

MIDDLE TEXAS COASTAL WATERS

ROB HART

WFO CRP MARINE PROGRAM LEADER

It's All About WIND!

Sea Fog

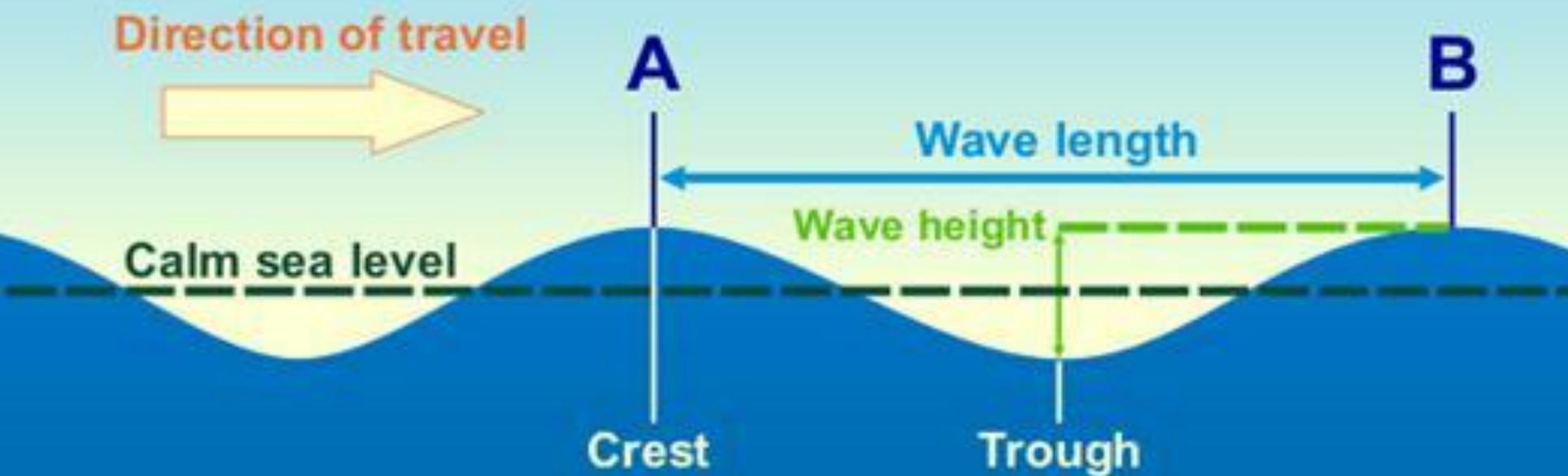
Rip Currents

Waves

Waterspouts

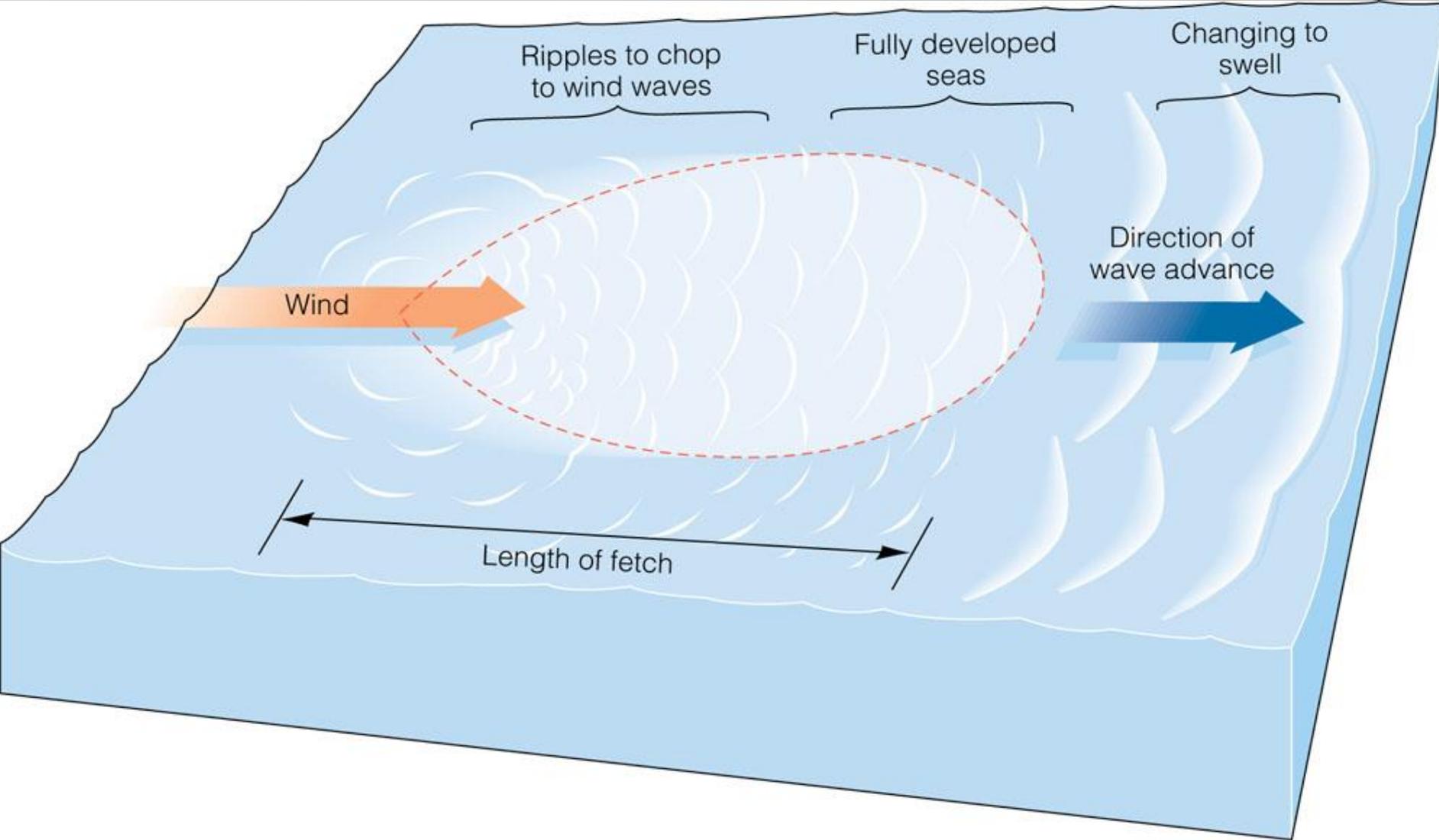
Hurricanes

Tides



Wave Frequency
The number of wave crests passing point A each second

Wave Period
The time required for the wave crest at point A to reach point B



direction of wave
propagation

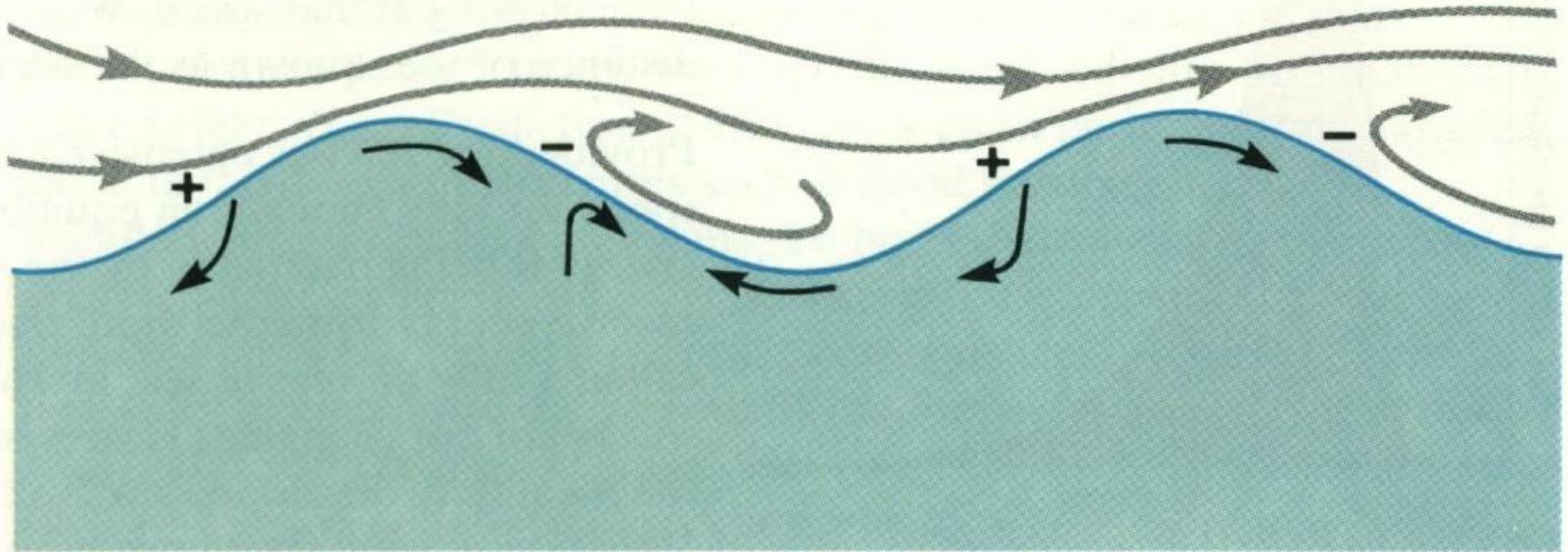
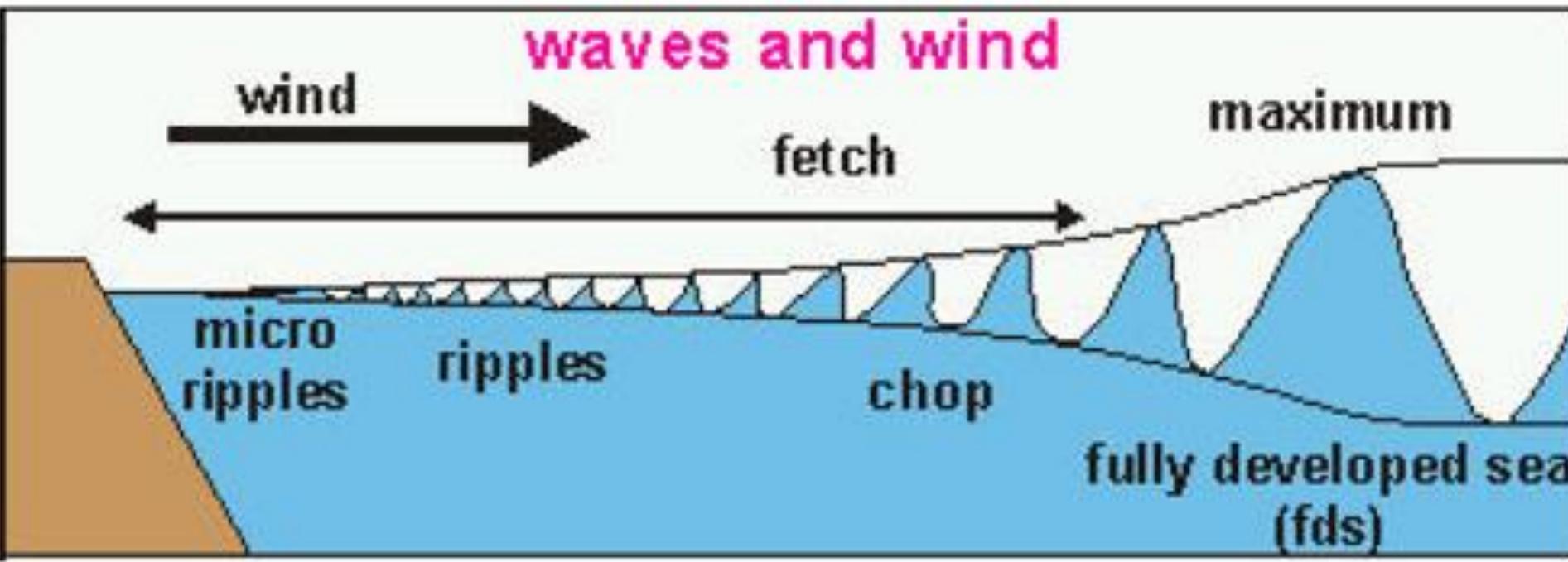
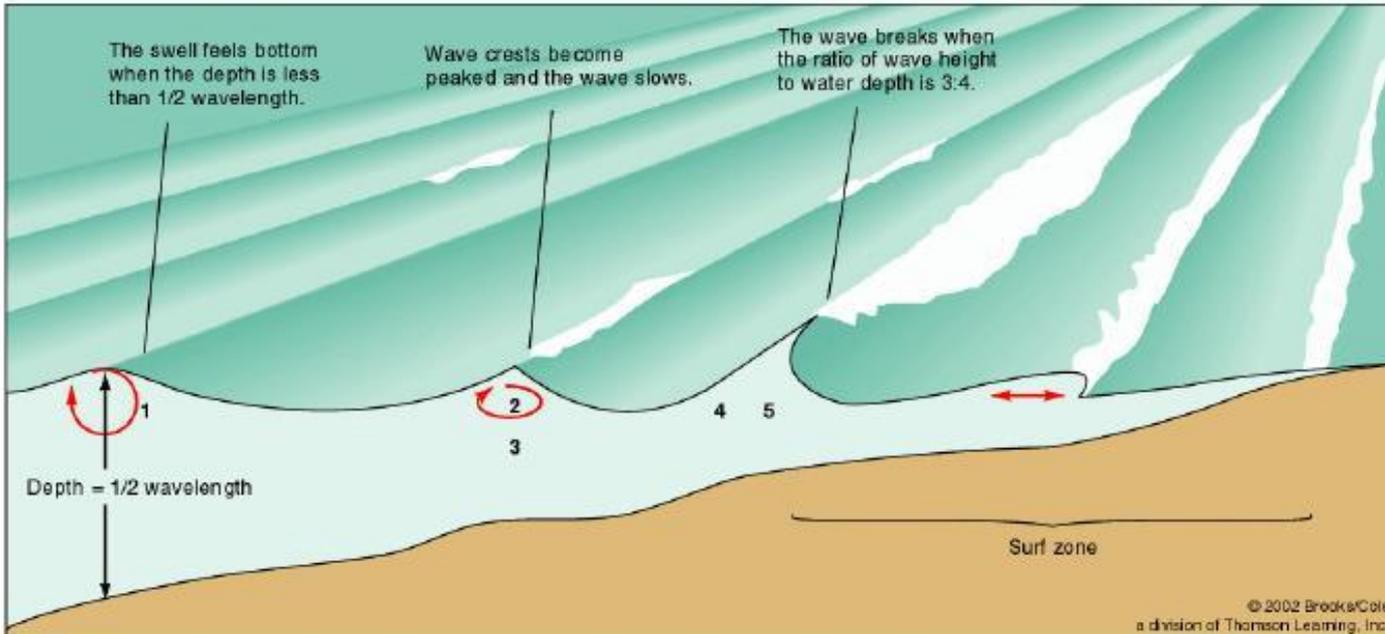


Figure 1.3 Jeffreys' 'sheltering' model of wave generation. Curved lines indicate air flow; short, straight arrows show water movement, which will be explained more fully in Section 1.2.1. The rear face of the wave against which the wind blows experiences a higher pressure than the front face, which is sheltered from the force of the wind. Air eddies are formed in front of each wave, leading to differences in air pressure. The excesses and deficiencies of pressure are shown by plus and minus signs respectively. The pressure difference pushes the wave along.

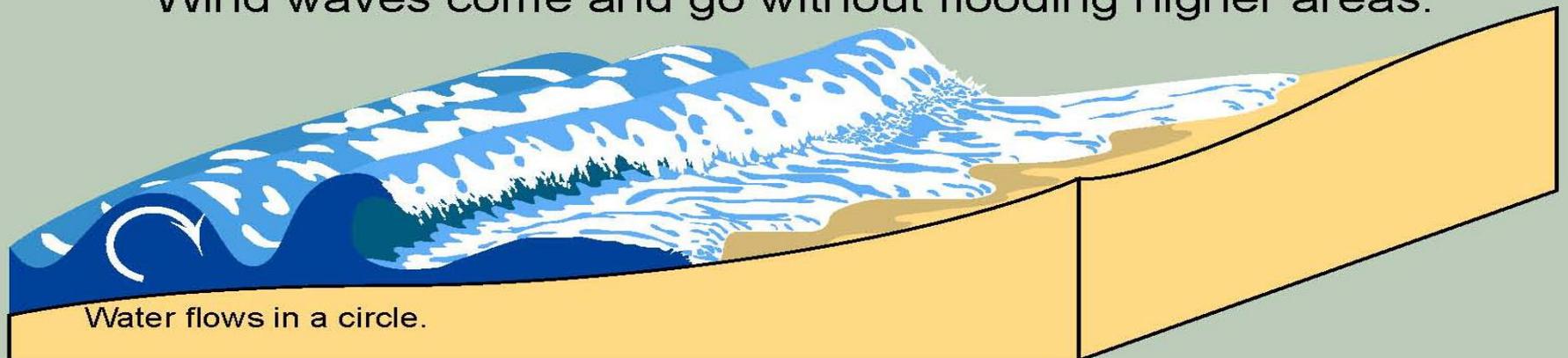
waves and wind

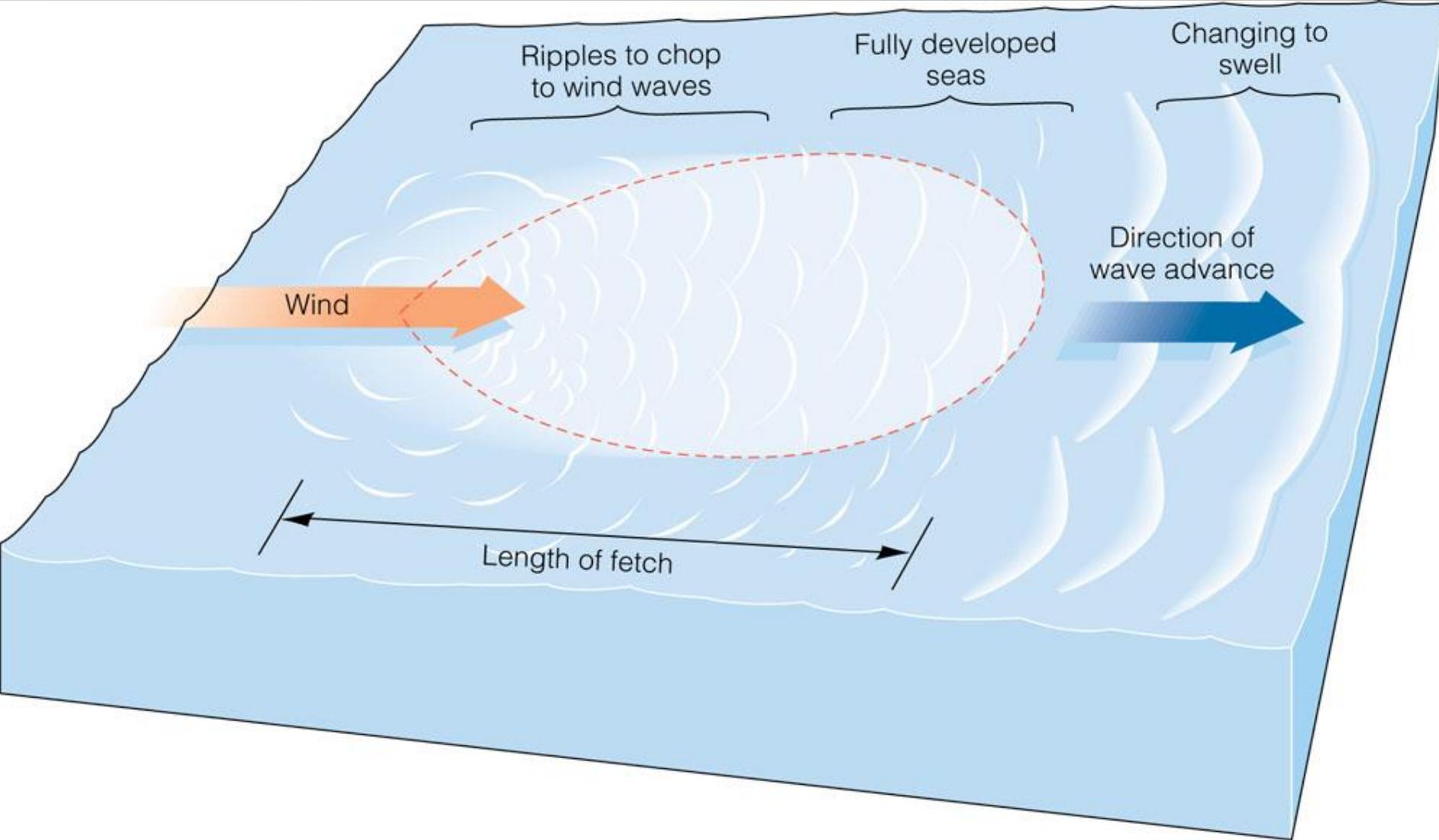


Wind Waves Approaching Shore



Wind waves come and go without flooding higher areas.



