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**Center for Satellite
Applications and Research**

formerly ORA — Office of Research and Applications



Harvey and IRMA): A View from NUCAPS and MiRS

Tony Reale

Bomin Sun, Mike Pettey and Ryan Smith

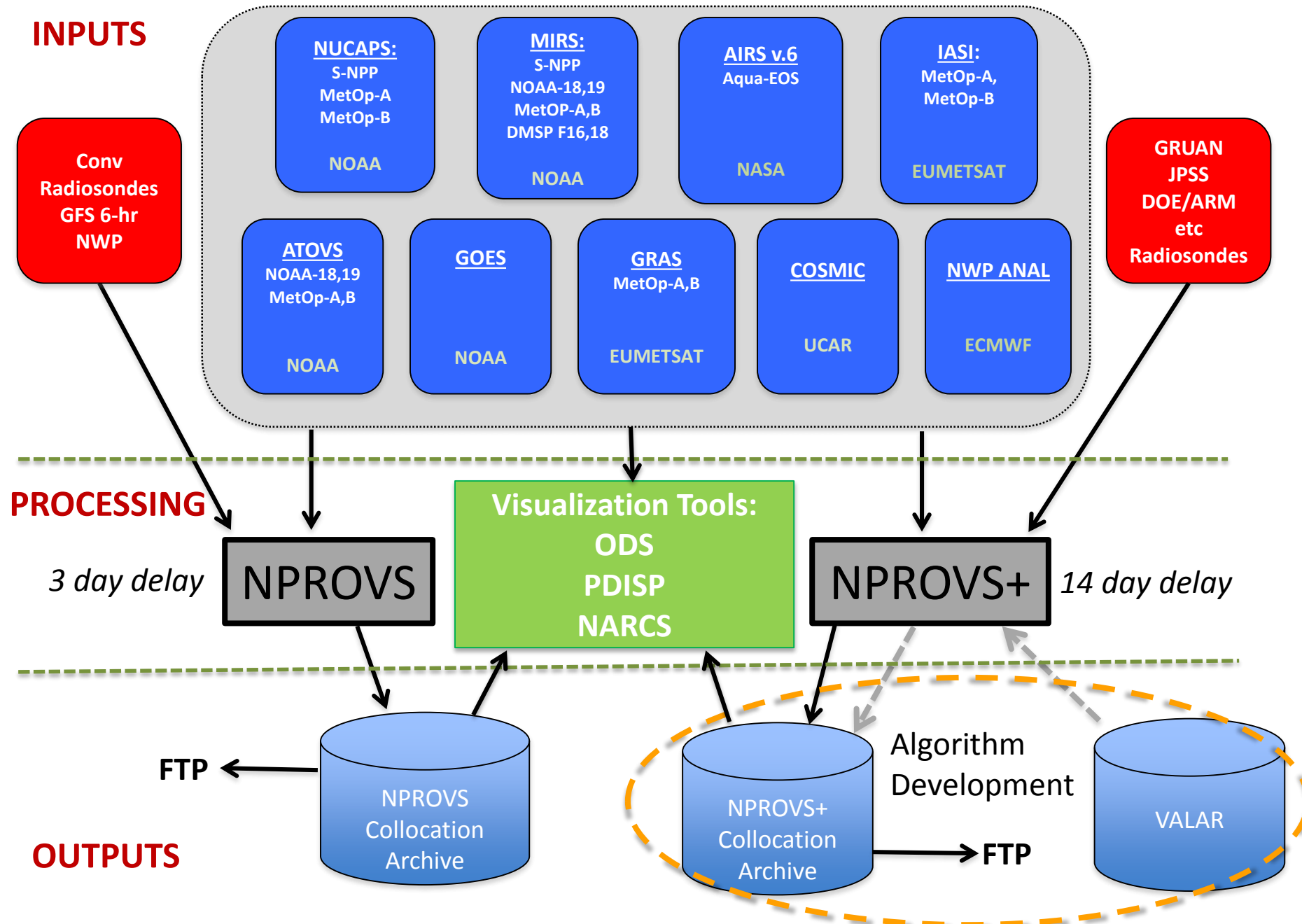
9/11/2017



NPROVS and NPROVS+

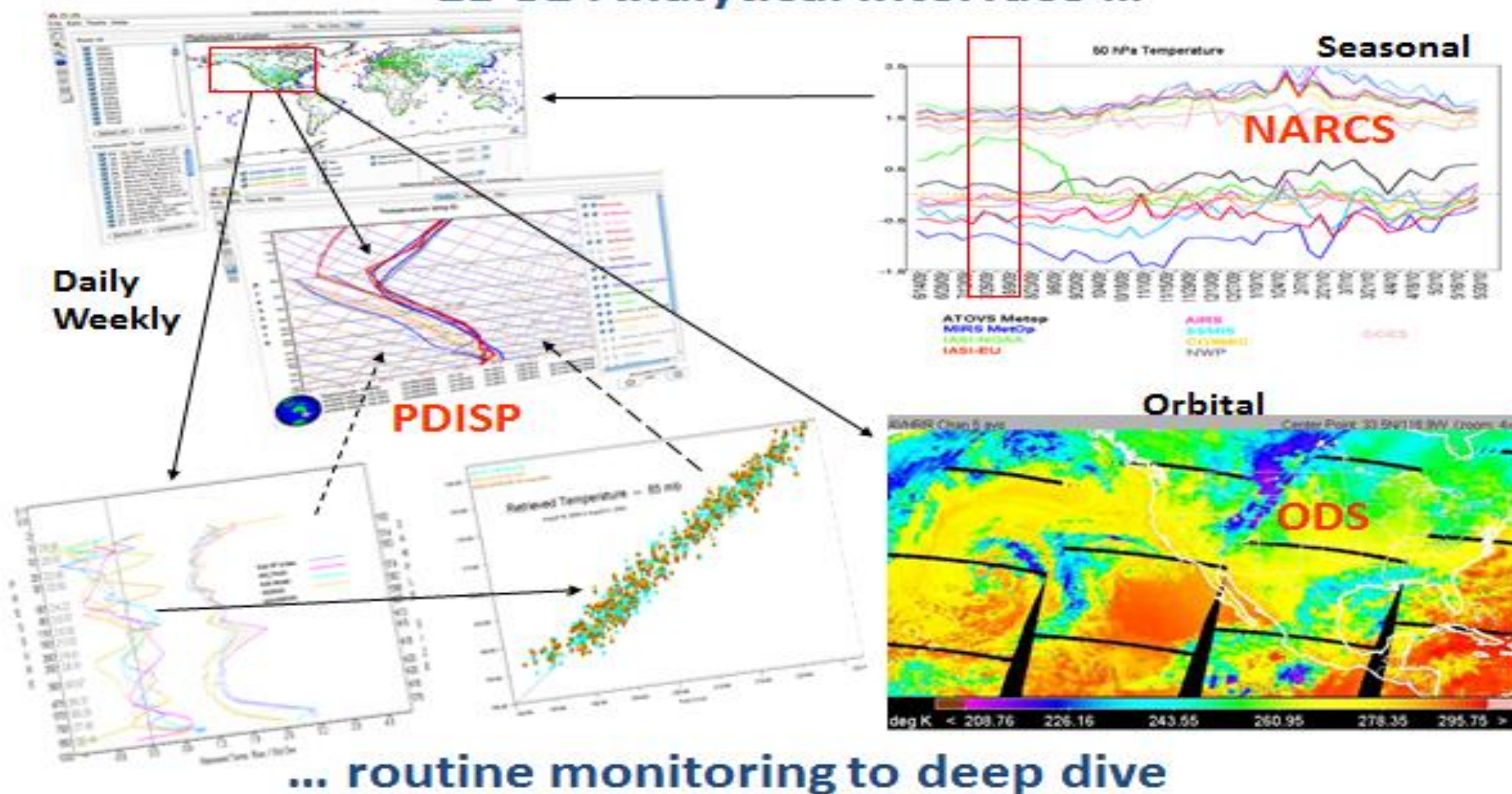
(Enterprise Validation)

NPROVS/NPROVS+ Data Management Schematic



NPROVS Graphical Analysis Tools

EDGE Analytical Interface ...





NPROVS Assessment of NUCAPS

Time-line for NUCAPS “FSR” Staged Upgrades in Parallel Test:

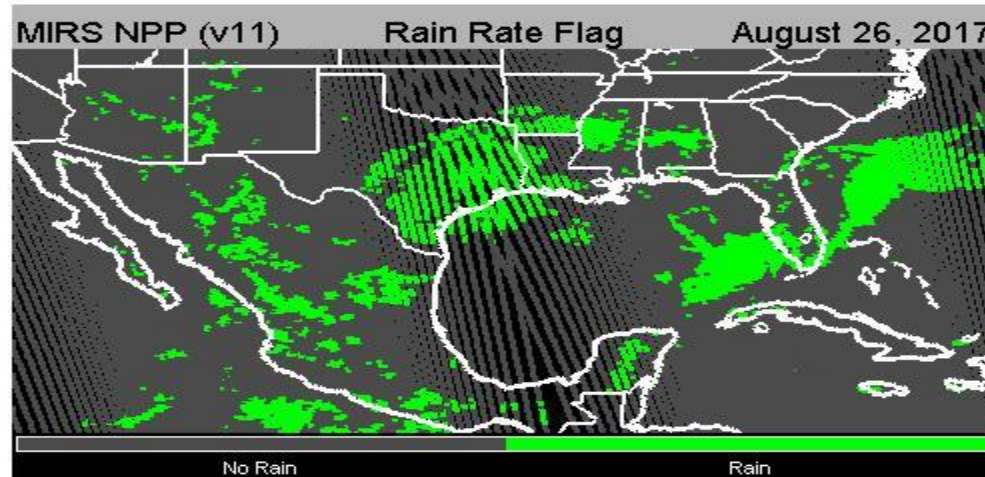
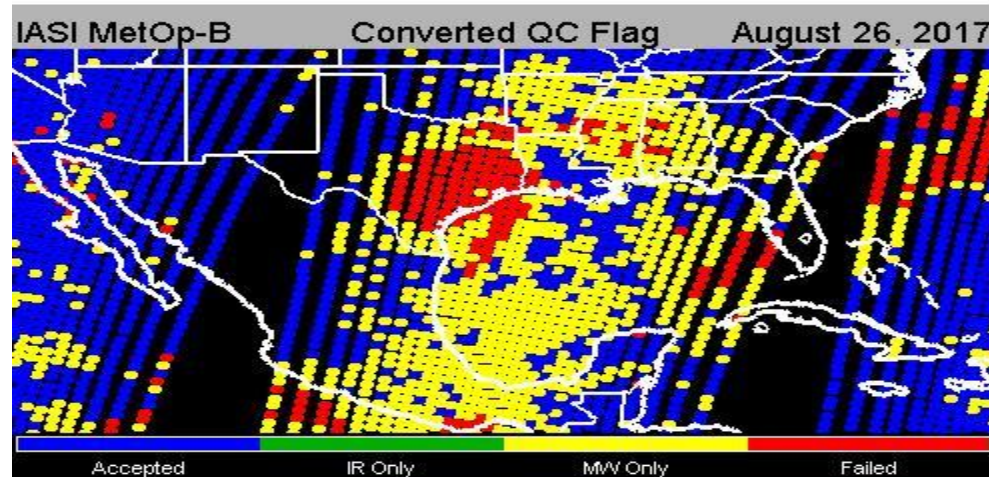
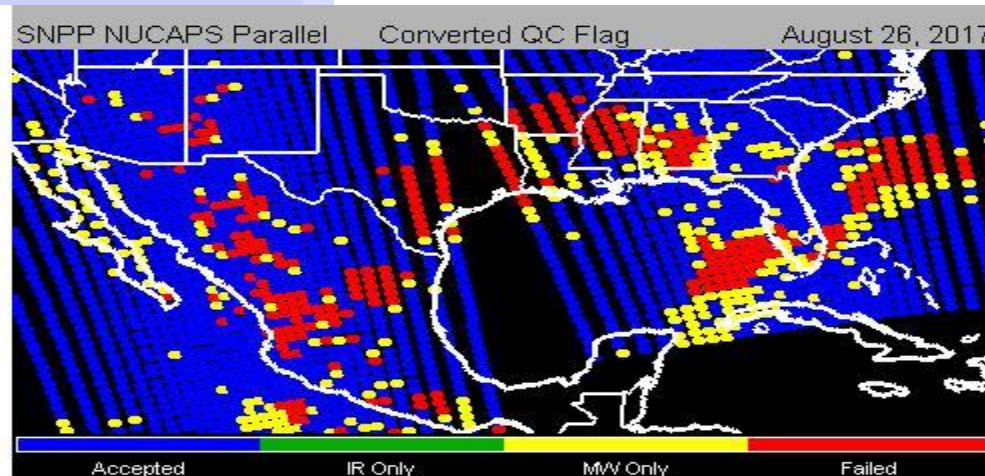
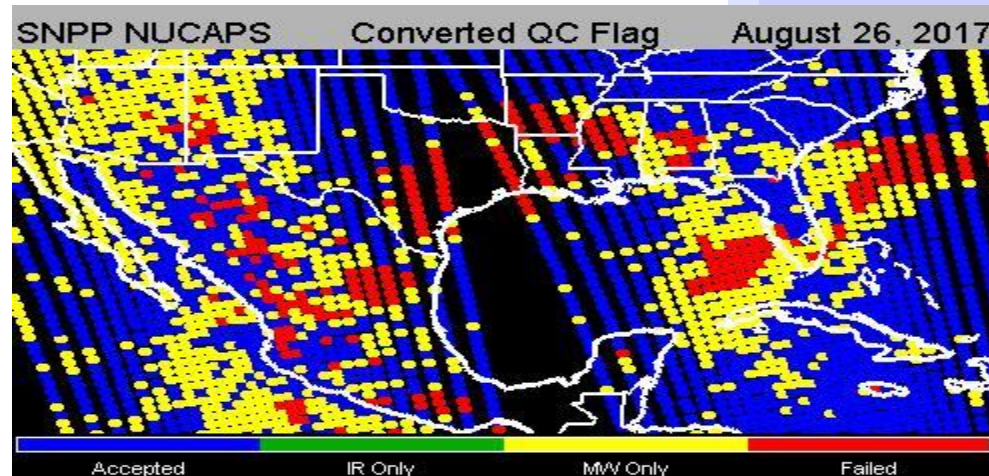
v1.9.3	up to March 3	
v2.0.1	March 3-13	<i>all-sky for MIT</i>
v2.0.2	March 13-17	<i>all-sky for MIT</i>
v2.0.4	March 17-30	IR+MW
v2.0.4.1	March 30	IR-only
v2.0.4	April 21	IR+MW
v2.0.5	May 18	IR+MW new RTA tuning !!
v2.0.5.4	June 22 16Z	IR+WW Block 2 tuning
V2.0.5.?	July 14 19Z	IR-only
v2.1.1DB	Aug 8	IR+MW (7FOV)
v2.1.1	Aug 11	IR+MW
v2.1.1DB	Aug 21	IR+MW (7FOV)
v2.1.2	Aug 22	IR+MW +new CCR ... final for AK

ATMS Block 1-2:

March 8

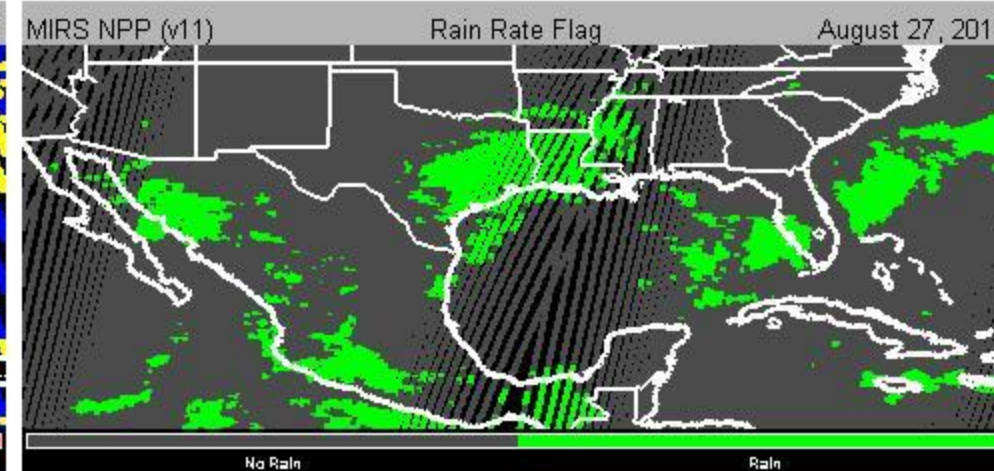
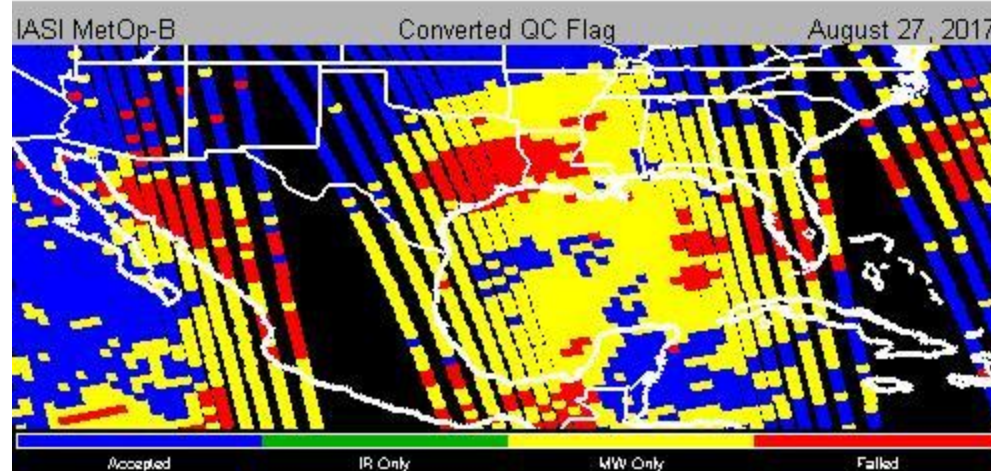
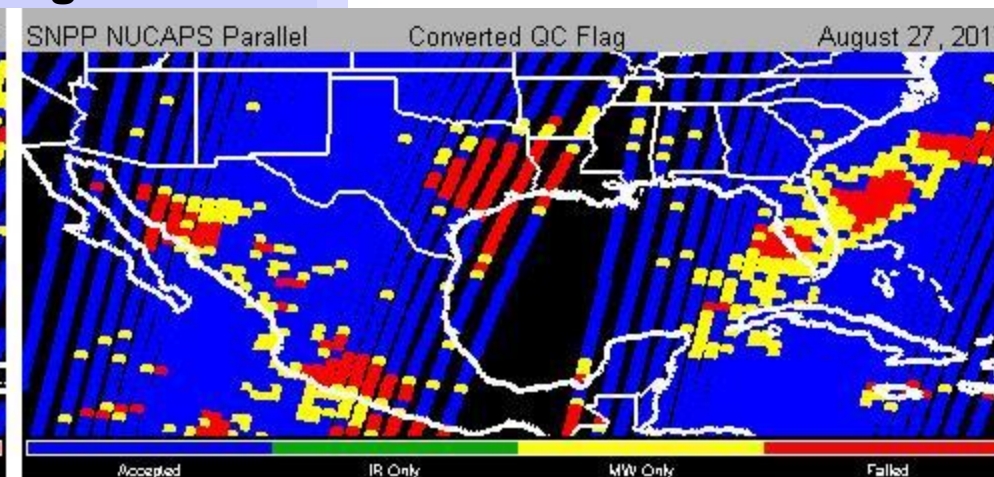
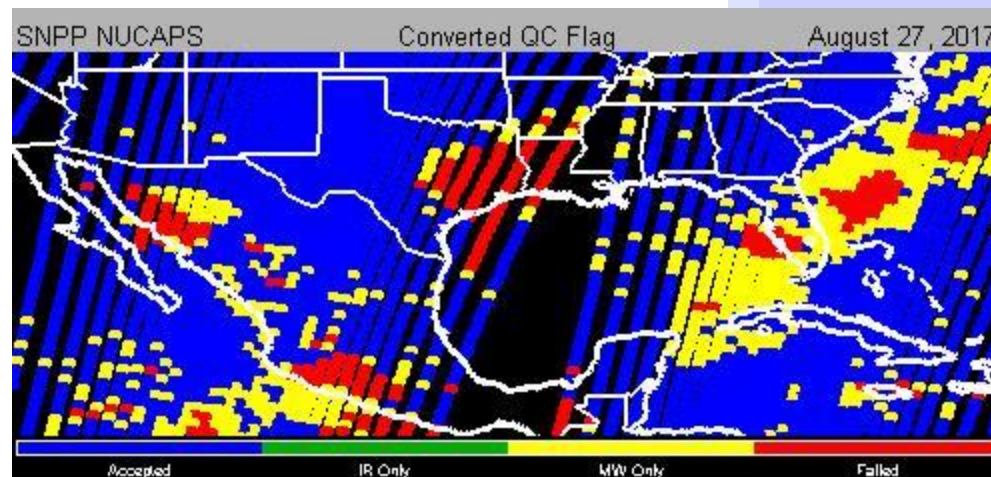


QC flags



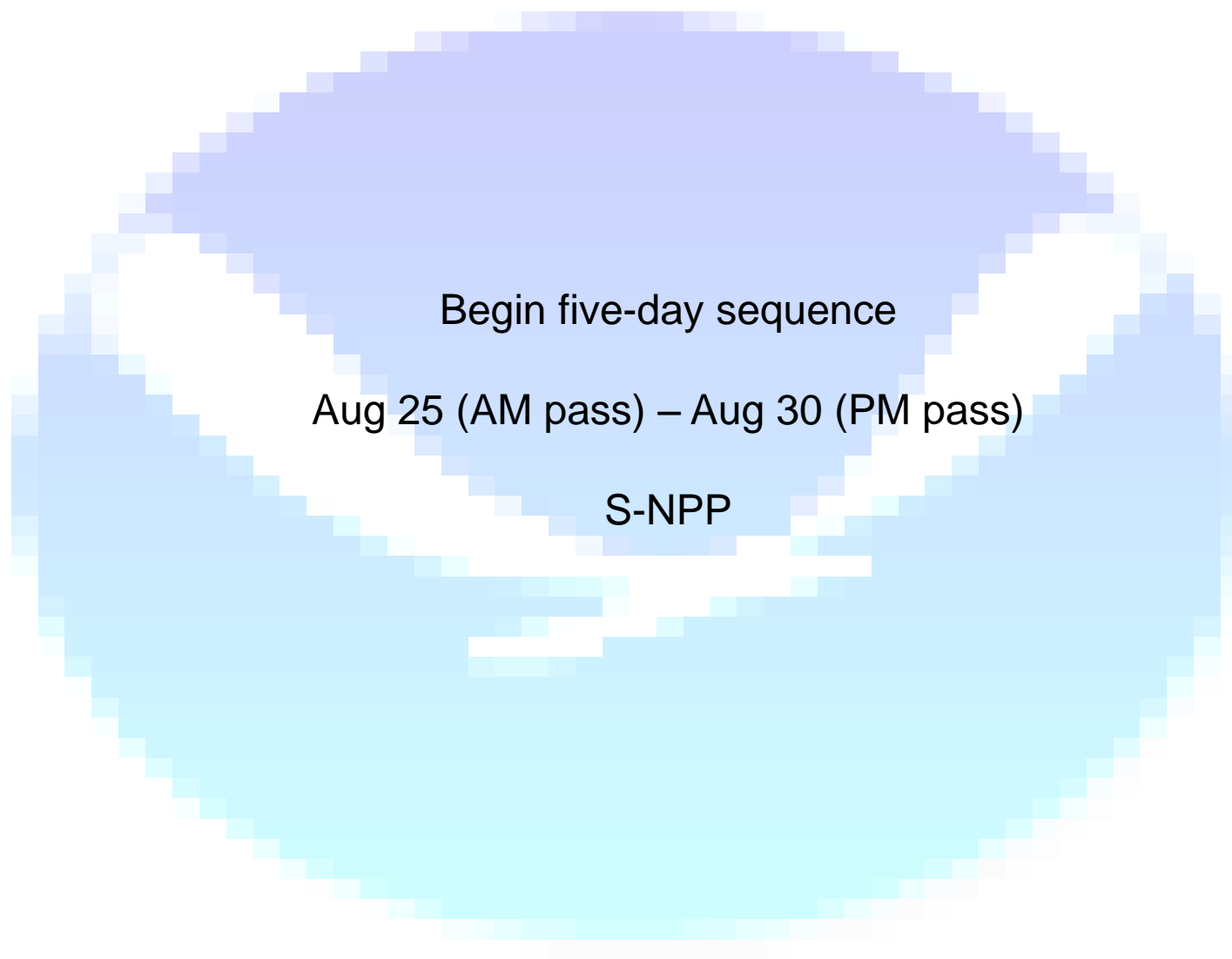
Left to right Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS V11 RAIN Flag, NUCAPS IASI-B

