STAR GCOM-W1/AMSR2 PROJECT UPDATE AND STATUS

STAR GCOM-W1 Project Team
Presented by Paul Chang
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STAR – GCOM-W1 AMSR2 ALGORITHM SOFTWARE PROCESSOR (GAASP)

Major Updates

- Converted Ocean and Precipitation algorithms to use CMC SST ancillary data files instead of Reynolds SST
- Updated Precipitation algorithm
  - TMI correction
  - Snow Flagging – new dynamic ancillary data file
  - Climatology Flagging
  - Clouds Screening Procedure
- Updated Ocean algorithm
  - Sea Surface Winds

DAP Deliveries

- GAASP_v2-4_20180117.tar.gz
  - Uses CMC SST instead of Reynolds SST
  - NDE on January 17, 2018
  - CSPP on January 17, 2018

Reprocessing and local NRT processing

- Rerun missing NRT data for STAR data repository
- Rerun data with new wind processor for Ocean algorithm development support
- Troubleshoot and Updated STAR local NRT processing scripts to be more robust with missing data
- Ran tests on the impacts of the new GFS FV3 ancillary data on the GCOM products

Future Plans

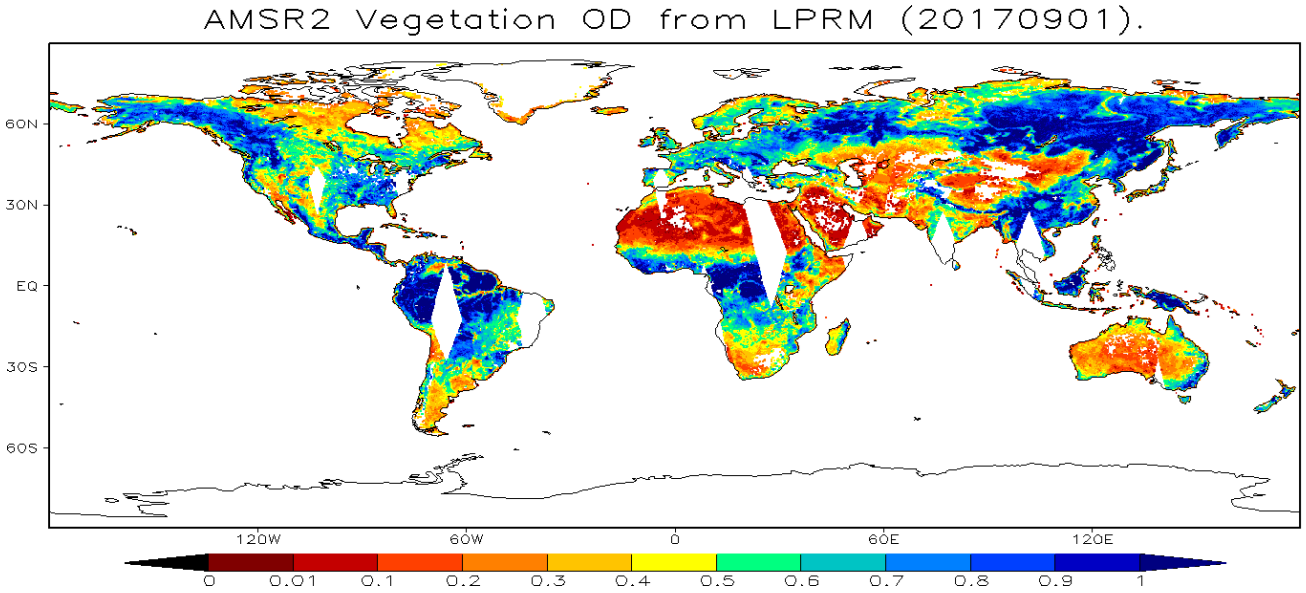
- Validate Ocean and Precipitation Updates
- Deliver Ocean and Precipitation Updates to NDE and CSPP
  - Also includes a minor update to netCDF metadata (production_site and production_environment added)
- Full GCOM life cycle local reprocessing with most up-to-date algorithms.

Land Products Update

JPSS GCOM-W1/AMSR2 Soil Moisture

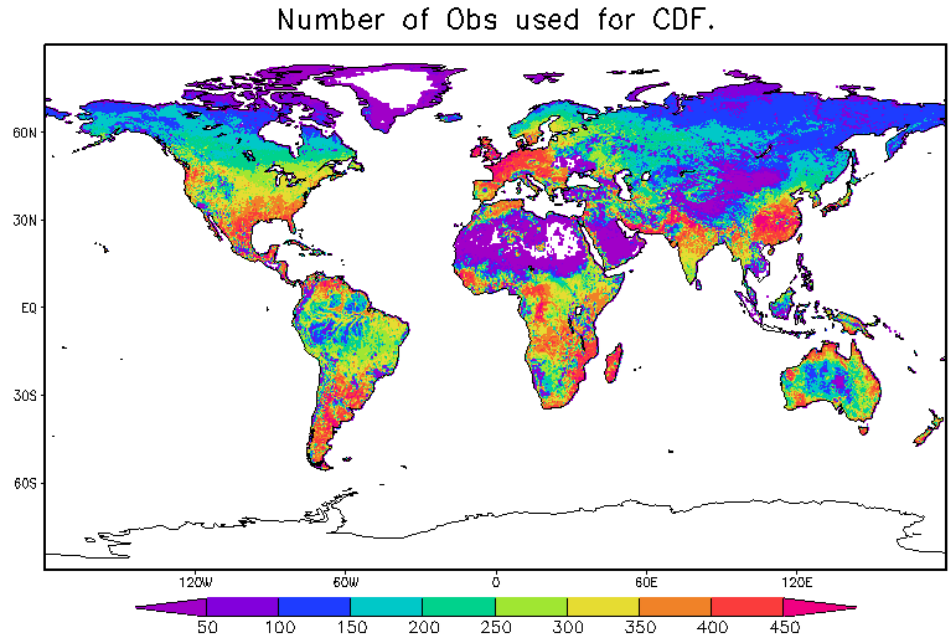
Algorithm and Refinement:

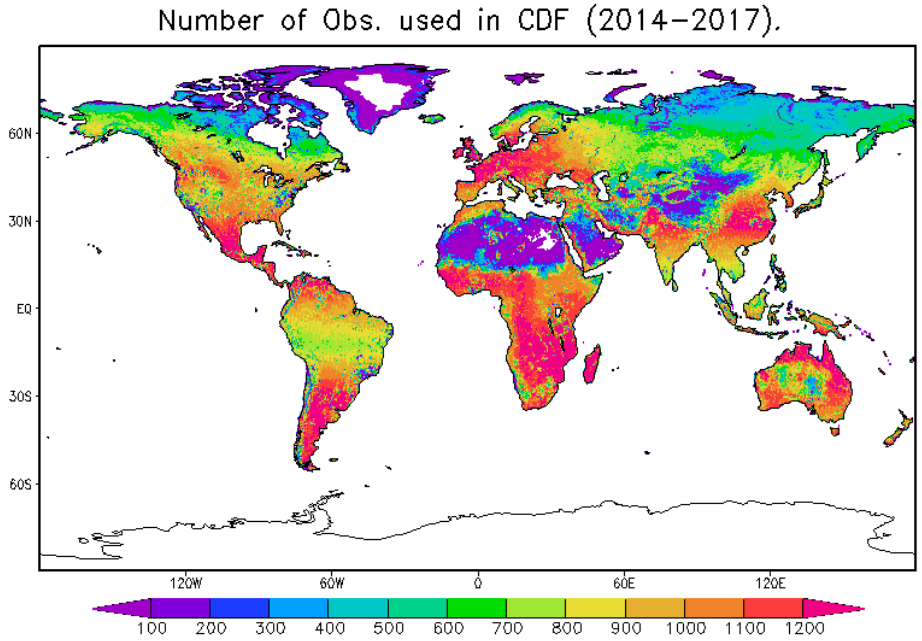
- The LPRM algorithm was used to retrieve Vegetation Optical Depth (VOD) from TBv and TBh
- Derive VOD climatology for Single Channel Algorithm (SCA) of soil moisture retrieval with historical AMSR2 data
- Inverse soil moisture from TBh using the VOD scaled to VOD climatology with CDF matching
- **Improved temporal dynamics and spatial coverage with improved LPRM vegetation Optical Depth retrieval algorithm (below) .**
- **Improved spatial coverage with longer period of historical data for generating Cumulative Distribution Function (CDF) data base.**
- **Validation with global in situ measurement data and other products are ongoing.**



JPSS GCOM-W1/AMSR2 Soil Moisture

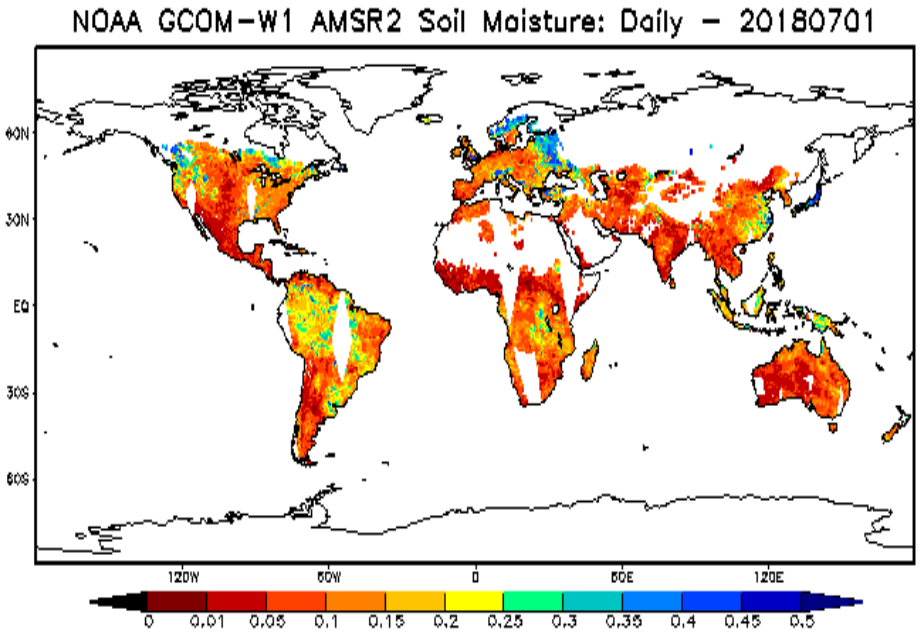
More reliable CDF with more historical AMSR2 data

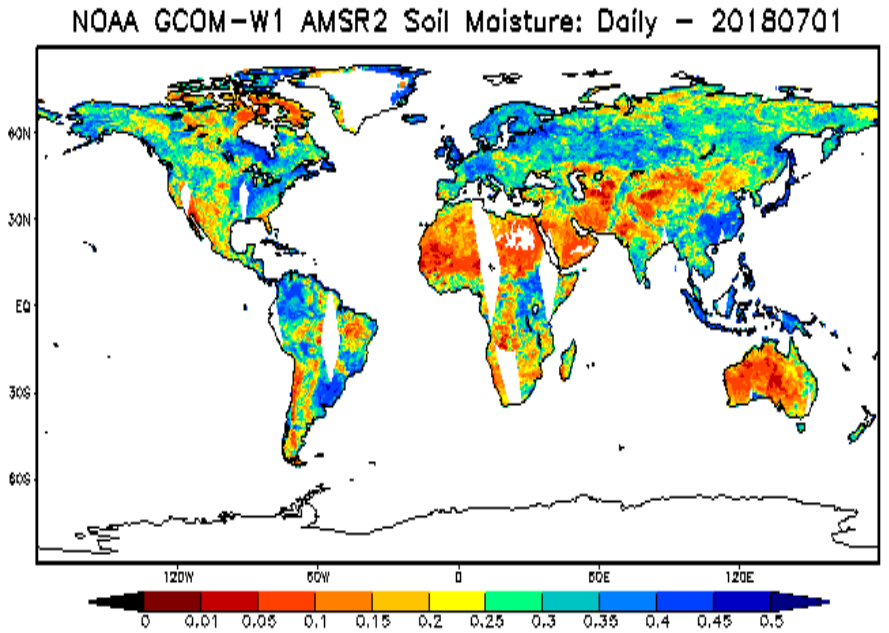




JPSS GCOM-W1/AMSR2 Soil Moisture

Better spatial coverage and the dynamic range of the final product.

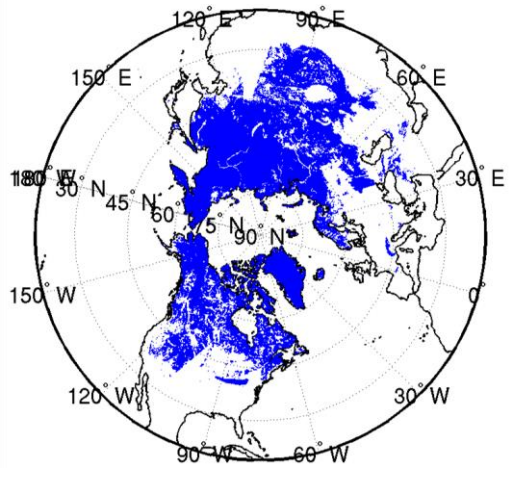




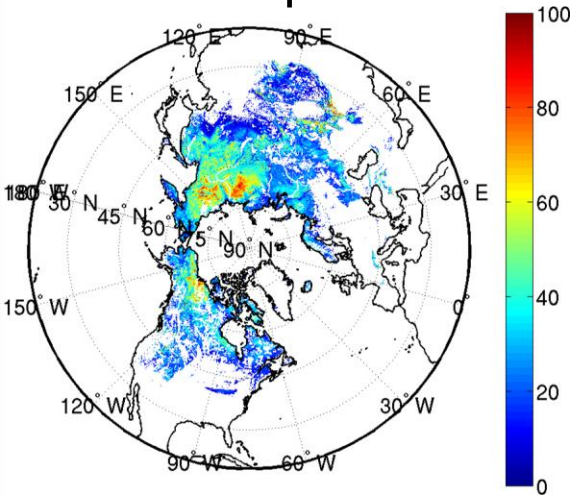
Snow Products Update

AMSR2 Snow and Ice Products

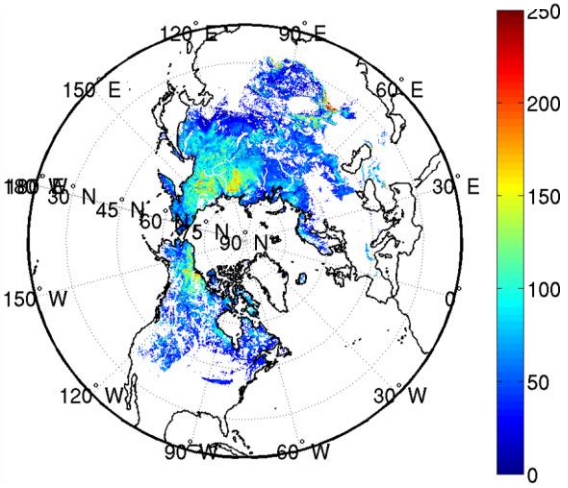
Snow Cover



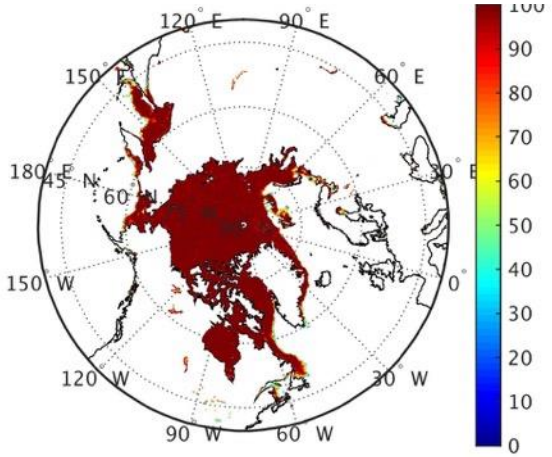
Snow Depth



Snow Water Equivalent

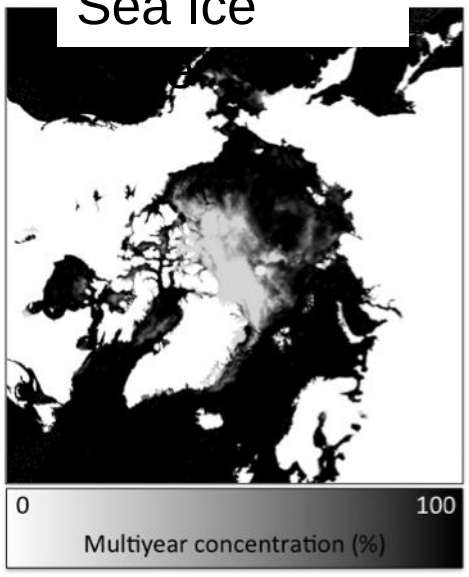


Sea Ice Concentration



Status: Operational, nominal, products meet requirements

Sea Ice



Product Performance – AMSR2

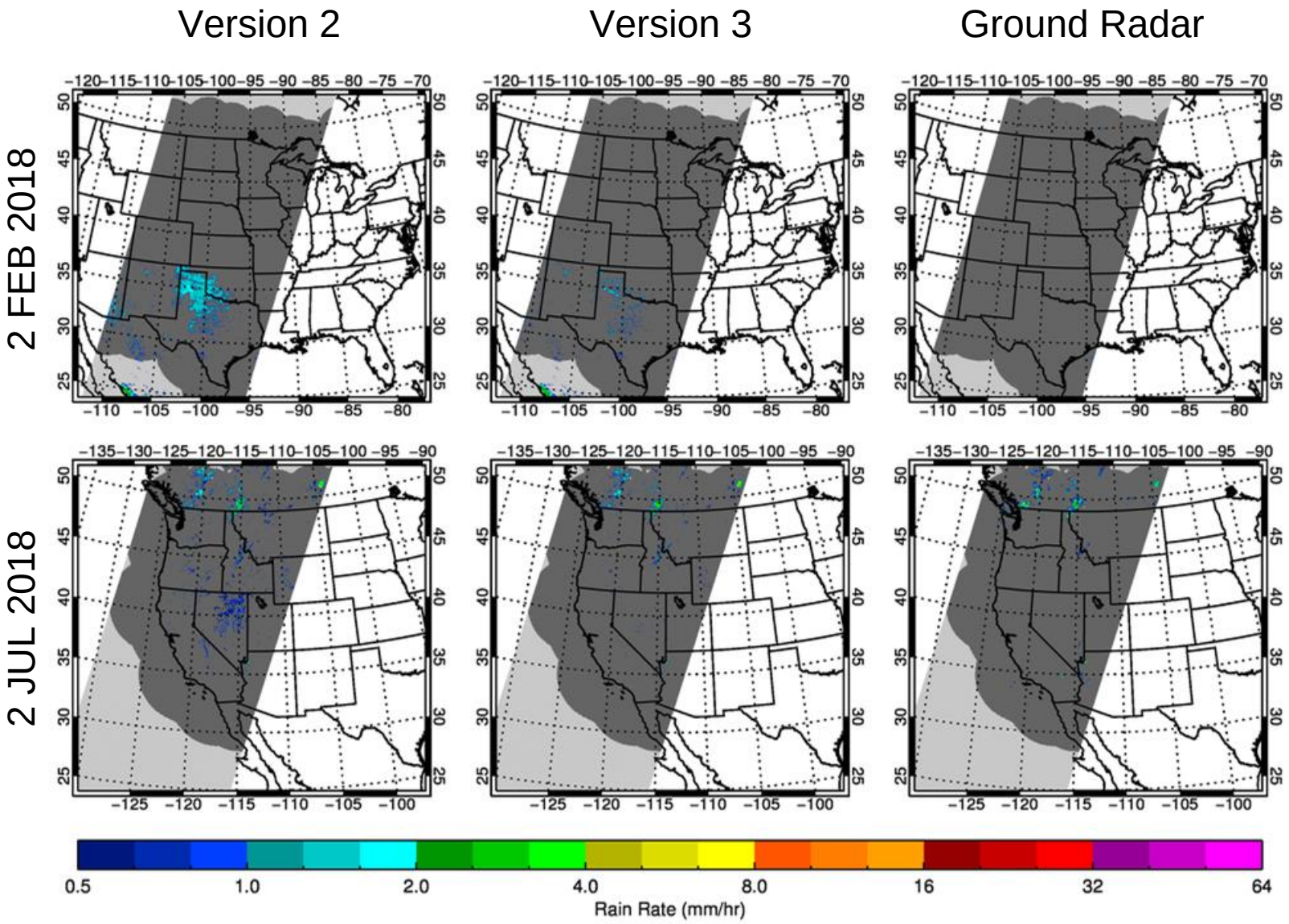
Product	L1RDS APU Thresholds	Performance	Meets Spec?
Snow cover (binary)	80% correct typing	72-97%	Y
Snow depth	20 cm uncertainty	15-22 cm	Y (marginal)
SWE	50-70% uncertainty (shallow to thick snowpacks)	~20-22%	Y
Ice concentration	10% uncertainty	3.9% NH; 4.4% SH	Y
Ice type	70% correct typing	80-90%, Arctic winter	Y

