From research to peer-review publication: a Northern Gulf Coast sea breeze study

Chris Hill, Pat Fitzpatrick*, James Corbin, Yee Lau, and Sachin Bhate

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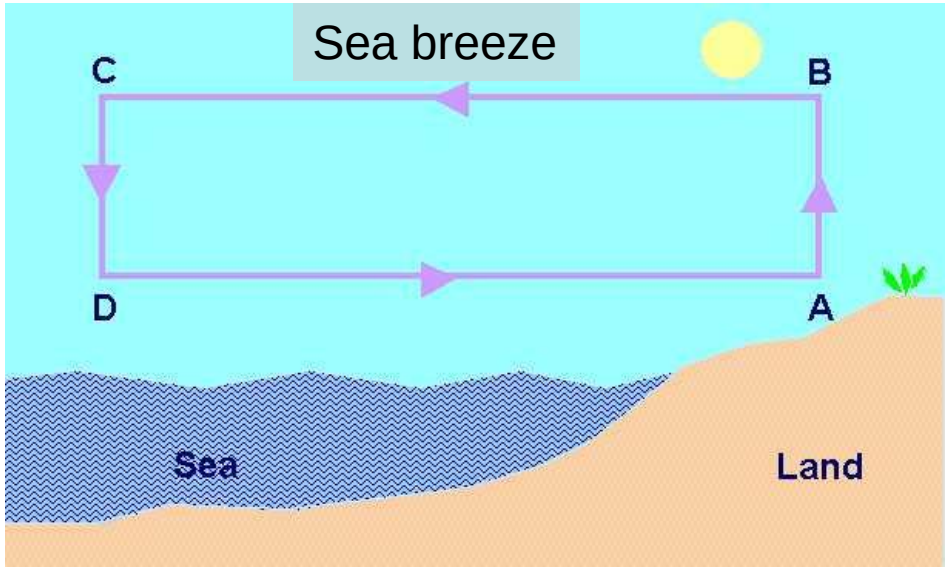
Sea breeze
C
B
D
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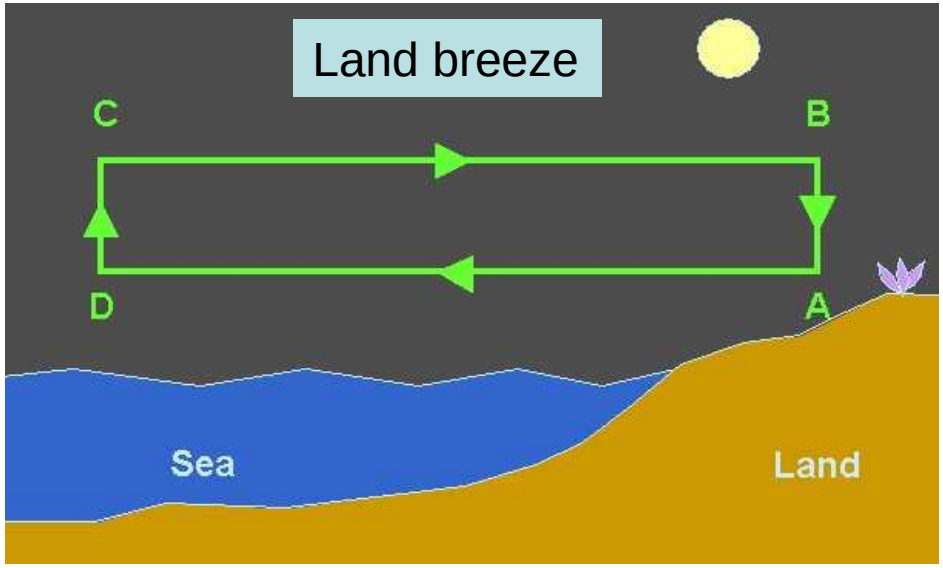
Sea
Land


Land breeze
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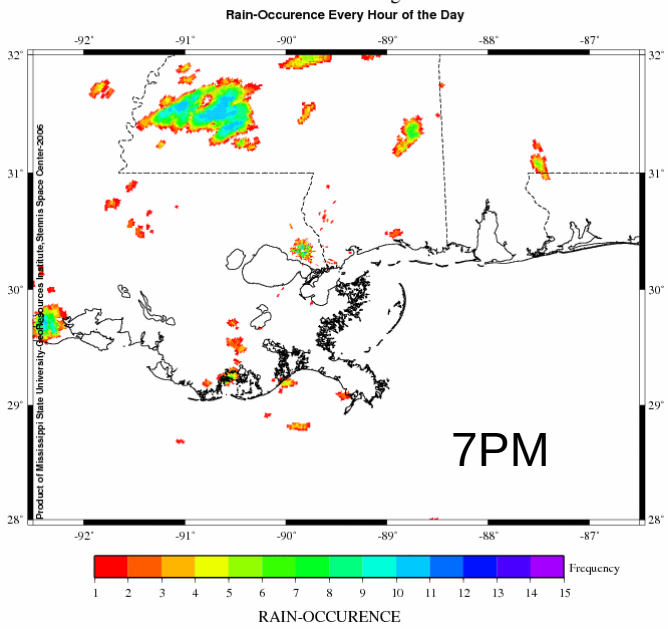

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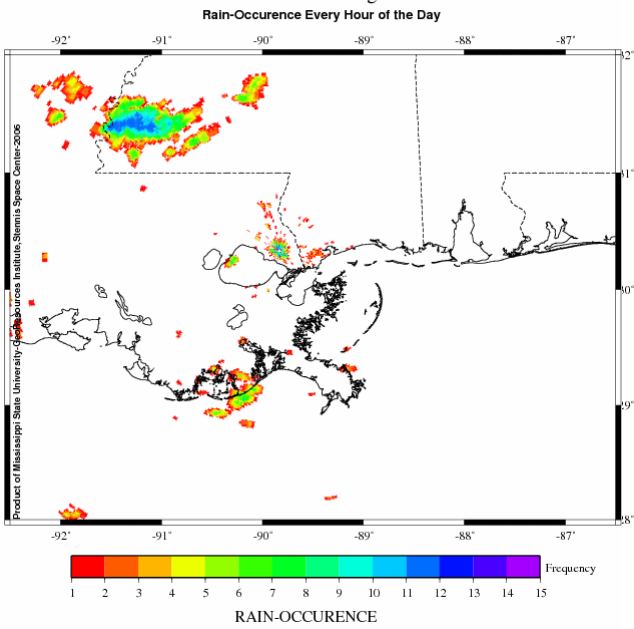

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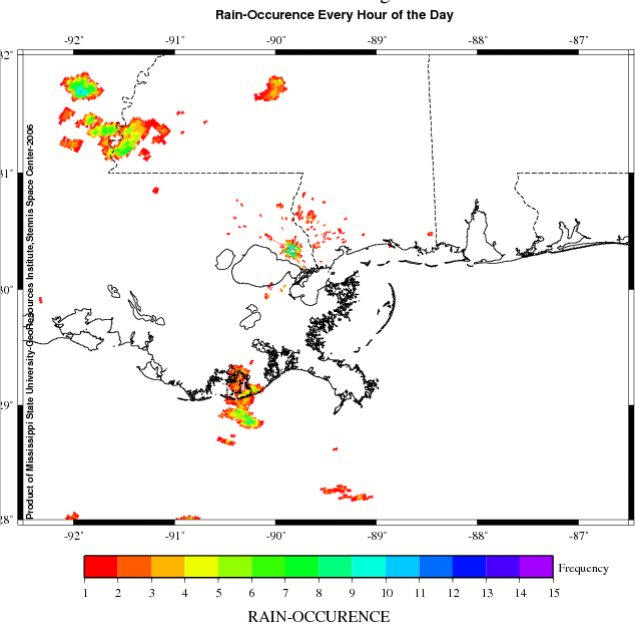

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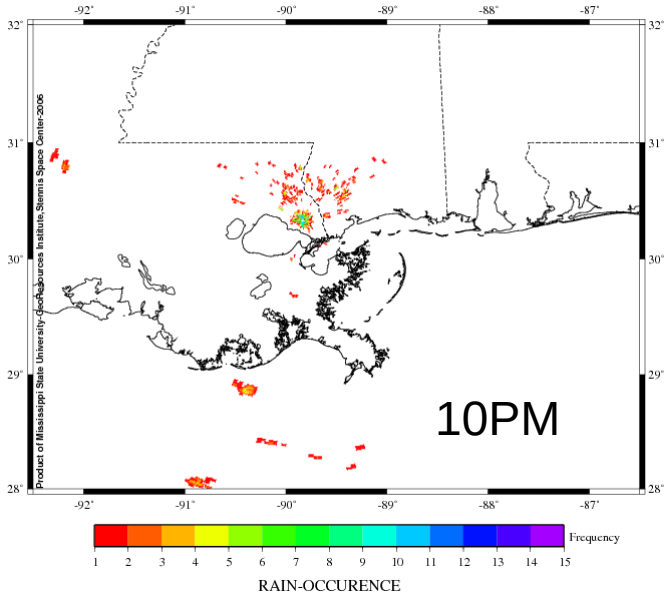

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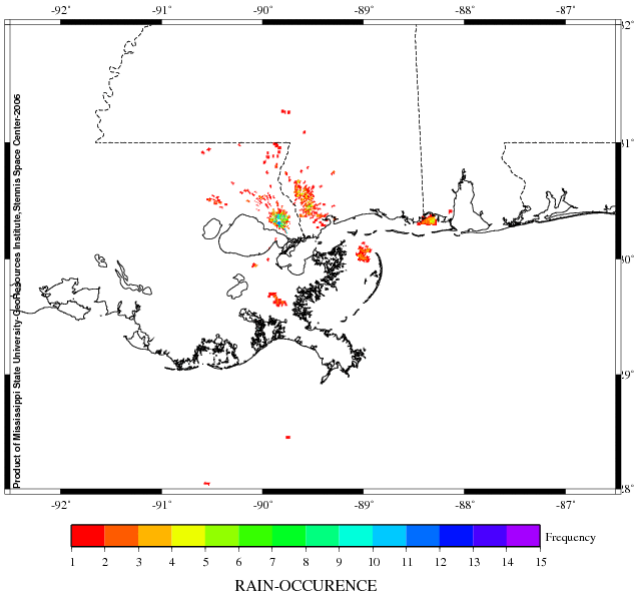

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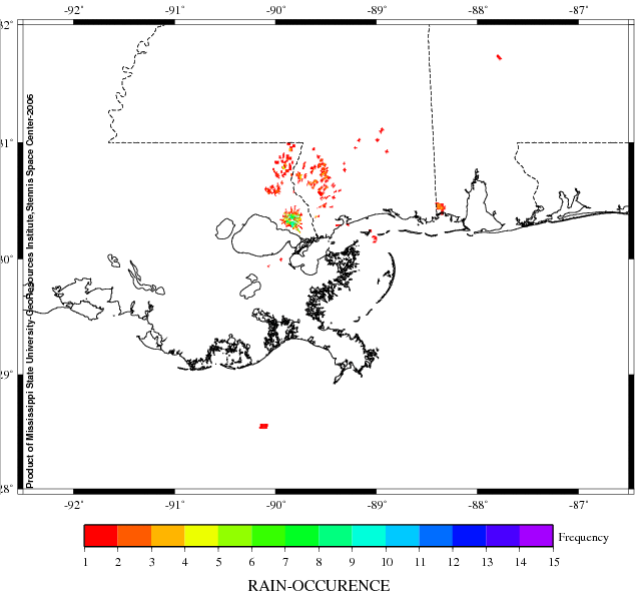

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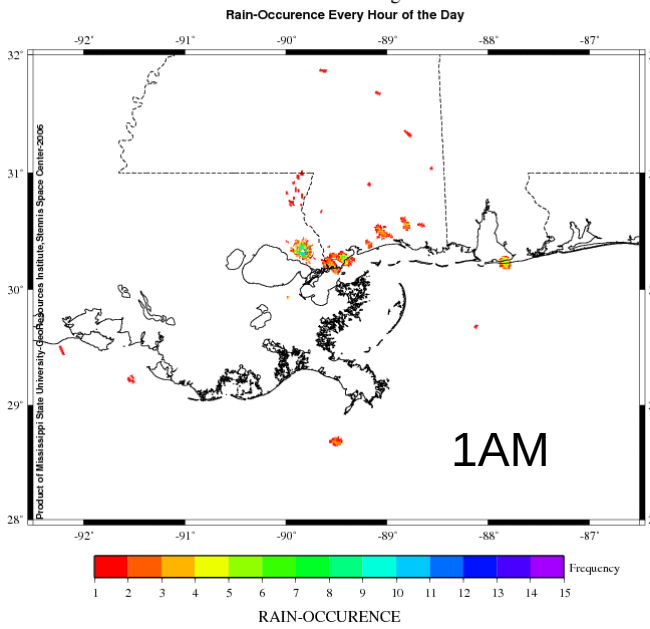

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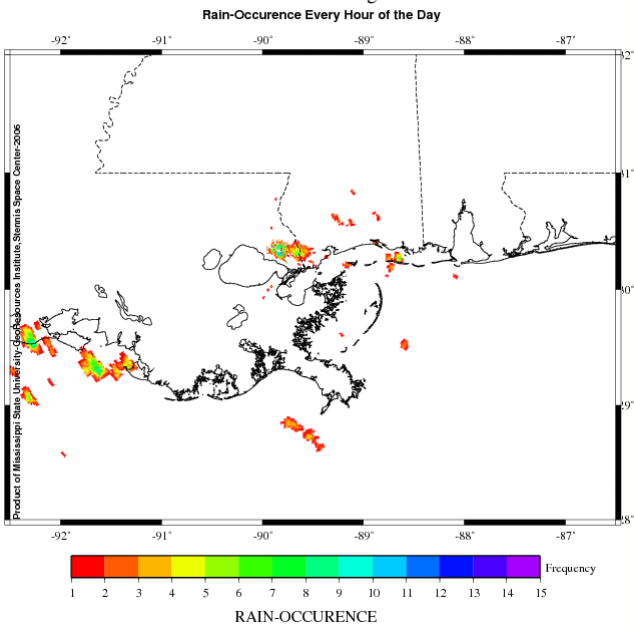

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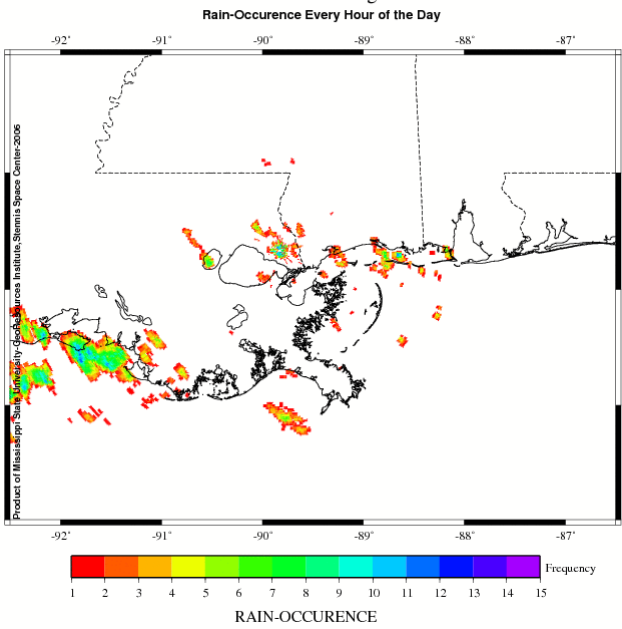

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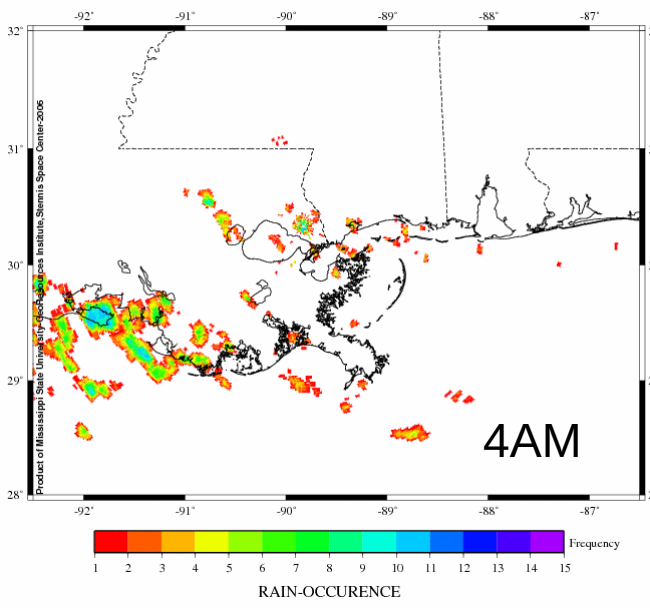