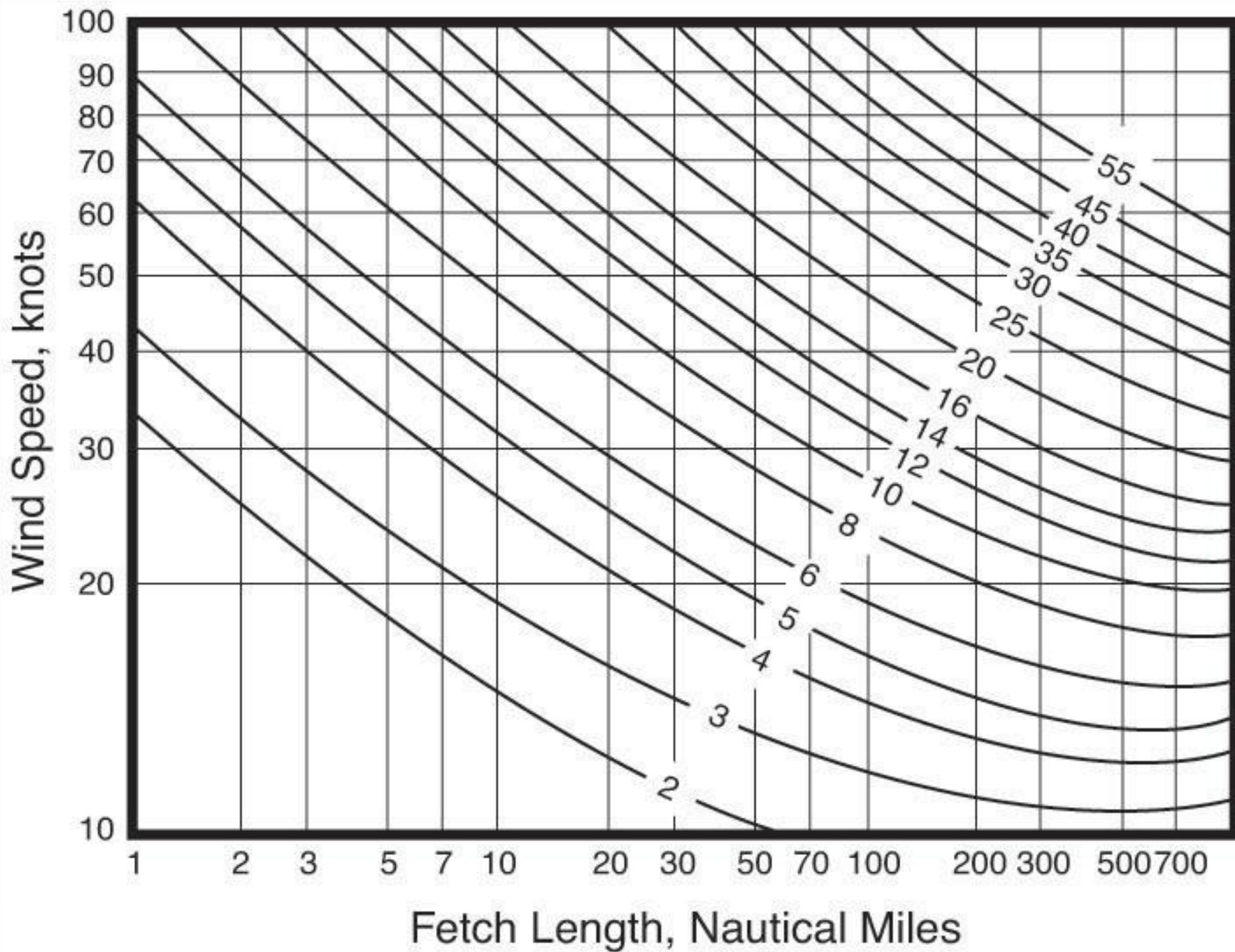


Swell

Longer swell period = greater energy

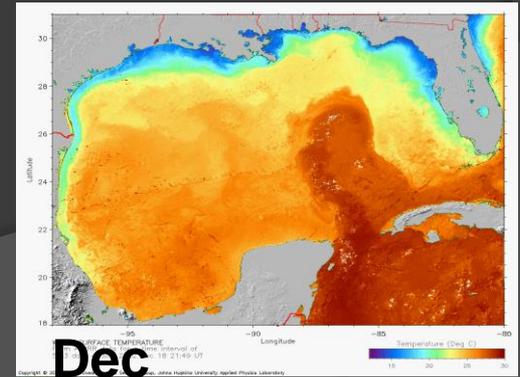
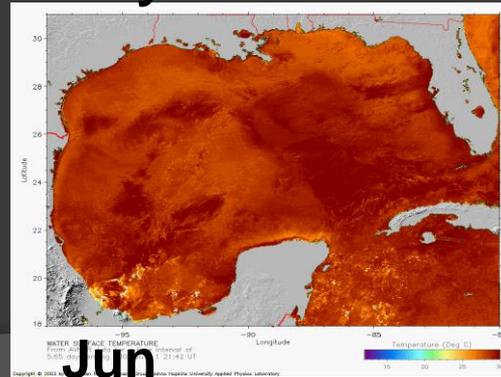
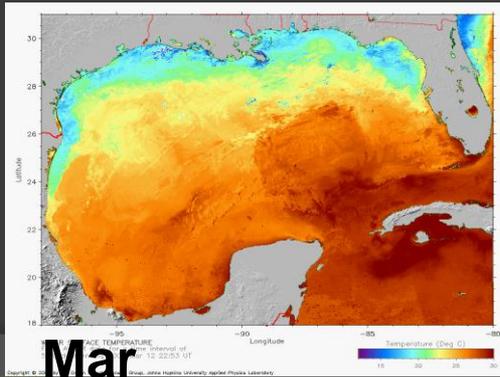
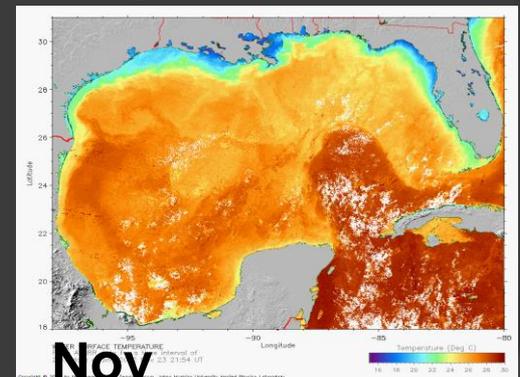
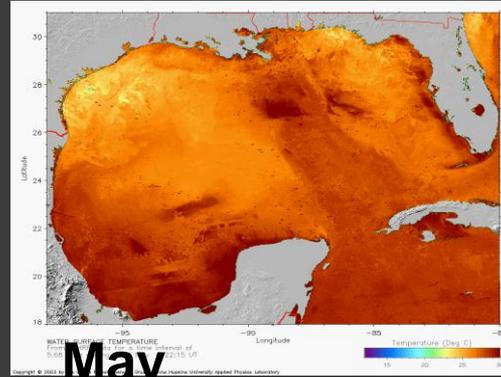
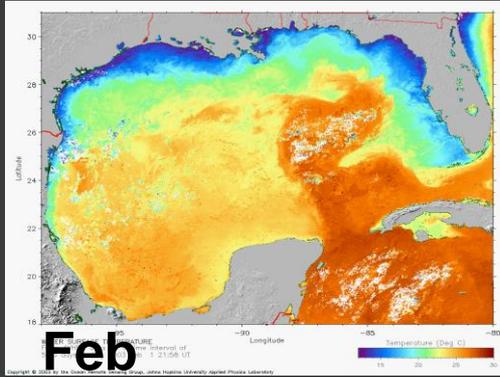
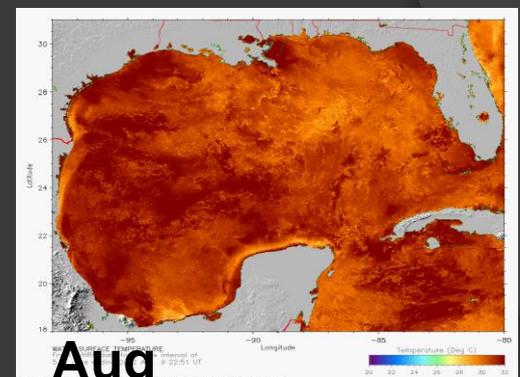
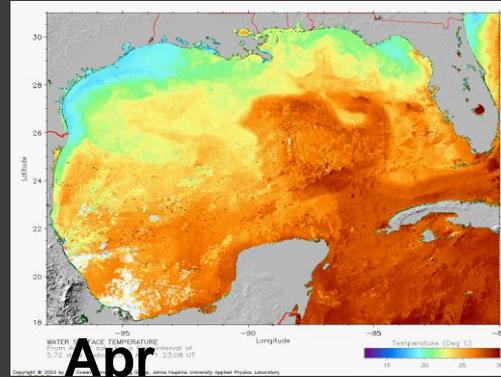
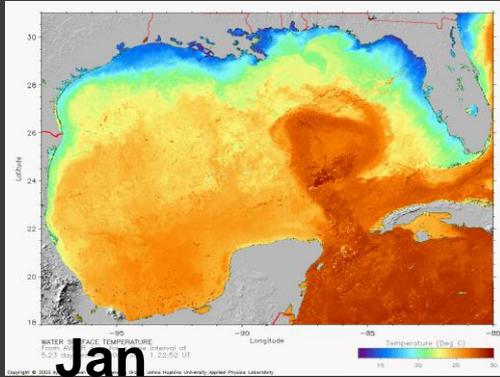
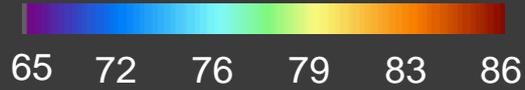
Greater the amount of energy = higher chances
of water pushing into the dunes





