

AN OVERVIEW OF NOAA's GCOM-W1/AMSR-2 PRODUCT PROCESSING AND UTILIZATION

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1. INTRODUCTION

Operational weather analysis, forecasting, and warning utilize a wide variety of data products and tools, including satellite imagery and derived products. Satellite observations provide information where *in-situ* measurements are lacking or not readily available. Passive microwave satellite observations are routinely exploited by forecasters at the National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS) in the United States (U.S.) to support their weather analysis and forecasts. In this paper, we present examples of ocean measurements and derived products from Advanced Scanning Radiometer –2 (AMSR-2) on the Global Change Observation Mission (GCOM), which is part of the Japanese Aerospace Exploration Agency (JAXA) that supported critical forecasts.

The NOAA GCOM-W1 product development and validation project is providing NOAA's users access to critical geophysical products derived from AMSR-2. These products, detailed in NOAA's Joint Polar Satellite System (JPSS) Level 1 Requirements Document Supplement [1], include: calibrated microwave brightness

temperature (MBT), total precipitable water (TPW), cloud liquid water (CLW), rain rate (RR), sea surface temperature (SST), Sea Surface Wind Speed (SSW), soil moisture, snow cover and sea ice.

2. NOAA's GCOM-W Data Acquisition System

GCOM-W1 data is being captured at the KSAT Svalbard Ground Station and assembled into application process identifier (APID) packets. Using the JPSS NPOESS Preparatory Project (NPP) infrastructure, the GCOM raw data (APID packets) are routed in near-real time to NOAA Interface Data Processing System (IDPS).

Once received at the IDPS, the APID packets are reformatted into Raw Data Records (RDRs) and sent to the NPP Data Exploitation (NDE) system for distribution to the Environmental Satellite Data Processing System where further processing to brightness temperatures (Level-1 sensor data records [SDRs]) and geophysical products (Level-2 Environmental Data Records [EDRs]) are performed. The RDRs are processed to SDRs utilizing software provided by JAXA. Afterwards, the operational EDRs are generated utilizing NOAA's GCOM-W1 AMSR-2 Algorithm Software Processor (GAASP).

3. NOAA Ocean EDR Products

NOAA near-real time AMSR-2 Ocean EDR processor produces five ocean EDRs: Total Precipitable Water (TPW), Cloud Liquid Water (CLW), Rain Rate (RR), Sea Surface Temperature (SST) and Wind Speed (WS).

The inferred parameters were validated with other numerical model data, satellite products and in-situ measurements to show that they meet measurement performance requirements. An example of the, RR, TPW, SST and SSW product validations are plotted in Fig. 2-4 [4].

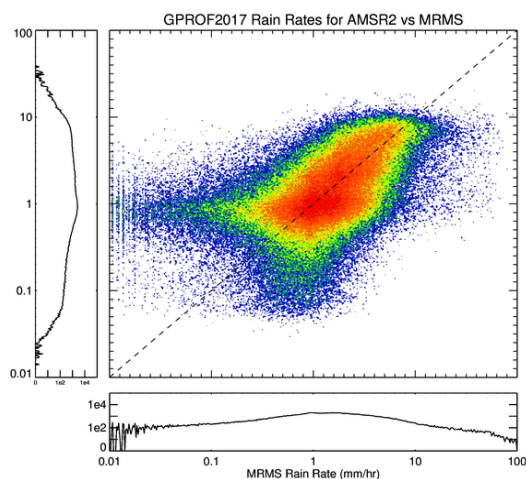


Fig 2 Scatter plot of the AMSR-2 rain rate vs MRSM rain rate; (bottom)

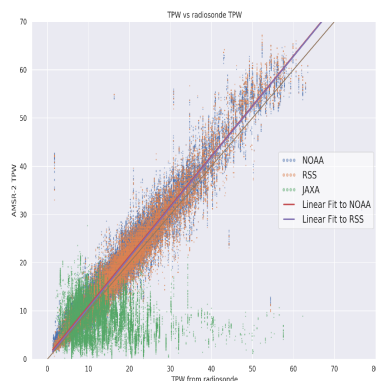


Fig 3 Example of TPW validation. Comparisons between NOAA, JAXA and RSS AMSR-2 TPW