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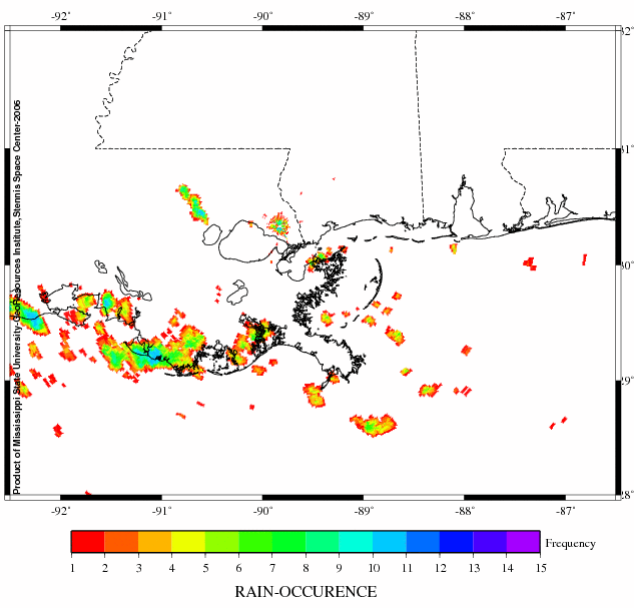

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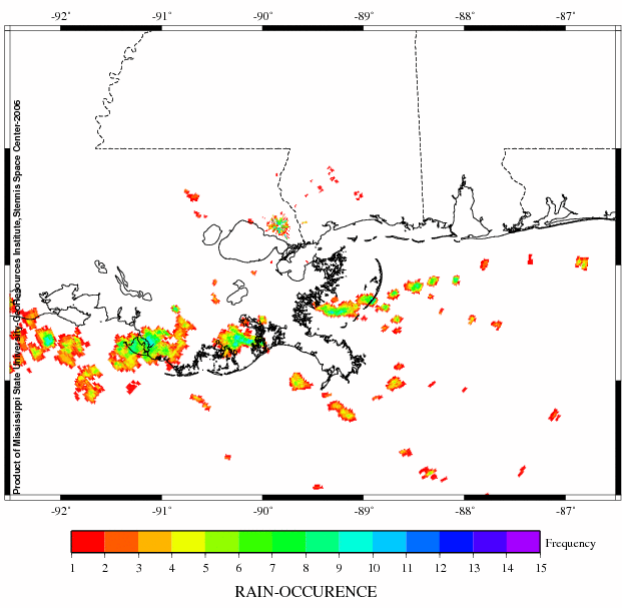

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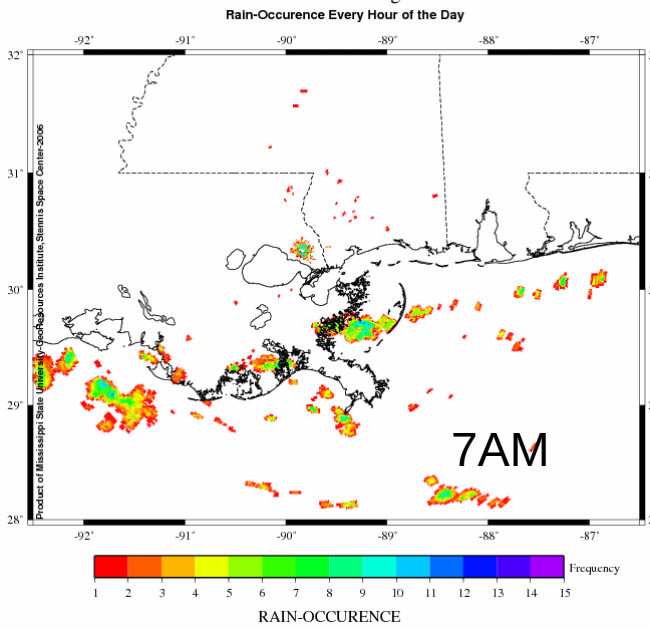

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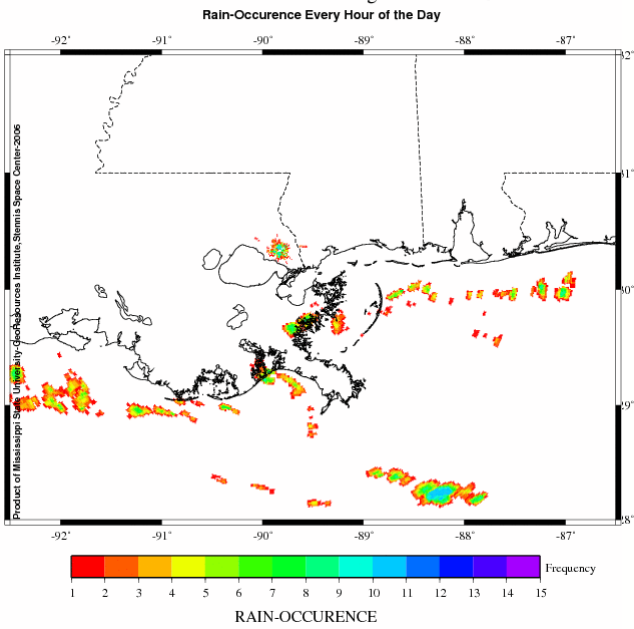

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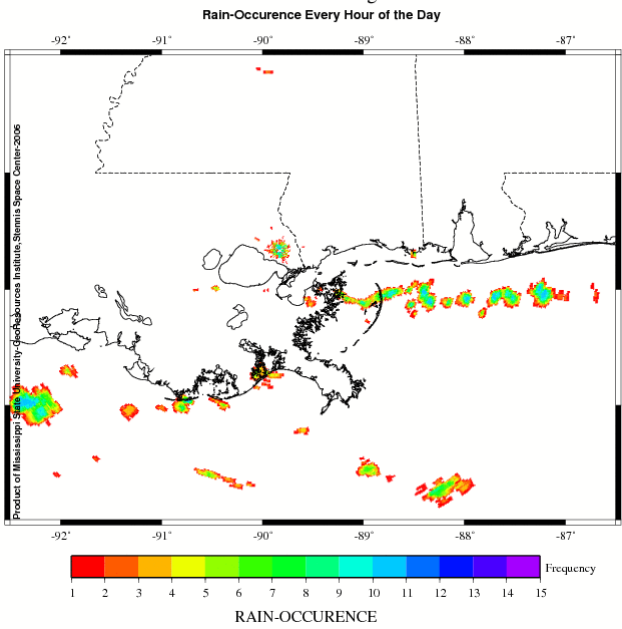

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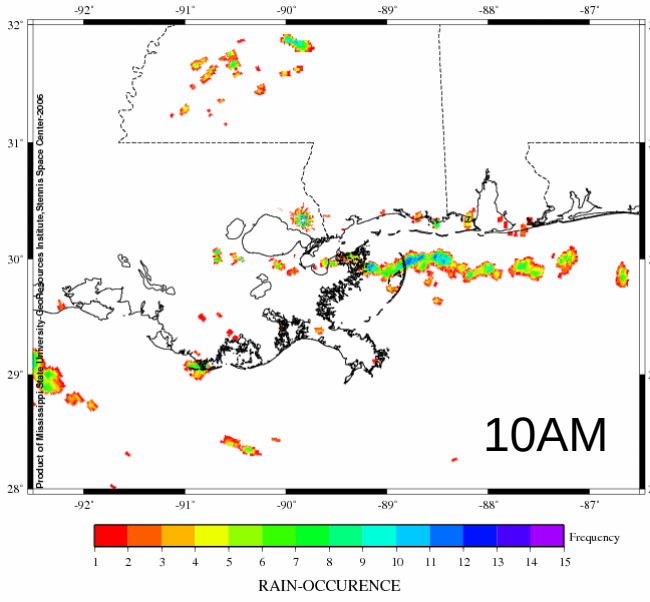

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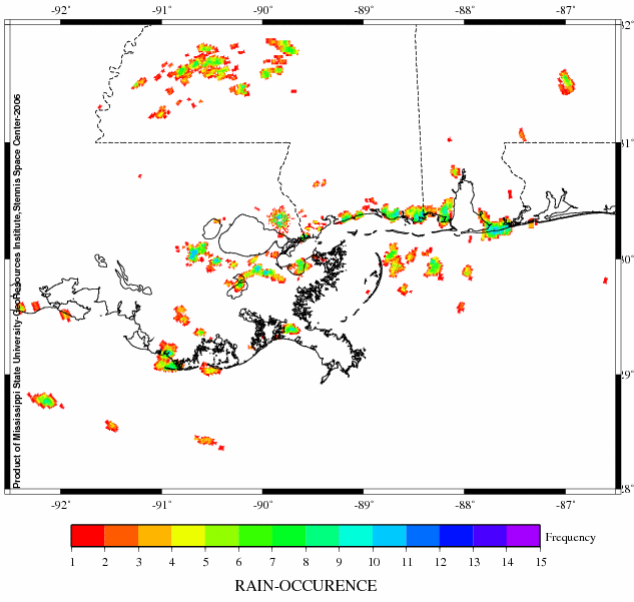

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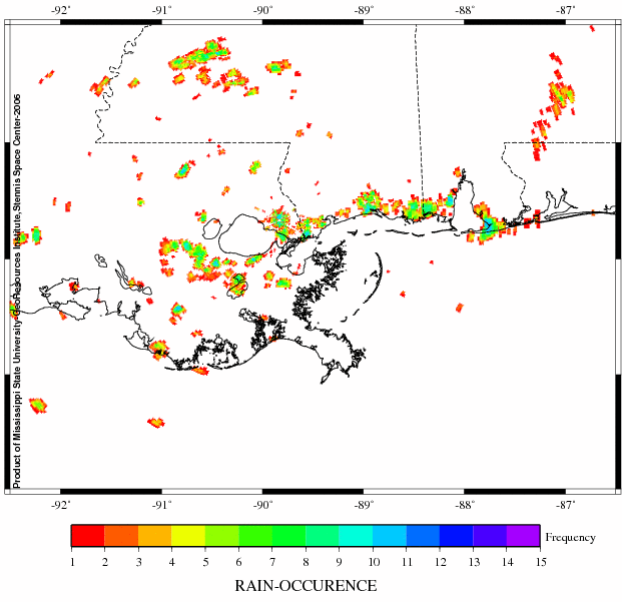

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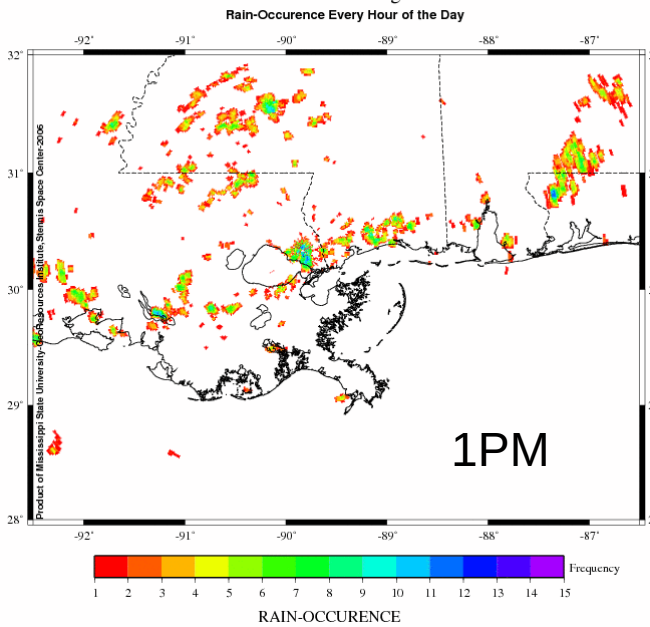

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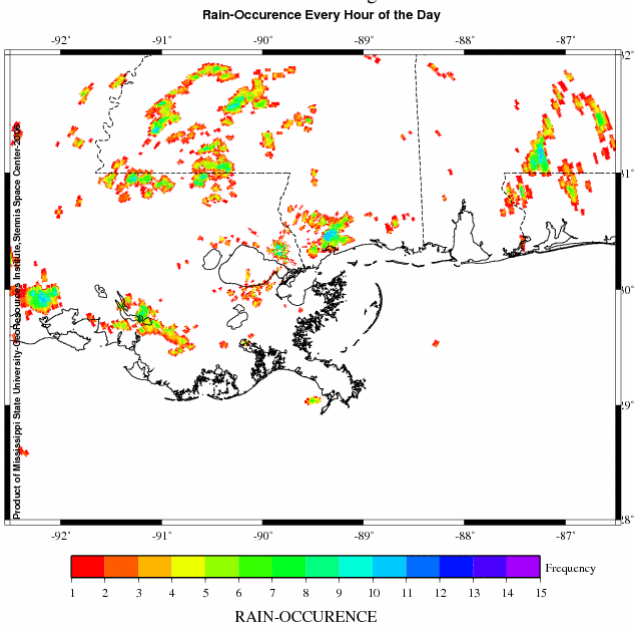

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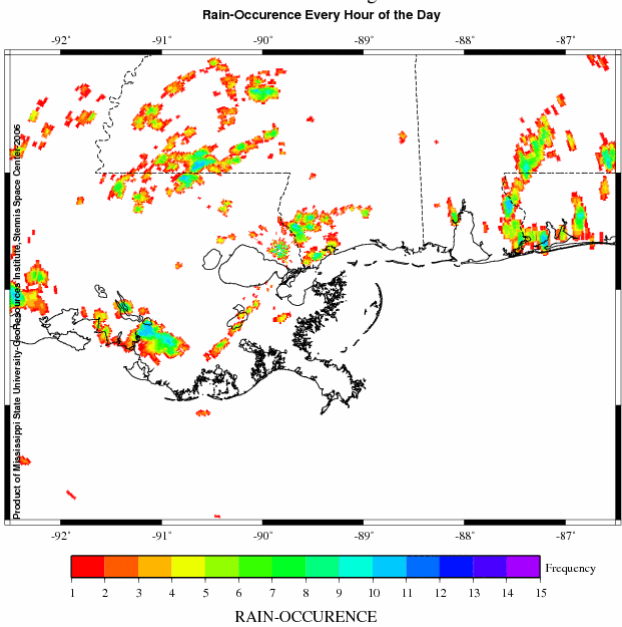

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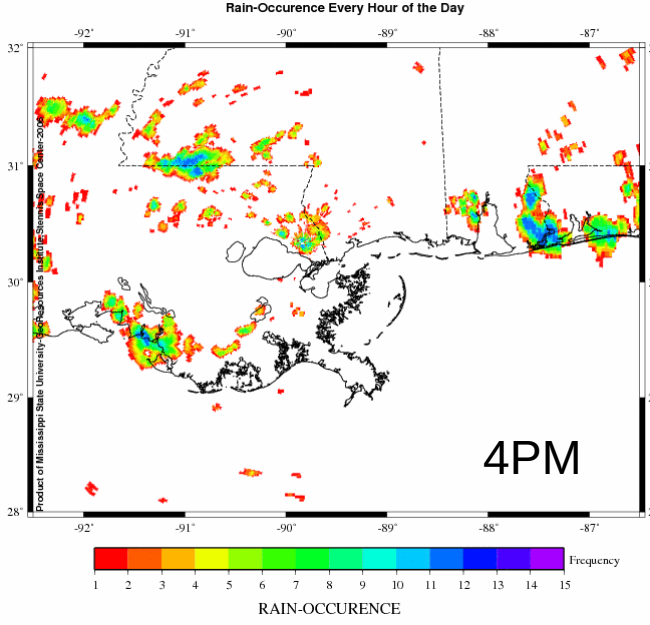

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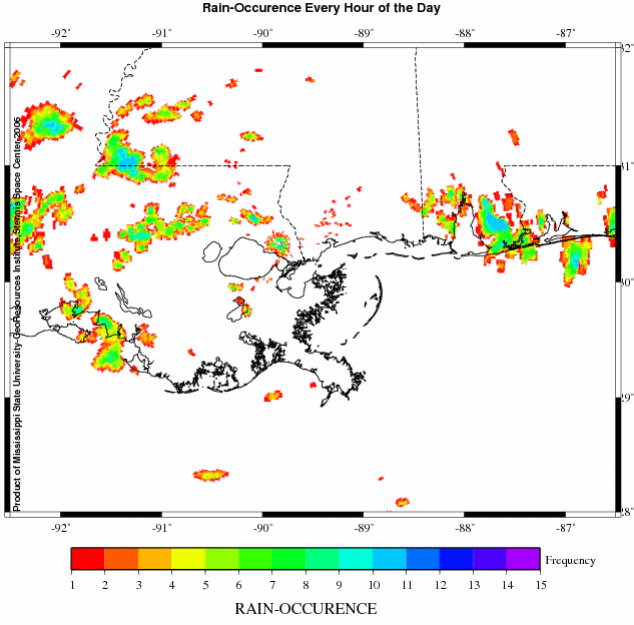

