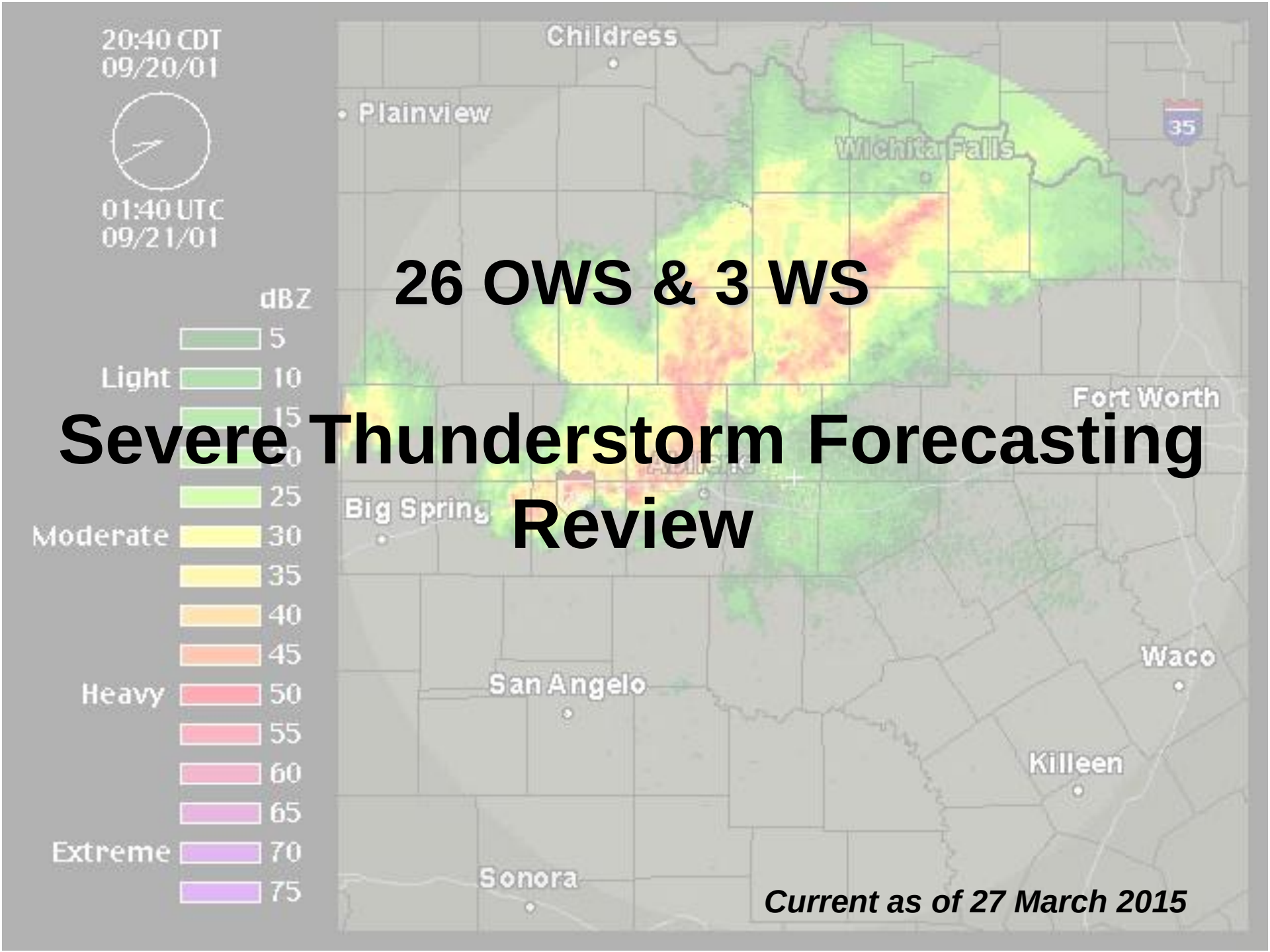
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Childress
Plainview
Wichita Falls
35
Fort Worth
Big Spring
San Angelo
Waco
Killeen
Sonora
26 OWS & 3 WS
Severe Thunderstorm Forecasting Review
Current as of 27 March 2015

These images are of the Jarrell, TX tornado that occurred shortly before 3:45 pm CDT on 27 May 1997. Jarrell, TX is a small rural town in northern Williamson County, located just 20 miles southeast of Fort Hood. The tornado killed 27 people, injured 12, and caused $40 million in damages.

Incredible F5 churning through Texas countryside: May 27, 1997

Foundations were blasted clean as if by an immense machine.

Those who sought refuge in this home had no chance. NWS photo.

Photos from: http://www.examiner.com/article/atmospheric-archive-jarrell-tornado-the-last-killer-f5-to-hit-texas

When conditions are ripe for severe weather to strike, the worst thing any meteorologist can do is sit around waiting for something to happen. Thousands of lives and millions of dollars in assets may rely on your ability to warn them of the potential and imminent danger from thunderstorms and tornadoes.

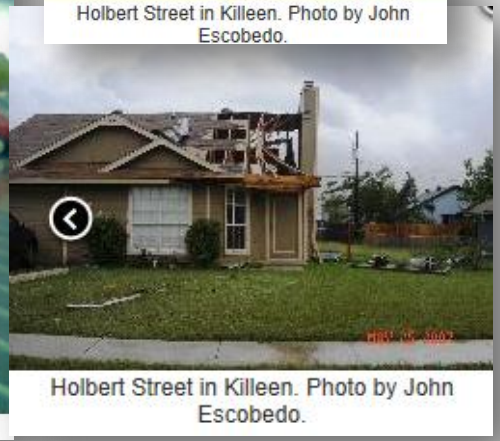
As soon as the potential of thunderstorms is expected, the weather forecaster should use available tools and resources to evaluate how strong those storms will become.

Although we are expected to be as accurate as possible, weather is not an exact science, so we may not always have all the answers. Fortunately, our customers understand this and would rather have us err on the side of caution when faced with potential severe weather.

Holbert Street in Killeen. Photo by John Escobedo.

Funnel Cloud -- Taken from Wal-Mart Parking Lot in Harker Heights -- Picture From Loraine Moffett

Holbert Street in Killeen. Photo by John Escobedo.



Holbert Street in Killeen. Photo by John Escobedo.

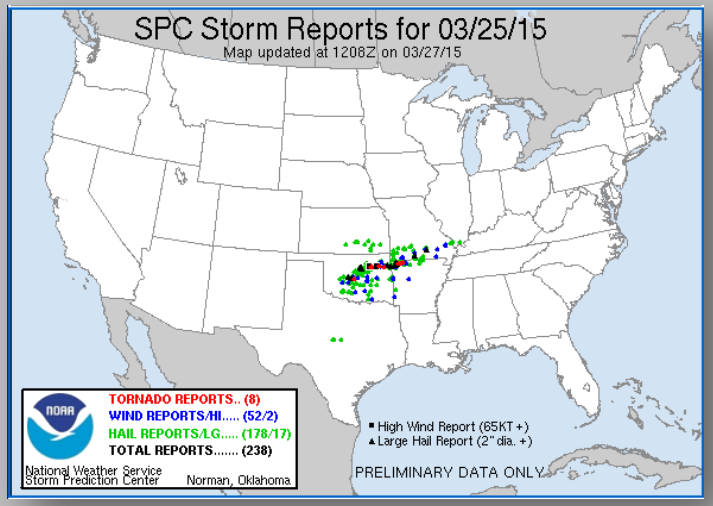
May 27, 2007
Killeen TX
Tornado

EU/CU Collaboration

Active discussion about weather scenario prior and during event is critical to successful resource protection

Overview

- Fort Hood WWAs
- SWAP
- Impacts to Operations
- Fort Hood Observations
- Supplementing Observations
- Thunderstorm Reporting
- Unofficial Weather Reports
- Review of the Basics
- Identify/Forecast the Threat



Fort Hood Weather Watches Issued by 26 OWS

Weather Watches			
Watch Type	**Criteria**	**Desired Lead Time**	
Tornado *(SWAP)*	Forecast	**As potential warrants**	CU
Severe Thunderstorm *(SWAP)*	Damaging Wind GTE 45KT associated with thunderstorms -AND/OR- Damaging Hail GTE 1/2 inch	**As potential warrants**	CU
Damaging Wind *(SWAP)*	Surface wind not associated with thunderstorm GTE 45KT	**As potential warrants**	CU
Freezing Precipitation	Liquid precipitation of any type and intensity falls and produces glaze ice on exposed surfaces	**As potential warrants**	CU
Lightning	within 5 nautical miles of the Fort Hood Reservation	**30 minutes**	CU

IMPORTANT:

1. **Severe Thunderstorm watch/warning will be issued as a bundle and will always contain both damaging wind (≥ 45KT) AND damaging hail (≥ 1/2 inch). The Moderate Thunderstorm warning will also be issued as a bundle and will always contain both high wind (≥ 35KT and less than 45KT) AND large hail (≥ 1/4 inch and less than 1/2 inch). Occurrence of either of the specified criteria in severe thunderstorm and moderate thunderstorm warnings verifies these warnings.**
2. **Watches/warnings will include maximum wind speed, maximum hail size, maximum rain/snow accumulation expected.**

Fort Hood Weather Warnings Issued by 26 OWS

Weather Warnings			
Warning Type	**Criteria**	**Desired Lead Time**	**Issued By**
Tornado *(SWAP)*	Forecast	**15 minutes**	CU
Severe Thunderstorm *(SWAP)*	Damaging Wind GTE 45KT associated with thunderstorms -AND/OR- Damaging Hail GTE 1/2 inch	**1 hour**	CU
Moderate Thunderstorm	High Wind GTE 35KT and less than 45KT associated with thunderstorms -AND/OR- Large Hail GTE 1/4 inch and less than 1/2 inch	**1 hour**	CU
Damaging Wind *(SWAP)*	Surface wind not associated with thunderstorm GTE 45KT	**1 hour**	CU
Strong Wind	Surface wind not associated with thunderstorms GTE 35KT and less than 45KT	**1 hour**	CU
Freezing Precipitation	Liquid precipitation of any type and intensity falls and produces glaze ice on exposed surfaces	**1 hour**	CU
Heavy Rain	≥ 2 inches within 12 hrs	**1 hour**	CU
Heavy Snow	≥ 2 inches within 12 hrs	**1 hour**	CU

IMPORTANT:

1. **Severe Thunderstorm watch/warning will be issued as a bundle and will always contain both damaging wind (≥ 45KT) AND damaging hail (≥ 1/2 inch). The Moderate Thunderstorm warning will also be issued as a bundle and will always contain both high wind (≥ 35KT and less than 45KT) AND large hail (≥ 1/4 inch and less than 1/2 inch). Occurrence of either of the specified criteria in severe thunderstorm and moderate thunderstorm warnings verifies these warnings.**
2. **Watches/warnings will include maximum wind speed, maximum hail size, maximum rain/snow accumulation expected.**

Weather Watches/Warnings
Issued by 3 WS

Fort Hood Weather Warning:

Lightning	within 5 statue miles of the Fort Hood Reservation	Observed	WF

Table D-3. Western Training Area (WTA) Weather Watches and Warnings

Threat/Threshold	Impact	Watch Desired Lead-time	Warning Desired Lead-time
Thunderstorms[1] within the WTA[2]	Increased risk to exposed personnel; increased risk of damage to unsecured property; increased risk to aircraft or vehicles; disrupts aviation operations/missions.	**2 hours**	**As observed**

