same input data. This is not seen when other compiler versions are used.

MIRS Design & Development Team

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MIRS Oversight Board

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Point of Contact:

Feedback, comments, criticisms, and suggestions, are welcome and should be sent to:

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