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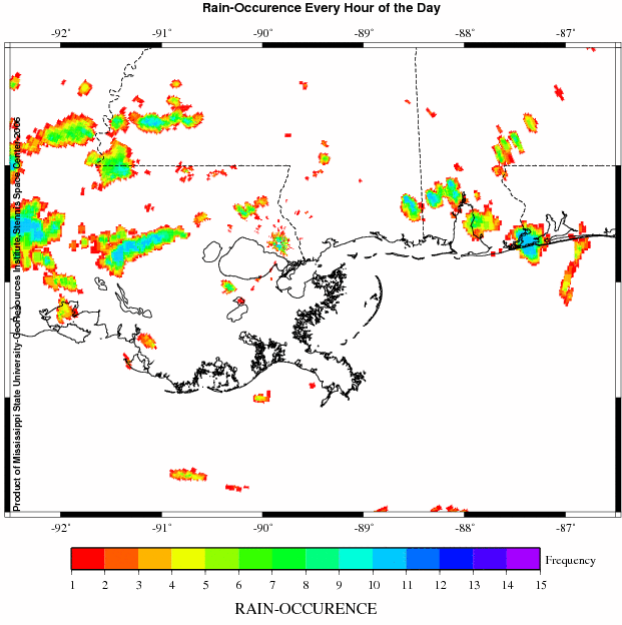

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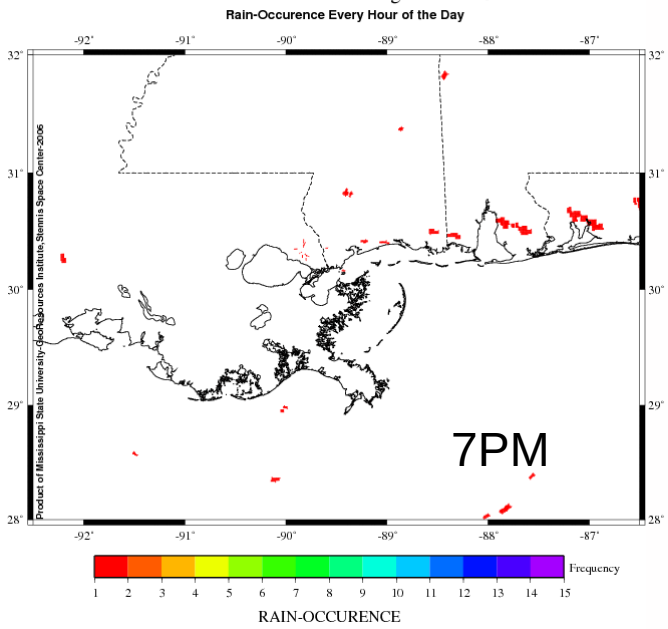

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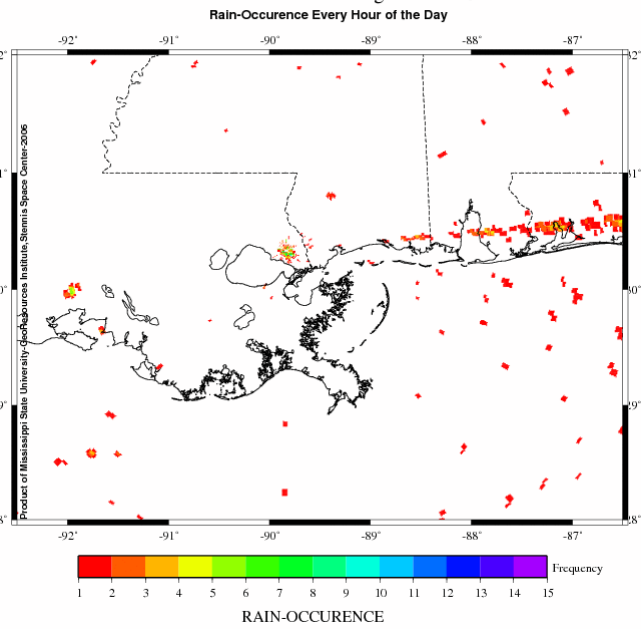

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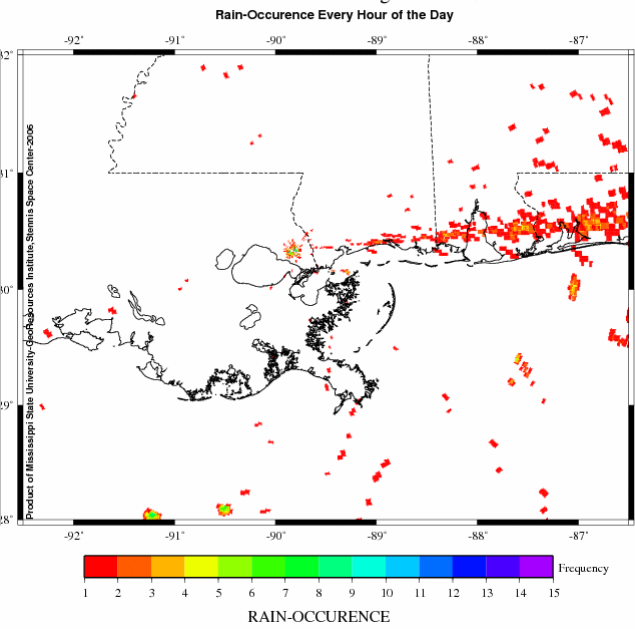

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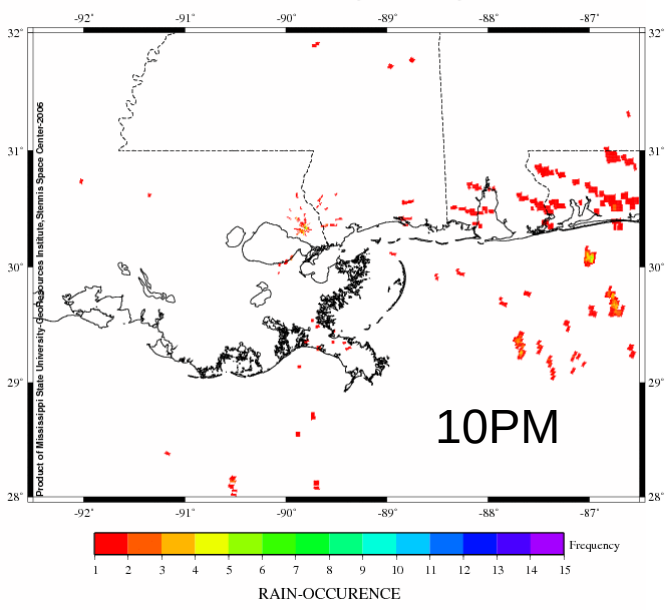

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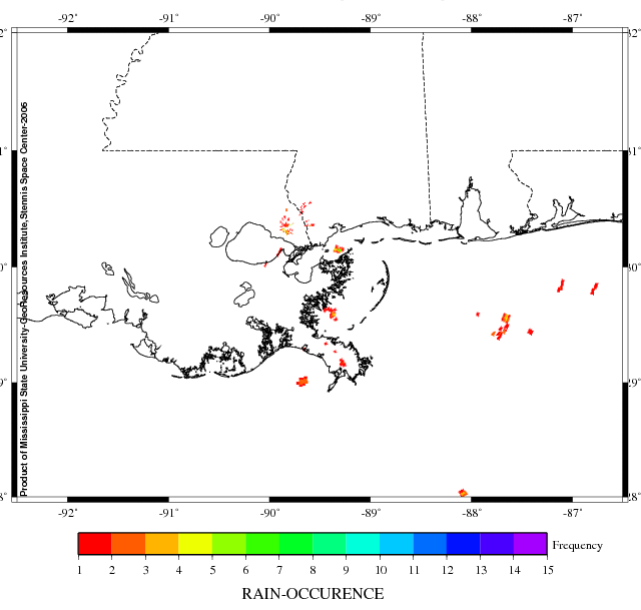

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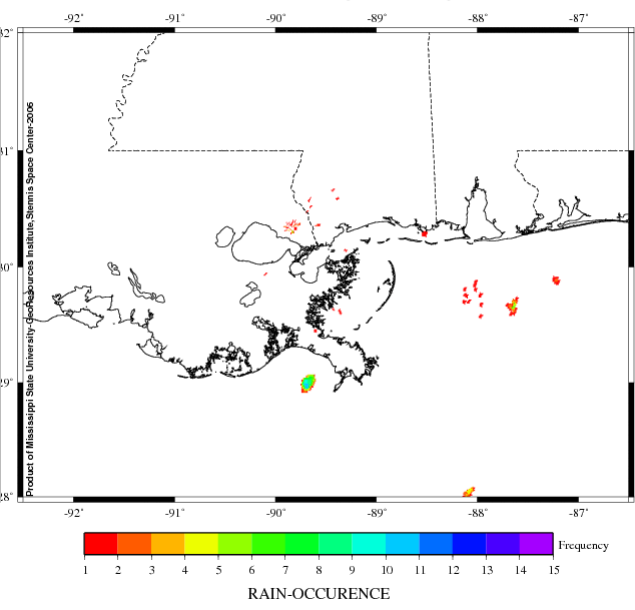

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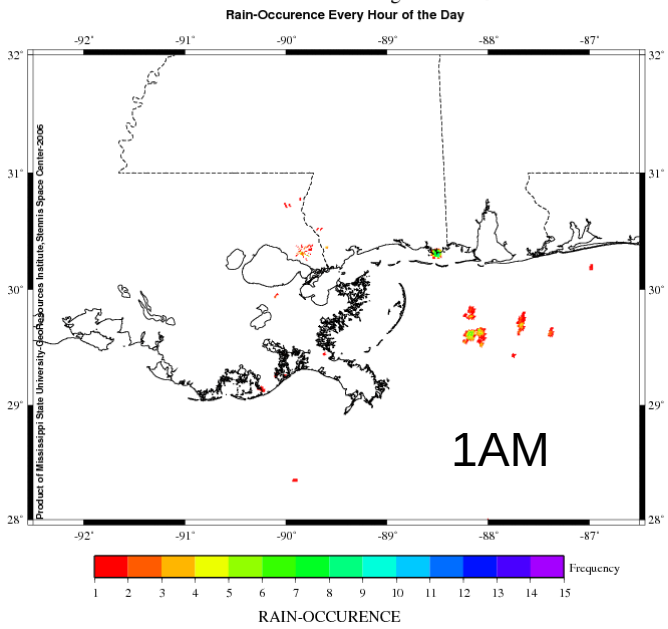

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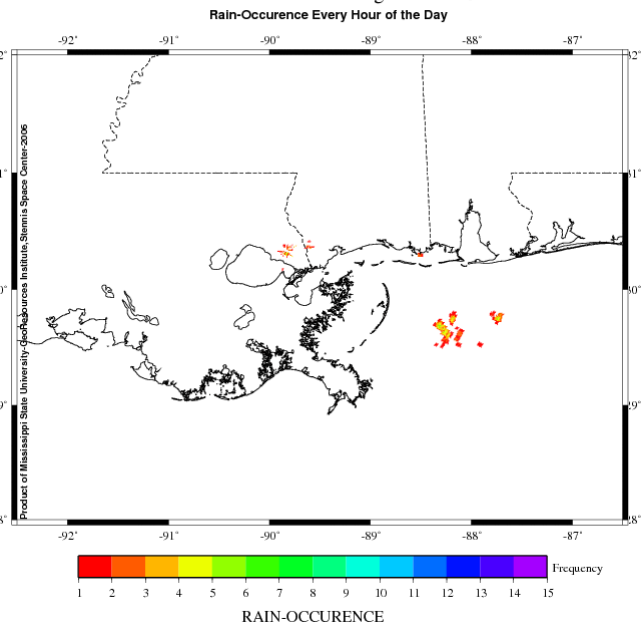

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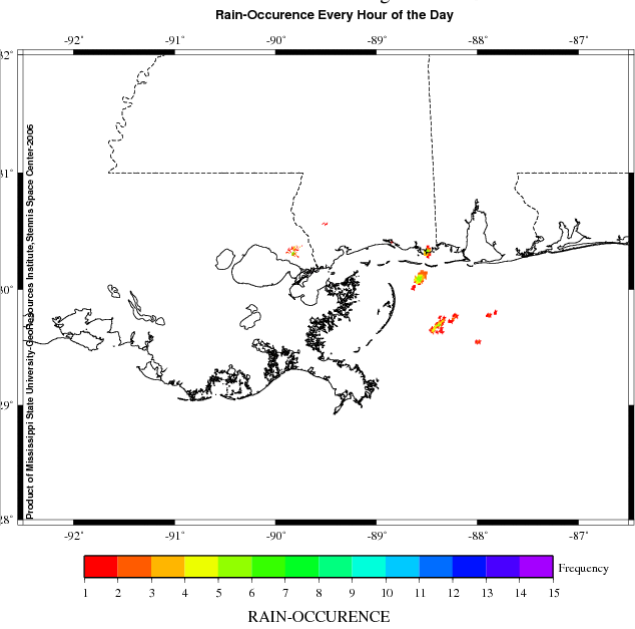

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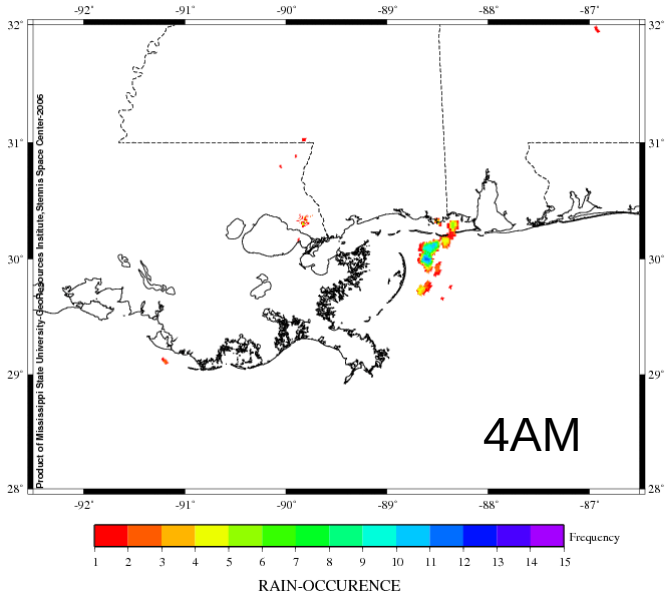

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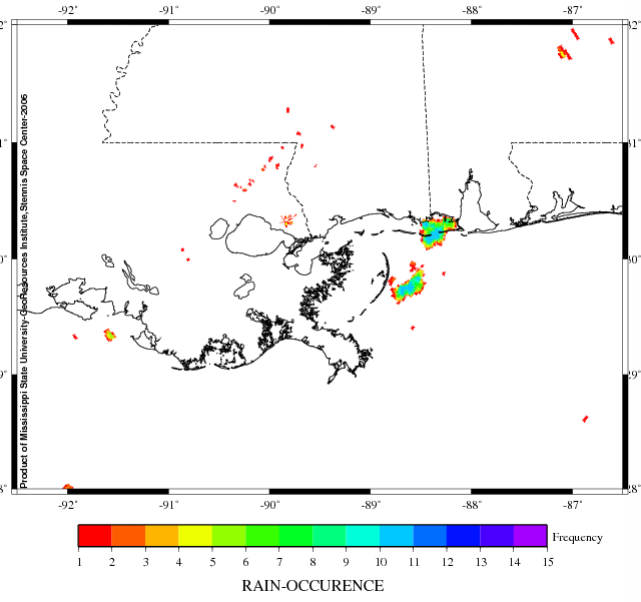

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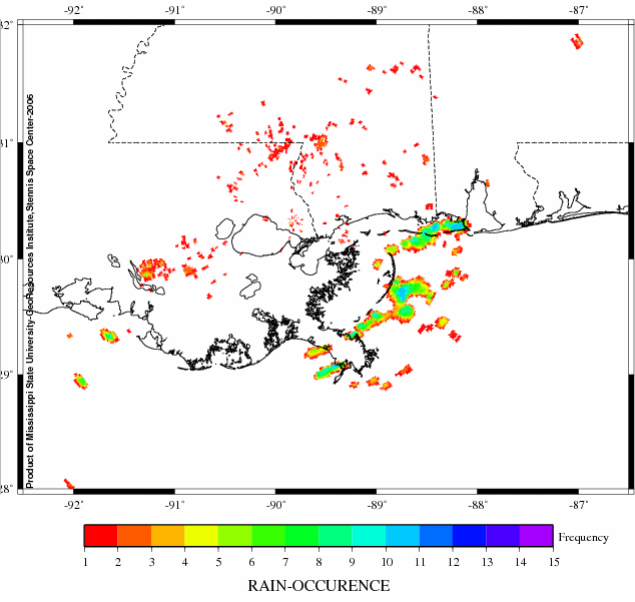

