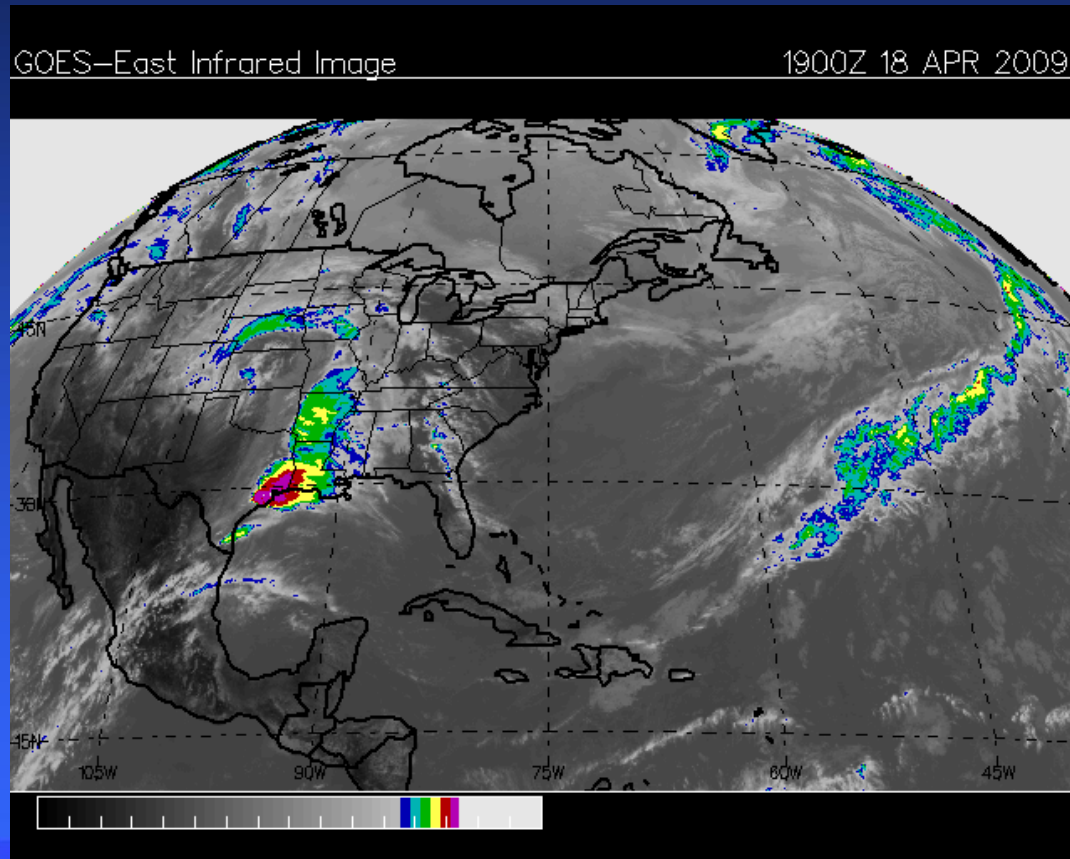


Using the SPoRT MET Scripts to Assess the WRF EMS for a Southeast Texas Heavy Rainfall Event

Patrick Blood and Lance Wood



NWS Houston/Galveston

Stage IV

24hr QPE Accumulation

Valid Period:

11/08/2011 12:00:00 - 11/09/2011 12:00:00 UTC

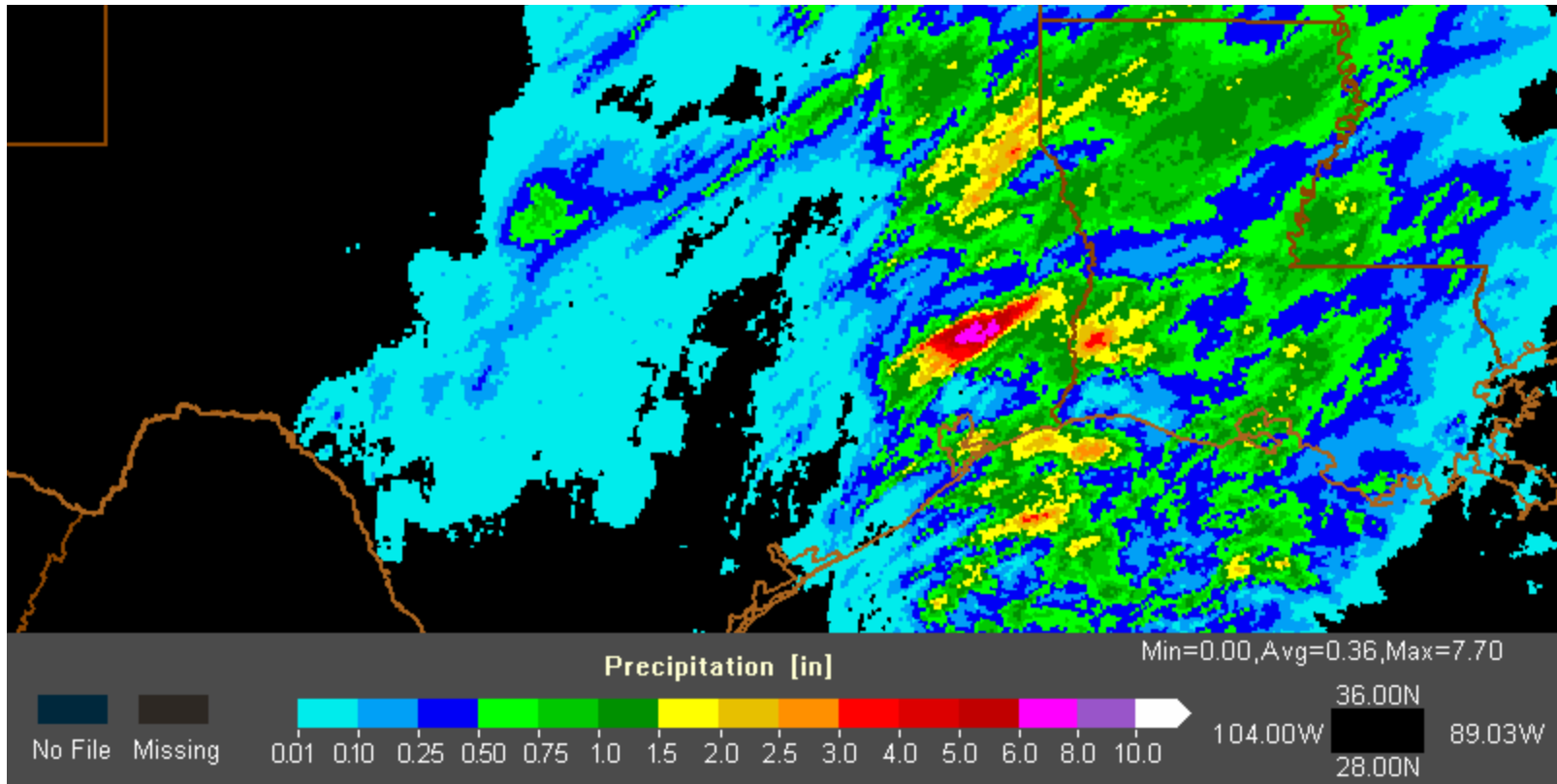


SPoRT Model Simulation Matrix

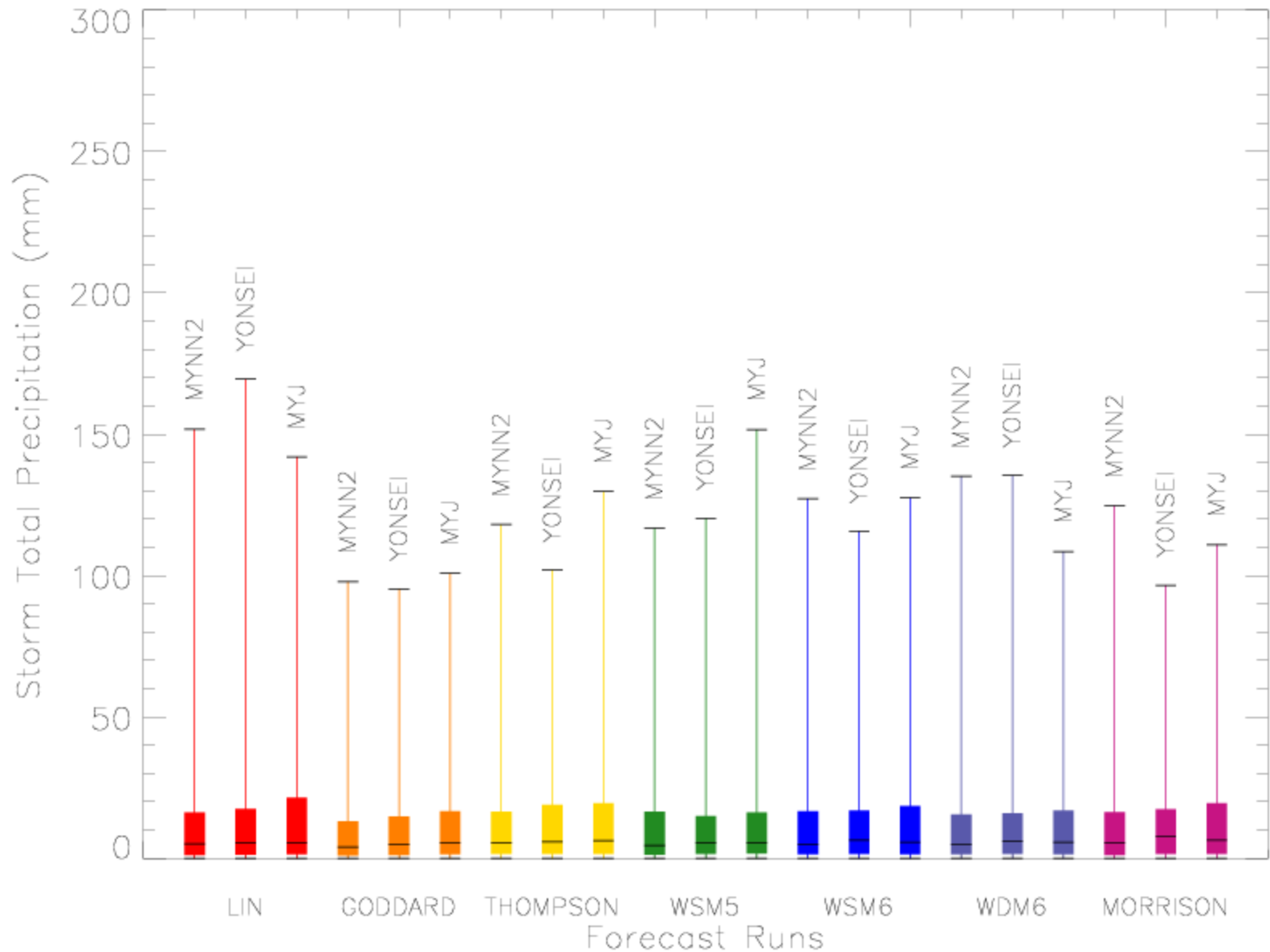
Cold Season Heavy Rainfall - WFO Houston Case Study