products with radiosonde

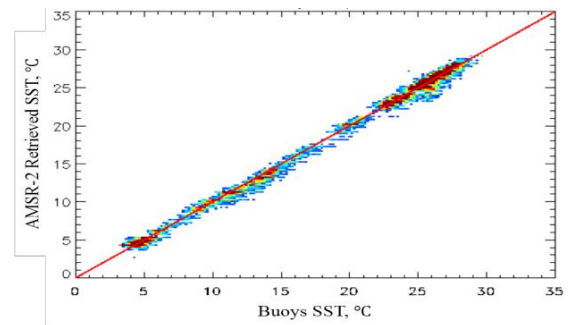


Fig 4. Comparison of NOAA AMSR-2 SST product with buoys

Additionally, a SST anomaly product and a percent normal TPW product have been developed and are being produced in near real-time.

4. Examples of AMSR-2 Ocean EDR's in Operational Applications

AMSR-2 data is utilized routinely to support various parts of NOAA's mission. Two examples shown below illustrate the utility of the percent normal TPW product and the SST anomaly product. In the first example, moisture associated with Hurricane Joaquin in 2015 brought extensive flooding into South Carolina. The NOAA blended TPW product, which included the AMSR2 TPW, suggested the 2 inch precipitable water (PWAT) was approximately 175 miles long. This plume is clearly indicated in the percent normal TPW AMSR2 product shown in fig 5. The second example illustrates the impact of SST on the intensity of Hurricane Maria in 2017. In fig 5a the AMSR2 SST anomaly product clearly depicts the cool wake of Hurricane Jose, which is also mentioned in the NHC discussion for Hurricane Maria. The corresponding AMSR2 wind speeds for

Hurricane Maria are shown in fig 5b and show a decrease of intensity over two days as cooler SSTs were encountered.

South Carolina Flooding Event October 3rd, 2015

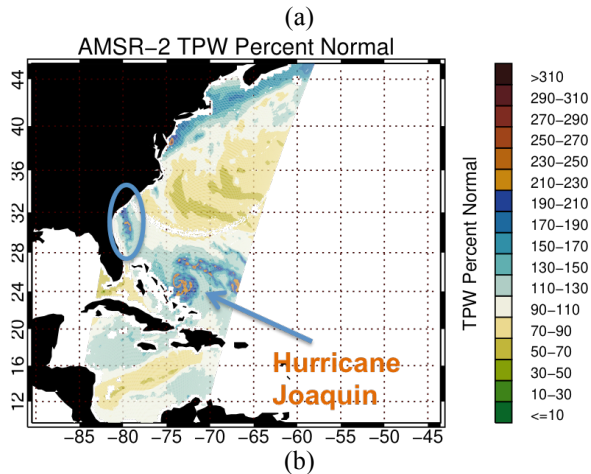
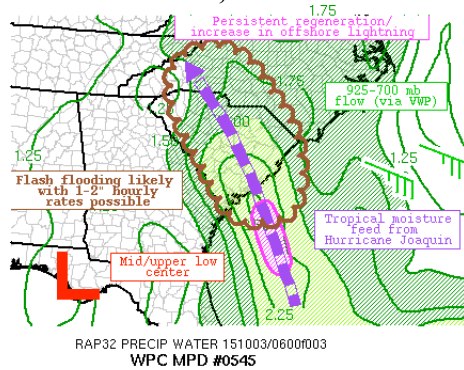
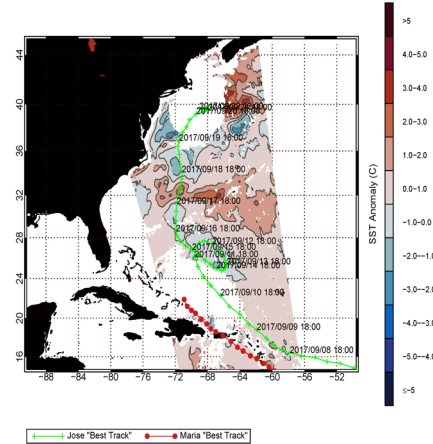


Fig 5 WPC Discussion: Water Vapor Imagery early this morning showed an upper low circulating over the panhandle with the broad ridge extending across western Atlantic. These combined circulations have helped channel a narrow plume of the moisture from the vicinity of hurricane Joaquin and extending northwestward into to southeastern U.S. The blended TPW product that includes AMSR-2 TPW suggested the extent of the 2" precipitable water (PWAT) within the tropical moisture plume was ~175mi. NOAA TPW percent normal product detected plume as highlighted within a circle on the bottom plot