Figure D-3

Observed Weather Advisories
Issued by 3 WS

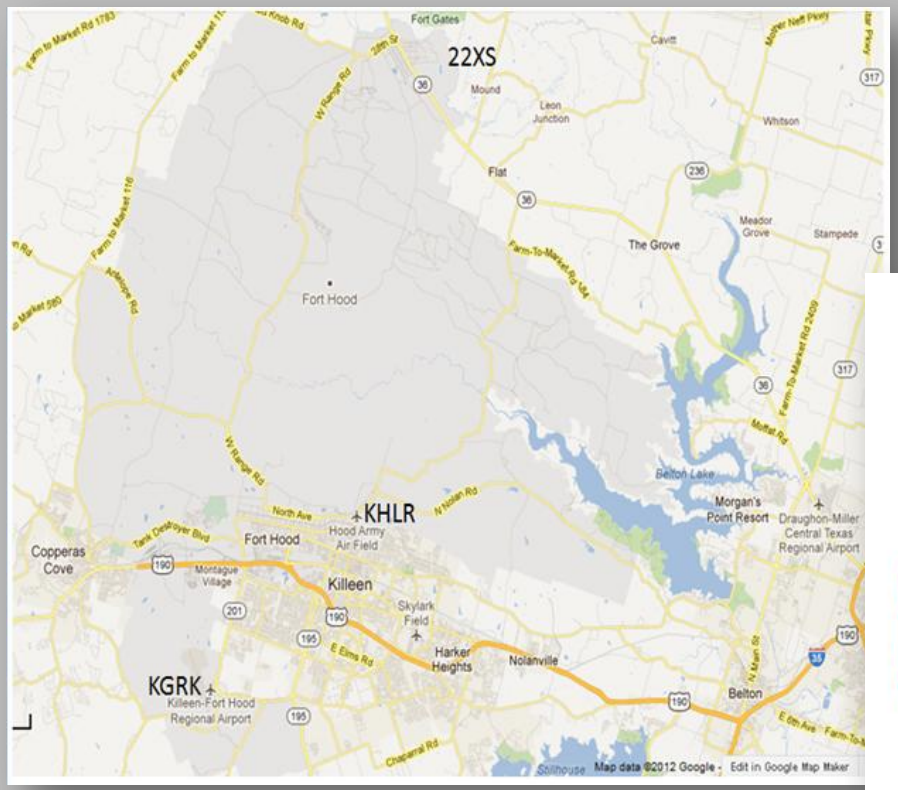
Table E-1. Observed weather advisories

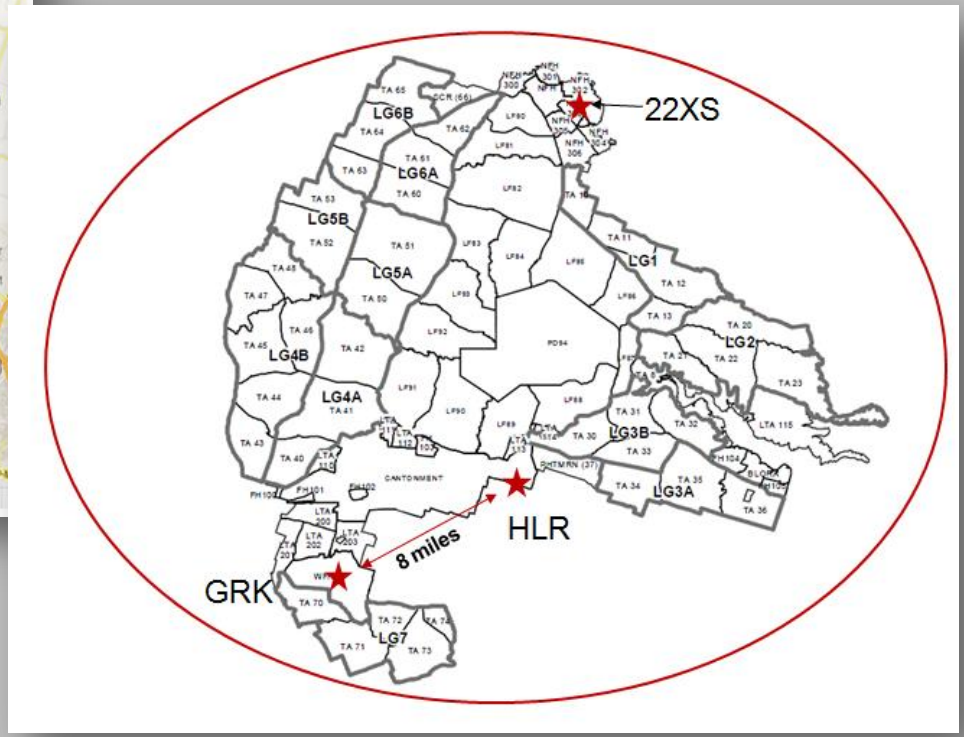
Criteria	Area Affected
Low-level wind shear below 2,000 feet AGL (not associated with thunderstorms)	within 50 NM of Fort Hood
Moderate or greater icing below 10,000 feet AGL (not associated with thunderstorms)	within 50 NM of Fort Hood
Moderate or greater turbulence below 10,000 feet AGL (not associated with thunderstorms)	within 50 NM of Fort Hood
Surface wind greater than or equal to 25 knots	Fort Hood Reservation

Figure E-1

IMPORTANT…

26 OWS Watches/Warnings Issued for <u>Entire</u> Fort Hood Reservation





3 WS Severe Weather Action Procedures (SWAP)

- SWAP **will** be implemented for the mandatory severe weather watch/warning criteria indicated below:

Threat/Threshold	Impact
Tornado / Funnel cloud (detected by radar or visually observed) AND threatening the Fort Hood Reservation	Immediate threat of catastrophic damage to personnel and property
Severe Thunderstorm Damaging Wind GTE 45KT associated with thunderstorms -AND/OR- Damaging Hail GTE 1/2 inch	Immediate threat to exposed personnel; high risk of damage to facilities and exposed aircraft/equipment
Damaging Wind Surface wind not associated with thunderstorm GTE 45KT	Immediate threat to exposed personnel; increased risk of damage to facilities and equipment

3 WS Severe Weather Action Procedures (SWAP)

- The **3 WS SWAP team** will consist of the individuals below *(total number of personnel will be an ORM decision based on the nature and magnitude of the severe weather event or mission(s) expected)*
  - Airfield Services Forecaster *(Team Leader)
  - Mission Weather Forecaster ***(could be same person as above when only one person on duty)***
  - Severe Standby Technician - Senior SQ forecaster identified on duty schedule as “Severe Standby Technician” and will be available 24 hours a day
  - Flight CC and/or NCOIC
  - Additional squadron forecasters as determined by Flight CC and/or NCOIC

3 WS Severe Weather Action Procedures (SWAP)

- The SWAP Leader and Severe Standby Technician will discuss, analyze (complete severe weather checklists), and assess threat in conjunction with 26 OWS
- During normal duty hours or as situation dictates the Flight CC/NCOIC and any other available squadron forecasters will also be available to discuss the meteorological situation
- **The goal is to commit to course of action(s) and issue severe weather watches and warnings based more on severe weather indicators and less on actual sightings**

26 OWS Severe Weather Action Procedures (SWAP)

- The 26 OWS routinely schedules adequate manning resources for each duty shift to respond to severe weather situations within the AOR

- The 26 OWS Operations Floor leaders continuously assess severe weather threats and shift manning, as needed, to address additional workload needs for locations

Impacts to Operations

Table 6-1. Severe Weather Warning – High Risk

Note: Actions listed in the "Action" column apply to each of the warnings listed in the "Warning" column.

Warning	Action
1. Tornados and Tropical Storms	
2. Severe Thunderstorms: - Damaging wind 45 knots or greater and/or hail half Inch or more in diameter	* Recall/ground aircraft * Hangar and Moor aircraft * Secure equipment * Update IOC every 60 minutes until all aircraft and flight line equipment is secure.
3. Damaging surface wind not associated with Thunderstorms 45 knots or greater	

Aircraft Actions in Flight

1. Aircraft operating within R-6302, WTA or immediate area:
   a. If associate weather warning conditions are not present, immediately return to RGAAF, HAAF, or tactical field site.
   b. If associate weather warning conditions are not present, the PC will determine the best course of action and notify Hood Radio of intentions.
2. Aircraft in the local flying area (outside of 1 above): upon receipt of a warning, the PC will determine the best course of action and notify the command as soon as practicable.

Legend:

IOC – Installation Operations Center
PC – Pilot in Command
RGAAF – Robert Gray Army Airfield
HAAF – Hood Army Airfield
IAW – In Accordance With
WTA – Western Training Area

Fort Hood Regulation 95-1 (1 Apr 2013)

Impacts to Operations

Table 6-2. Severe Weather Warning – Medium Risk

Note: All of the actions listed in the "Action" column apply to each of the warnings listed in the "Warning" column.

Warning	Action
1. Moderate Thunderstorms: - High wind greater than 35 knots but less than 45 knots or greater and/or hail quarter inch or in diameter but less than half Inch or more in diameter 2. Strong surface wind not associated with thunderstorms greater than 35 knots but less than 45 knots. 3. Freezing precipitation	* Within operational capabilities of each aircraft, aviation operations in theses warning may occur; however, these mission are an automatic Medium Risk. Battalion commander (O-5) and above may approve on a case-by-case basis. * Commanders will ensure all aircraft and flight line equipment is secure.

Aircraft Actions in Flight

1. Operating within the area of the warning:
   a. If associate weather warning conditions are not present, immediately return to RGAAF, HAAF, or tactical field site.
   b. If associate weather warning conditions are not present, the PC will determine the best course of action and notify Hood Radio of intentions.
2. PCs may continue the briefed mission outside the area of the warning as long as they do not encounter weather conditions associated with the warning.

Legend:

IOC – Installation Operations Center	PC – Pilot in Command
RGAAF – Robert Gray Army Airfield	HAAF – Hood Army Airfield

Fort Hood Regulation 95-1 (1 Apr 2013)

Impacts to Operations

Table 6-3. Lightning Warning

Note: All of the actions listed in the "Action" column apply to each of the warnings listed in the "Warning" column.

Warning	Action
1. Lightning warning or observed lightning Within 5 miles (8.05 kilometers)	* All aircraft refueling will cease * Commanders will take necessary action To protect personnel and equipment.

Aircraft Actions in Flight
1. PCs will determine the best course of action to prevent airborne lightning strikes.
2. PCs will not takeoff in areas covered by a lightning warning.
3. Aircrews should avoid all known thunderstorms by at least 20 nautical miles (NM)

Legend:
PC – Pilot in Command
NM – Nautical Miles

Table 6-4. Weather Watches and Advisories

Note: All of the actions listed in the "Action" column apply to each of the warnings listed in the "Warning" column.

Actions for Severer Weather Watches and/or Advisories
1. Aviation operations may occur in areas covered by a weather watch or advisory. However, commanders will establish recovery procedures in the event a warning is issued for the weather phenomena contained in the watch and/or advisory.
2. PCs will establish and maintain radio/telephone contact every 30 minutes or at intermediate stops with their unit flight operations.

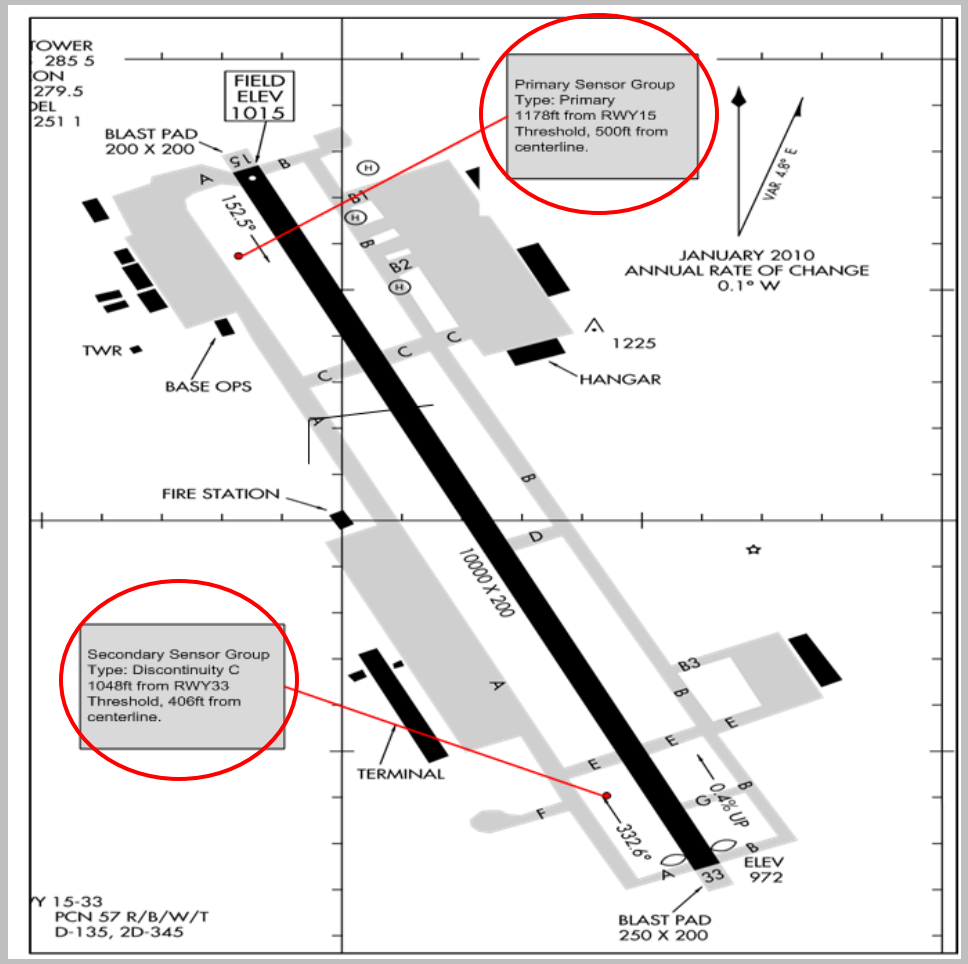
Legend:
PC – Pilot in Command

Fort Hood Regulation 95-1 (1 Apr 3013)

Fort Hood Airfield Weather Sensors

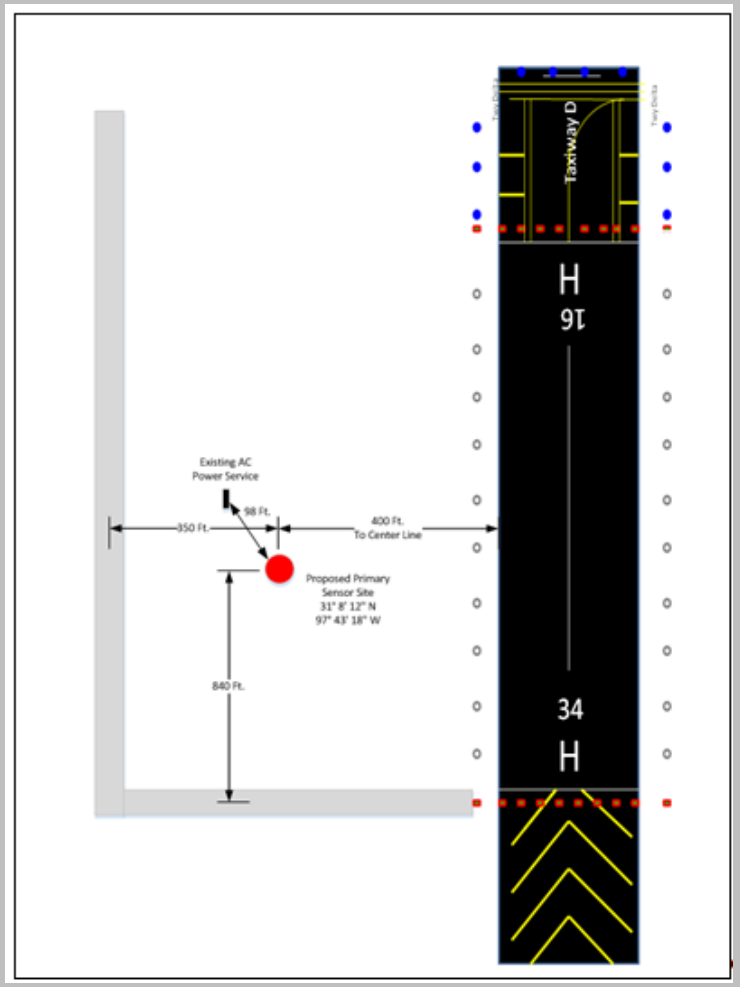
- **RGAAF (KGRK) and HAAF (KHLR)**
  - The FMQ-23 Automated Meteorological Observing Systems (AMOS) at **KGRK** and **KHLR** are operated in full automated mode to provide the official METAR and SPECI observations
  - Weather forecasters are available 24/7 to augment (supplement and back-up) the **KGRK AMOS** IAW **AFMAN15-111, IC-1** and anything that would adversely impact flight/ground operations (*flight safety will always be the highest priority!*)
  - Weather forecasters will augment (back-up only) the **KHLR AMOS** during HAAF operating hours (M-F 0800-2400L)