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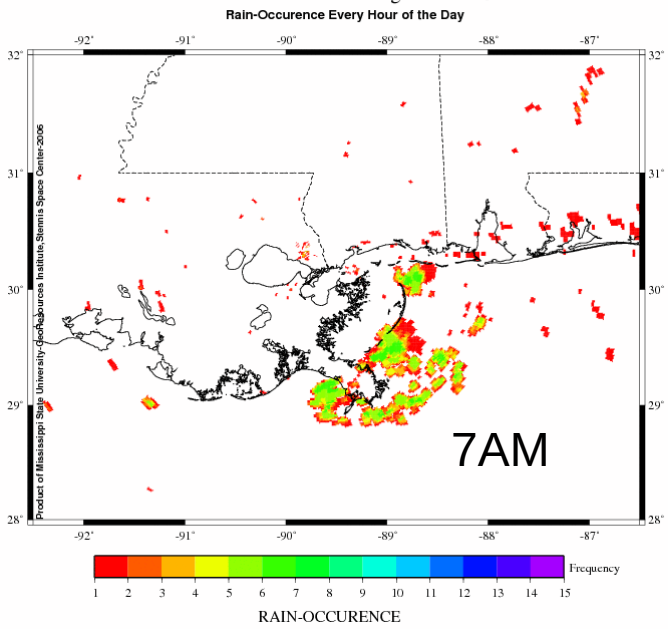

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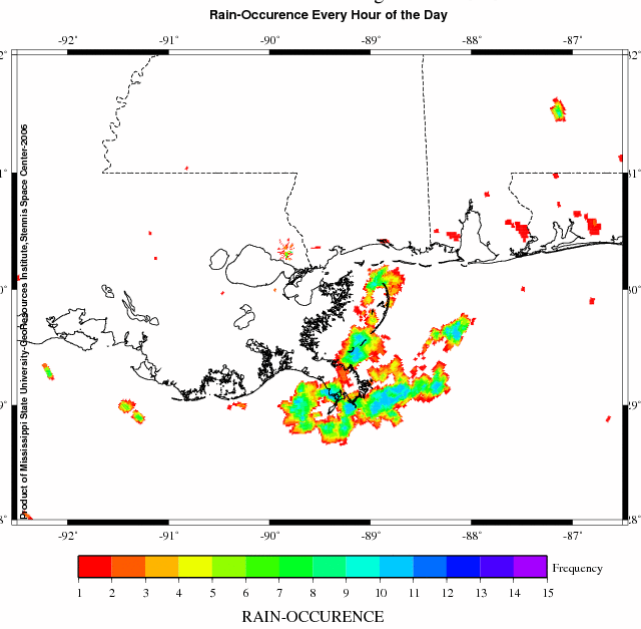

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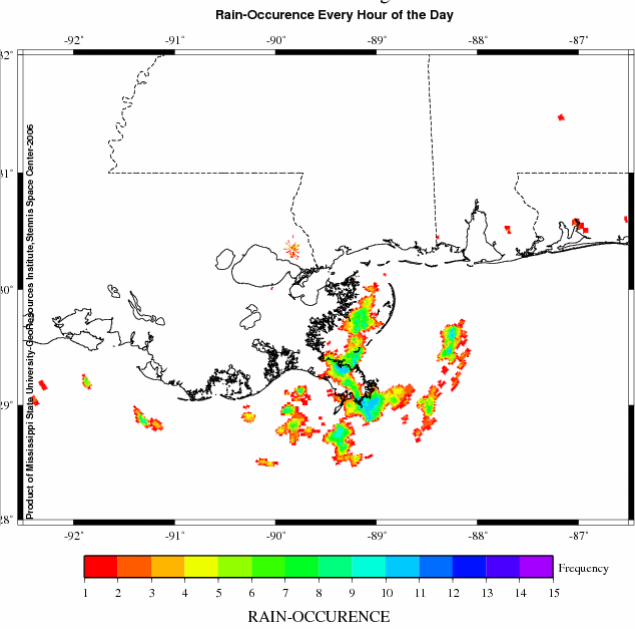

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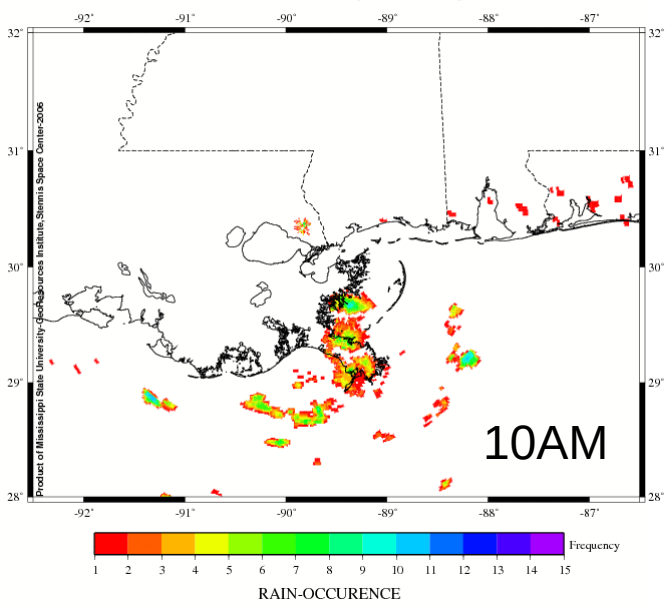

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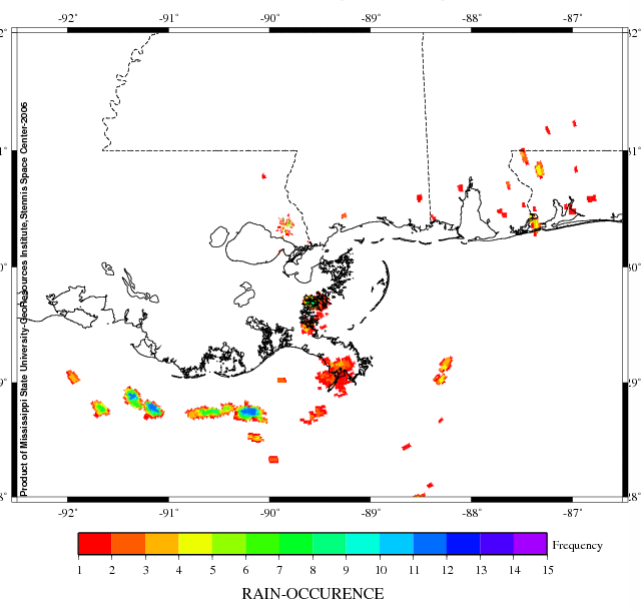

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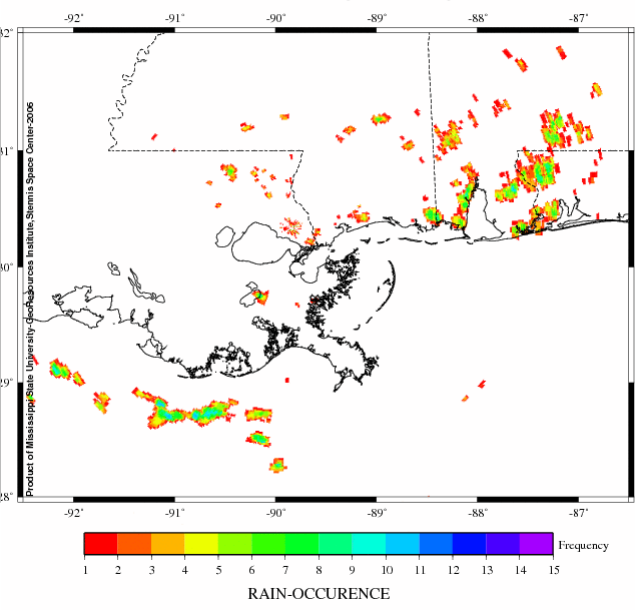

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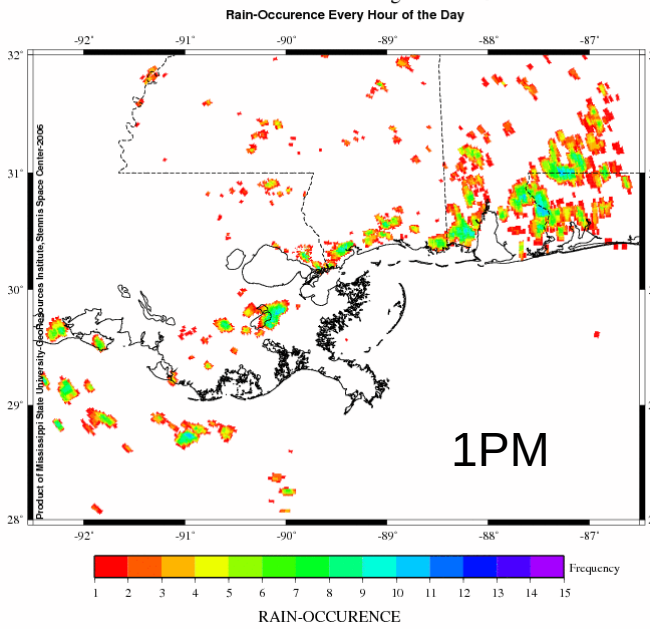

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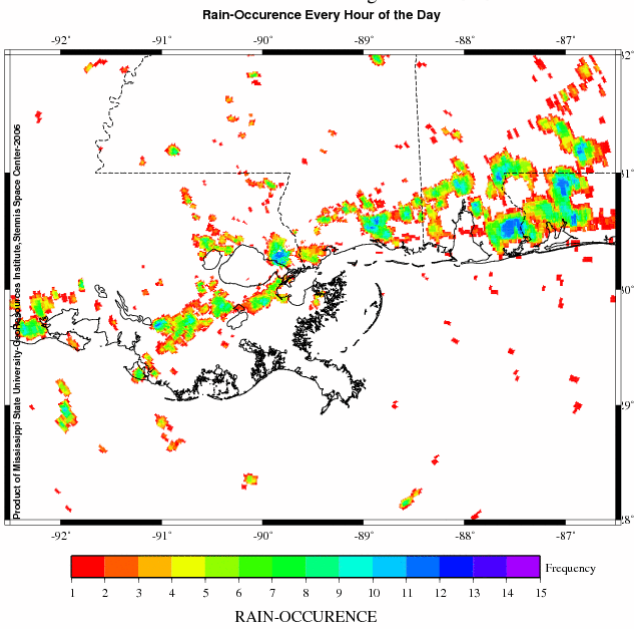

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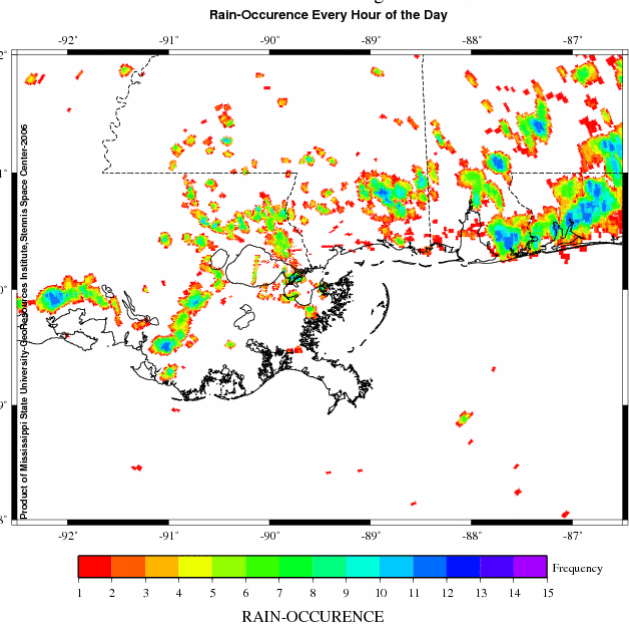

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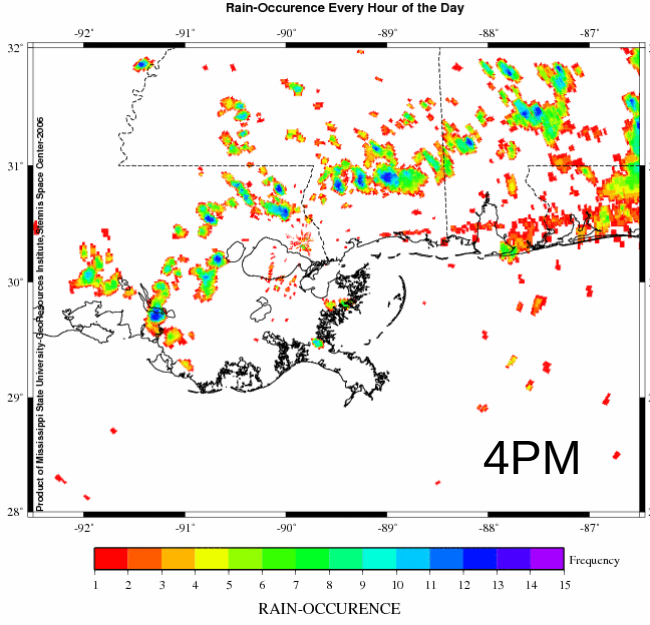

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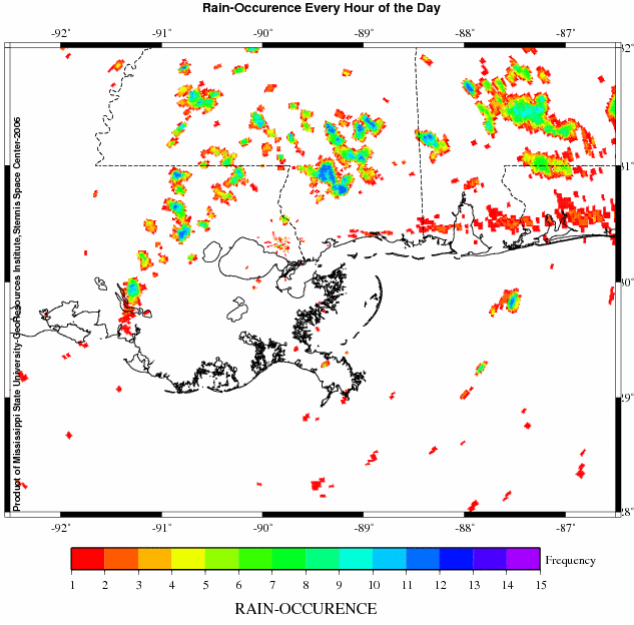

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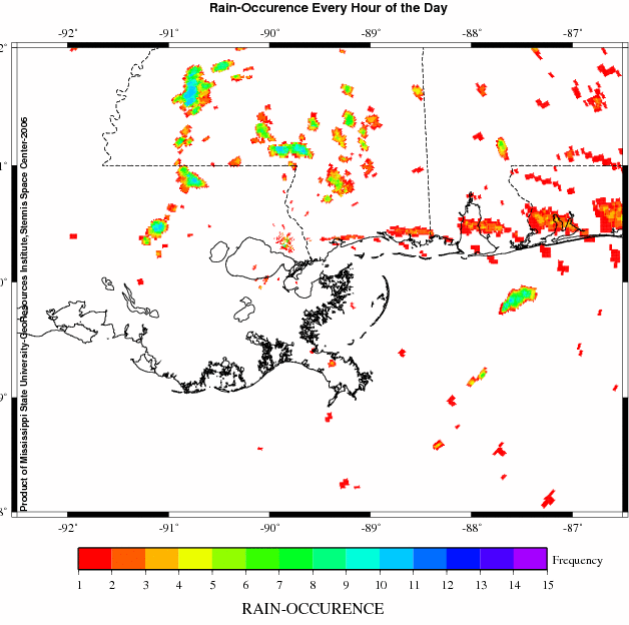

Goal

Determine summertime precipitation and wind regimes in southern Mississippi and southeast Louisiana

Procedure

- Review literature and previous research
- Identify datasets, process data
- Composite wind and radar data