AMSR2 SST Anomaly for 20170922-1616



AMSR2 SST Anomaly for 20170924-0616

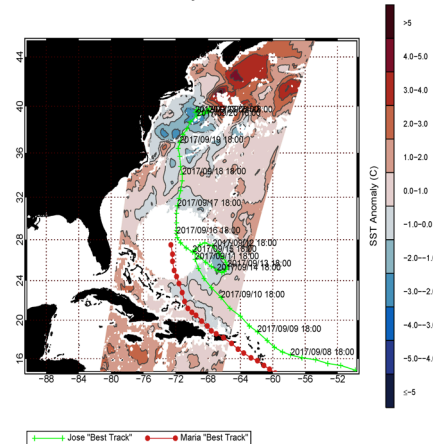


Fig 5a) Hurricane Maria Discussion Number 34
NWS National Hurricane Center Miami FL
AL152017
1100 AM EDT Sun Sep 24 2017

Some fluctuations in intensity could still occur during the next day or so while Maria moves over warm water and remains in a low shear environment. Later in the forecast period, **cooler waters from the wake of Hurricane Jose that traversed the same area last week will likely cause a gradual decrease in intensity.**

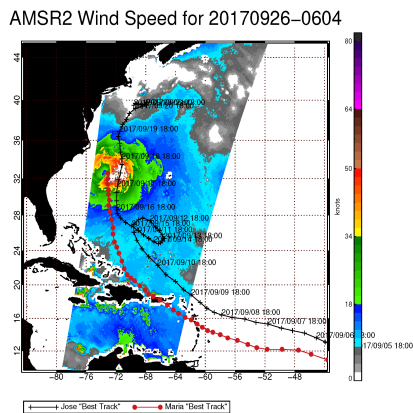
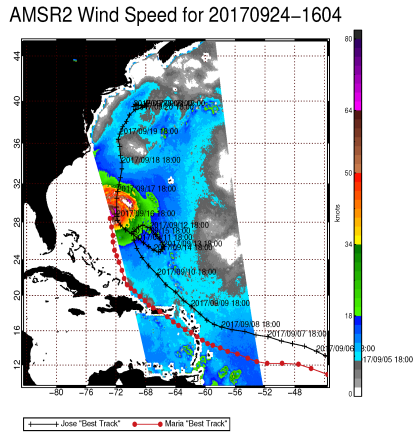


Fig 5b) Hurricane Maria Discussion Number 36
NWS National Hurricane Center Miami FL
AL152017
1100 PM EDT Sun Sep 24 2017
Observations from a NOAA aircraft indicate that the SSTs beneath Maria are on the order of 24-25 deg C, which has probably contributed to the decrease of intensity. **These relatively cool waters are likely due to mixing and upwelling from slow-moving Hurricane Jose, which traversed the area a little over a week ago.** Gradual weakening is anticipated for the next few days, and the official intensity forecast is near or above the latest model consensus. Maria is expected to remain a hurricane for at least the next few days, however.

5. Summary

GCOM-W1/AMSR-2, part of NOAA's JPSS program, provides critical satellite observations that support many facets of NOAA's mission. A summary of the AMSR2 Ocean EDRs from the NOAA GAASP will be discussed along with validation results. Examples of operational utilization of these EDRs at NOAA will also be presented.

References:

- [1] NOAA JPSS program web page: <http://www.jpss.noaa.gov>
- [2] K. Imaoka et al., "Instrument performance and calibration of Amsr-E and Amsr2," in Proc. Int. Arch. Photogramm. Remote Sens. Spat. Inf. Sci., Kyoto, Japan, 2010, vol. 38, Part 8.
- [3] Alsweiss, S.; Jelenak, Z.; Chang, P.; Park, J.; Meyers, P., "Inter-calibration Results of the Advanced Microwave Scanning Radiometer-2 Over Ocean," *Selected Topics in Applied Earth Observations and Remote Sensing, IEEE Journal of*, vol. PP, no.99, pp.1,9. doi: 10.1109/JSTARS.2014.2330980
- [4] NOAA GCOM-W program webpage: http://manati.star.nesdis.noaa.gov/gcom/datasets/GCOM2D_ata.php