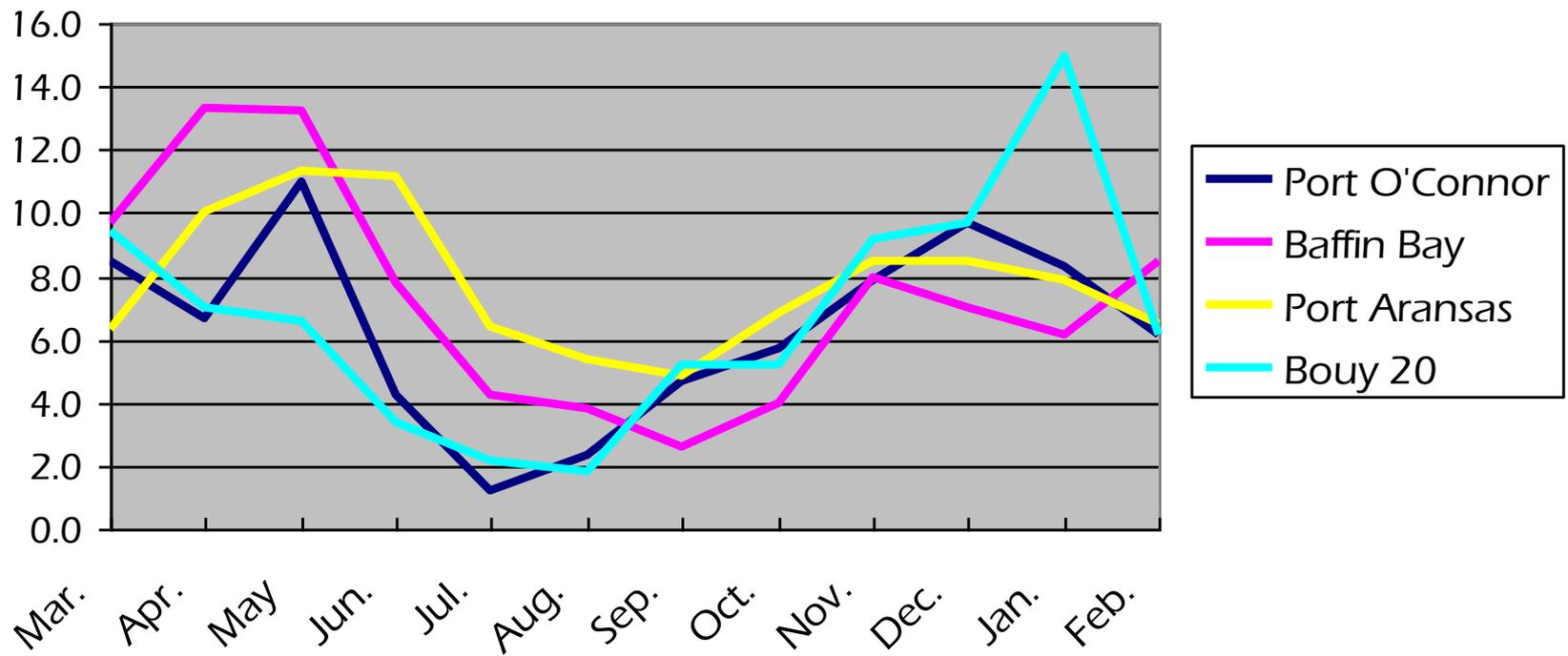
Gulf of Mexico

Water Temperatures

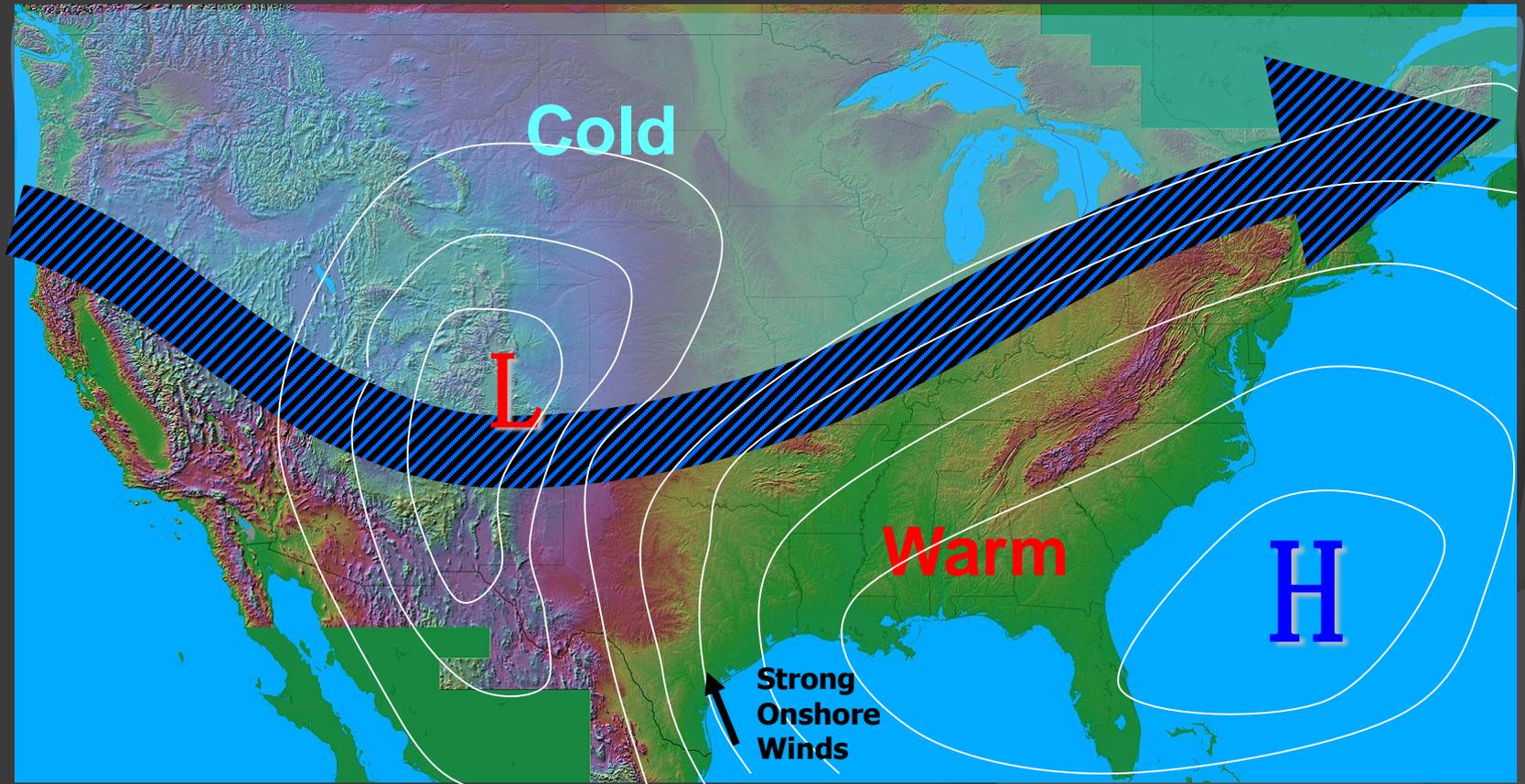


Wind Climatology

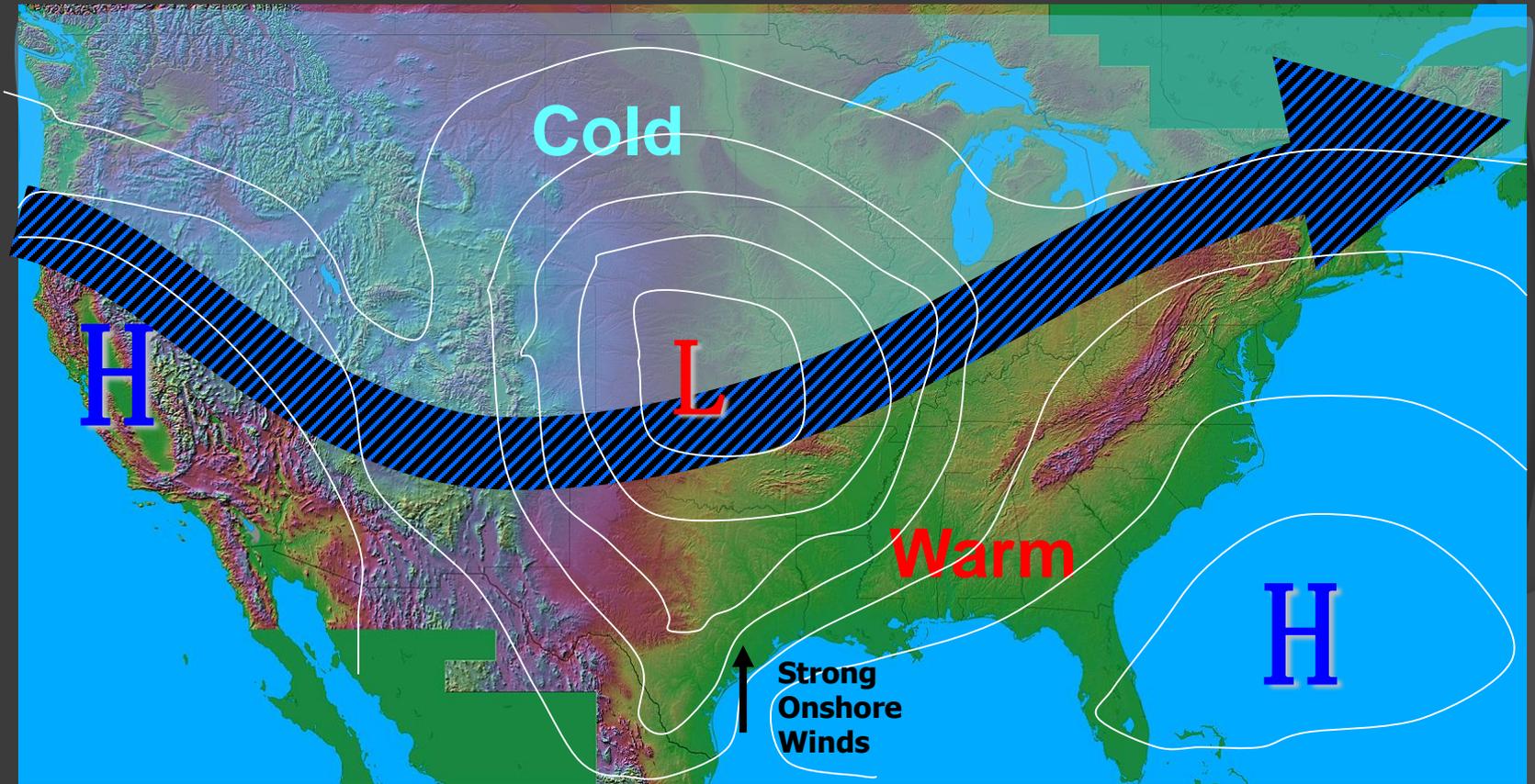
Average Number of Days W/ SCA



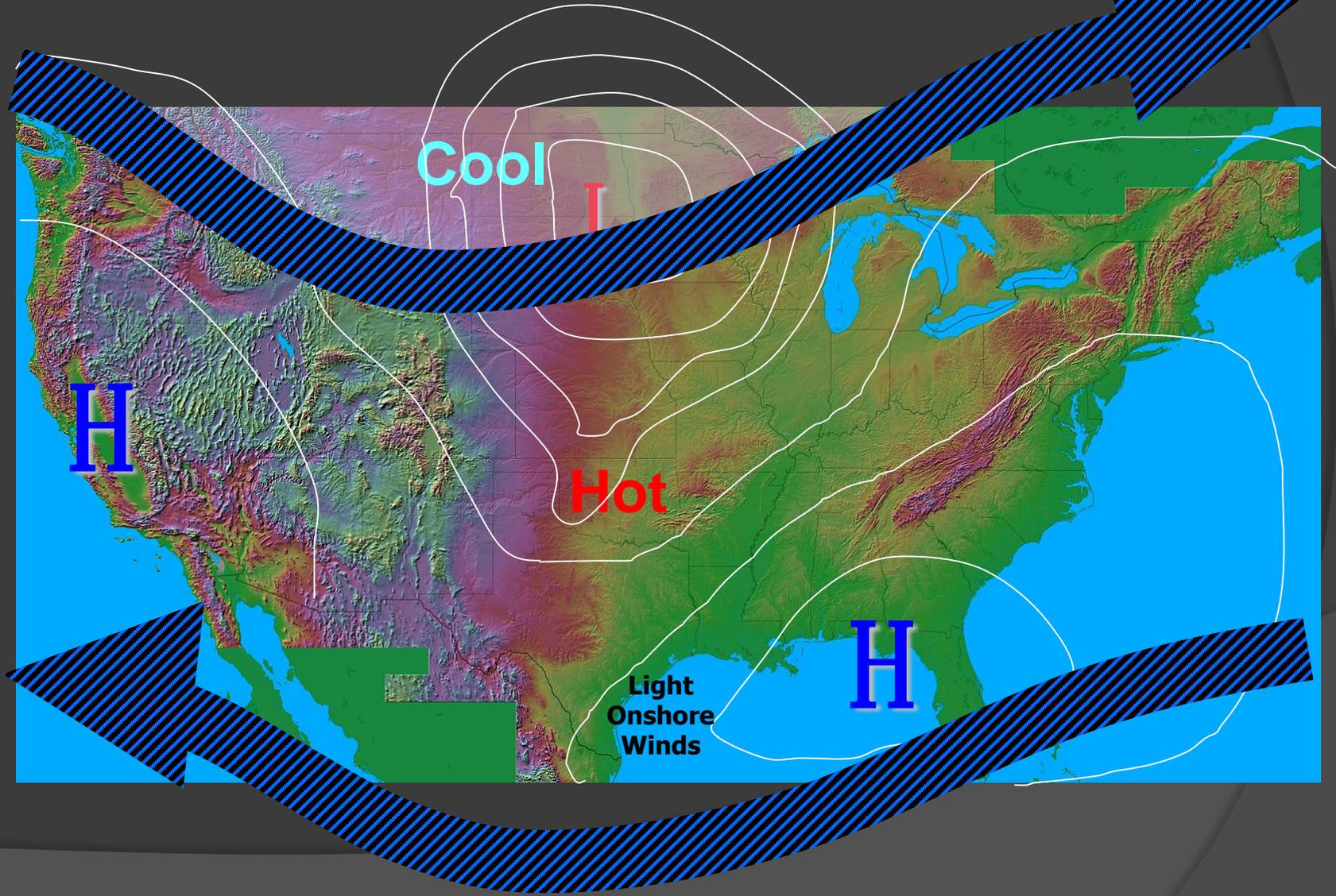
Spring Pattern



Spring Pattern

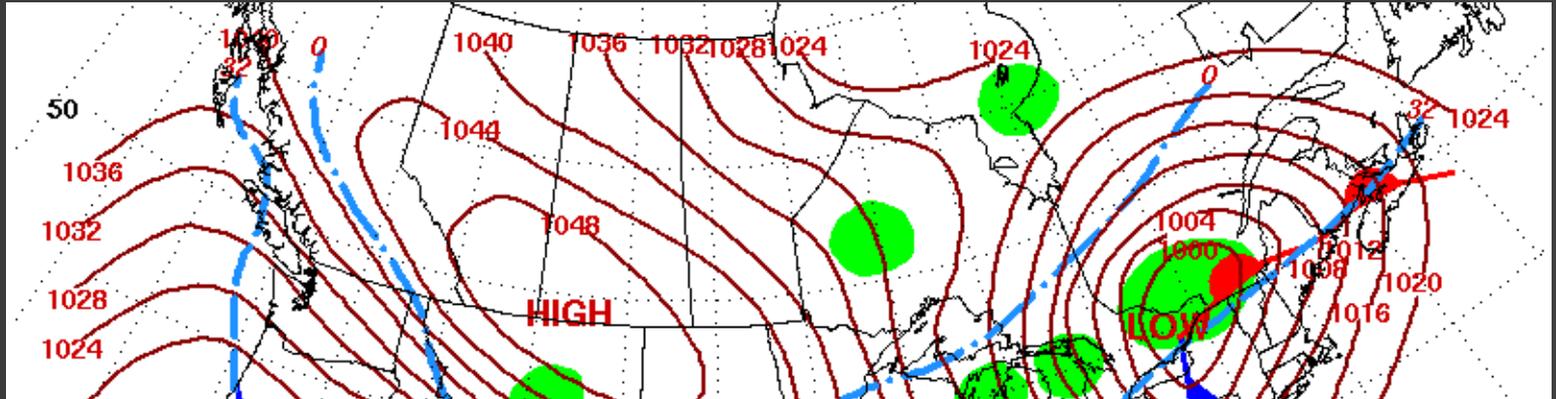


Summer Pattern

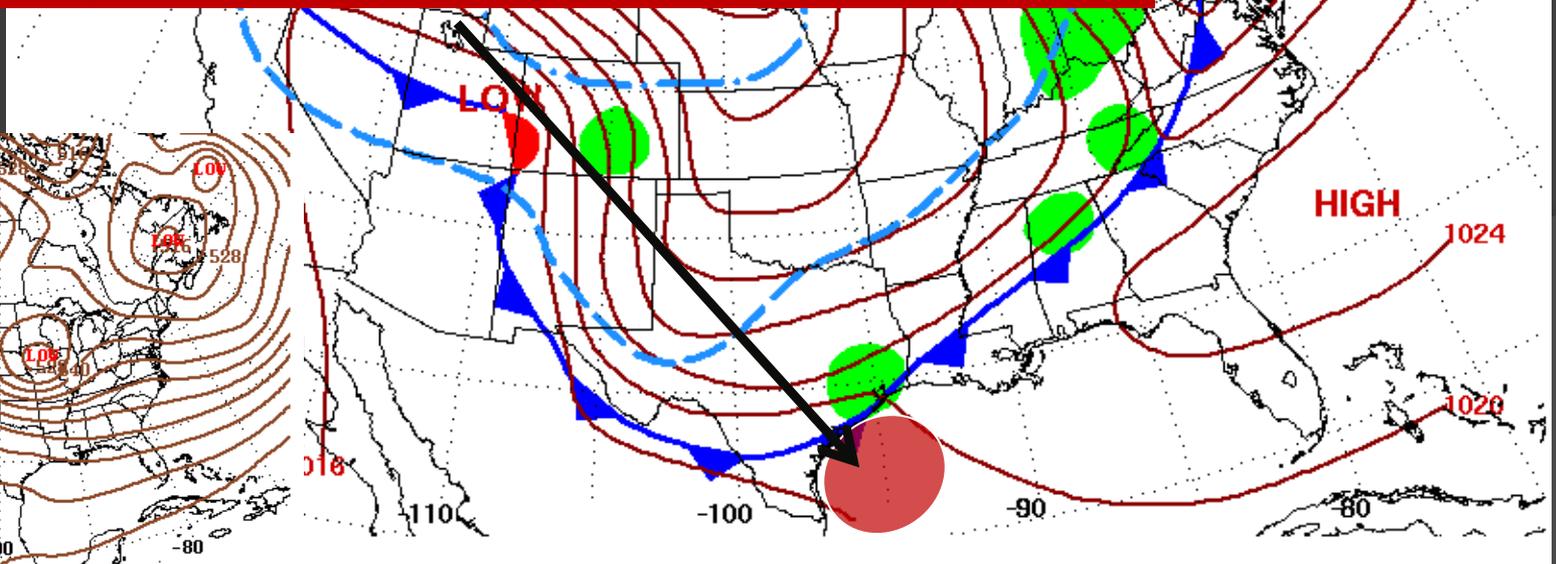


Common Strong Wind Patterns

Strong Arctic/Canadian Cold Fronts: Late Fall – Early Spring



Tends to produce strongest winds offshore

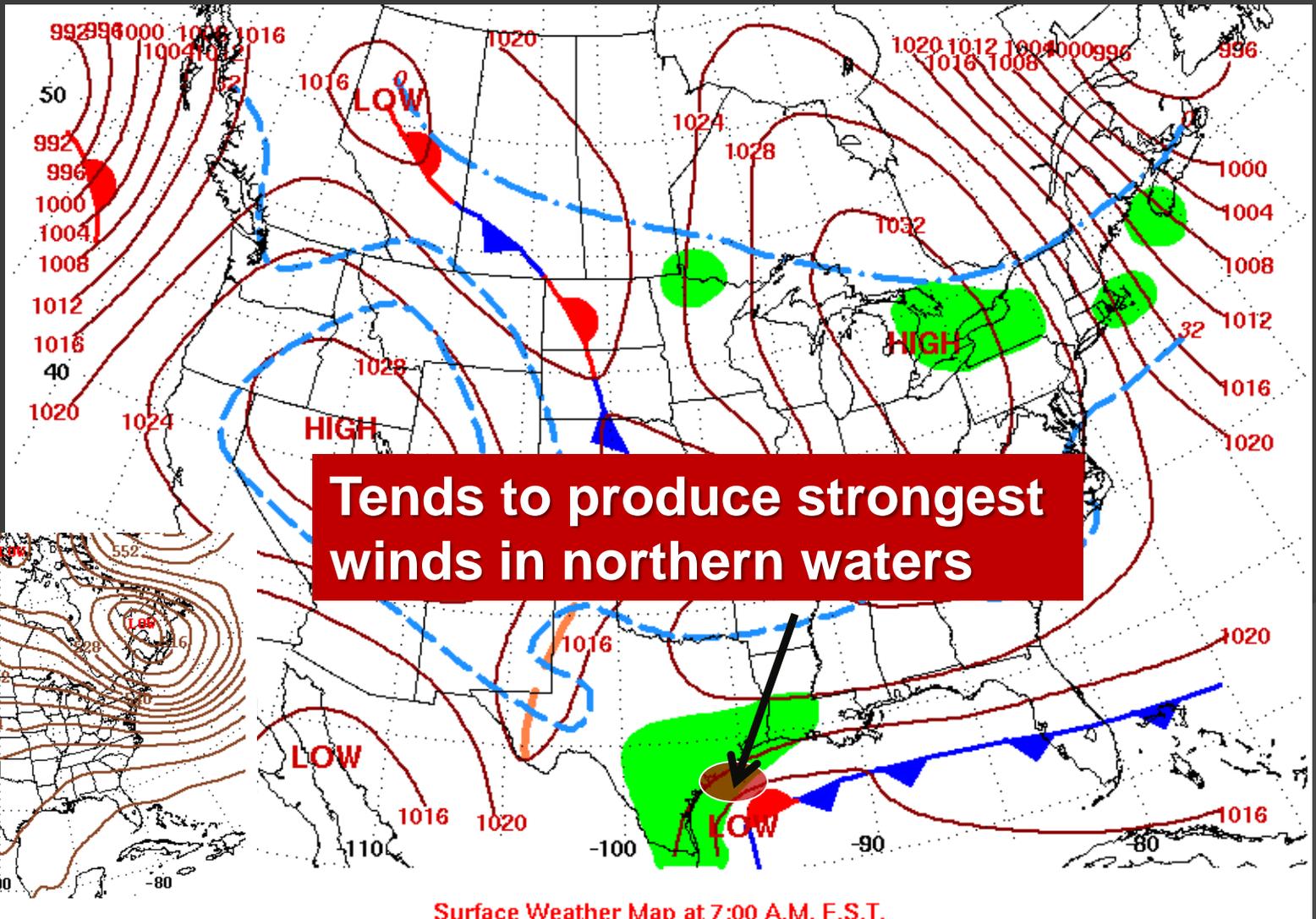


500-Millibar Height Contour at 7:00 A.M. E.S.T.

Surface Weather Map at 7:00 A.M. E.S.T.

Common Strong Wind Patterns

South Texas Coastal Trough/Low: Late Fall – Early Spring

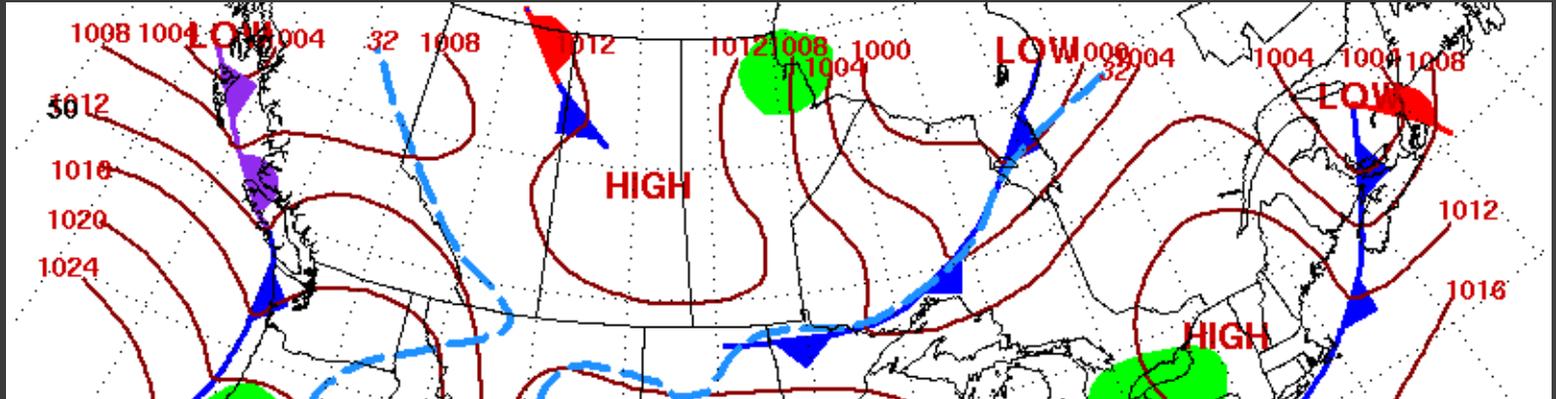


500-Millibar Height Contour at 7:00 A.M. E.S.T.

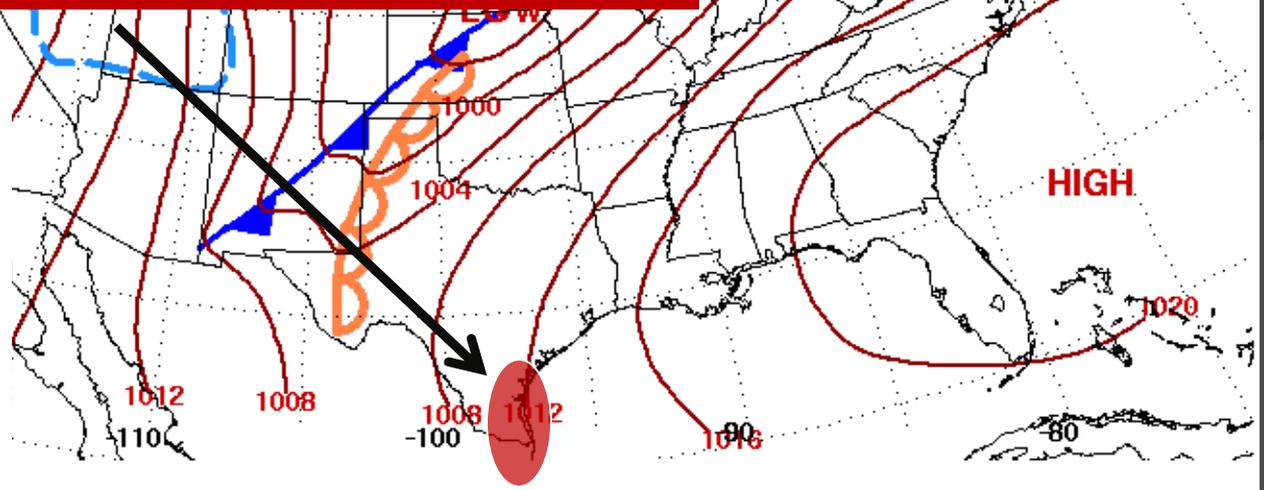
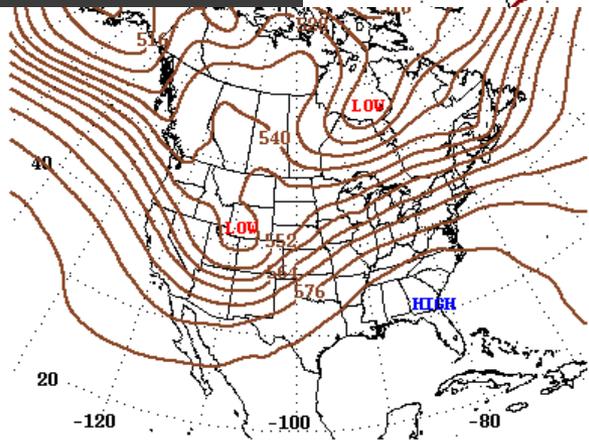
Surface Weather Map at 7:00 A.M. E.S.T.

Common Strong Wind Patterns

Low pressure across the plains: Spring / Fall



Tends to produce strongest winds in southern bays and nearshore waters

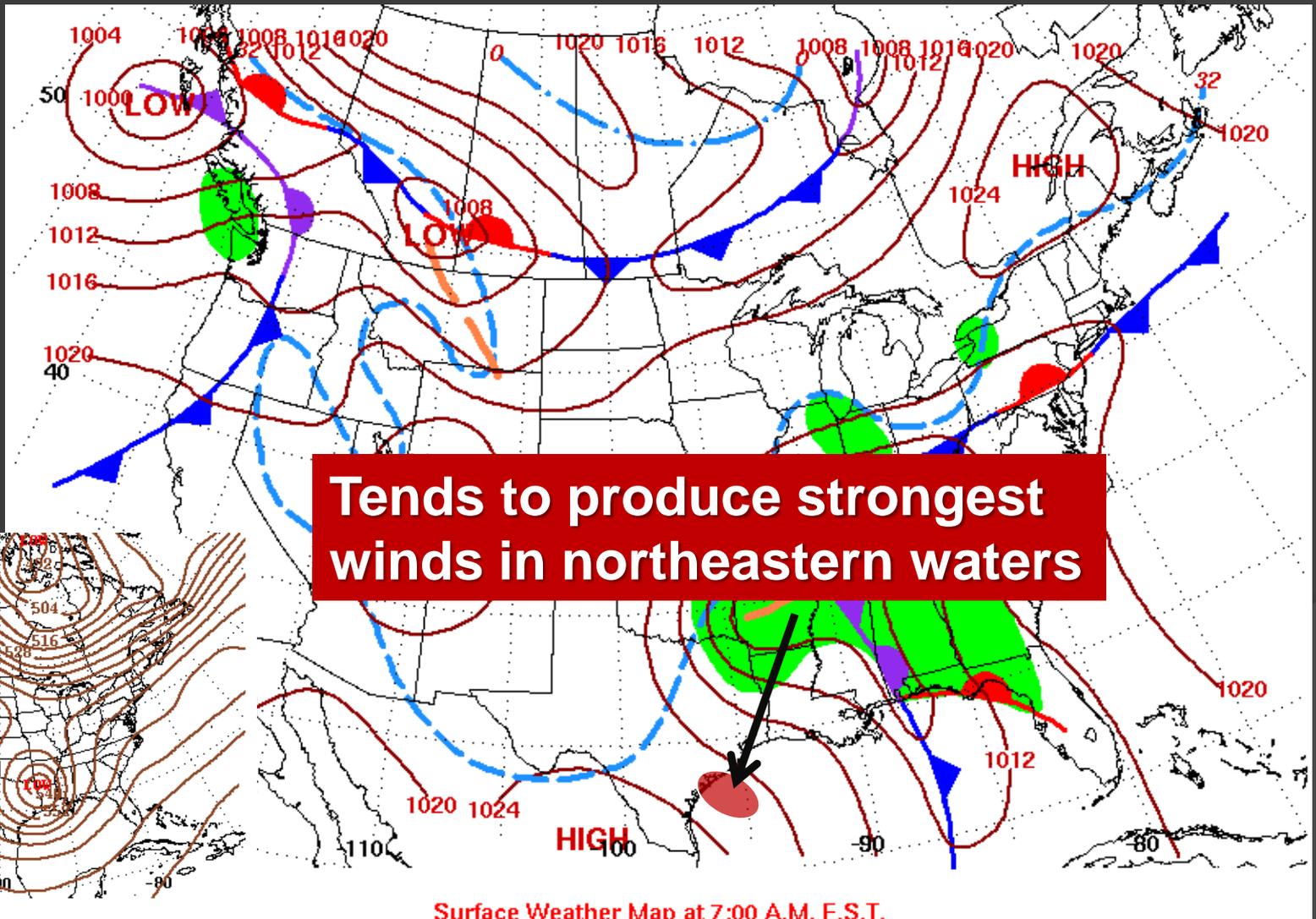


500-Millibar Height Contour at 7:00 A.M. E.S.T.