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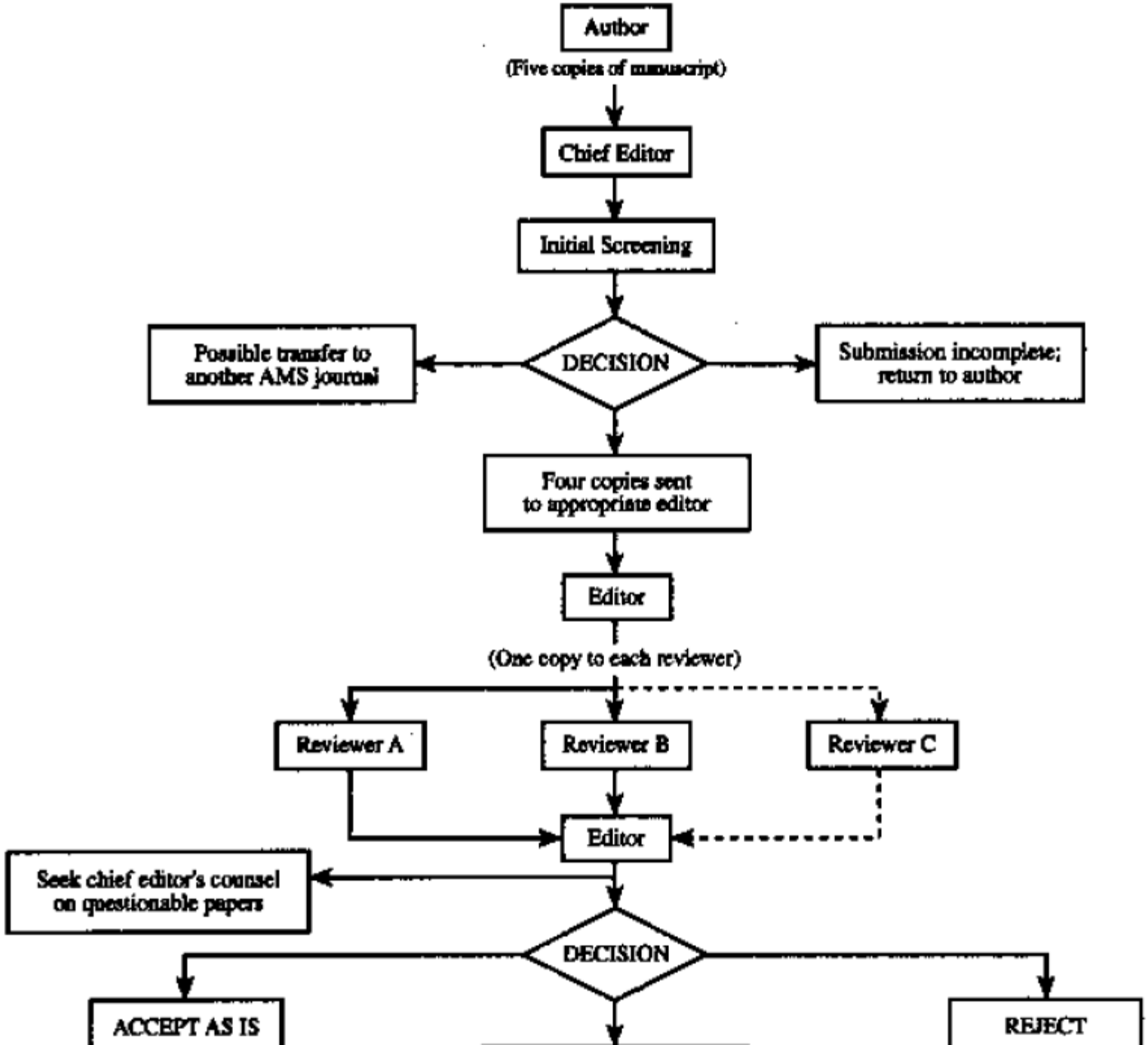
- Publish findings in peer-review journal article

What is a “peer-review” journal article?

A scientific manuscript which has undergone critical assessment by (generally anonymous) experts in the same field, usually requiring several rewrites before publication

Peer review benefits

- Prevents publication of bad research
- Encourages high quality research and sound methodology
- Reasonably ensures results are interpreted correctly and are not too preliminary or speculative
- Acknowledges existing body of work (literature review)
- Checks that the work is original and advances the science. Discusses significance of new work.
- Improves readability and coherence of publication
- Gains the scientist(s) recognition in the field
- Active publication history often required for promotions, employment, and grant funding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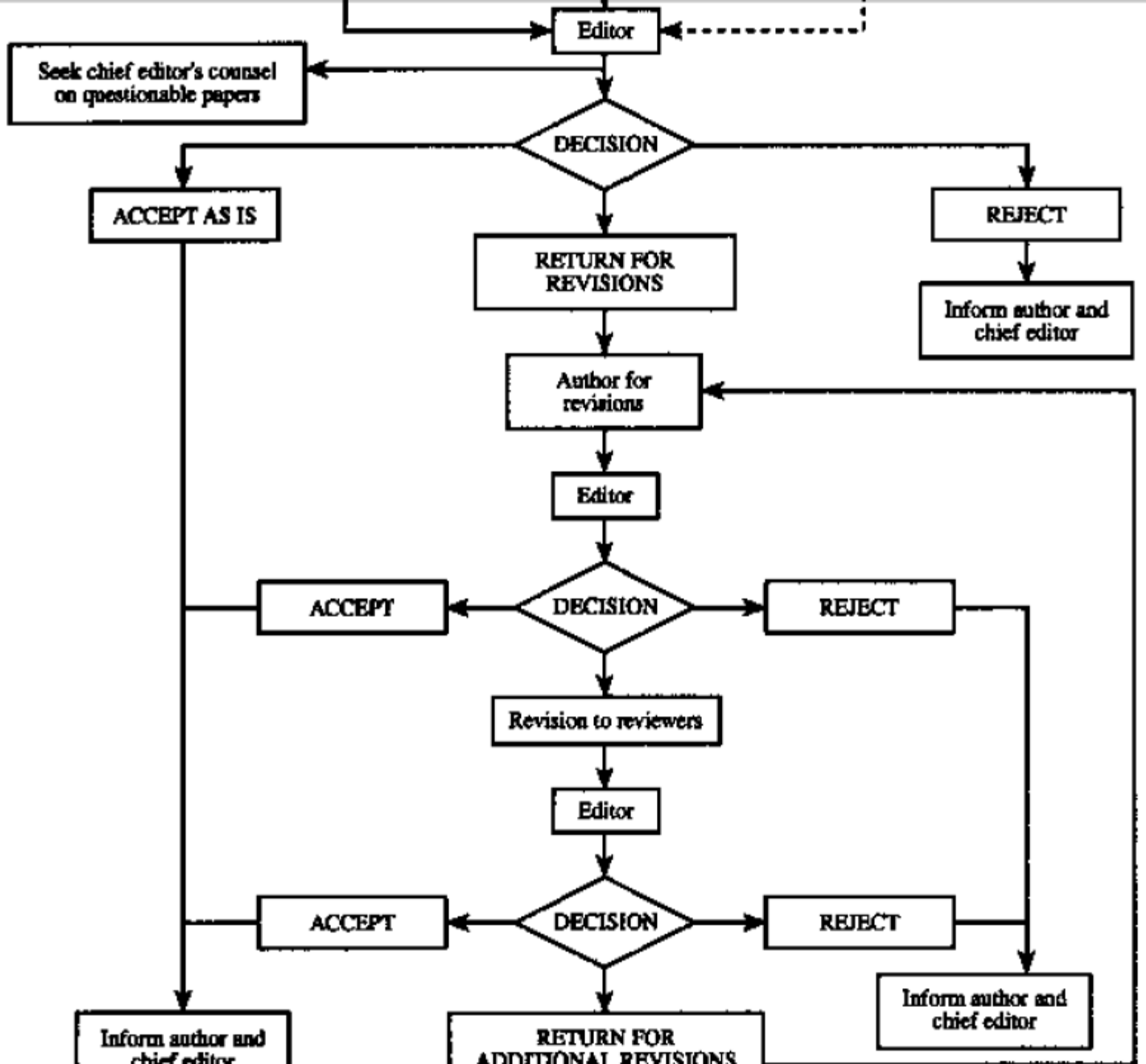
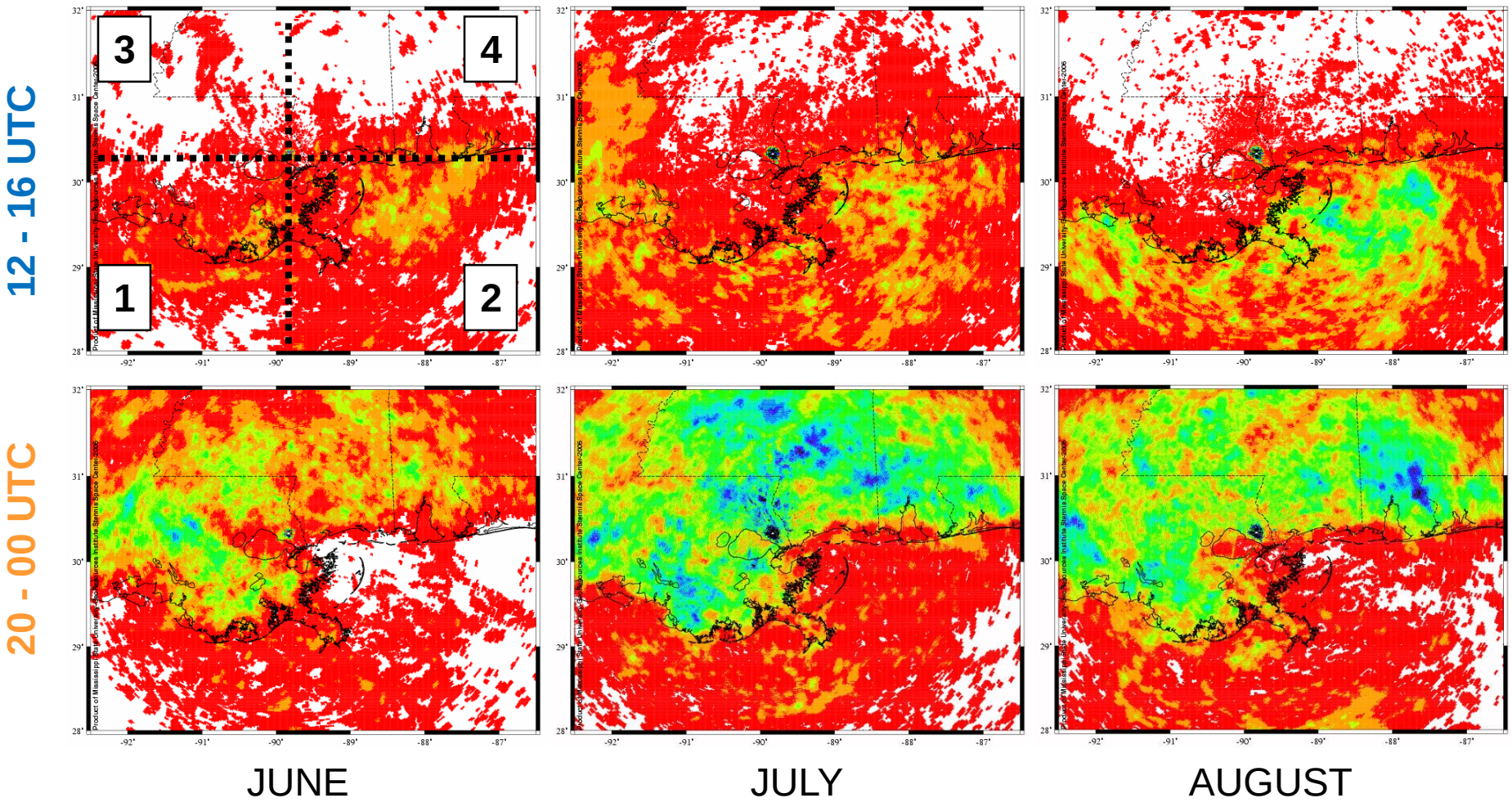
Reviewer C
Editor
Seek chief editor's counsel on questionable papers
DECISION
ACCEPT AS IS
REJECT


Editor
Seek chief editor's counsel on questionable papers
DECISION
ACCEPT AS IS
RETURN FOR REVISIONS
REJECT
Inform author and chief editor
Author for revisions
Editor
ACCEPT
DECISION
REJECT
Revision to reviewers
Editor
ACCEPT
DECISION
REJECT
Inform author and chief editor
Inform author and
RETURN FOR

Monthly composites of convective rain pixels for 2003 – 2005

102 of 276 days (no synoptic forcing)