November 8-9, 2011

Andrew Molthan



Variability in Storm Total Precipitation – All Points, All Hours



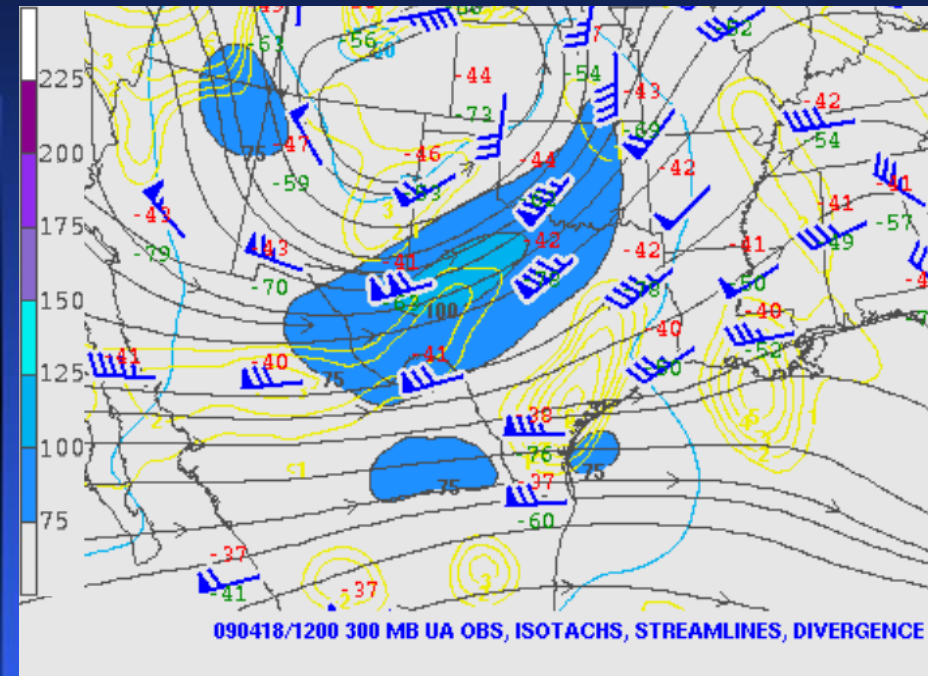
We learned that selecting the appropriate PBL and Microphysics is important

18 April 2009 Synoptic Overview

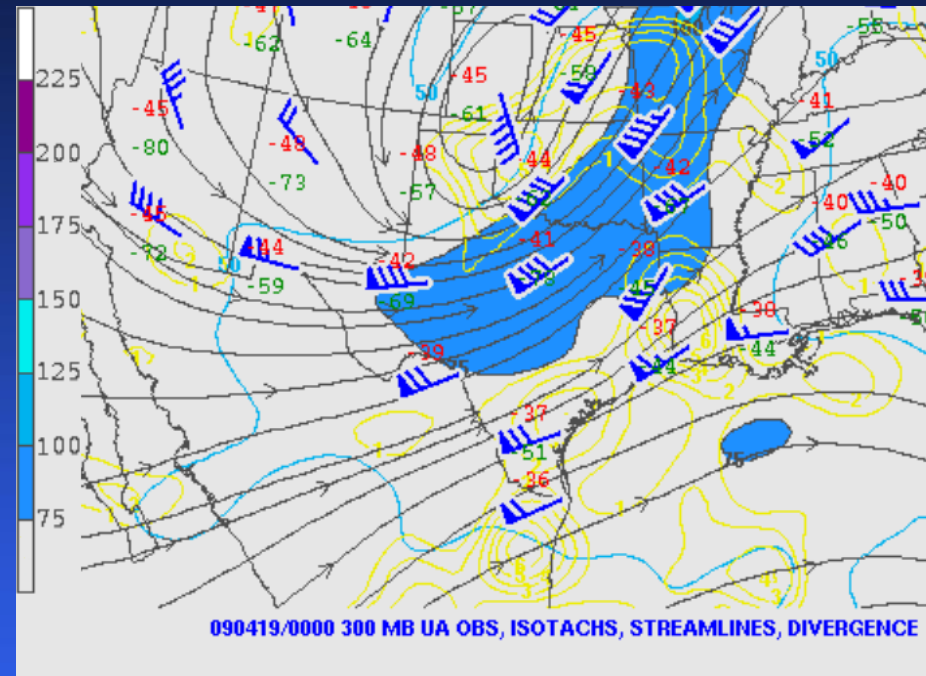
- Upper divergence apparent at 300 mb level with SE Texas between two diverging jet streaks.
- 500 mb low moving over the southern plains with a shortwave trough moving across SE Texas.
- Deep layer moisture in the lower levels noticed at the 850 and 700 mb levels (PWATS : ~1.55" (25th percentile)).
- Pre-existing surface trough over the Houston area with a dry line and cold front approaching from the west.

18 April 2009 Synoptic Overview

courtesy of <http://www.spc.noaa.gov/obswx/maps/>



12 UTC 18 April 2009



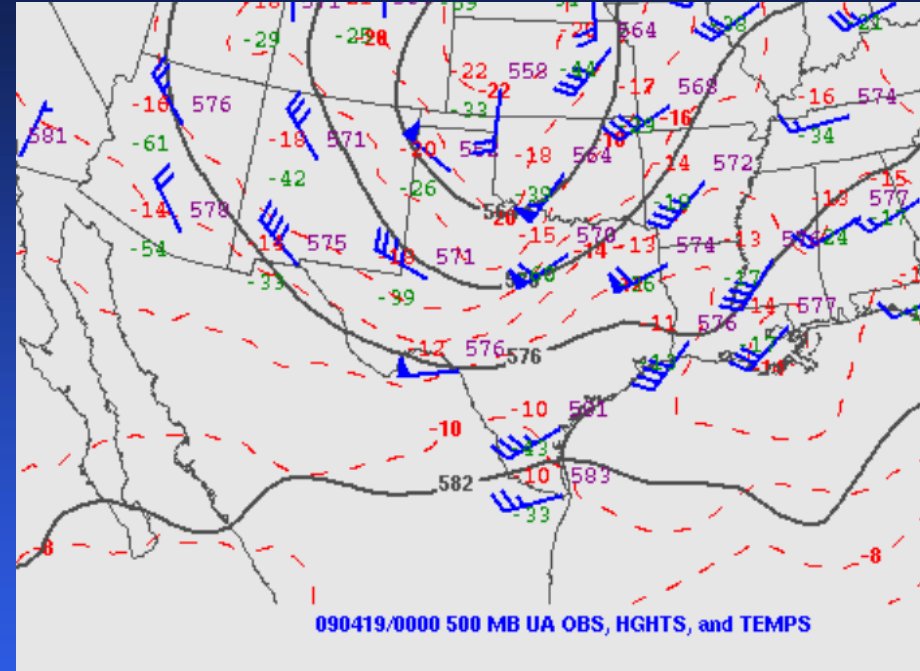
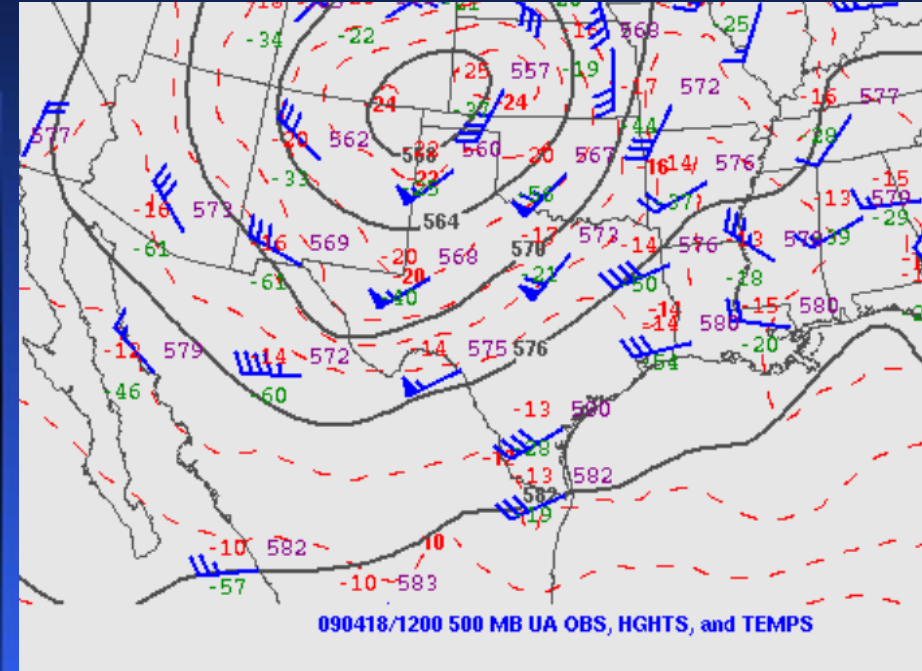
00 UTC 19 April 2009

300 mb

NWS Houston/Galveston

18 April 2009 Synoptic Overview

courtesy of <http://www.spc.noaa.gov/obswx/maps/>



12 UTC 18 April 2009

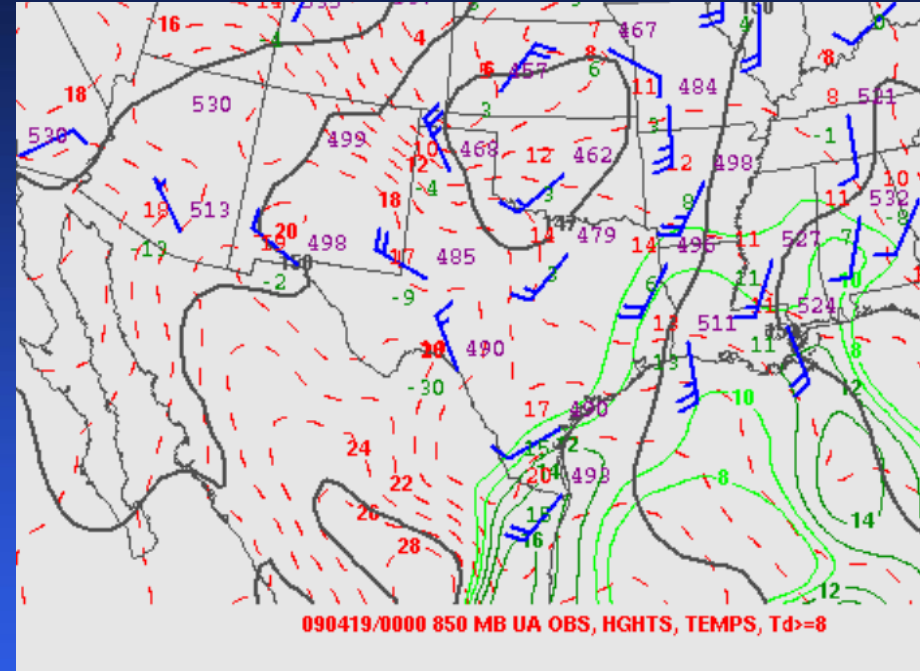
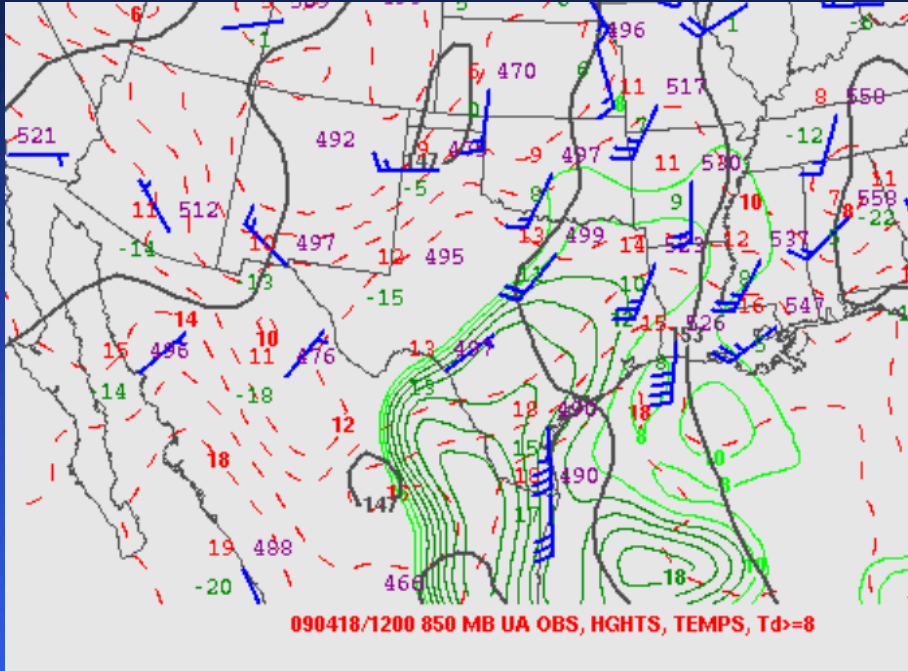
00 UTC 19 April 2009