Fort Hood Airfield Weather Sensors



KGRK AMOS Locations

KHLR AMOS Locations



Supplementing Tornadic Activity

- Tornado(s) (+FC), waterspout(s) (+FC), or funnel cloud(s) (FC) will be reported in a METAR/SPECI IAW AFMAN15-111, Atch 2 whenever they are **observed to begin (first seen), are in progress, or disappear (end)**
- Encode tornadoes, funnel clouds, or waterspouts in format, Tornadic activity_B/E(hh)mm_ LOC/DIR_(MOV), where TORNADO, FUNNEL CLOUD, or WATERSPOUT identifies the specific tornadic activity
  - B/E denotes beginning and/or ending time
  - (hh)mm is time of occurrence (only minutes are required if the hour can be inferred from the report time)
  - LOC/DIR is location (distance if known) and/or direction of the phenomena from the EU, and MOV is the movement, if known
- Tornadic activity will be encoded as the first remark after the "RMK" entry Example: **TORNADO B13 6 NE**

Supplementing Hail

- Hail (GR) will be reported in a METAR/SPECI when hail ≥ 1/4 inch begins (*local warning criteria*), is in progress or ends
- Depth of hail on the ground is not reported in the METAR/SPECI report
- When hail is supplemented in the body of the report, a remark should be included to report beginning or ending time, unless the SPECI time is the beginning or ending time of the hail
- Report hailstone size in remarks when hailstones **1/4" or larger** in diameter occur *(no intensity is assigned)*
  - Encode Hailstone size (≥ 1/4 inch) in format, GR_[size]_[Plain Language]
    - GR is the remark identifier
    - [size] is the diameter of the largest hailstone
    - Hailstone size is encoded in 1/4 inch increments

Example: GR 1 3/4

- *NOTE: If GS is encoded in the body of the report, no hailstone size remark is required*

Thunderstorm Reporting

- Thunderstorm (TS) - A local storm produced by a cumulonimbus cloud accompanied by lightning and/or thunder

  Note: Due to the various types of thunderstorm/lightning sensors employed on AF AMOSs, thunderstorm/lightning detection and ranging capability differs from platform to platform (e.g., FMQ-19, TMQ-53, FMQ-22). Weather technicians should review the **Lightning Detection Technique and Procedure available on the Air Force Weather Agency Confluence web site**, as well as the technical order or operations manual of the AMOS used to gain situational awareness about the capabilities/limitations of these sensors and the need to supplement sensed data from stand-alone sensors with data from a networked lightning detection system and/or other reliable sources (when available)

Thunderstorm Reporting

- A thunderstorm with or without precipitation will be reported in the body or remarks of the observation when observed to begin, be in progress, or to end
- Remarks concerning the location, movement, and direction (if known) of the storm may be added to the METAR/SPECI that reported the thunderstorm
- A SPECI will be encoded/disseminated when a thunderstorm begins or ends (a SPECI is not required to report the beginning of a new thunderstorm if one is currently reported)

Thunderstorm Reporting

- For reporting purposes, a thunderstorm is considered to have begun and to be occurring "at the station" when:

(1) thunder is first heard when location is unknown,

(2) when hail is falling or lightning is observed at or near the airfield and the local noise level is such that resulting thunder cannot be heard, or

(3) lightning detection equipment indicates lightning strikes within 5 nautical miles of the airfield

Thunderstorm Reporting

- When thunder is heard and the location is known (i.e., determined by radar or lighting detector)
  - VCTS may be reported if the location of the storm is determined to be between 5-10 nautical miles
  - If thunder is heard and the location is determined to be beyond 10-nautical miles, do not carry TS or VCTS in present weather, technicians may include TS comments in remarks (e.g., "TS 12SE MOV NE")
- A thunderstorm is considered to have ended 15 minutes after the last occurrence of any of the criteria previously mentioned

Unofficial Weather Reports

Unofficial weather reports are defined as a report of one or more weather elements from an individual who is not task certified to take official observations (i.e., pilot or law enforcement official). Unofficial reports can provide additional and supplemental information that may be important to the safety of local aviation and public safety.

Unofficial reports of severe weather from credible sources within **15 statute miles** will be appended in the remarks of the observation and disseminated long-line and locally. Follow up credible reports of severe weather with the 26 OWS. Mission-restricting weather may be appended in the remarks of the observation and sent out at the technician's discretion.

Example Observation:

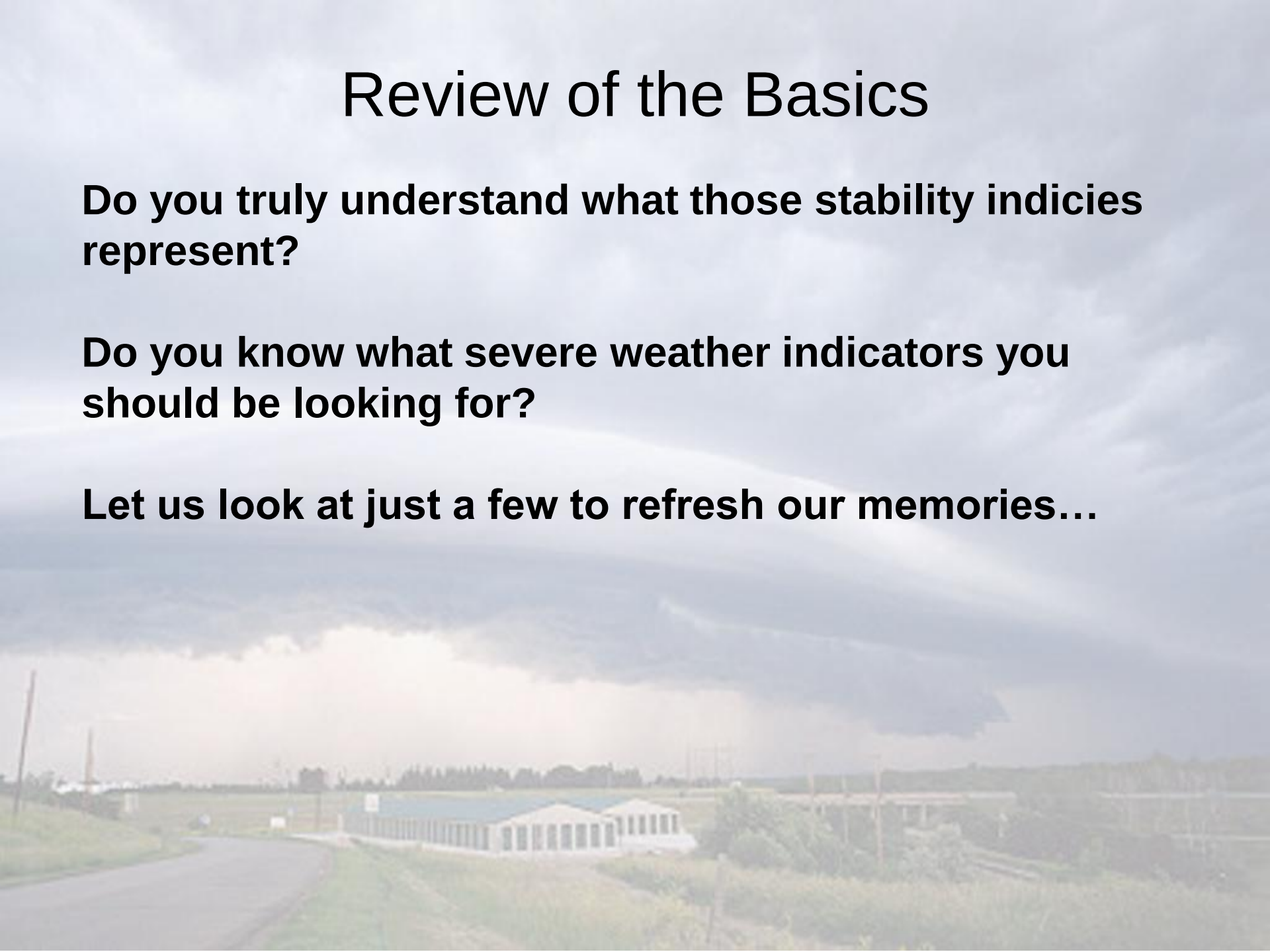
KGRK SPECI 101945Z 25015G32KT 7SM BKN025 25/21 A2980 RMK **UNCONFIRMED TORNADO 9SW MOV NE PER LAW ENFORCEMENT** DSNT LTG SW PRESRR

Review of the Basics

Do you truly understand what those stability indicies represent?

Do you know what severe weather indicators you should be looking for?

Let us look at just a few to refresh our memories…

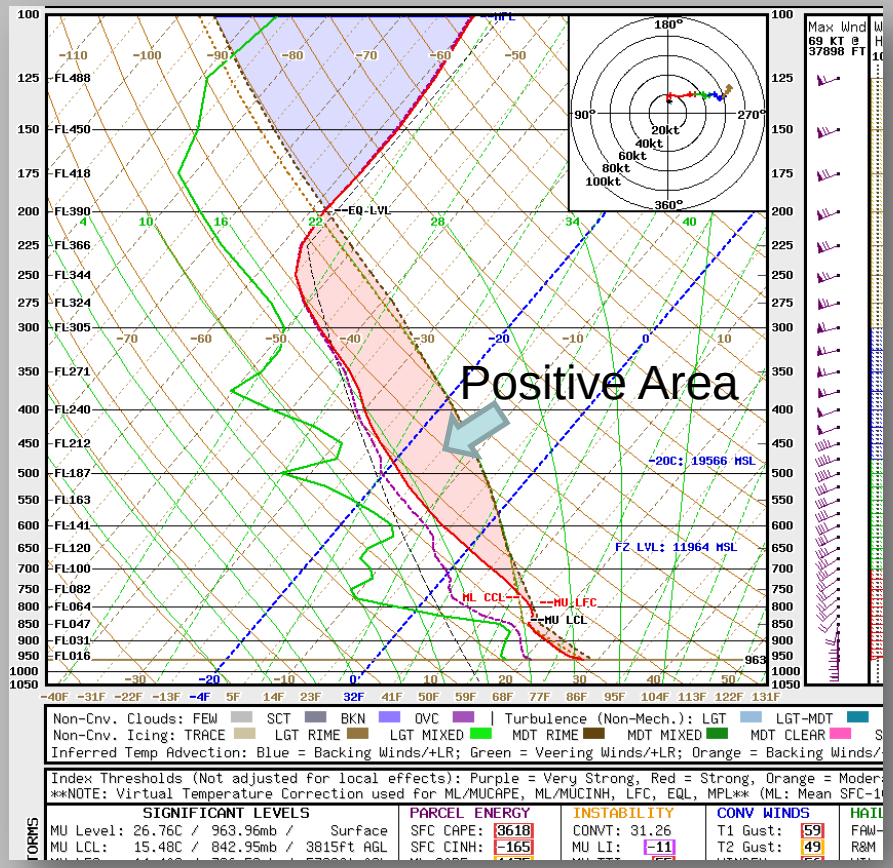


CAPE
(Convective Available Potential Energy)

What is CAPE? This is a measure of the convective instability of the atmosphere and thus, the potential for thunderstorms

How is CAPE determined? The positive area on a sounding is proportional to the amount of CAPE

- The higher the positive area, the higher the CAPE
- The positive area is the area where the parcel sounding is to the right (warmer) than the environmental sounding
- The units of CAPE are Joules per kilogram (energy per unit mass)



This sounding shows a CAPE of 3618 Joules per kilogram

CAPE
(Convective Available Potential Energy)

Hail: As CAPE increases (especially above 2,500 J/kg) the hail potential increases--large hail requires very large CAPE values

Downdraft: An intense updraft often produces an intense downdraft since an intense updraft will condense out a large amount of moisture; expect isolated regions of very heavy rain when storms form in a large or extreme CAPE environment

Lightning: Large and extreme CAPE will produce storms with abundant lightning

Pitfalls:

- Storms will only form and the CAPE actualized if the low level capping inversion is broken

- CAPE magnitude can rise or fall very rapidly across time and space

CAPE
(Convective Available Potential Energy)

What is the operational significance of CAPE?