Precipitation Products Update

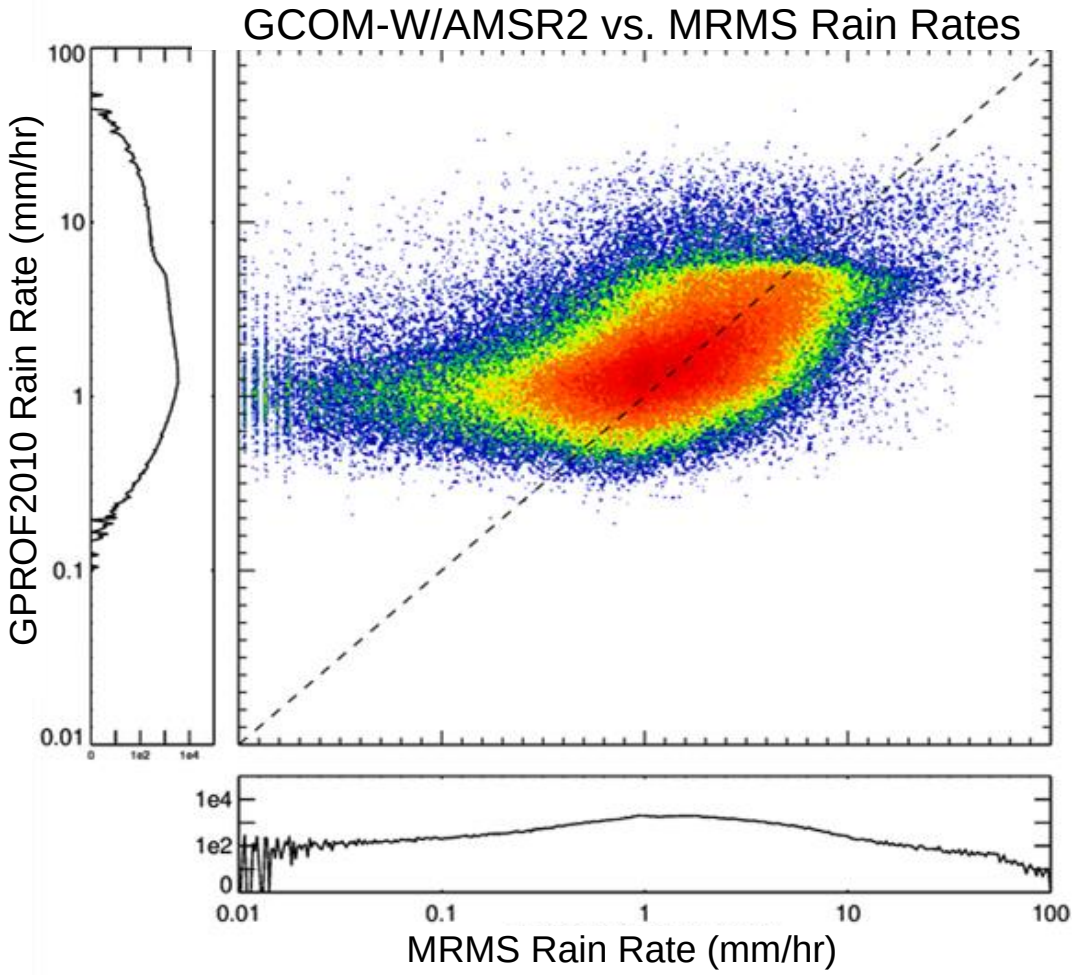
Precipitation Improvements
GPROF2010 – Version 3

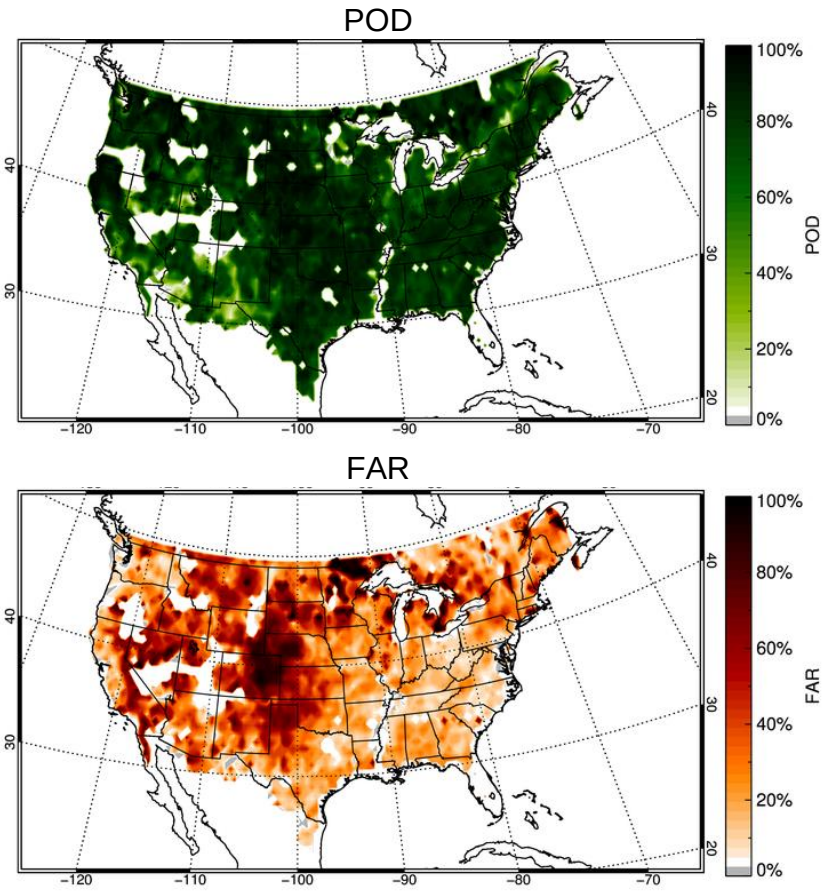
- Eliminates automatic flagging in climatological snowy areas
  - Use daily NOAA AutoSnow analysis for screening
- Applies no-cloud test to reduce false alarms
- Updated Tb-Rain Rate relationship
- Improved quality flags
  - Provide more valid retrievals (i.e. over snow)
- RMSE and rain detection improved by 10%

Screening Comparison

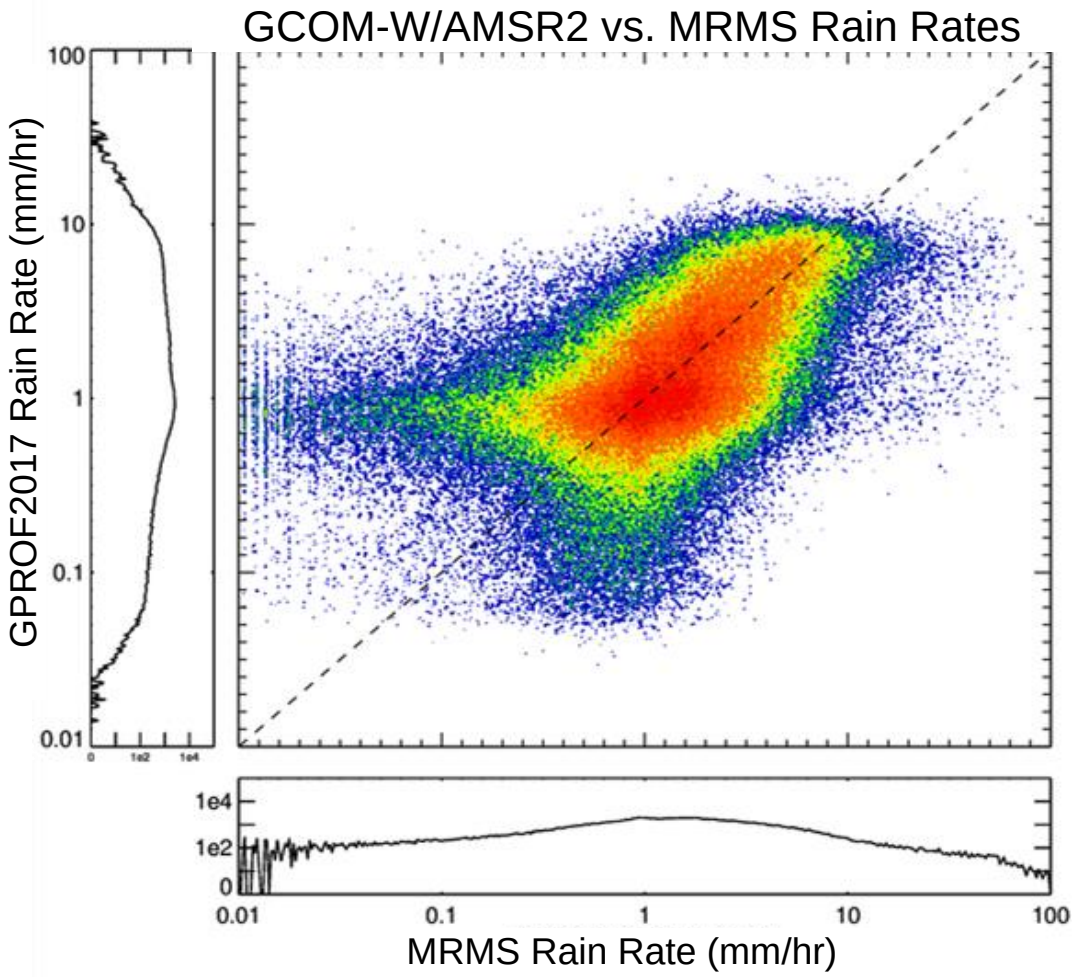


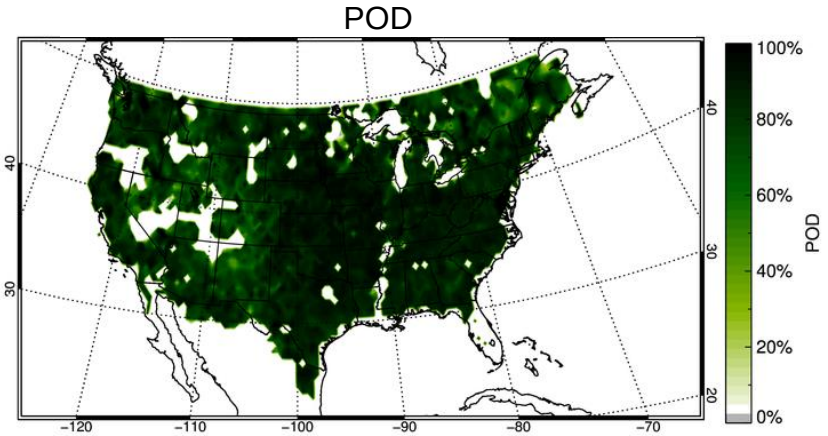
GPROF2010V3

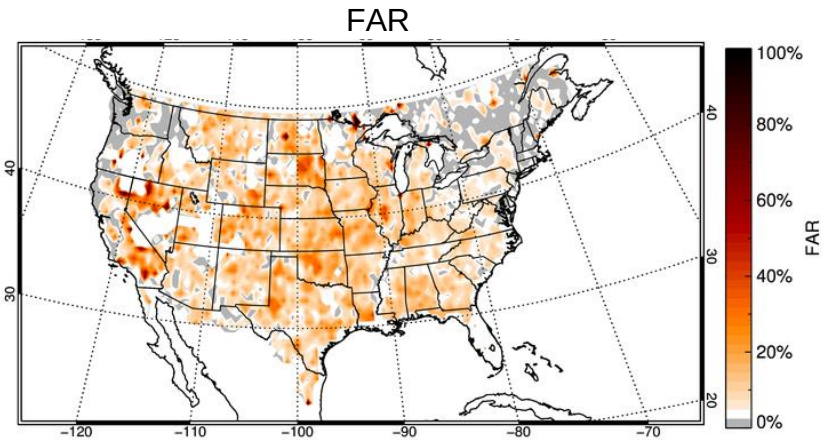




GPROF2017

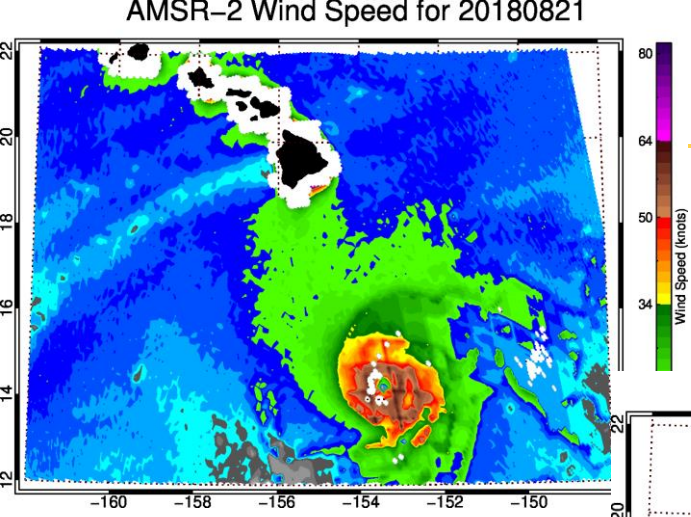

GCOM-W/AMSR2 vs. MRMS Rain Rates
GPROF2017 Rain Rate (mm/hr)
MRMS Rain Rate (mm/hr)
100
10
1
0.1
0.01
1e4
1e2
0
0.01
0.1
1
10
100

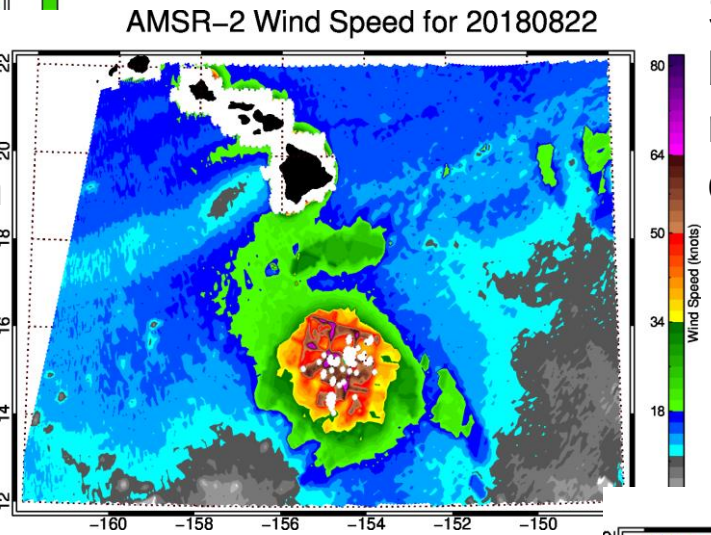

POD
100%
80%
60%
40%
20%
0%
POD
−120
−110
−100
−90
−80
−70
40
30
20

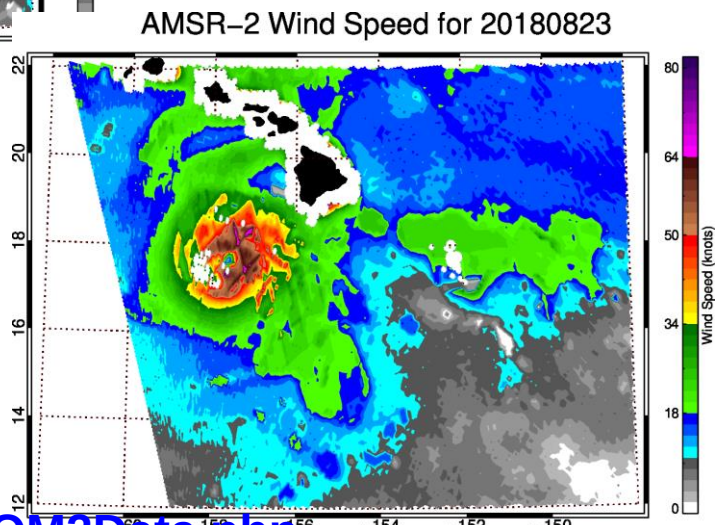

FAR
100%
80%
60%
40%
20%
0%
FAR
−120
−110
−100
−90
−80
−70
40
30
20

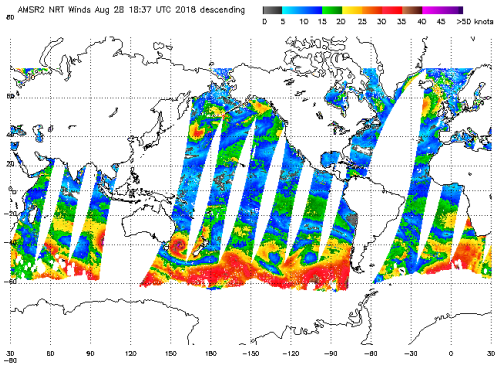
Ocean Products Update

New Wind Speed Product







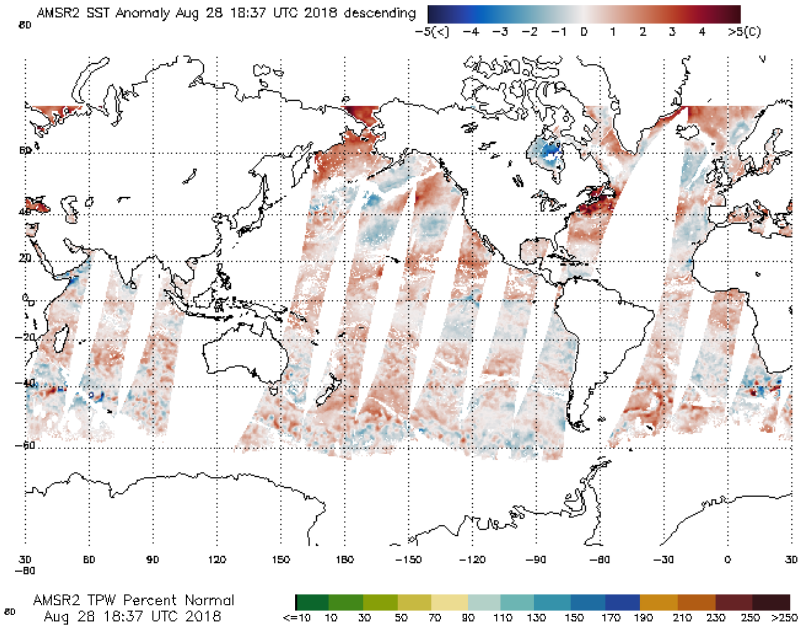


- New wind processor presented during last year JPSS Annual Science meeting has been transitioned from research to operational code