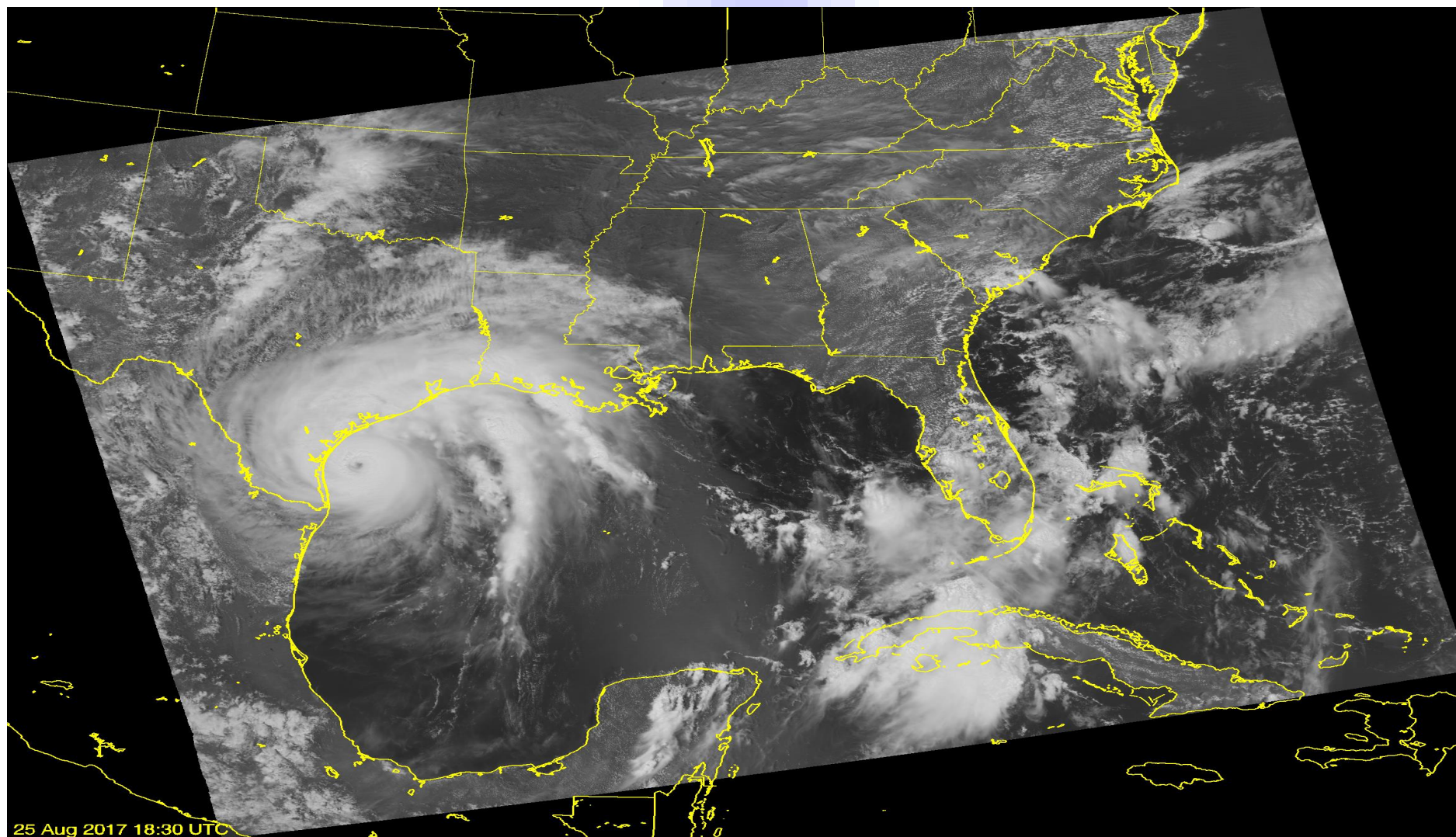
QC flags



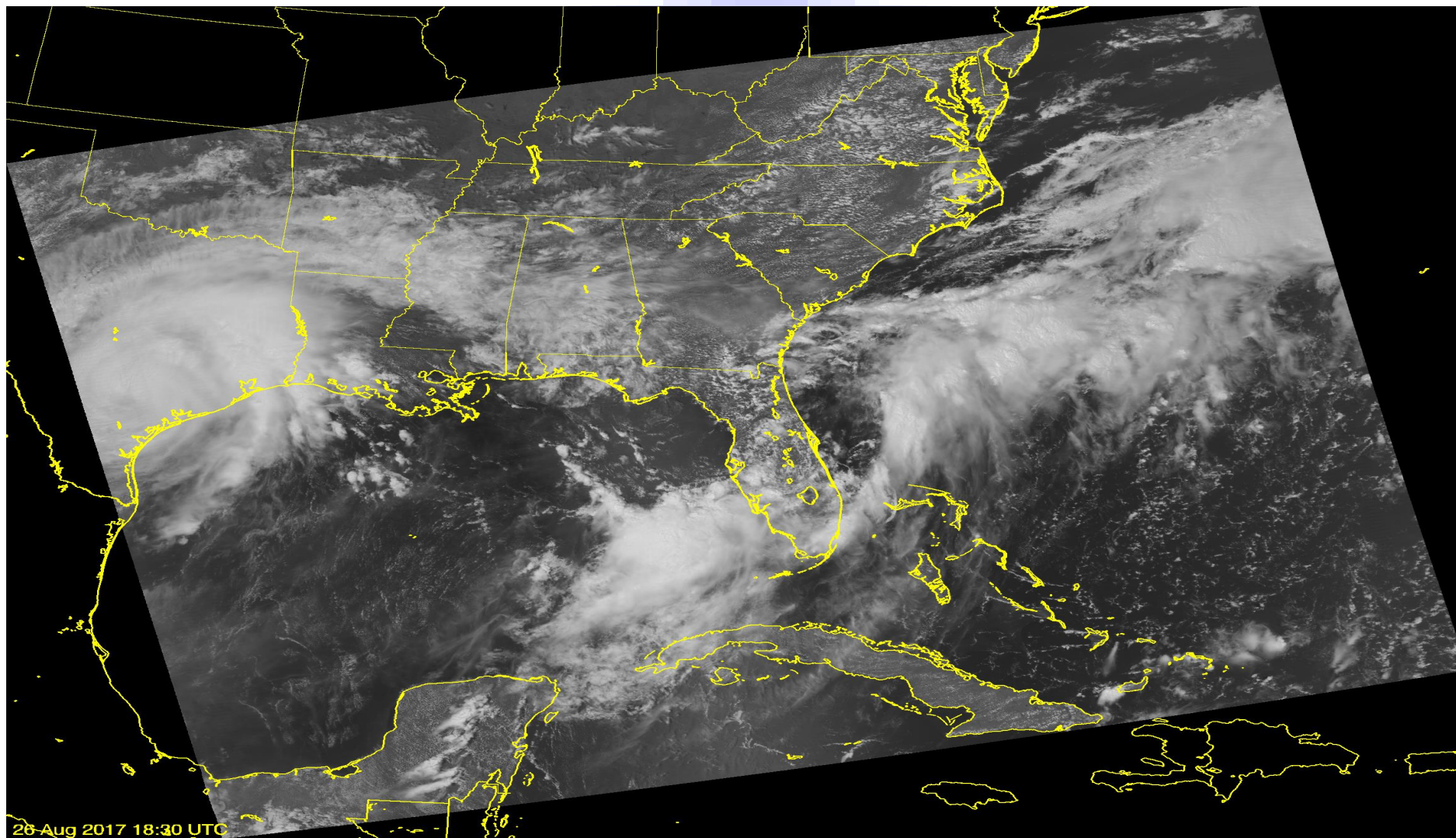
Left to right Clockwise: NUCAPS 1.5, NUCAPS 2.1..2, MiRS V11 RAIN Flag, NUCAPS IASI-B

Sunday Morning Deluge in Houston!



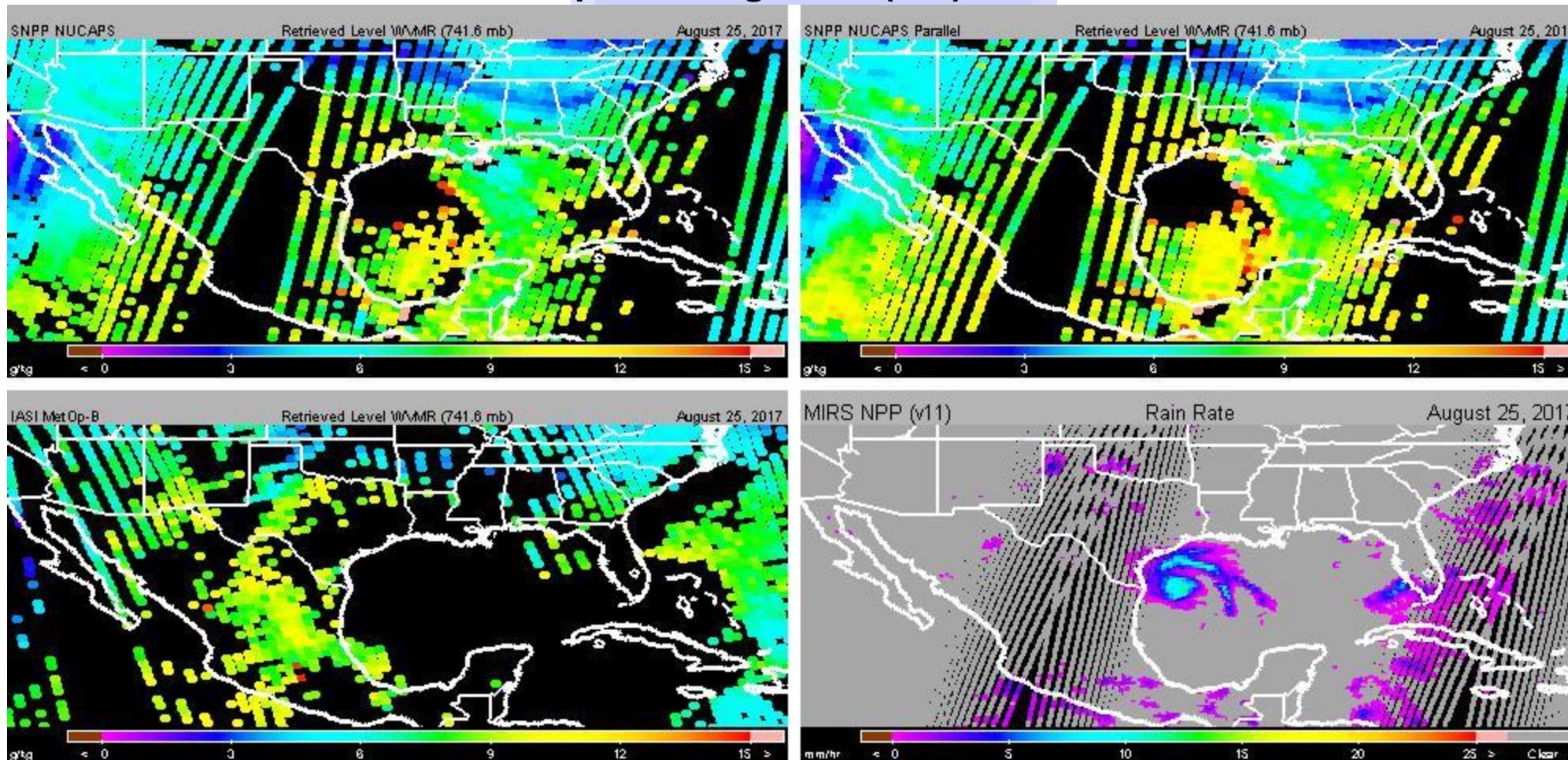


Day/Nite Band VIIRS Imagery



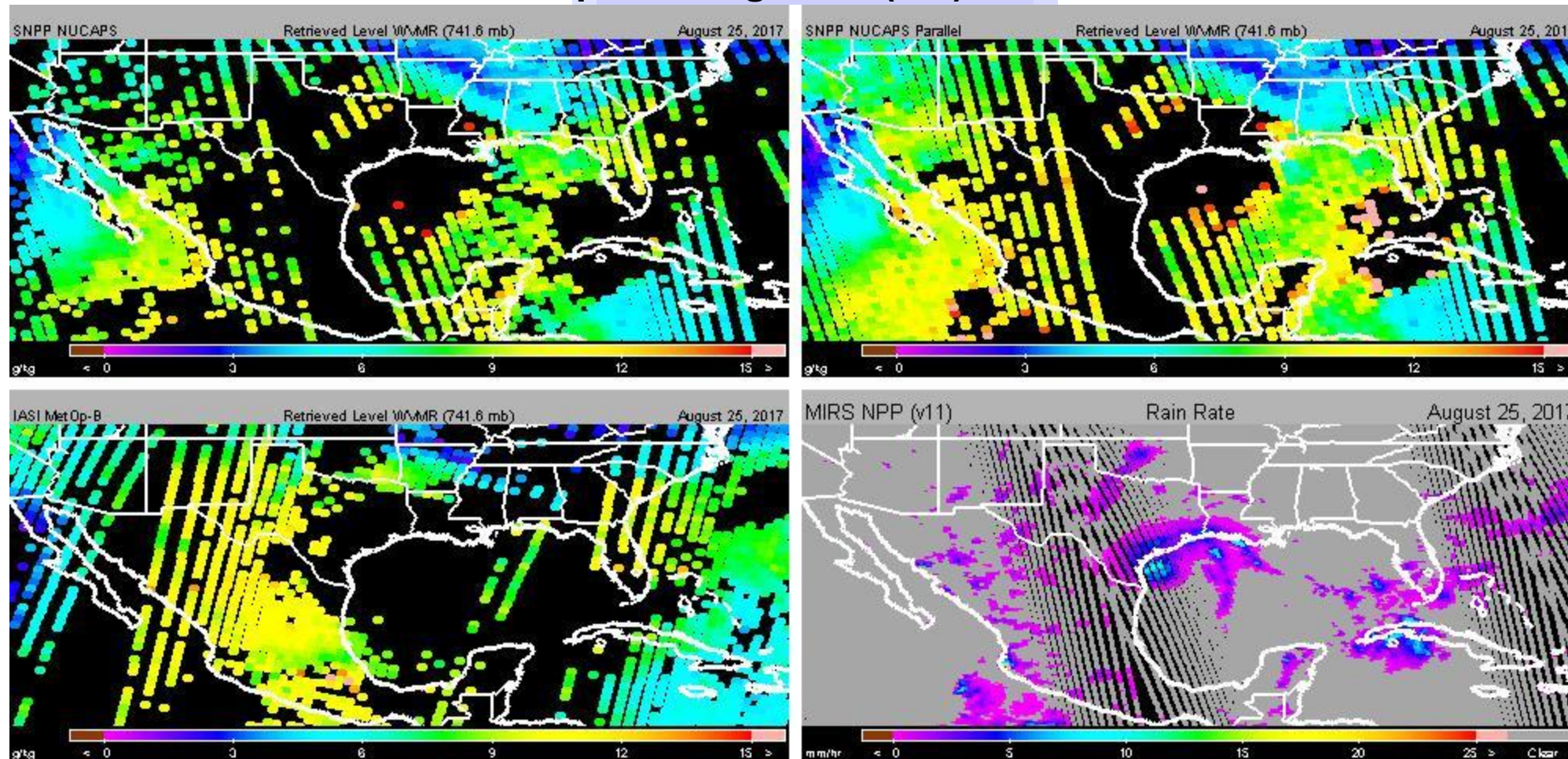
Day/Nite Band VIIRS Imagery

H2O Vapor Mixing Ratio (MR) @ 750 hPa



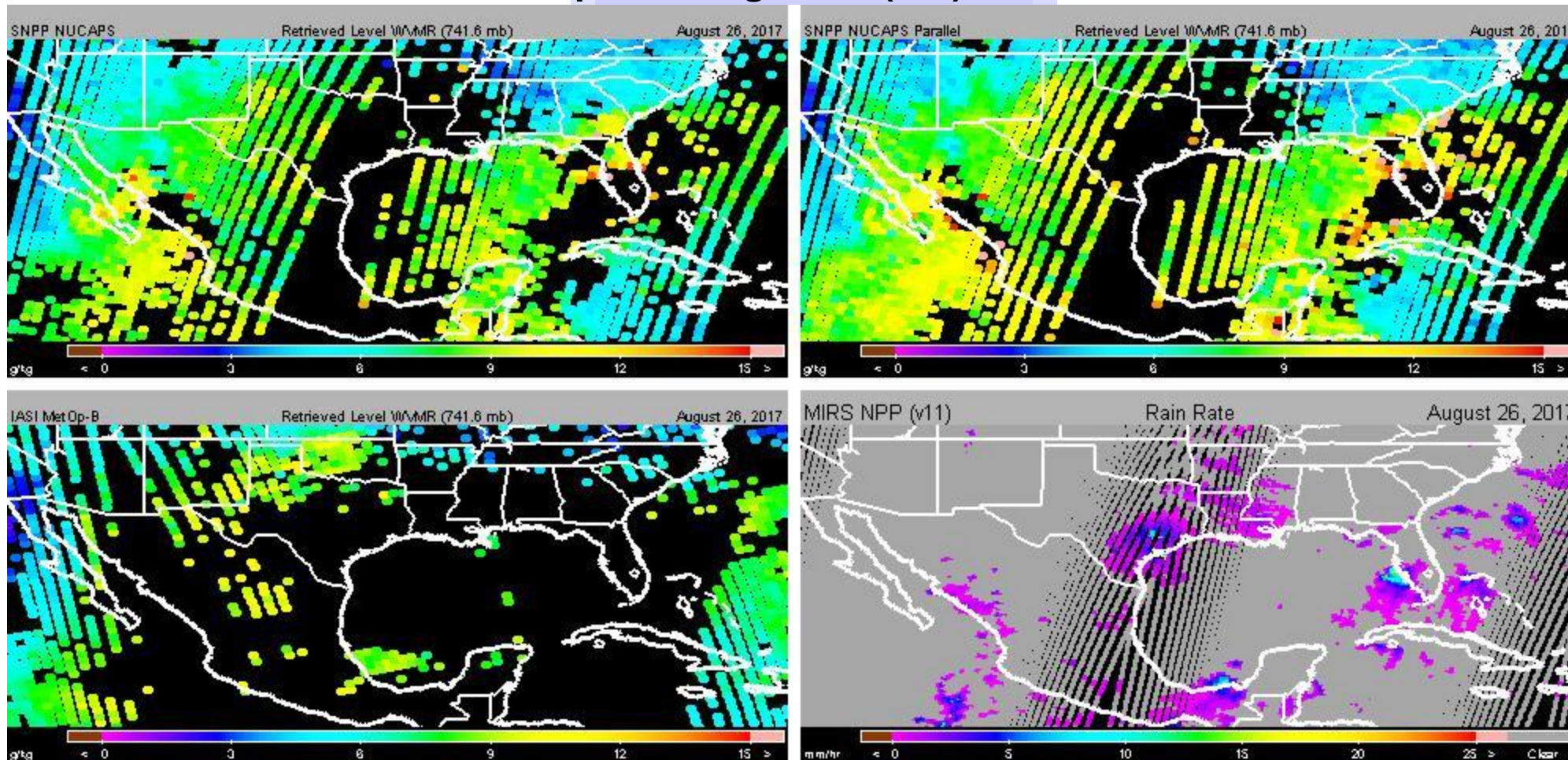
Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS Rain Rate, NUCAPS IASI-B

H2O Vapor Mixing Ratio (MR) @ 750 hPa



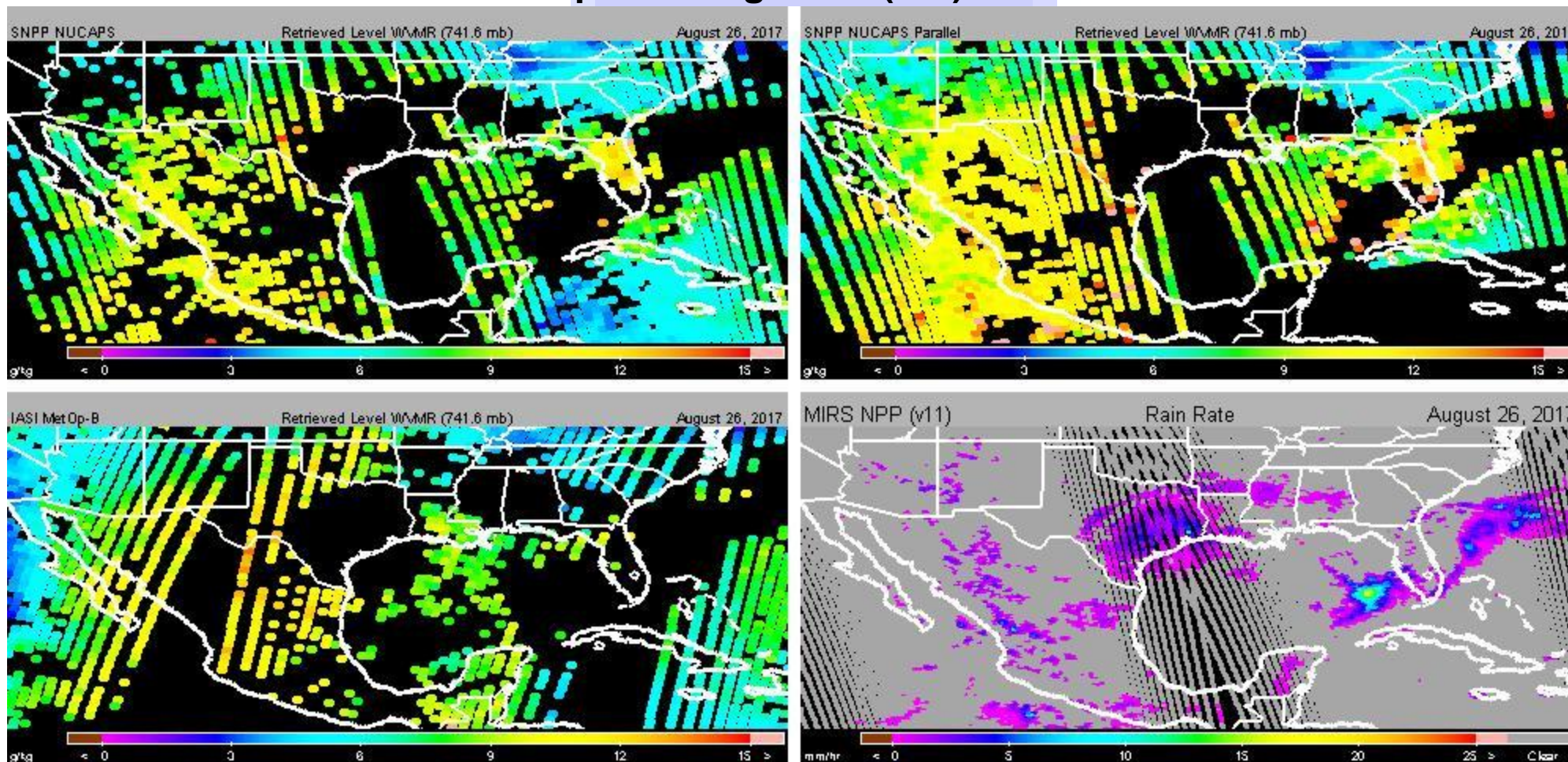
Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS Rain Rate, NUCAPS IASI-B
... Landfall at Corpus Christi

H2O Vapor Mixing Ratio (MR) @ 750 hPa



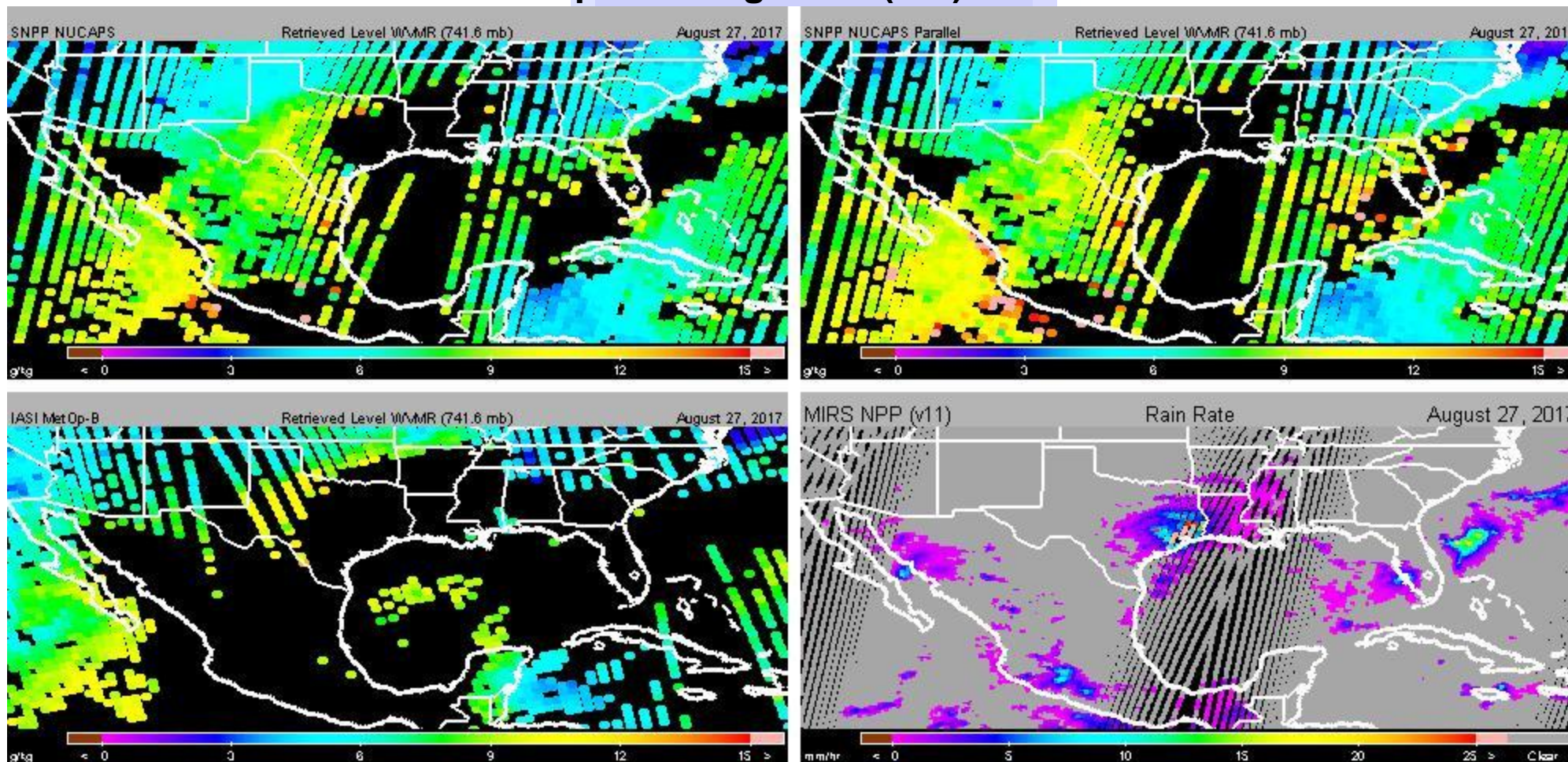
Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS Rain Rate, NUCAPS IASI-B