Index	Region	Weak (Low)	Moderate	Strong (High)
CAPE		300 to 1000	1000 to 2500	2500 to 3500

AFWA TN98-002, Table 3-2

- High CAPE means storms will build vertically very quickly
- The updraft speed depends on the CAPE environment

CAPE
(Convective Available Potential Energy)

CAPE values are <u>not</u> a direct indicator of severe weather

• They should be used in conjunction with helicity (a measure of the rotation potential of a column of air) for forecasting severe weather

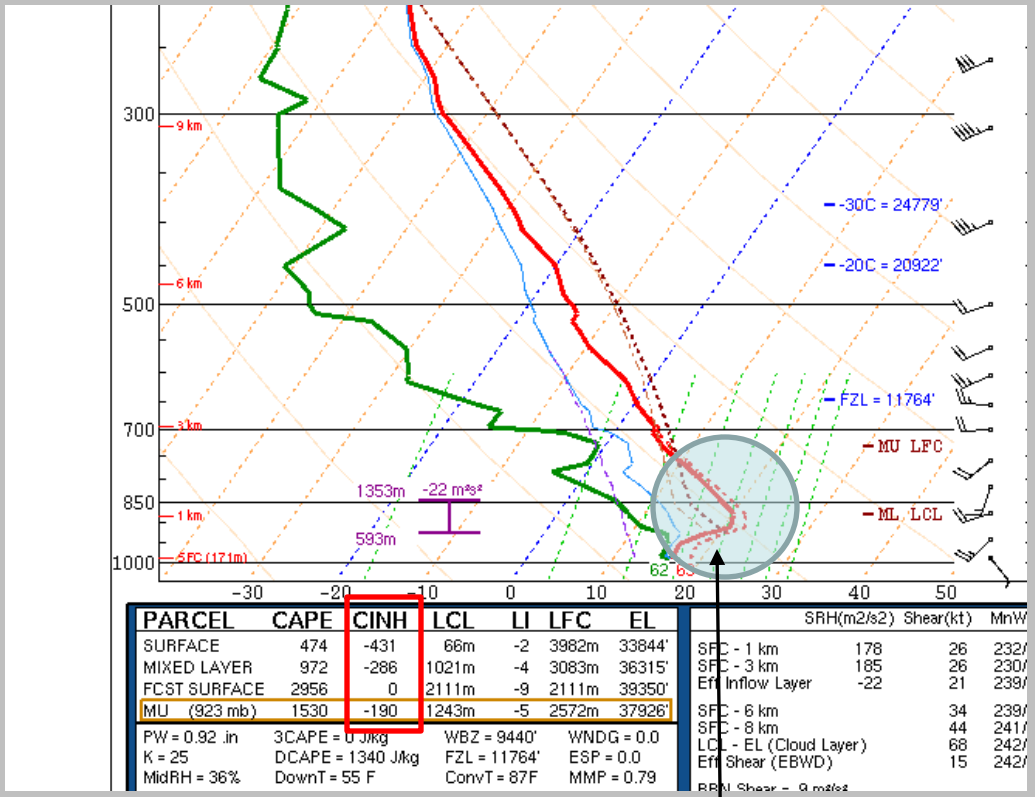
• Use values above 200 J/kg in conjunction with helicity to determine conditions for tornadic thunderstorms and severe weather

• Be aware violent thunderstorms and tornadoes are associated with a wide range of values: *large CAPE values combined with low wind shear, and conversely, low CAPE values combined with high wind shear are both capable of producing conditions favorable for the development of tornadoes (mesocyclogenesis)*

CINH or CIN
(Convective Inhibition)

What is CINH?

- Anti-CAPE (negative CAPE) in the lower troposphere. Another term for CINH is the “cap” or “capping layer”
- The cap must be broken before surface-based lifting is able to move into the +CAPE region of a sounding and develop into deep convection



Moderate to strong cap

CINH or CIN
(Convective Inhibition)

- **CINH will be reduced by:**

1) daytime heating
2) synoptic upward forcing
3) low level convergence
4) low level warm air advection (especially if accompanied by higher dewpoints

CINH	
0 - 50	Weak Cap
51 - 199	Moderate Cap
200+	Strong Cap

- CINH is most likely to be small in the late afternoon since daytime heating plays a crucial role in reducing CINH

“Cap”—Fort Hood ROT

Thunderstorm ROT

1. **700mb temperature** - During the spring to early fall months (Apr-Sep), monitor the 700 mb temperature for the presence of a warm-air cap when the potential of thunderstorms exists. Temperatures above +10 deg C may inhibit thunderstorm development, while temperatures below +10 deg C could aid in development and/or sustainment of thunderstorms.

Verification Rate = 67%

HINT: Use AMDAR data to monitor 700mb temperature between synoptic RAOB times:
http://amdar.noaa.gov/oper/

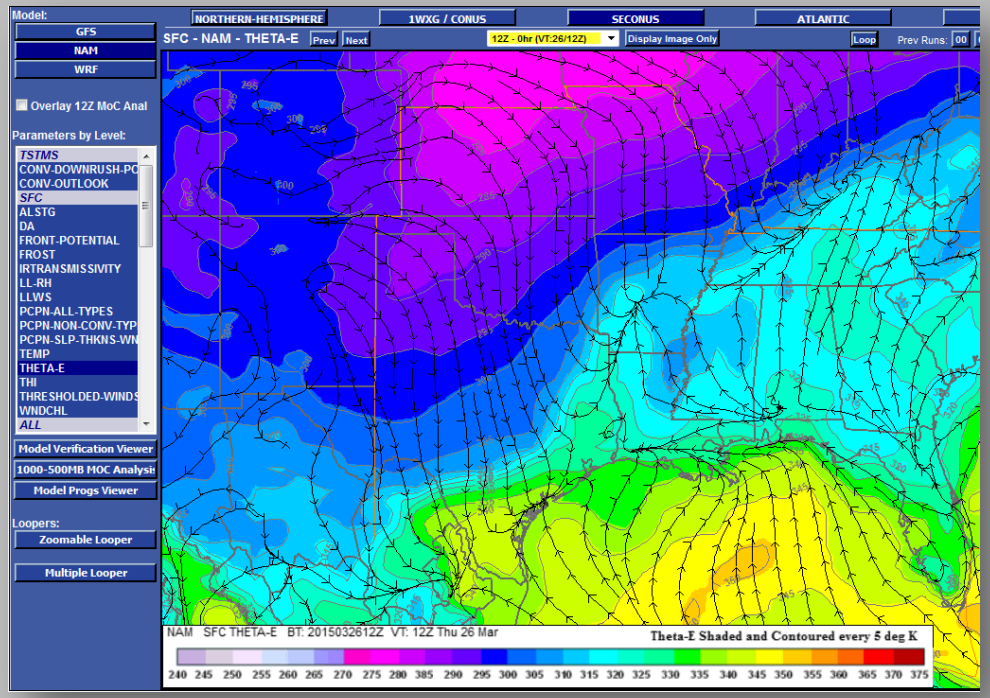
Remember…*reaching convective temp will break a cap; however, convective temp does not necessarily mean convection, but rather the point in which CU will form*

THETA-E

Equivalent Potential Temperature

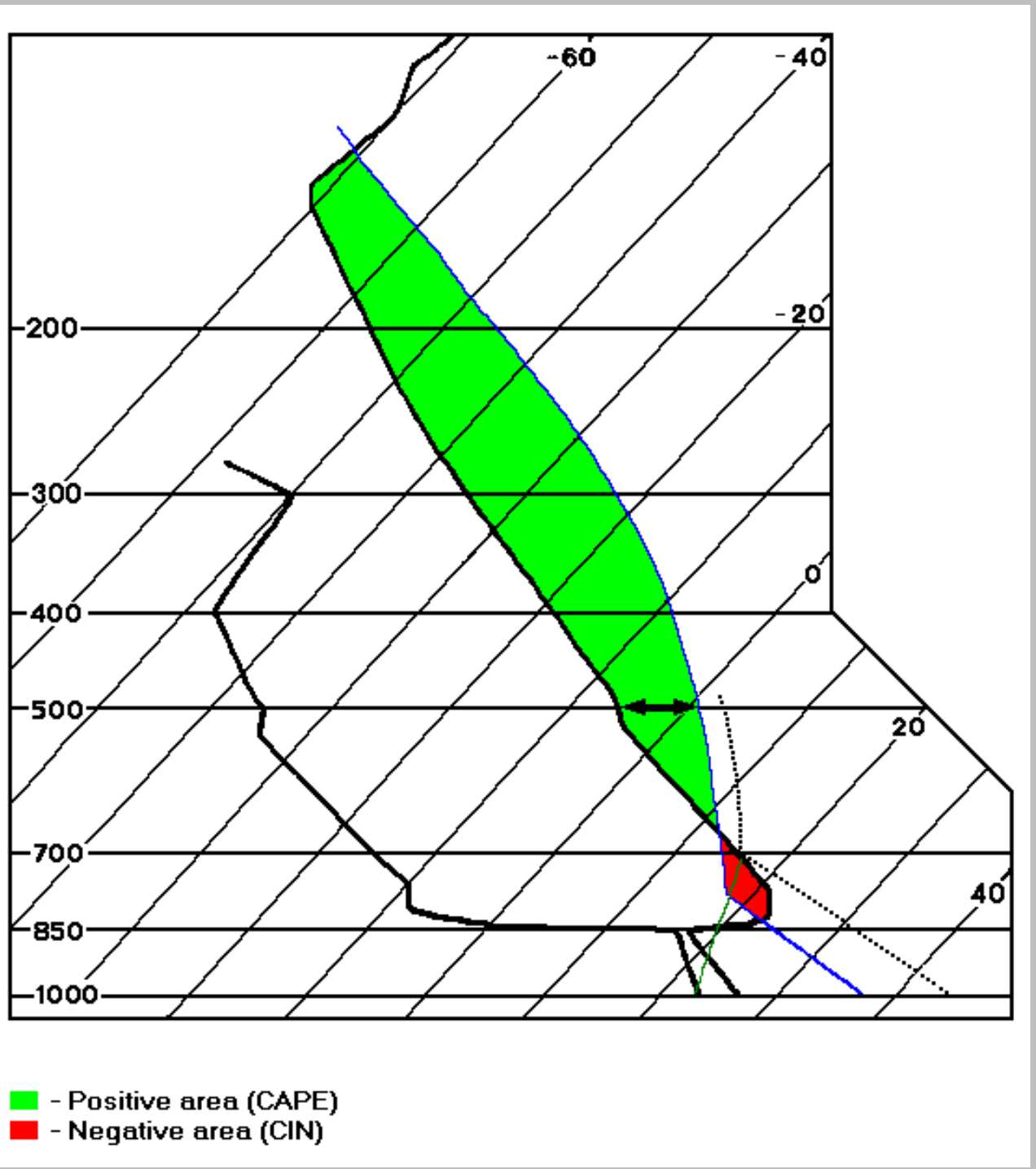
- Measure of the temperature a parcel of air would have if lifted to saturation, thus releasing the latent heat in the parcel, and then lowered dry-adiabatically to 1000 mb
- Takes into account both moisture content and temperature of the air—THETA-E increases as temperature and moisture increases

- Areas of high THETA-E are positively buoyant and unstable, and thus more favorable for thunderstorm development
- THETA-E ridges, regions of particularly high THETA-E, can be found in areas of strong warm air and moisture advection, and are prime locations for thunderstorm development



Goalposts or “Loaded Gun” Sounding

- Severe weather sounding (large CAPE, very unstable LI)
- Large hydro lapse in mid-levels (mT air in boundary layer capped by cT air)
- There must be an inversion above mT air
- Most common in Great Plains, Midwest and SE US
- Most common severe weather: Large hail, tornadoes, convective wind gusts of 58mph or greater
- If speed /directional wind shear and strong low-level jet are present on sounding, severe weather chances are enhanced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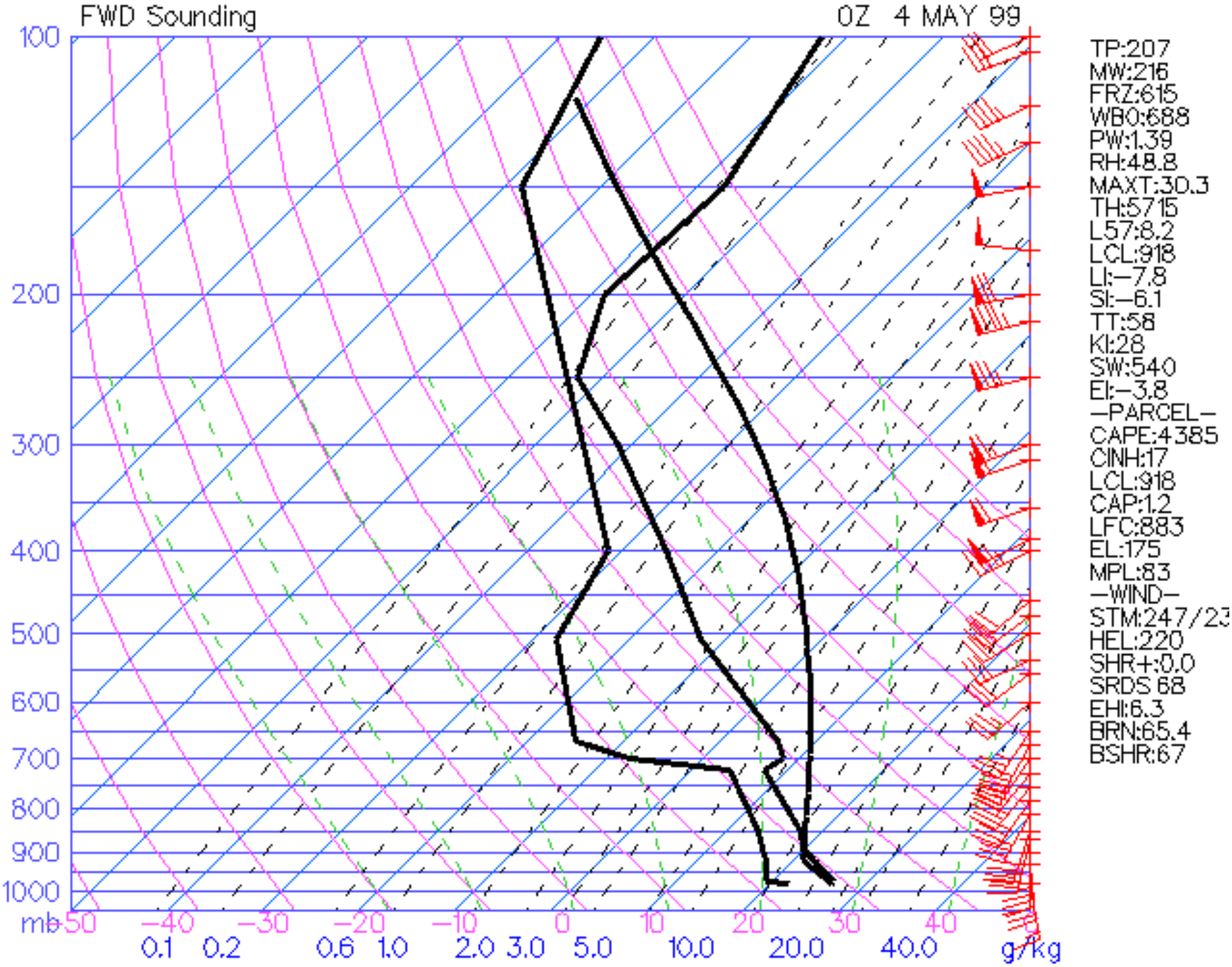
- Positive area (CAPE)
- Negative area (CIN)