June

11PM-3AM

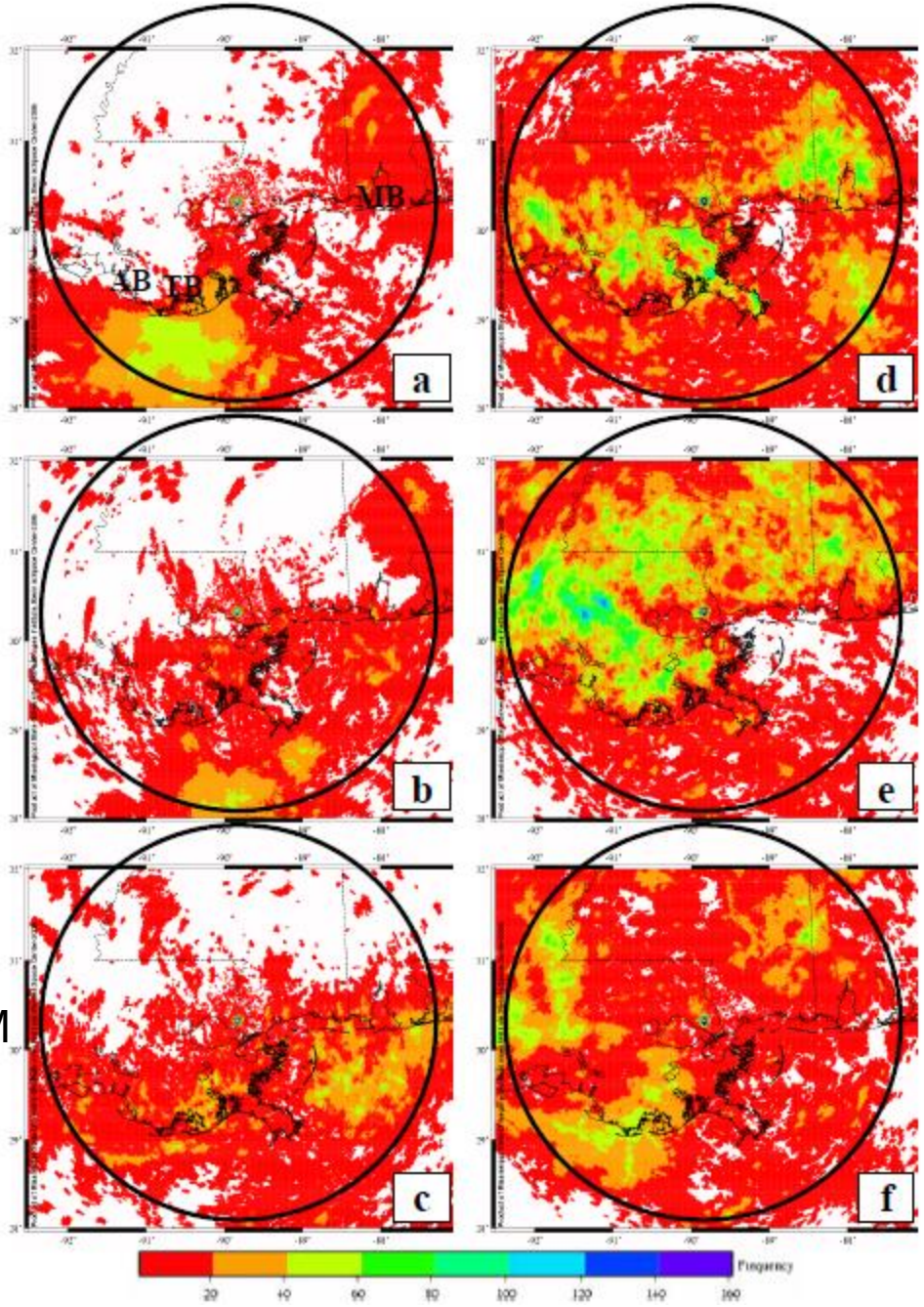
11AM-3PM

3AM-7AM

3PM-7PM

7AM-11AM

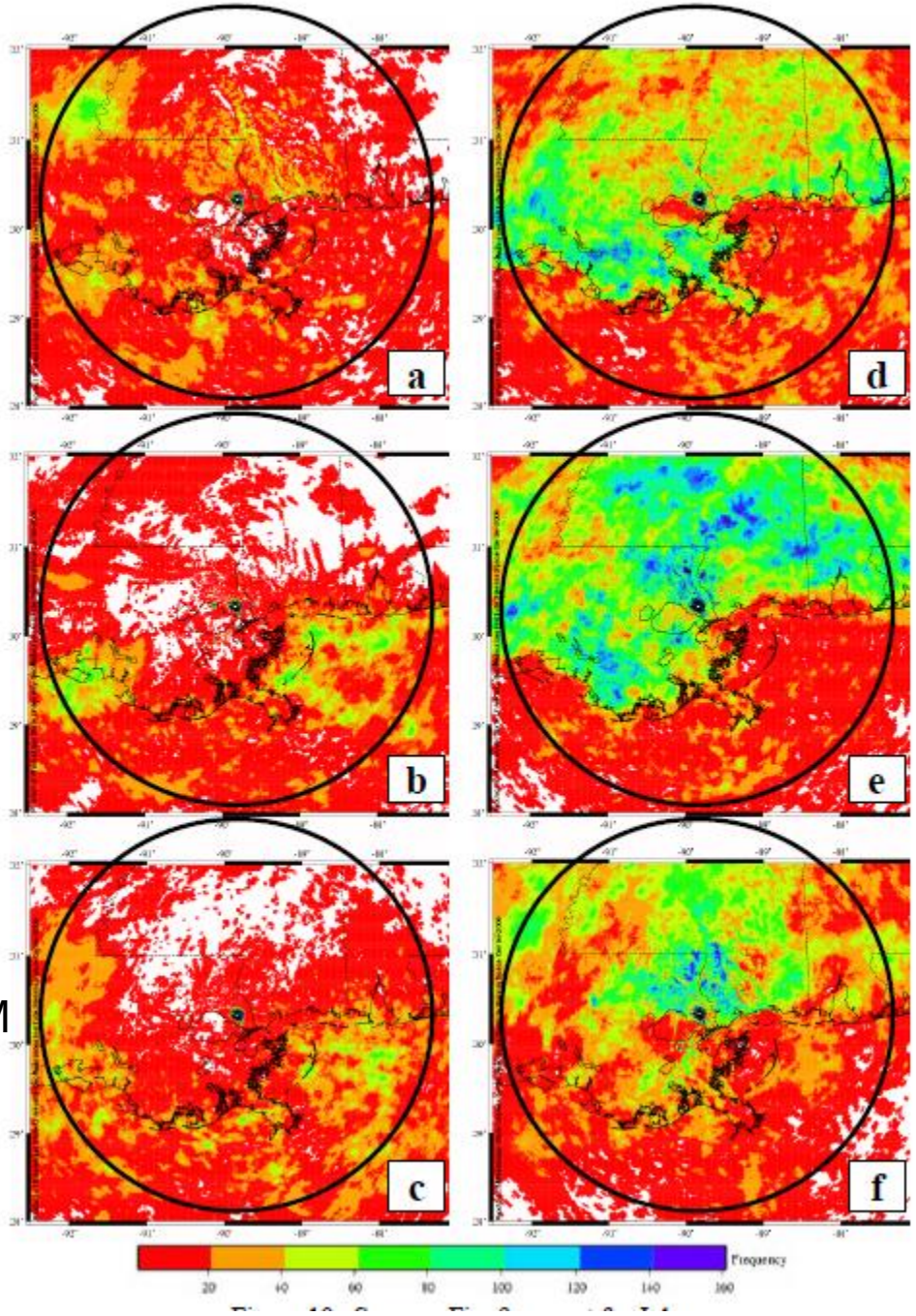
7PM-11PM



July

11PM-3AM

11AM-3PM



3AM-7AM

3PM-7PM

7AM-11AM

7PM-11PM

August

11PM-3AM

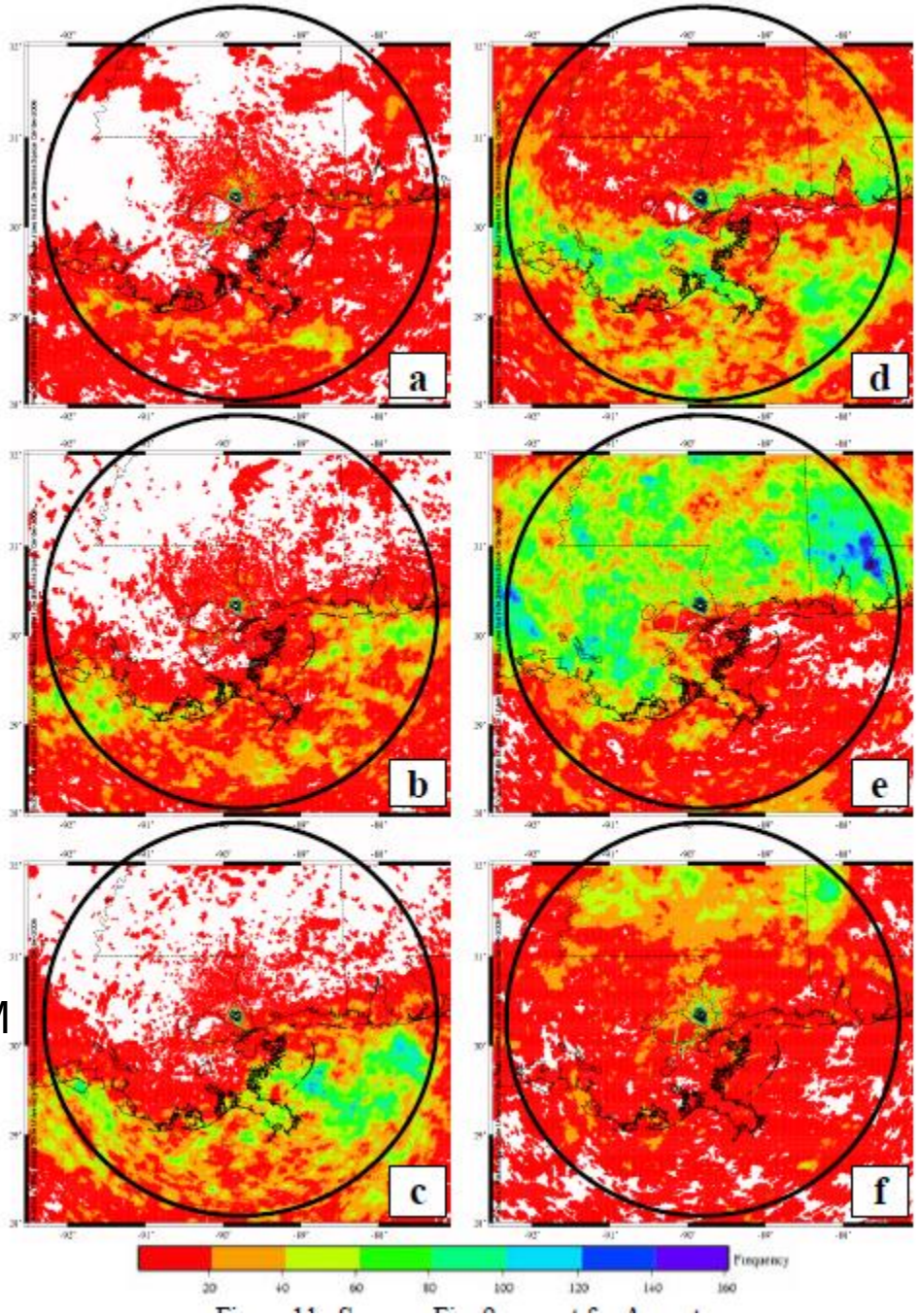
11AM-3PM

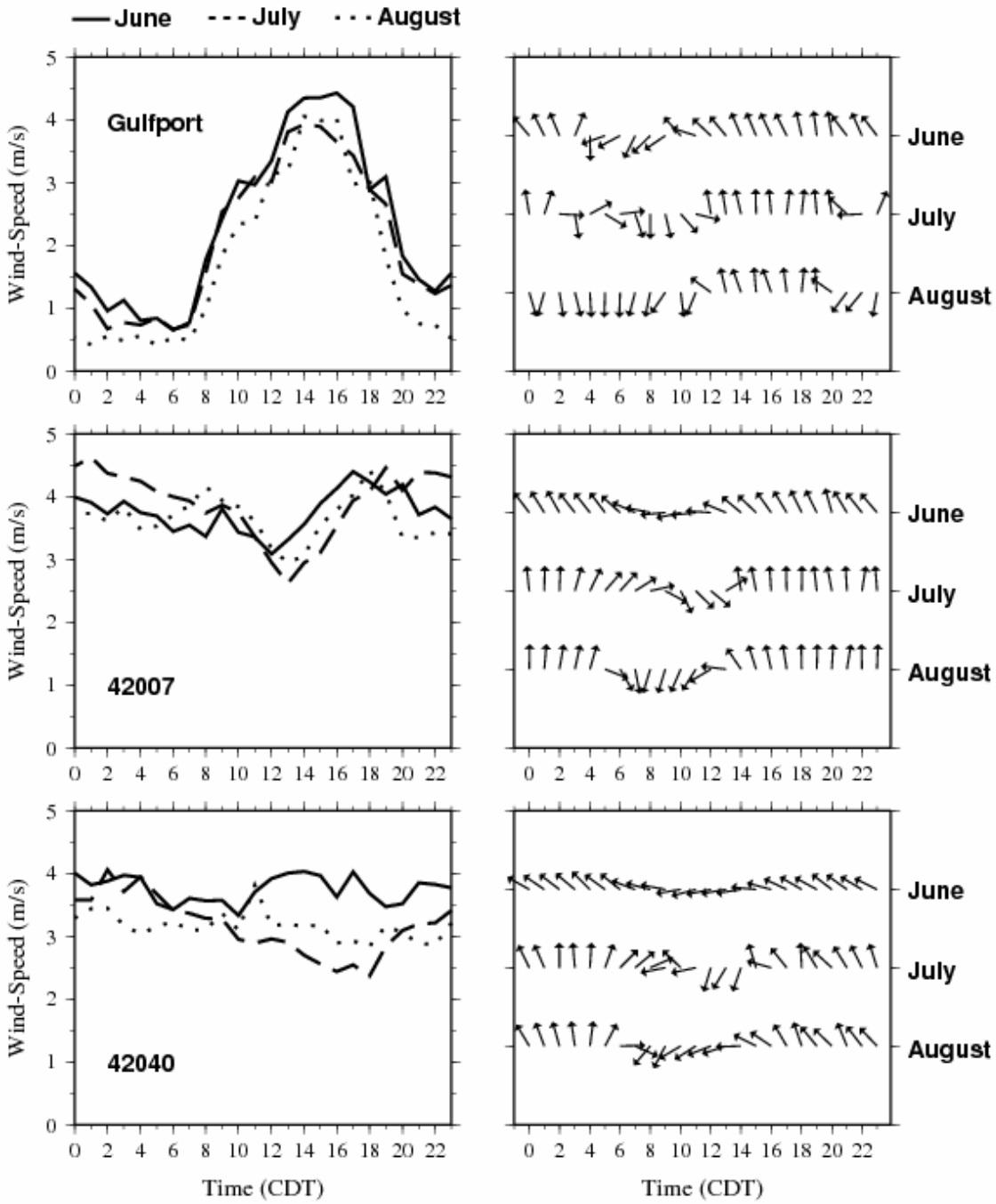
3AM-7AM

3PM-7PM

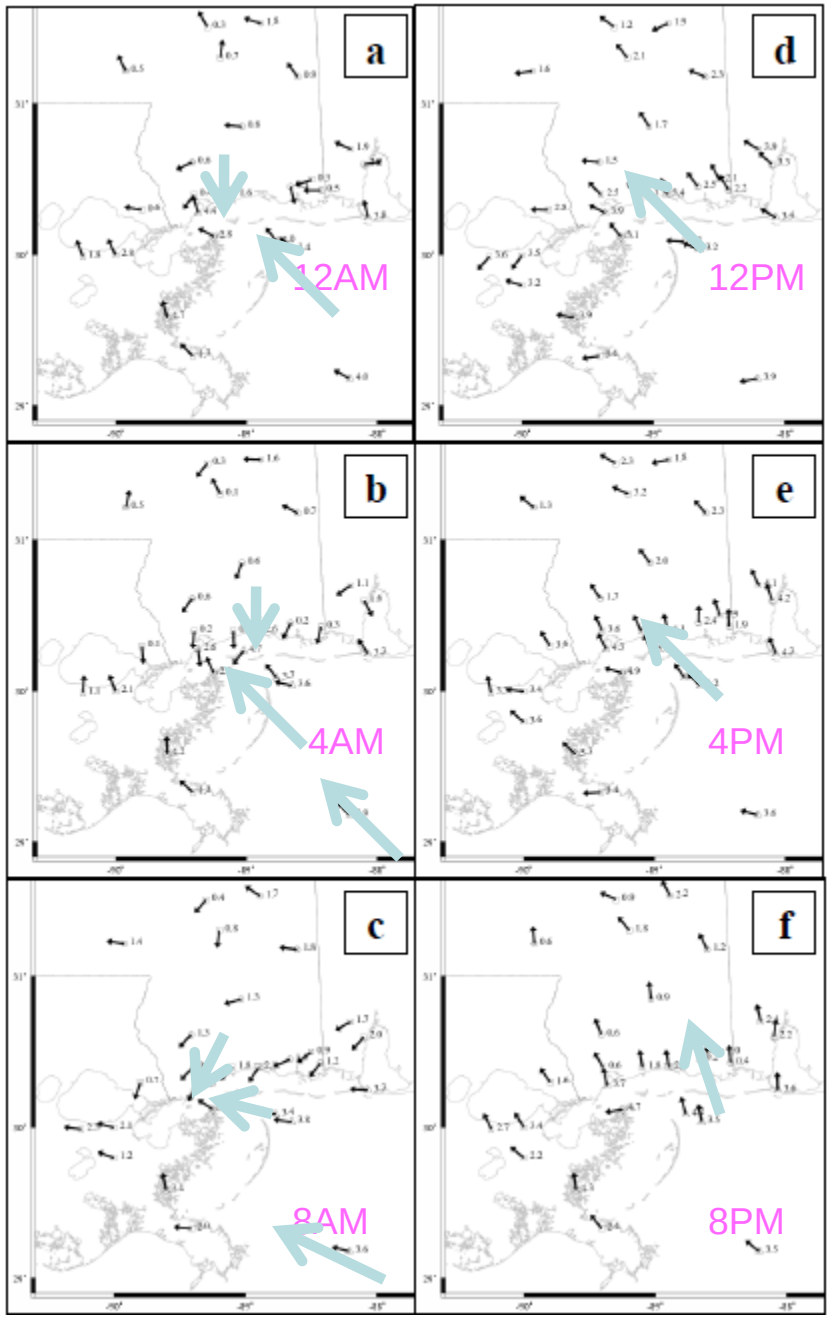
7AM-11AM

7PM-11PM




3-Year Wind Composite for Gulfport, 42007, 42040
June
July
August
Gulfport
42007
42040
Wind-Speed (m/s)
Time (CDT)
0 2 4 6 8 10 12 14 16 18 20 22
0 1 2 3 4 5
June
July
August

Wind composite
for sea breeze days,
June.



Wind composite
for sea breeze days,
July.

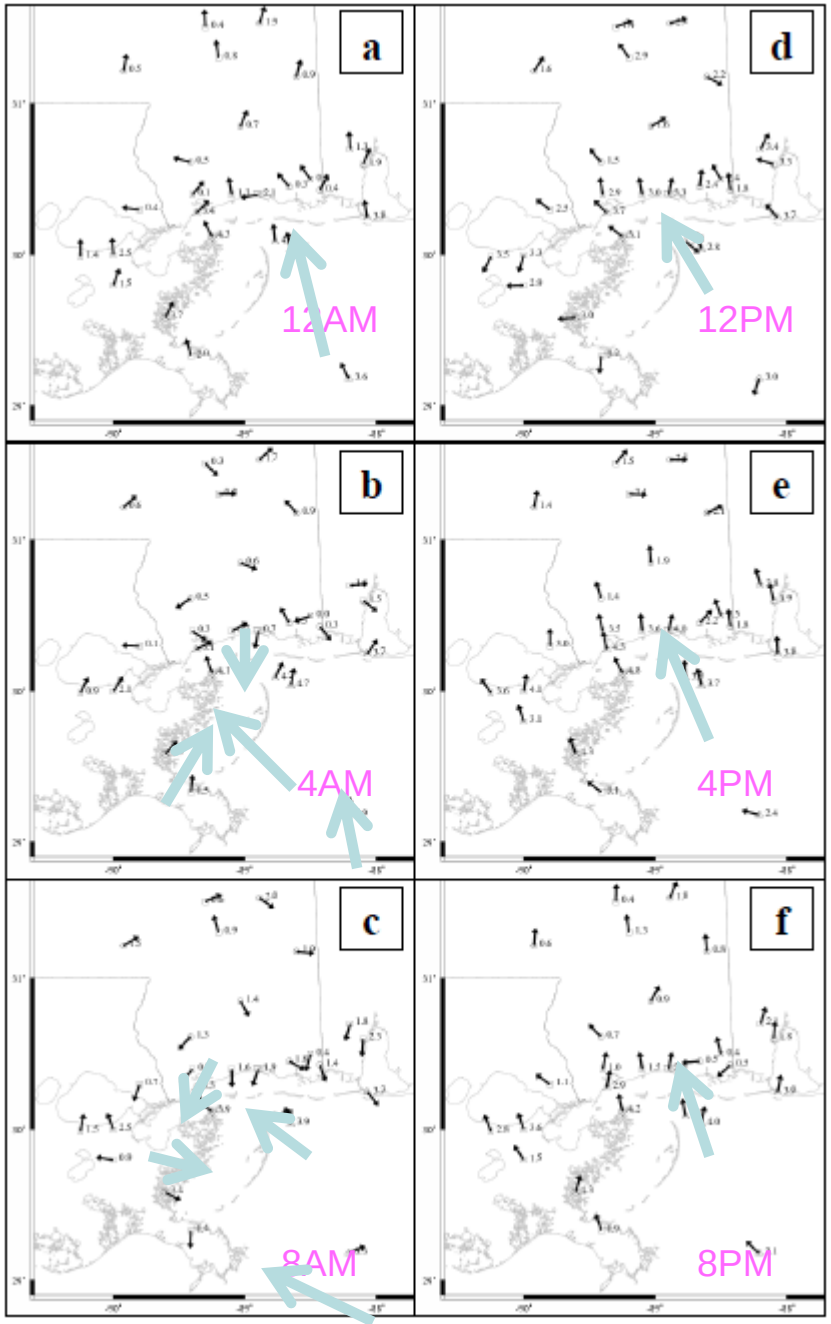


Figure 5. Same as Figure 4, except for July.