Surface Weather Map at 7:00 A.M. E.S.T.

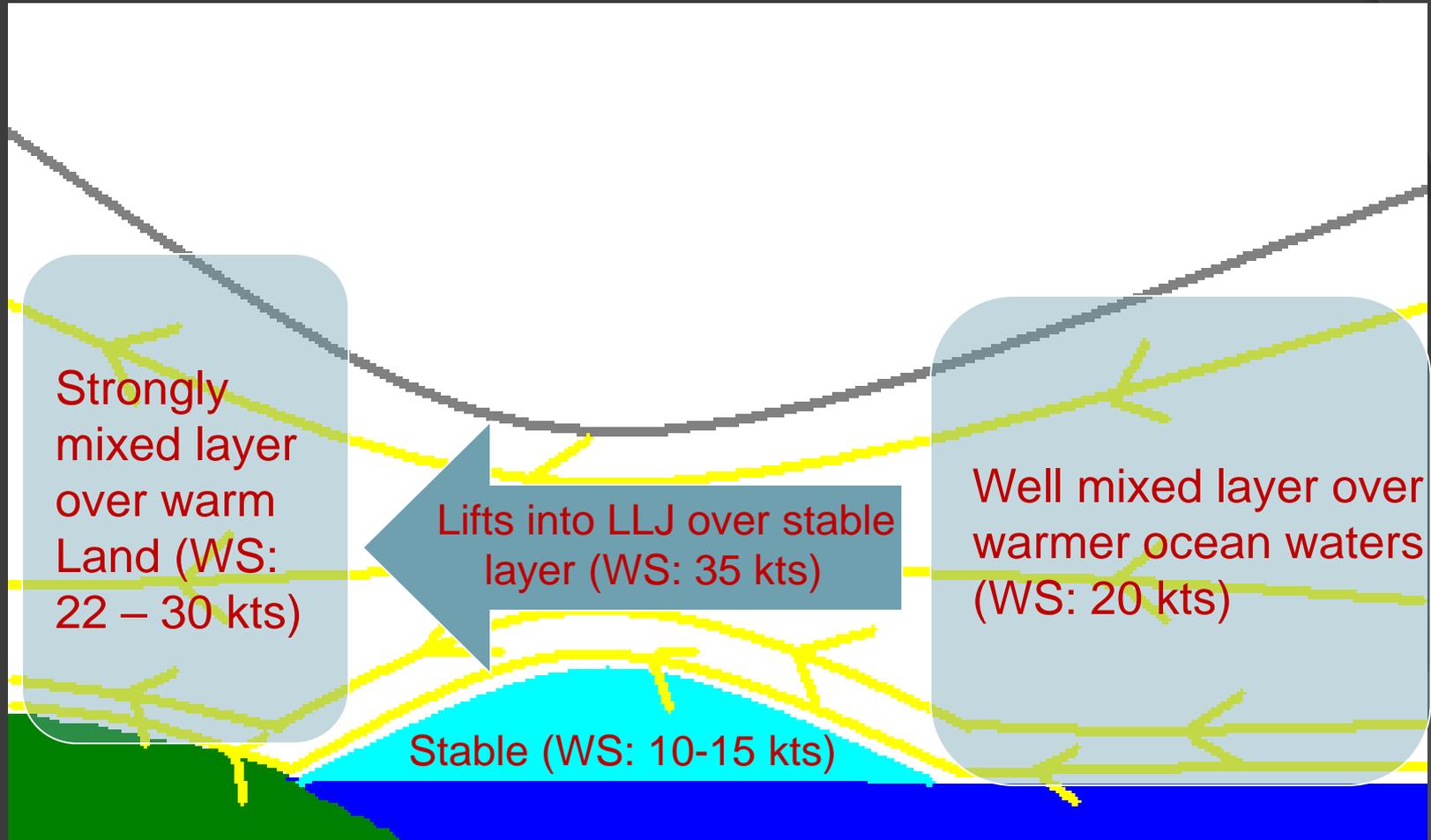
Common Strong Wind Patterns

High / Low combo: Fall - Spring

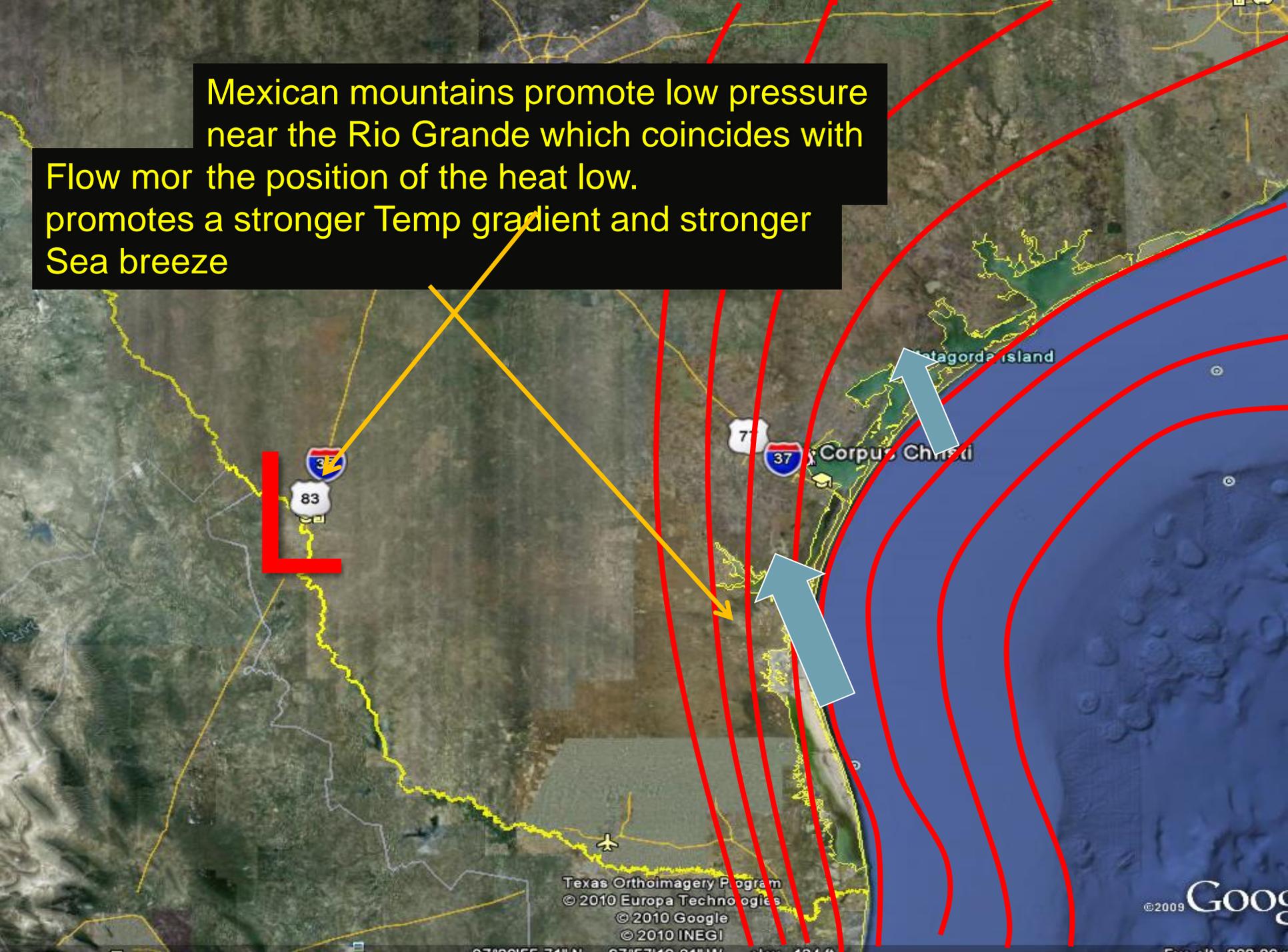


500-Millibar Height Contour at 7:00 A.M. E.S.T.

Influence of Cold Shelf Waters



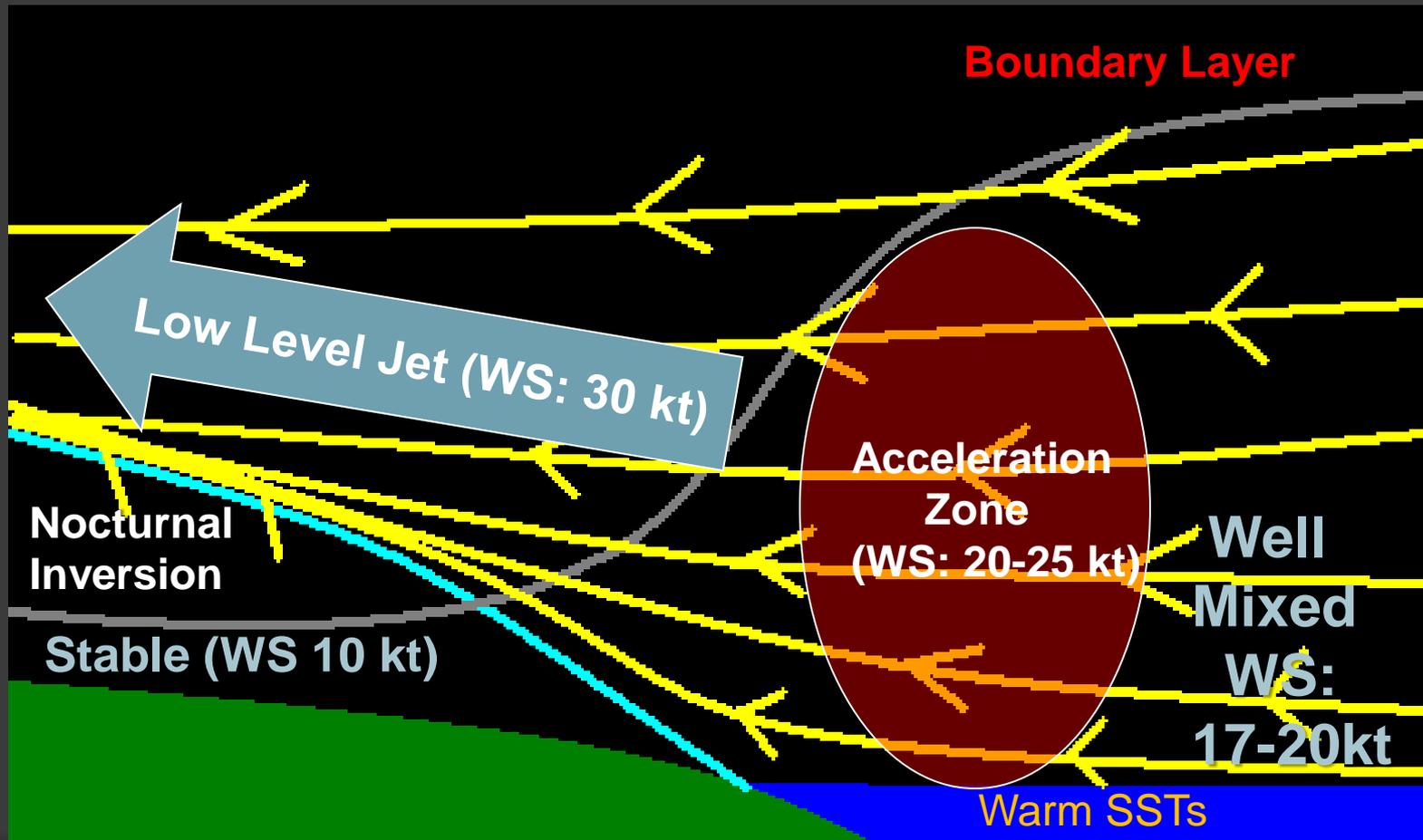
Mexican mountains promote low pressure near the Rio Grande which coincides with Flow mor the position of the heat low. promotes a stronger Temp gradient and stronger Sea breeze



Texas Orthoimagery Program
© 2010 Europa Technologies
© 2010 Google
© 2010 INEGI

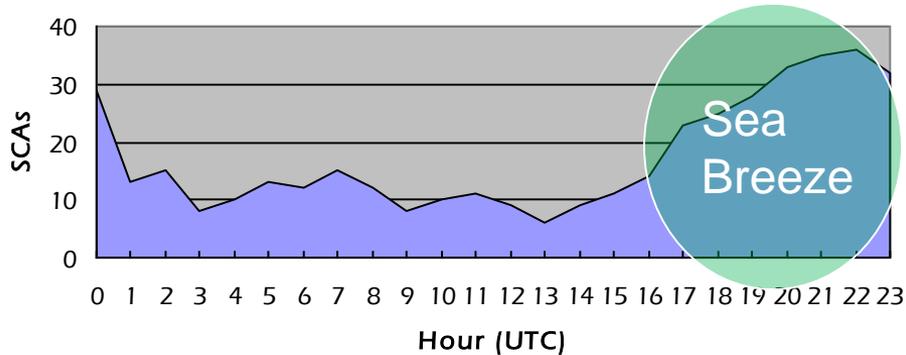
©2009 Google

Marine Nocturnal Jet

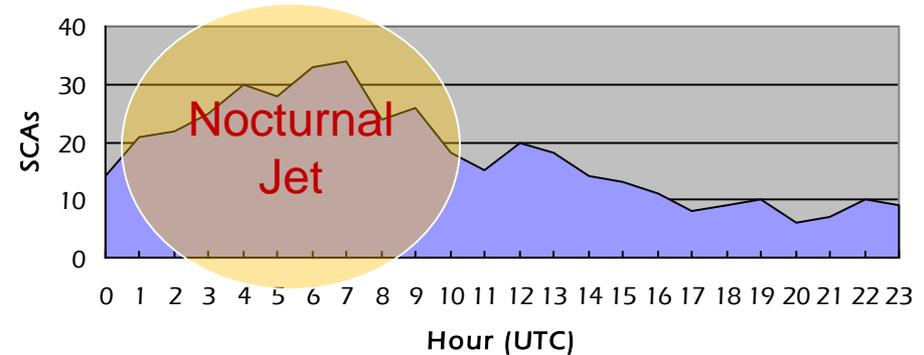


What's Causing the Timing Difference?

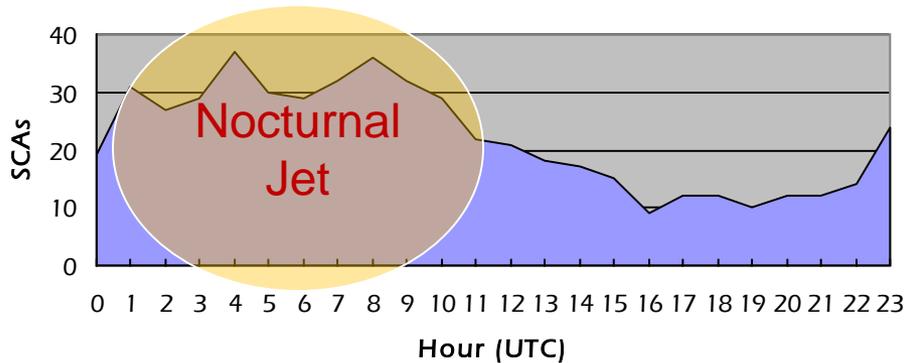
SCAs Per Hour
Baffin Bay (May 2000-2004)



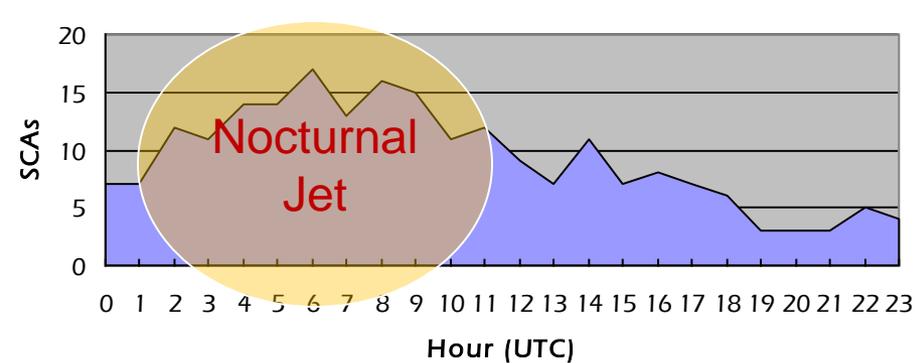
SCAs Per Hour
Port O'Connor (May 1999-2004)



SCAs Per Hour
Port Aransas (May 1999-2004)

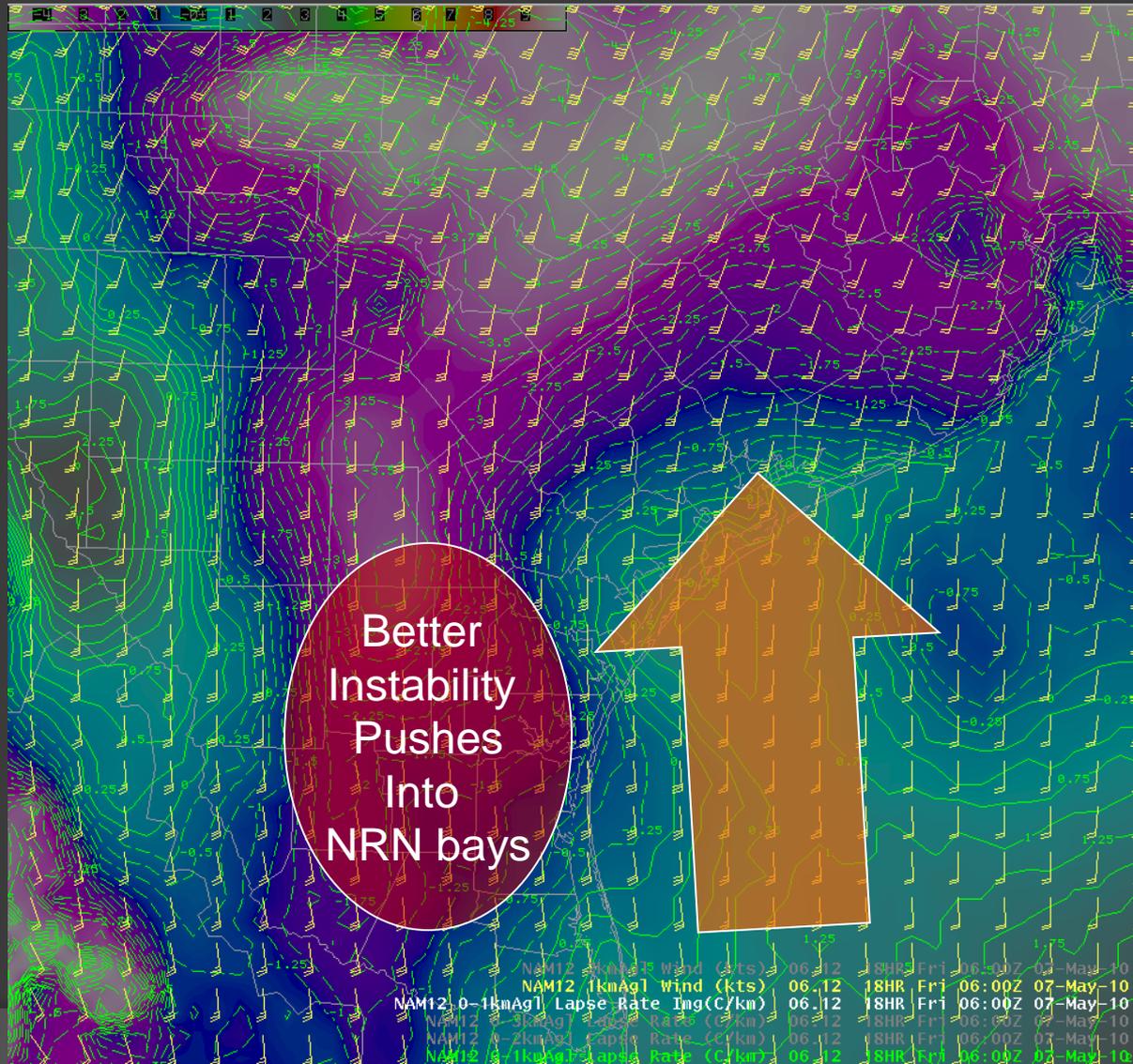


SCAs Per Hour
Buoy 20 (May 1999-2004)



