Operational Implementation of Microwave Integrated Retrieval System

Introduction

The MIRS is a state-of-the-art retrieval system developed to support POES, MetOp, DMSP, NPP/NPOESS programs at NESDIS in generating operational temperature, water vapor and hydrological parameters from microwave sensors. It is based on an assimilation-type scheme and capable of optimally retrieving atmospheric and surface state parameters in all weather and over all-surface conditions. The MIRS is being implemented into operation at NESDIS to upgrade the current operational surface and precipitation products from Microwave Surface and Precipitation Products System (MSPPS) and build a one-stop shop for operational microwave products from various satellites with different instrumental configurations.

With the capability of providing optimal and physically-based retrievals of atmospheric and surface state parameters, the operational MIRS aims to produce advanced near-real-time surface and precipitation products in all weather and over all-surface conditions using brightness temperatures from the microwave instruments, which include AMSU-A and AMSU-B, MHS instruments on board of NOAA and EUMETSAT polar orbiting satellites, SSMIS on DMSP polar satellites and ATMS on NPP/NPOESS. Currently, the following products from NOAA-18 and MetOp-A are made operationally available: temperature profiles over ocean, moisture profiles over ocean and non-coastal land, total precipitable water over ocean and non-coastal land, cloud liquid water over ocean, snow cover, sea ice concentration, snow-water equivalent, surface emissivity over land and snow from all AMSU-A and MHS channels.

Operational MIRS Products and Their Dissemination

- The current operational MIRS products include: temperature profiles over ocean, moisture profiles over ocean and non-coastal land, total precipitable water over ocean and non-coastal land, cloud liquid water over ocean, snow cover, sea ice concentration, snow-water equivalent and snow water equivalent. Image examples are shown below.
- The near real-time MIRS products are available through NESDIS/OISPD, and user requests should be addressed to Limin Zhao1, Aiwu Li2 and Jiang Zhao2.
- Historical MIRS data files can be queried from NOAA/CLASS/NCDC: http://www.class.ngdc.noaa.gov/saa/products/welcome.

Validation and QC Monitoring

While the QC monitoring on the product generation, timeliness and dissemination is being performed in real-time mode on a 24/7 base at NESDIS/OISPD, the validation of product quality currently is heavily relied on research scientists at NESDIS/STAR who are continuously check out and improve the quality of products on a day-to-day basis. Intensive validations are being performed to compare the MIRS products with those from ROAB, GDAS, MSPPS, ECMWF and COSMIC and results can be accessed through the MIRS web site. The following images show a general performance of MIRS products when compared with GDAS, ROAB and NESDIS MIRS operational Interactive Multi-sensor Snow and Ice Analysis (IMS).

Potential Use of Global MIRS TPW on Precipitation Analysis

TPW is used by forecasters for locating high concentrations of low level moisture, so-called TPW plume or atmospheric river, which is one of the most recognizable satellite signatures of potential heavy rainfall and subsequent flooding. Shown right are the current NESDIS experiment blended TPW products that merge AMSU, SSM/I and GPS products into an unified resource to provide forecasters non-gap TPW coverage over oceans and CONUS and have been approved to be a very helpful tool for forecasters to identify conditions that could result in heavy precipitation and subsequent flooding.

The TPW over land from the MIRS would extend this capability into the global and adds a big addition to the exist capability and allow analysts to more effectively monitor surges of moisture from the ocean areas to land and better anticipate and forecast heavy rain and flooding events.

One of the important components of the operational MIRS is to generate value added MIRS products and make them available to satellite analysis and forecasters. Shown above are examples of the blended MIRS TPW from NOAA-A18 and MetOp-A with data accumulation of 6 hours, 12 hours, 18 hours and 24 hours. It’s shown that a global non-gap TPW map can be produced with 24 hours accumulation from two satellites, which is expected to enhance the TPW tools that have approved valuable on helping meteorologists understand the contributions of low level moisture for the development of weather hazards and contribute to improved forecasts and land times for hazardous weather events and enhance NOAA’s mission of protecting lives and property.

> CLASS ID for MIRS orbital products: MIRS ORB.
> Searchable by Temporal, Satellite, Data Type and Format.
> Products separated into SMD and IMG files with the following name convention: NPR>MIRS.V2.SMD.AMMH.*.Dyyddd.shhmm.llmhh.B*.he4
> NPR>MIRS.V2.IMG.AMMH.*.Dyyddd.shhmm.Emnhh.B*.he4