FWD Sounding
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5.0
10.0
20.0
40.0
g/kg
TP:207
MW:216
FRZ:615
WBO:688
PW:1.39
RH:48.8
MAXT:30.3
TH:5715
L57:8.2
LCL:918
LI:-7.8
SI:-6.1
TT:58
KI:28
SW:540
EI:-3.8
-PARCEL-
CAPE:4385
CINH:17
LCL:918
CAP:1.2
LFC:883
EL:175
MPL:83
-WIND-
STM:247/23
HEL:220
SHR+:0.0
SRDS 68
EHI:6.3
BRN:65.4
BSHR:67

Wet Microburst Sounding

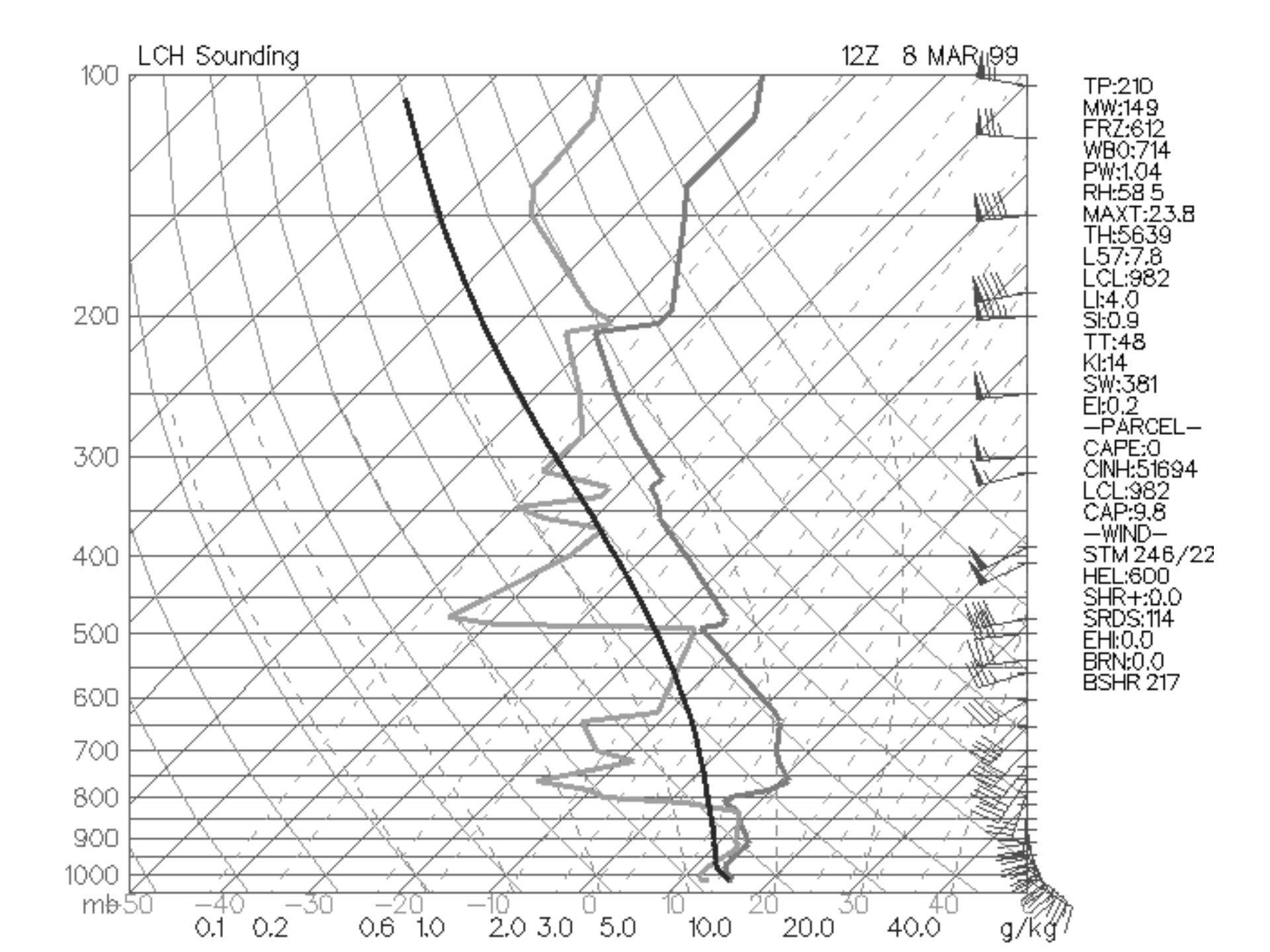
- Mid-level dry air

- Similar to goal post sounding but with more moisture (higher precipitable water in sounding)

- Dry air aloft will entrain into the downdraft and cause evaporational cooling--this increases the negative buoyancy and can result in microbursts and macrobursts

- If supercells develop they are most likely to be high precipitation supercells

- Most common severe weather: winds $\geq$ 58mph, small hail near the 3/4" threshold, tornadoes possible (depends on low level shear and CAPE)


LCH Sounding
12Z 8 MAR 99
100
200
300
400
500
600
700
800
900
1000
mb
-50
-40
-30
-20
-10
0
10
20
30
40
0.1
0.2
0.6
1.0
2.0
3.0
5.0
10.0
20.0
40.0
g/kg
TP:210
MW:149
FRZ:612
WB0:714
PW:1.04
RH:58 5
MAXT:23.8
TH:5639
L57:7.8
LCL:982
LI:4.0
SI:0.9
TT:48
KI:14
SW:381
EI:0.2
—PARCEL—
CAPE:0
CINH:51694
LCL:982
CAP:9.8
—WIND—
STM 246/22
HEL:600
SHR+:0.0
SRDS:114
EHI:0.0
BRN:0.0
BSHR 217

What is the Dryline?

- Topography plays an important role in dryline development/movement

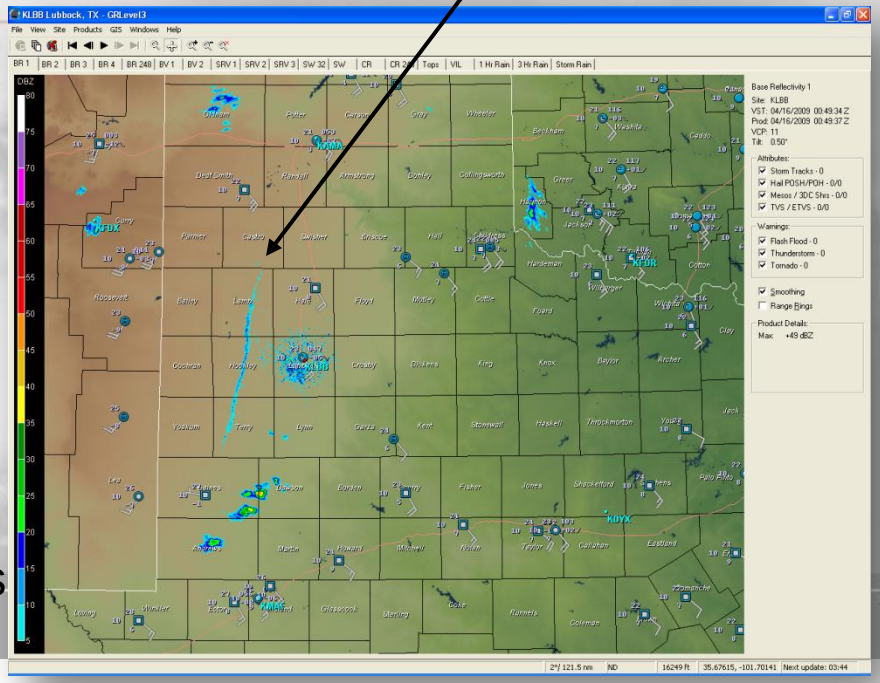
- Elevation from western Nebraska south through west Texas averages about 3,000 feet above sea level--air descending the eastern slopes of the Rockies warms and dries out as it sinks, creating a hot, dry, cloud-free zone that gives birth to the dryline

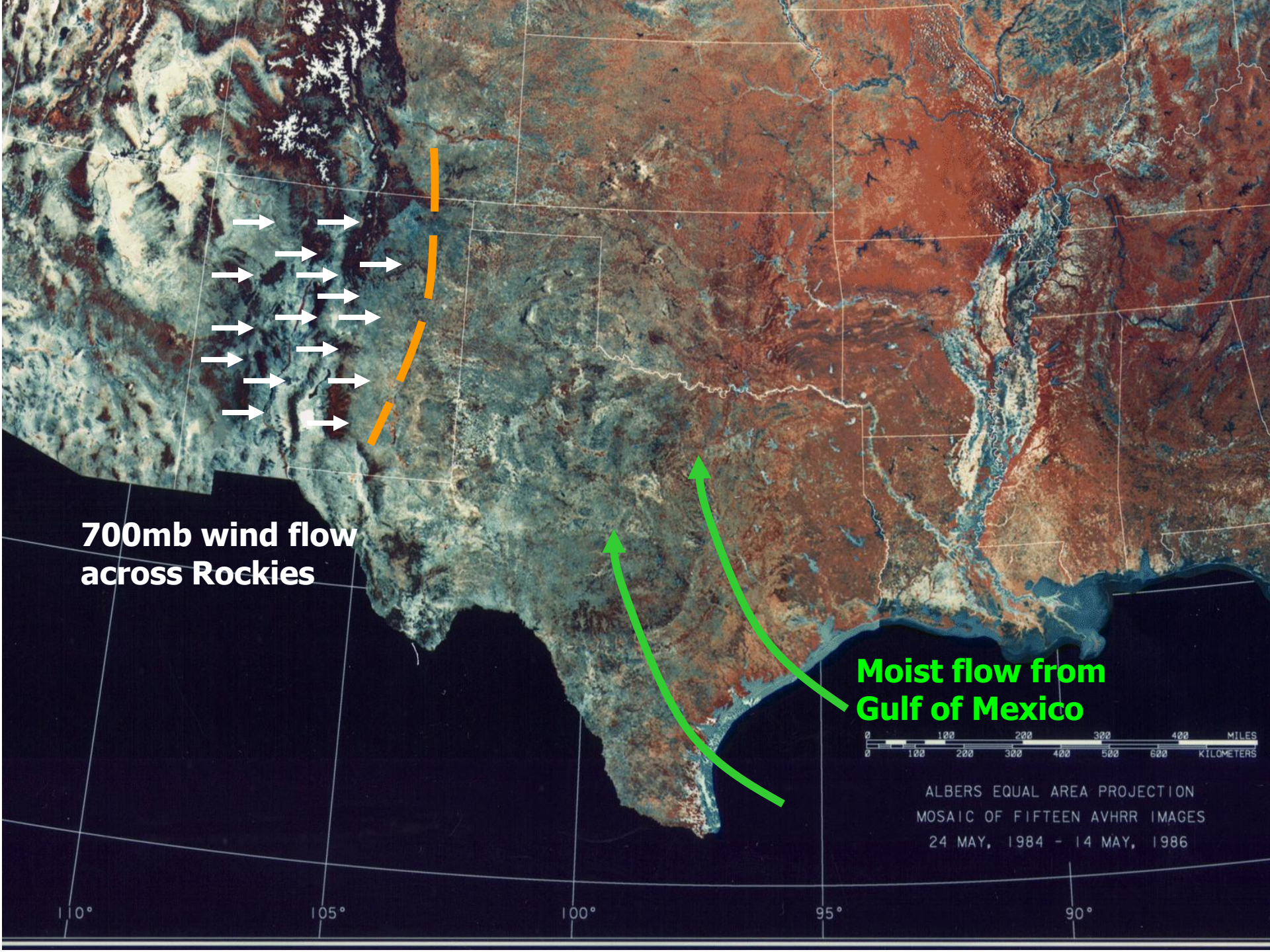
- As the parched air moves eastward toward lower elevations, it encounters more and more moisture and has more and more air to mix--this slows it down, and by mid-afternoon the dryline usually stalls

- By early evening, the dryline is in full retreat back to the high plains, pushed westward by low-level winds on the moist side of the boundary

- Sometimes the dryline repeats this cycle for an entire week, producing severe storms day after day

Dryline as seen on Lubbock radar just before sunset…




700mb wind flow
across Rockies
Moist flow from
Gulf of Mexico
0 100 200 300 400 MILES
0 100 200 300 400 500 600 KILOMETERS
ALBERS EQUAL AREA PROJECTION
MOSAIC OF FIFTEEN AVHRR IMAGES
24 MAY, 1984 - 14 MAY, 1986
110°
105°
100°
95°
90°

What is the Dryline?