H2O Vapor Mixing Ratio (MR) @ 750 hPa



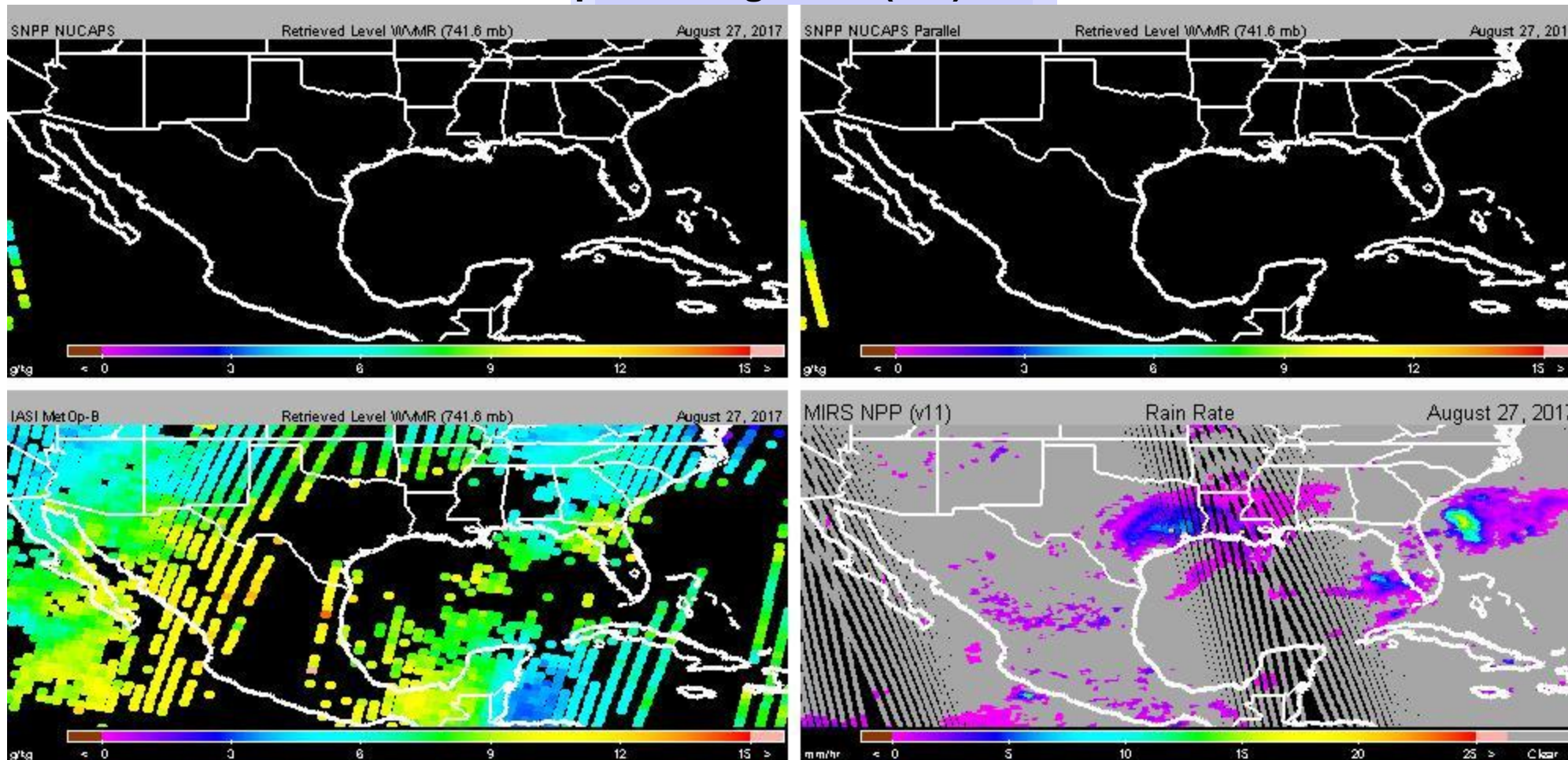
Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS Rain Rate, NUCAPS IASI-B
... moisture advection from west and south toward Harvey / Houston

H₂O Vapor Mixing Ratio (MR) @ 750 hPa



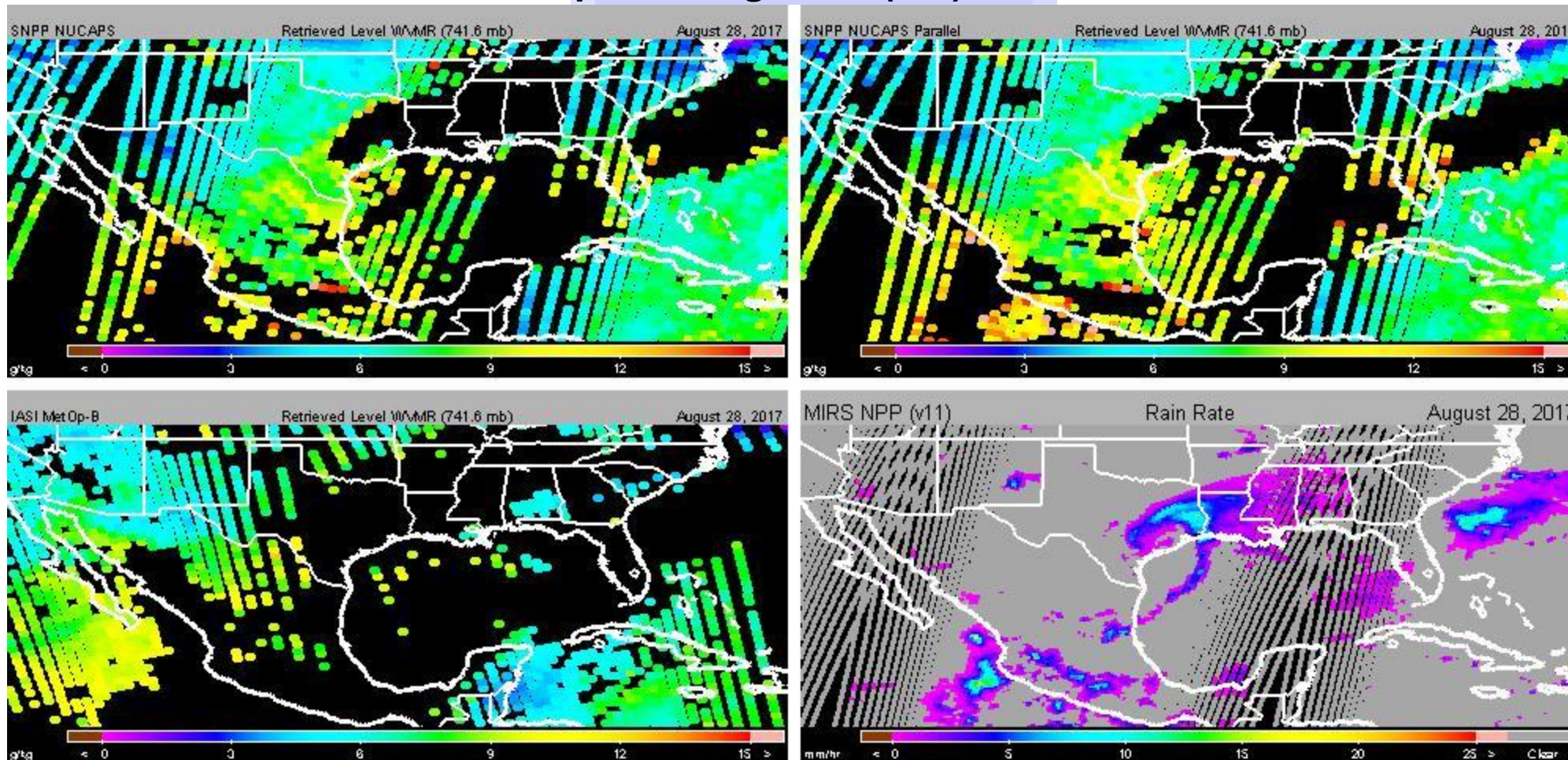
Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS V11 Rain Rate, NUCAPS IASI-B
Heaviest Rainfall in Houston early Sunday morning, August 27

H2O Vapor Mixing Ratio (MR) @ 750 hPa



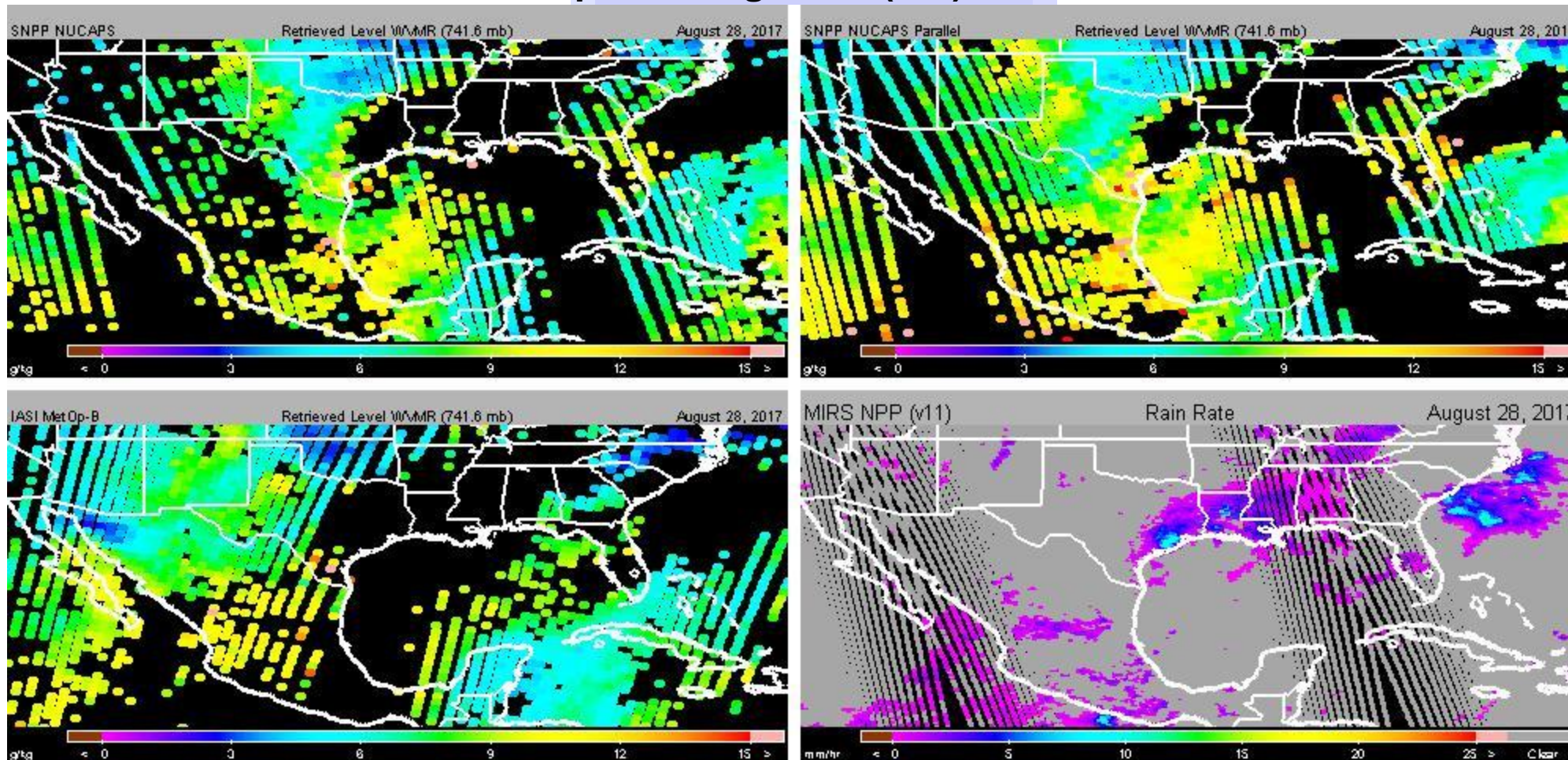
Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS Rain Rate, NUCAPS IASI-B
(NUCAPS missing)

H2O Vapor Mixing Ratio (MR) @ 750 hPa



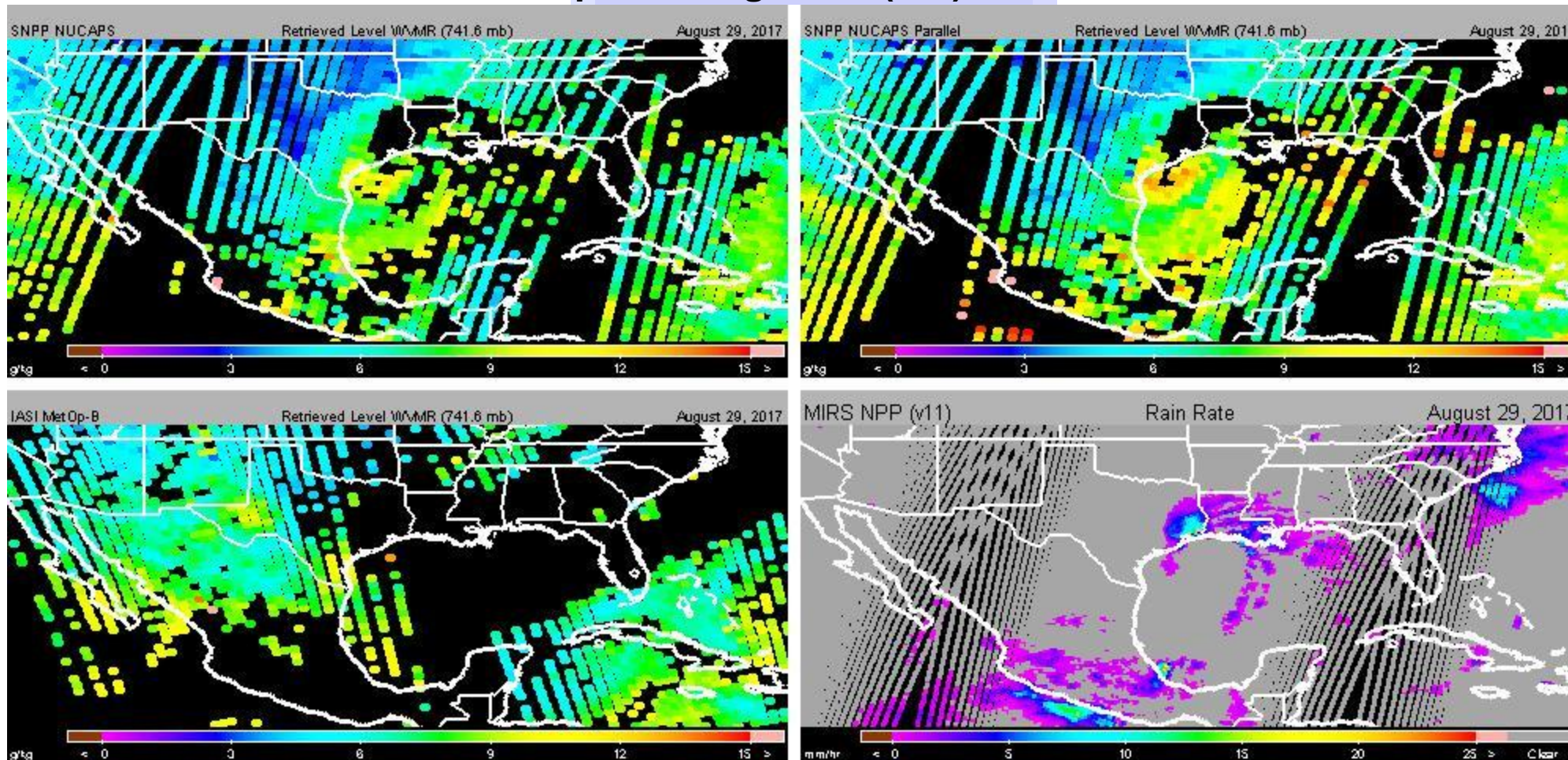
Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS Rain Rate, NUCAPS IASI-B
... 4-storms and precip bands

H2O Vapor Mixing Ratio (MR) @ 750 hPa



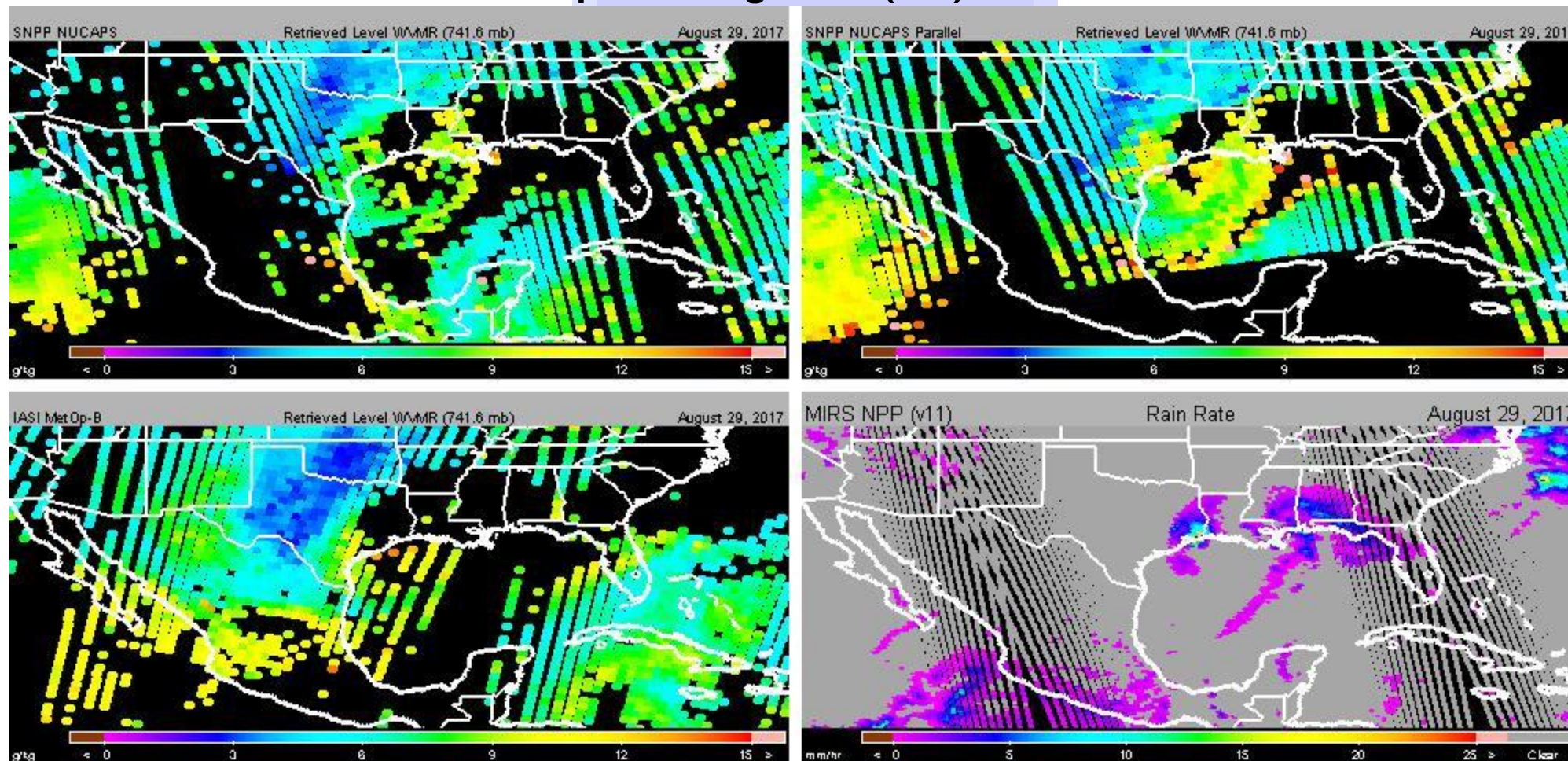
Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS Rain Rate, NUCAPS IASI-B
... precip band impacts new Orleans

H2O Vapor Mixing Ratio (MR) @ 750 hPa



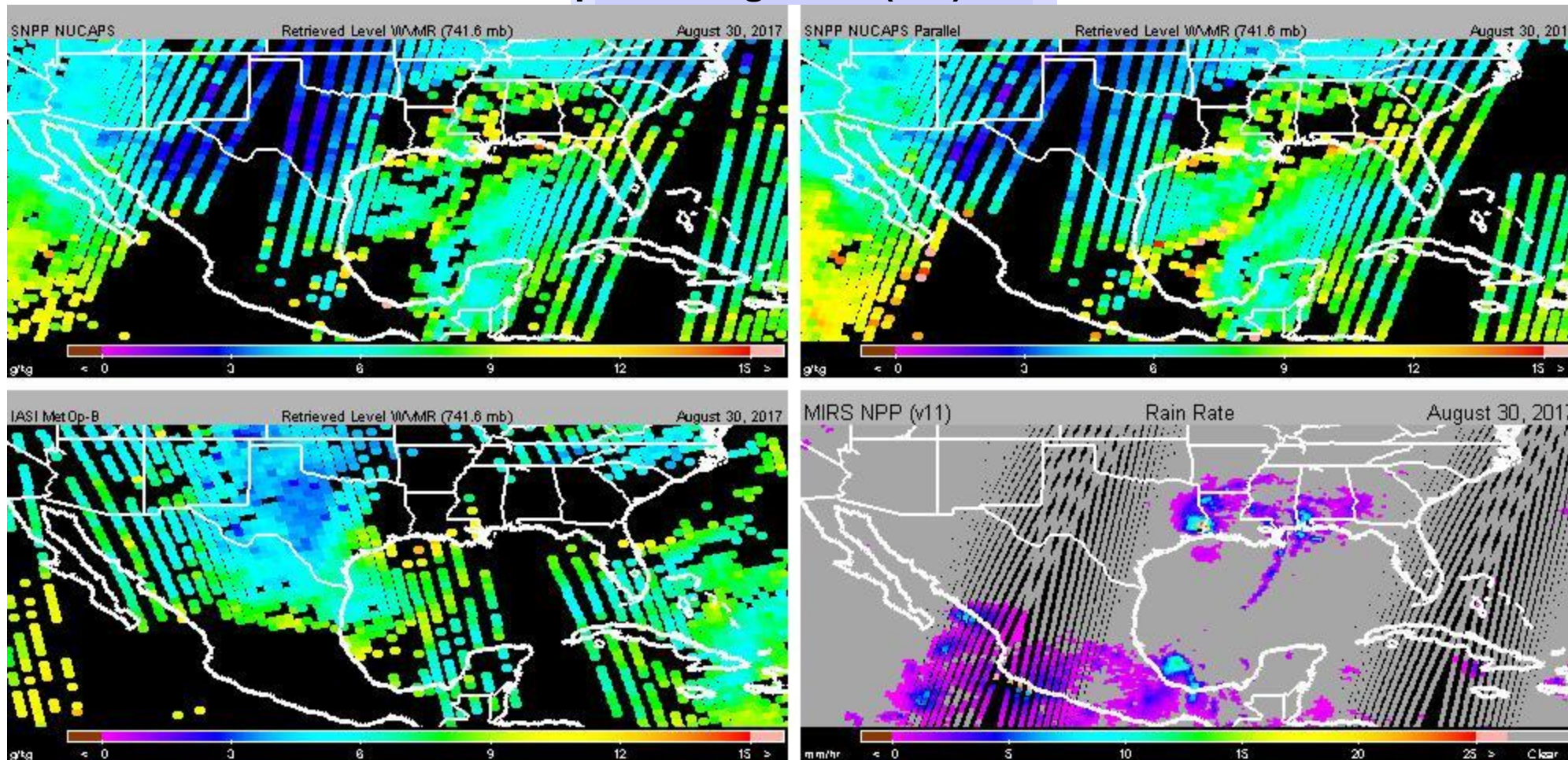
Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS Rain Rate, NUCAPS IASI-B
... dry air intrusion from north, precip band retrogrades west

