**Algorithm Inventory – Microwave Integrated Retrieval System**

**Updated 22 June 2011**

## 1. Description/Theory

The Microwave Integrated Retrieval System (MiRS) is a physical retrieval algorithm developed and run operationally at NOAA/NESDIS. The algorithm is based on a 1D-variational approach where temperature, water vapor, and hydrometeor profiles, surface emissivity and surface rainfall rate are retrieved simultaneously. The rainfall rate itself is derived from its relationship with the retrieved hydrometeors, including cloud liquid water, rain water path, and ice water path. MiRS is currently applicable to NOAA-18, NOAA-19 and Metop-A AMSU/MHS, as well as DMSP F-16 and F-18 SSMI/S measurements.

## 2. Strengths and Weaknesses

### Strengths:

- Applicable over all surface types and in all weather conditions.
- Good characterization of surface emissivity as it is part of the retrieved state vector.
- Core algorithm is sensor-independent and is applied to all supported microwave sensors.

### Weaknesses:

- Cold season (stratiform/warm rain) rain detection

## 3. Algorithm Inputs

### A. Satellite Data

#### 1. Geostationary - None

#### 2. Low Earth Orbit

A. NOAA-18 AMSU-A/MHS TDR
B. NOAA-19 AMSU-A/MHS TDR
C. Metop-A AMSU-A/MHS TDR
D. F-16 SSMI/S TDR
E. F-18 SSMI/S TDR

*Note: The algorithm uses all available channels of good quality. Noisy or failed channels are deweighted or not used. Latency for all products is approximately 2-3 hours.*

**B. Ancillary Data**

**1. Model Data - None**

**2. Other (i.e. topography data base)**

A. Static Land/Sea database used for preliminary surface type classification

**4. Processing (i.e. Level 2 processing ingests Level 1 products as input)**

**A. Product Development Level 1 - None**

**B. Product Development Level 2**

1. Input satellite TDR data.
2. Determine processing spatial resolution and match footprints (e.g. AMSU-A with MHS).
3. Classify surface as sea, sea-ice, land, snow-covered land and apply bias correction to measurements.
4. Apply 1DVAR algorithm to invert brightness temperatures into geophysical parameters.
5. Use integrated cloud, rain and ice to determine surface rainfall rate.

**5. Output Products**

**A. Final Product – Imaging Products**

Total Precipitable Water
Land Surface Temperature
Land Surface Emissivity
Cloud Liquid Water
Sea-ice Concentration
Snow Water Equivalent
Snow Cover
Ice Water Path
Rain Water Path
Surface Rainfall Rate

1. Temporal/Spatial Resolution

Currently available in AMSU-A resolution and UAS resolution for SSMI/S-based products

2. Spatial Coverage
   Global

3. Dedicated Product Web Page Location
   http://www.osdpd.noaa.gov/ml/mirs/index.html (operational)
   http://mirs.nesdis.noaa.gov (experimental)

4. Processing Specifics (if possible)
   A. Latency (2-3 hours)

5. Operational Availability of Product (if possible)
   A. Source
      NOAA CLASS – http://www.class.noaa.gov
   B. Latency
      2-3 hours
   C. Update Frequency
      N/A
   D. Available Record Length (usually a rotating archive)
      NOAA-18: August 28, 2007-Current
      Metop-A: August 28, 2007-Current
      DMSP F16: October 27, 2008-Current
      NOAA-19: June 1, 2009-Current
      DMSP F18: Currently not available operationally

6. Historical Availability of Product
   N/A

**B. Final Product – Sounding Products**

Temperature Profile
Water Vapor Profile

1. Temporal/Spatial Resolution
   Currently available in AMSU-A resolution and UAS resolution for SSMI/S-based products

2. Spatial Coverage
   Global

3. Dedicated Product Web Page Location
   http://www.osdpd.noaa.gov/ml/mirs/index.html (operational)
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4. Processing Specifics (if possible)
   A. Latency (2-3 hours)

5. Operational Availability of Product (if possible)
   A. Source
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6. Historical Availability of Product
   N/A

6. Planned Modifications/Improvements

7. Capability of Producing Retrospective Data

MiRS software package (DAP) is available for download from: http://mirs.nesdis.noaa.gov/downloaddap.php

Users must sign and submit a license agreement (free of charge) to obtain access to the MiRS software.

8. Contact Personnel

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9. Additional Comments

Rainfall Rate validation is available from the IPWG website over U.S., South America, Australia, and Japan. http://cawcr.gov.au/projects/SatRainVal/validation-intercomparison.html

Direct links an more rainfall assessment (comparisons to NCEP Stage IV and CPC rain gauge) may be found at: http://mirs.nesdis.noaa.gov/validation.php (username/password required).