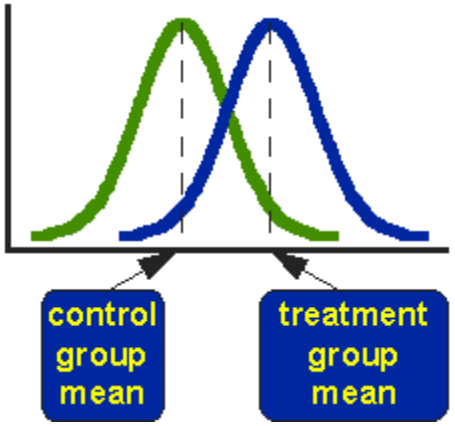
What is statistical significance?

What is the likelihood that a dataset is different compared to another dataset with similar characteristics, and that this difference did not occur by chance? (evidence against the “null hypothesis” that there is no difference)

This definition is for paired-observation comparisons.

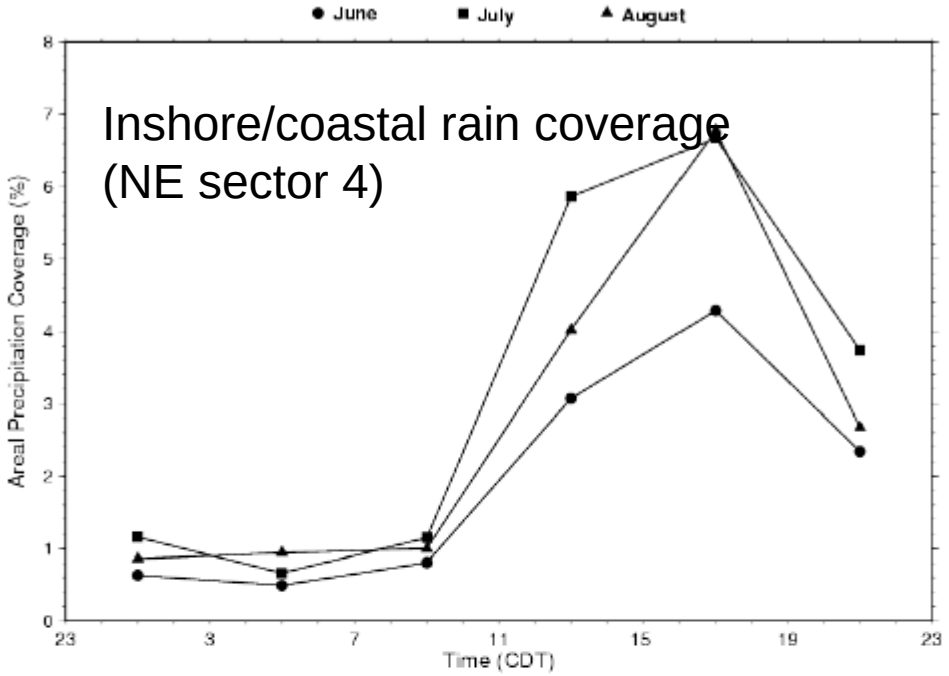
Methodology

- The evidence required to accept that a dataset's difference is unlikely to have arisen by chance is known as the significance level, quantified by a critical *p-value*
- There are different statistical tests based on the datasets' sample size and distribution pattern
  - Z-test, for large samples (n>30) and Gaussian distribution; or if population standard deviation known
  - t-test, for small samples (n<30), approximately Gaussian distribution, population standard deviation not known
  - Wilcoxon rank-sum test, distribution not Gaussian (conservative, tends to give higher p-values)



My P-value interpretation

P value range	Evidence that two datasets are different	Tabular symbol used
> 0.15	No difference	
0.05 to 0.15	Suggestive, but inconclusive	^
0.01 to 0.05	Moderately convincing	*
0.001-0.01	Convincing	**
< 0.001	Very convincing	***



June vs July

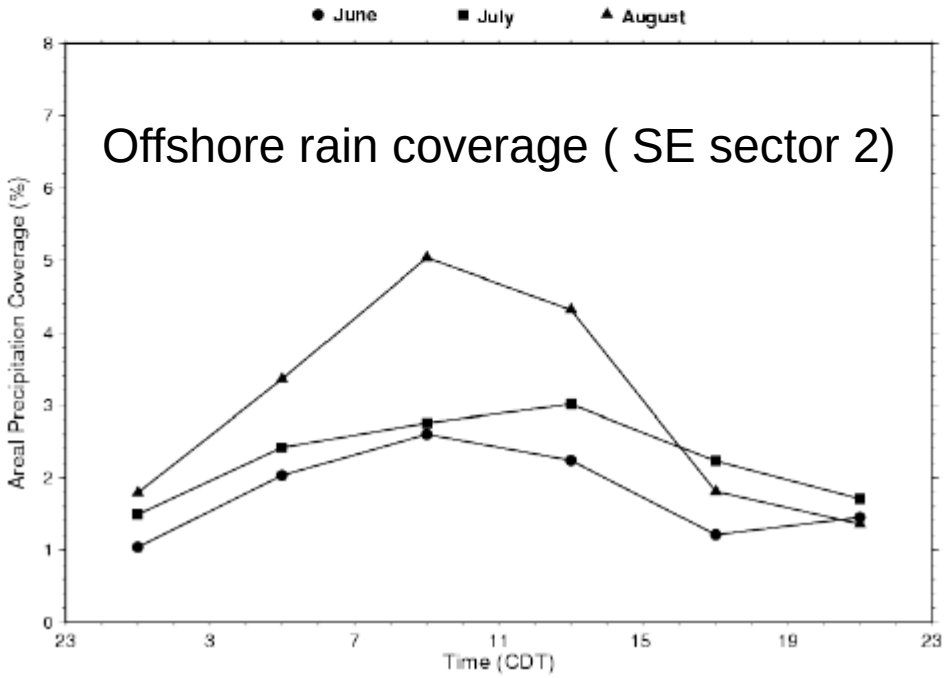
Hour (CDT)	Sector 2	Sector 4
23-03	^	*
03-07	^	^
07-11		^
11-15	*	**
15-19	**	*
19-23	^	^

Much more daytime inshore rain coverage in July versus June

Even though coverage is small, more daytime offshore rain in July versus June

July vs August

Hour (CDT)	Sector 2	Sector 4
23-03		
03-07	*	^
07-11	*	
11-15		^
15-19		
19-23		



June vs August

Hour (CDT)	Sector 2	Sector 4
23-03	*	**
03-07	**	**
07-11	**	^
11-15	**	
15-19	**	^
19-23		

Even though coverage is small, more nighttime inshore rain in August versus June

Much more nighttime and morning offshore rain coverage in August versus June

	Zonal wind								
	June vs July			July vs August			June vs August		
Hour (CDT)	KGPT	42007	42040	KGPT	42007	42040	KGPT	42007	42040
0000	^	*	**					*	*
0100	^	*	*					*	*
0200	*	*	*					*	^
0300		*	**					*	*
0400	^	**	*	^				*	*
0500		**	*					^	**
0600	^	**	**					^	*
0700	^	**	**	^					**
0800	^	*	**		^				*
0900	*	*	**	**	^				*
1000	*	*	**		^				*
1100	*	***	**		*	^			
1200	*	***	***		*	*			^
1300	**	***	***		*	^		^	^
1400	*	**	***		^	*		*	^
1500	^	**	***			*	^	*	*
1600	*	**	***				^	*	**
1700	**	**	***				^	*	**
1800	**	**	***				^	^	**
1900		^	*					*	*
2000			*						**
2100		^	^					*	*
2200		**	*					*	*
2300	*	**	**			^		**	^

	Meridional wind								
	June vs July			July vs August			June vs August		
Hour (CDT)	KGPT	42007	42040	KGPT	42007	42040	KGPT	42007	42040
0000				*	^		*		
0100				**	*		*	^	
0200				**	**		*	^	
0300				^	*		*		
0400				**	*		^	^	
0500				*	**	^	*	*	
0600				**	*	^	^	**	^
0700				**	***	^	*	**	
0800				^	**		*	**	
0900					**		^	**	^
1000	^				**		*	**	
1100				*	*	^	*	**	
1200				^	^		^	*	
1300								^	
1400	^								
1500									
1600	^						*		
1700	^				^				
1800	^		^				^		
1900							^		

Statistical tests of u,v, and speed for onshore and offshore winds are Complicated, but support general conclusions seen in monthly plots

Meridional wind

Hour (CDT)	June vs July			July vs August			June vs August		
	KGPT	42007	42040	KGPT	42007	42040	KGPT	42007	42040
2000			*						*
2100				^	^		^		^
2200					*		^	^	
2300					*		^		

Total wind speed

Hour (CDT)	June vs July			July vs August			June vs August		
	KGPT	42007	42040	KGPT	42007	42040	KGPT	42007	42040
0000					*				
0100		^		^	*				
0200	^	^			*	^			
0300					^				^
0400					*	^			^
0500						^			
0600	^								
0700	^			*					*
0800									
0900									
1000				*			*		
1100			^						
1200			^						
1300		^	*					^	^
1400			**					^	*
1500		*	**			^		^	^
1600	**	*	*				*	^	^
1700	**		***						**
1800			**						*
1900			^				**		
2000									
2100		^			*				^
2200					*	^			*
2300		^			*				

Stepwise Multiple Regression Analysis:

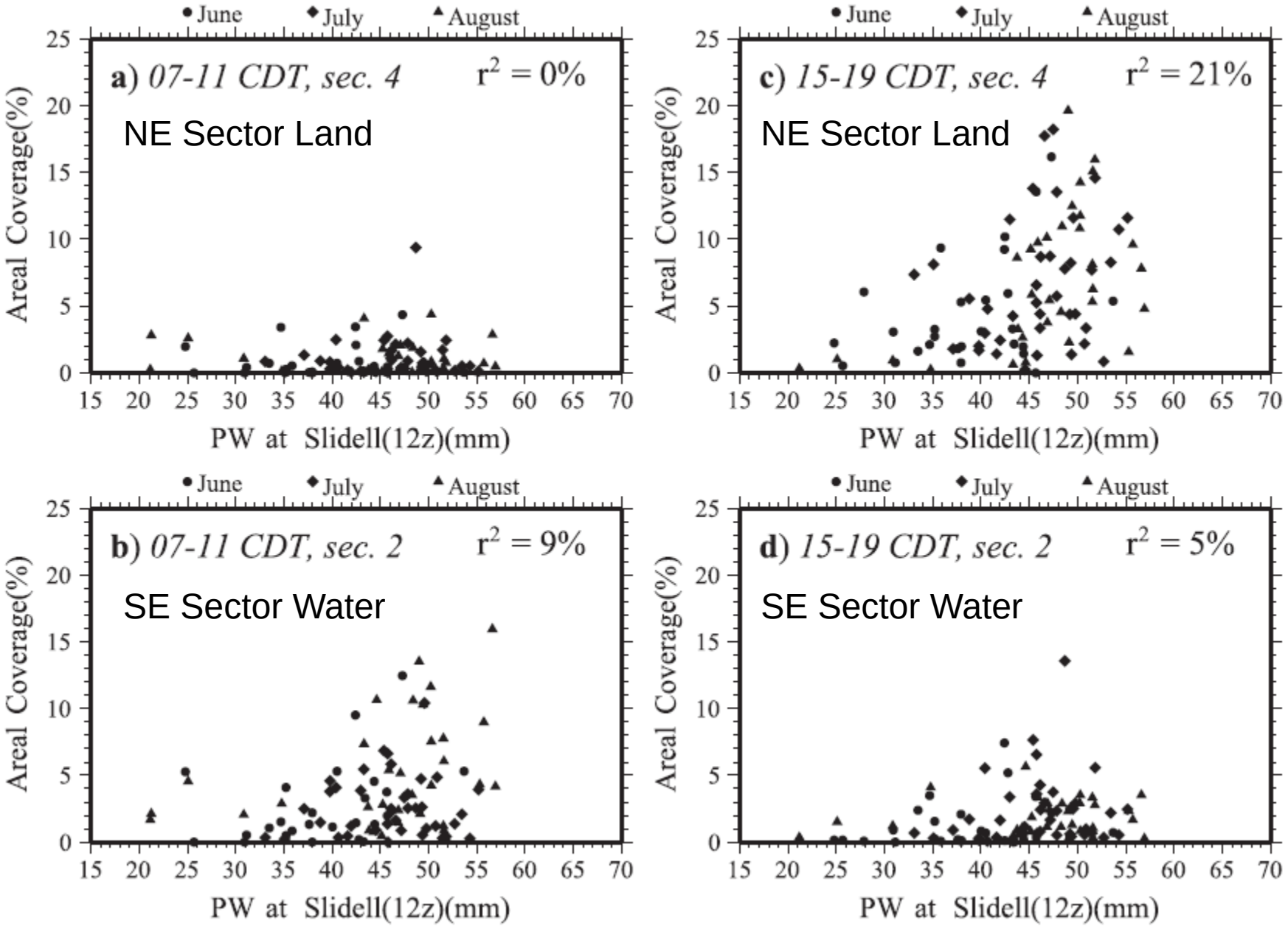
Upper-air quantities correlated against Areal Precipitation Coverage

(yellow > 99% significant level)

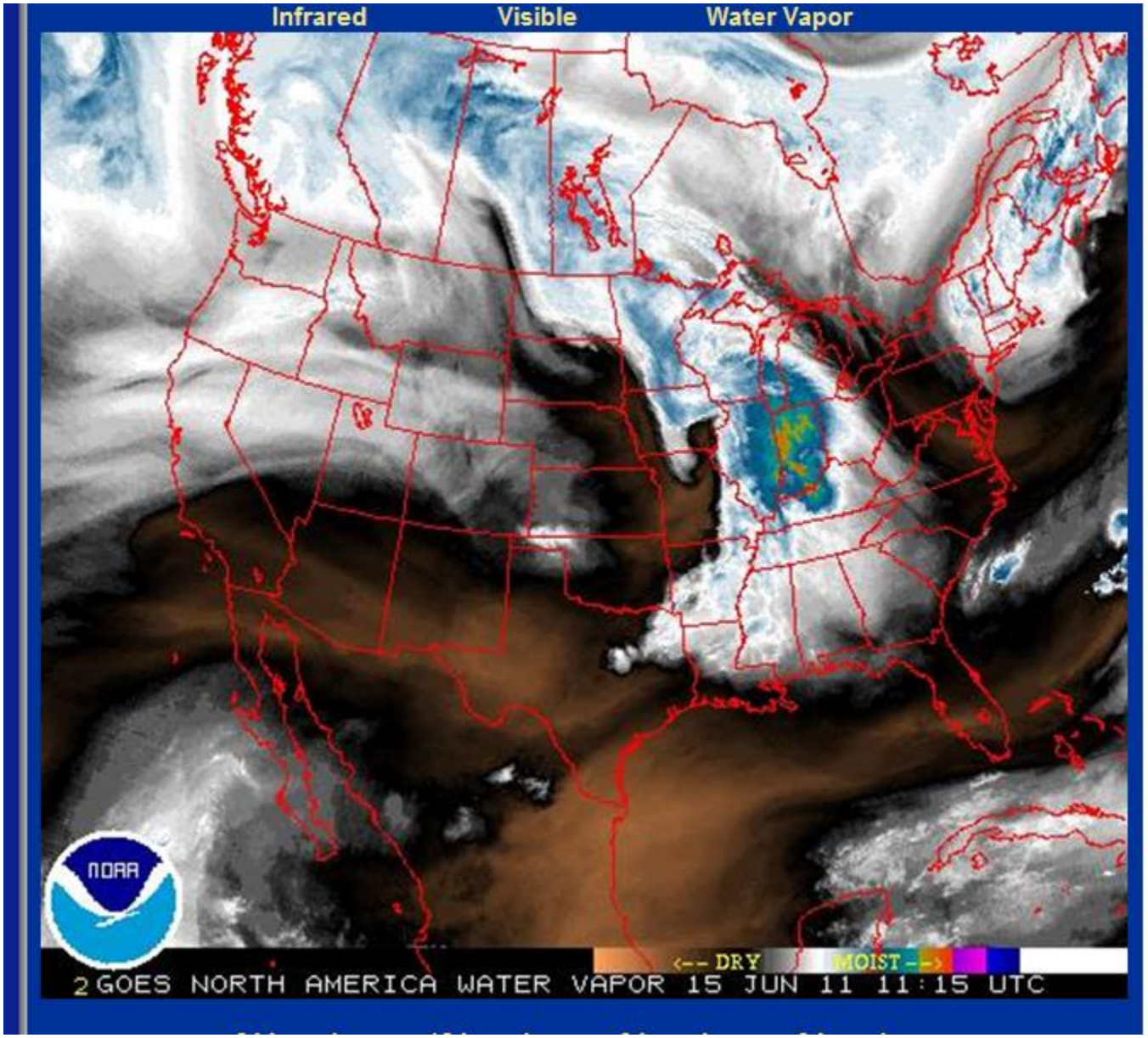
		7 - 11 AM (land breeze convection)	3 - 7 PM (sea breeze convection)
NE sector (4)	Land	R^2=4% 850-mb Wind direction=0.19	R^2=29% PW=0.48 CAPE=0.26 Td850=-0.18
SE sector (2)	Water	R^2=19% PW=0.37 CAPE=0.29 T850-T500=-0.21 Td850=-0.16	R^2=6% PW=0.23 850-mb Wind direction=0.11

For all 24 cases (Sectors 1-4, 6 four-h periods), at 90-100% significance level, PW occurs 17 times, CAPE 11 times, wind direction 3 times, Td850 5 times, and lapse rate 4 times.