H2O Vapor Mixing Ratio (MR) @ 750 hPa



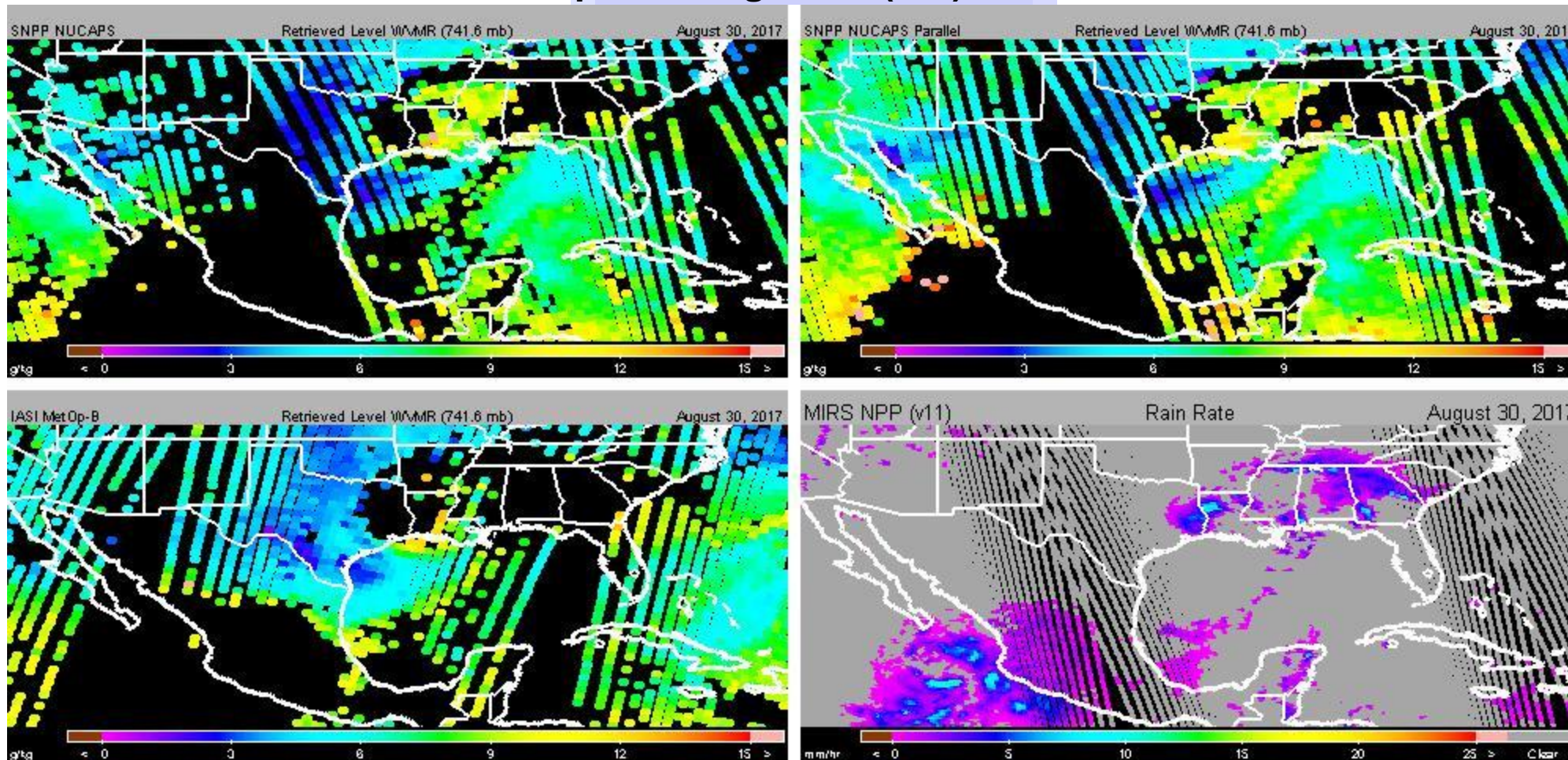
Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS Rain Rate, NUCAPS IASI-B
... dry air intrusions into Harvey, precip bands to east and west

H2O Vapor Mixing Ratio (MR) @ 750 hPa



Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS Rain Rate, NUCAPS IASI-B

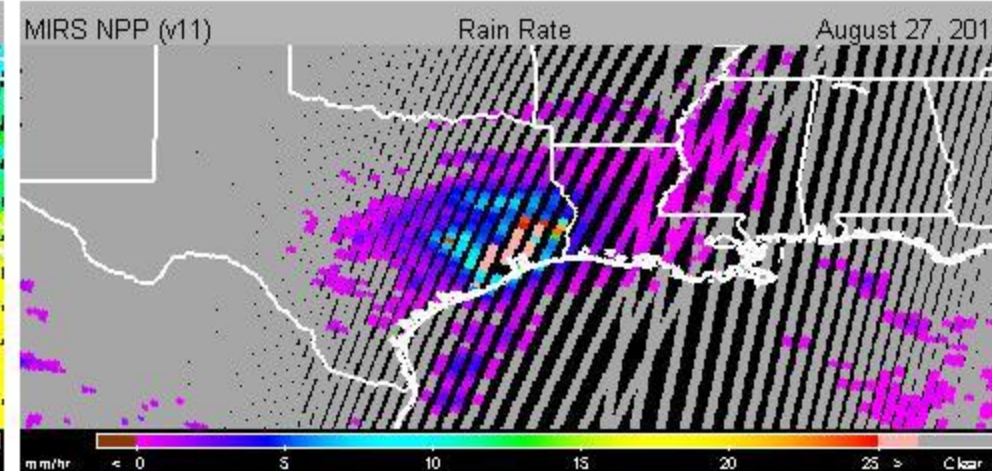
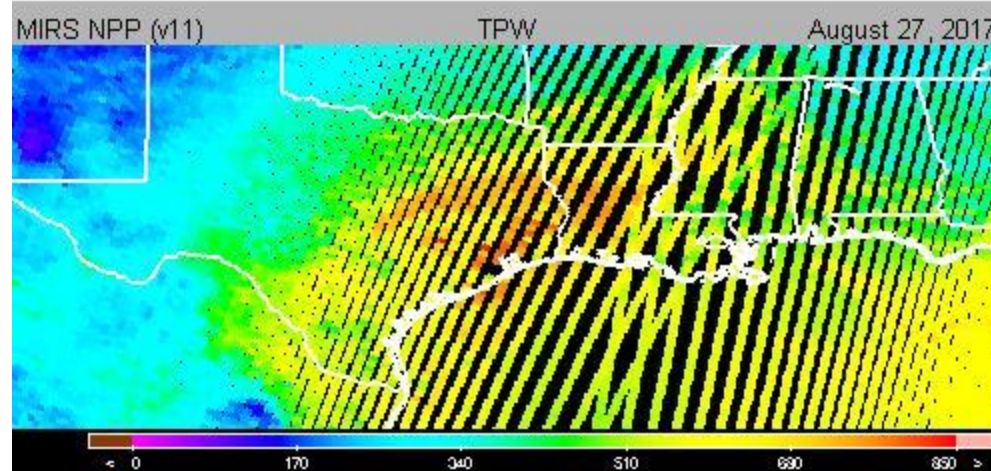
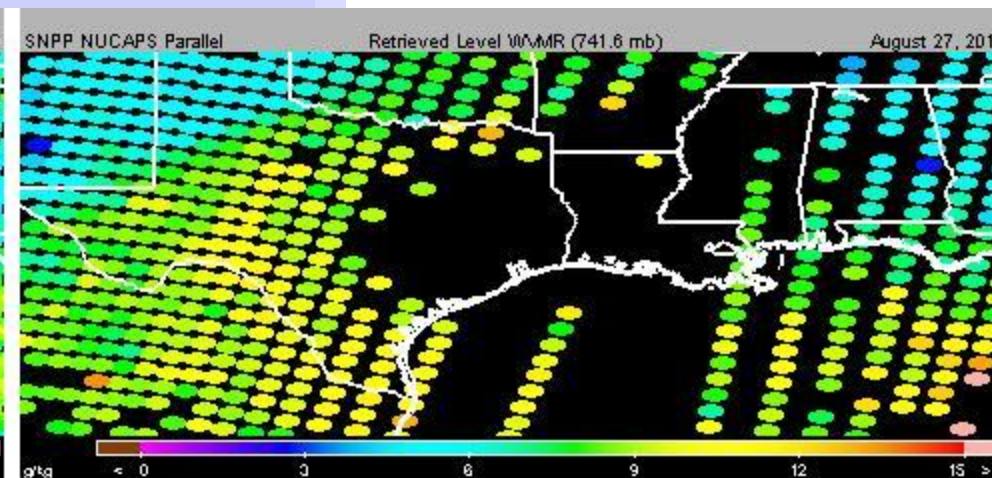
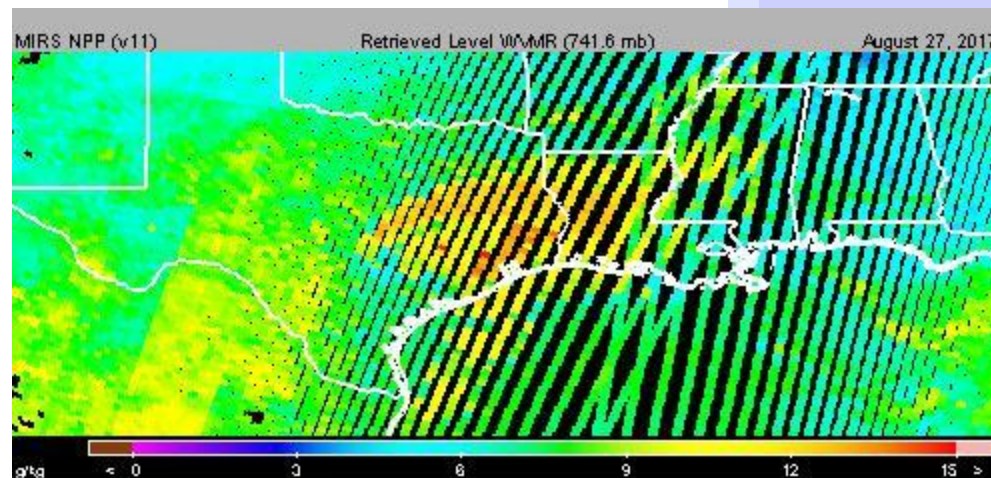
H2O Vapor Mixing Ratio (MR) @ 750 hPa



Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS Rain Rate, NUCAPS IASI-B

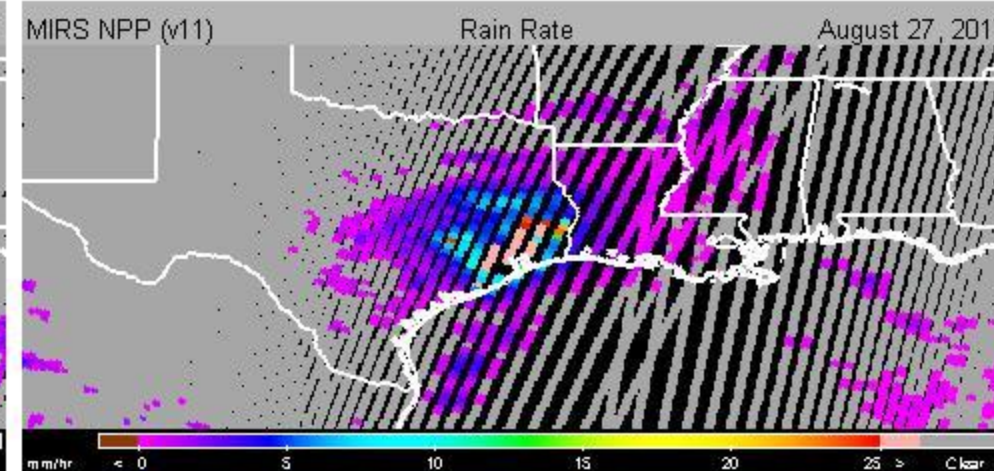
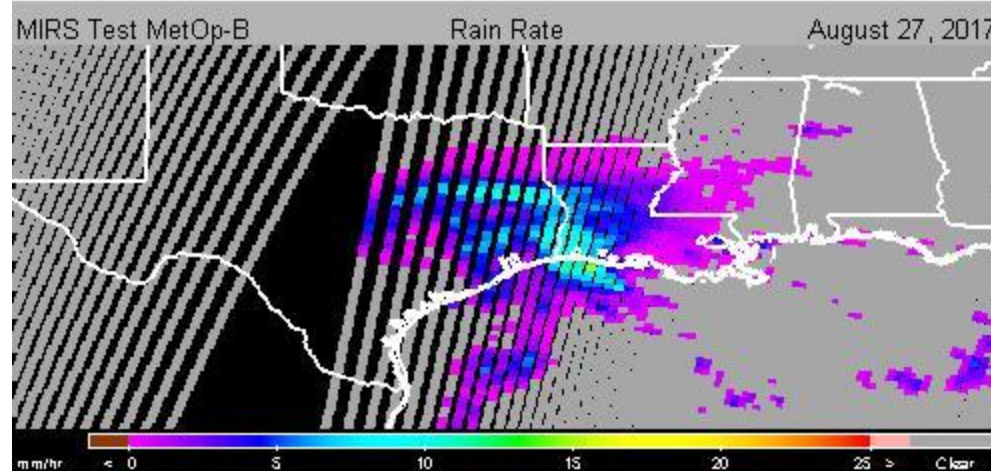
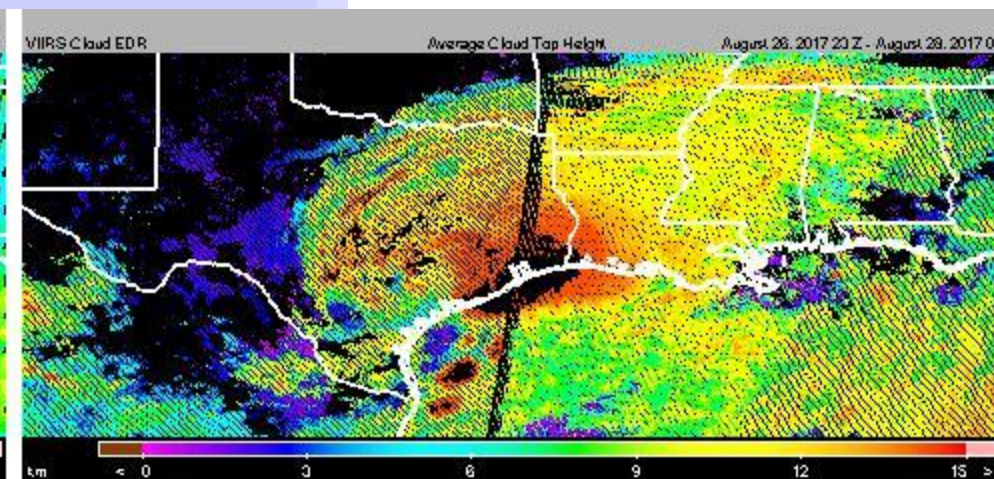
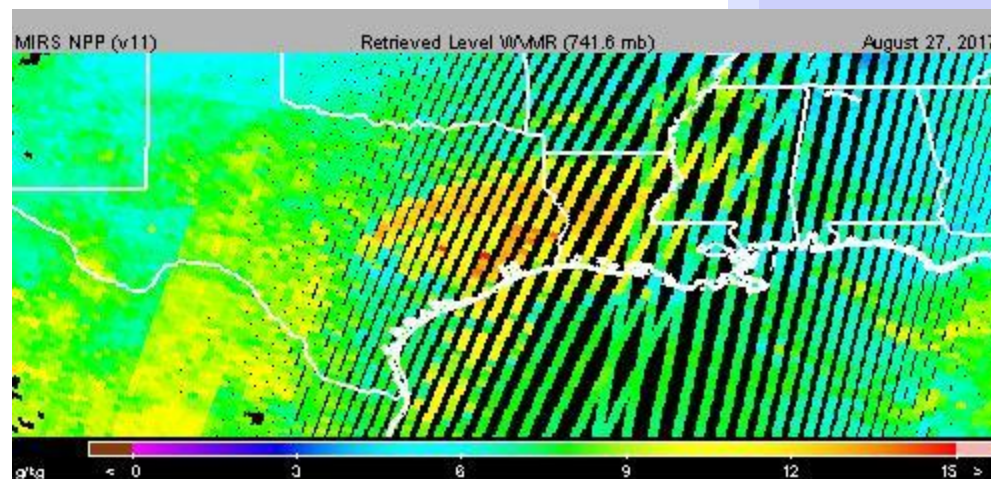


Rain Rate Validation



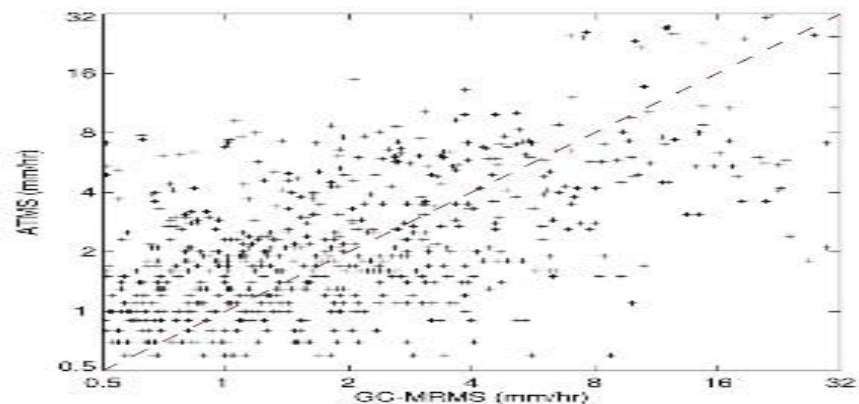
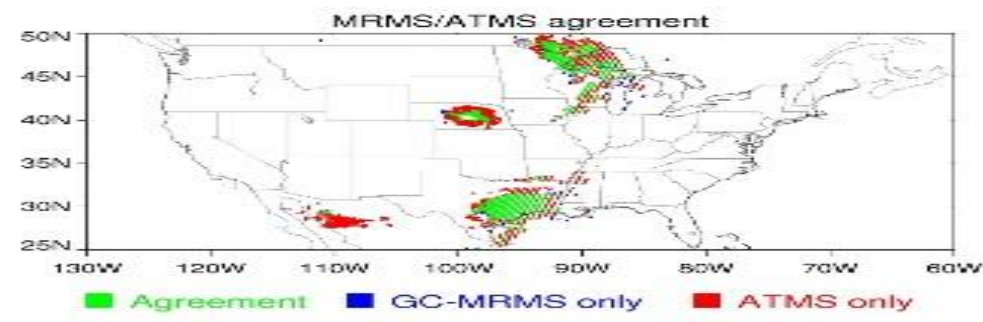
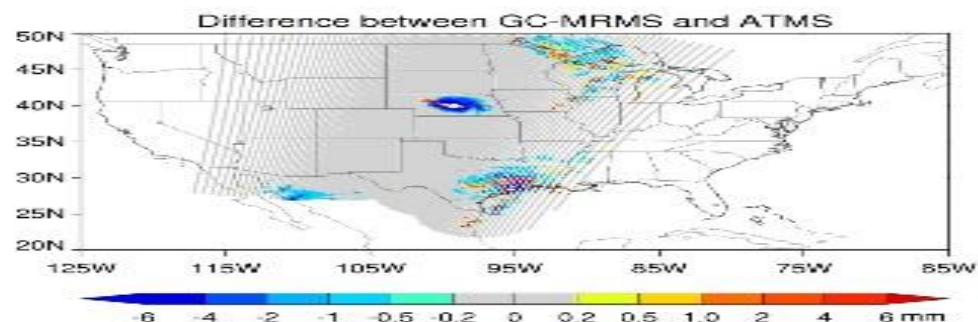
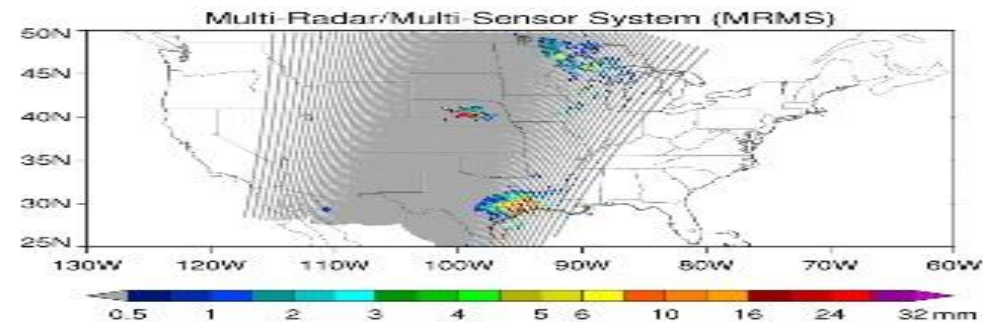
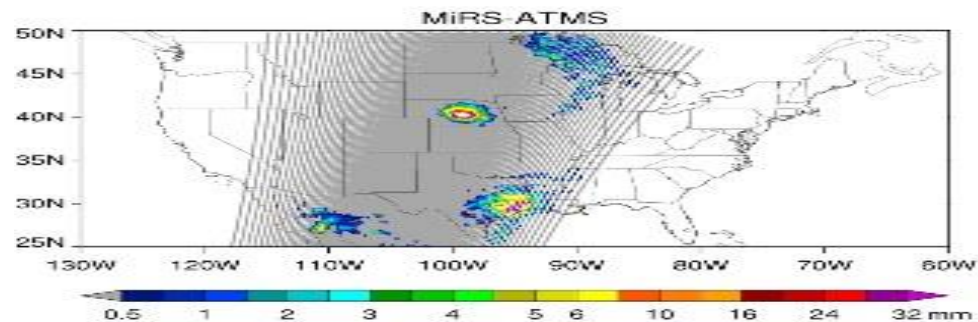
Upper Left, Clockwise: MiRS 750hPa MR, NUCAPS 750hPa MR, MiRS Rain Rate, MiRS TPW

Sunday Morning Deluge in Houston!



Upper Left, Clockwise: MiRS 750hPa MR, VIIRS Cloud Height, MiRS S-NPP Rain Rate (1AM LST),
MiRS MetOp-B Rain Rate (10AM LST)
Sunday Morning Deluge in Houston!

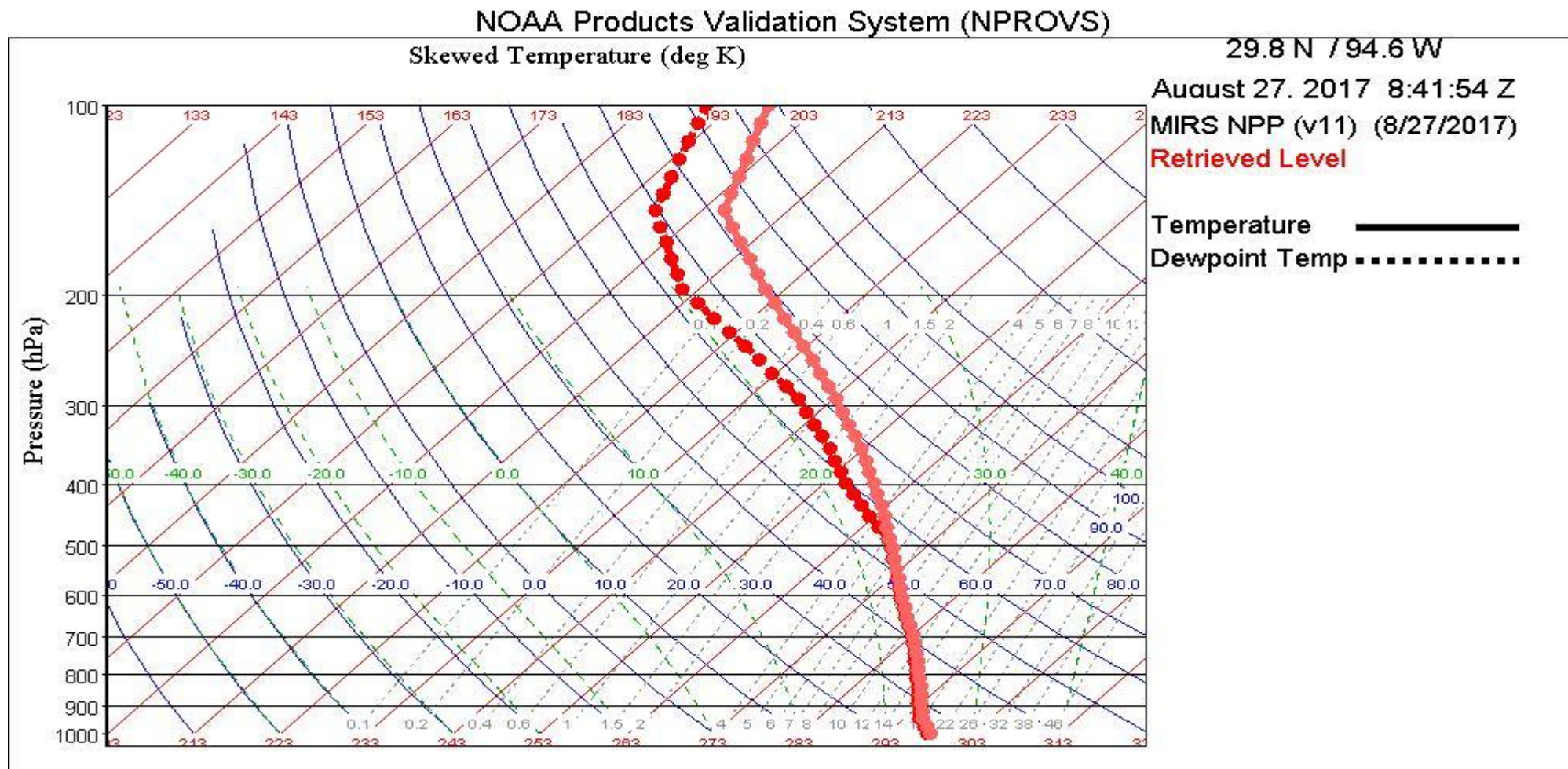
ATMS & MRMS Precipitation Rate @ 20170827-1018UTC



Correlation: 0.59
 RMSE (mm/hr): 1.99
 Probability of Detection: 0.89
 False Alarm Ratio: 0.53
 Heidke Skill Score: 0.58