Lapse Rates

NAM 0-1 km Lapse Rates: 6Z May 7, 2010



TERMINOLOGY

Basic NWS Marine Terminology

Wind speeds: “Intensify” or “Increase”, but not “decrease”

Wave heights: “Build” or “Subside”

Wind Bay & Sea Relationships

Advisory	Wind Speed	Classification	Bays		10NM	50NM	100NM
			NW-NE Wind Direction	E-S-W Wind Direction	Wave HT	Wave HT	Wave HT
-	Light Wind	Weak	Smooth	Smooth	1 ft or less	2 ft or less	2 ft or less
-	5 to 10 KT	Weak	Smooth to Slightly Choppy	Smooth	1 ft or less	2 ft or less	2 ft or less
-	Near 10 KT	Weak	Slightly Choppy	Slightly Choppy	1 ft	2 ft	2 ft
-	10 to 15 KT	Weak to Mod	Slightly Choppy to Occ Choppy	Slightly Choppy to Occ Choppy	1 to 2 ft	2 to 4 ft	2 to 4 ft
-	Near 15 KT	Moderate	Choppy	Slightly Choppy to Choppy	2 ft	3 to 4 ft	4 ft
SCEC	15 to 20 KT	Moderate	Choppy to Occasionally Rough	Choppy	2 to 3 ft	4 to 5 ft	5 to 6 ft
S.C.A.	Near 20 KT	Mod to Strong	Choppy to Occasionally Rough	Choppy to Occ Rough	3 ft	5 to 6 ft	7 ft
S.C.A.	20 to 25 KT	Strong	Choppy to Rough	Choppy to Occ Rough	3 to 4 ft	6 to 7 ft	7 to 9 ft
S.C.A.	Near 25 KT	Strong	Choppy to Rough	Choppy to Rough	4 ft	7 to 8 ft	9 ft
S.C.A.	25 to 30 KT	Very Strong	Rough to Occ Very Rough	Rough	4 to 5 ft	8 to 9 ft	9 to 11 ft
S.C.A.	Near 30 KT	Very Strong	Rough to Occ Very Rough	Rough to Occ Very Rough	5 ft	9 to 10 ft	11 ft
Gale	30 to 35 KT	Gale	Rough to Very Rough	Rough to Occ Very Rough	5 to 6 ft	10 to 11 ft	11 to 13 ft
Gale	>35 KT	Gale	Very Rough	Very Rough	≥ 6 ft	11 to 14 ft	14 to 18 ft
Storm	>45 KT	Storm	Extremely Rough	Extremely Rough	≥ 8 ft	≥ 15 ft	≥ 19 ft

DATA SOURCES

Data Sources

Buoys

TCOON

Mariners

USCG

Piers



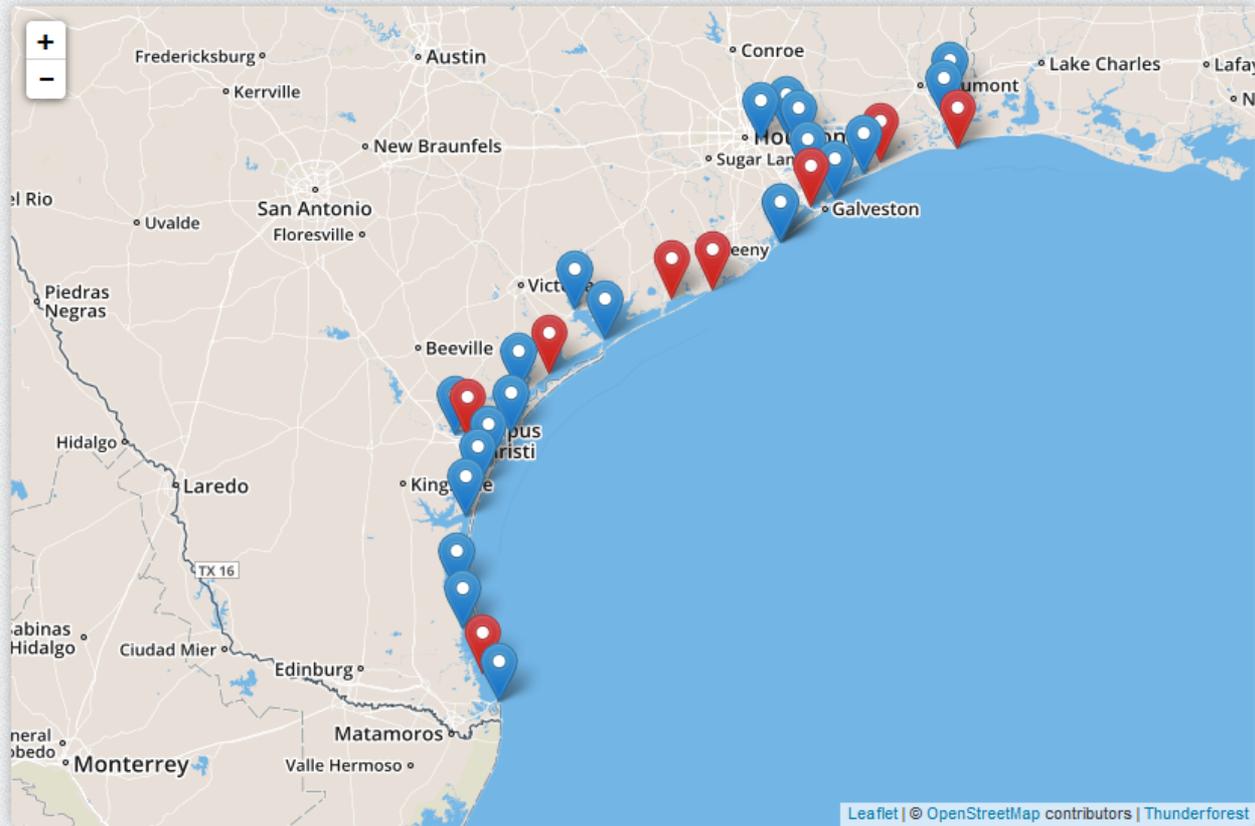


Select A Station

Search stations (name, id, etc.)



ID	Station Name
003	Rincon del San Jose
005	Packery Channel
008	USS Lexington 
009	Port Aransas
013	S. Bird Island
017	Port Mansfield
033	Port Lavaca
036	Copano Bay



057: Port O'Connor



Location: Matagorda Bay

CBI ID: 057

NOAA ID: 8773701

Established: May 1995

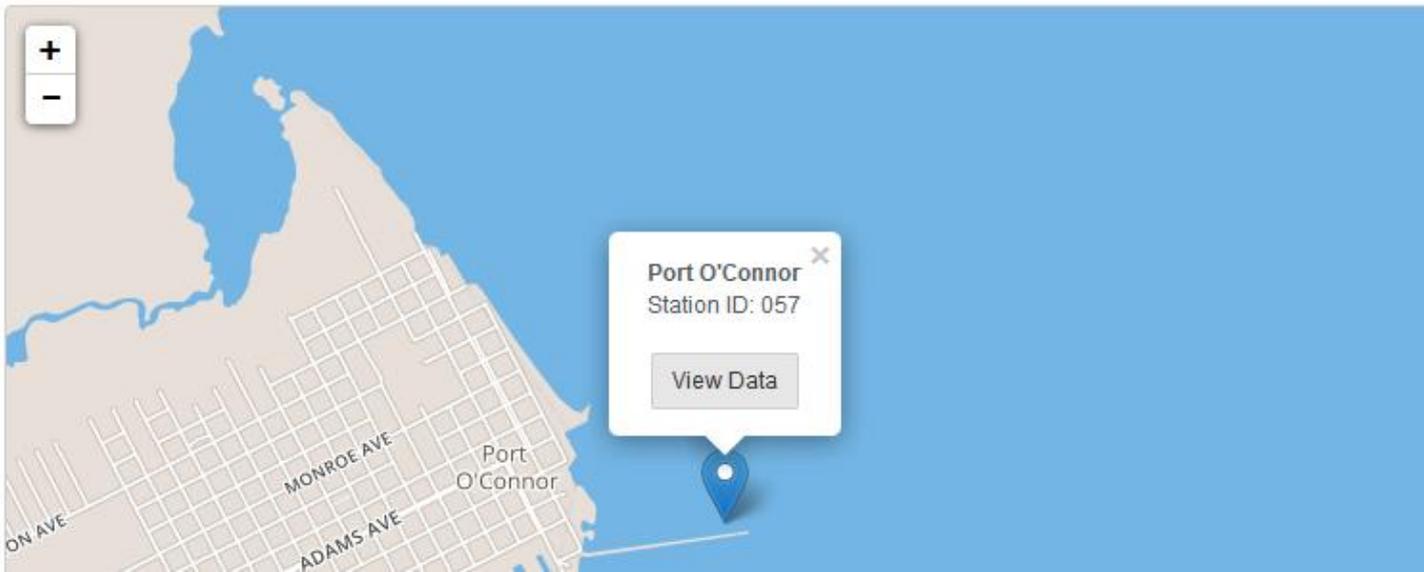
Latitude: 28.4460300 (28° 26' 45" N)

Longitude: -96.3960700 (96° 23' 45" W)

NOAA Chart: 11317

USGS: Port O'Connor

Map Station



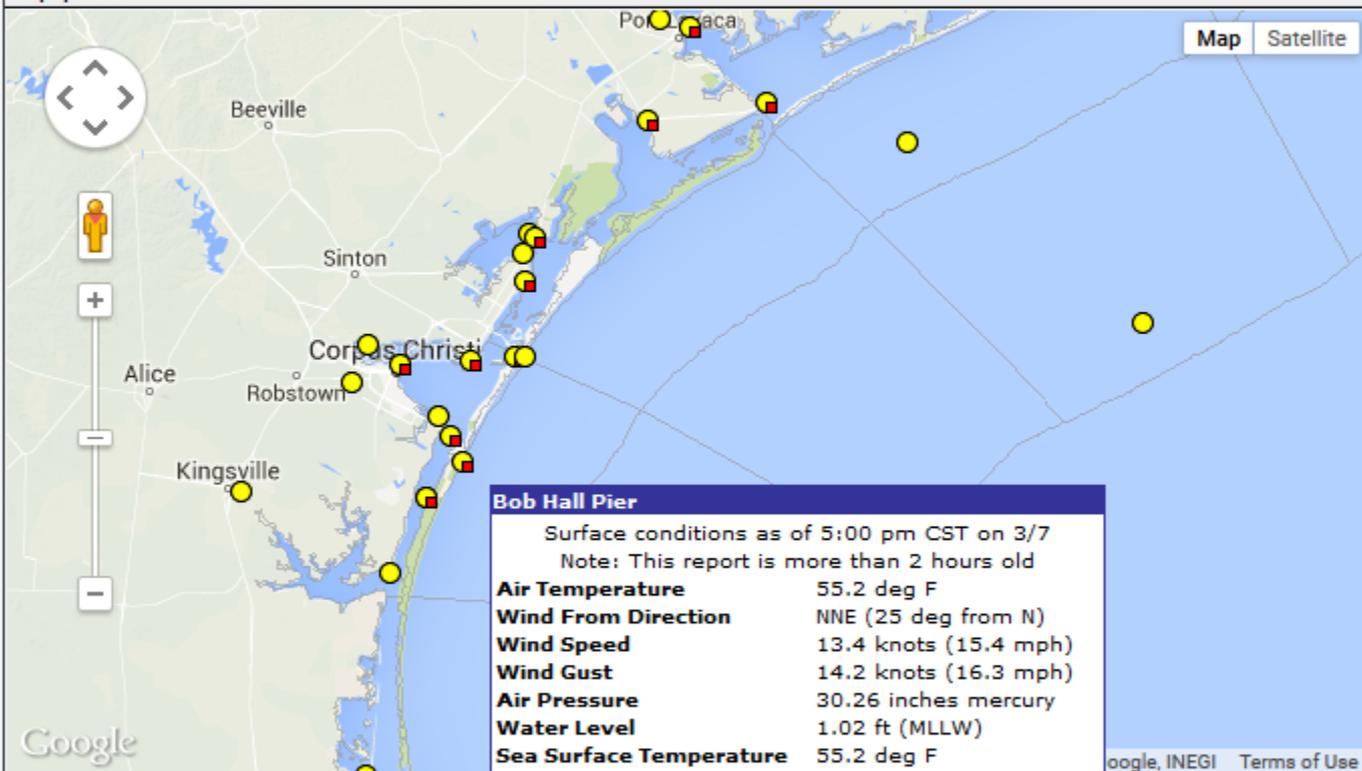
Submit a Marine Report

Additional maps and info for the Southeast at <http://secoora.org/data>

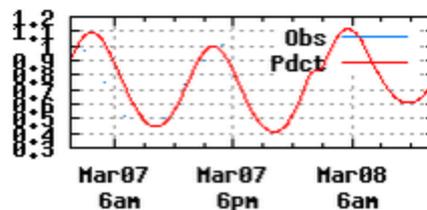
 Click here to learn how to use this map.

Background Hazards Winds Wave heights Water temp Radar Marine sites Bathymetry
 Predicted Storm Track Predicted Storm Wind Probability Storm Surge Predicted Storm Surge
 High Wind,Wave,Water

Popup data  Observations  Observations with WL



Water Levels in ft (CDT)



Google, INEGI Terms of Use



Wave ht opacity

Who Are Our Marine Customers?

- Recreational fishermen
- Commercial fishermen
- TX Parks & Wildlife
 - Game wardens
- Surfers
- United States Coast Guard
- Local pilots
- Port of Corpus Christi