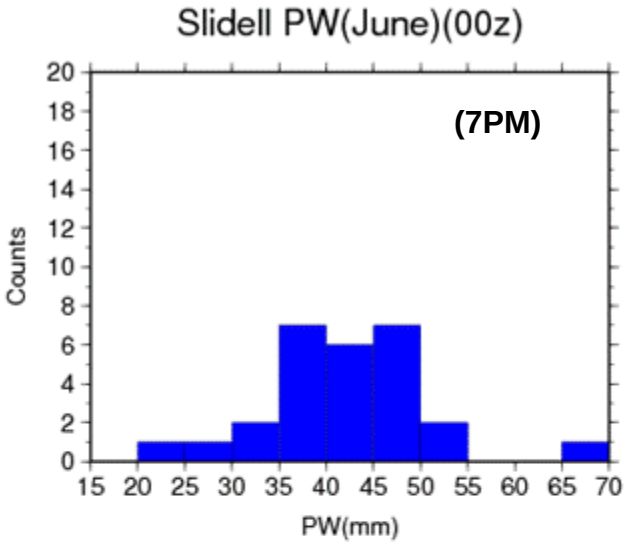
KI and 700-DD were only occasionally selected in stepwise routine, and rarely >90% significant

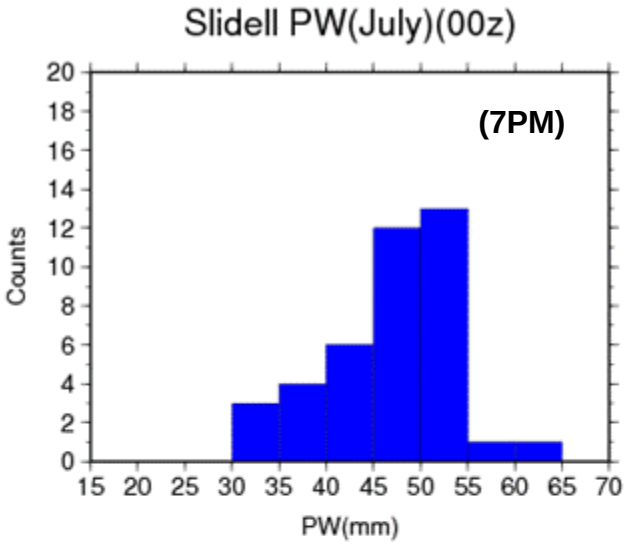

June
July
August
a) 07-11 CDT, sec. 4
r² = 0%
NE Sector Land
c) 15-19 CDT, sec. 4
r² = 21%
NE Sector Land
b) 07-11 CDT, sec. 2
r² = 9%
SE Sector Water
d) 15-19 CDT, sec. 2
r² = 5%
SE Sector Water
Areal Coverage(%)
PW at Slidell(12z)(mm)
0
5
10
15
20
25
15
20
25
30
35
40
45
50
55
60
65
70

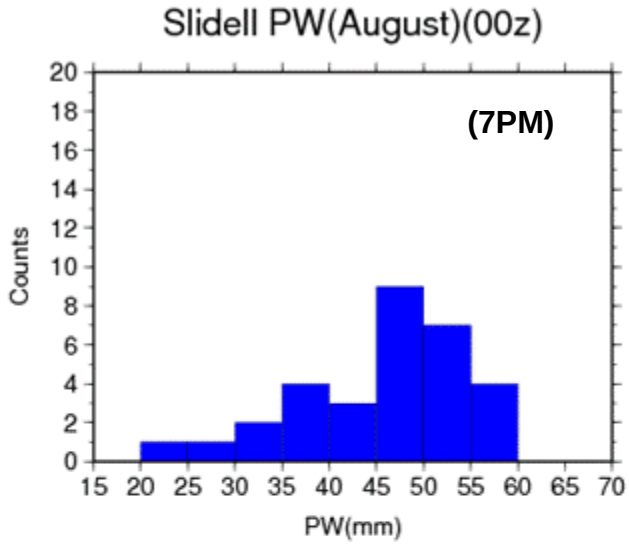
Water vapor image, 6:15AM this morning

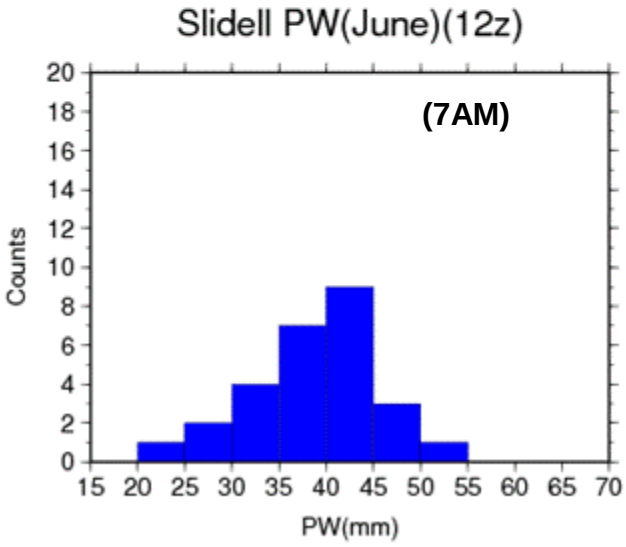


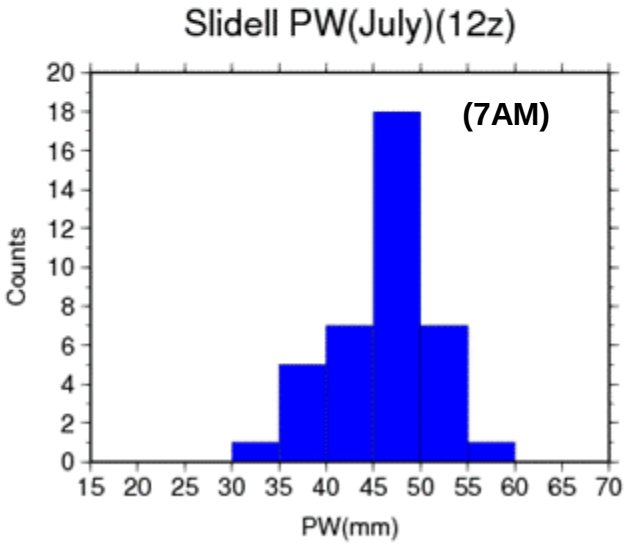
2003 – 2005 Slidell Precipitable Water, Sea Breeze Days Only

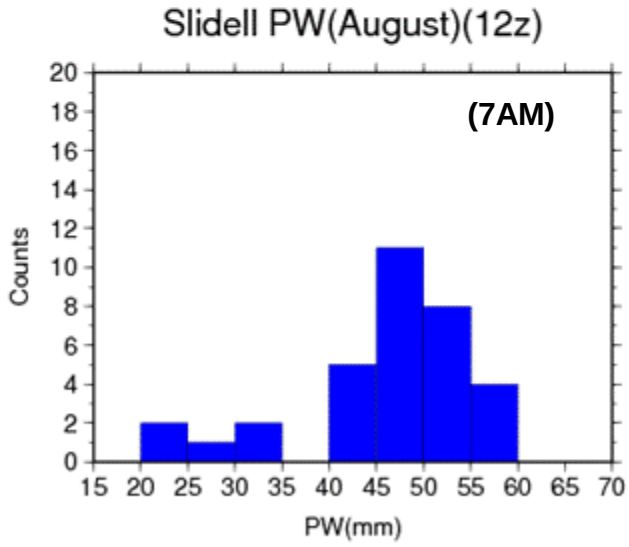




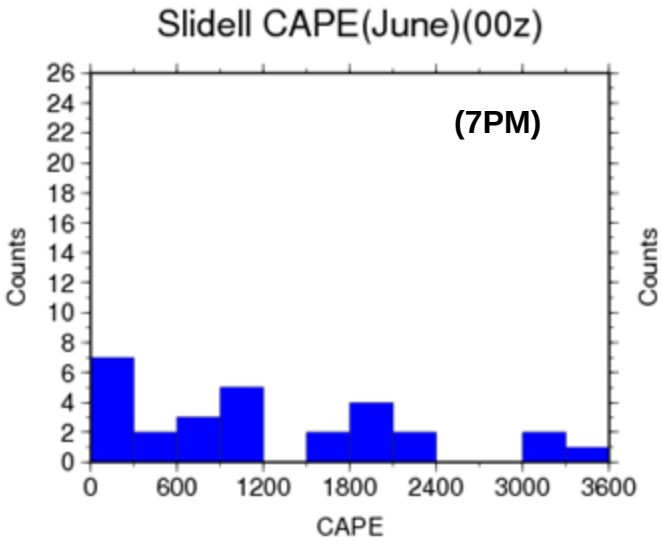


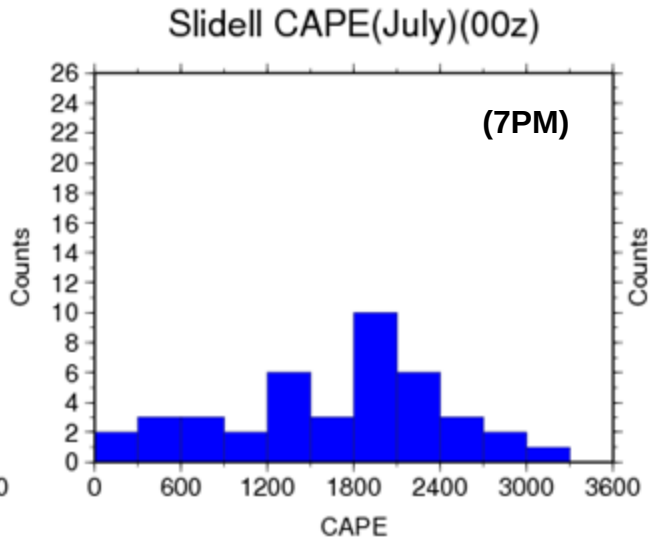


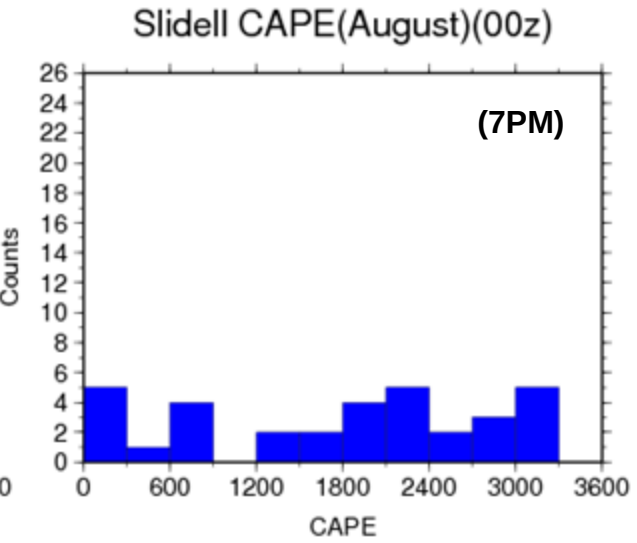


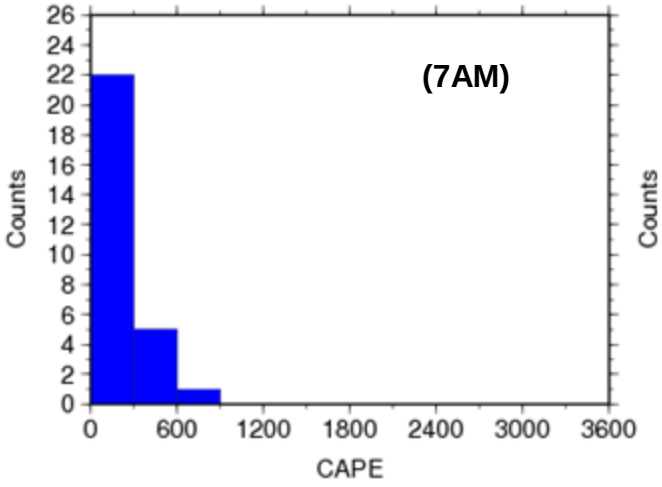


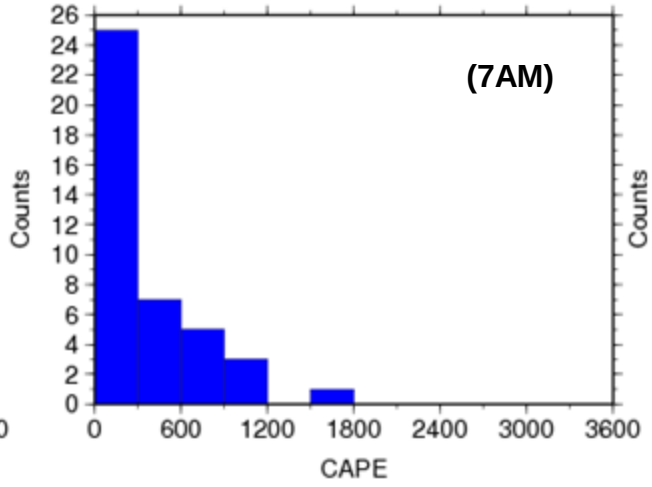
2003 – 2005 Slidell CAPE, Sea Breeze Days Only











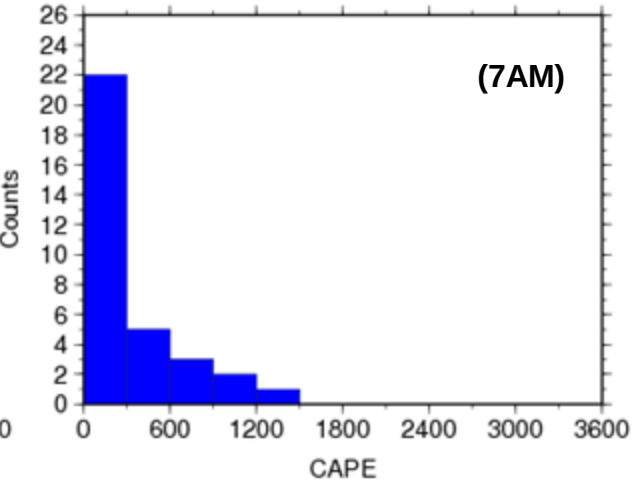


TABLE 6. Statistical significance results between the monthly PW and CAPE for 0000 UTC (1900 CDT) and 1200 UTC (0700 CDT) using the Wilcoxon rank sum test. Symbols are as in Table 3. Sample sizes for CAPE are June, 28; July, 41; and August, 33. PW are generally 1–2 less due to missing upper-tropospheric dewpoint data.

	PW	
	0700	1900
June vs July	***	**
June vs August	***	*
July vs August	—	—

	CAPE	
	0700	1900
June vs July	*	*
June vs August	*	^
July vs August	—	—

Precipitable water higher in July/August than June at 7AM; moderately convincing or convincing at 7PM

Moderately convincing that CAPE is higher in July/August than June

Final comments

- Recommended reading
  - *Eloquent Science* by David Schultz
  - *Scientific Papers and Presentations* by Martha Davis
  - *The Art of Being a Scientist: A Guide for Graduate Students and their Mentors* by Roel Snieder and Ken Larner
  - *Peer Review and Manuscript Management in Scientific Journals* by Irene James
- Recommended programming tools
  - Windows software is available for small datasets. But multiple large datasets requires more robust skills.
    - – Learn Linux/Unix
    - – Learn shell programming and at least one of the following: MATLAB, FORTRAN, PYTHON, IDL
    - – Learn R, a powerful free statistical and graphics programming with scripting capability. See www.r-project.org
- Start reading journals in your field
- Join professional society in your field