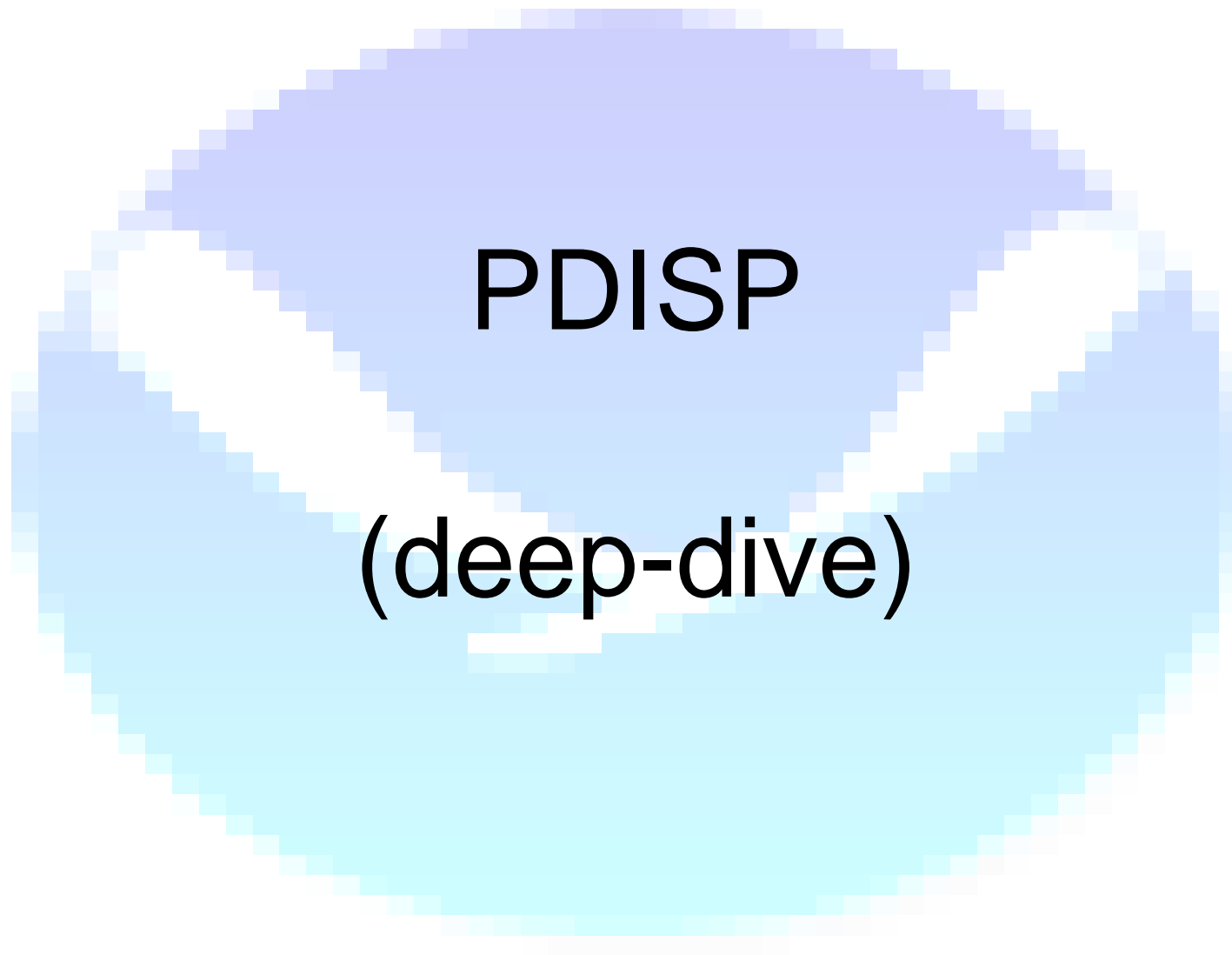
Courtesy, Yalei You / Ralph Ferraro (Chris Grassotti)

MiRS Rain Rate Validation vs Radar (MRMS)



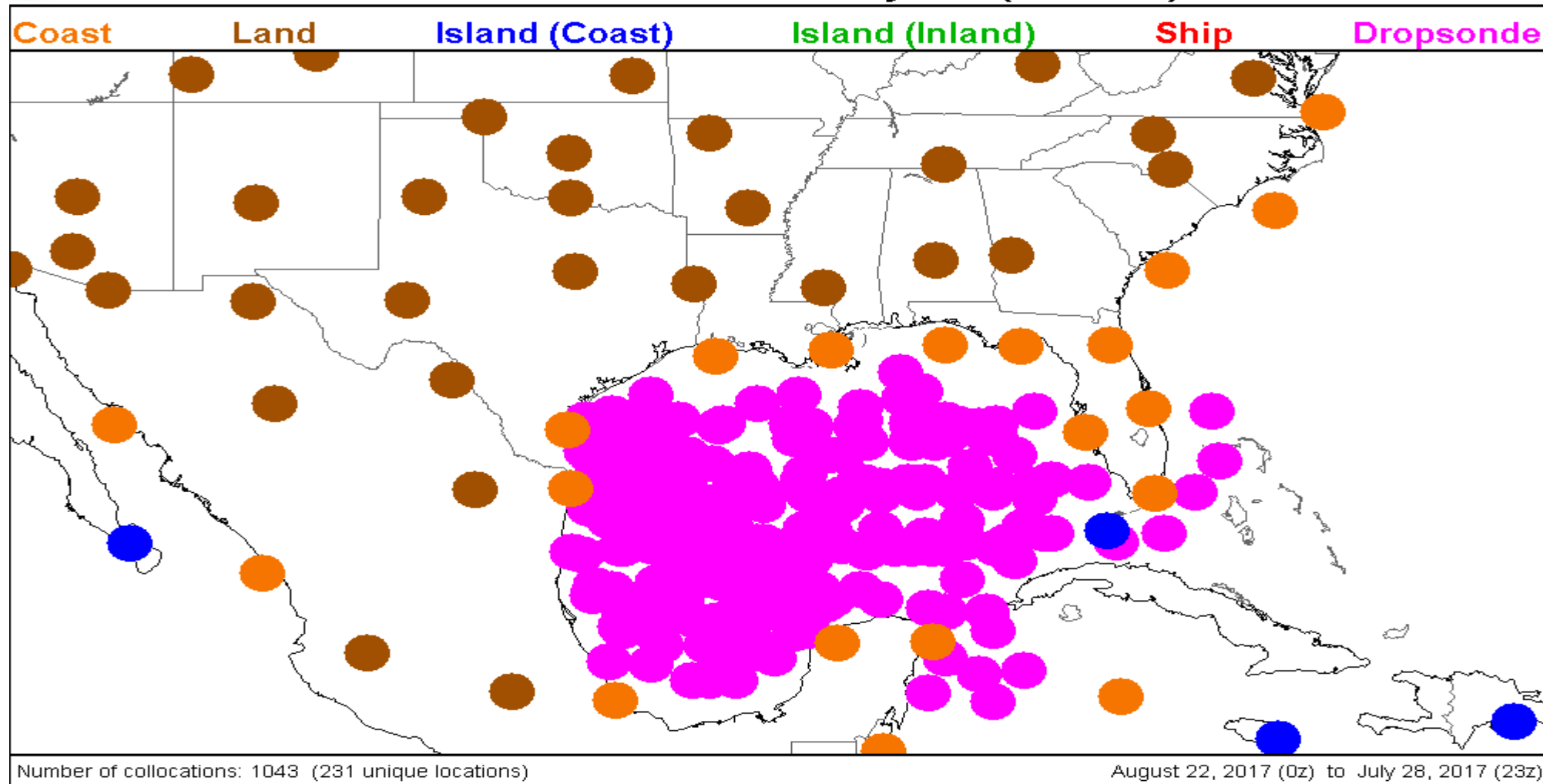
MiRS Profiles at Rain Rate 80+ mm/hr ... *super-saturation constraint* ... rejected sounding

Sunday Morning Deluge in Houston!

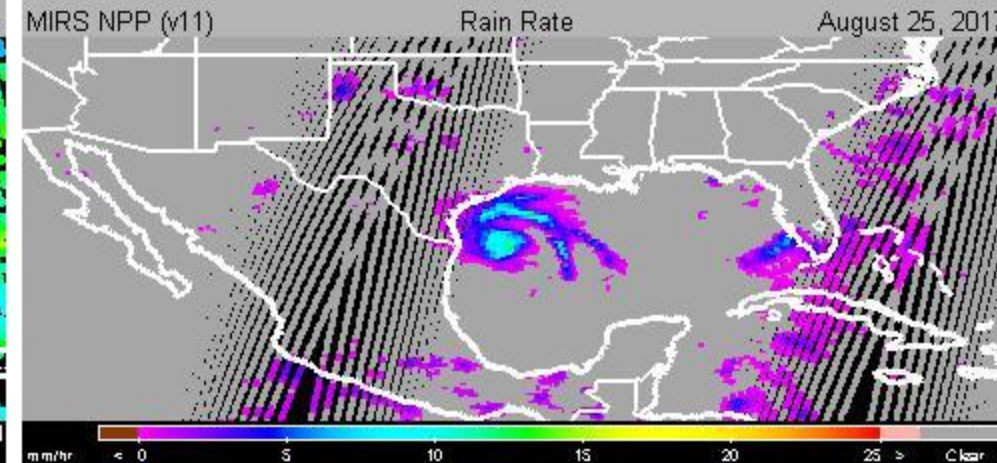
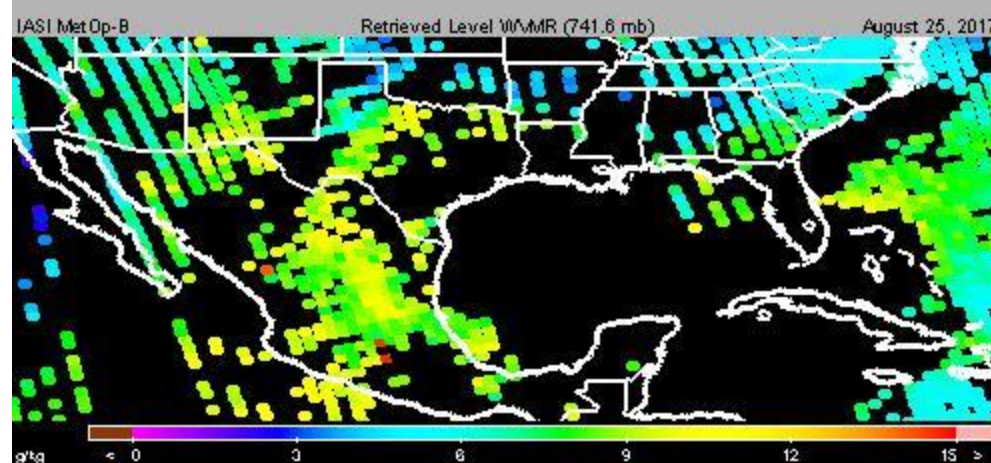
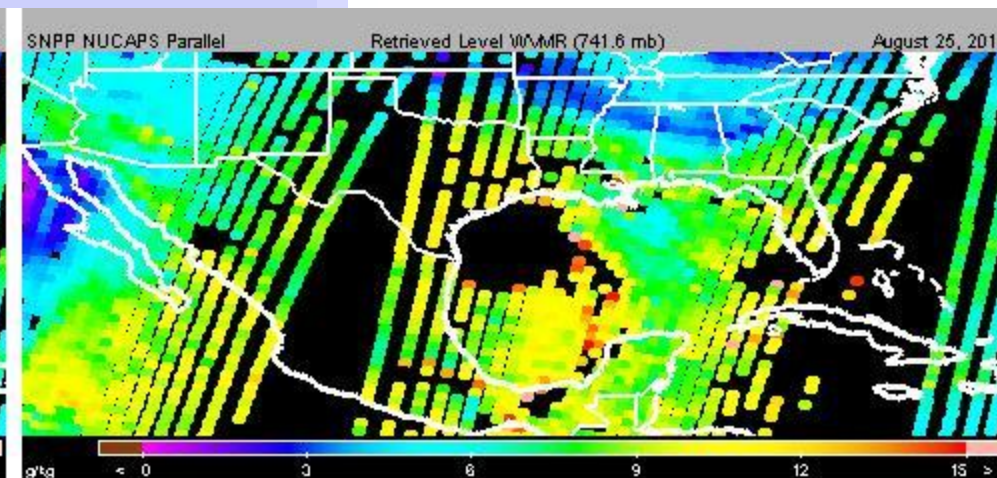
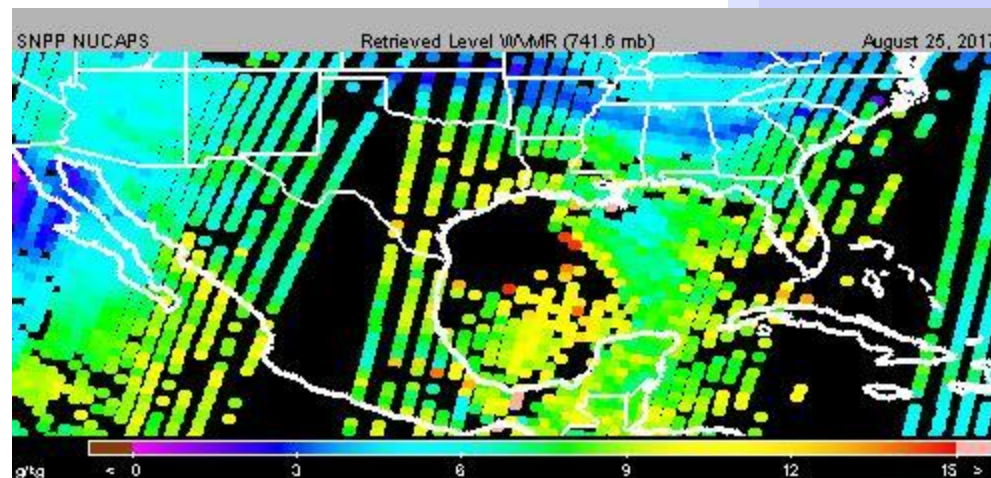




NOAA Products Validation System (NPROVS)



Harvey Dropsondes

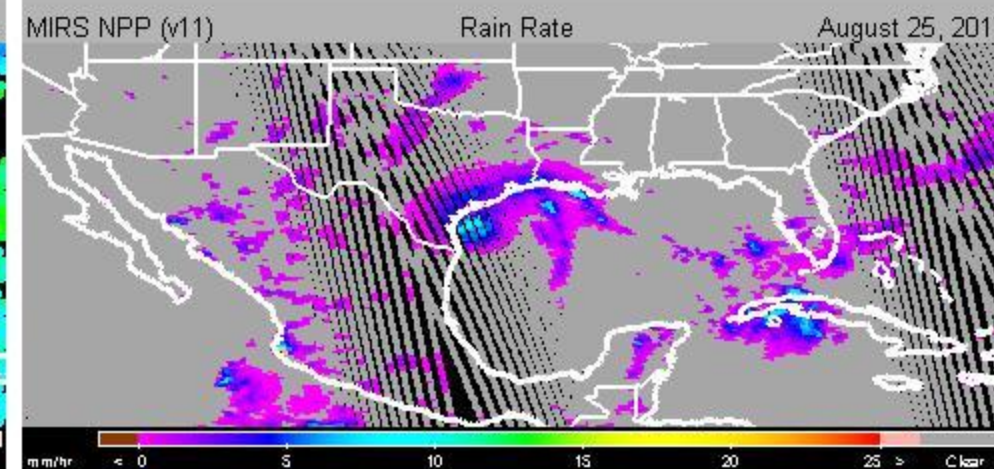
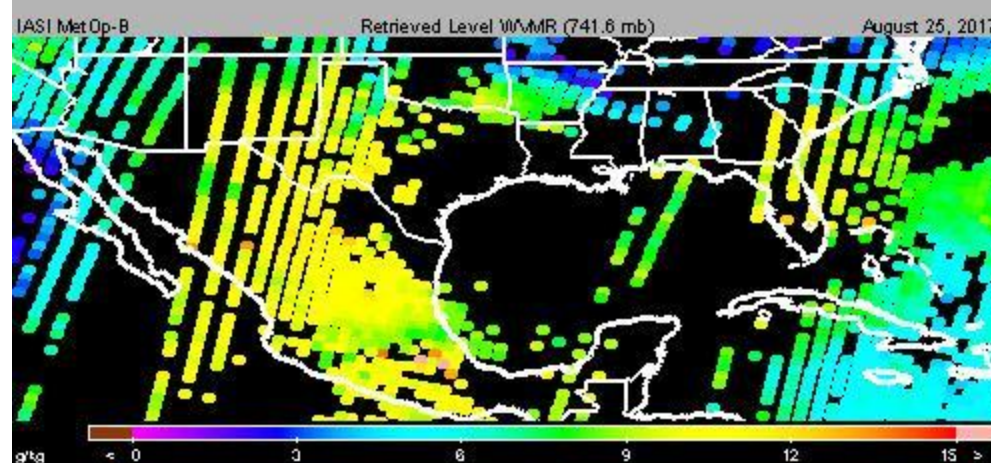
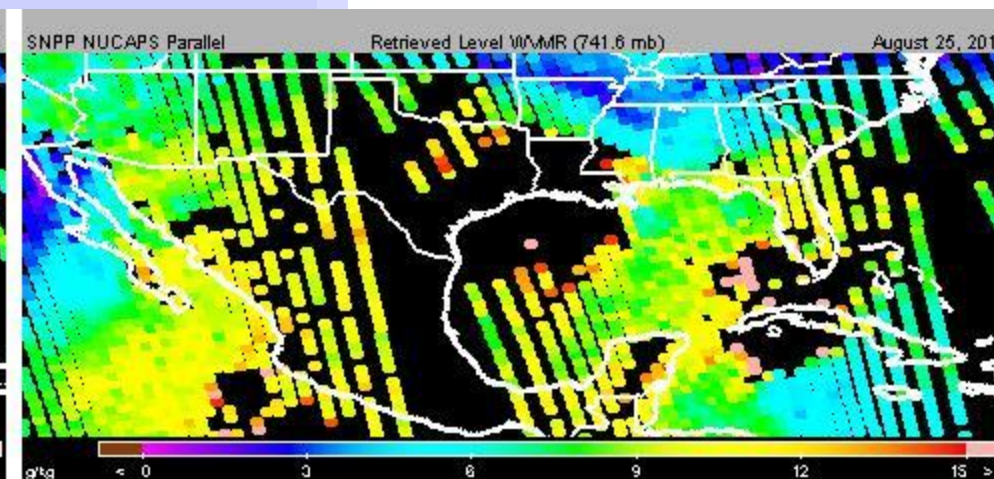
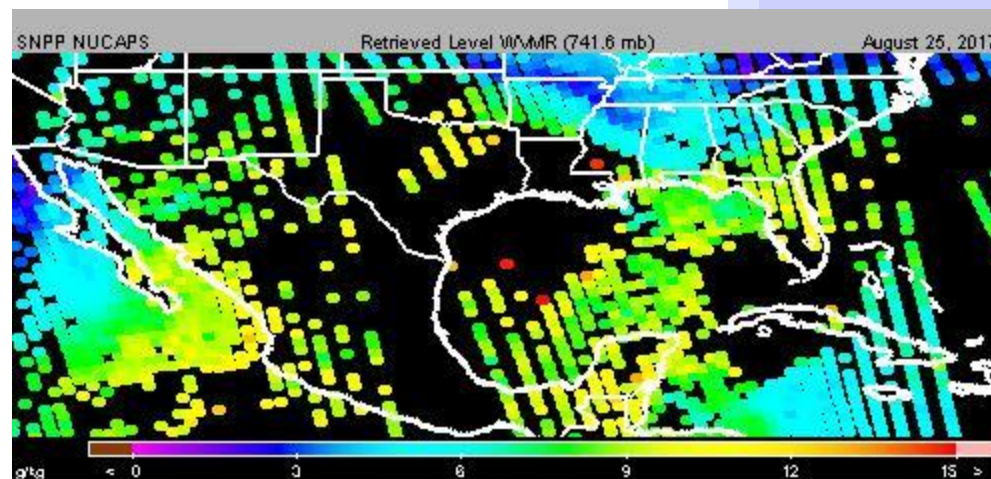


0130 LST SNPP; 1030 LST MetOp-B (low left) on 25th



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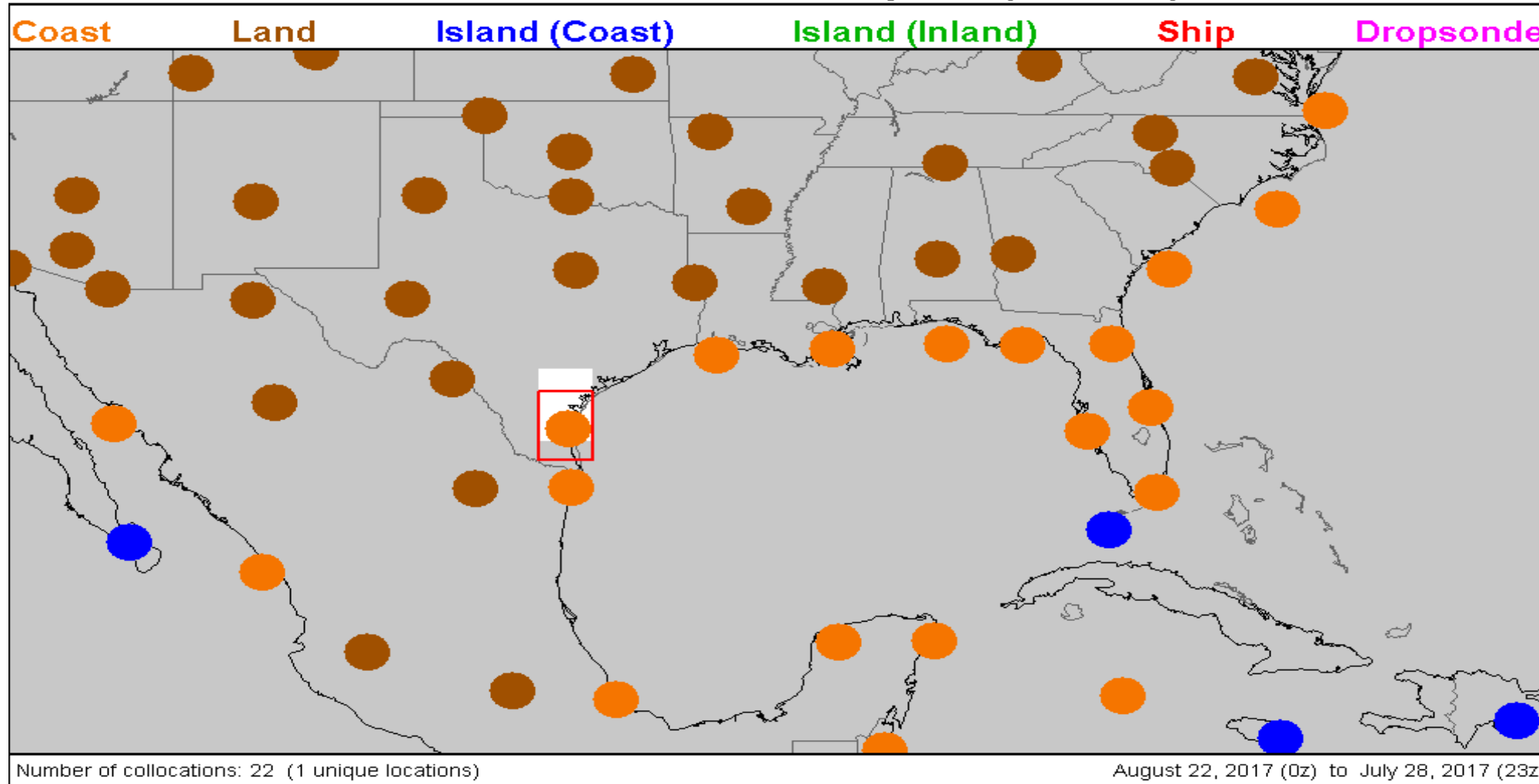
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1330 LST SNPP; 2230 LST MetOp-B (low left) on 25th



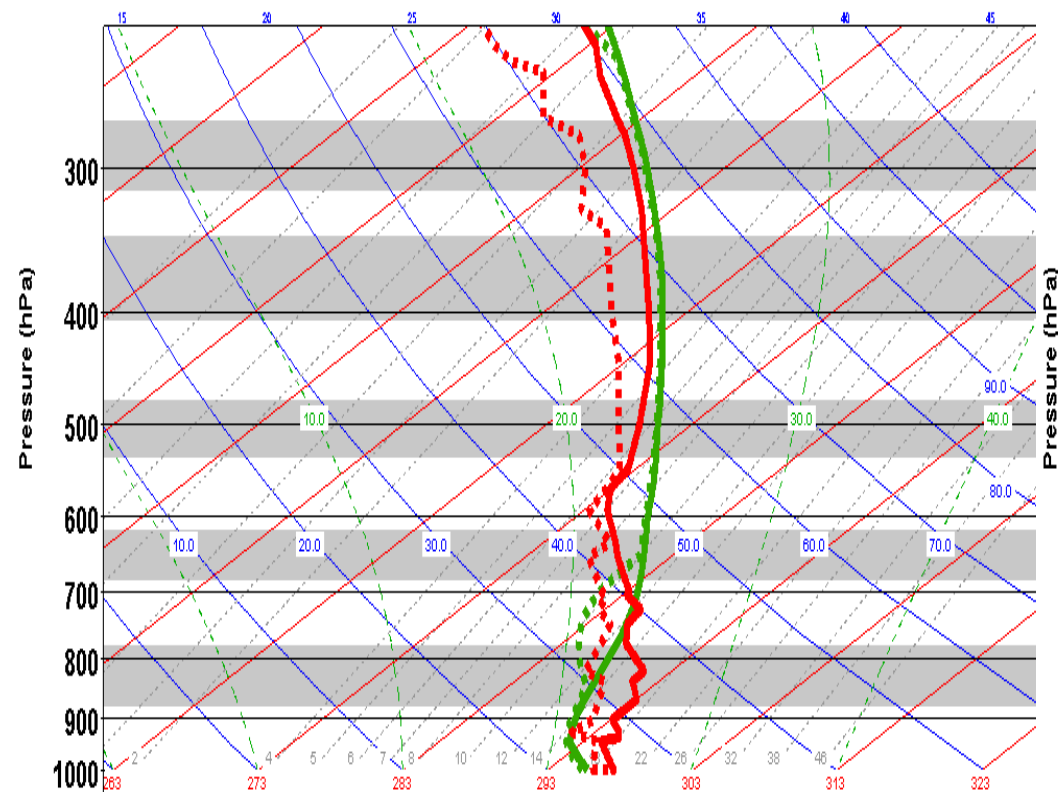
NOAA Products Validation System (NPROVS)



No NWS Raobs at Houston / Galverston ... ??