- The dryline separates warm/dry air from warm/moist air, but it is **NOT A FRONT**--the air density of the warm, dry air does not differ much from the warm, moist air ahead of it

- Most common and most intense in the spring and early summer season in the southern high plains region of the United States

- Tropospheric wind above the dryline will not be uniform across the entire dryline boundary

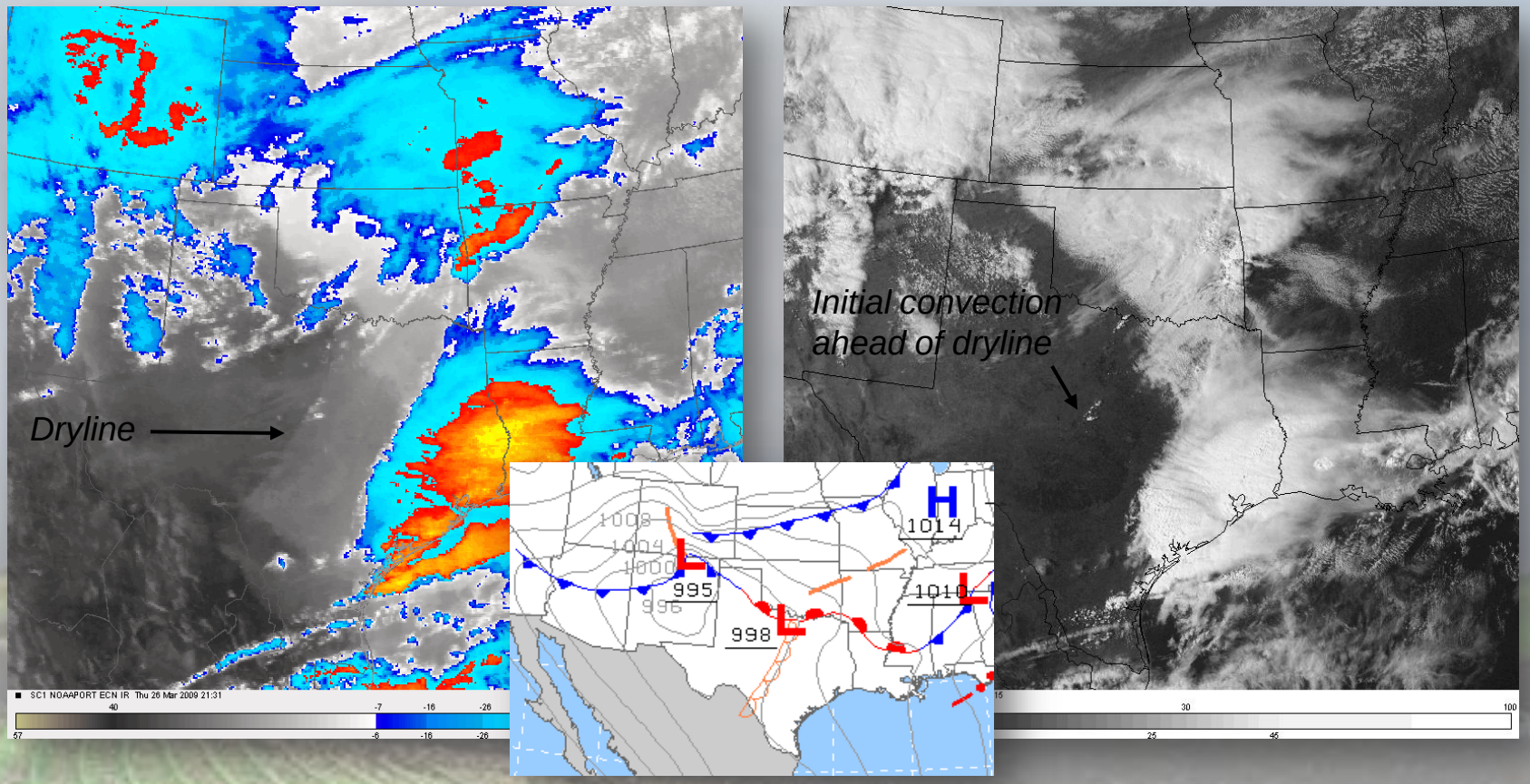
- Surges of stronger tropospheric wind will advance the dryline forward along segment(s) of the dryline—referred to as a dryline bulge

  - Low-level convergence/shear is enhanced along this advancing segment

  - Dryline thunderstorms can be initiated by this convergence enhanced uplift

Locating the Dryline

- Located by contrast in dew points
- 55° F isodrosotherm (line of equal dew point) is recommended first estimate of dry line
- At times can be seen on satellite (IR) and radar



Dryline Movement

- In order to determine the probable movement of the dryline, check the morning soundings to see how deep the low-level moisture is east of the dryline

- A moisture layer only **a few thousand feet** thick will tend to mix quickly, allowing the dryline to advance eastward rapidly

- Drylines reach speeds of 50 mph when there is little low-level moisture in their paths

- On the other hand, a moisture layer around **5,000** feet thick will tend to slow down the mixing process and could bring the dryline to a halt

Dryline Thunderstorms

- The dryline will not produce a severe storm by itself; it usually has to wait for an upper-air disturbance to lift the warm, moist surface air to its east through a stable layer (temperature inversion) aloft—capping layer

- Study morning soundings to determine the strength of the cap

- Stronger the cap, the more difficult it is for a storm to form

1/3 of storms developed within 15 miles of dry line

1/2 developed from 15 miles west to 65 miles east

Storms can even form on a retreating dry line

Dryline—Frontal Intersection

- A dryline-frontal intersection is also an area of enhanced moisture--and surface wind--convergence

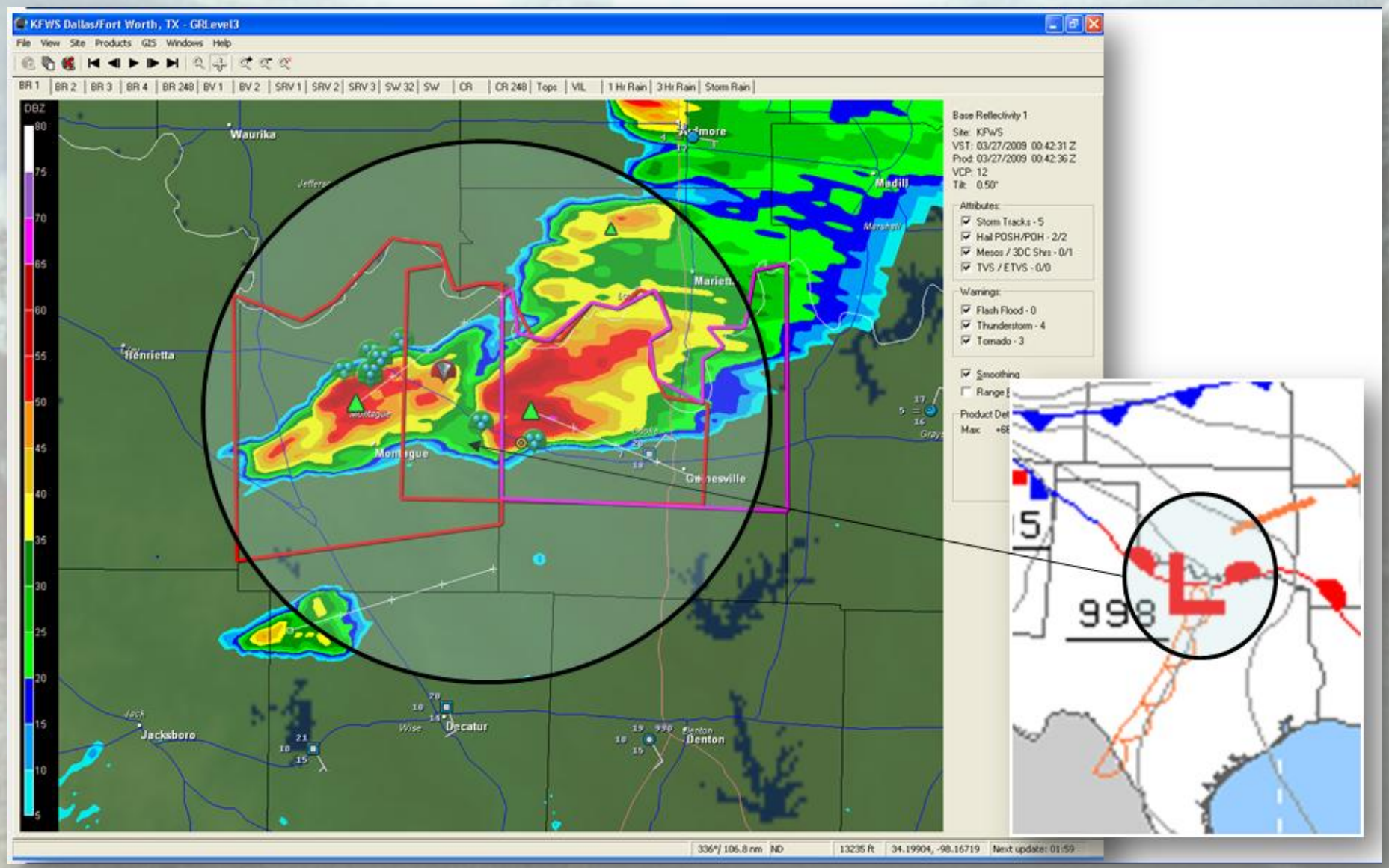
- The front can be cold or warm, or a thunderstorm outflow boundary

- Storms that form at such an intersection are literally located in a narrow canyon that channels moisture and wind into the storm

- Stationary or slow-moving cold fronts create a "point" for storm development at the intersection

- In contrast, a rapidly moving cold front merging with a dryline frequently creates a "line" of storms or a squall line

Dryline—Frontal Intersection



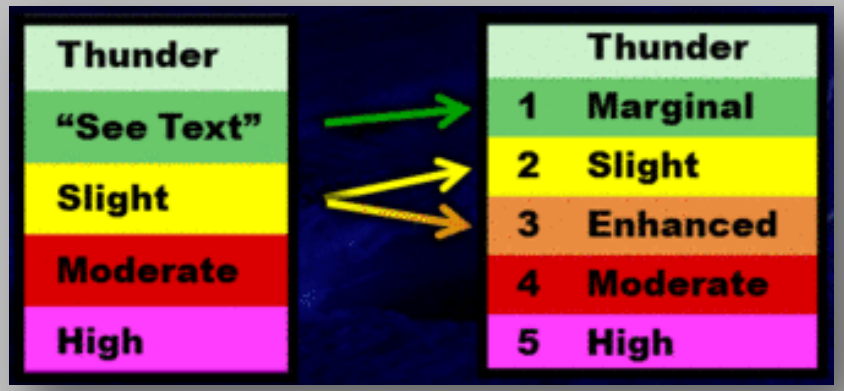
Identify/Forecast the Threat

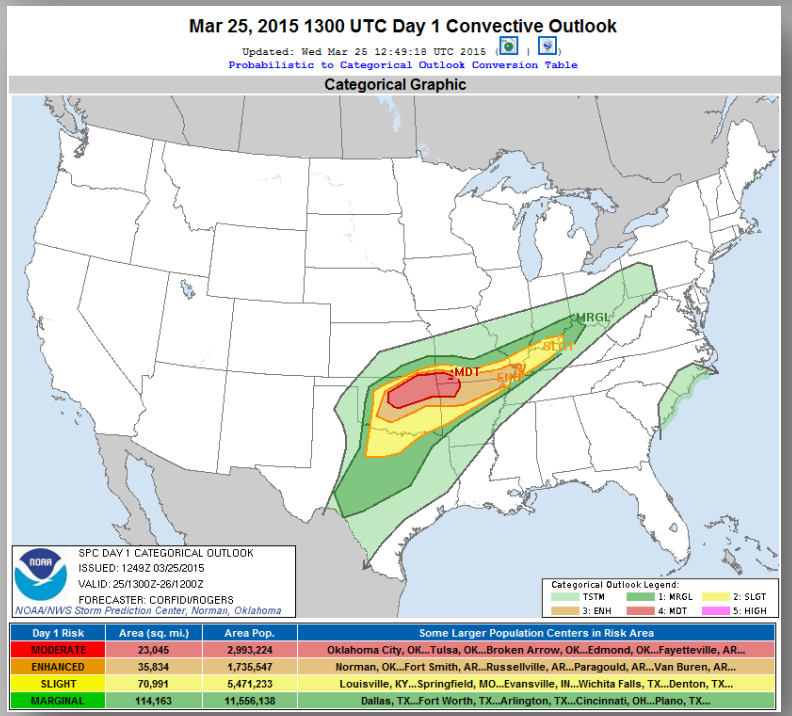
- Due to the large amount of weather data available in most cases, and the complexity of high-impact weather forecasting exploit 26 OWS and NWS tools--is there a threat (short-term and long-term)?
  - 26 OWS Threat Assessment
    - Outlines the potential for severe weather across an area, not necessarily that it will occur at Fort Hood
    - Provides confidence level (Low, Moderate, High, Extremely High)
    - Participate in daily DCO Chat (1130L)
  - SPC Convective Outlooks and Mesoscale Discussions
    - Each outlook involves detailed analysis of recent and current weather data, followed by intensive examination of computer forecast models
    - Mesoscale Discussions are concise short-term guidance messages that address areas of current or expected hazardous weather
  - NWS Dallas/Fort Worth Forecast Discussions, Watches & Warnings, and graphics

Click each of the links above to view the products

New Changes to SPC Outlooks

- Severe weather outlooks include one renamed category (Marginal) and one additional category (Enhanced)
- Categories may now be referred to by name or number
- Remember:
  - Equally dangerous thunderstorms can occur in any risk outlook category—higher categories don't imply more intense/severe thunderstorms, but rather more areal coverage of thunderstorms
  - The risk area can quickly change depending on the environment at any given time/day

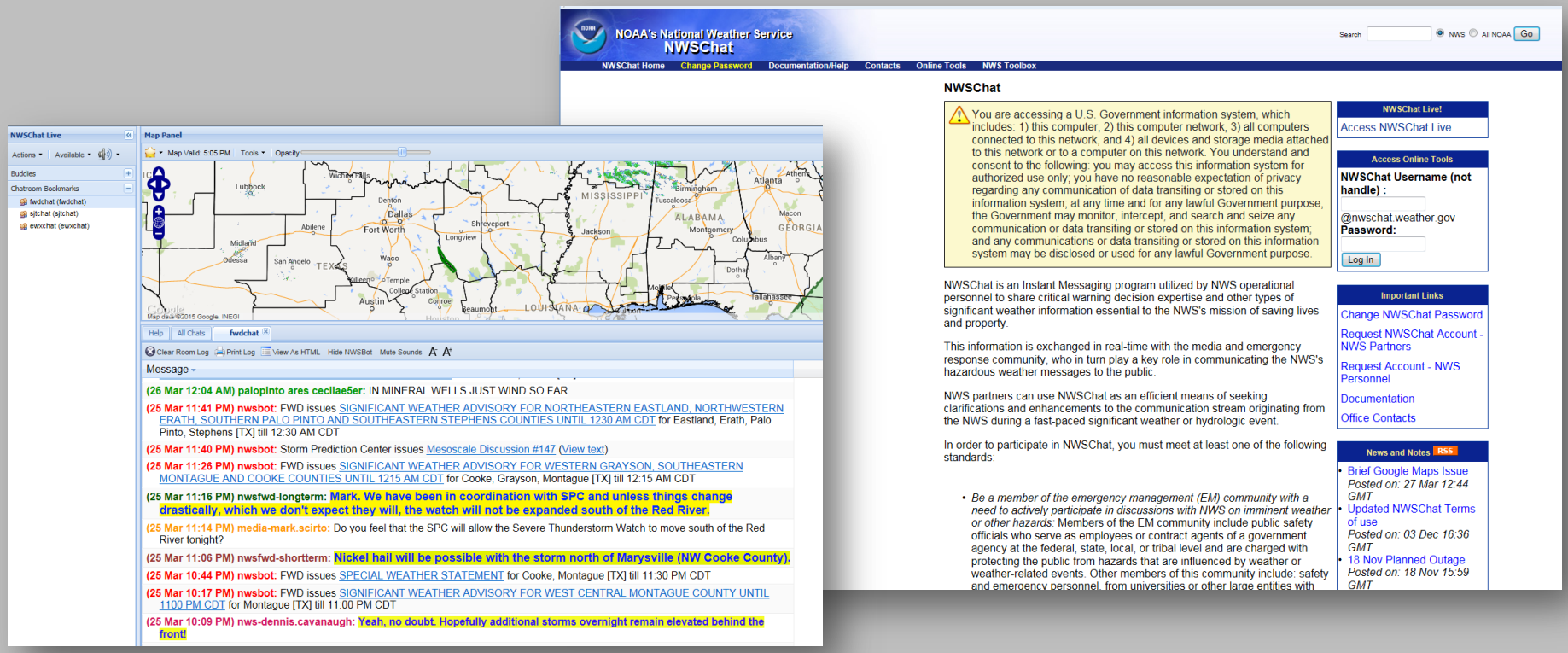




More detailed information on risk categories:
http://www.spc.noaa.gov/misc/about.html