- Comprehensive validation analysis completed
  - Major improvements of high wind retrievals in rain and cloudy areas
  - Results to be published in a paper in J-STARS
  - New product has been publically available on the STAR GCOM web page (manati) since August 2018
  - Reprocessing of previous data in process

https://manati.star.nesdis.noaa.gov/datasets//GCOM2Data.php

New Products

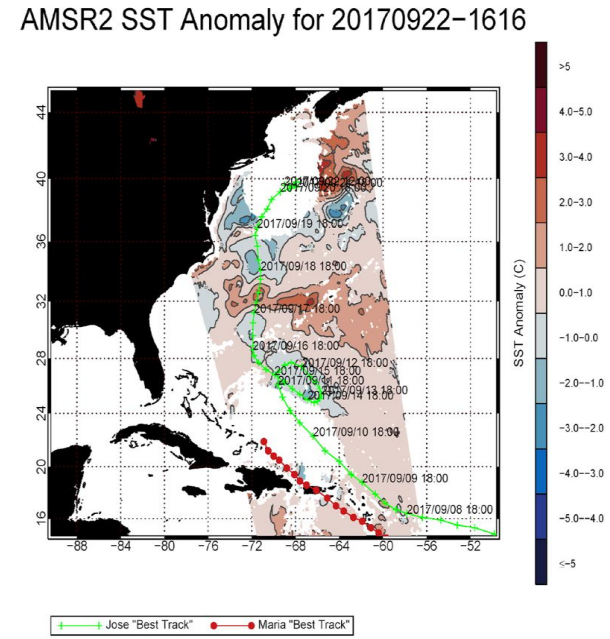


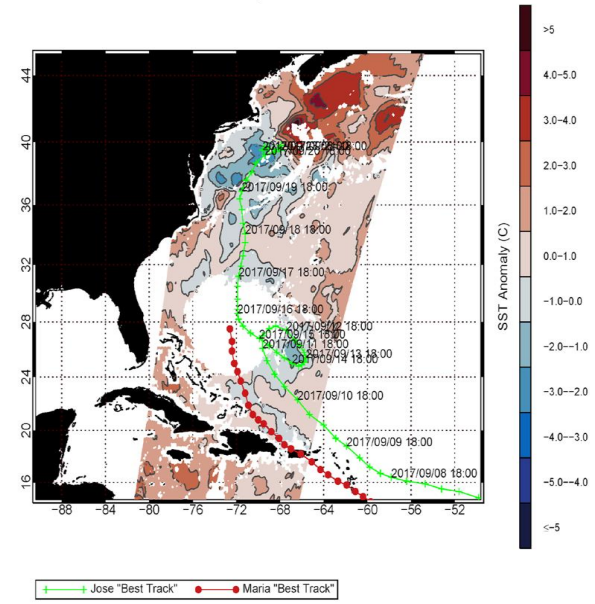
- **SST anomaly**
  - Calculated using the climatology from Banzon et al. (2014), available from NCEI
- **TPW anomaly – defined as TPW Percent Normal**
  - Calculated using NVAP-M daily level-3 dataset, which spans 1988 to 2009

https://manati.star.nesdis.noaa.gov/datasets//GCOM2Data.php

Hurricane Jose and Maria Sep, 2017
High Wind and SST Anomaly Example

Jose on Sep, 22nd 2017



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ZCZC MIATCDAT5 ALL
TTAA00 KNHC DDHHMM

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.
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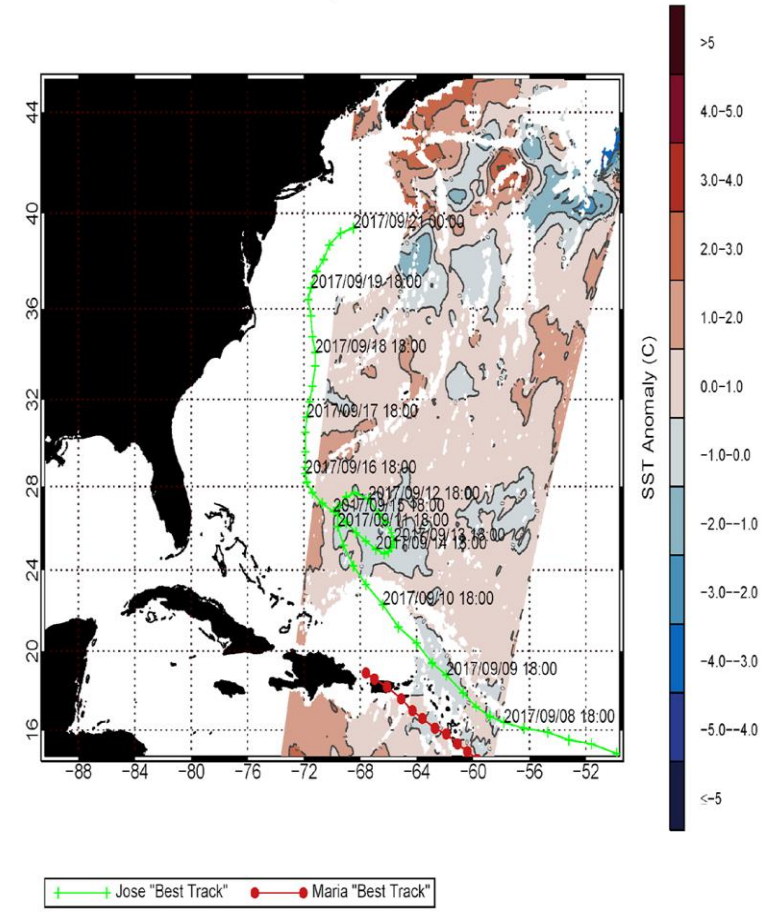
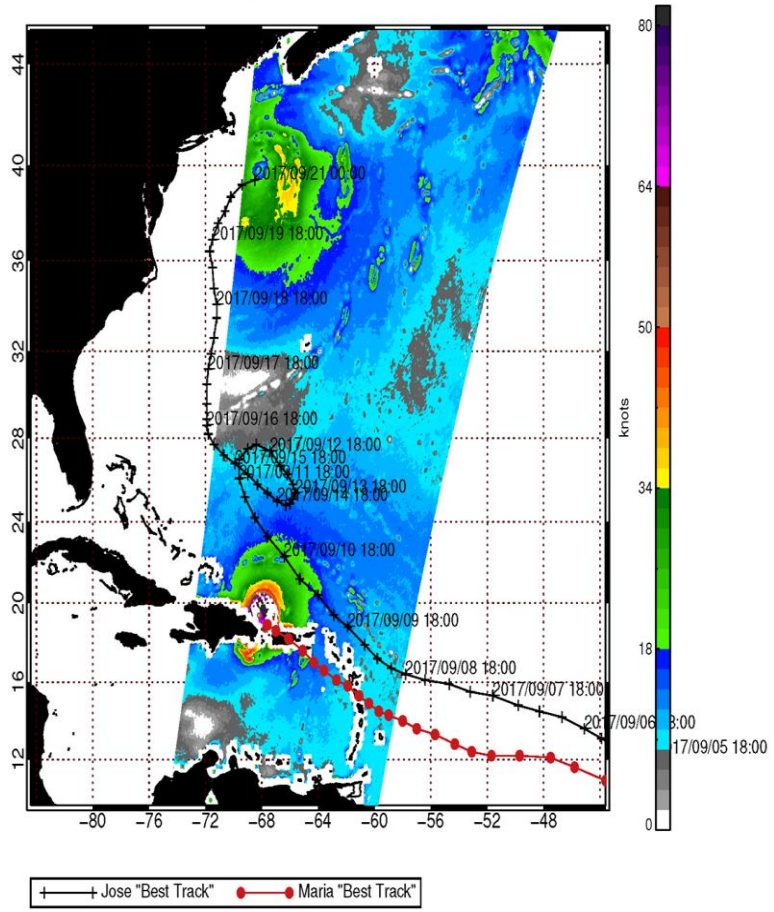
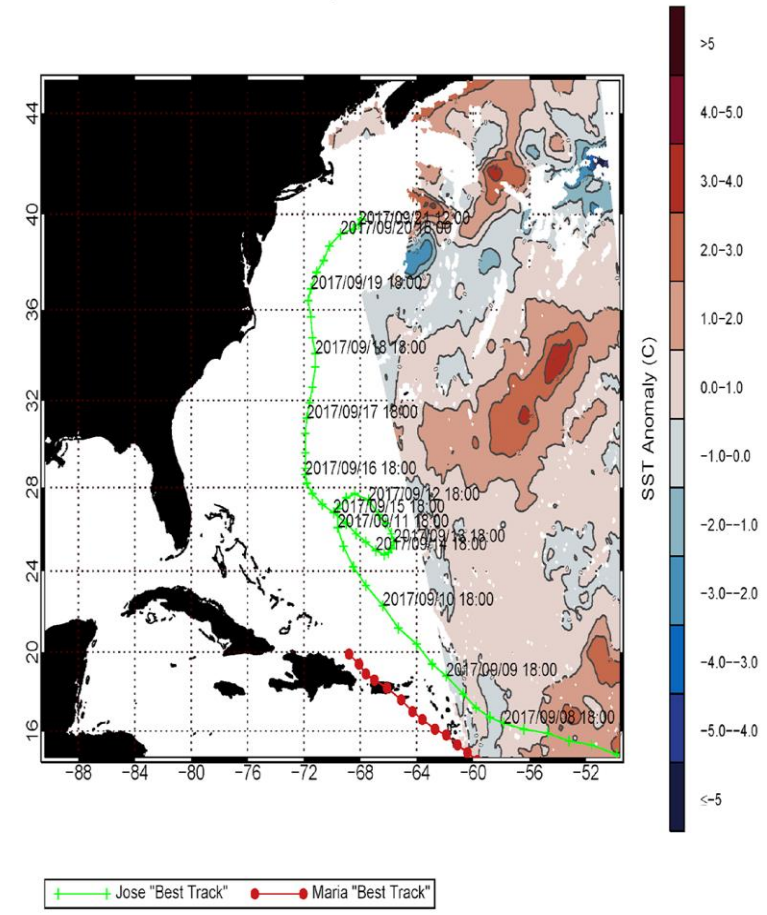
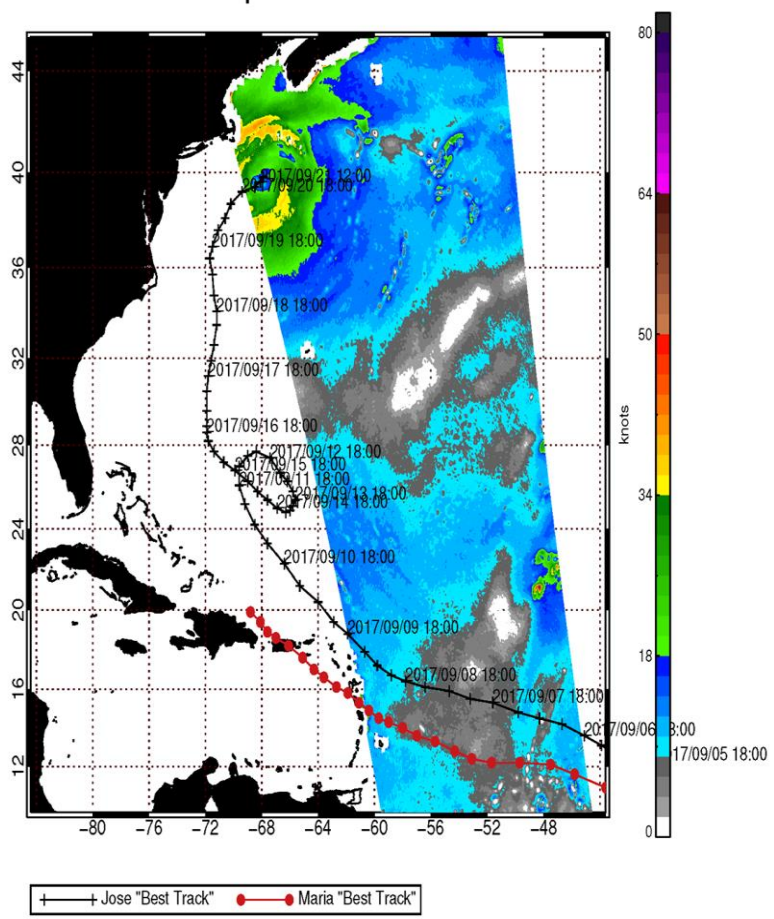