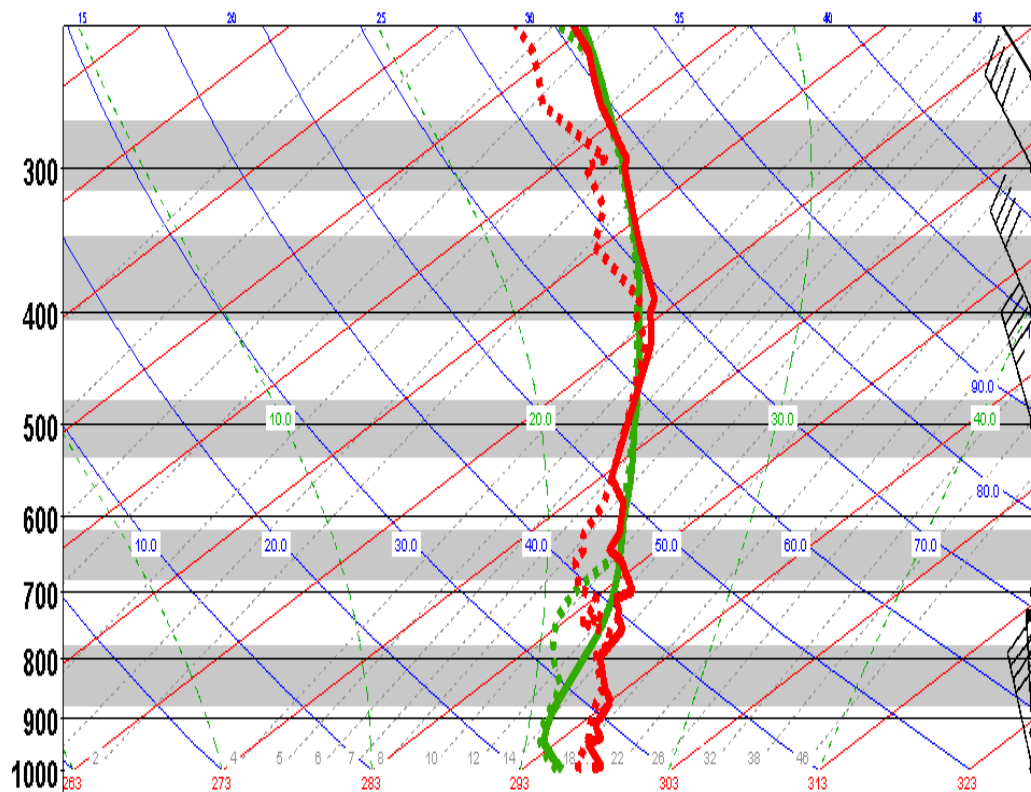
NOAA Products Validation System (NPROVS)

Dewpoint / Temperature (deg K)



NOAA Products Validation System (NPROVS)

Dewpoint / Temperature (deg K)



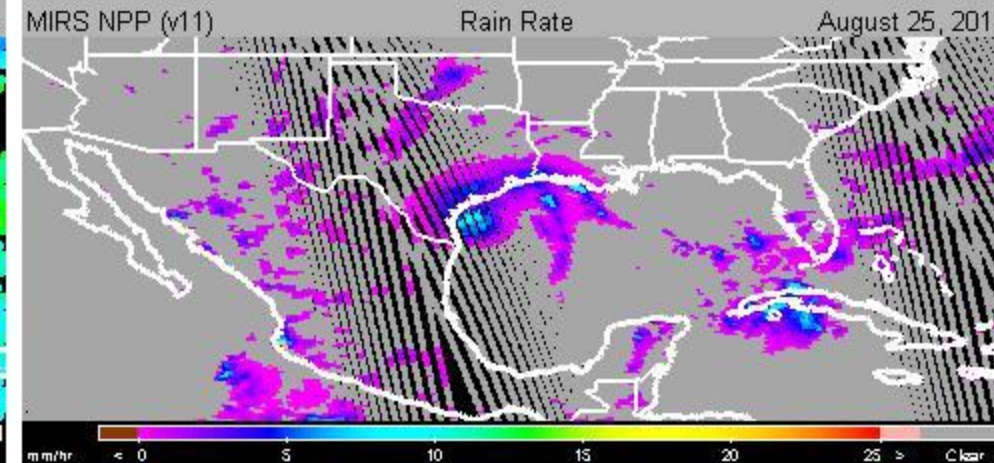
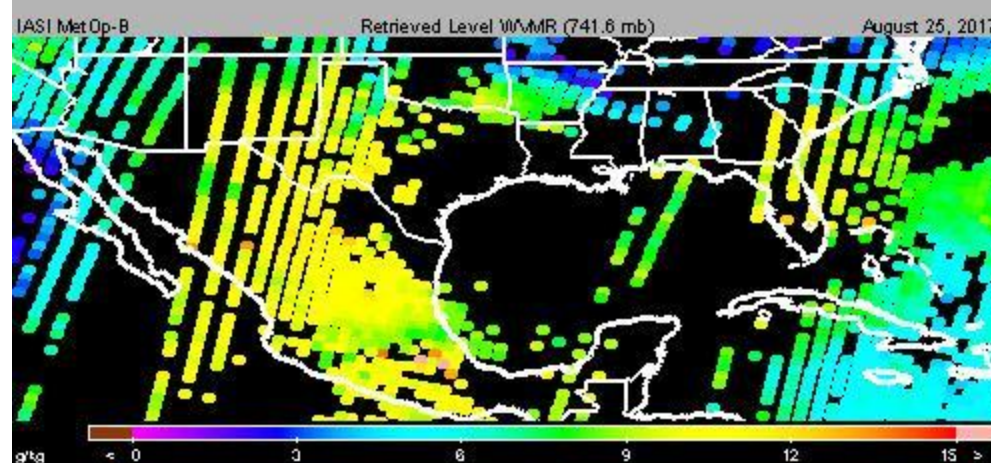
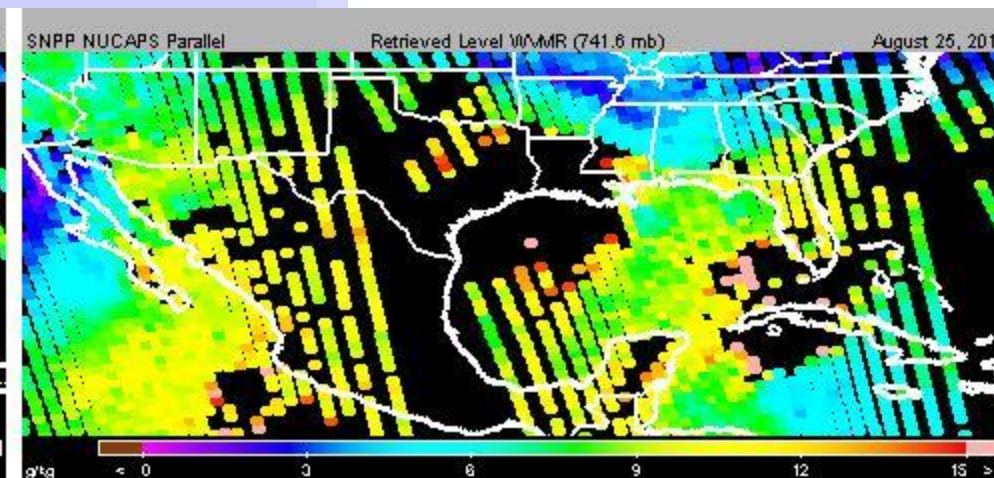
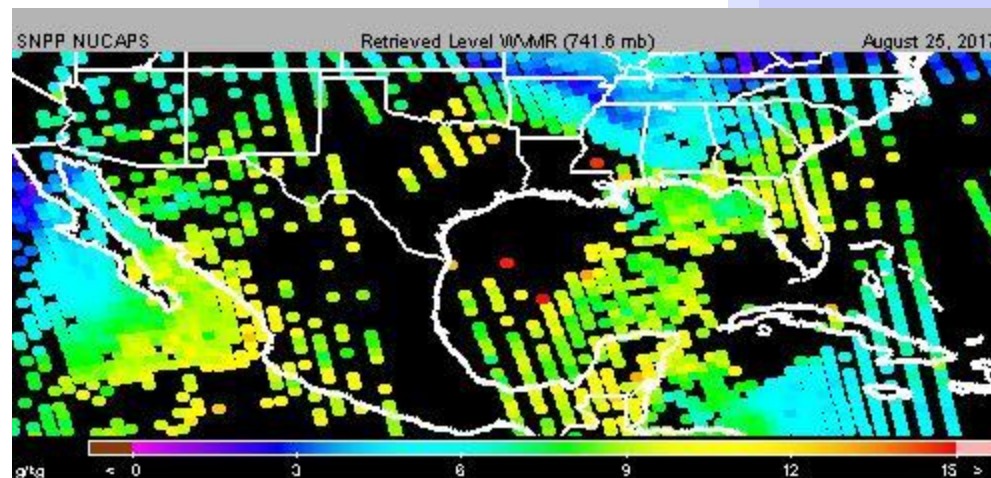
SONDE 72251 (152) SONDE **8/25/2017 17:01:00Z** **27.8 N / 97.5 W** **SONDE 72251 (152) SONDE** **8/25/2017 23:01:00Z** **27.8 N / 97.5 W**
MIRS NPP v11 (0.2) MIRS NPP v11 **8/25/2017 18:55:41Z (1.9 hours)** **27.9 N / 97.4 W (17 km)** **MIRS NPP v11 (0.2) MIRS NPP v11** **8/25/2017 18:55:41Z (-4.1 hours)** **27.9 N / 97.4 W (17 km)**

Corpus Christi radiosonde on 25th at 1100 (left) and 1700 (right) LST; MiRS 1330 LST



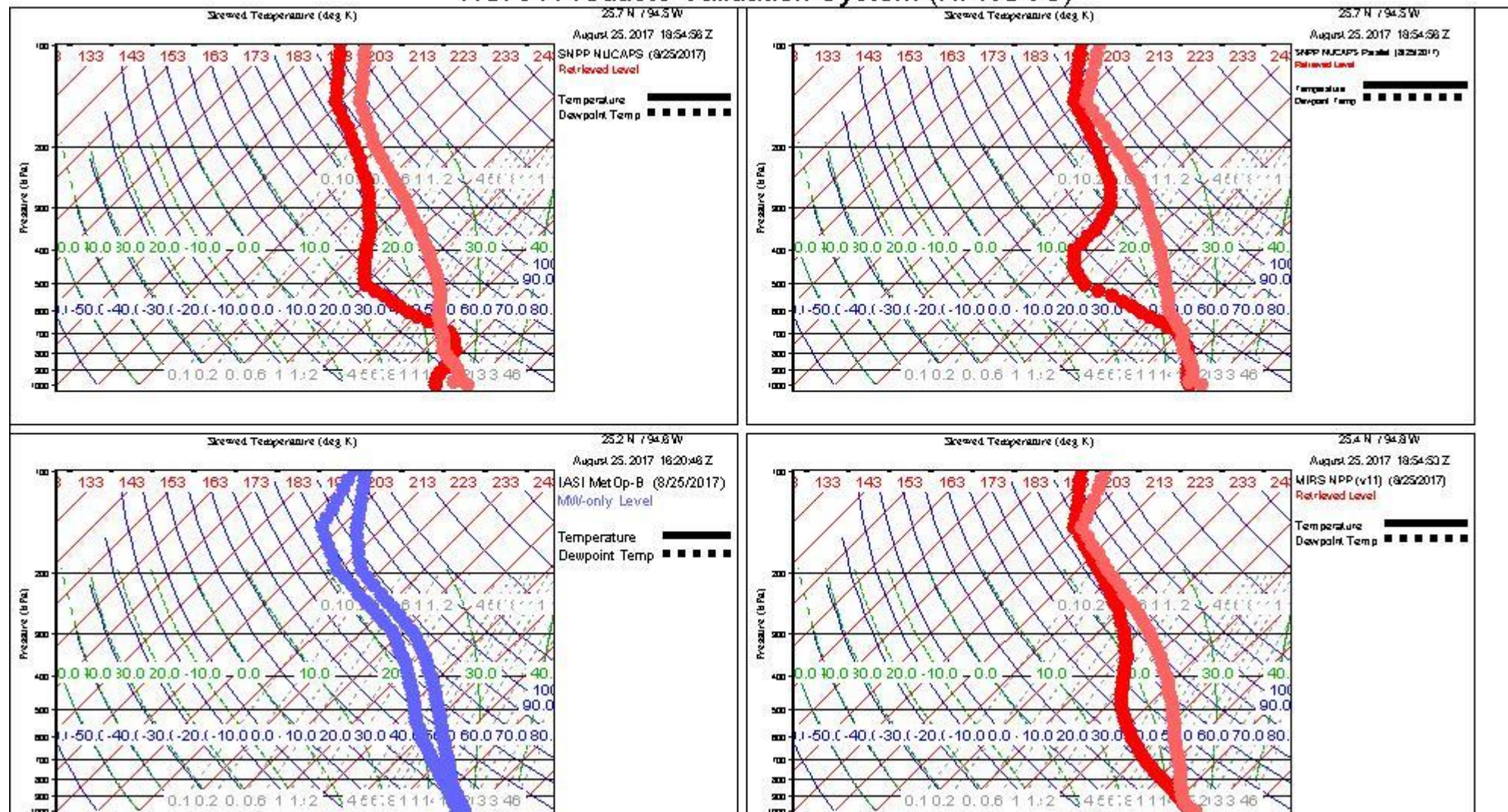
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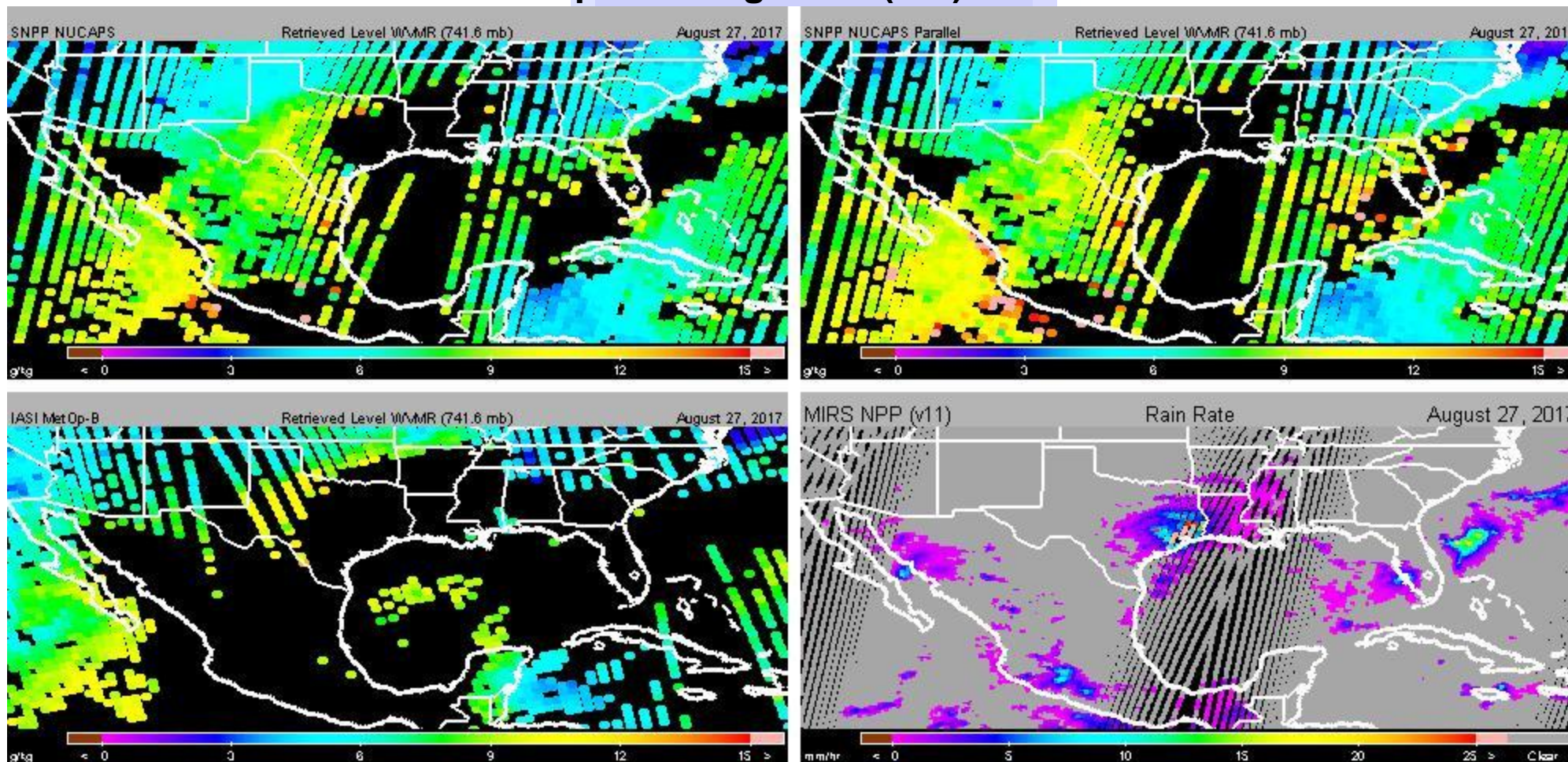
1330 LST SNPP; 2230 LST MetOp-B (low left) on 25th

NOAA Products Validation System (NPROVS)



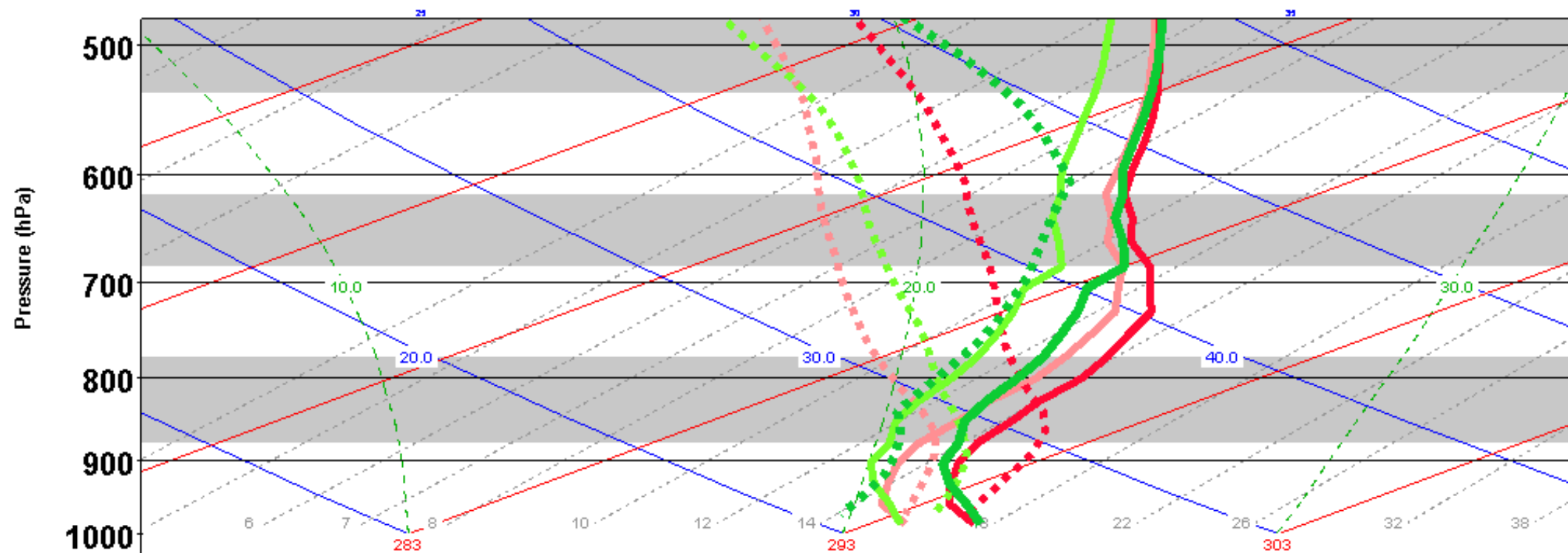
Isolated reddish fov for NUCAPS @ 1330LST on 25th ... IR passed

H2O Vapor Mixing Ratio (MR) @ 750 hPa



Upper Left, Clockwise: NUCAPS 1.5, NUCAPS 2.1.2, MiRS V11 Rain Rate, NUCAPS IASI-B
Heaviest Rainfall in Houston early Sunday morning, August 27

NOAA Products Validation System (NPROVS) Dewpoint / Temperature (deg K)



NUCAPS NPP

NUCAPS NPP First Guess

NUCAPS NPP TEST

8/27/2017 8:42:40Z (-2.4 hours)

8/27/2017 8:42:40Z (-2.4 hours)

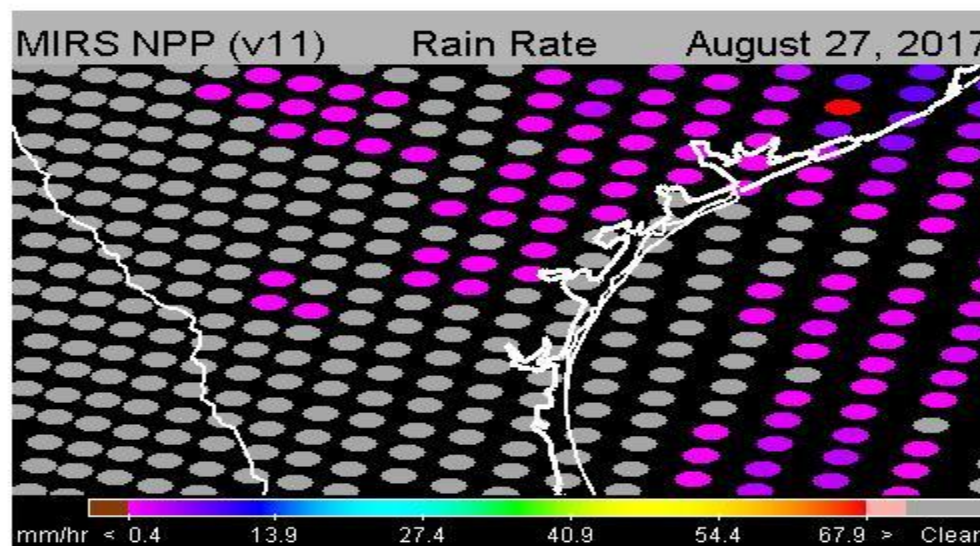
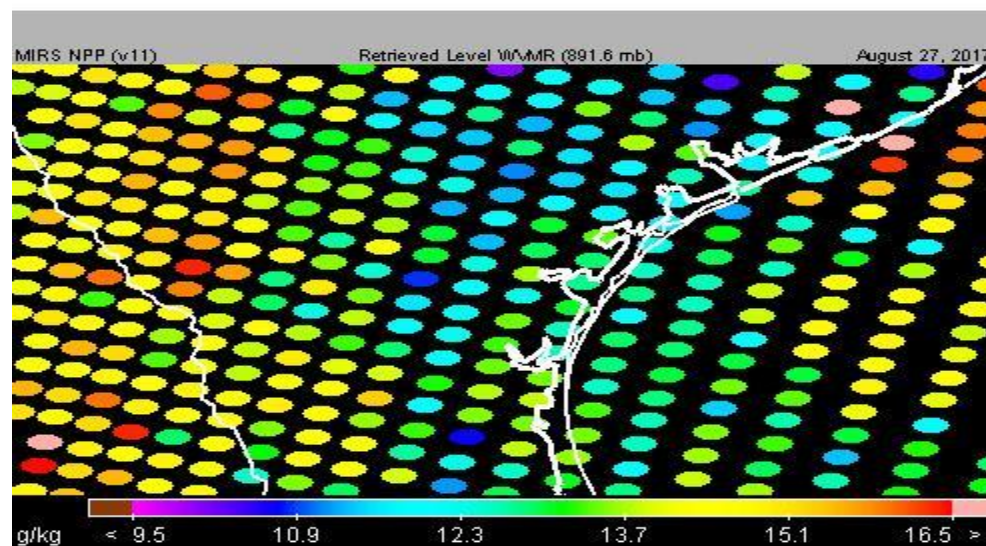
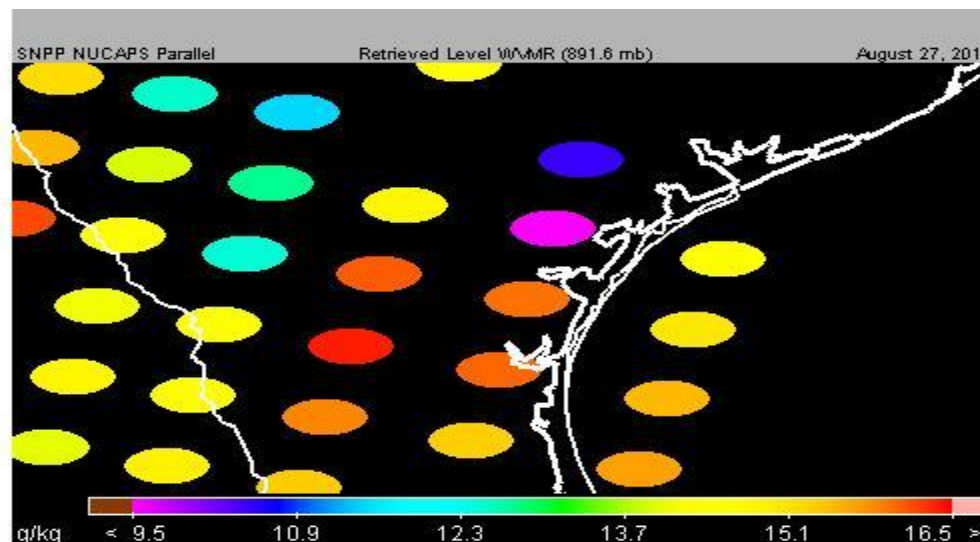
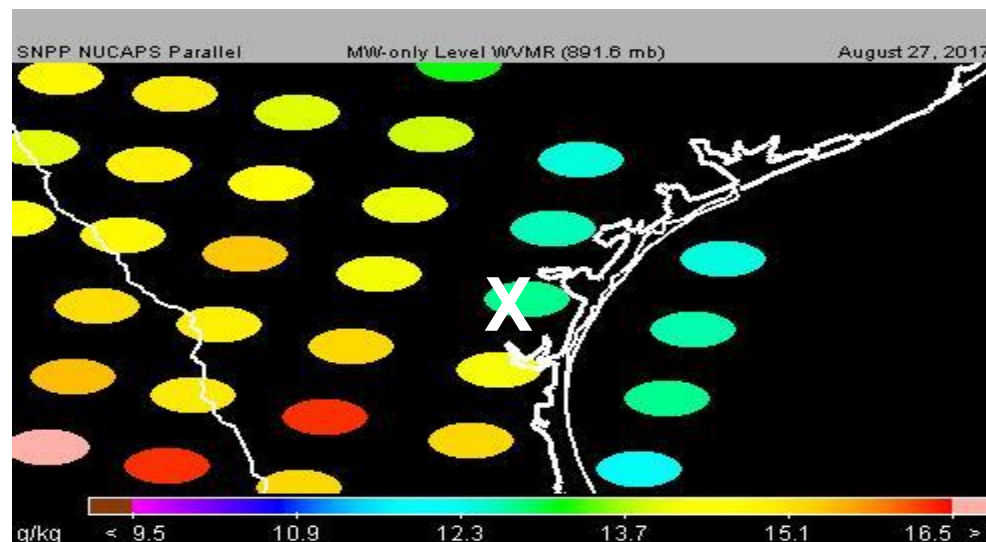
8/27/2017 8:42:40Z (-2.4 hours)