500 mb

NWS Houston/Galveston

18 April 2009 Synoptic Overview

courtesy of <http://www.spc.noaa.gov/obswx/maps/>



12 UTC 18 April 2009

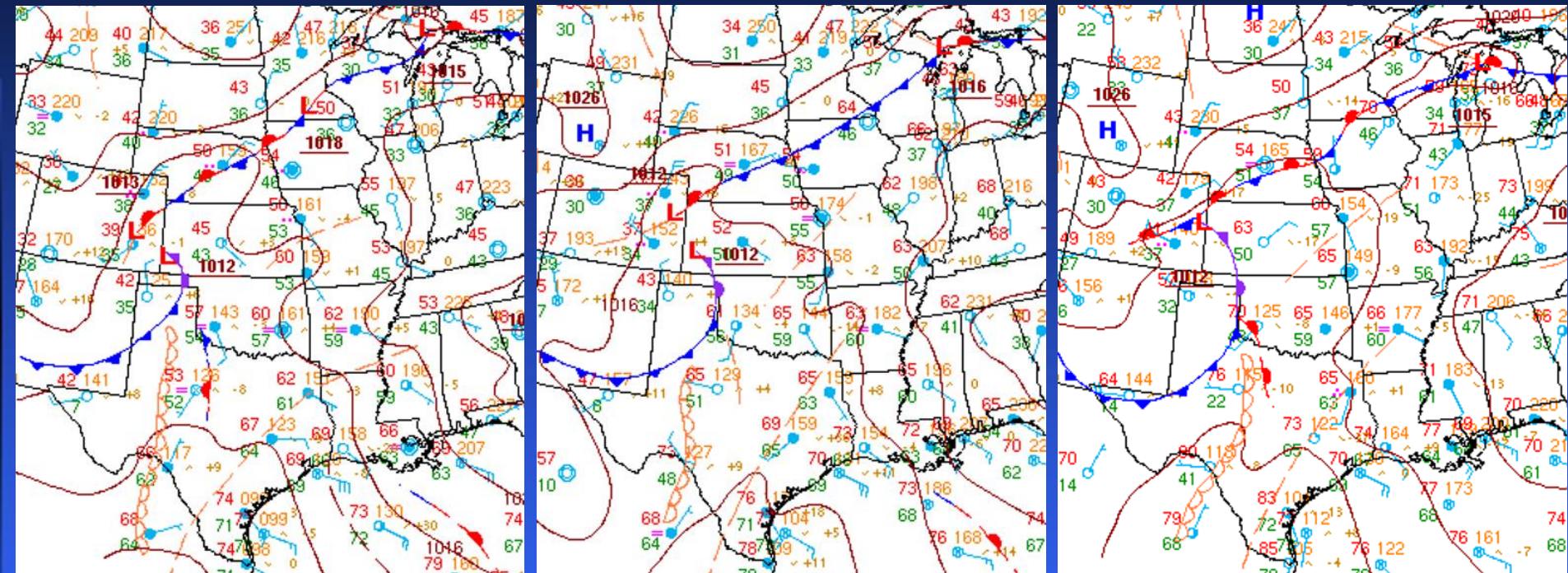
00 UTC 19 April 2009

850 mb

NWS Houston/Galveston

18 April 2009 Synoptic Overview

courtesy of http://www.hpc.ncep.noaa.gov/html/sfc_archive.shtml



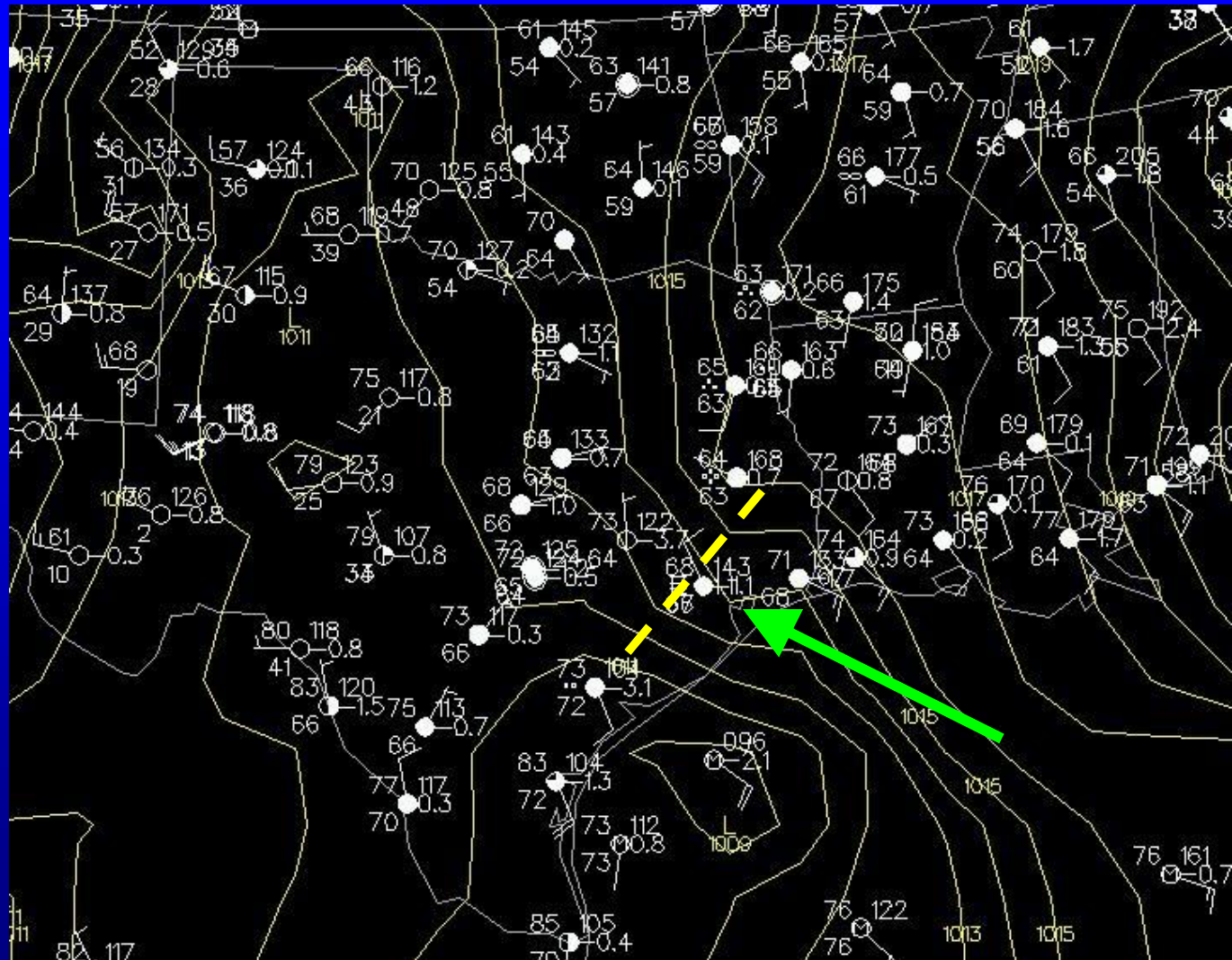
12 UTC 18 Apr 2009 15 UTC 18 Apr 2009 18 UTC 19 Apr 2009

Surface plot/fronts/pressure

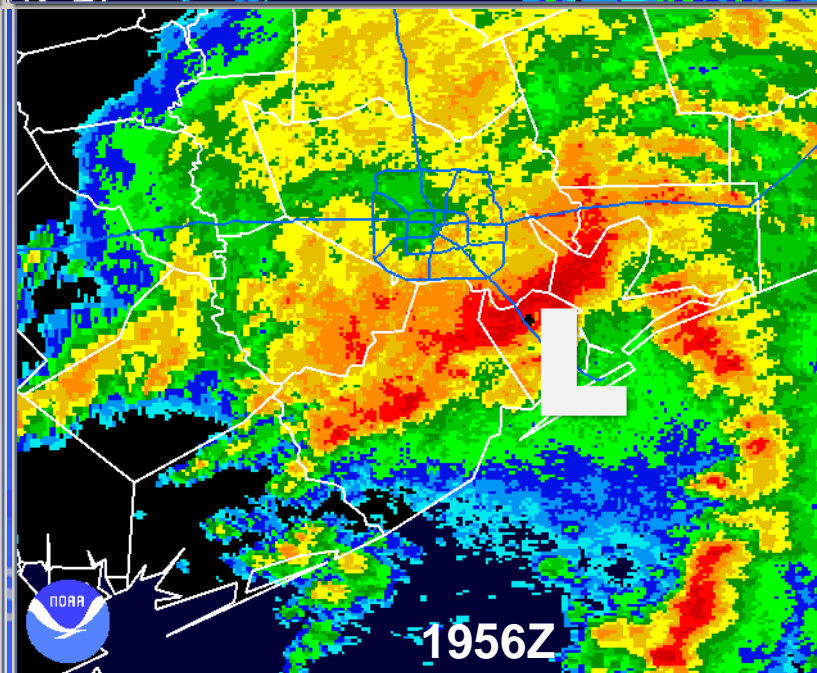
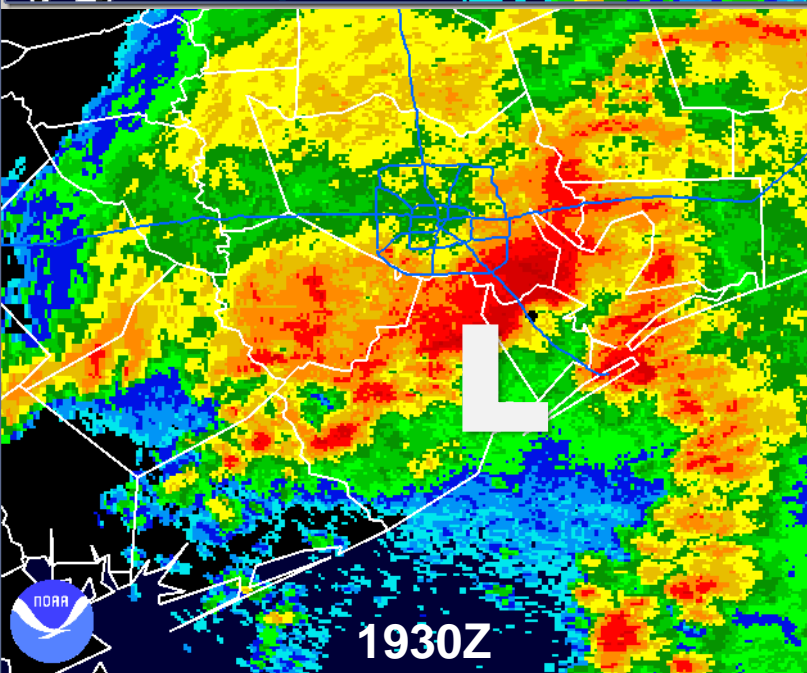
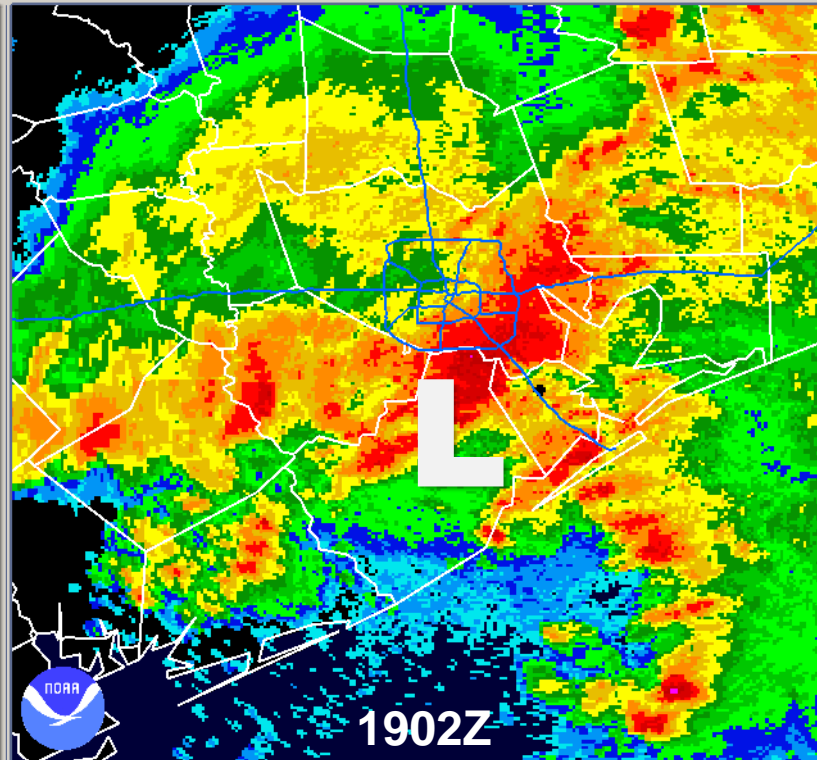
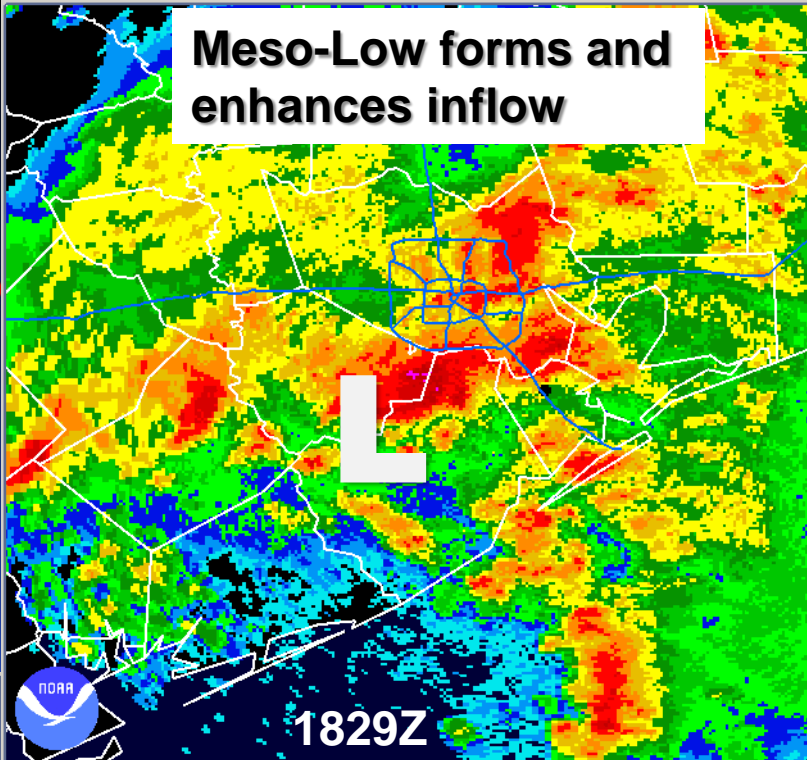
NWS Houston/Galveston