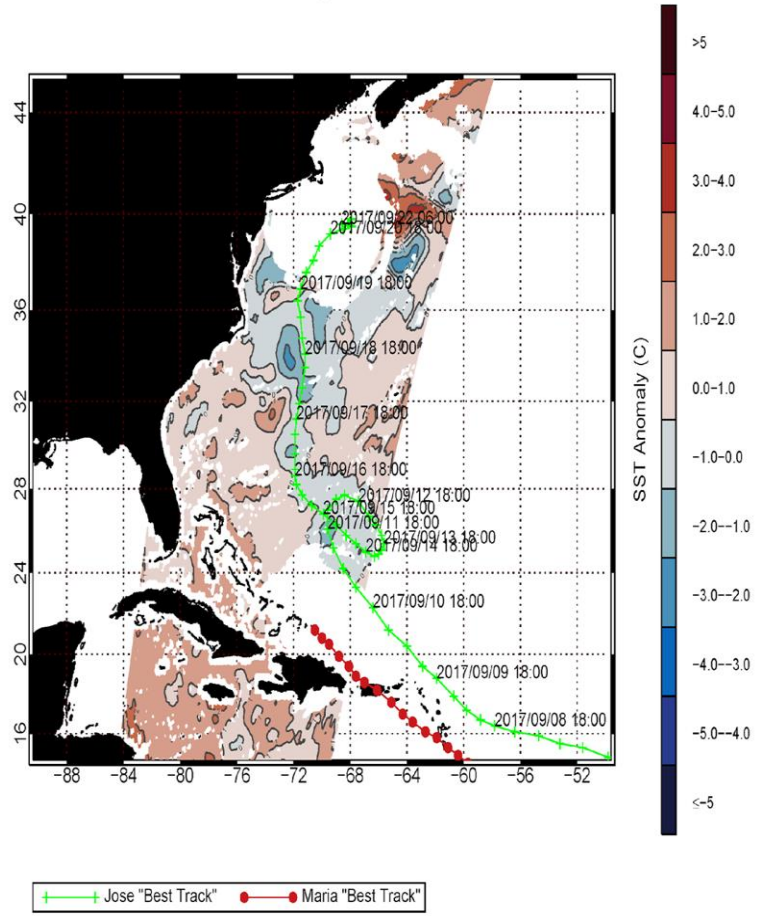
Max sustained winds 115mph



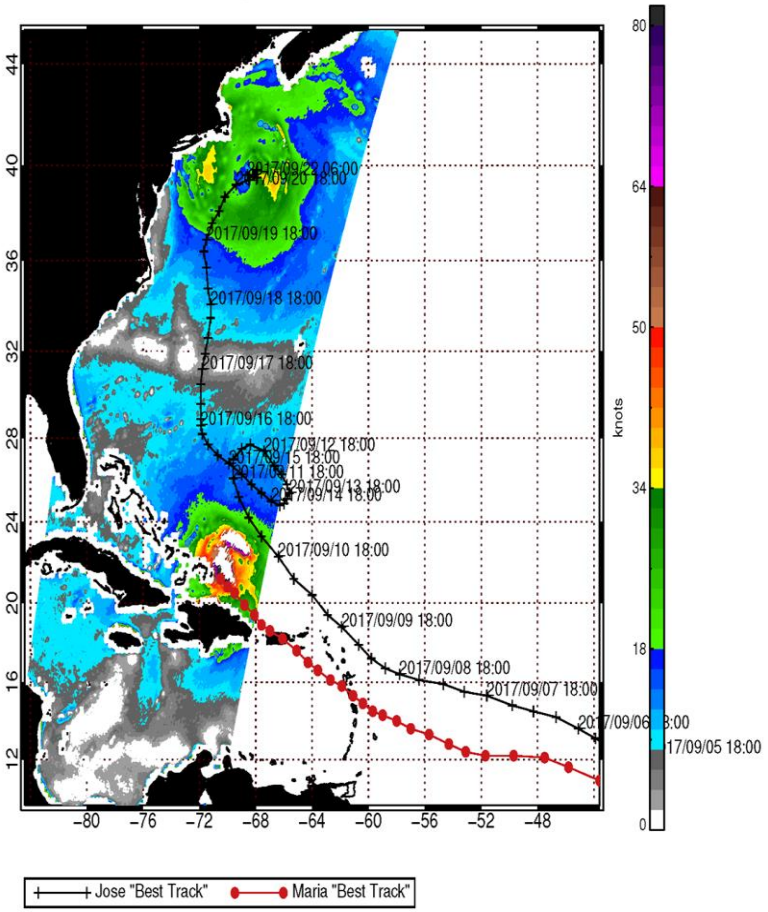


Max sustained winds 120mph

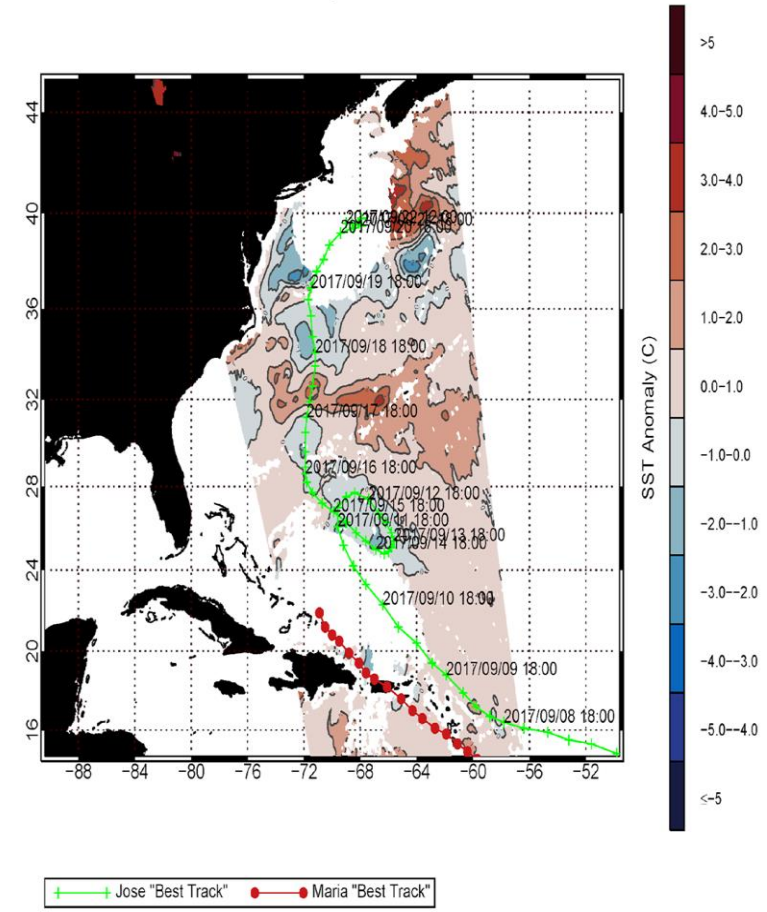
AMSR2 SST Anomaly for 20170922-0628

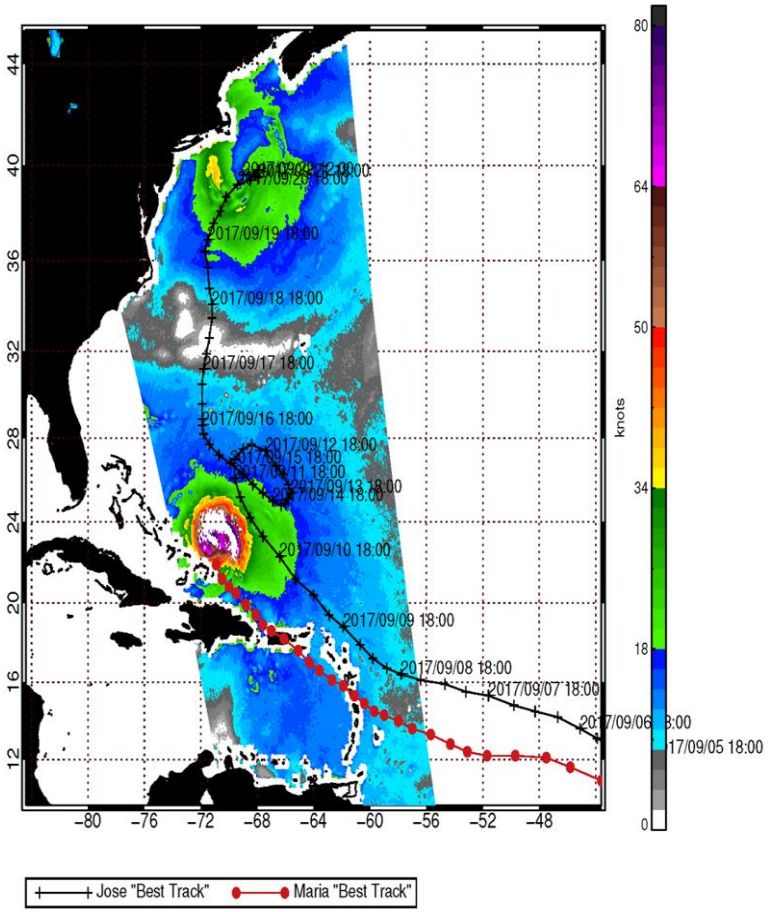


AMSR2 Wind Speed for 20170922-0628

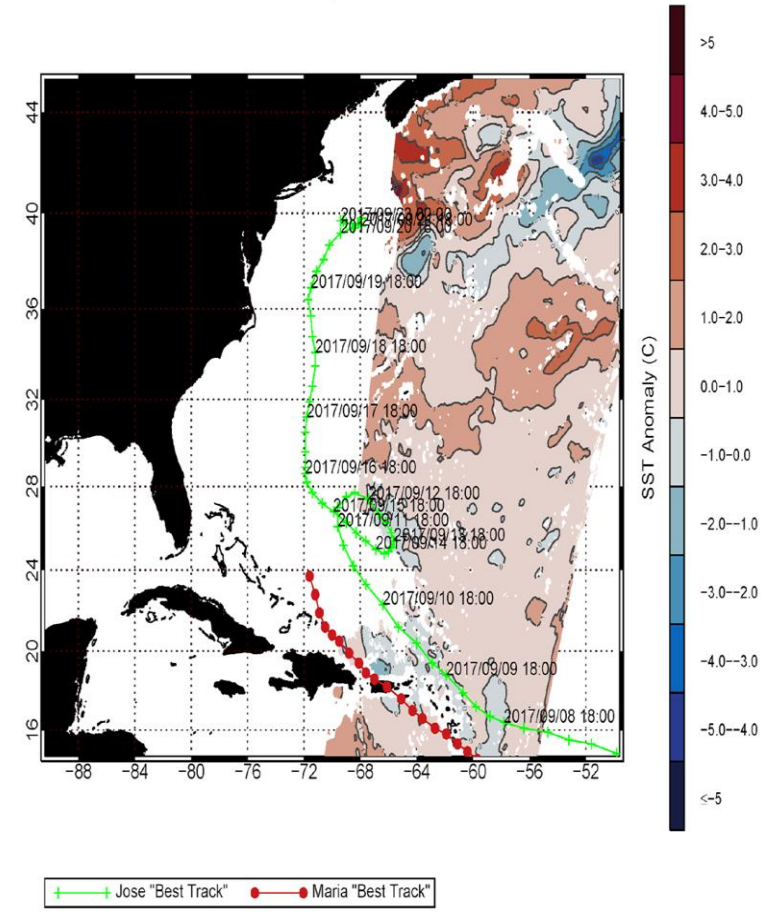


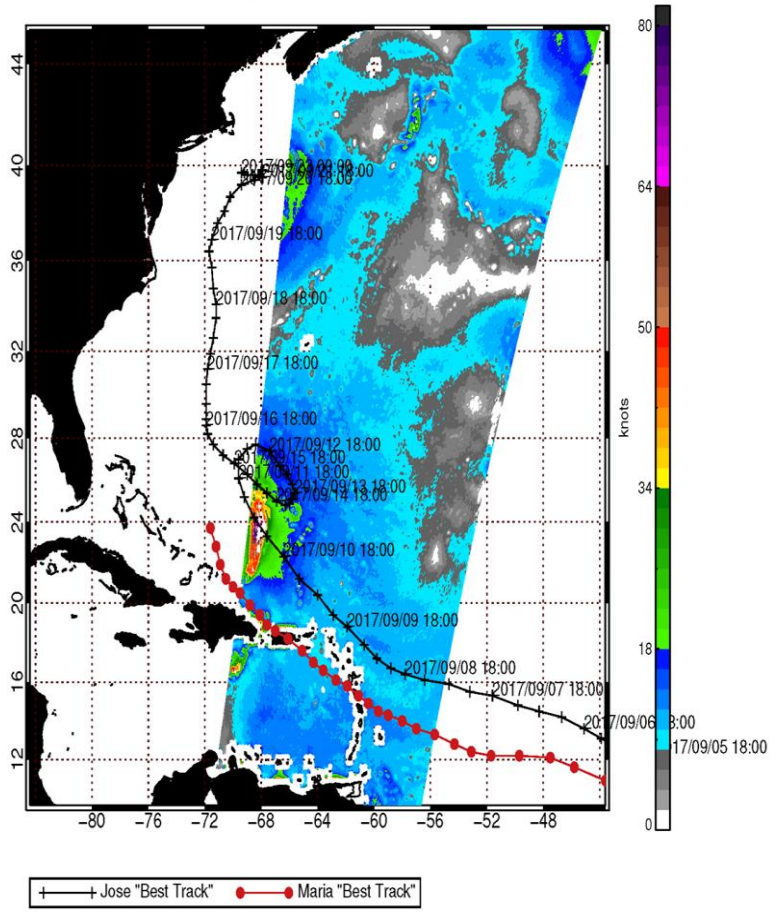
Max sustained winds 125mph



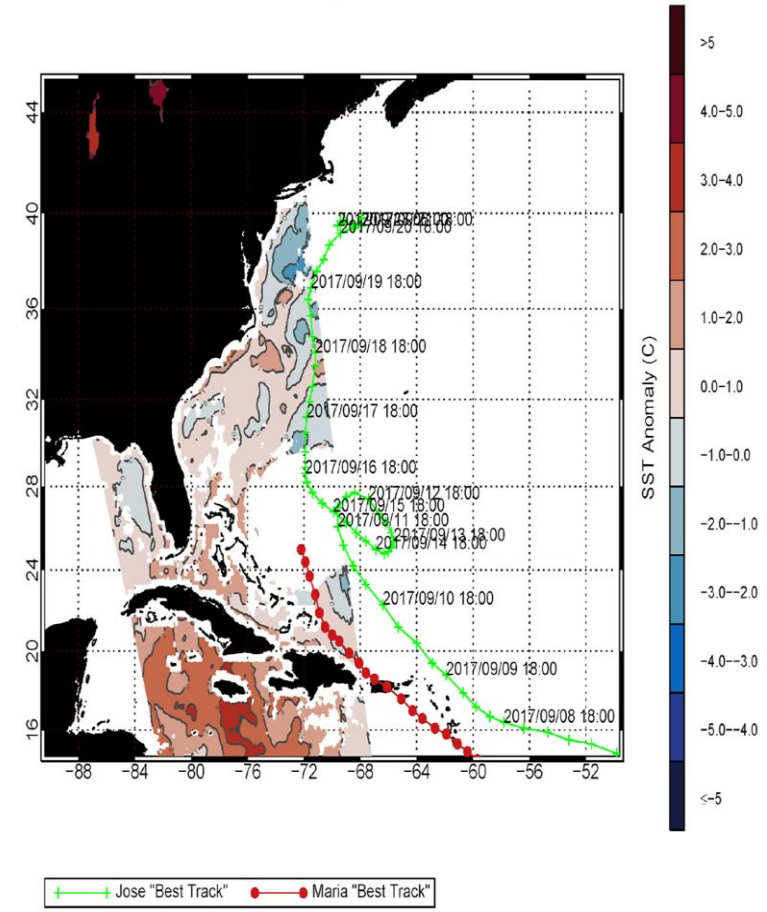


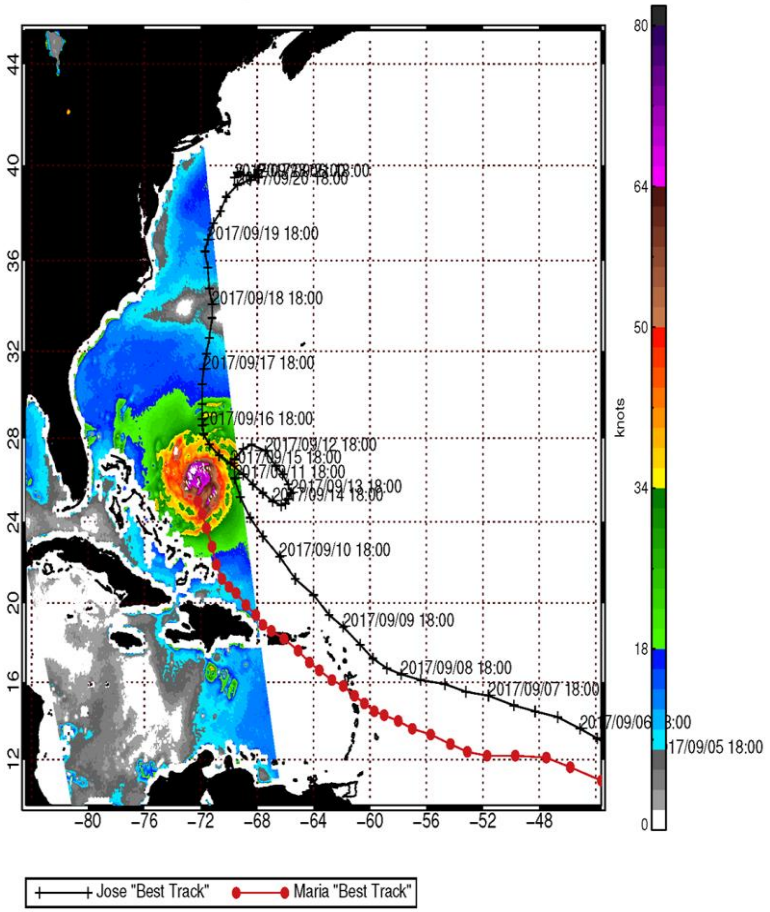
Max sustained winds 125mph





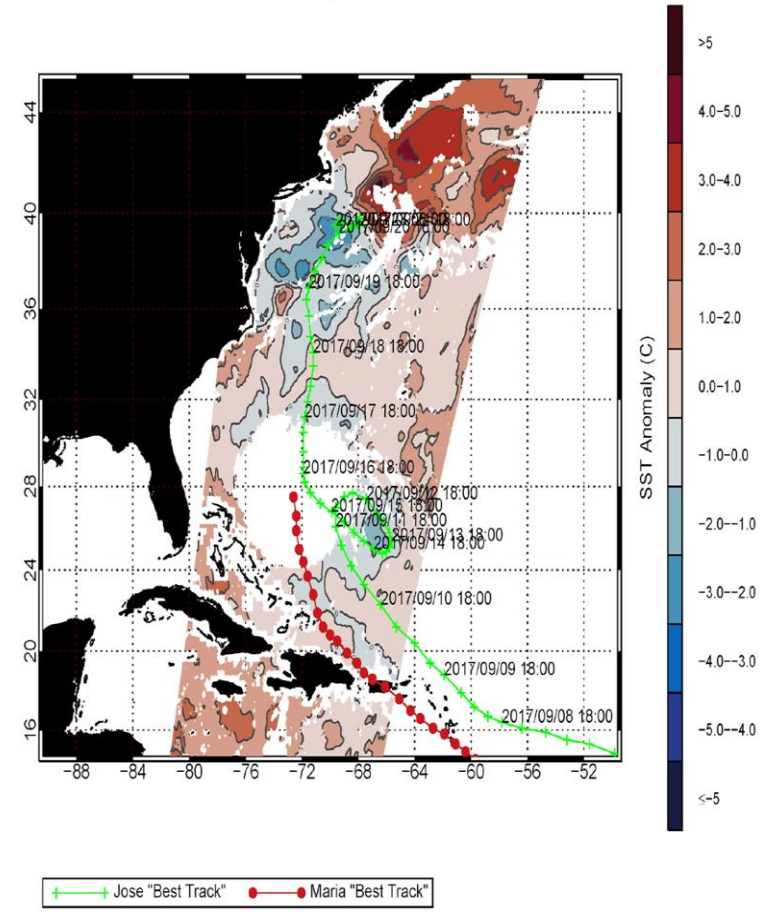
Max sustained winds 120mph



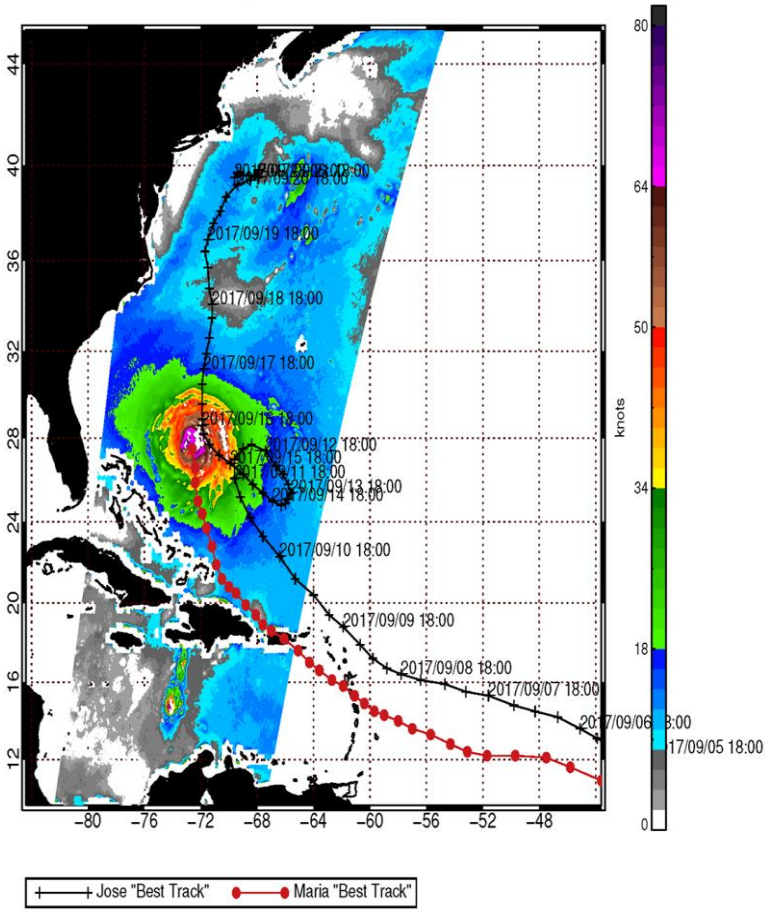


Max sustained winds 115mph

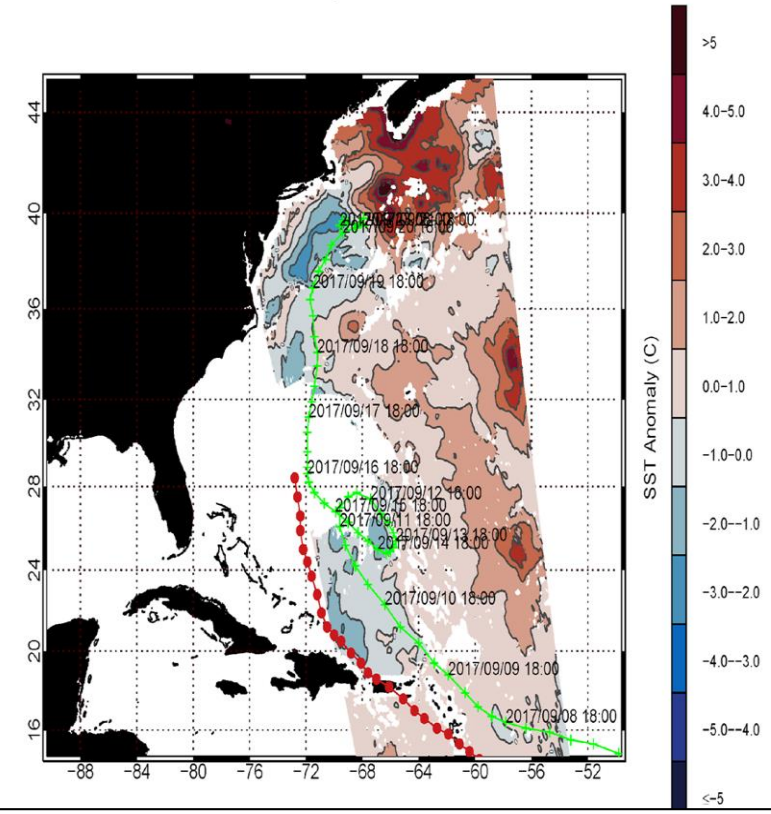
AMSR2 SST Anomaly for 20170924-0616