27.7 N / 97.6 W (14.4 km)

27.7 N / 97.6 W (14.4 km)

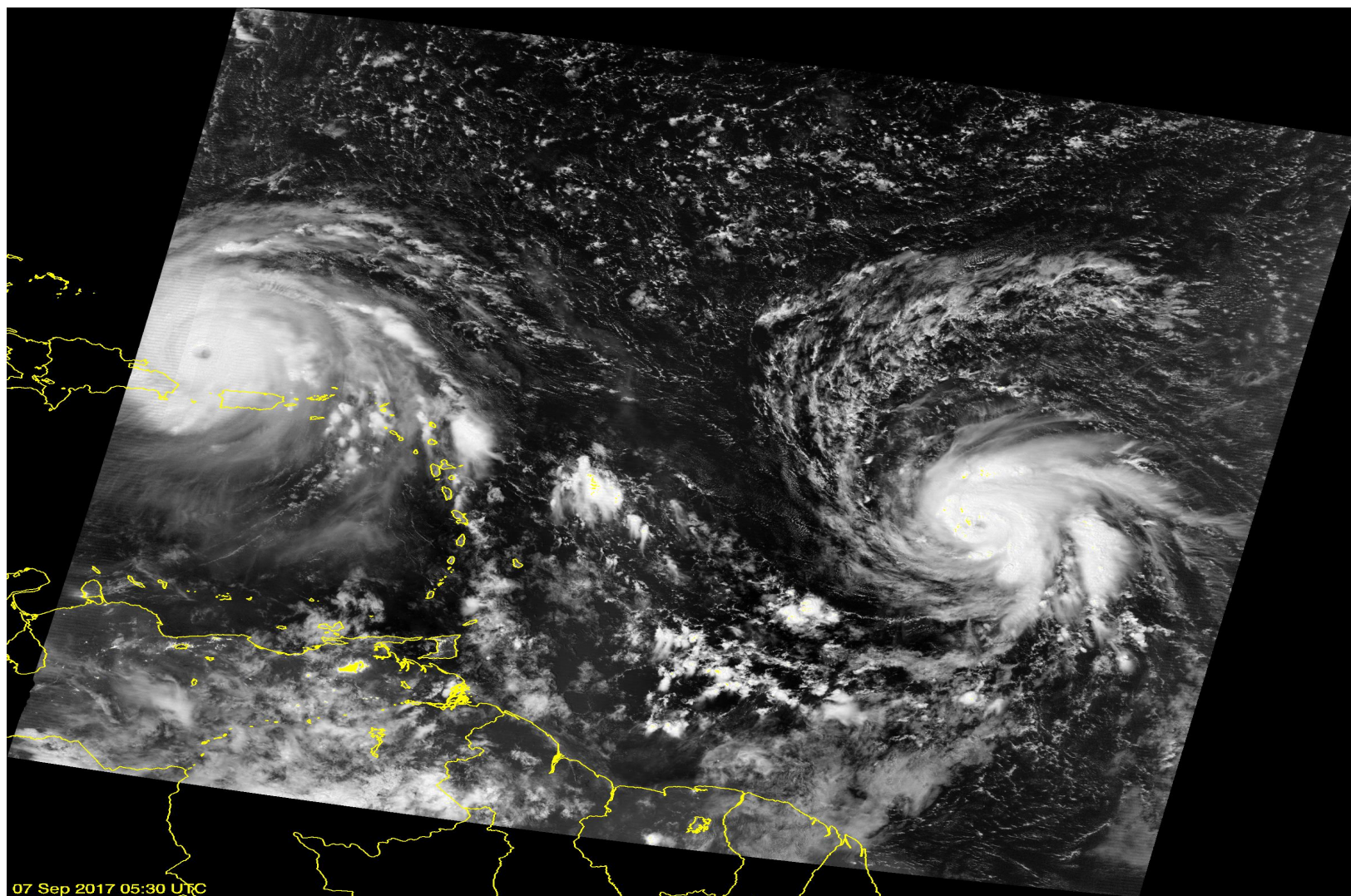
27.7 N / 97.6 W (14.4 km)

... example for NUCAPS supersaturation diagnostic; IR pass QC

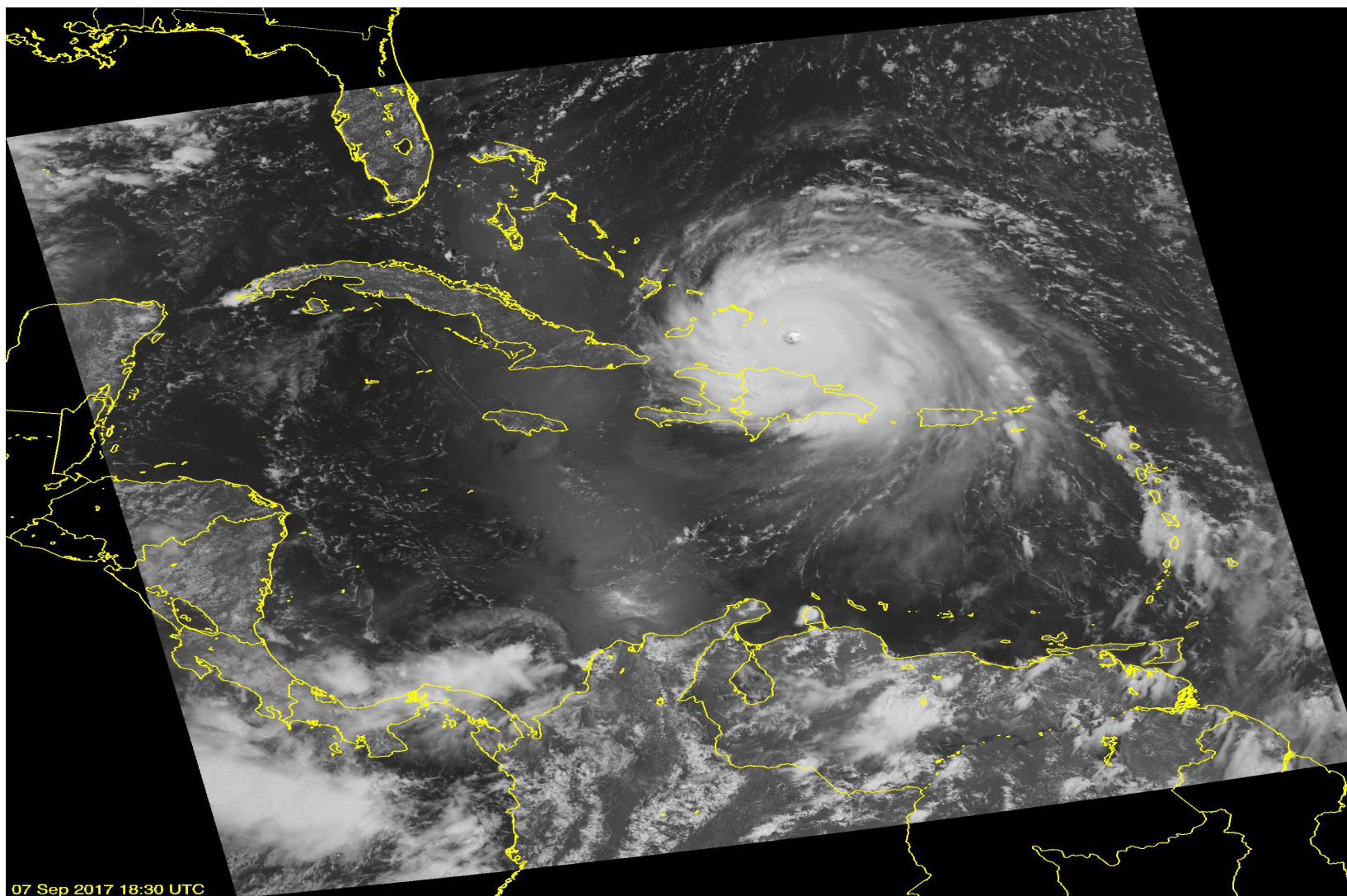


... example for NUCAPS supersaturation diagnostic; IR pass QC

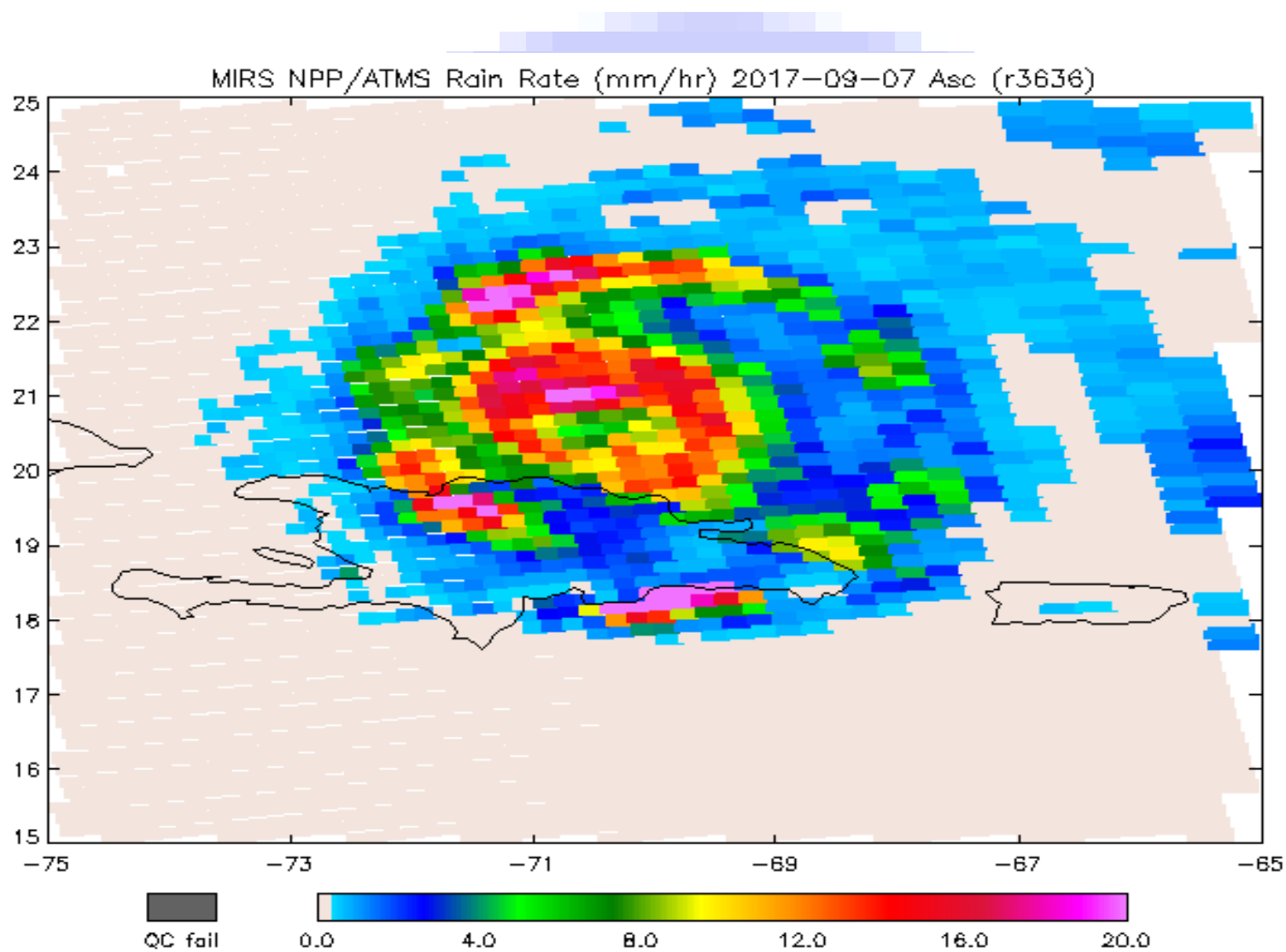


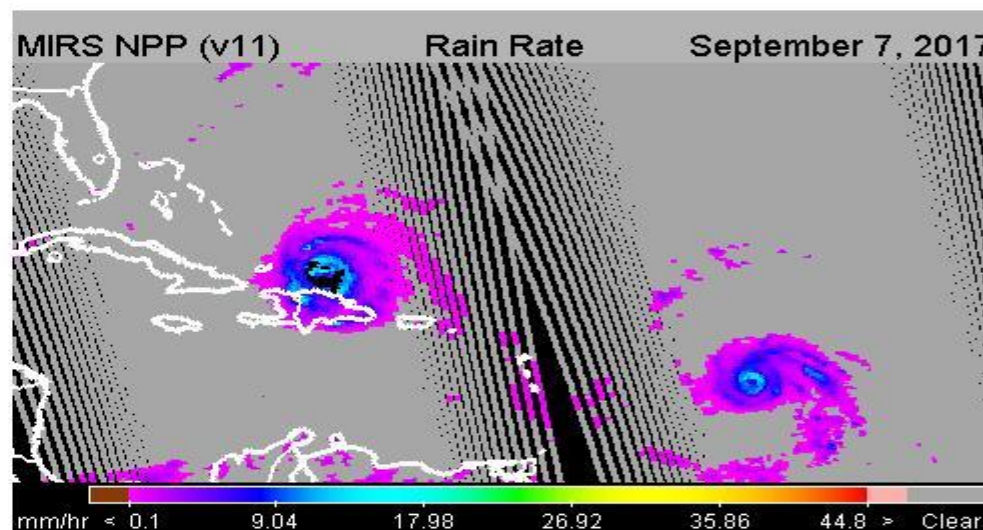
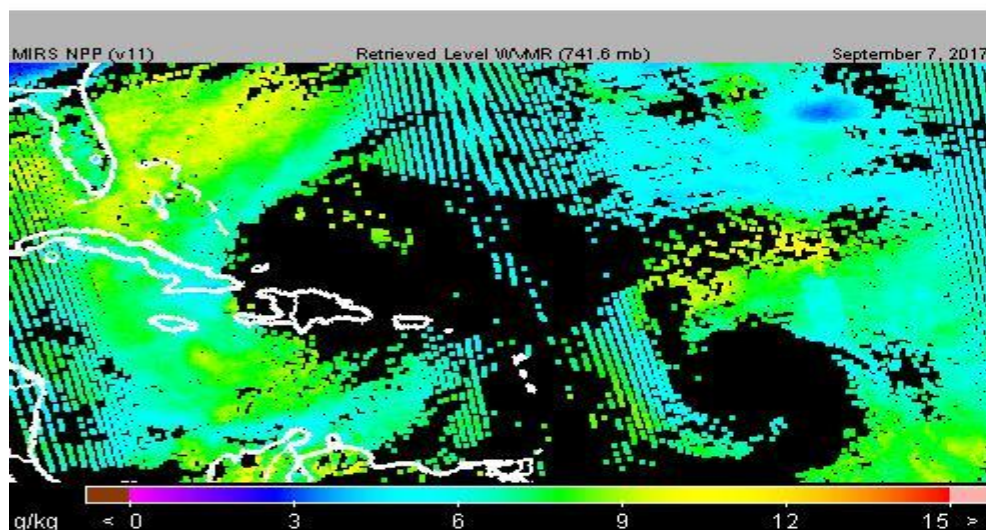
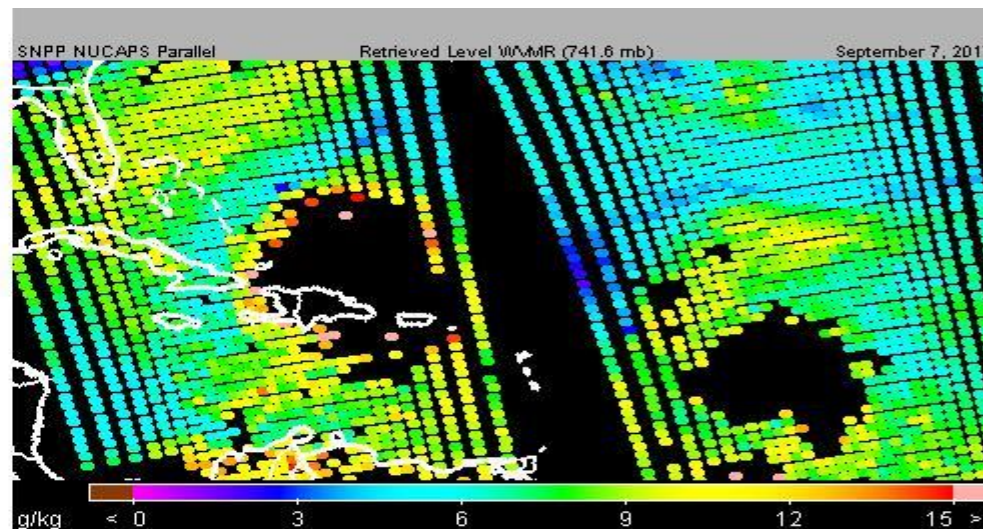
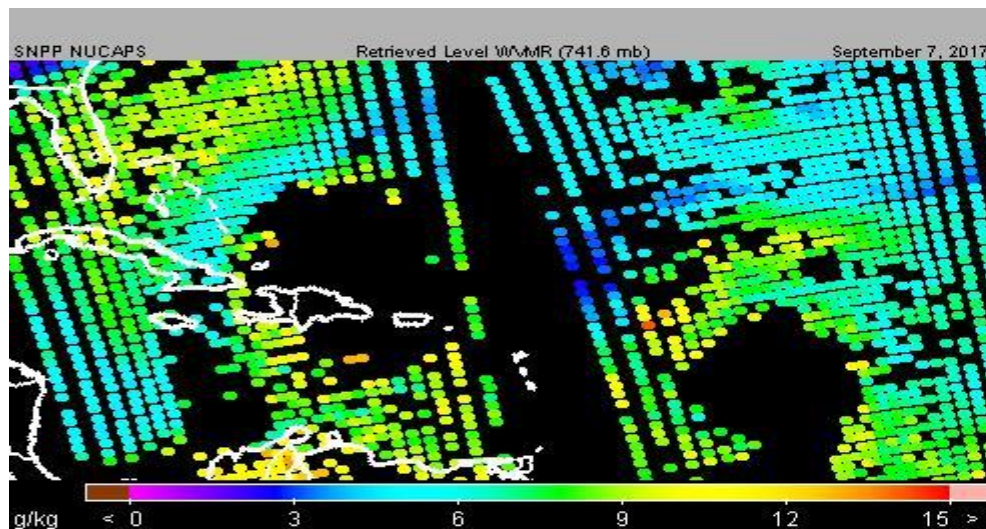


Day/Nite Band VIIRS Imagery

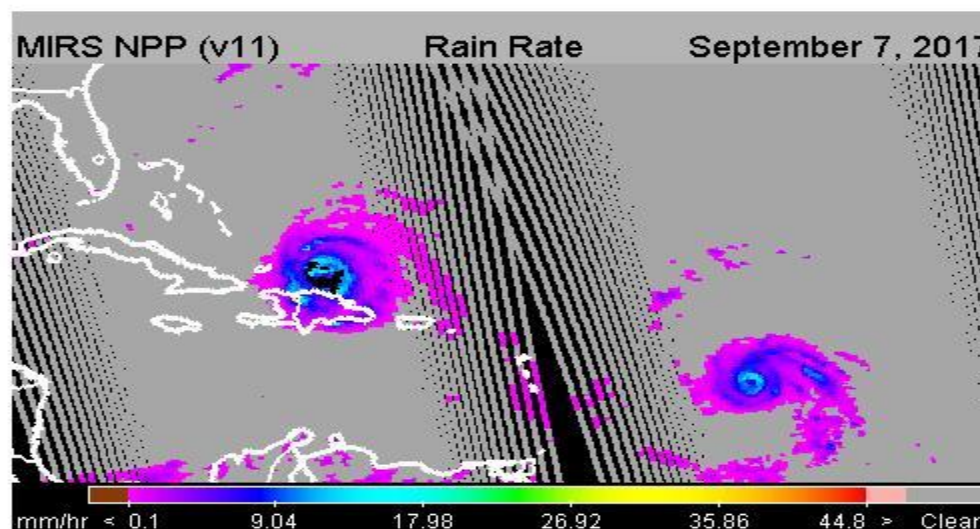
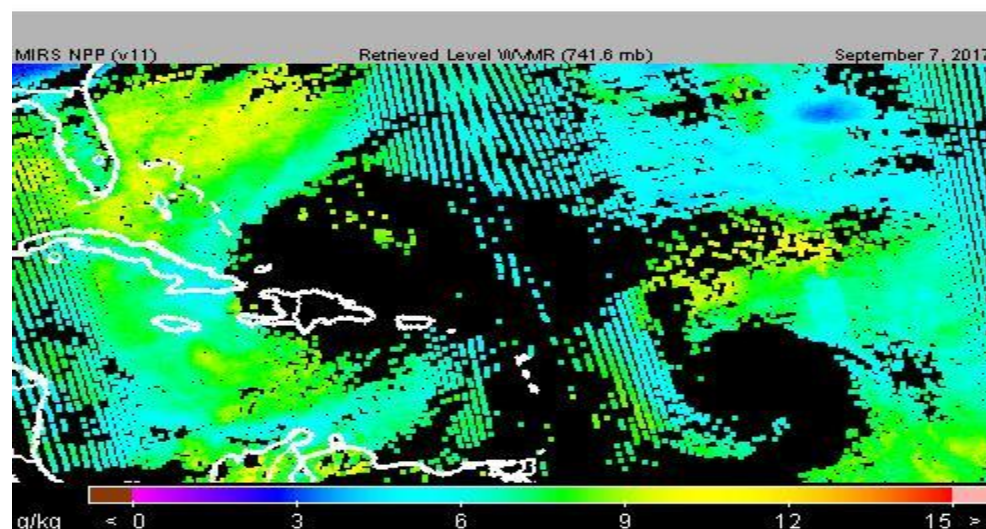
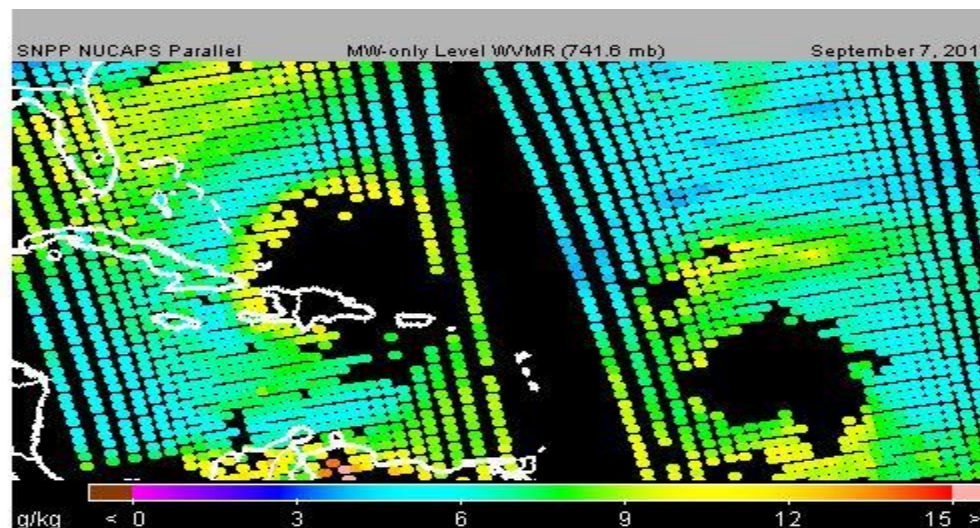
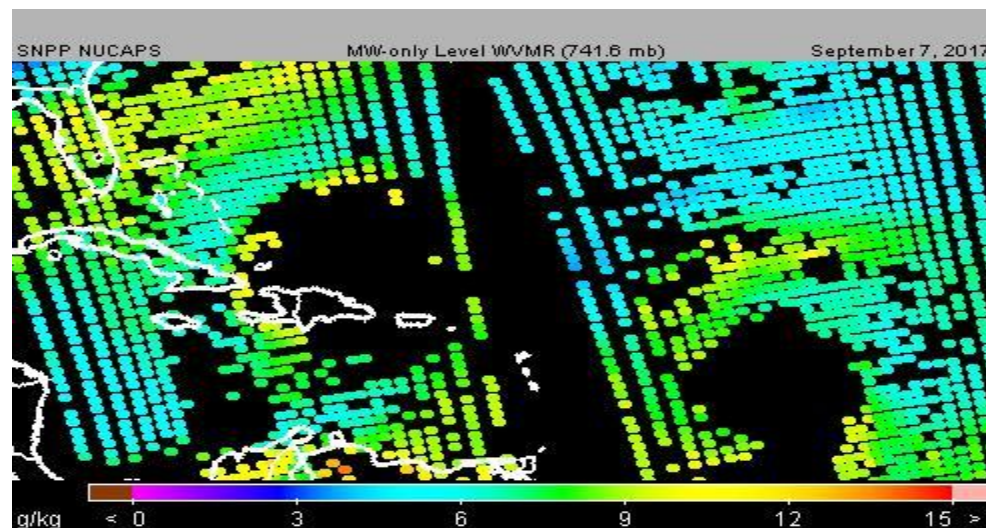