The April 18th 2009 Extreme Rain Event

18Z Surface Analysis



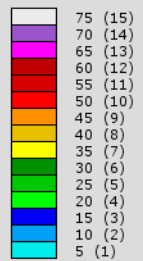
Meso-Low forms and enhances inflow



NEXRAD LEVEL-III
COMPOSITE REF. 124NM
KHGX - HOUSTON, TX
04/18/2009 19:56:07 GMT
LAT: 29/28/19 N
LON: 95/04/44 W
ELEV: 115 FT
MODE/VCP: A / 212

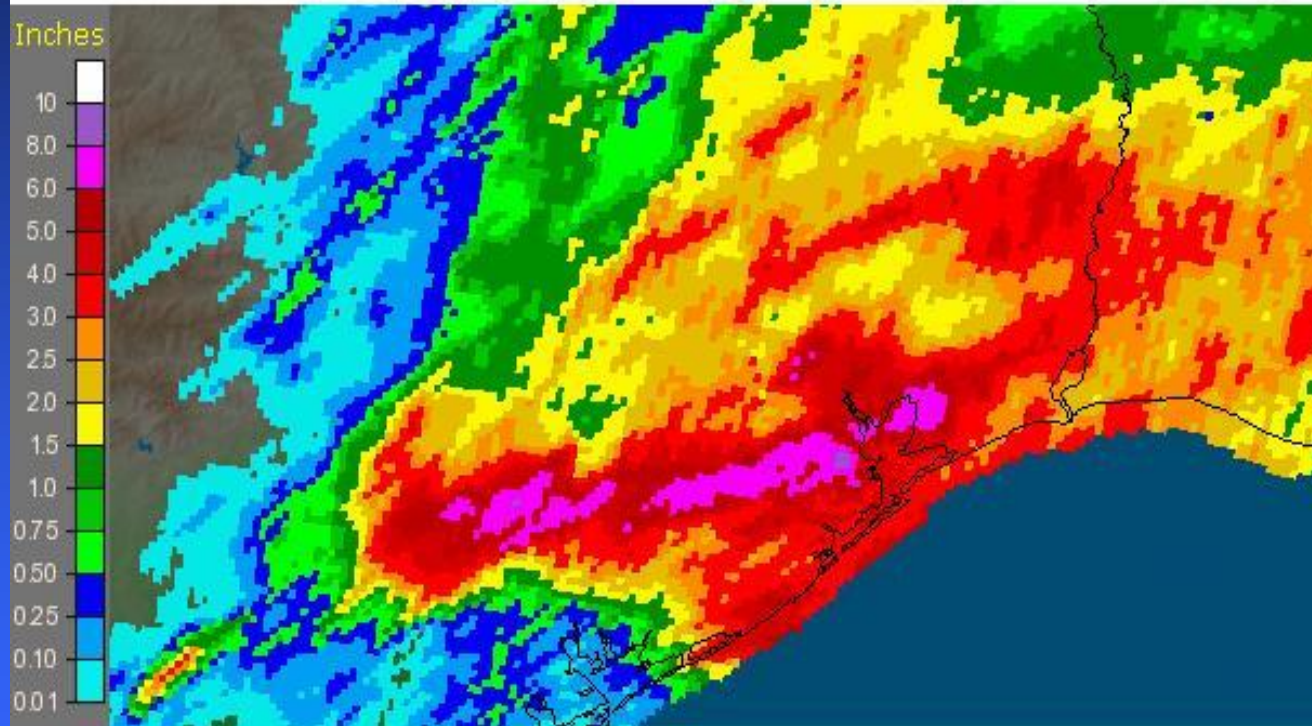
MAX: 63 dBZ
BOT: 0 KFT
TOP: 0 KFT

Legend: dBZ (Category)



24 Hour Precipitation Estimate from KHGX

Houston/Galveston, TX (HGX): 4/19/2009 1-Day Observed
Precipitation
Valid at 4/19/2009 1200 UTC- Created 4/21/09 10:33 UTC



NWS Houston/Galveston

Rainfall Rate Comparisons / Impacts

Comparison Rainfall Rates						
Date	1-hr	3-hr	6-hr	12-hr	24-hr	House Flooding Estimates
6/08/01 (TS Allison)	6.3	13.5	21.2	28.3	28.5	73000
6/19/06	5.0	8.6	10.4	10.7	10.7	3370
6/26/07 (Marble Falls, TX)	6.8	13.4	17.8	17.8	17.8	N/A
4/18/09	6.9	9.2	9.9	10.0	11.0	200
Maximum gage recorded rainfall in inches						
Return Period:	10year	25year	50year	100year	500year	

The 18 April event had 9.9 of its 11 inch max of rainfall fall in 6 hours with 6.9 inches in one hour.

The April 18th 2009 Extreme Rain Event

Friendswood



Image Courtesy: Galveston Daily News

The Strand



Image Courtesy: Galveston Daily News

NWS Houston/Galveston

Historical WRF EMS Runs and Assessing with the Model Evaluation Tools (MET)

Forecaster Patrick Blood has utilized 3 different model initialization datasets, 6 PBLs, and 8 microphysical schemes to produce 144 model runs to analyze - using v3.4 of the WRF EMS.

Using the SPoRT MET scripts v4.1 and the new grib2 capability (courtesy of Brad Zavodsky) to objectively assess the precipitation forecasts.

This work is part of Mr. Blood's MS Thesis work at the University of Houston. He is in the early stages of data analysis.

CSI

25 mm 24 km x 24 km

Re-Analysis
Initialization:

C : CFSR

PBL Schemes:

1: Yonsei

4: QNSE

Microphysical
Schemes:

02: Lin

06: WSM 6 Class

08: Thompson

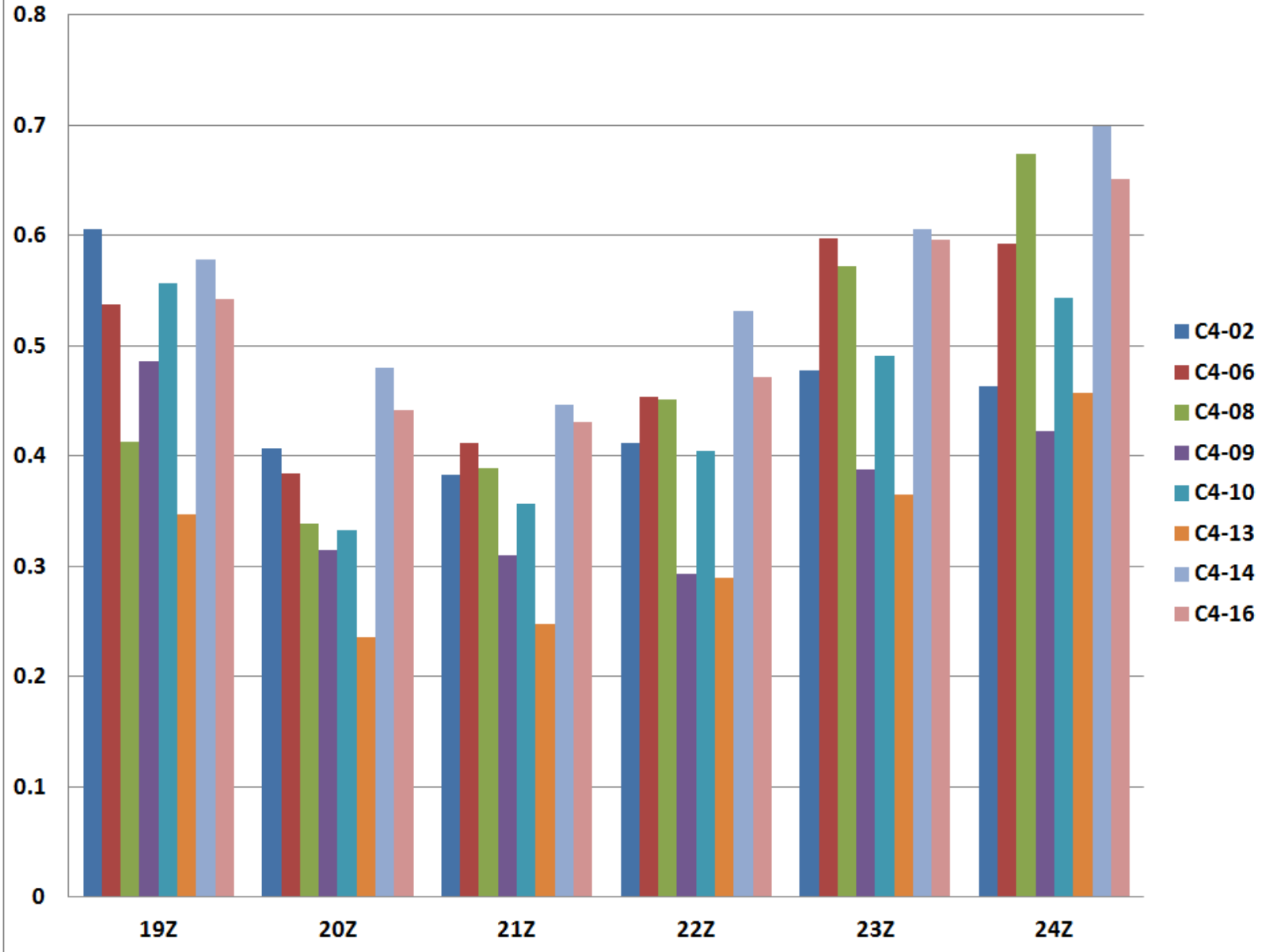
09: Milbrandt-Yau

10: Morrison

13: Stony Brook
University

14: WDM 5-Class

16: WDM 6-Class



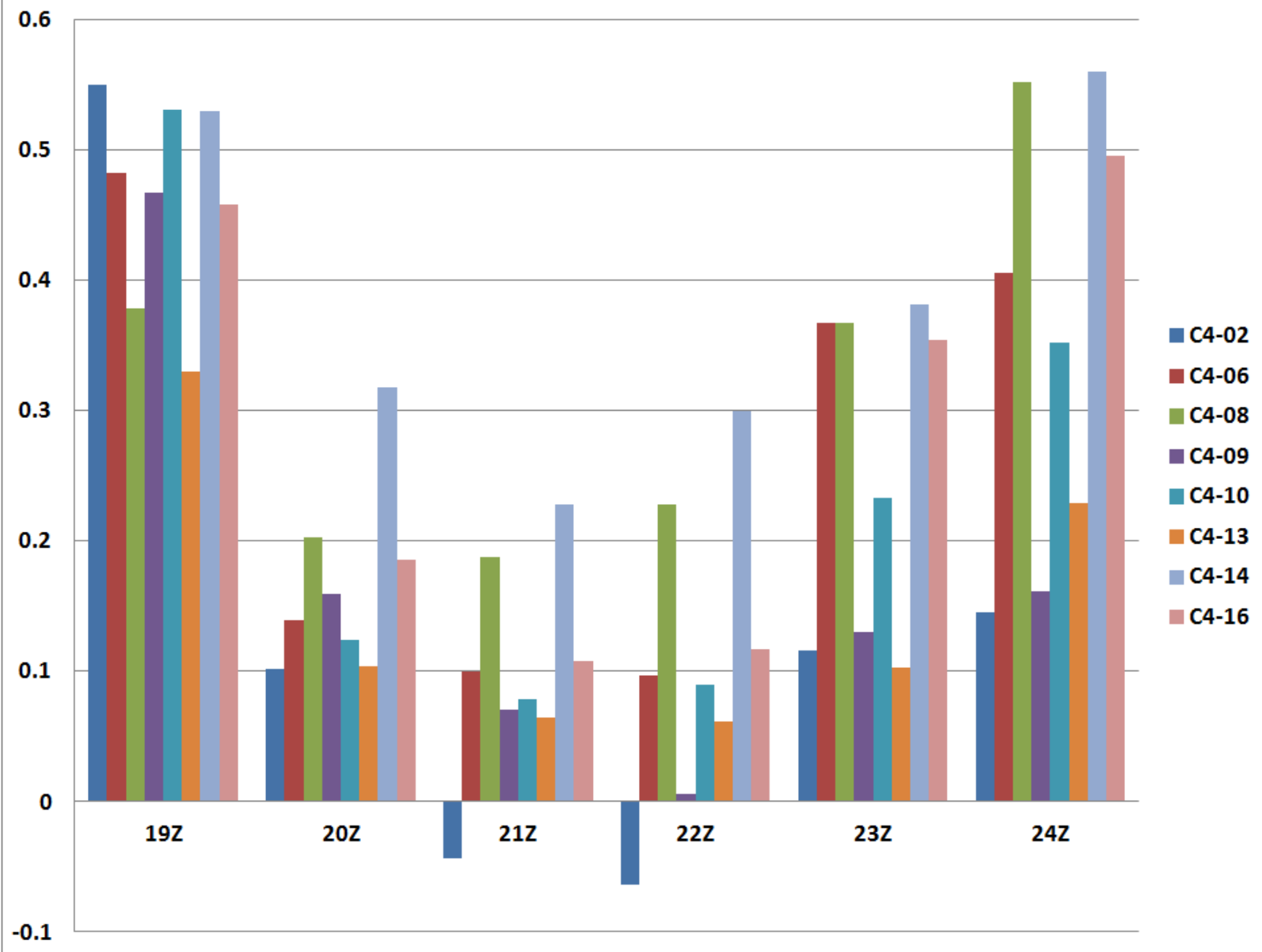
HSS

25 mm 24 km x 24 km

Re-Analysis
Initialization:
C : CFSR

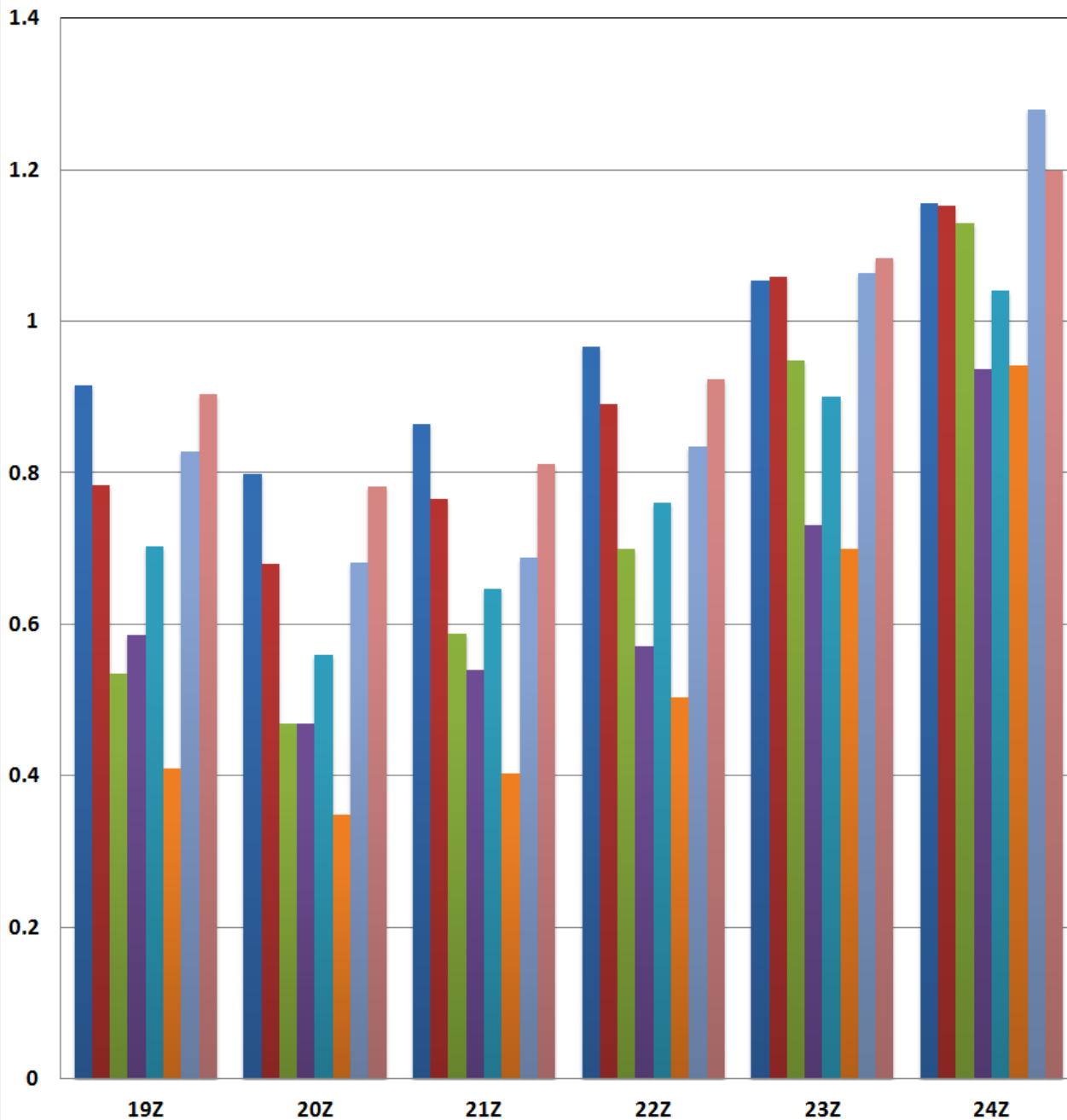
PBL Schemes:
1: Yonsei
4: QNSE

Microphysical
Schemes:
02: Lin
06: WSM 6 Class
08: Thompson
09: Milbrandt-Yau
10: Morrison
13: Stony Brook
University
14: WDM 5-Class
16: WDM 6-Class



Frequency Bias

25 mm 24 km x 24 km



Re-Analysis Initialization:

C : CFSR

PBL Schemes:

1: Yonsei

4: QNSE

Microphysical Schemes:

02: Lin

06: WSM 6 Class

08: Thompson

09: Milbrandt-Yau

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CSI
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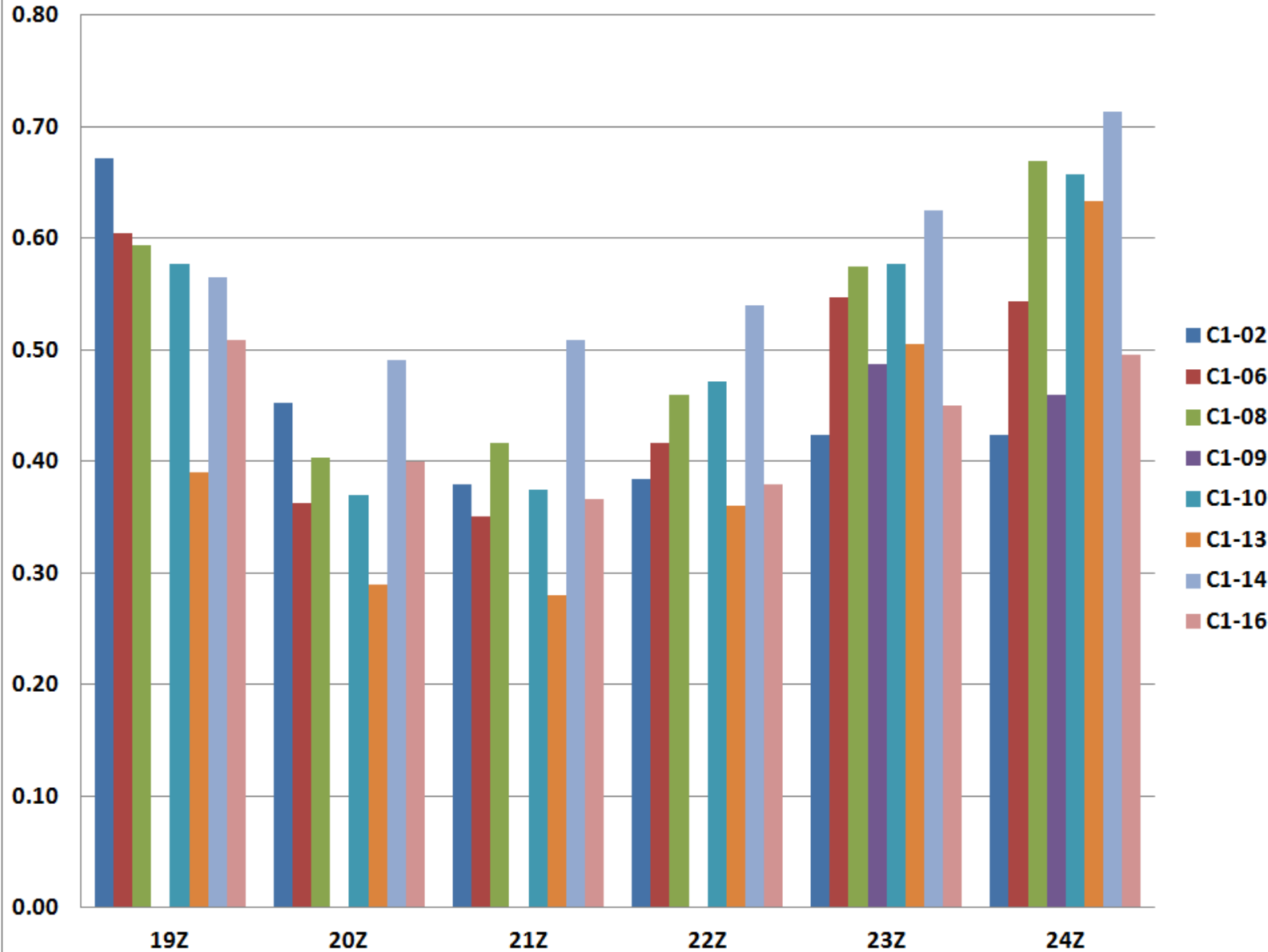
09: Milbrandt-Yau

10: Morrison

13: Stony Brook
University

14: WDM 5-Class

16: WDM 6-Class



HSS 25 mm, 24 km x 24 km

Re-Analysis
Initialization:

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Schemes:

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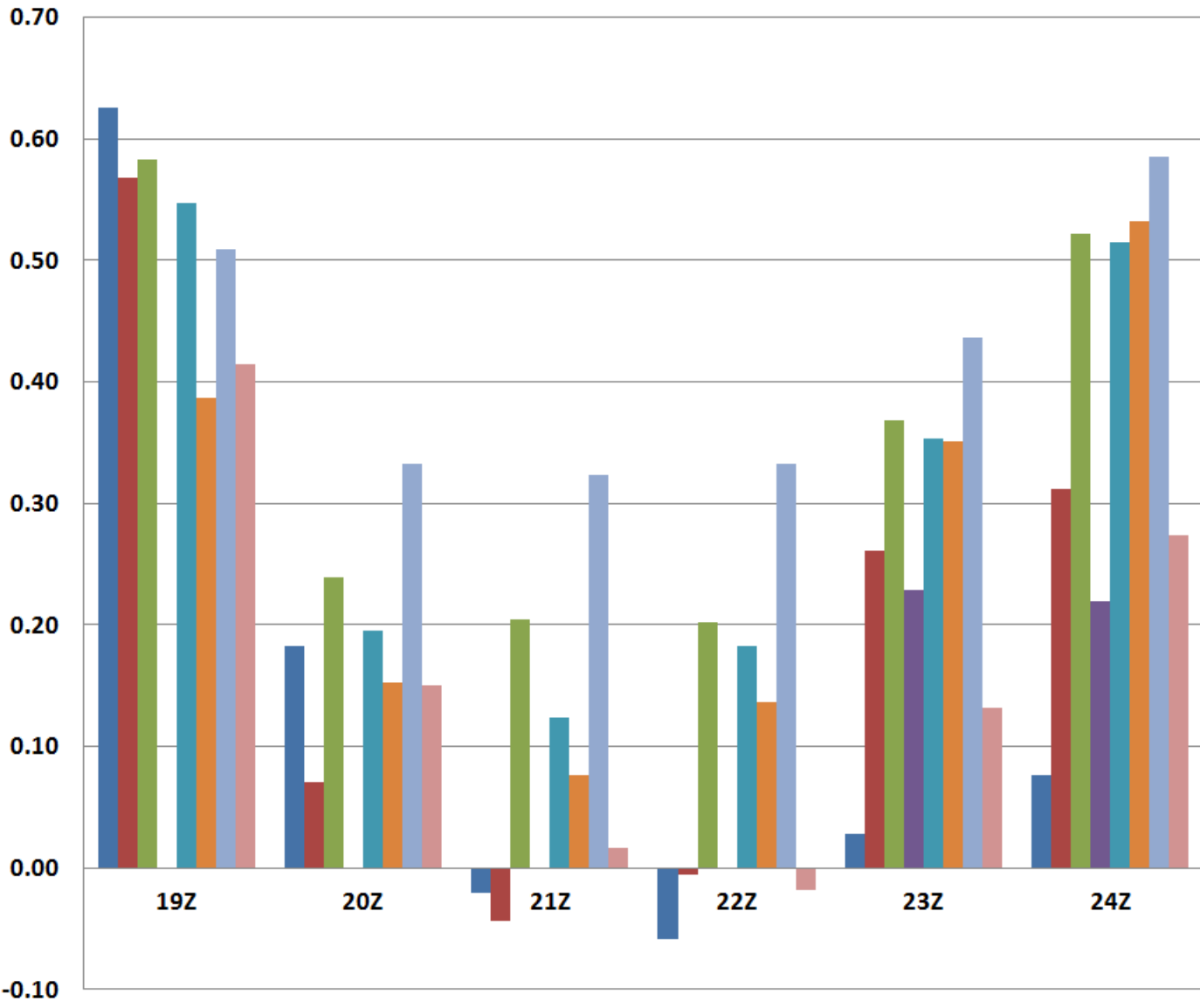
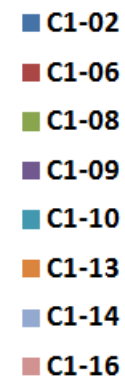
09: Milbrandt-Yau

10: Morrison

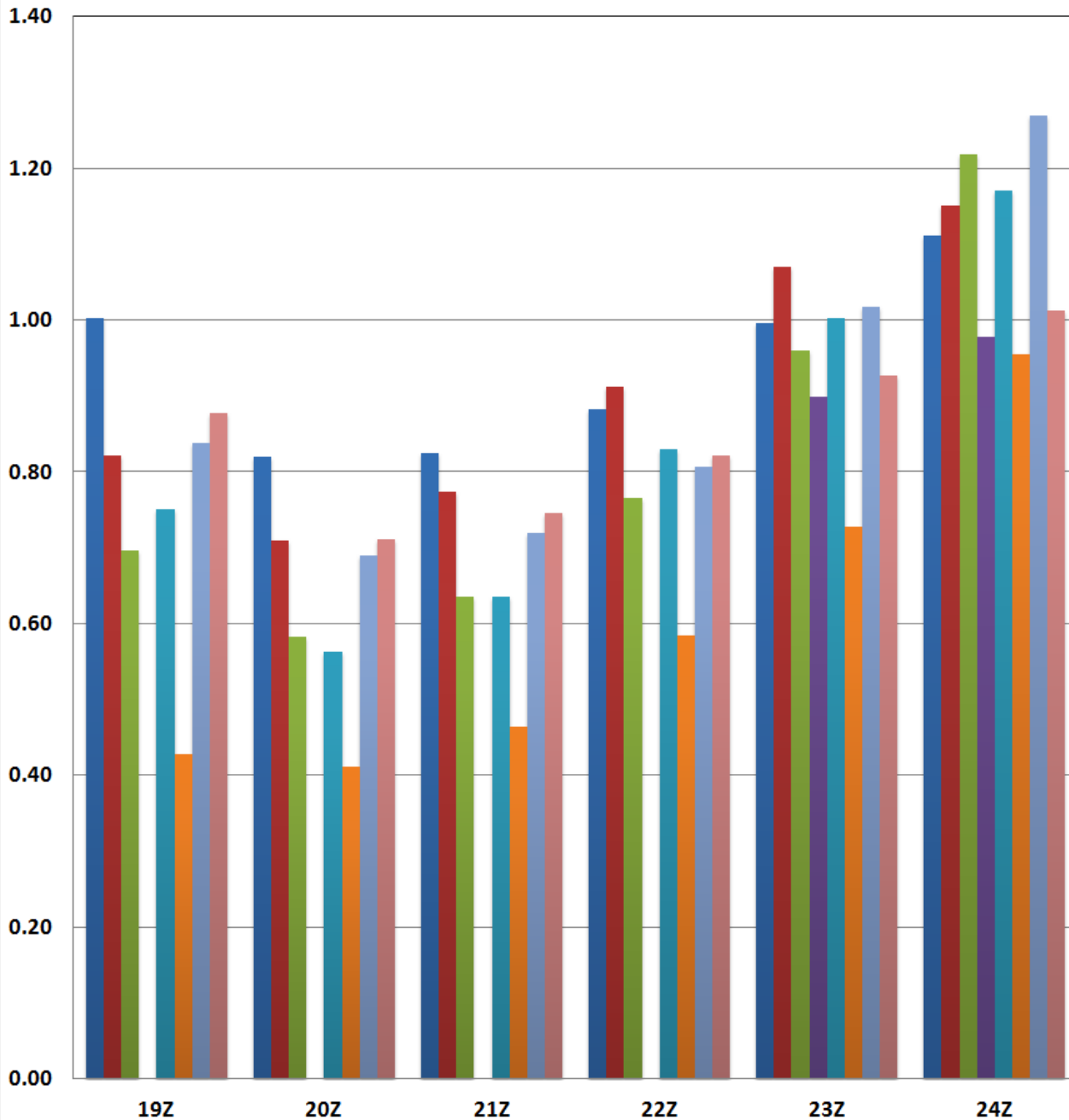
13: Stony Brook
University

14: WDM 5-Class

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Frequency Bias
25 mm 24 km x 24 km