NWSChat

- An Instant Messaging program utilized by NWS operational personnel to share critical warning decision expertise and other types of significant weather information
- Great tool for monitoring current severe weather threat
- Mandatory for 3 WS SWAP Standby Personnel



Identify/Forecast the Threat

- Ok…there is a theat, so dig into the situation yourself—evaluate the potential short-term and long-term
  - Begin with most representative upstream Skew-T to the location and analyze for indication of convective instability in the airmass
  - Analyze upper-air/surface products to determine favorable or unfavorable conditions for severe weather
  - Don’t forget real-time data such as METSAT and radar to evaluate the immediate threat

Next slides refer to AFWA/TN-98/002,Table 3-5; Table 3-3 and Table 3-4 for a review of severe weather analysis indicators and stability indicies

AFWA/TN-98/002 Table 3-5

Product Analysis Matrix/Reasoning

Charts	Feature to Analyze	Why (favorable/unfavorable; weak, moderate, strong chance for severe weather conditions.)
200 mb/300 mb	Identify jet maximums.	• ≤ 55 knots **Weak**
		• 56 to 85 knots **Moderate**
		• ≥ 86 knots **Strong**
	Streamline and identify diffluent areas.	Favorable for development.
	Shade areas of horizontal wind speed shear.	Favorable for development.
500 mb	Identify jet maximums.	• ≤ 35 kt **Weak**
		• 36 to 49 **Moderate**
		• ≥ 50 **Strong**
	Streamline and identify diffluent areas.	Favorable for development.
	Isopleth 12-hour height falls (Oct to Apr) or 24-hour height falls (May to Sep).	• ≤ 30 m **Weak**
		• 31 to 60 m **Moderate**
		• ≥ 61 m **Strong**
	Perform 2°C isotherm analysis, color cold pools, identify thermal ridges and troughs.	Severe activity suppressed near and east of thermal ridge particularly when in phase with streamline ridge.
	Identify areas of cold air advection.	The following temperatures are favorable:
		• Dec to Feb: -16°C or lower.
		• Mar, Apr, Oct, Nov: -14°C or lower.
		• May, Jun: -12°C or lower.
		• Jul to Sep: -10°C or lower.
	Identify dew-point depressions of 6°C or less, moisture analysis.	Cut-off moisture sources indicate a short wave is present.
	Identify areas of vorticity advection.	NVA: **Weak Or Not Favorable.**
		Positive Vorticity isopleths crossing 500-mb height contours:
		• ≤ 30° **Moderate**
		• > 30° **Strong**
		Storms develop on the periphery of the vorticity maximum and not directly below.
700 mb	Perform 2° isotherm analysis, identify thermal troughs and ridges.	Good stacking of cold air here and at 500 mb is favorable for severe.
	Indicate (12-hour) temperature no-change line.	Advancement of the temp. no-change line ahead of the 700-mb trough indicates the surface low will intensify.
	Draw dew-point depression lines.	Moisture fields detached from the main moisture field indicate rising motions and a possible short wave in the area.
	Mark dry line. The dry line can be placed where dew point is ≤ 0°C, the dew point depression is ≥ 7°C, or the RH is ≤ 50 percent.	Weak winds across the dry line: **Weak**
		Winds 15 to 25 knots crossing between 10° and 40°: **Moderate**
		Winds ≥ 26 knots crossing between 41° and 90°: **Strong**
	Streamline and identify confluent areas.	Confluent areas are favorable for severe.

Charts	Feature to Analyze	Why (favorable/unfavorable; weak, moderate, strong chance for severe weather conditions).
850 mb	Streamline and identify confluent zones.	The greater the angle of winds from dry to moist air, the more unstable.
	Identify wind speed maximums.	• ≤ 20 knots **Weak** • 21 to 34 knots **Moderate** • ≥ 35 knots **Strong**
	Draw every 2°C isotherm starting with an isotherm that bisects the entire U.S. Mark thermal ridges.	Thermal ridge is often ahead of convergence zone. Cold air advection often found behind the main convergence zone, unless a dry line forms and moves out ahead of the cold advection. (Warm air is usually ahead of the main convergence zone).
	Draw isodrosotherms every 2°C starting at 6°C (43°F).	Dew point: • < 8°C (46°F) **Weak** • 9°C to 12°C (48 to 54°C) **Moderate** • ≥ 13°C (55°F) **Strong**
	Color in areas of significant moisture.	A diffuse moisture field is unfavorable for development of severe weather. Thermal ridge east of moisture axis: **Weak** Thermal ridge coincident with the moisture axis: **Moderate** Thermal ridge west of the moisture axis: **Strong**
	Identify dry line.	Note the angle of winds crossing from dry to moist air, the greater the angle, the greater the instability. Where the dry line is intruding into moist areas is unstable.
Surface	2-mb isobar analysis	Surface pressure patterns indicate likely areas for severe weather: • > 1009 mb **Weak** • 1009 to 1005 mb **Moderate** • < 1005 **Strong**
	Isallobaric analysis (12-hour) identify areas of falling pressure.	Squall lines often develop in narrow troughs of falling pressure. A strong pressure rise/fall couplet is favorable for severe weather. The following values indicate probability of severe weather: • ≤ 1 mb **Weak** • 2 to 5 mb **Moderate** • > 6 mb **Strong**
	Identify areas of rapid temperature and dew point change	Favorable for development of severe weather
	2° isodrosotherm analysis starting at 50°F (10°C).	Areas of horizontal moisture convergence are favorable. The following dew point temperatures indicate probability of severe weather: • ≤ 50°F (10°C) **Severe Unlikely** • > 51 to 55°F (11 to 12°C) **Weak** • > 56 to 64°F (13 to 17°C) **Moderate** • > 65°F (18°C) **Strong**
	Identify confluent streamline areas.	Areas of strong winds converging with weak winds is favorable.
	Identify highs, lows, fronts, squall lines, and dry lines and mark their previous locations.	Any discontinuity line is a likely place for thunderstorm development. Intersecting discontinuity lines are highly probable locations for development. Use distance between past and current locations to extrapolate onset of thunderstorms.
1000/500 mb Thickness	Mark thickness ridge.	Probable area for squall line.
	Mark thickness no-change line (12-hour).	Indicates area of cold advection.

AFWA/TN-98/002

Severe Weather Indices

Table 3-3. Severe thunderstorm indicators.

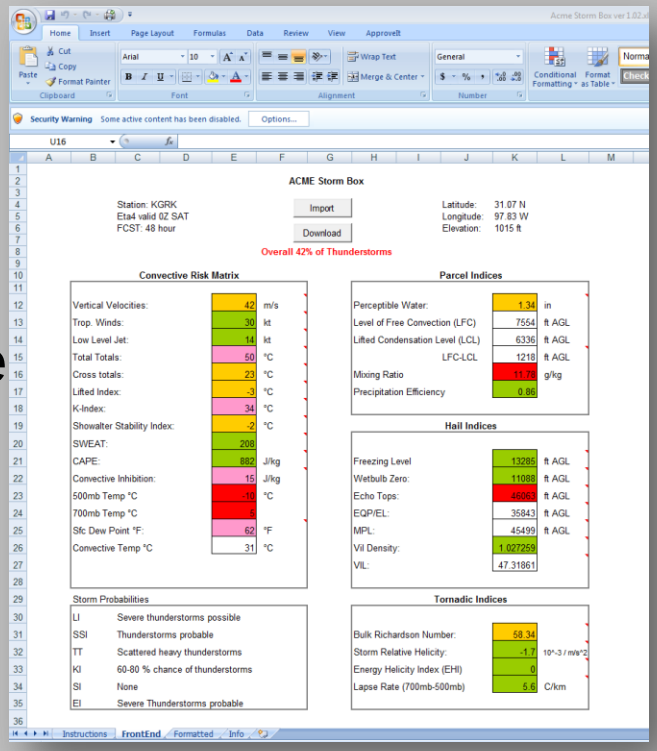
Severe Thunderstorm Indicators				
Index	**Region**	**Weak (Low)**	**Moderate**	**Strong (High)**
Bulk Richardson Number (BRN)		> 50		10 to 50
		Multi-cellular storms		Supercells
Cross Totals (CT)	East of Rockies	22 to 23	24 to 25	> 25
	Gulf Coast	16 to 21	22 to 25	> 25
	West of Rockies	< 22	22 to 25	> 25
Modified Lifted Index (MLI)	Europe	0 to -2	-3 to -5	-5 and lower
Surface Cross Totals (SCTI)	East of 100°W			=> 27
	High Plains			=> 25
	Foothills of Rockies			=> 22
SWEAT Index	Midwest and Plains	< 275	275 - 300	=> 300
	(unreliable at higher elevations)			
Thompson Index (TI)	Over the Rockies	20 to 29	30 to 34	=> 35
	East of Rockies	25 to 34	35 to 39	=> 40
Total-Totals (TT)	West of Rockies	55 to 57	58 to 60	=> 61
	East of Rockies	48 to 49	50 to 55	=> 56
Wet-Bulb Zero (WBZ) Height	Not for use with deep mT air masses	< 5,000 ft	5,000 to 12,000 ft	7,000 to 9,000 ft
			Large Hail	Tornado

Table 3-4. Tornado indicators.

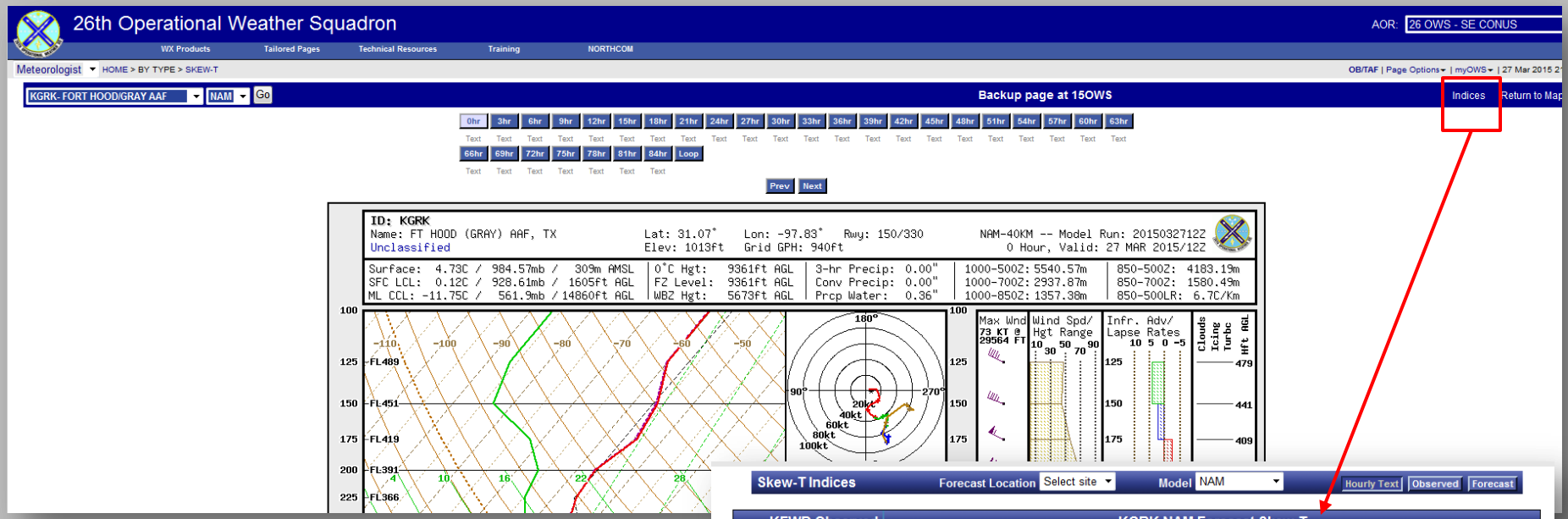
Tornado Indicators		
Index	Value	Interpretation
Energy/Helicity Index (EHI)	0.8 to 1	Weak tornadoes.
	1 to 4	Strong tornadoes.
	> 4	Violent tornadoes.
Lifted Index (LI)	< -6	Tornadoes possible.
Mean Storm Inflow (MSI)	> 20	Mesocyclone development possible.
Showalter Index (SSI)	< -6	Tornadoes possible.
Storm Relative Directional Shear (SRDS)	> 70	Mesocyclone development possible
Storm Relative Helicity (SRH)	> 400	Tornadoes possible.
SWEAT Index	≥ 400	Tornadoes possible.
Wet-Bulb Zero (WBZ) Height	7,000 to 9,000 ft (mP)	Families of tornadoes.
	≥ 11,000 ft (mT)	Single tornadoes.