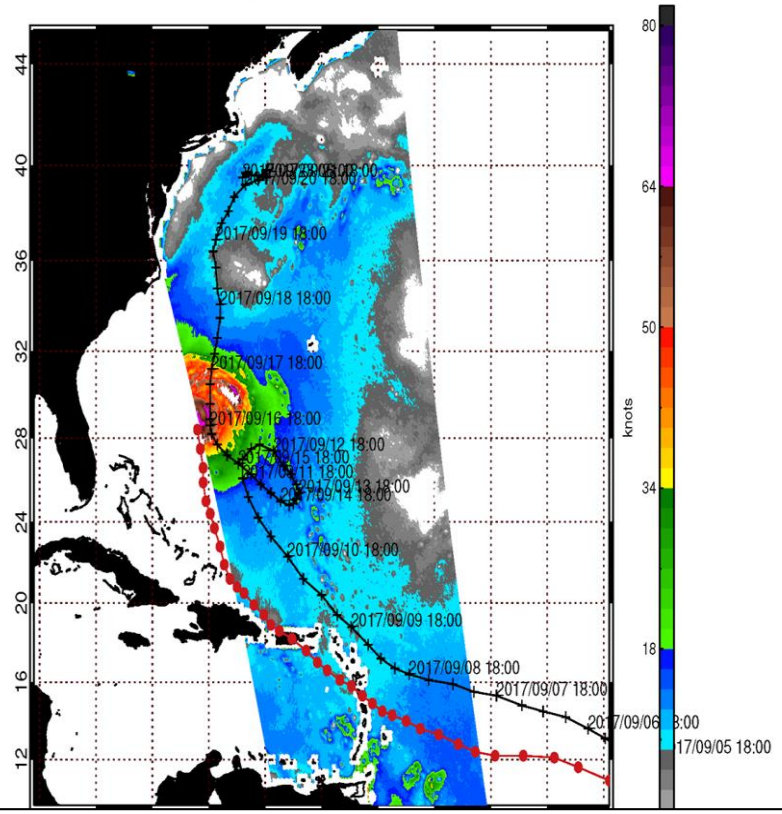


AMSR2 Wind Speed for 20170924-0616



Max sustained winds 110mph

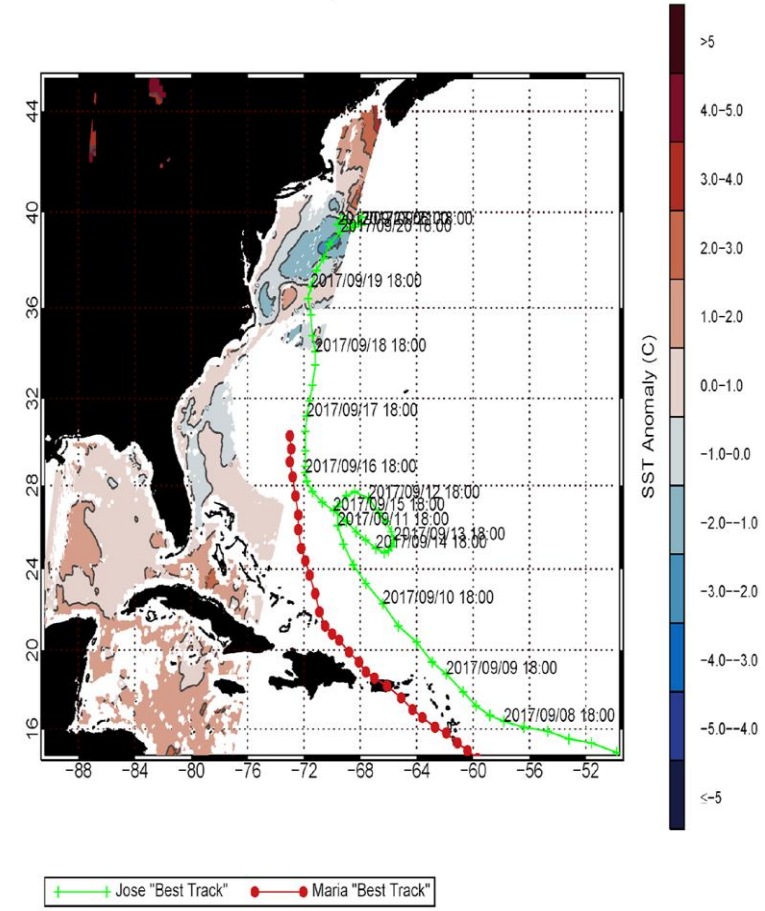


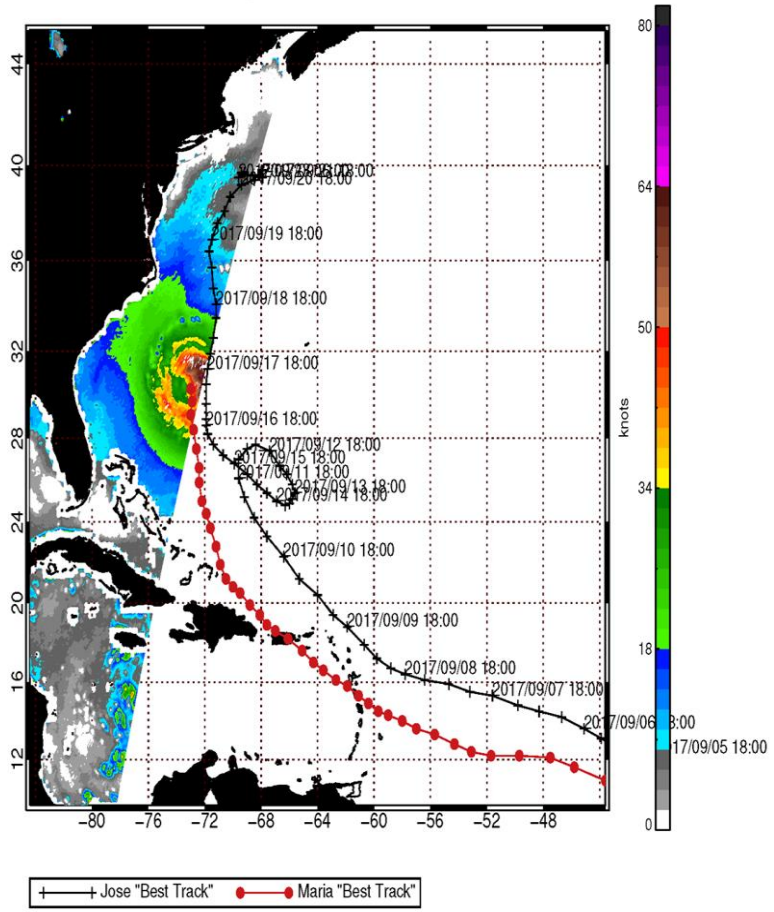


Hurricane Maria Discussion Number 36
NWS National Hurricane Center Miami FL AL152017
1100 PM EDT Sun Sep 24 2017

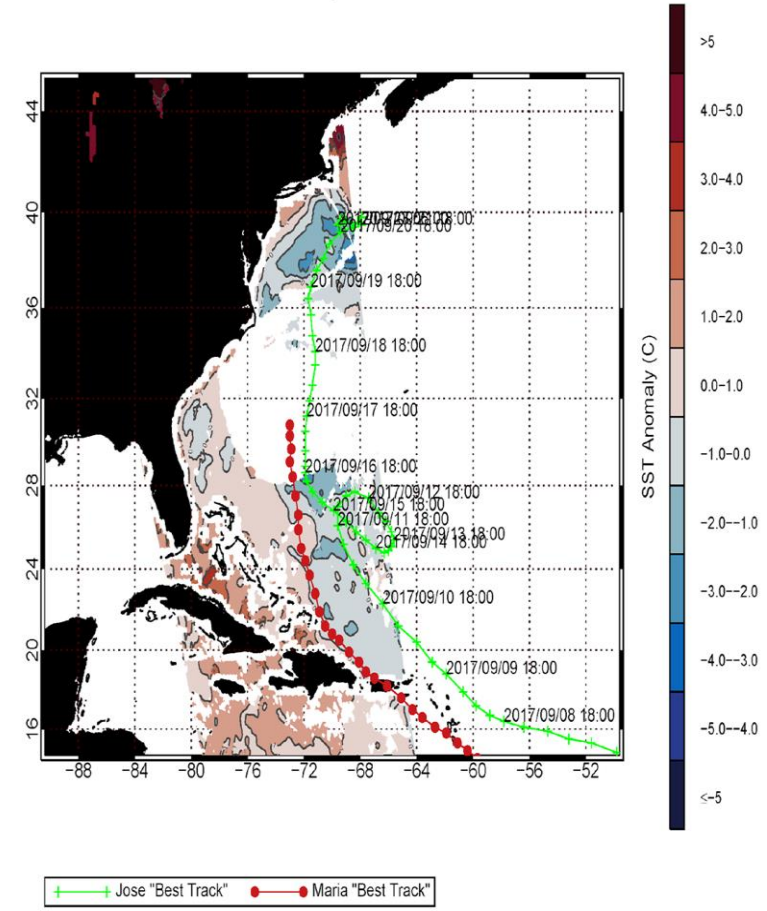
Max sustained winds 105mph

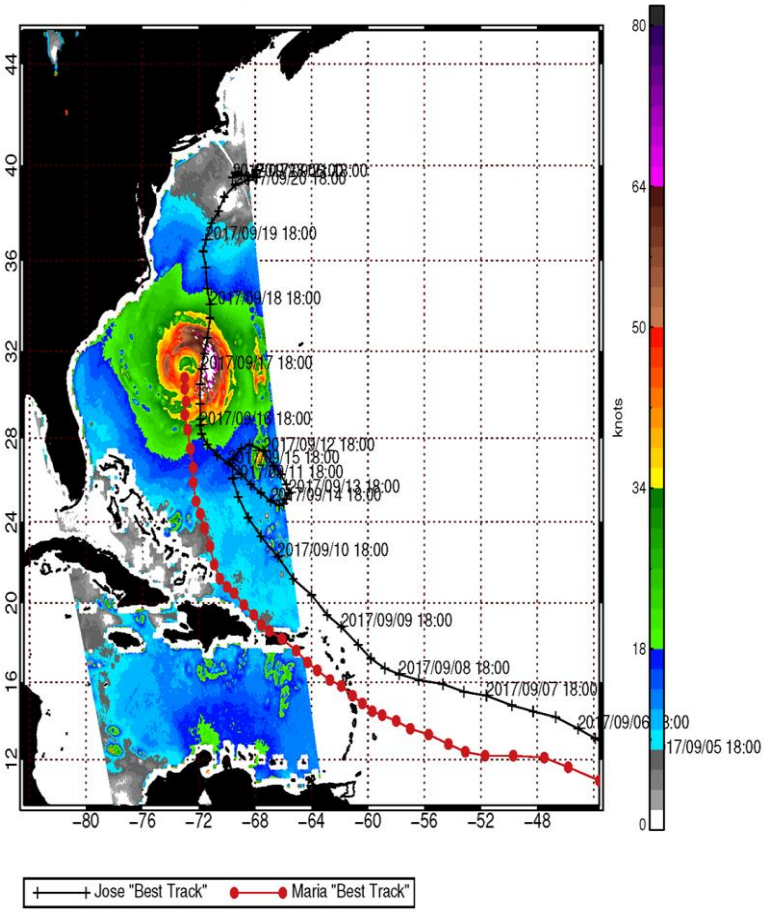
Observations from a NOAA aircraft indicate that the SSTs beneath Maria are on the order of 24-25 deg C, which has probably contributed to the decrease of intensity. **These relatively cool waters are likely due to mixing and upwelling from slow-moving Hurricane Jose, which traversed the area a little 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.