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10: Morrison

13: Stony Brook University

14: WDM 5-Class

16: WDM 6-Class

Stage III Precipitation

18-19 Z

21-22 Z

19-20 Z

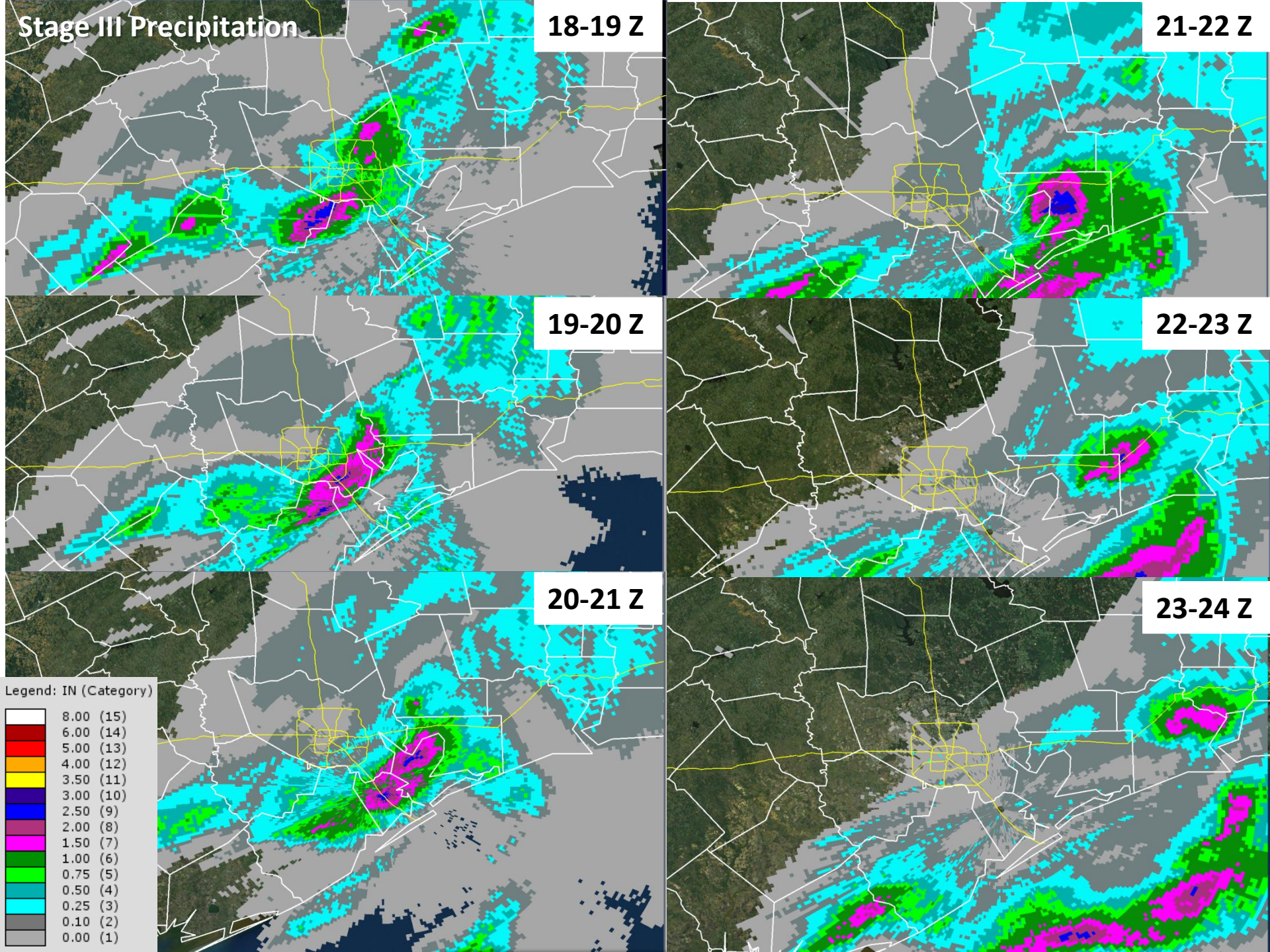
22-23 Z

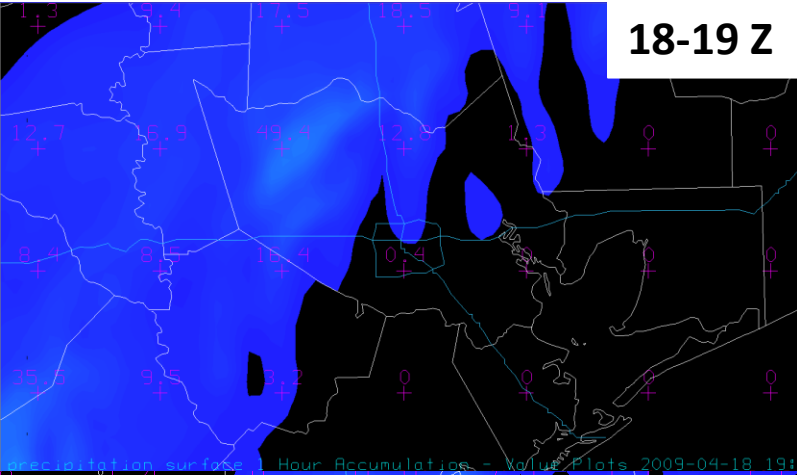
20-21 Z

23-24 Z

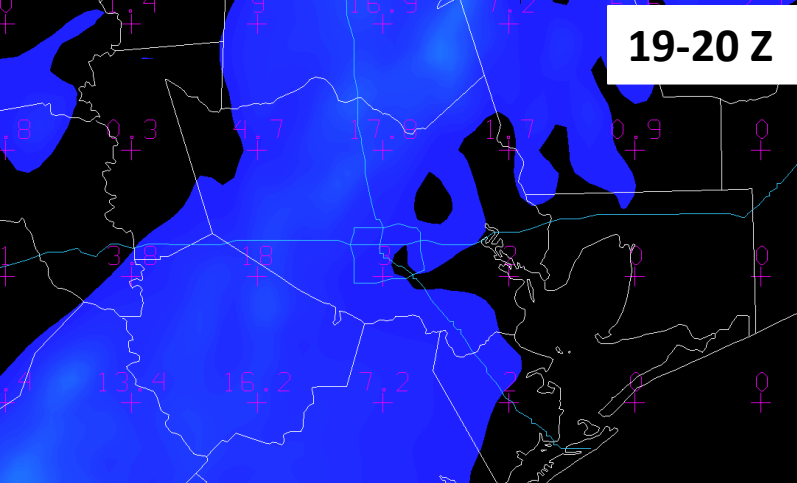
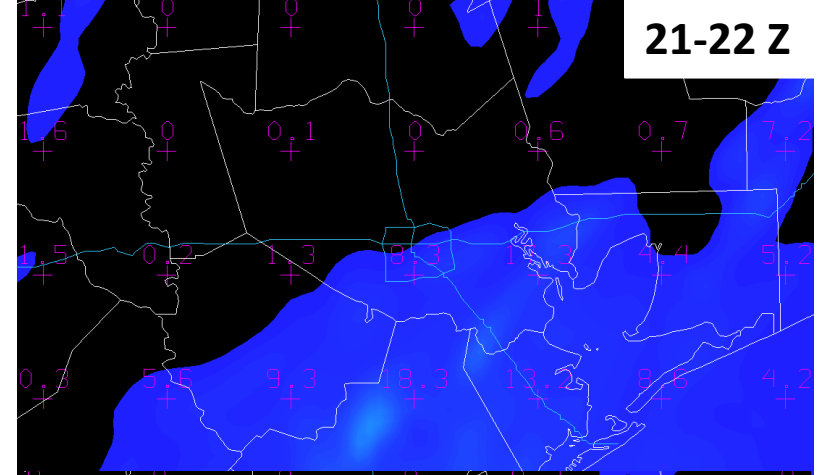
Legend: IN (Category)

White	8.00 (15)
Red	6.00 (14)
Orange	5.00 (13)
Yellow	4.00 (12)
Light Green	3.50 (11)
Green	3.00 (10)
Dark Green	2.50 (9)
Light Blue	2.00 (8)
Blue	1.50 (7)
Dark Blue	1.00 (6)
Magenta	0.75 (5)
Cyan	0.50 (4)
Light Cyan	0.25 (3)
Grey	0.10 (2)
Dark Grey	0.00 (1)

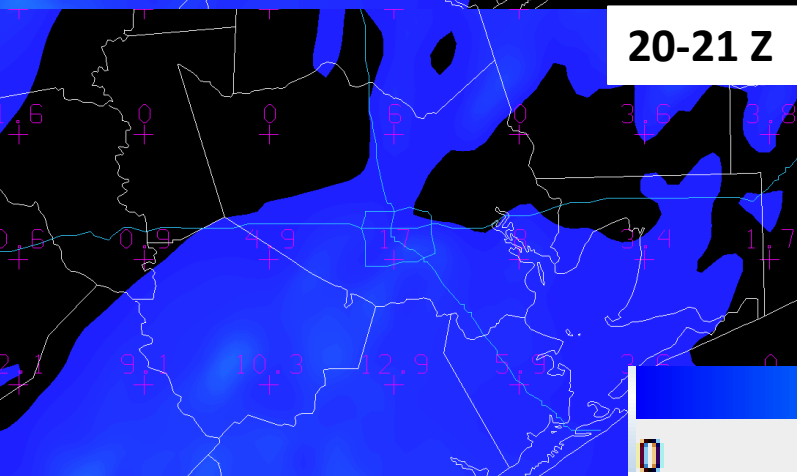
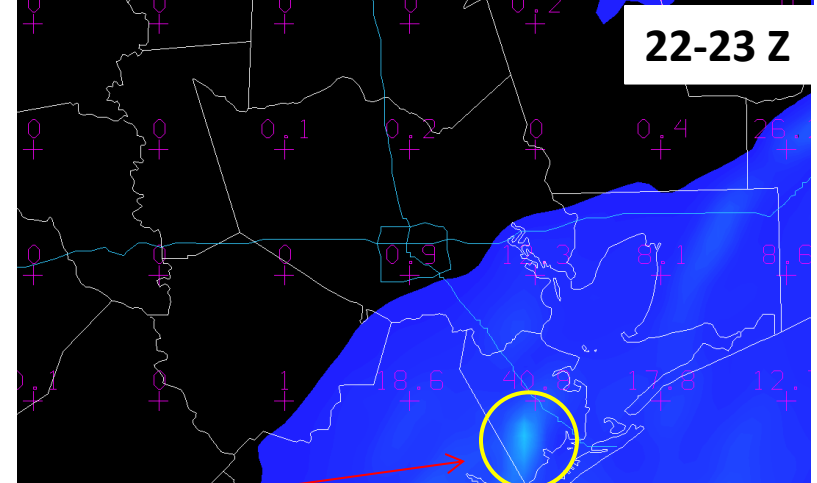




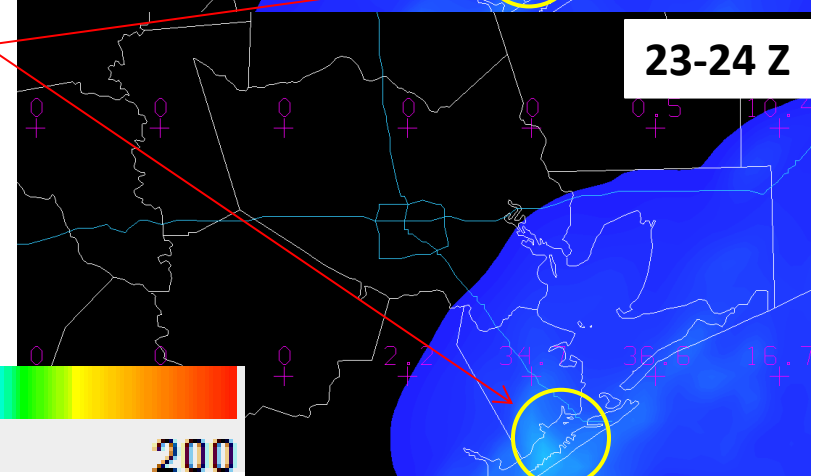
Example of 6 consecutive 1 hour precip. totals from a WRF-EMS run During the critical afternoon period



PBL: BouLac
Microphysics:
WDM 5-class



> 3 inches



Re-Analysis Initialization:

C : CFSR

PBL Schemes:

1: Yonsei

4: QNSE

Microphysical Schemes:

02: Lin

06: WSM 6 Class

08: Thompson

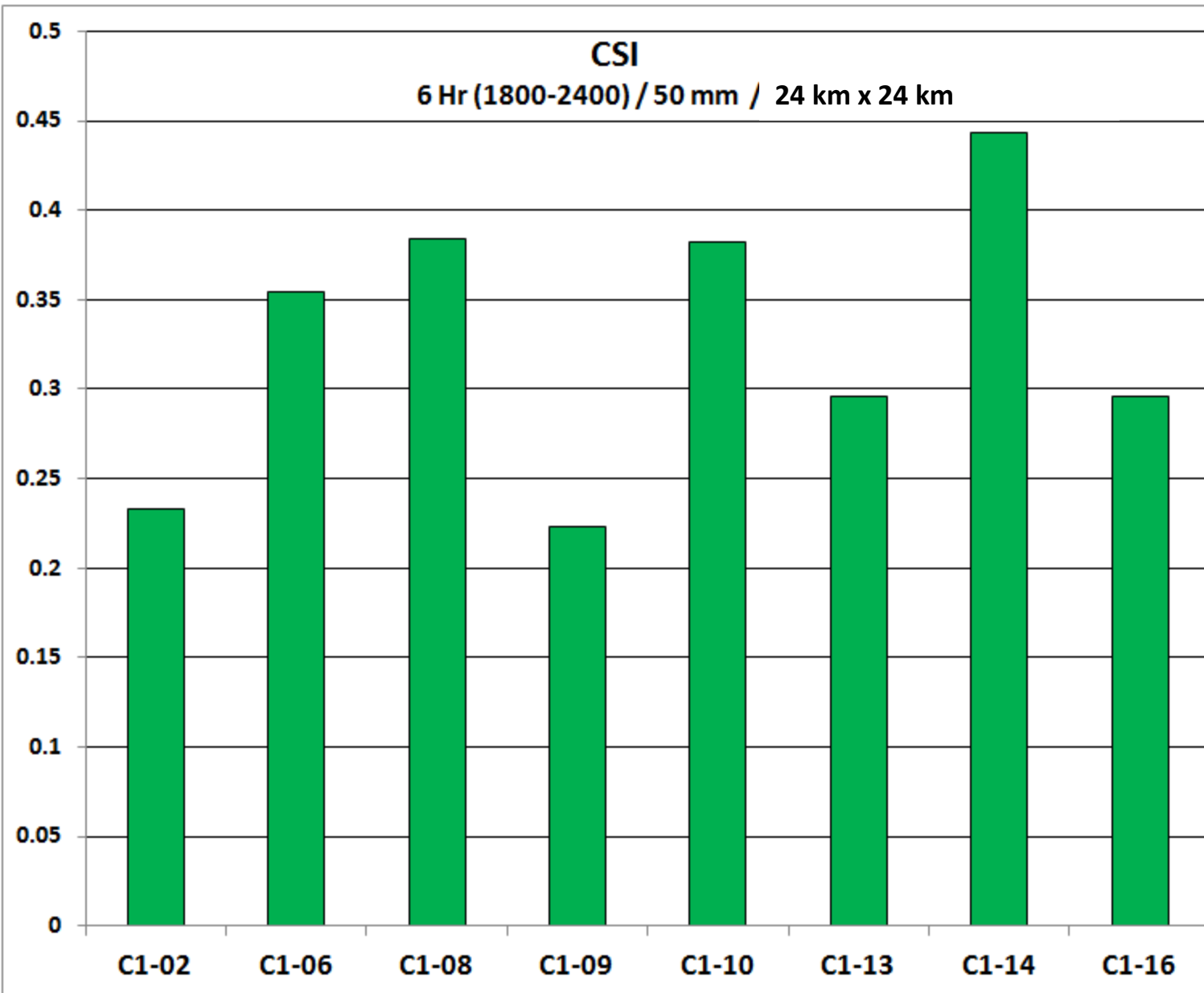
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Re-Analysis Initialization:

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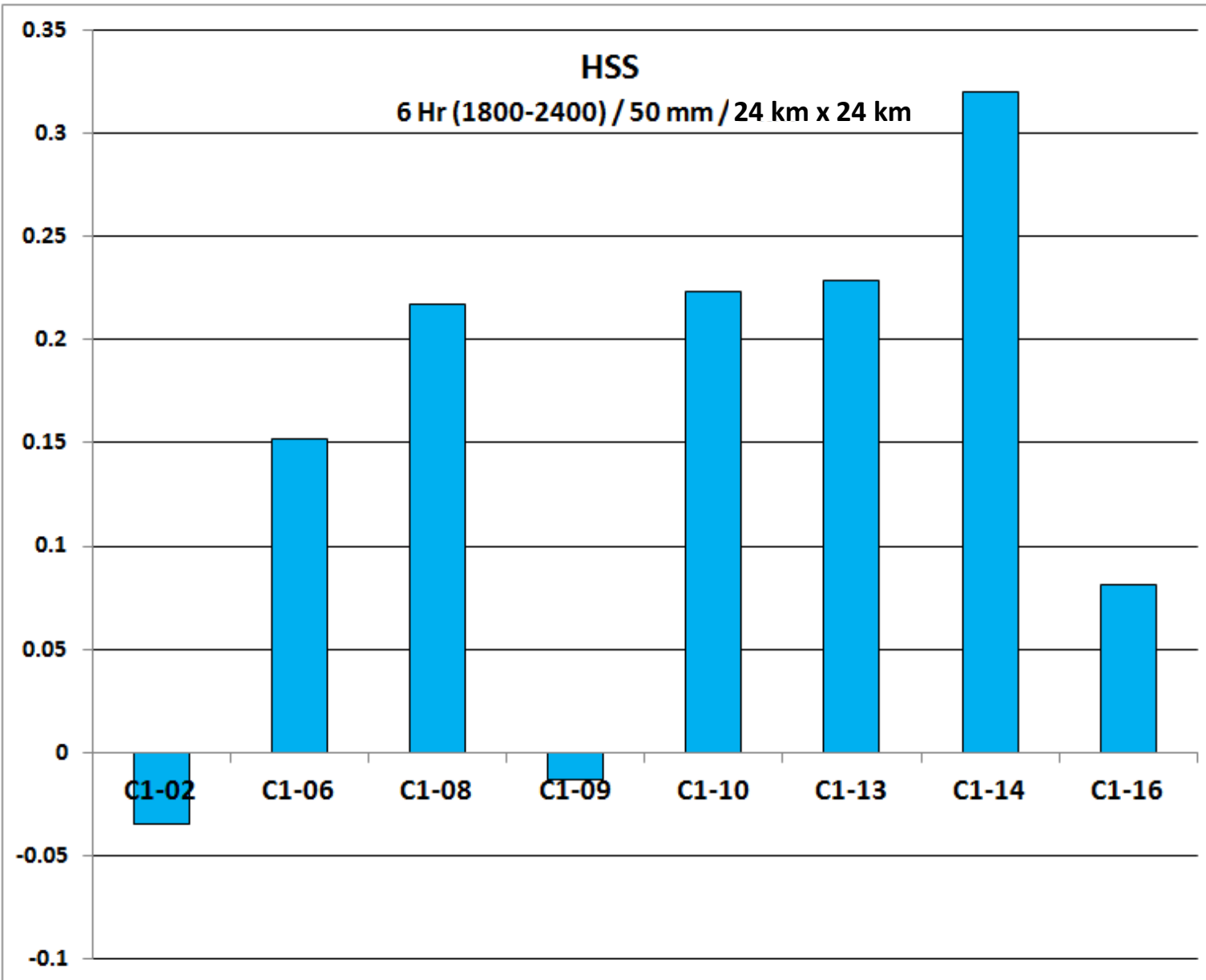
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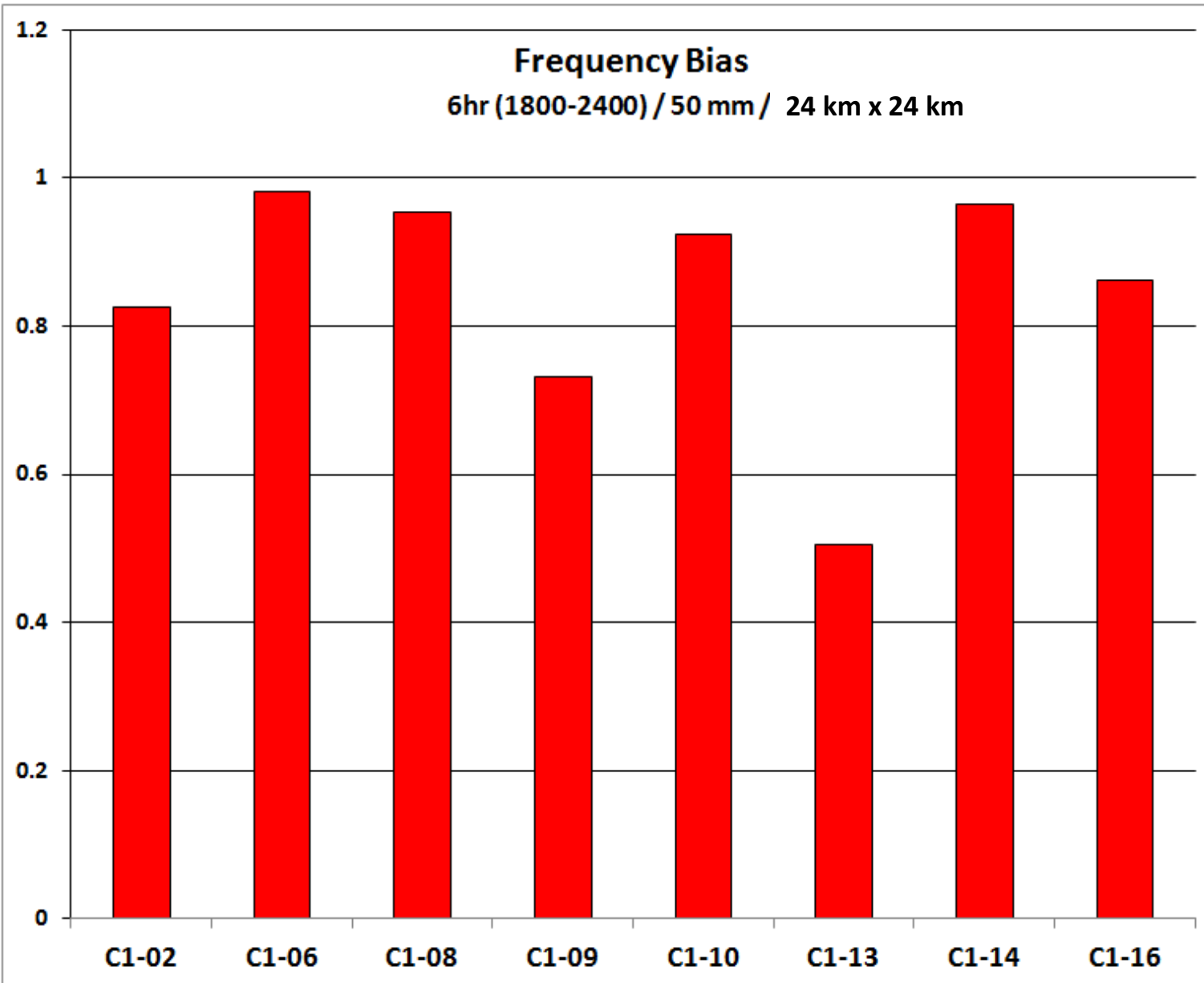
09: Milbrandt-Yau

10: Morrison

13: Stony Brook University

14: WDM 5-Class

16: WDM 6-Class



Early Observations

The strongest performers across the three PBLs/spatial-temporal schemes were the Lin, Thompson, WRF Single Moment (WSM) 6 class, and both WRF Double Moment (WDM) 5 and 6 classes.

There was a trend to over-forecast 1 inch rainfall amounts (Frequency Bias) in the last couple of hours (Yonsei, QNSE) and under-forecast during the early-mid afternoon heavy rainfall period.

The BouLac-WDM 5 class simulation performed well. It placed a 2 to 3 inch bulls-eye over central and southern Galveston County (22 - 24Z) a couple of hours behind where 2 to 3 inches were sensed by the radar (20 – 22Z).

Acknowledgements: Brad Zavodsky, Jon Case, Jayanthi Srikishen