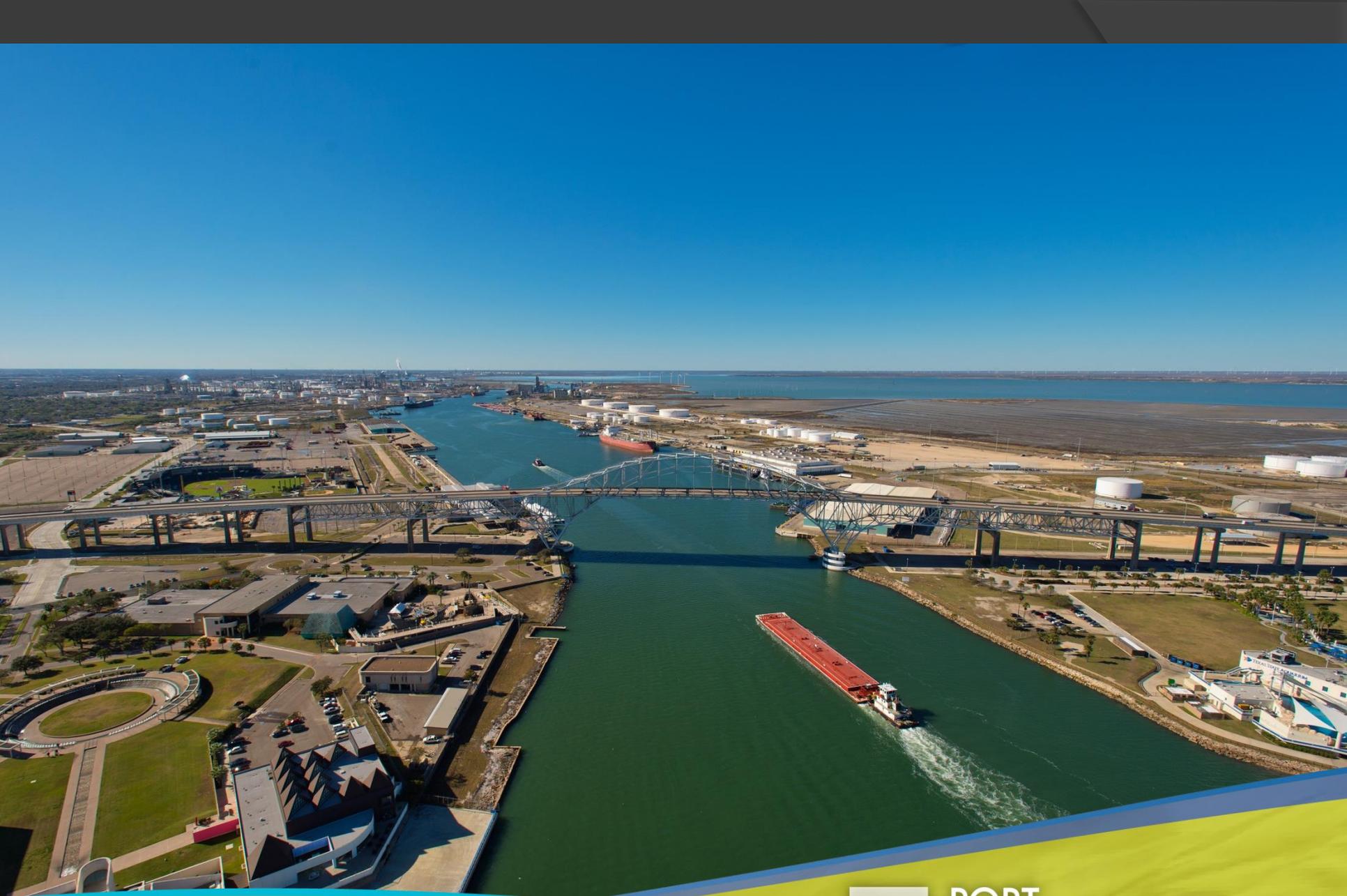




87343



U. S. COAST GUARD



Port of Corpus Christi

-5th largest port in US

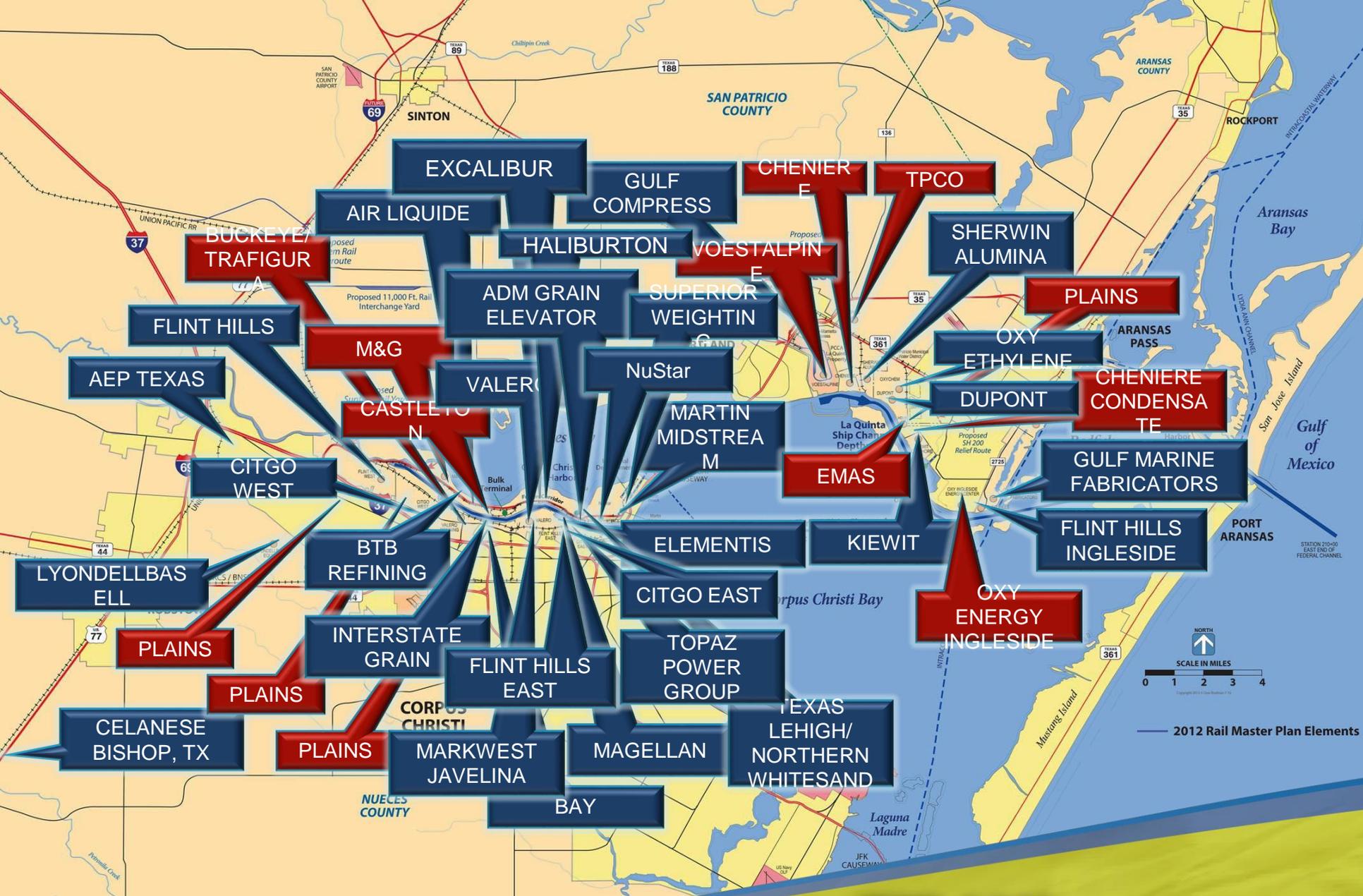
-Operates 24/7

-Millions of \$\$\$ lost when Port is shutdown



40 Miles Of Ship Channel





— 2012 Rail Master Plan Elements

SEA BREEZE

Sea Breeze

Caused by thermal contrasts along the marine-land regime

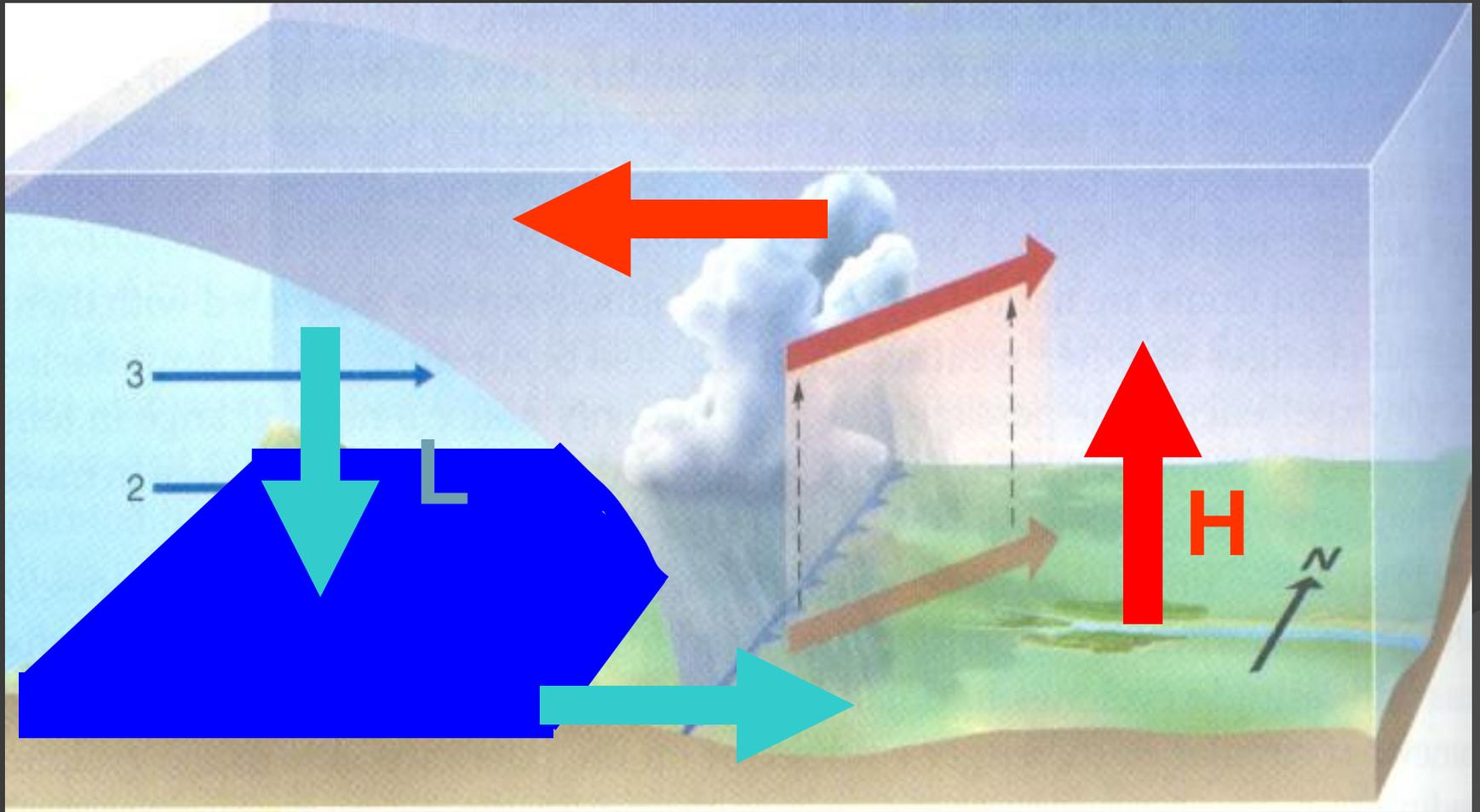
May through September

Can happen year round

Sea Breeze

Factors Needed

- Weak surface gradient
- Ample insolation (little cloud cover)
- Weak flow from sfc to 700 mb
- Strong thermal contrast between inland areas and waters
 - At least 10 to 15 degree difference



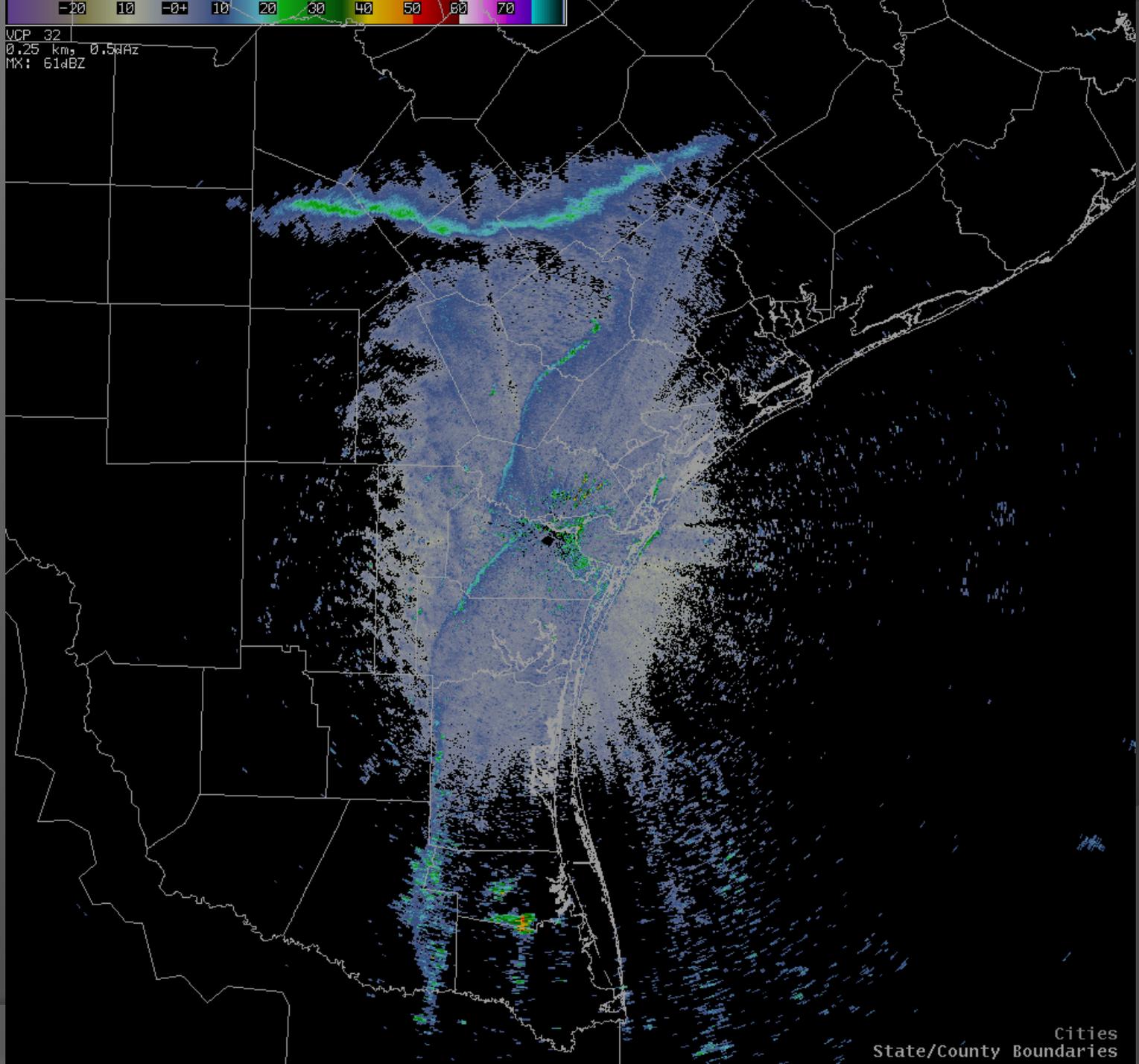
Sea Breeze Impacts

-If enough instability present, LLVL convergence from seabreeze can develop showers/t'storms
May, Early June, September

Temperatures fall ~5 degrees after passage
Wind direction transitions from SSE to SE or ESE after passage



UCP 32
0.25 km, 0.5dBZ
MX: 61dBZ



Cities
State/County Boundaries

WATERSPOUTS

Non-Deep Convection Related Waterspouts

Late Spring/Summer

Most undetected by radar

Light easterly LLVL winds

Steeper LLVL lapse rates

~1 hour after sunrise through ~mid morning



© Andy Heatwole





TIDES

Tidal Flooding

Astronomical tides

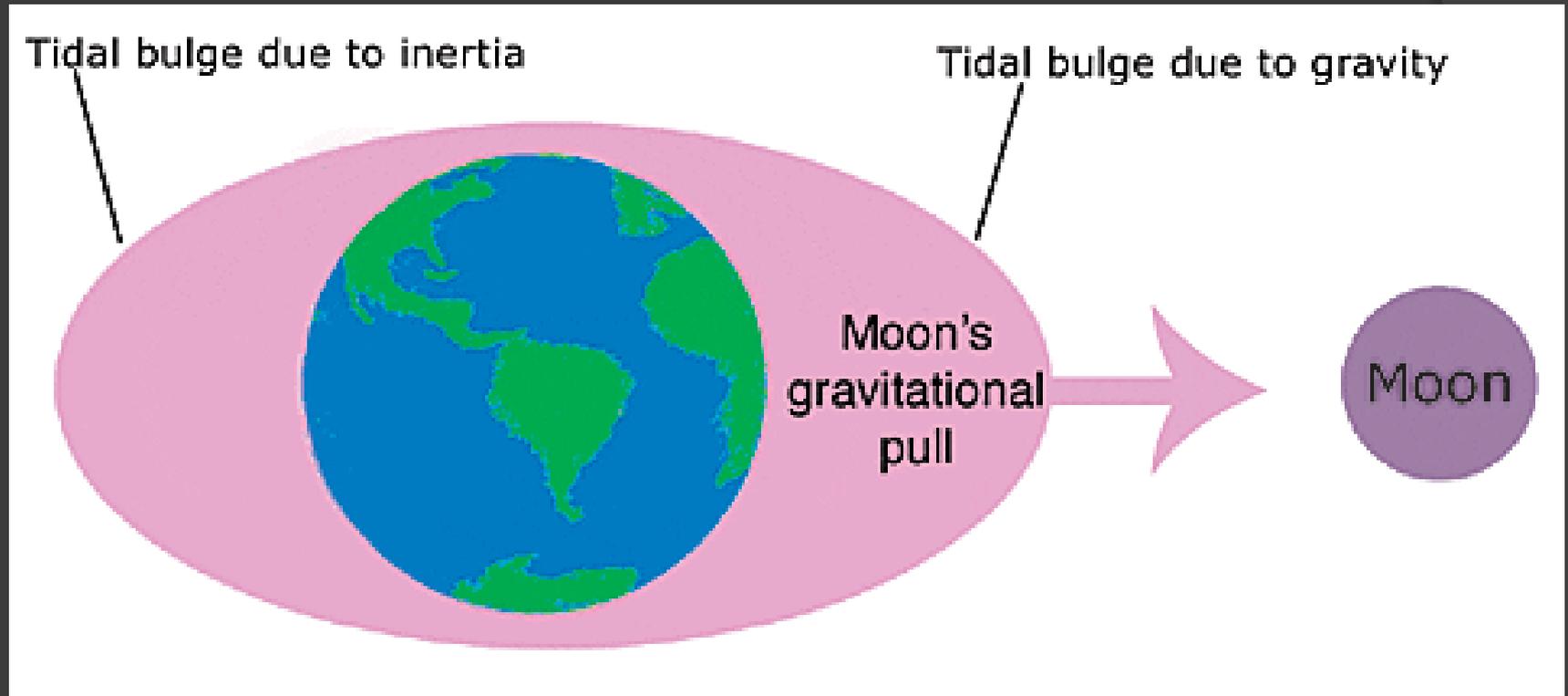
Strong wind

Surge/swell

Tsunamis

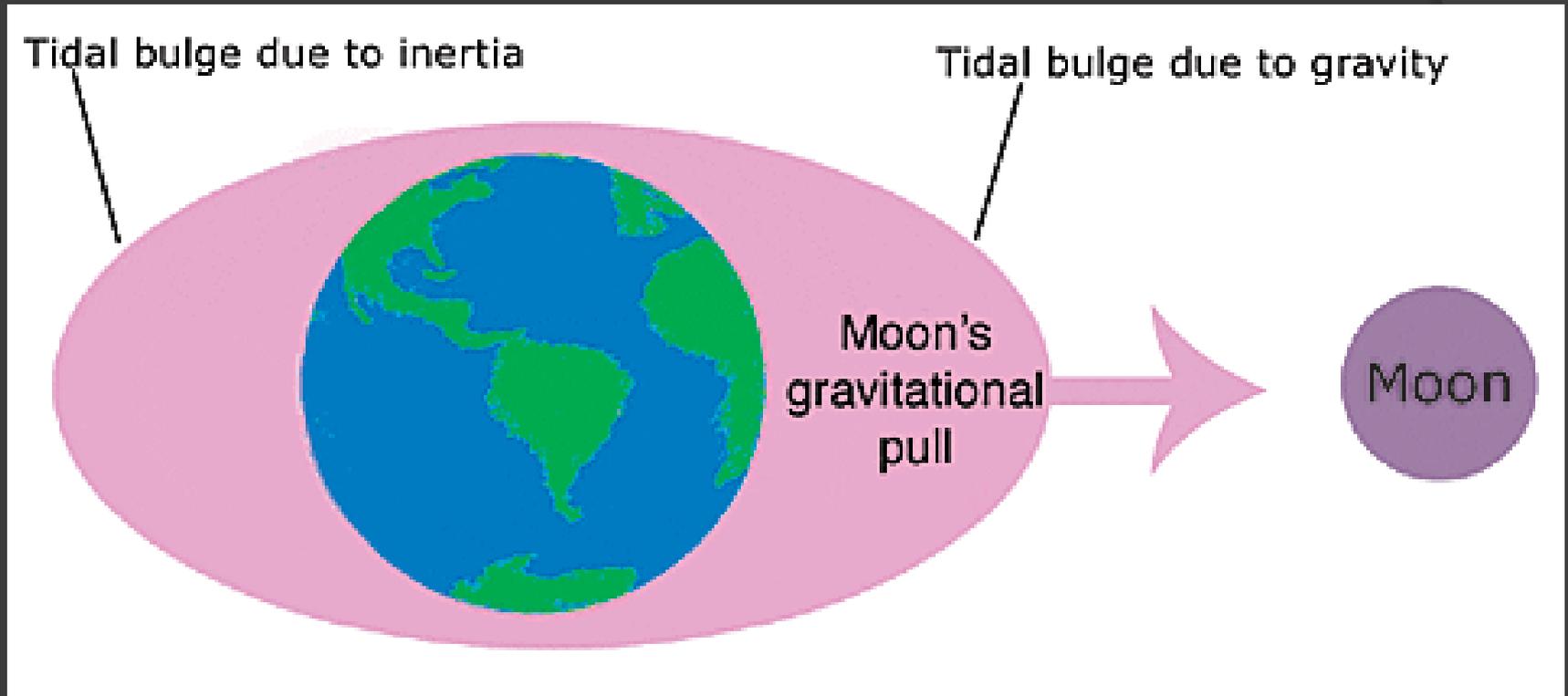
Combination of factors

Moon's Effects on Tides



Two tidal bulges leads to 2 high tides and 2 low tides each day

Moon's Effects on Tides



Effects of continents and islands disrupt the bulges and leads to diurnal, semidiurnal, and mixed diurnal tides