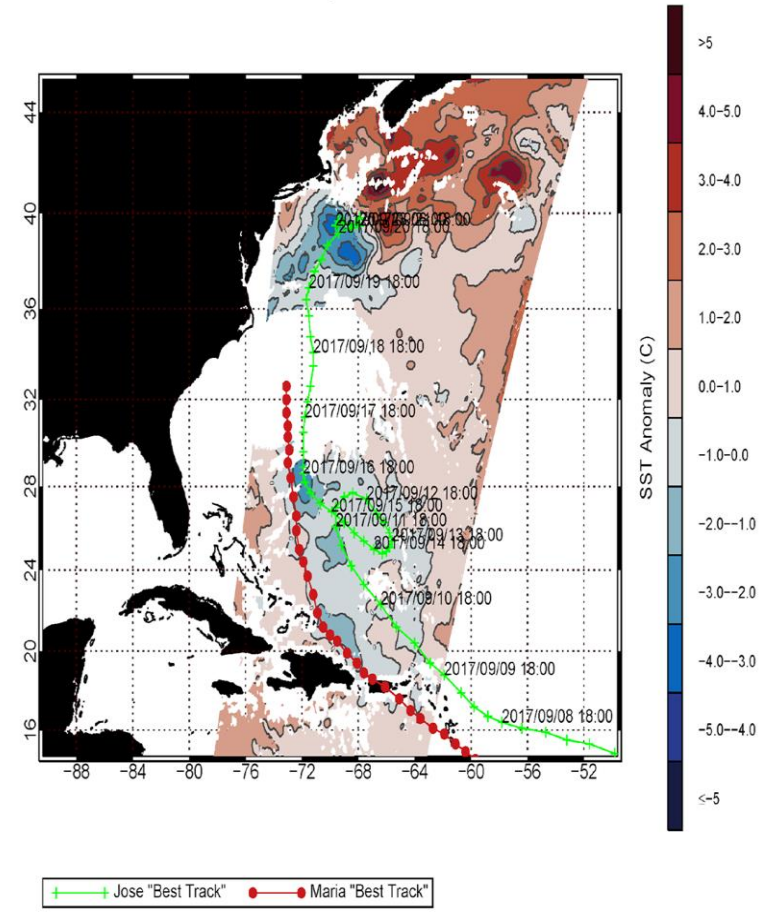
Max sustained winds 80mph



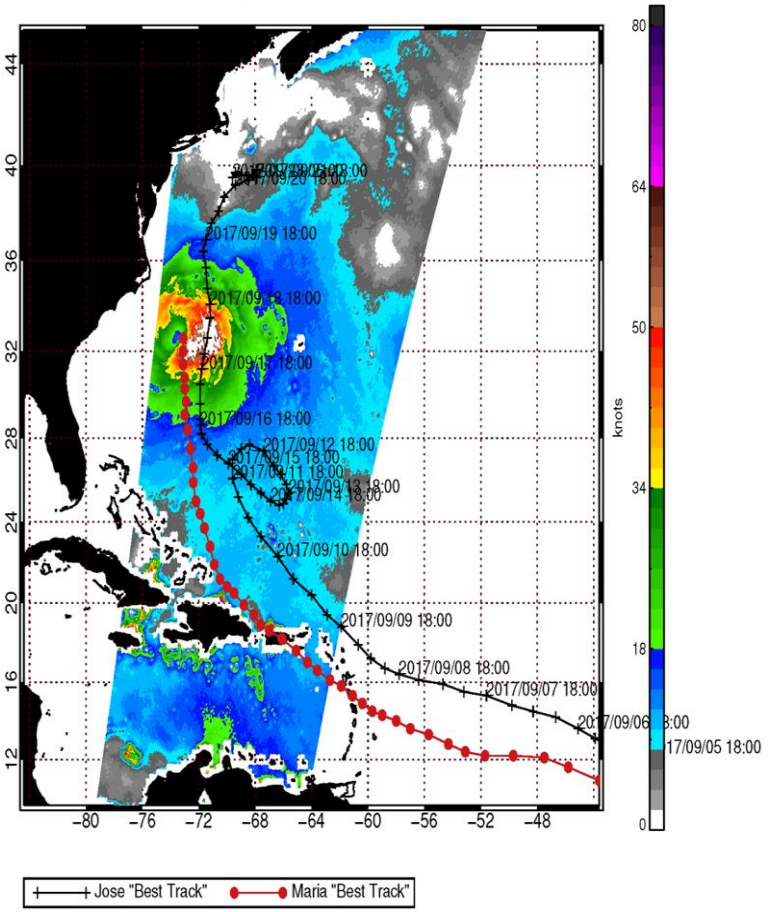


Max sustained winds 75mph

AMSR2 SST Anomaly for 20170926-0604



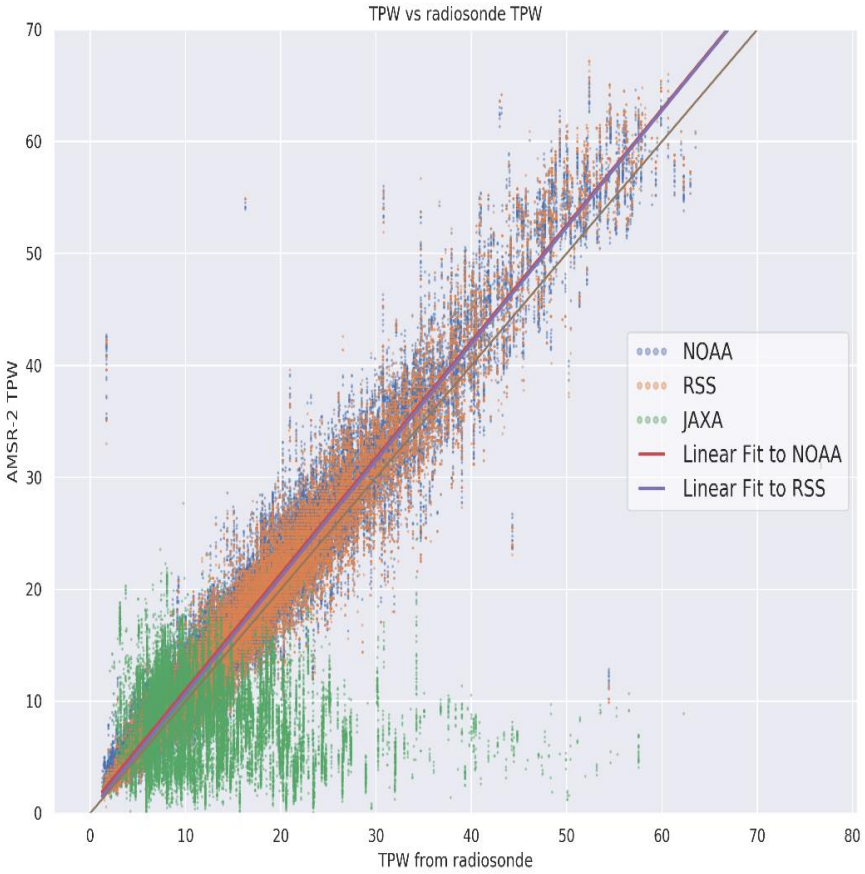
AMSR2 Wind Speed for 20170926-0604



Max sustained winds 65mph

TPW Validation

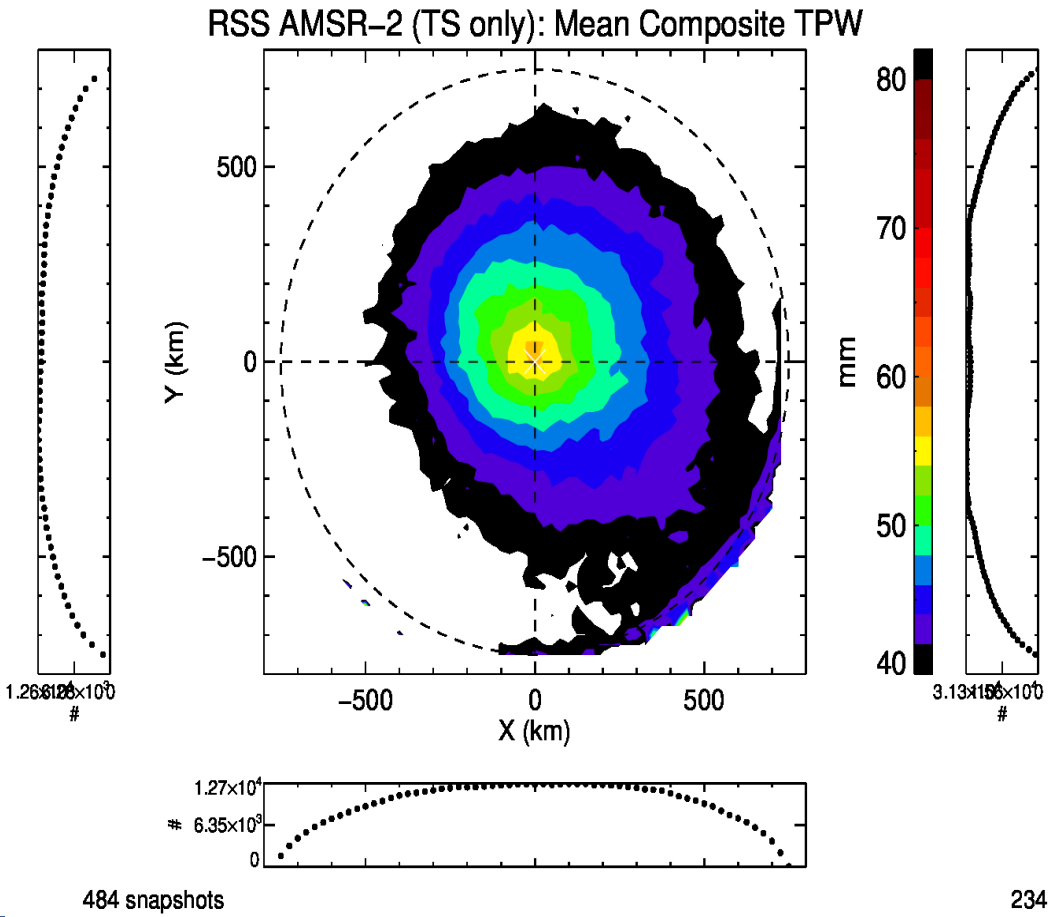
AMSR-2 TPW vs. Radiosonde TPW

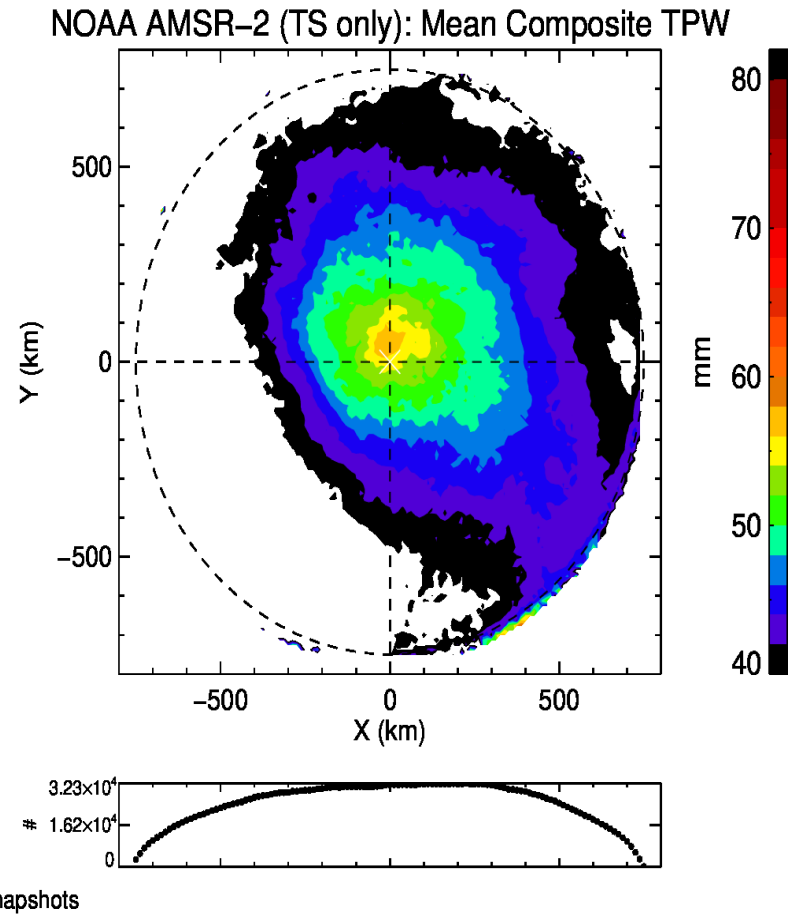


- NOAA, RSS, and JAXA TPW
- All data shown is from a collocation with radiosondes
  - < 50km
  - < 1 hour
  - No RFI, land mask (ours or RSS), no sunglint
- JAXA TPW is not very good
- Both RSS and NOAA slightly overestimate compared to radiosondes
  - Radiosonde “TPW” is actually “precipitable water below 500hPa”, so maybe not exactly “total”

Mean TPW Composites – Atlantic TS

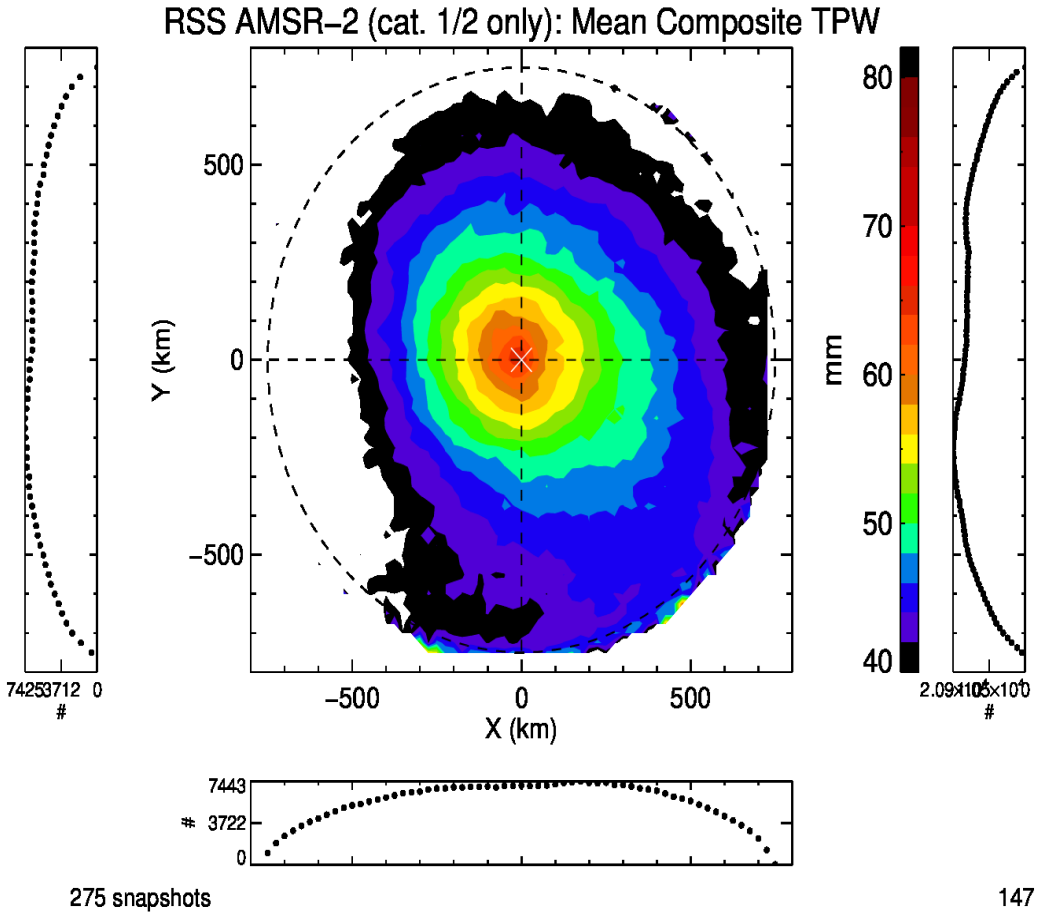
- Comparison of RSS and NOAA TPW products assessed using TPW composite field within different stages of tropical cyclone
- NOAA product is showing higher resolution by resolving finer field structures then RSS product

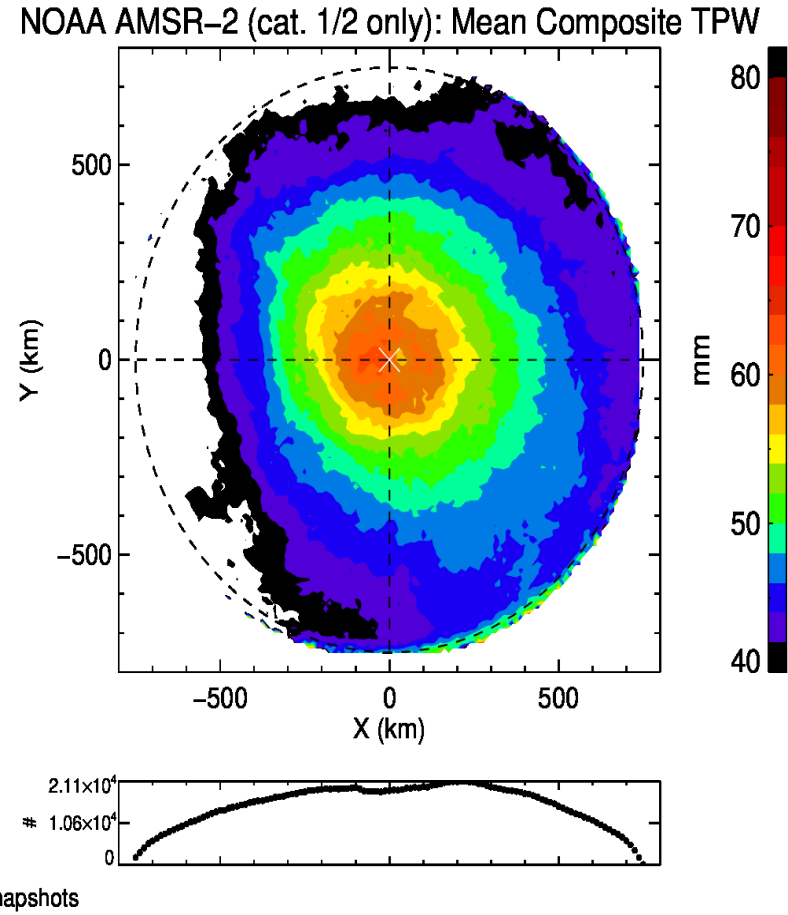




Mean TPW Composites - Atlantic Hurricanes Cat. 1/2

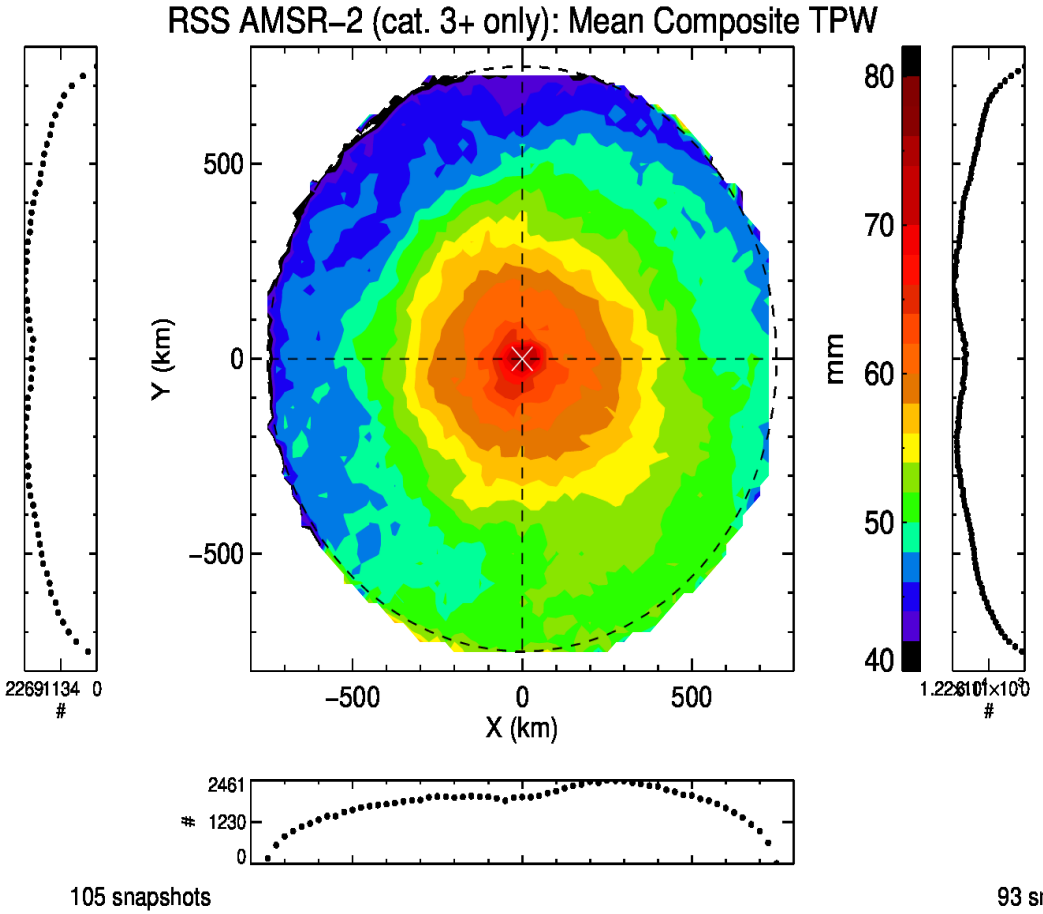
- Overall mean TPW field within category 1 and 2 hurricanes is larger in NOAA product than RSS product
- In RSS product highest TPW values are produced within storm center while in NOAA product highest values are concentrated more on the west side of the storm