Day/Nite Band VIIRS Imagery

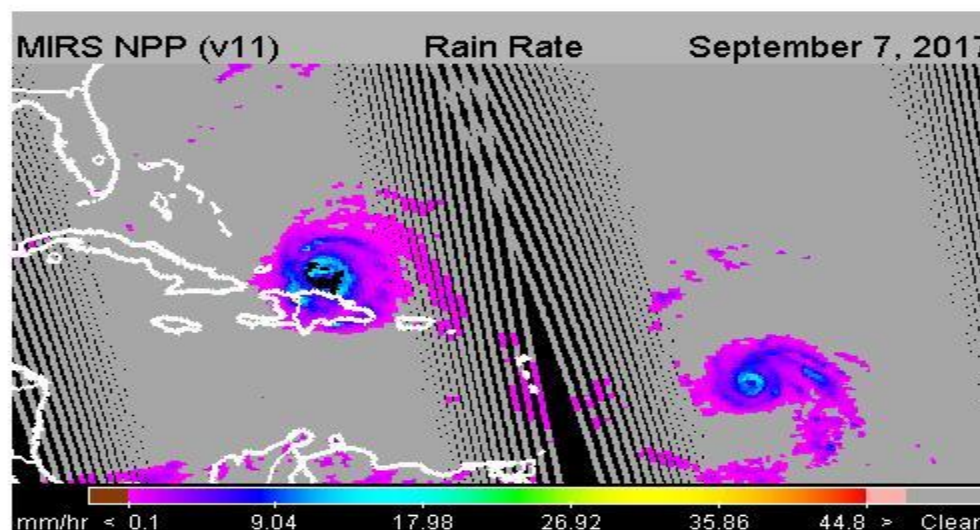
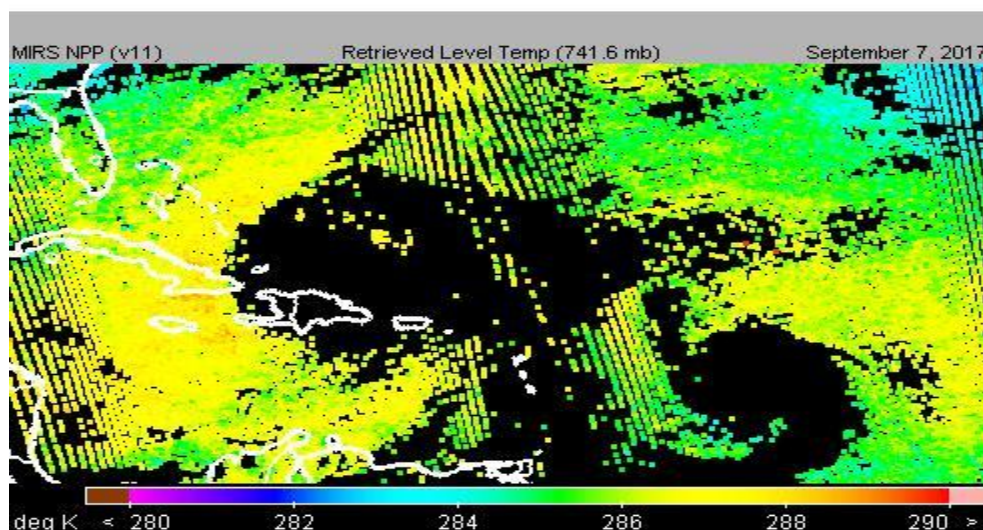
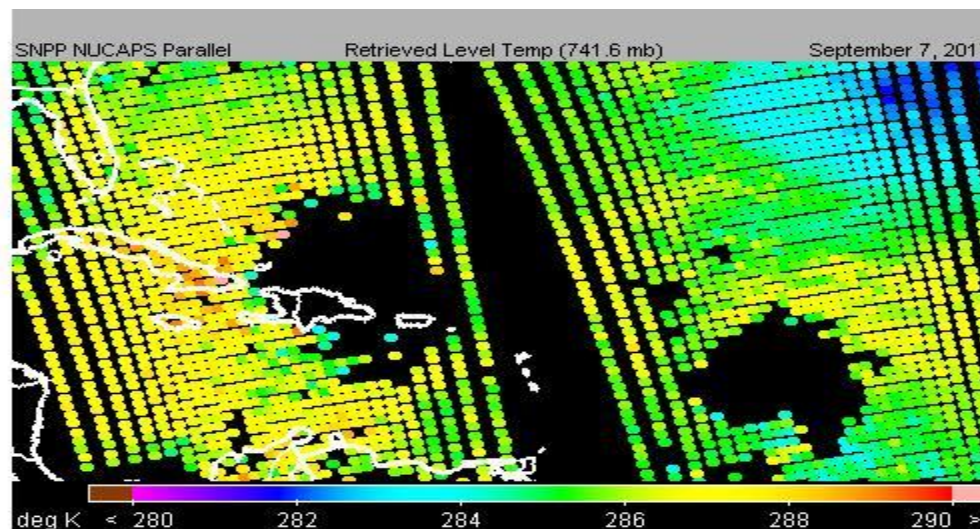
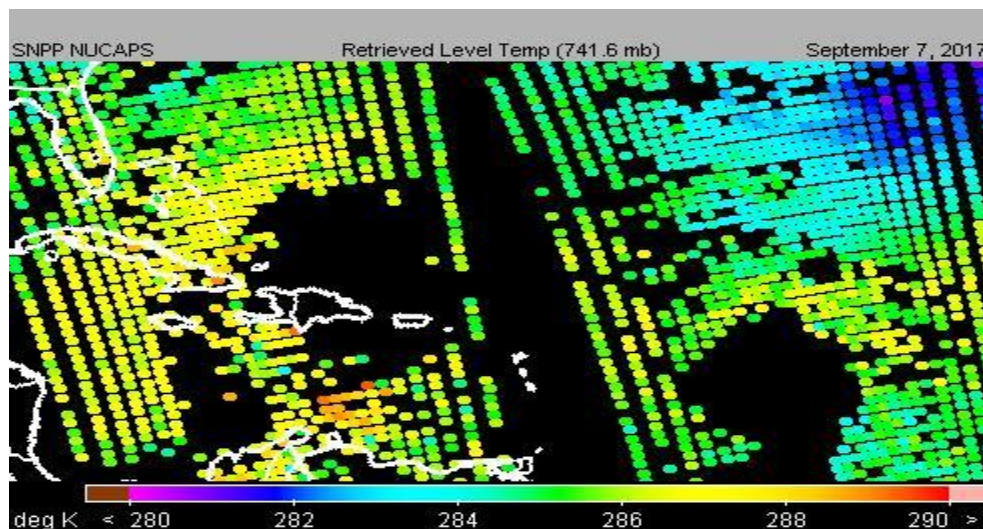




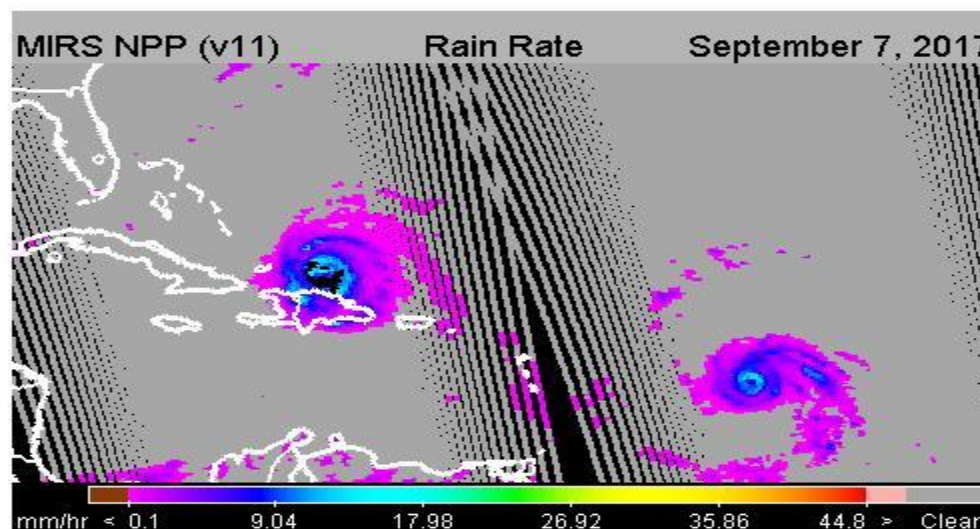
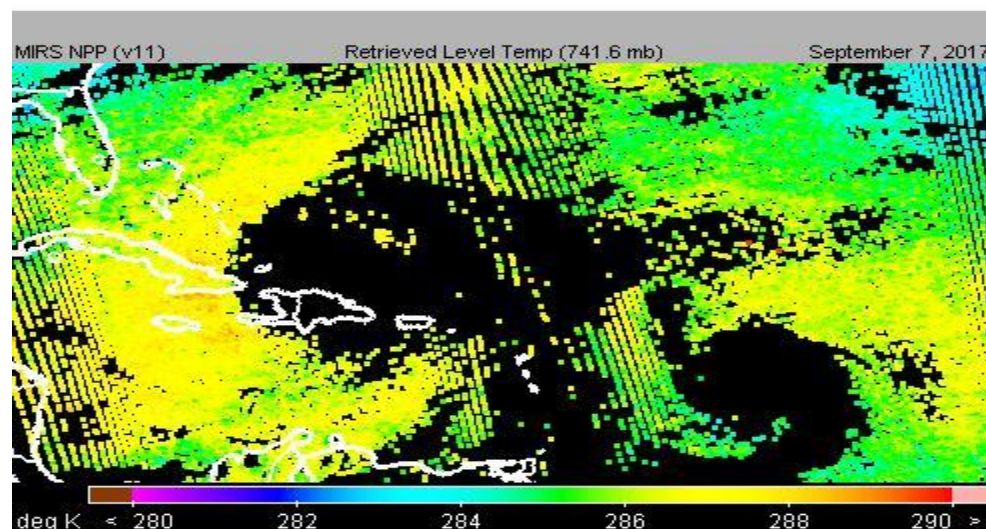
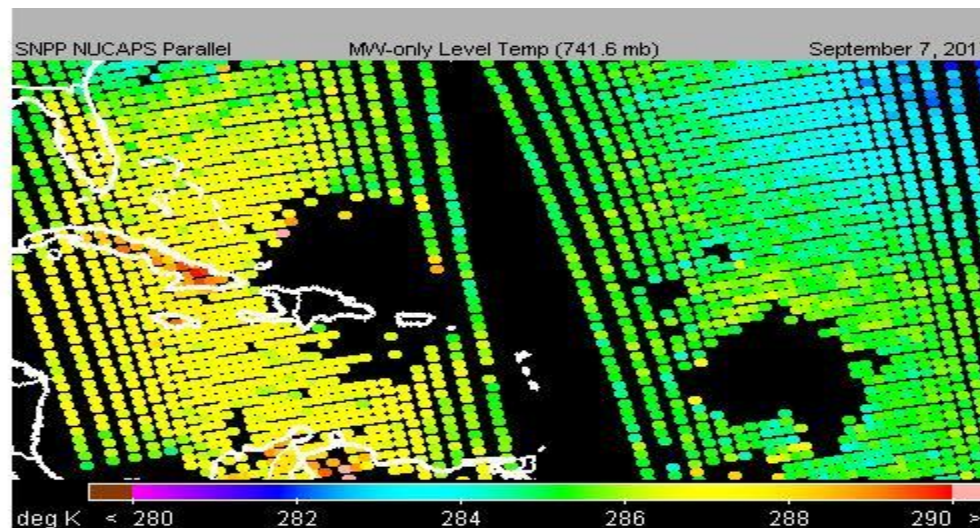
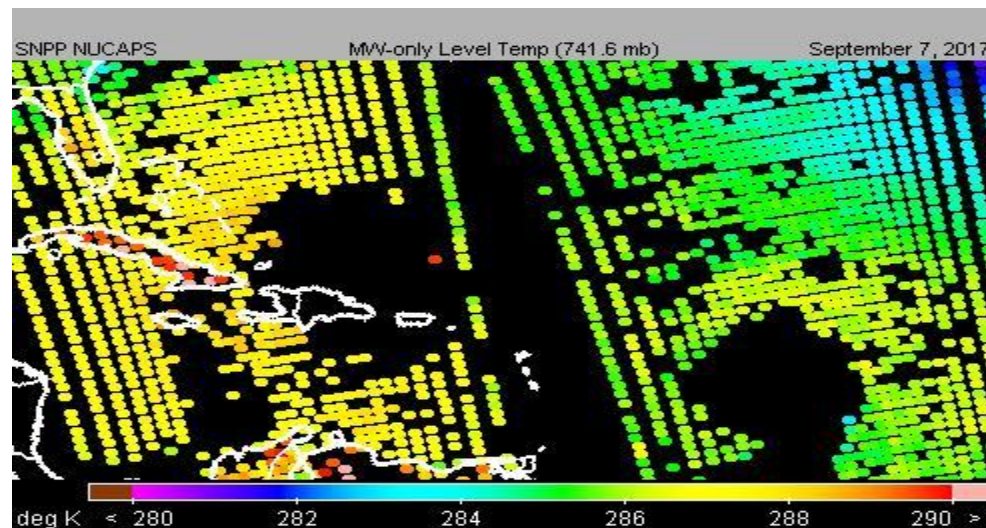
Upper Left, Clockwise: NUCAPS 1.5 IR, NUCAPS 2.1.2 IR, MiRS Rain Rate, MiRS v11
(H₂O MR g/kg)



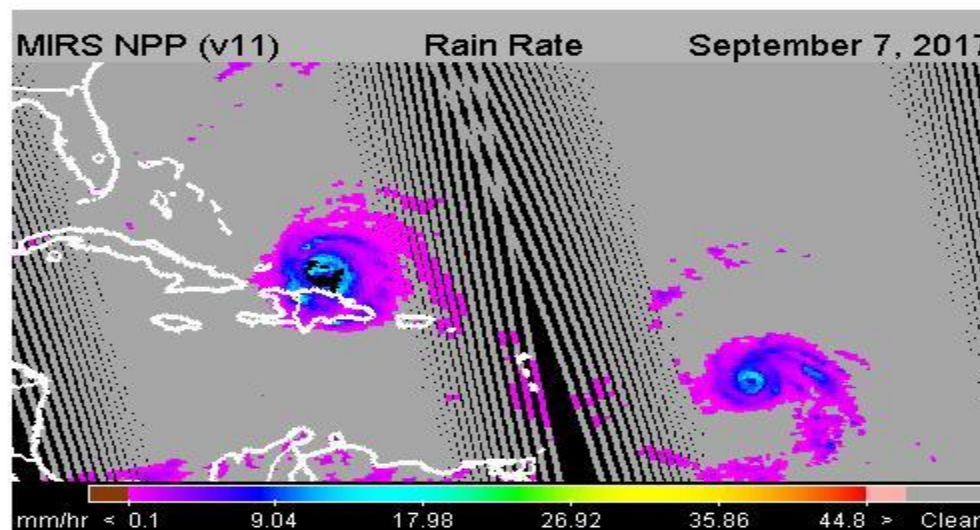
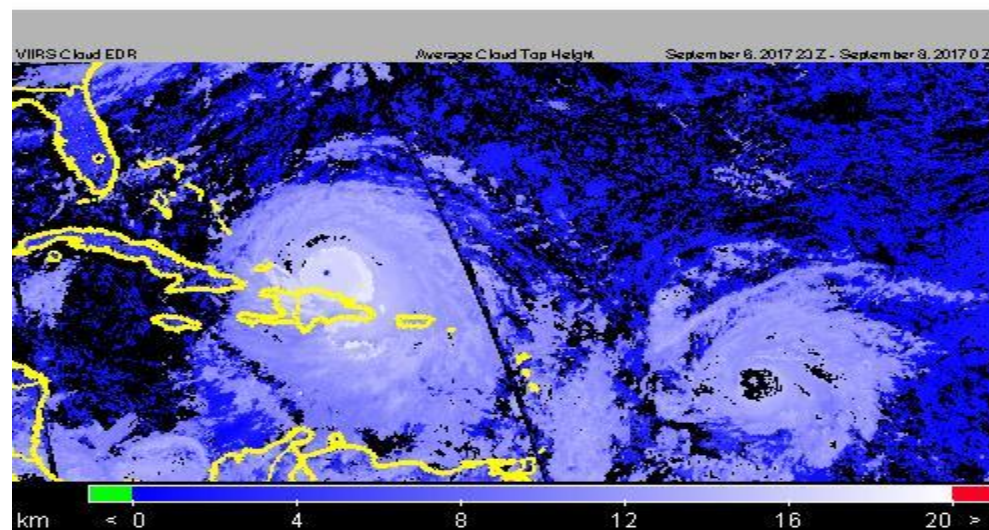
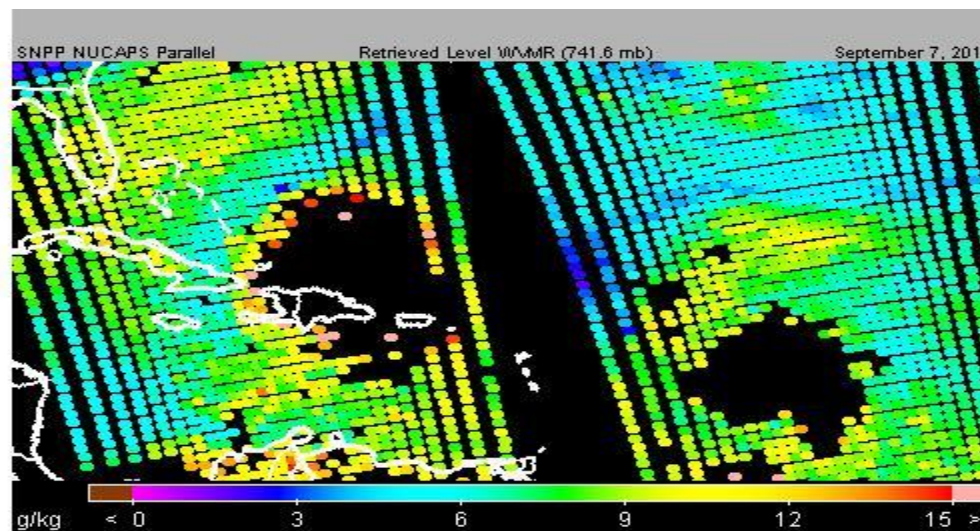
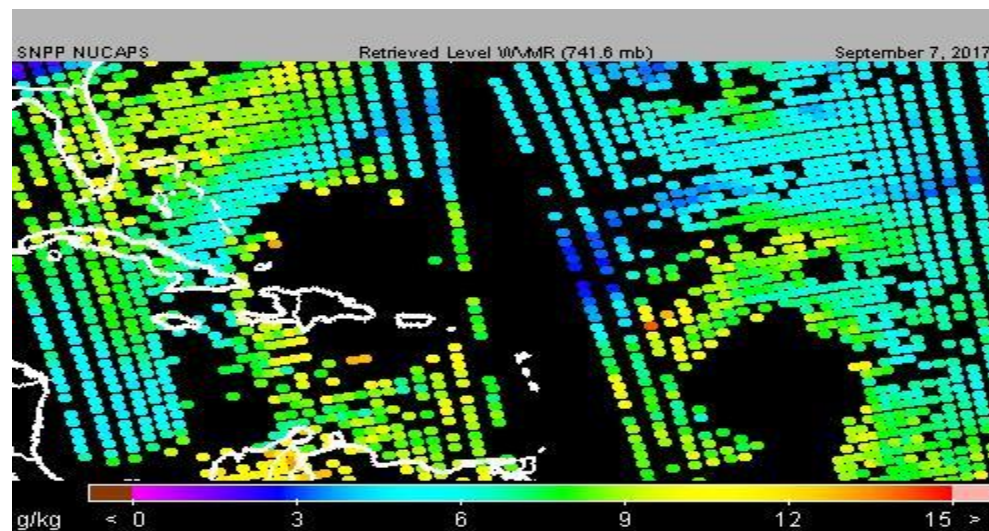
Upper Left, Clockwise: NUCAPS 1.5 MW, NUCAPS 2.1.2 MW, MiRS Rain Rate, MiRS v11 (H2O MR g/kg)



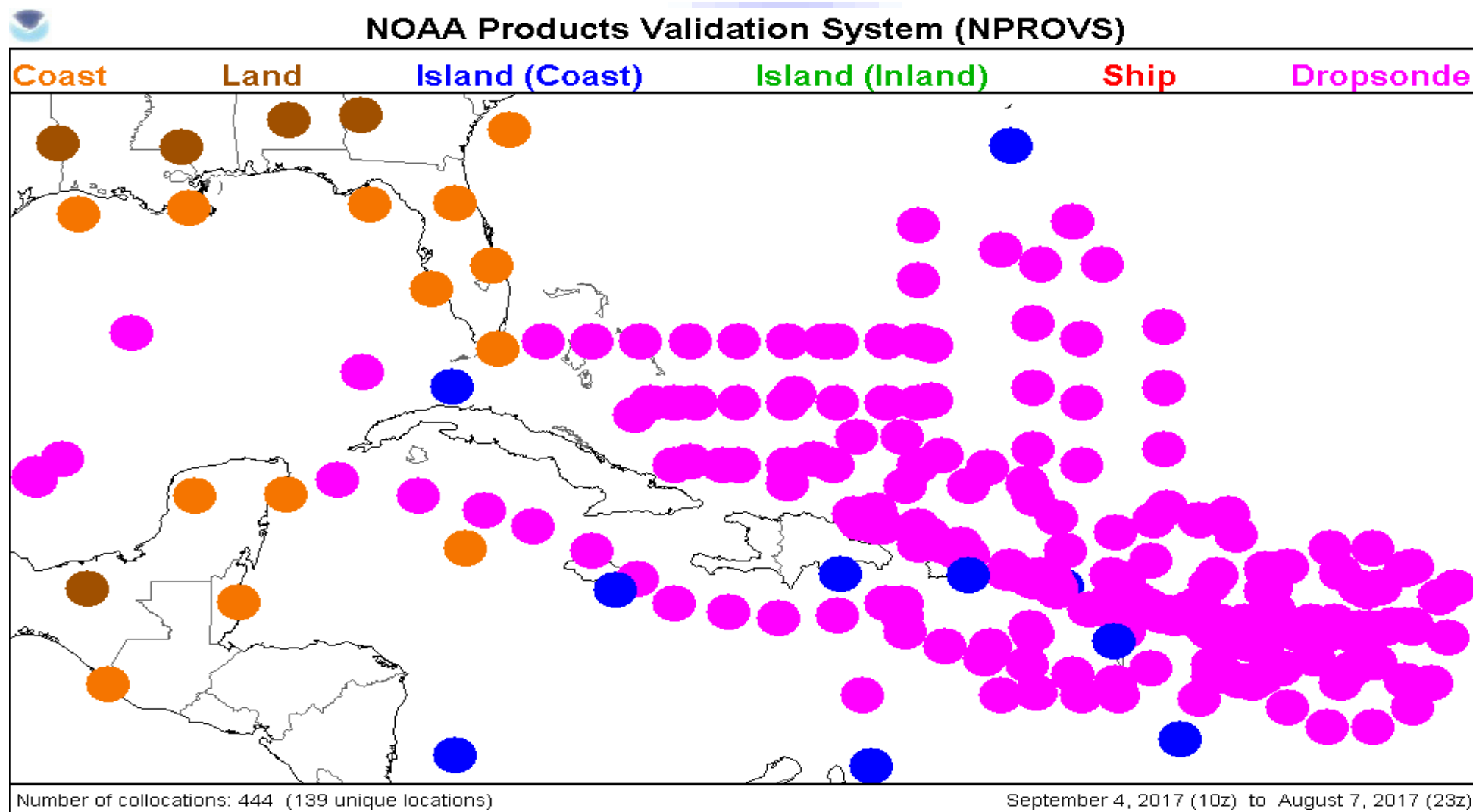
Upper Left, Clockwise: NUCAPS 1.5 IR, NUCAPS 2.1.2 IR, MiRS Rain Rate, MiRS v11 (Temp)



Upper Left, Clockwise: NUCAPS 1.5 MW, NUCAPS 2.1.2 MW, MiRS Rain Rate, MiRS v11 (Temp)







Irma Dropsondes (Sept. 4-7 ...)

Summary

- ❖ NPROVS provides “Enterprise Validation” ... same validation datasets/approach for different sounding product suites
- ❖ *NUCAPS Performance over 6 days Harvey-Gulf Coast Track and Irma’s approach to Florida good particularly for S-NPP NUCAPS 2.1.2*
- ❖ Good consistency with MiRS rain-rate which nicely tracks rainfall event particularly for early Sunday morning deluge on 27th ...
- ❖ MiRS sounding algorithm constrains moisture to 100% RH in cases of retrieved supersaturation; NUCAPS has supersaturation issue ...
- ❖ Follow-up dropsonde validation exercise, etc ...