Other Influences on Tides

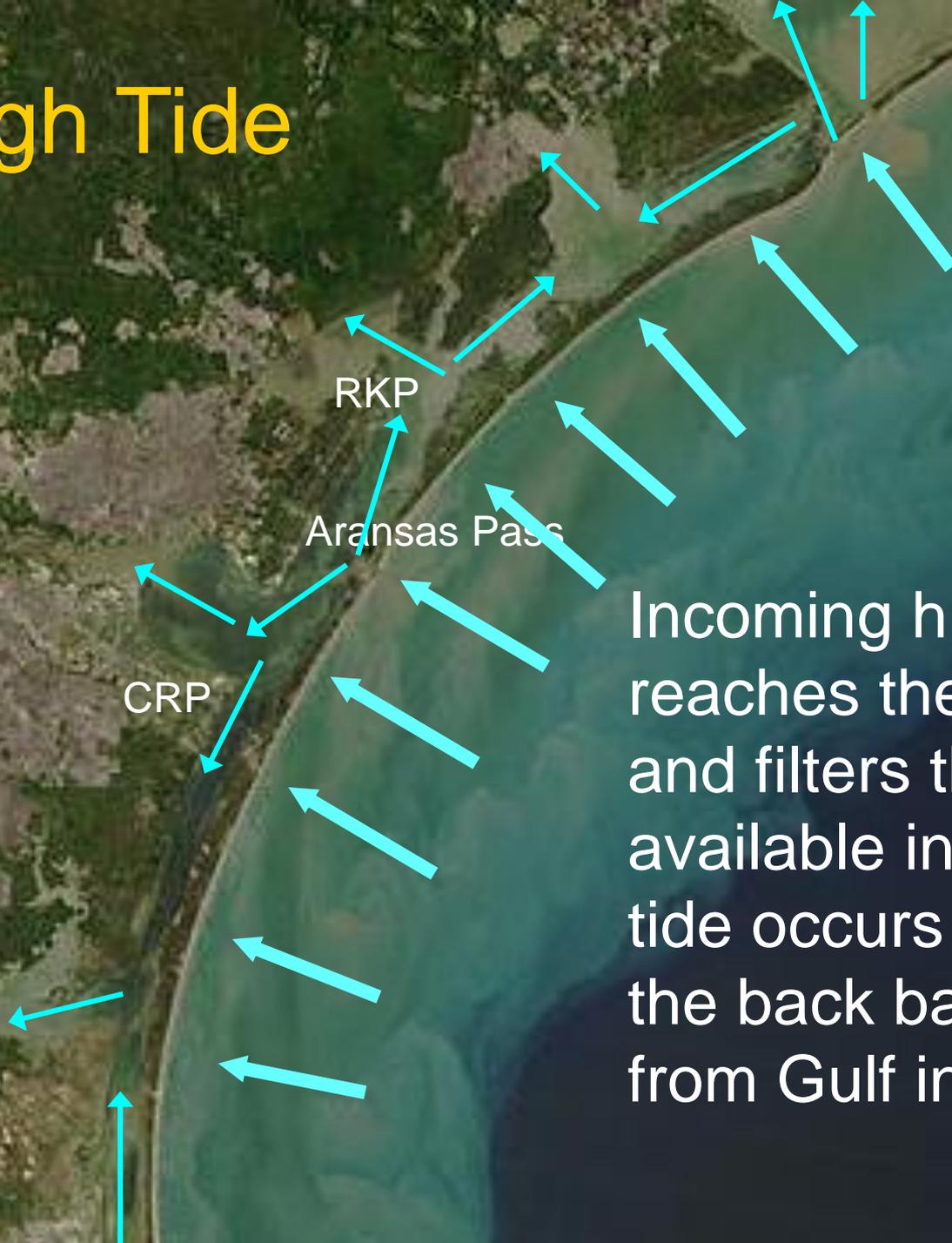
Shape of the shoreline

Shape of bays and estuaries

Narrow inlets and shallow water dissipate incoming tides

Local weather patterns

High Tide



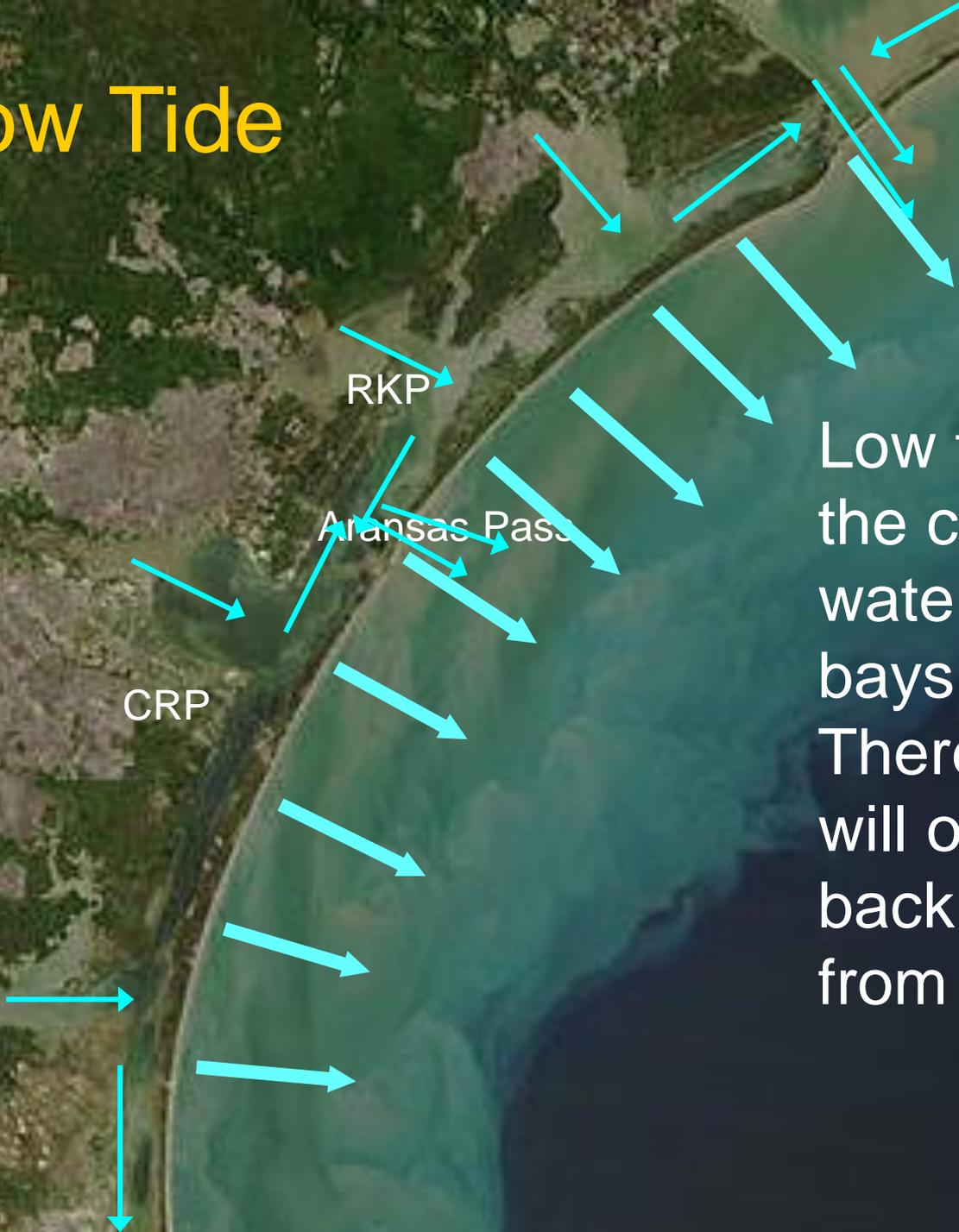
CRP

RKP

Aransas Pass

Incoming high tide reaches the shoreline and filters through available inlets. High tide occurs last in the back bays furthest from Gulf inlets.

Low Tide



RKP

Aransas Pass

CRP

Low tide occurs at the coast first and water flows out of the bays to fill the void. Therefore, low tide will occur last in the back bays furthest from the inlets.

Tidal Flooding

Minor: ~2.0 to ~2.9ft above MSL

Water reaches dunes along barrier islands. Lowest roads along bays are passable, but have water over them in spots

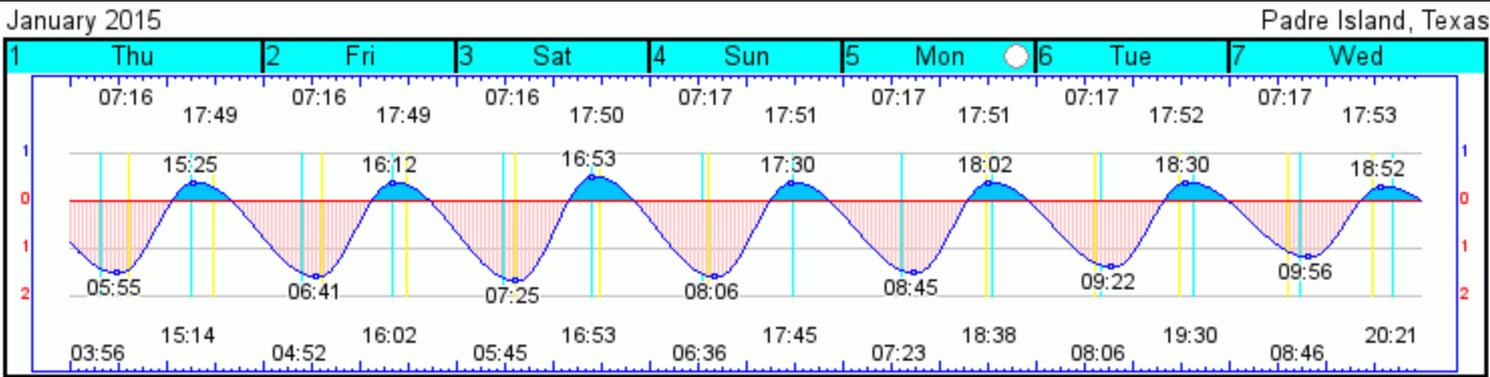
Moderate: ~3.0 to ~3.9 ft above MSL

Water well into dunes. Significant beach erosion occurs. Some homes cut off. Few flooded

Major: ~4.0 ft above MSL or higher

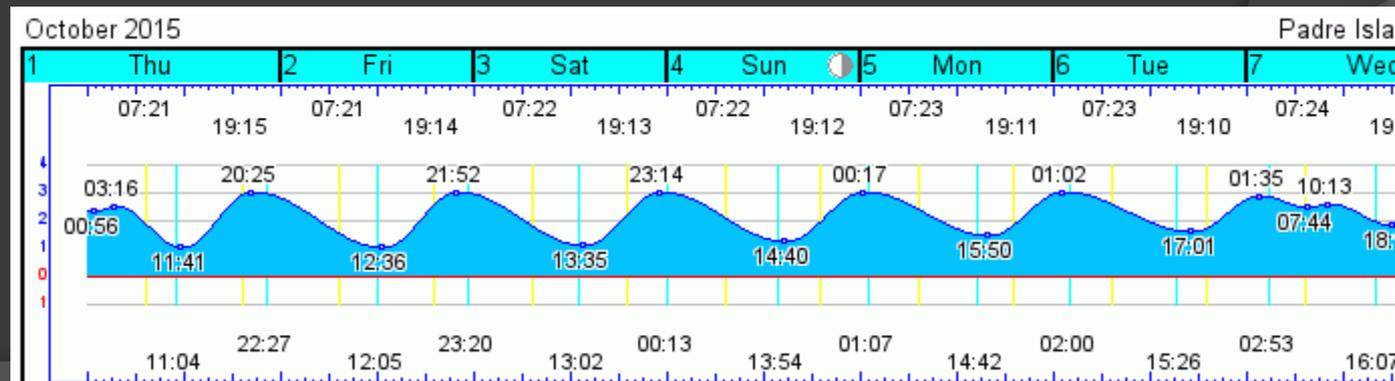
Major beach erosion. Widespread of roads. Many homes flooded

High/Low Astronomical Tides



January
Low Astronomical Tides
≤ 1 foot above MSL

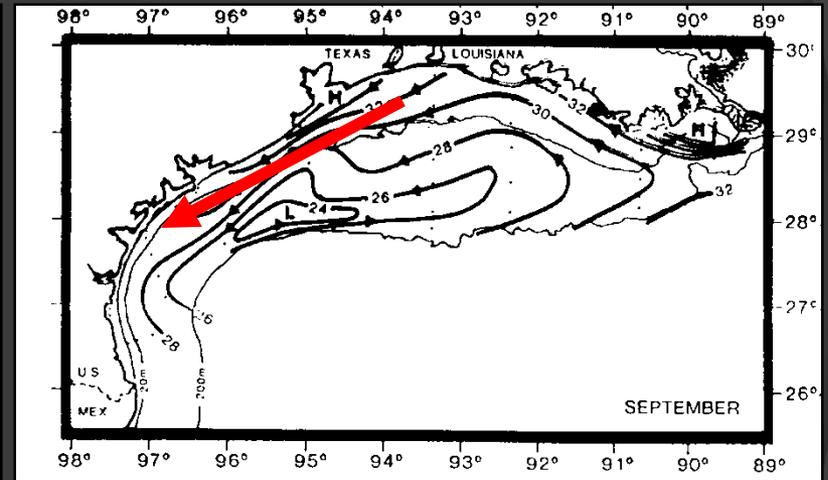
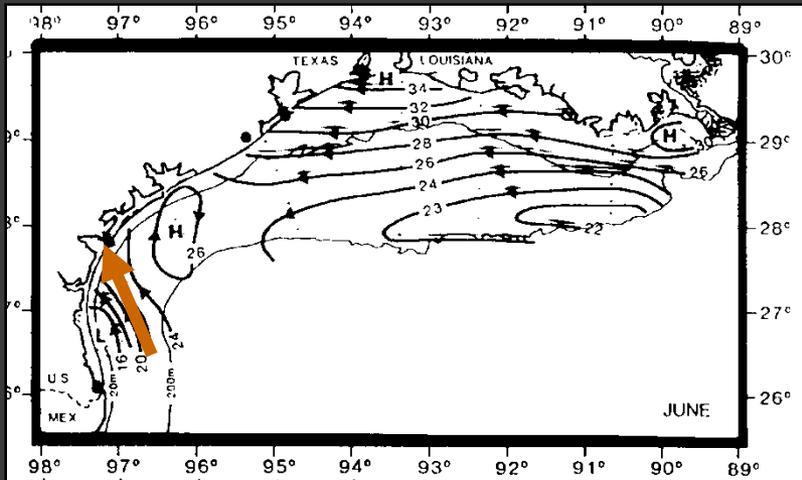
October
High Astronomical Tides
≥ 2 feet above MSL



Currents

Summer

Spring & Fall



Weak Onshore Flow

Strong Alongshore Flow

ISLAND CAM

Thu 9:01 AM





© MVP 2008

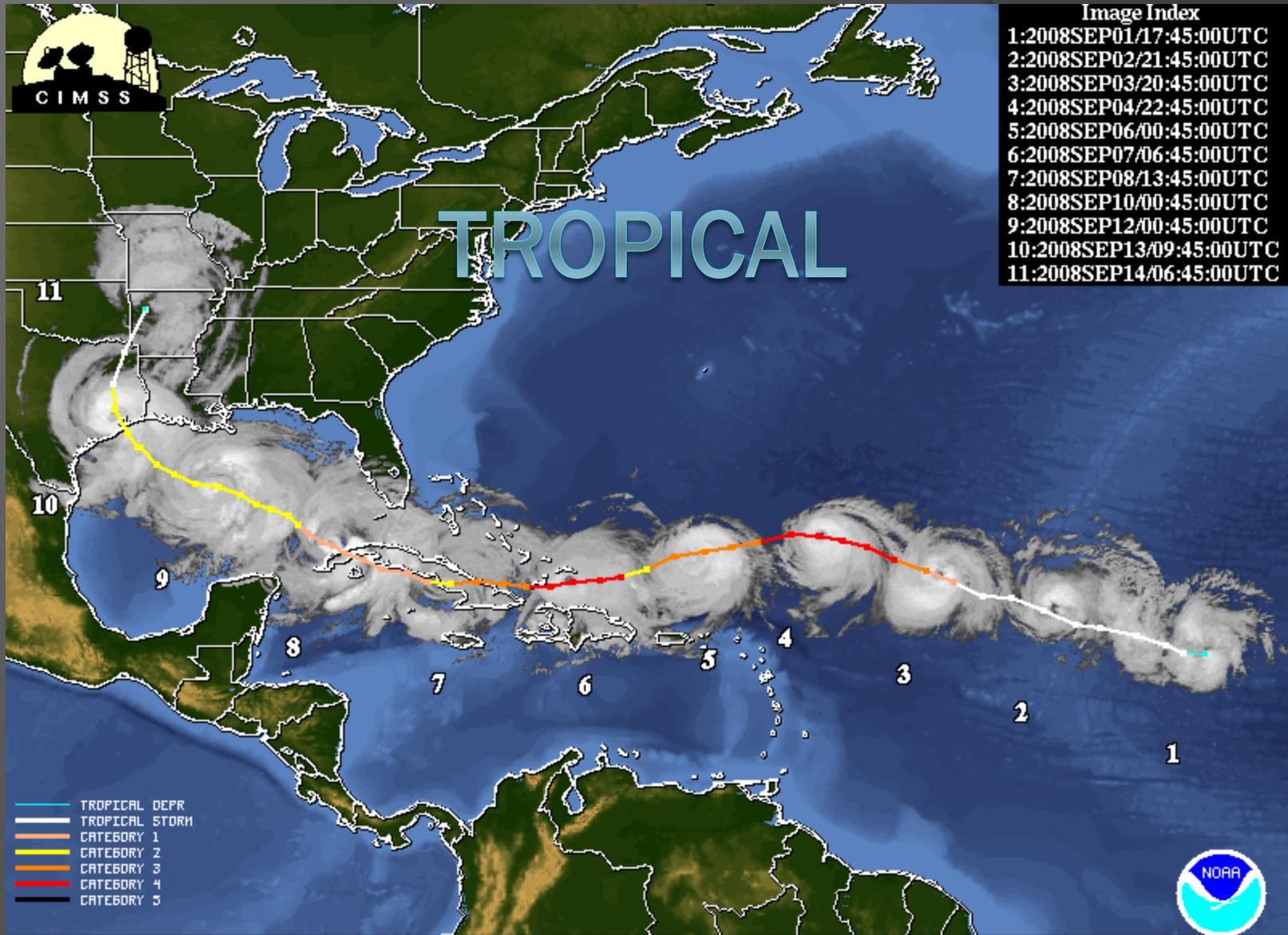




TROPICAL

Image Index

- 1:2008SEP01/17:45:00UTC
- 2:2008SEP02/21:45:00UTC
- 3:2008SEP03/20:45:00UTC
- 4:2008SEP04/22:45:00UTC
- 5:2008SEP06/00:45:00UTC
- 6:2008SEP07/06:45:00UTC
- 7:2008SEP08/13:45:00UTC
- 8:2008SEP10/00:45:00UTC
- 9:2008SEP12/00:45:00UTC
- 10:2008SEP13/09:45:00UTC
- 11:2008SEP14/06:45:00UTC



- TROPICAL DEPR
- TROPICAL STORM
- CATEGORY 1
- CATEGORY 2
- CATEGORY 3
- CATEGORY 4
- CATEGORY 5



RIP CURRENTS

Rip Currents

Year-round threat

Most common near breaks in sandbars
Swell increases threat

Rip Current Forecasting

Low, Moderate, High Risks

Likely to change within 5 years.

- Yes/No

- Modeling being developed at WFO MFL and in Australia

Only handful of High Risks per year

Easterly swell

East/SE wind

Tropical systems

Onshore Factor		Onshore Factor	Longshore Factor														
0		70-140°	10-60°, 150-210°														
or	<10 kt	0	0														
Longshore Factor	10 kt	1	0														
0	10-14 kt	2	-0.5														
	15-19 kt	3	-1														
	20-24 kt	4	-2														
	25 kt +	5	-3														
<hr/>																	
Swell Factor	Swell Only. Do NOT include wind waves. Swell directions of 60 - 170°.																
0		8 s	9 s	10 s	11 s	12 s	13 s	14 s	15 s	16 s							
	1 ft	1	1	1	1.5	1.5	2	2.5	3	3							
	2 ft	1.5	1.5	2	2	3	3	3	4	4							
	3 ft	2	3	3.5	4	5	5	5	5.5	5.5							
	4 ft	3	3.5	4	4.5	5	5.5	5.5	6	6							
	5 ft	4	4.5	5	5.5	5.5	5.5	6	6	7							
	6 ft	5	5	5.5	5.5	6	6	6.5	7	7							
	7 ft	6	6	6.5	6.5	6.5	7	7	7	7							
	8 ft	6	6	6.5	7	7	7	7.5	7.5	7.5							
<hr/>																	
Misc. Factors	<ul style="list-style-type: none"> If the forecast period is within 3 days of a full or new moon. 0.5 								0.5								
0	<ul style="list-style-type: none"> If the synoptic flow been between 070 and 140 degrees 80% or more of the time over the last 48 hrs? 0.5 								0.5								
<hr/>																	
Total																	
0																	
Low Risk																	
	<table border="1"> <tr> <th colspan="2">Risk Breakdown</th> </tr> <tr> <td>< 4.0</td> <td>Low</td> </tr> <tr> <td>4.0 - 5.5</td> <td>Moderate</td> </tr> <tr> <td>> 5.5</td> <td>High</td> </tr> </table>									Risk Breakdown		< 4.0	Low	4.0 - 5.5	Moderate	> 5.5	High
Risk Breakdown																	
< 4.0	Low																
4.0 - 5.5	Moderate																
> 5.5	High																

SEA FOG

Sea Fog

Late fall-early spring

Forms when warm/moist air advects over cooler SSTs

Warmer air cools to that of dewpoint, forming fog

Rule of thumb: When dewpoints are warmer than SSTs, dense sea fog is possible.

Sea Fog

Late fall-early spring

SSTs 55 to 65 F

East or SE wind direction

Less frictional effects over water. Fog can form even in strong winds.

Fog in Coastal Bend with 20 kt winds

Spread inland?

Impacts from Sea Fog

MAJOR safety issue

**Entire marine industry shuts down
Significant financial hit**

Can last for days

SPECIAL MARINE WARNINGS

LEAD TIME!!!