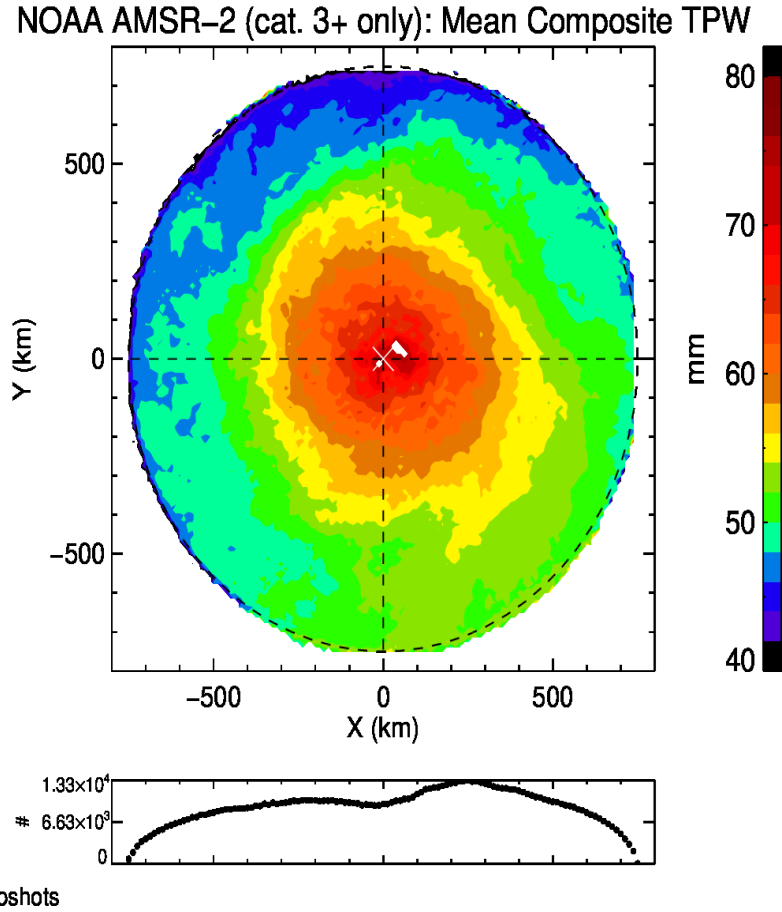




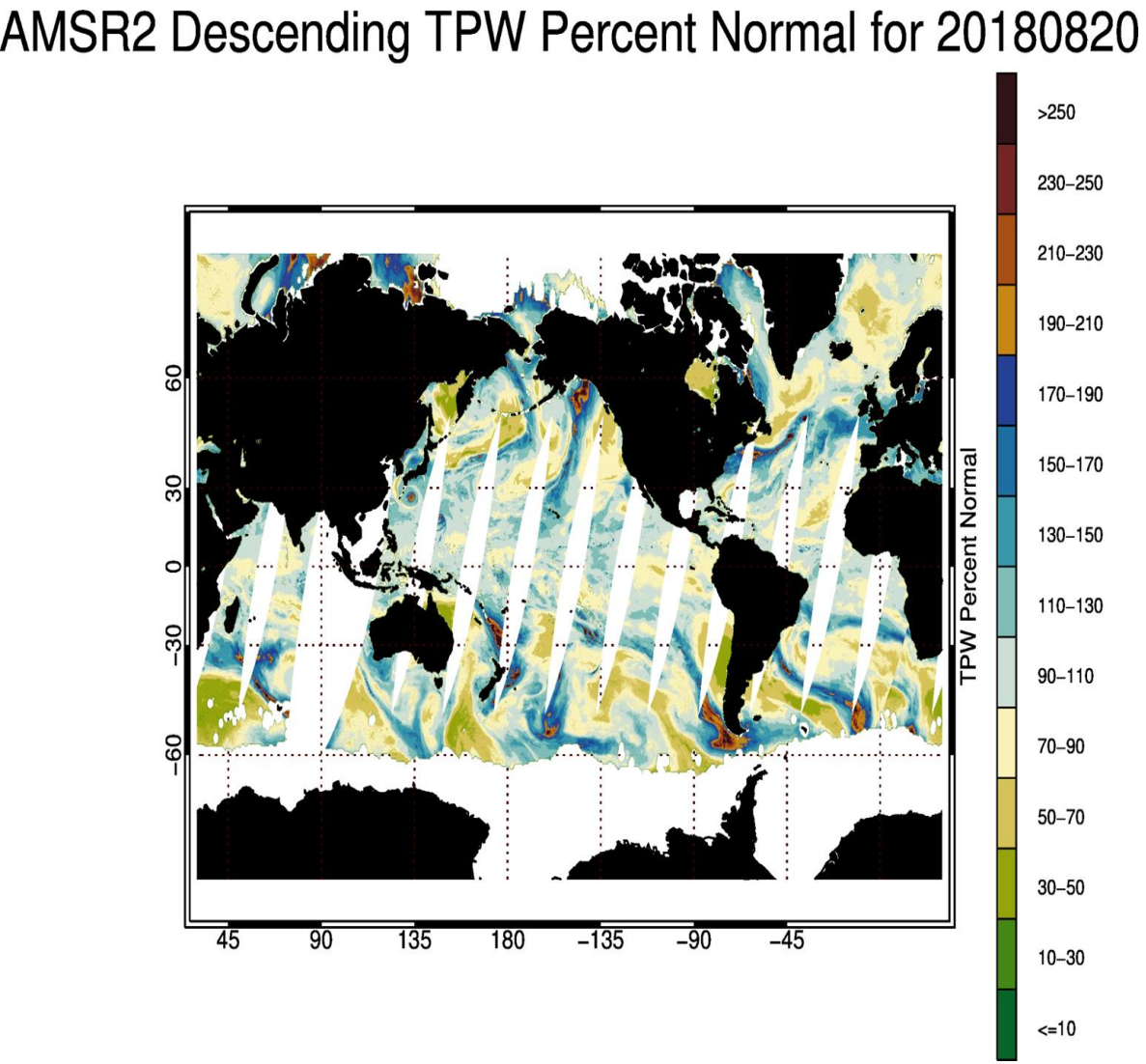
Mean TPW Composites – Atlantic Major Hurricanes

- Both NOAA and RSS products depicting double radius maxima TPW within major hurricanes however NOAA product is placing secondary maxima between 150-200km from the storm center while RSS product extends it up to 50-75km
- NOAA product is showing asymmetric nature of TPW field within first maxima while RSS product is not capable of resolving it





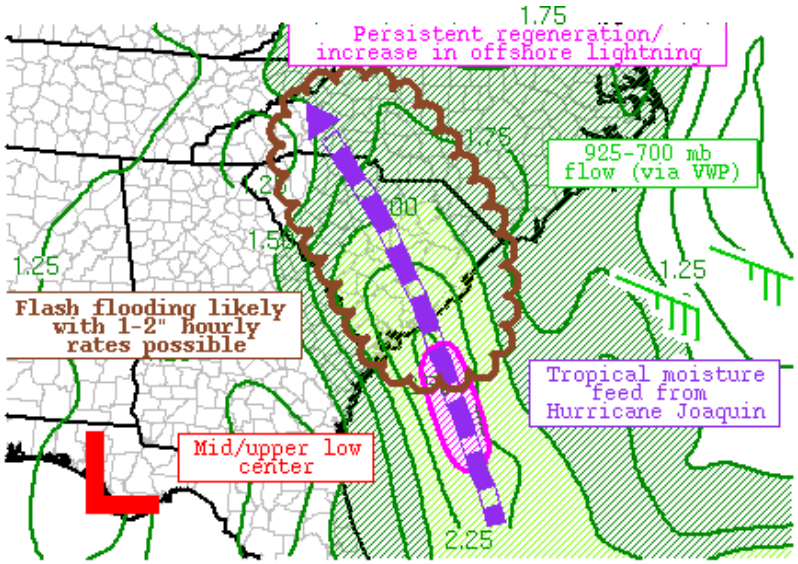
New Product
TPW Percent Normal



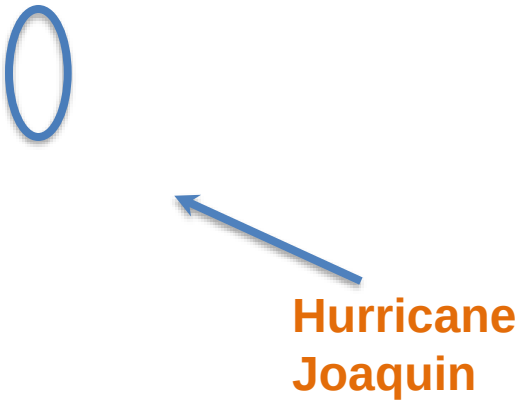
- Percent normal compared to NVAP-M daily climatology
- Very high percentage values (200% or more) indicate a strong flooding potential or a possible severe weather indicator, while low values indicate potential fire hazards.

Anomalous TPW Example: South Carolina Flooding Event Oct 3rd, 2015

Ferraro, R., et.al.,"Application of GCOM-W AMSR2 and S-NPP ATMS Hydrological Products to a Flooding Event in the United States" IEEE J-STARS, vol. 10, no. 9, pp. 3384-3891, Sept. 2017, DOI: 10.1109/JSTAR.2017.2696304



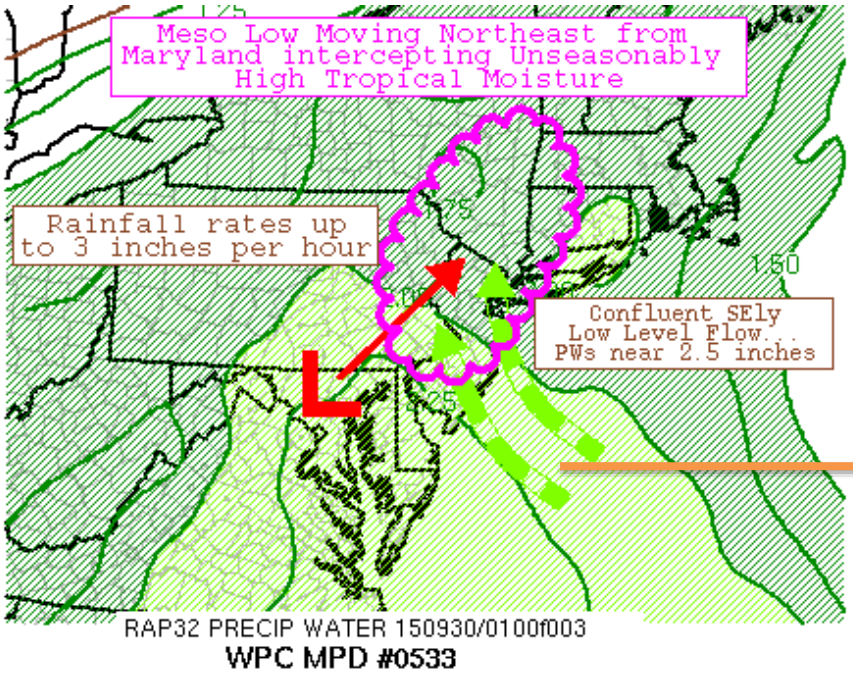
RAP32 PRECIP WATER 151003/0600f003
WPC MPD #0545



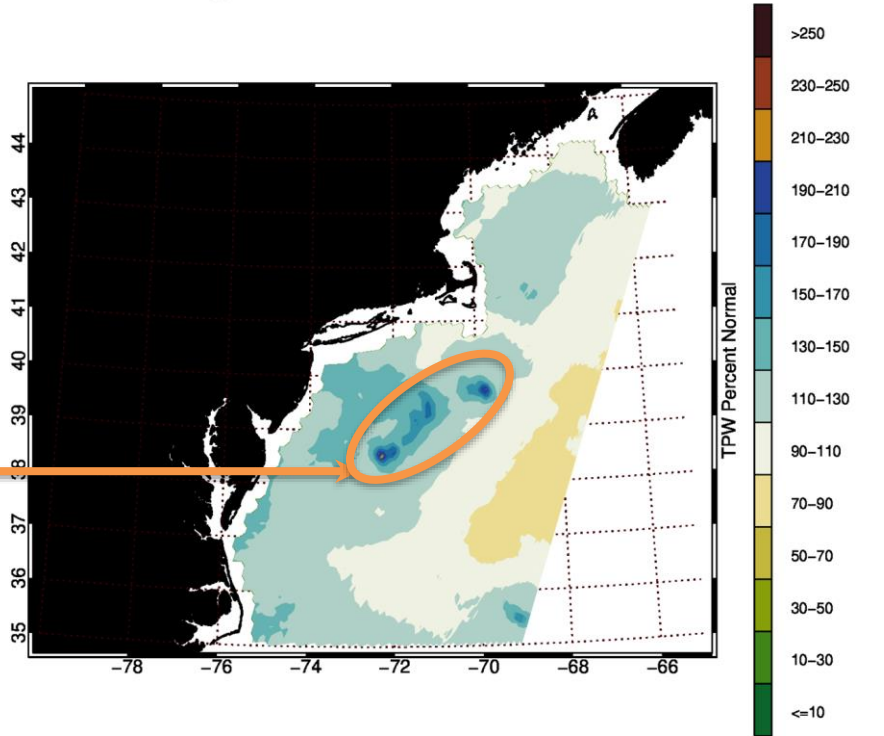
DISCUSSION...WATER VAPOR IMAGERY EARLY THIS MORNING SHOWED AN UPPER LOW CIRCULATING OVER THE FL PANHANDLE WITH A BROAD RIDGE EXTENDING ACROSS THE WESTERN ATLANTIC. THESE **COMBINED CIRCULATIONS HAVE HELPED CHANNEL A NARROW PLUME OF MOISTURE FROM THE VICINITY OF HURRICANE JOAQUIN** AND EXTENDING NORTHWESTWARD INTO THE SOUTHEASTERN U.S. THE BLENDED-TPW PRODUCT SUGGESTED THE EXTENT OF THE 2" **PWAT WITHIN THE TROPICAL MOISTURE PLUME WAS APPROXIMATELY 175 MILES**.

Unseasonably High Tropical Moisture Bringing Floods to East Coast, Sep 30th, 2015

DISCUSSION...SFC/RADAR IMAGERY SHOWS A WELL DEFINED MESO LOW CIRCULATION OVER NORTHERN MARYLAND RIDING NORTHEASTWARD ALONG RIBBON OF WEAK INSTABILITY TOWARD SOUTHEAST PENNSYLVANIA. SATELLITE IMAGERY CONTINUES TO SHOW FAIRLY COLD TOP CONVECTION WITH AND TO THE NORTHEAST OF THIS SYSTEM. **THE LOW ITSELF IS HELPING PROVIDE INCREASING MOISTURE CONFLUENCE/LIFT IN AN OTHERWISE IMPRESSIVE TROPICAL MOISTURE REGIME WELL IN ADVANCE OF A SYNOPTIC COLD FRONT** ACROSS THE OH VALLEY. SATELLITE AND GPS PWS NDICATE PWS AS HIGH AS 2.5 INCHES EAST OF THE LOW CIRCULATION AND THE COMBINATION OF THE VERY HIGH MOISTURE...TALL SKINNY CAPES...AND ENHANCED CONVERGENCE WITH THE LOW WILL CONTINUE TO LEAD TO SOME VERY IMPRESSIVE LOCALIZED HEAVY RAINFALL RATES.



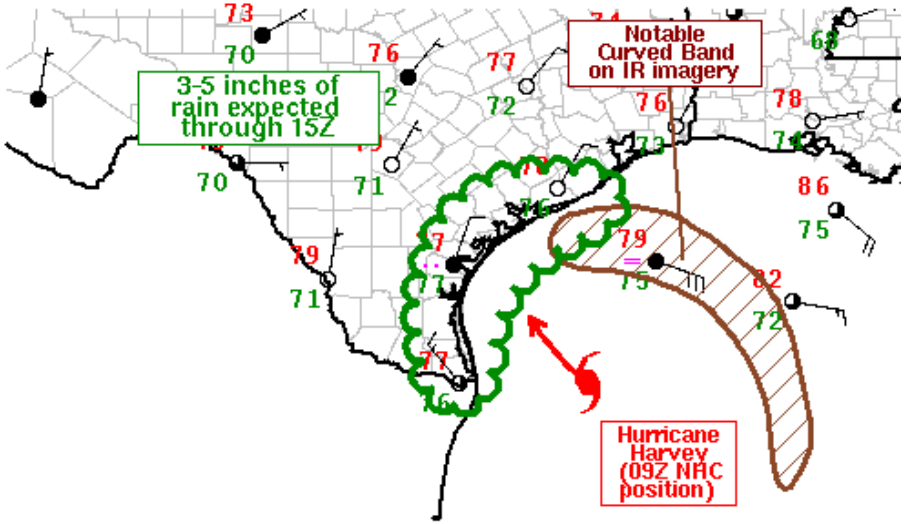
AMSR2 Descending TPW Percent Normal for 20150929



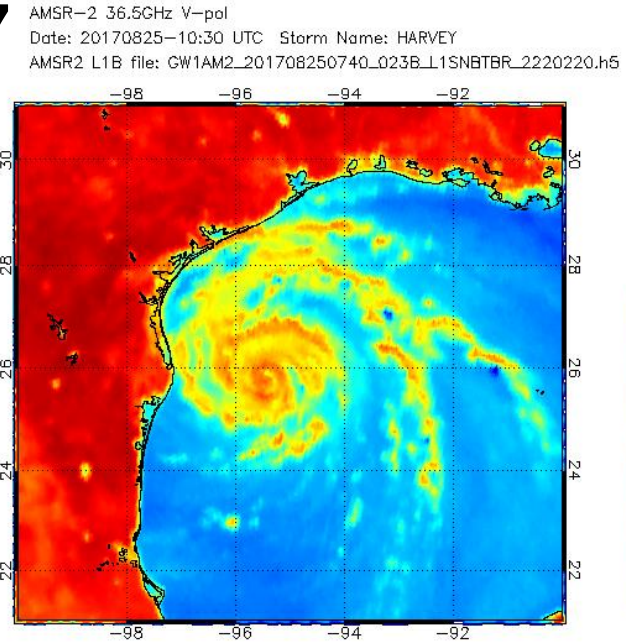
Hurricane Harvey Aug 25th, 2017

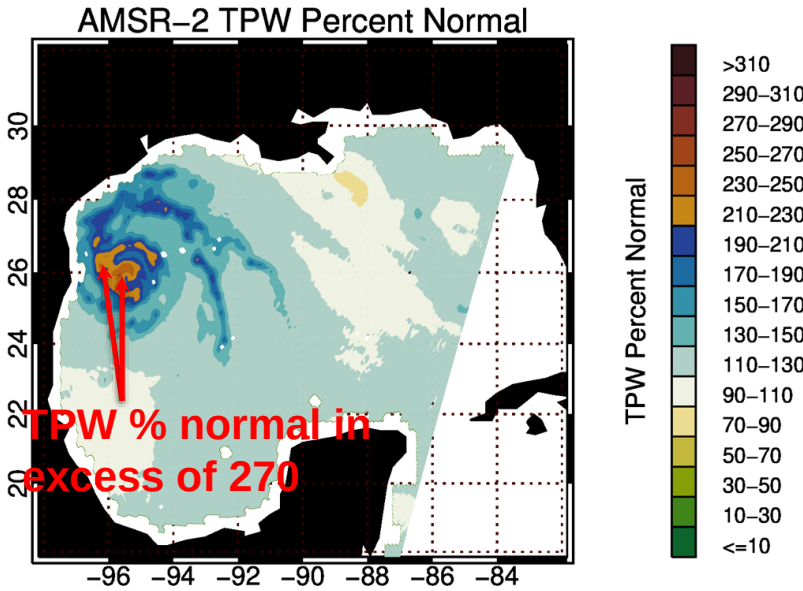
DISCUSSION...HURRICANE HARVEY CONTINUES MOVING NORTHWEST AT 10 MPH PER THE LATEST NHC ADVISORY. **THE SYSTEM HAS RECENTLY EXHIBITED A DOUBLE EYEWALL STRUCTURE WITH THIRD NEARBY INNER SPIRAL BANDEVIDENT**, AND THE LEADING EDGE OF ITS CDO LIES WITHIN AN HOUR OF THE COAST. **PRECIPITABLE WATER VALUES ARE ~2.5" PER RECENT GPS DATA**.

SHOULD THE SYSTEM NOT COMPLETE ITS EYEWALL REPLACEMENT CYCLE, THE OUTERMOST EYEWALL COULD REACH THE COAST AT THE END OF THE MPD HORIZON. HOURLY RAIN **TOTALS UP TO 3" WITH LOCAL AMOUNTS UP TO 6" ARE EXPECTED. THIS SHOULD LEAD TO FLASH FLOODING**, PARTICULARLY WITHIN URBAN AREAS.

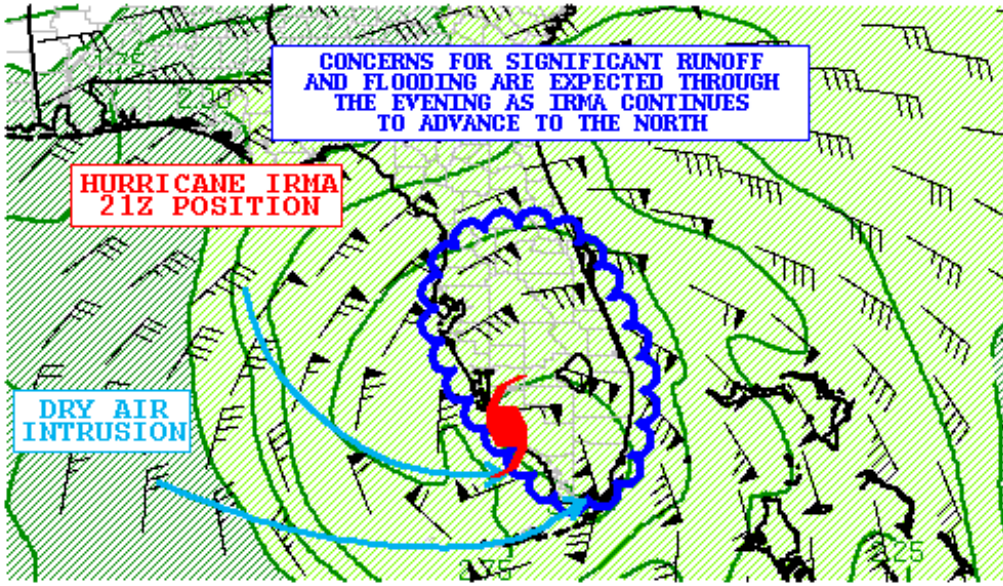


METAR 170825/0900
WPC MPD #0722





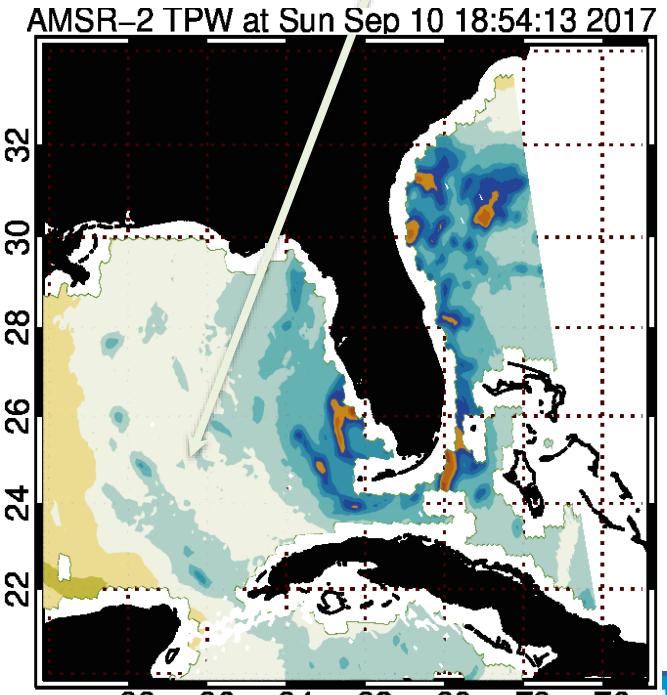
Hurricane Irma
Sep 10-11th, 2017

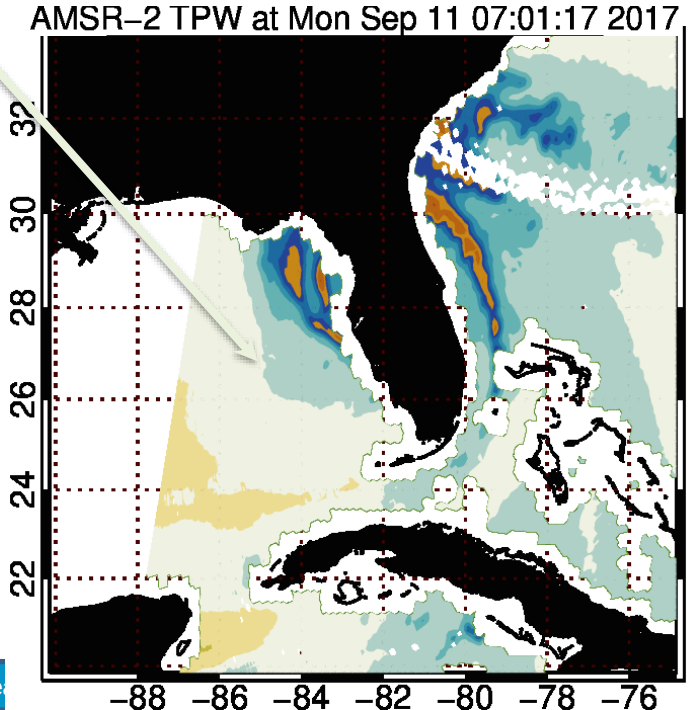


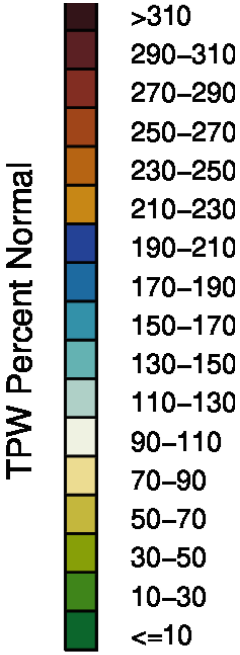
LATEST SPC/RAP MESOANALYSIS INDICATES PWAT VALUES OF 2.7-2.9 IN... LOW-LEVEL WATER

VAPOR IMAGERY SHOW VERY DRY AIR WRAPPING AROUND THE WESTERN SIDE OF IRMA, BUT AT THIS TIME THE DRY AIR IS **FAILING TO SIGNIFICANTLY PENETRATE THE STORM'S CORE, KEEPING PWATS HIGH.**

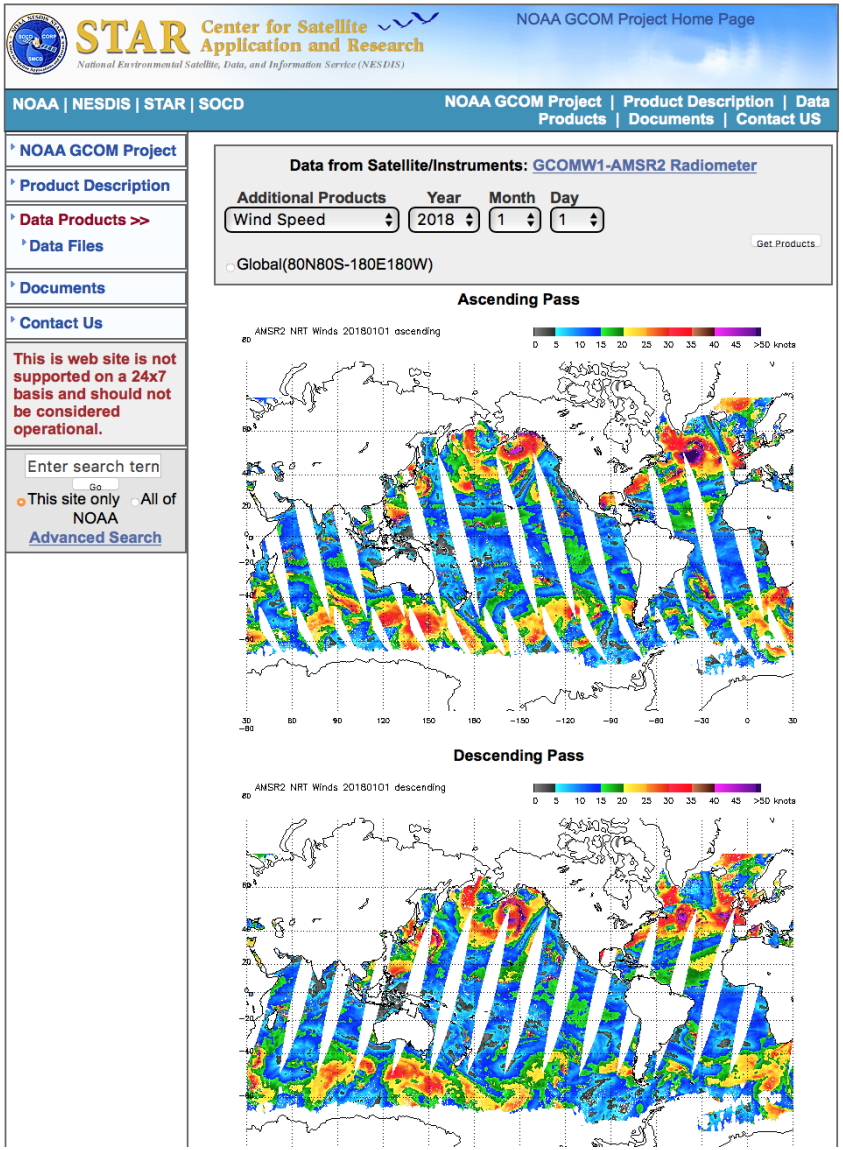
RAP32 PRECIP WATER 170910/2100f000
RAP32 850 MB WINDS 170910/2100f000
WPC MPD #0800



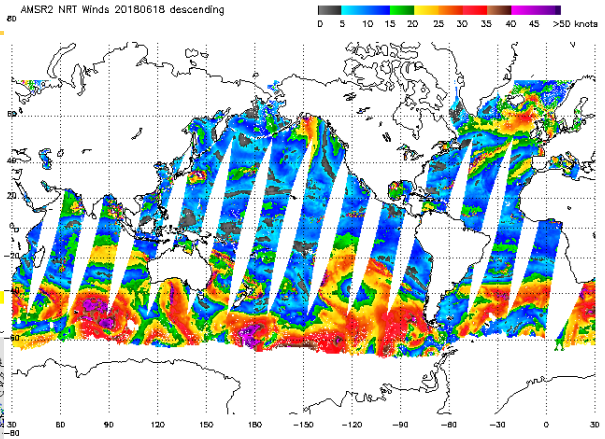


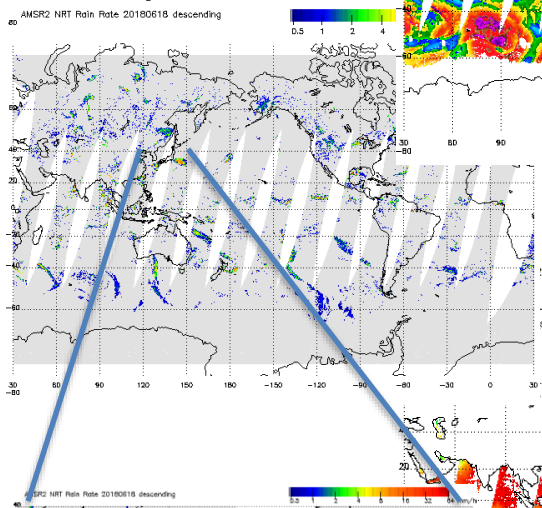


STAR AMSR-2 Product Monitoring and Data Portal

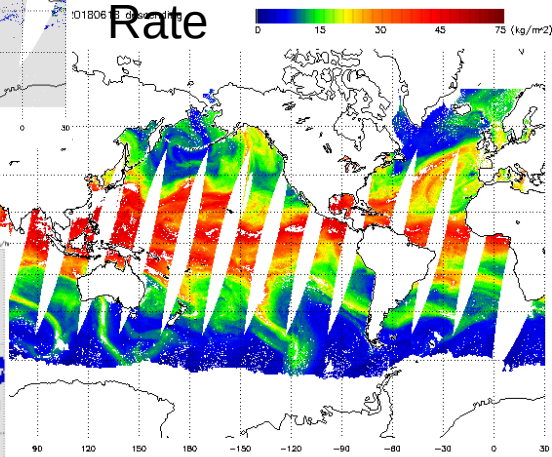


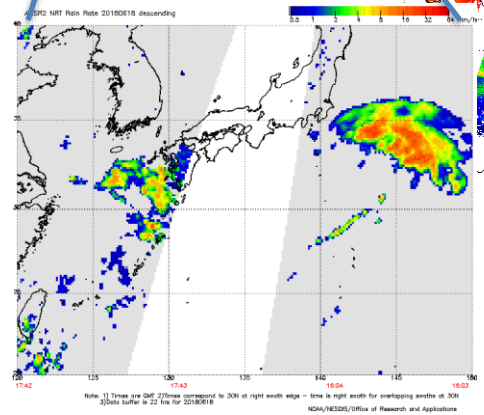
Wind Speed





Rain Rate



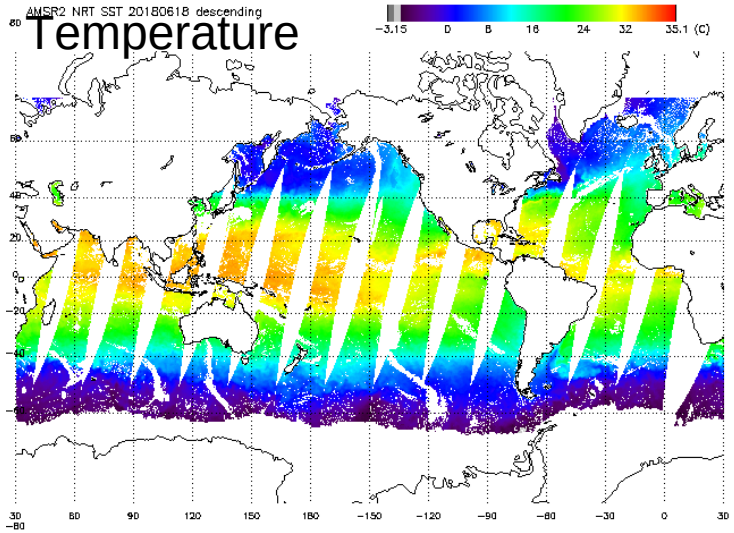


Total Precipitable Water

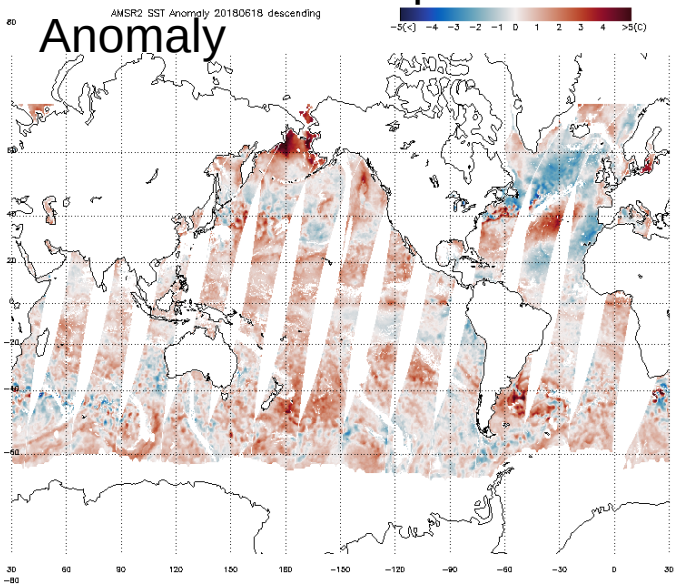
https://manati.star.nesdis.noaa.gov/gcom

STAR AMSR-2 Product Monitoring and Data Portal

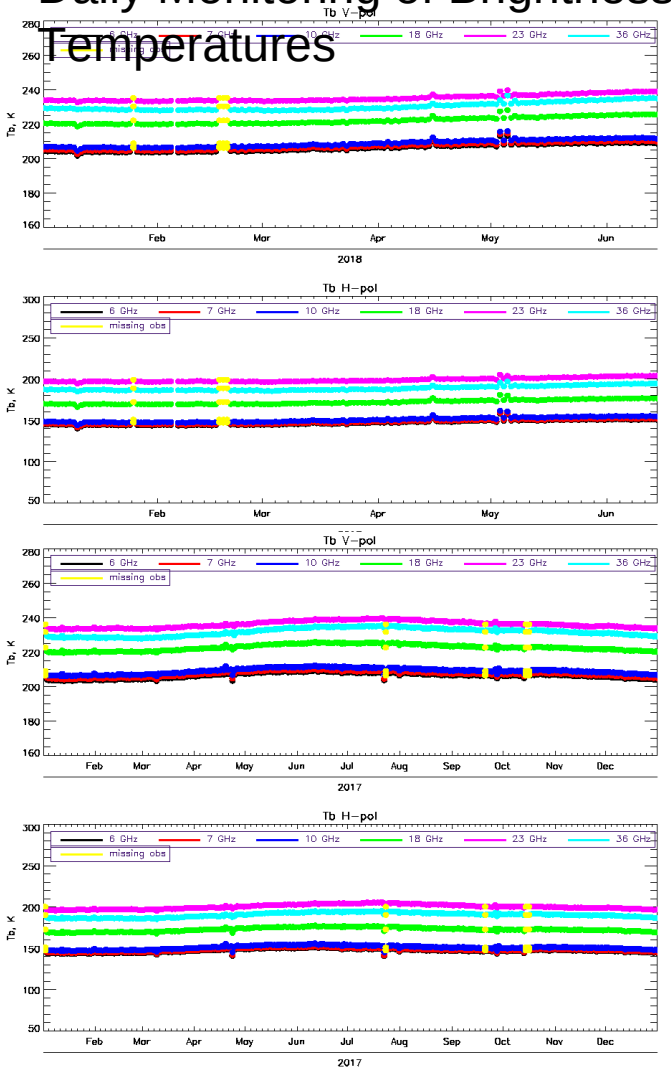
Sea Surface Temperature



Sea Surface Temperature Anomaly



Daily Monitoring of Brightness Temperatures



2018

2017

Thank You