Special Marine Warnings

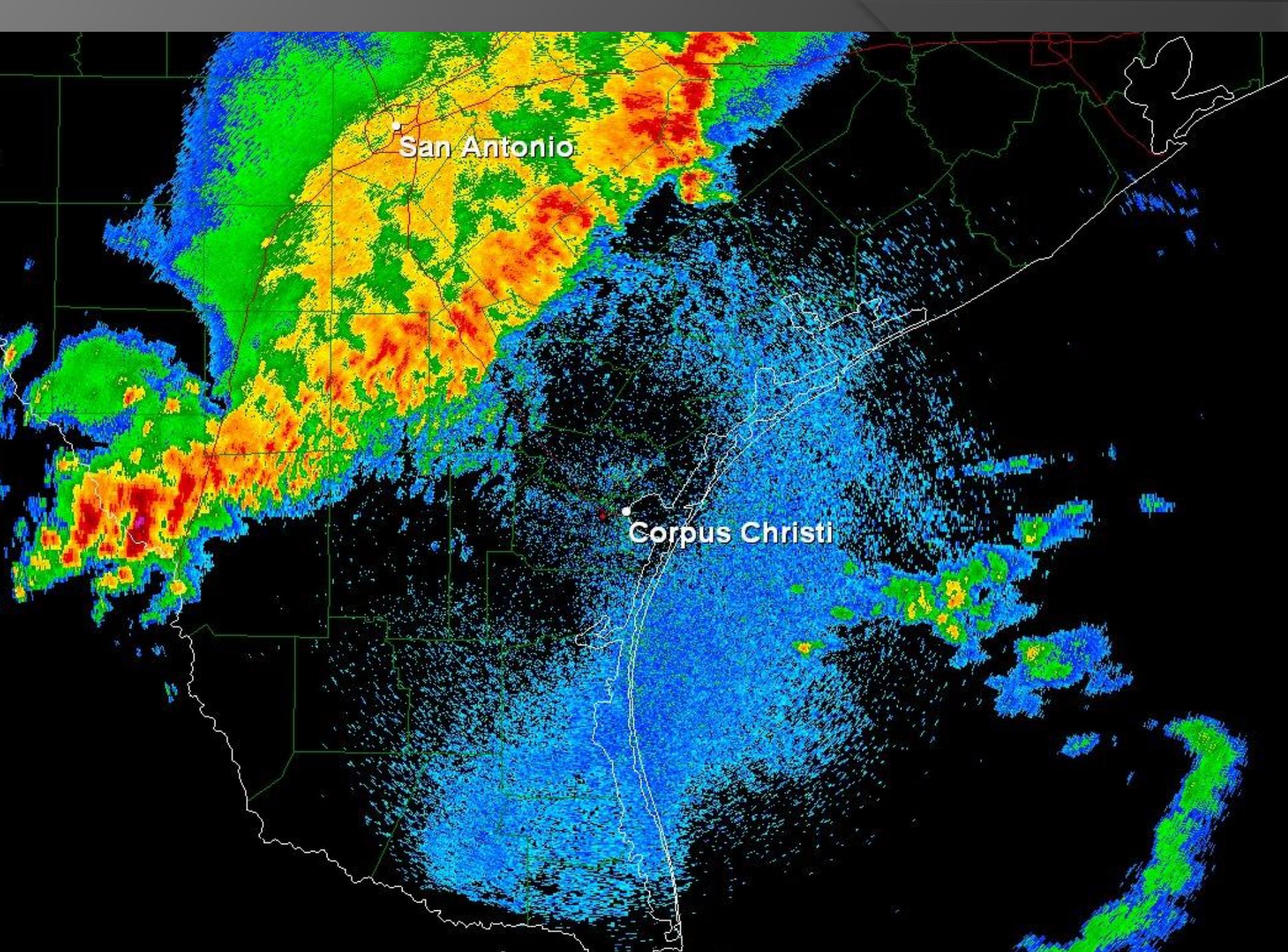
Sustained winds or gusts of 34kts or greater
Hail of $\frac{3}{4}$ " or greater.

Be aware of presence of marine layer

Unstable?

Stable?



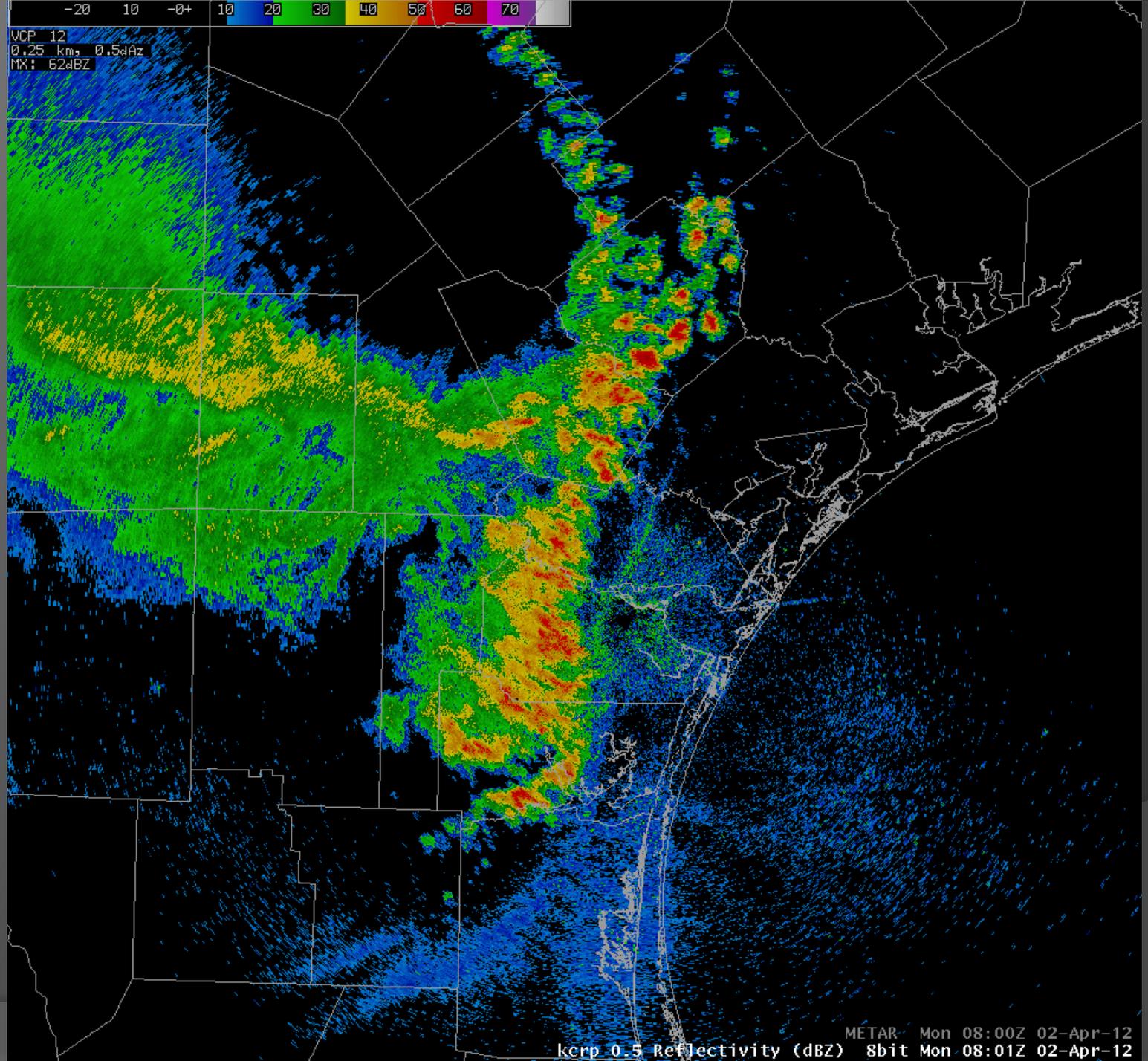


San Antonio

Corpus Christi

-20 10 -0+ 10 20 30 40 50 60 70

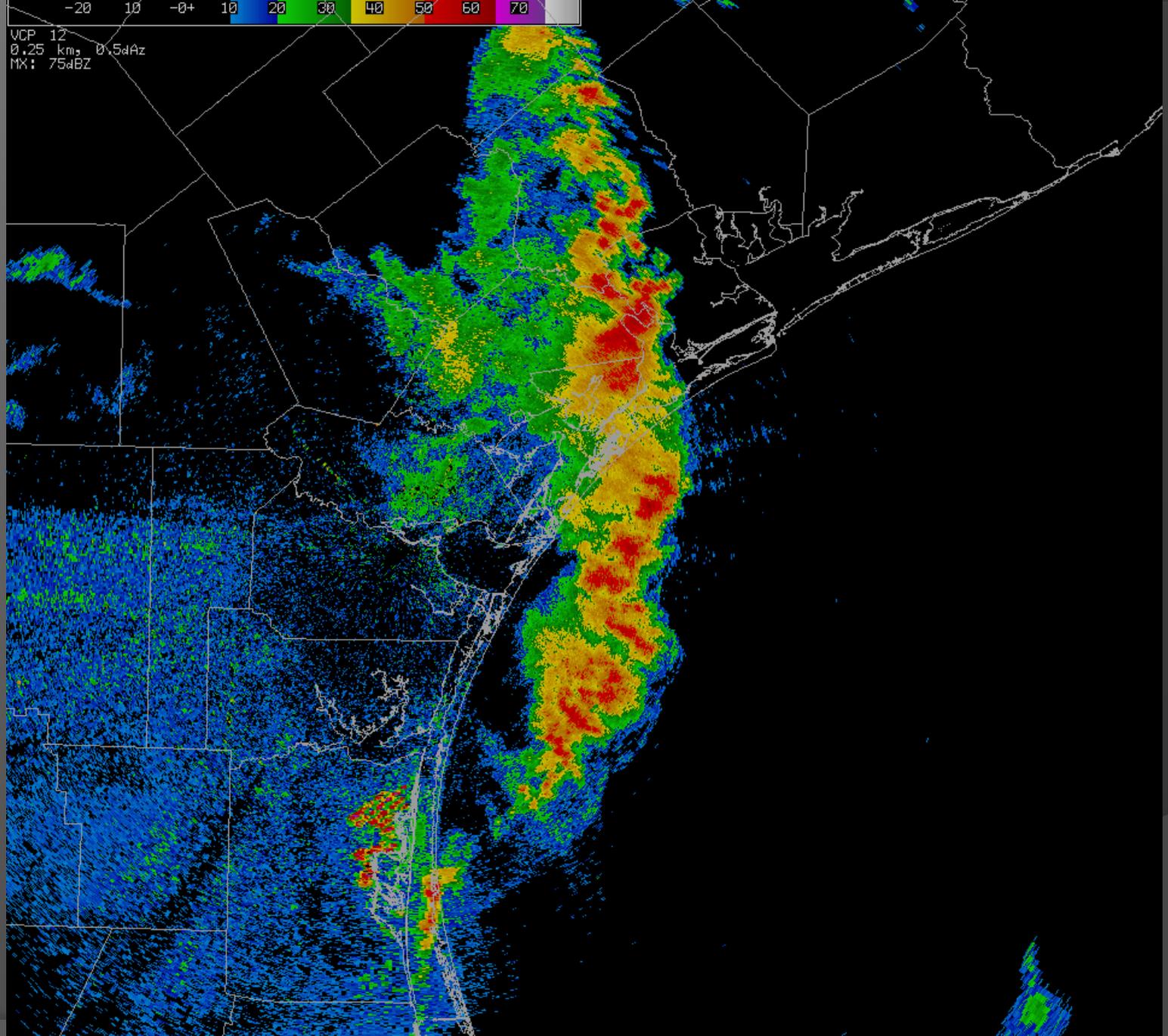
VCP 12
0.25 km, 0.5dBz
MX: 62dBZ



METAR: Mon 08:00Z 02-Apr-12
kcrp 0.5 Reflectivity (dBZ) 8bit Mon 08:01Z 02-Apr-12

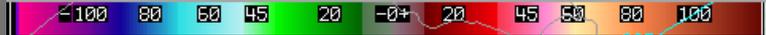
-20 10 -0+ 10 20 30 40 50 60 70

VCP 12
0.25 km, 0.5dAz
MX: 75dBZ



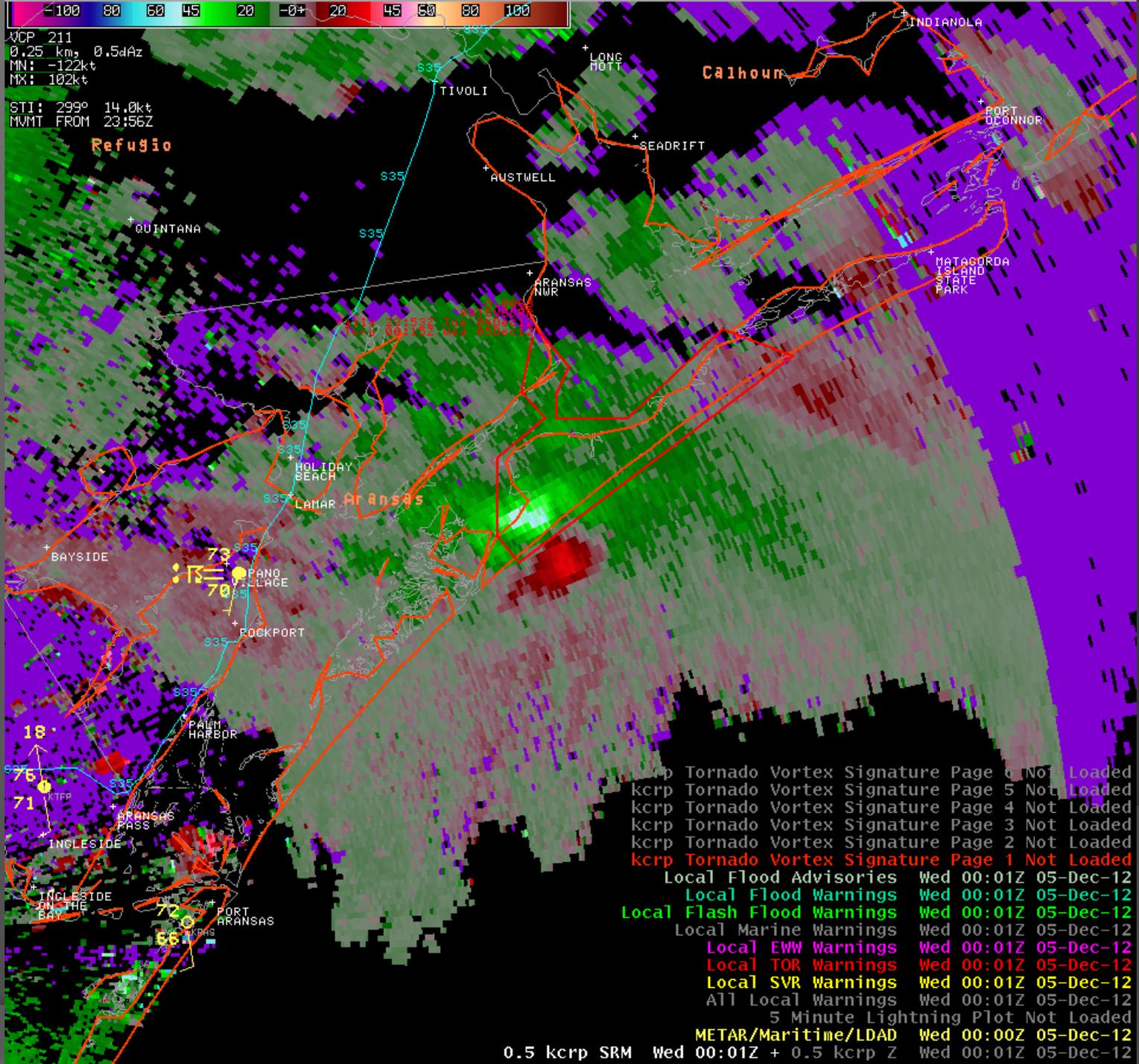
METAR Mon 10:00Z 02-Apr-12
kcrp 0.5 Reflectivity (dBZ) 8bit Mon 09:32Z 02-Apr-12





VCP 211
 0.25 km, 0.5dAz
 MN: -122kt
 MX: 102kt

STI: 299° 14.0kt
 MVMT FROM 23:56Z



kcrp	Tornado Vortex Signature	Page 6	Not Loaded
kcrp	Tornado Vortex Signature	Page 5	Not Loaded
kcrp	Tornado Vortex Signature	Page 4	Not Loaded
kcrp	Tornado Vortex Signature	Page 3	Not Loaded
kcrp	Tornado Vortex Signature	Page 2	Not Loaded
kcrp	Tornado Vortex Signature	Page 1	Not Loaded
	Local Flood Advisories	Wed 00:01Z	05-Dec-12
	Local Flood Warnings	Wed 00:01Z	05-Dec-12
	Local Flash Flood Warnings	Wed 00:01Z	05-Dec-12
	Local Marine Warnings	Wed 00:01Z	05-Dec-12
	Local EWW Warnings	Wed 00:01Z	05-Dec-12
	Local TOR Warnings	Wed 00:01Z	05-Dec-12
	Local SVR Warnings	Wed 00:01Z	05-Dec-12
	All Local Warnings	Wed 00:01Z	05-Dec-12
	5 Minute Lightning Plot	Not Loaded	
	METAR/Maritime/LDAD	Wed 00:00Z	05-Dec-12
0.5 kcrp SRM	Wed 00:01Z + 0.5 kcrp Z	Wed 00:01Z	05-Dec-12

COLD FRONTS

Cold Fronts

First strong front ~October
Last ~March

Small Craft Advisories

Gale Watches/Warnings

Unusually low water levels

Marine wind chills

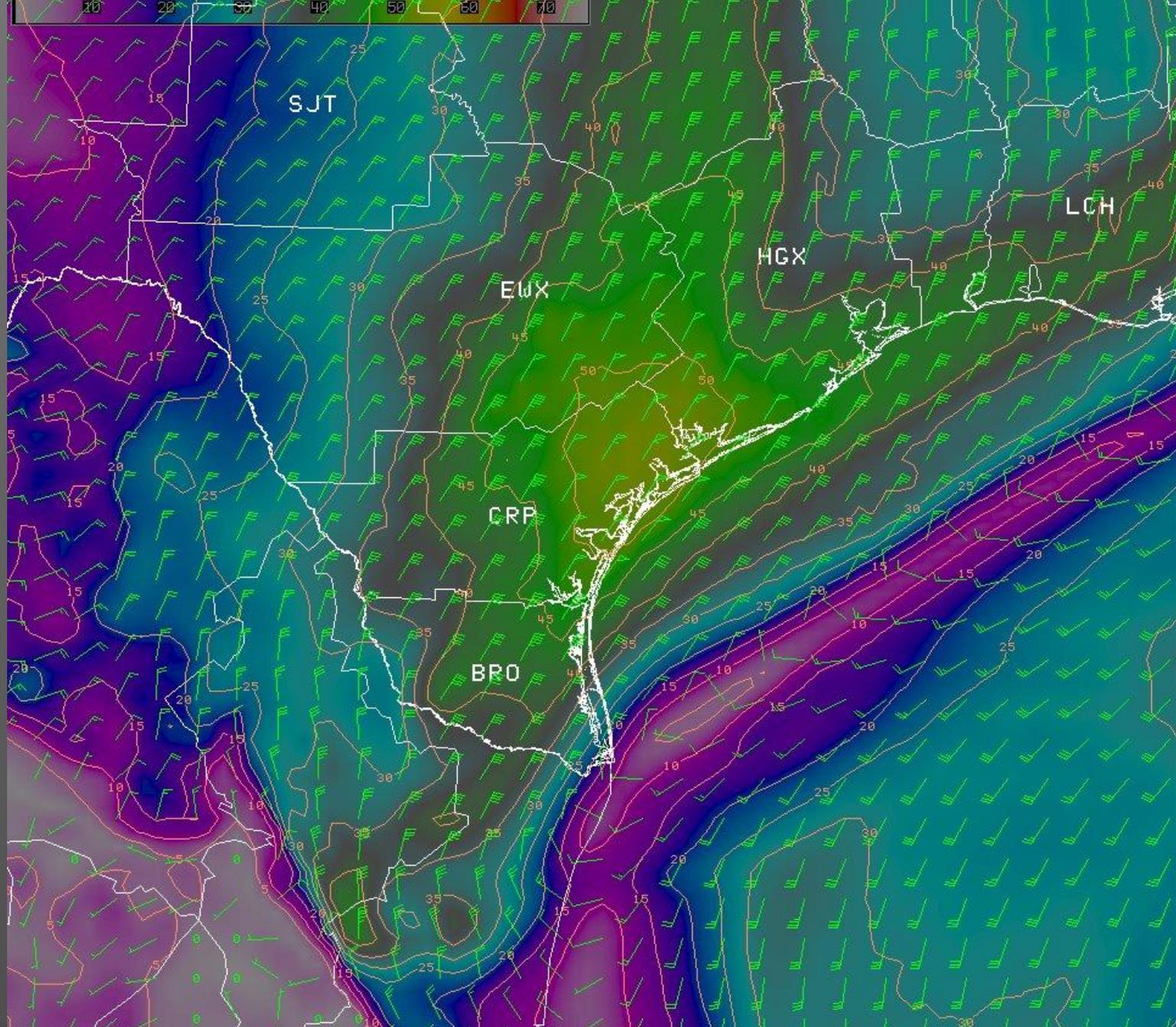
Cold Fronts - Gales

Primarily occur with Arctic fronts

Guidance too strong & too long with post FROPA winds

Too low with wave heights

925mb winds 35+ kts or greater



NAM12 925MB Windspeed (kt)	23.12	27HR	Fri 15:00Z	24-Feb-12
NAM12 925MB Windspeed (kts)	23.12	27HR	Fri 15:00Z	24-Feb-12
NAM12 925MB Wind (kts)	23.12	27HR	Fri 15:00Z	24-Feb-12

Questions?