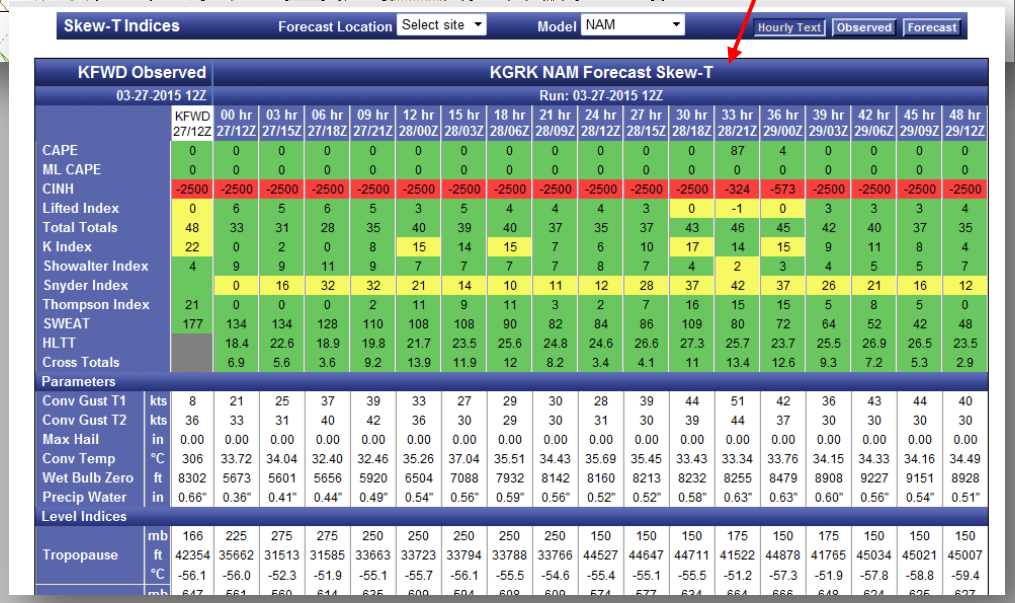
Identify/Forecast the Threat

- Keep digging—evaluate the potential
  - Review various forecast products
  - Look for consistencies among products to gain confidence in your forecast
- Apply specific forecast techniques—for example, use 3 WS MEF checklist (Acme Storm Box) available on 3 WS shared-drive Tools folder (Note: First tab (Instructions Worksheet) has operating instructions)
- The last slides will cover just a few products you might want to consider



Model Forecast Soundings/Indicies





KFWD Observed		KGRK NAM Forecast Skew-T																	
03-27-2015 12Z		Run: 03-27-2015 12Z																	
	KFWD 27/12Z	00 hr 27/12Z	03 hr 27/15Z	06 hr 27/18Z	09 hr 27/21Z	12 hr 28/00Z	15 hr 28/03Z	18 hr 28/06Z	21 hr 28/09Z	24 hr 28/12Z	27 hr 28/15Z	30 hr 28/18Z	33 hr 28/21Z	36 hr 29/00Z	39 hr 29/03Z	42 hr 29/06Z	45 hr 29/09Z	48 hr 29/12Z
CAPE	0	0	0	0	0	0	0	0	0	0	0	0	87	4	0	0	0	0
ML CAPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CINH	-2500	-2500	-2500	-2500	-2500	-2500	-2500	-2500	-2500	-2500	-2500	-2500	-324	-573	-2500	-2500	-2500	-2500
Lifted Index	0	6	5	6	5	3	5	4	4	4	3	0	-1	0	3	3	3	4
Total Totals	48	33	31	28	35	40	39	40	37	35	37	43	46	45	42	40	37	35
K Index	22	0	2	0	8	15	14	15	7	6	10	17	14	15	9	11	8	4
Showalter Index	4	9	9	11	9	7	7	7	7	8	7	4	2	3	4	5	5	7
Snyder Index		0	16	32	32	21	14	10	11	12	28	37	42	37	26	21	16	12
Thompson Index	21	0	0	0	2	11	9	11	3	2	7	16	15	15	5	8	5	0
SWEAT	177	134	134	128	110	108	108	90	82	84	86	109	80	72	64	52	42	48
HLTT		18.4	22.6	18.9	19.8	21.7	23.5	25.6	24.8	24.6	26.6	27.3	25.7	23.7	25.5	26.9	26.5	23.5
Cross Totals		6.9	5.6	3.6	9.2	13.9	11.9	12	8.2	3.4	4.1	11	13.4	12.6	9.3	7.2	5.3	2.9
Parameters																			
Conv Gust T1	kts	8	21	25	37	39	33	27	29	30	28	39	44	51	42	36	43	44	40
Conv Gust T2	kts	36	33	31	40	42	36	30	29	30	31	30	39	44	37	30	30	30	30
Max Hail	in	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Conv Temp	°C	306	33.72	34.04	32.40	32.46	35.26	37.04	35.51	34.43	35.69	35.45	33.43	33.34	33.76	34.15	34.33	34.16	34.49
Wet Bulb Zero	ft	8302	5673	5601	5656	5920	6504	7088	7932	8142	8160	8213	8232	8255	8479	8908	9227	9151	8928
Precip Water	in	0.66"	0.36"	0.41"	0.44"	0.49"	0.54"	0.56"	0.59"	0.56"	0.52"	0.52"	0.58"	0.63"	0.63"	0.60"	0.56"	0.54"	0.51"
Level Indices																			
Tropopause	mb	166	225	275	275	250	250	250	250	250	150	150	150	175	150	175	150	150	150
	ft	42354	35662	31513	31585	33663	33723	33794	33788	33766	44527	44647	44711	41522	44878	41765	45034	45021	45007
	°C	-56.1	-56.0	-52.3	-51.9	-55.1	-55.7	-56.1	-55.5	-54.6	-55.4	-55.1	-55.5	-51.2	-57.3	-51.9	-57.8	-58.8	-59.4

- For a finer scale look, utilize forecast soundings
- Reference AFWA/TN-98/002 Table 3-3 and 3-4 for info on specific indicies

TARP Display

- ***Great tool that provides an easy read display of key parameters***

KGRK - ROBERT GRAY AAF | NAM | 27 Mar 2015 12Z Extracted Model Run

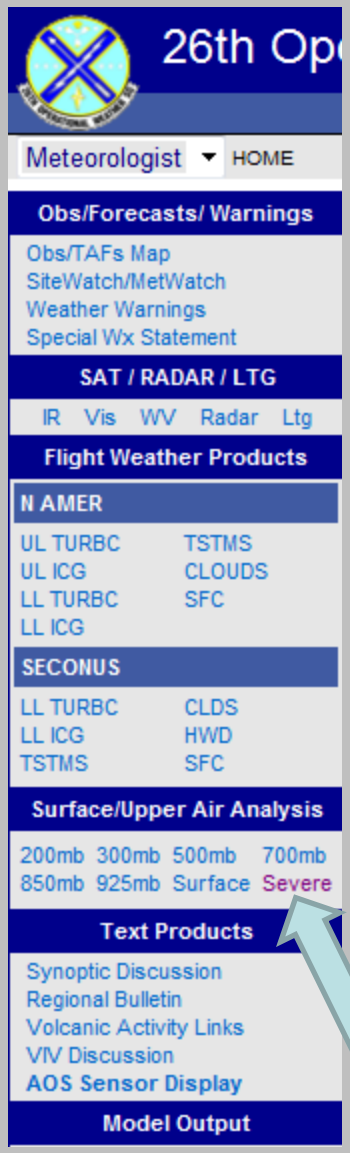
Elev: 1014ft / 309m Lat: 31.07 Long: -97.83 Runway: 150/330

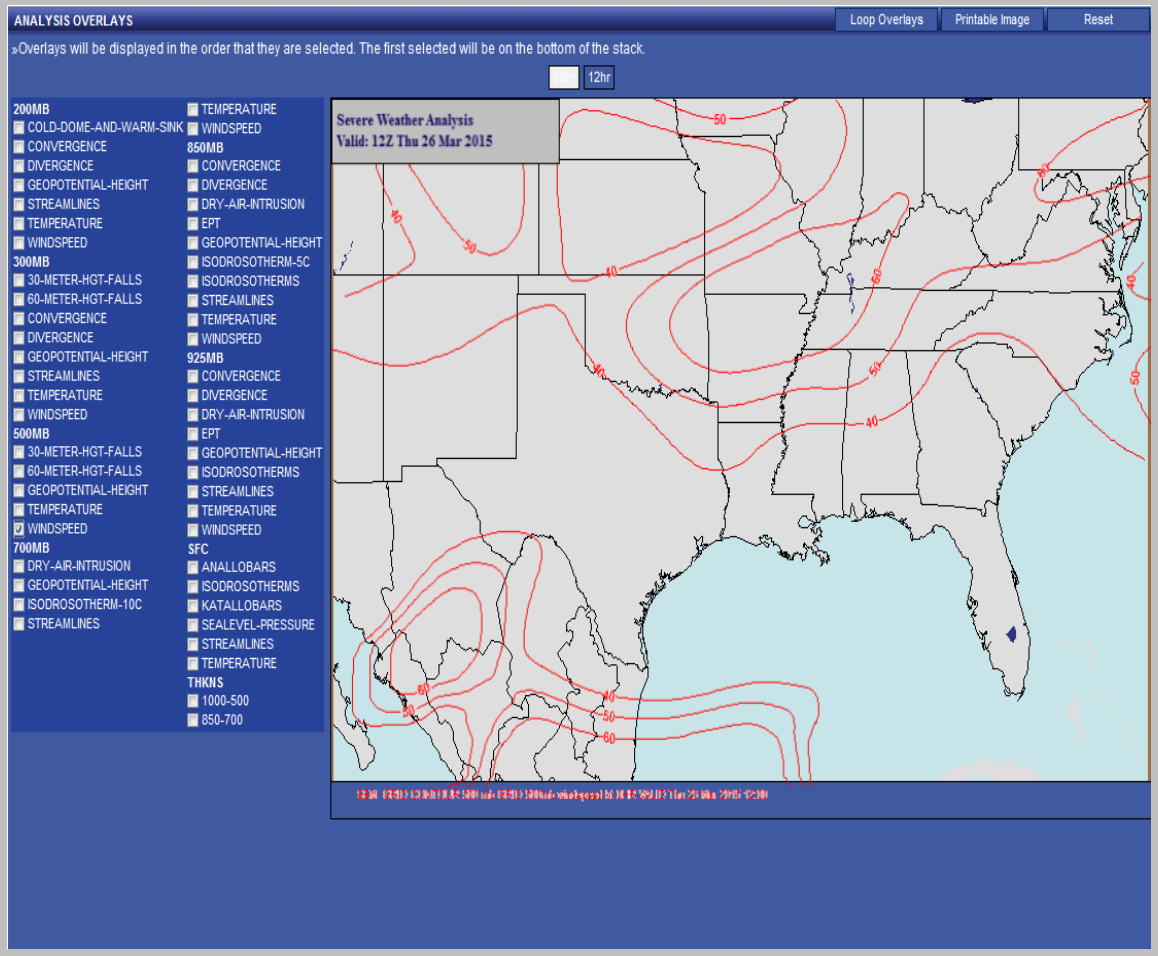
Gen Wx | Humidity | Temperature | Winds | Visibility | Icg / Turb | Press / Hgt | D-Value | Vert Vel | Clouds | Precip | Severe | Winter | Combined | TAF | Full Text

Severe

Valid	0 hr Fri 27/12Z	3 hr Fri 27/15Z	6 hr Fri 27/18Z	9 hr Fri 27/21Z	12 hr Sat 28/00Z	15 hr Sat 28/03Z	18 hr Sat 28/06Z	21 hr Sat 28/09Z	24 hr Sat 28/12Z	27 hr Sat 28/15Z	30 hr Sat 28/18Z	33 hr Sat 28/21Z	36 hr Sun 29/00Z	39 hr Sun 29/03Z	42 hr Sun 29/06Z	45 hr Sun 29/09Z	48 hr Sun 29/12Z	51 hr Sun 29/15Z	54 hr Sun 29/18Z	57 hr Sun 29/21Z	60 hr Mon 30/00Z	63 hr Mon 30/03Z	66 hr Mon 30/06Z	69 hr Mon 30/09Z	72 hr Mon 30/12Z	75 hr Mon 30/15Z	78 hr Mon 30/18Z	81 hr Mon 30/21Z	84 hr Tue 31/00Z
Temperature																													
2m Temp °F:	41	55	70	74	72	60	54	49	46	62	75	80	73	60	56	53	49	63	75	79	74	64	62	61	61	64	69	74	75
2m Dpt °F:	34	40	43	42	47	46	46	43	41	45	50	50	53	51	49	49	47	53	60	62	61	60	60	60	60	61	64	64	65
Conv Temp °F:	93	93	90	90	95	99	96	94	96	96	92	92	93	93	94	94	94	93	92	92	93	94	95	94	93	92	91	90	76
Precipitation																													
3 Hr Precip (in):	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0	0	0
3 Hr Conv Precip (in):	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Precipital Water:	0.36	0.41	0.44	0.49	0.54	0.56	0.59	0.56	0.52	0.52	0.58	0.63	0.63	0.60	0.56	0.54	0.51	0.53	0.61	0.70	0.71	0.67	0.65	0.72	0.73	0.82	0.87	0.89	1.02
Hail Size (in):	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.18	0	0
General Indicies																													
SSI:	9.14	9.90	11.36	9.79	7.10	7.62	7.01	7.66	8.28	7.19	4.31	2.97	3.44	4.74	5.53	5.95	7.04	8.09	7.98	7.01	6.01	4.57	5.29	6.35	6.68	6.48	6.14	5.01	-2.36
SWEAT:	134	134	128	110	108	108	90	82	84	86	109	80	72	64	52	42	48	50	62	105	78	62	64	68	93	91	91	97	346.3
MU LI:	6	6	6	5	4	5	4	4	4	3	1	-1	0	3	3	3	4	4	-1	-4	-2	0	2	2	2	-1	-3	-6	-7
MU TTI:	33.6	31.9	28.2	35.3	40.6	39.3	40.2	37.8	36	37.6	43.9	46.8	45.8	42.6	40.4	37.4	35.5	33.5	34.2	35.7	40	42.7	39.2	39	39	38.2	38.2	41.6	54.9
MU KI:	0	3	-1	8	15	15	16	8	7	11	18	14	15	9	11	9	5	4	4	5	9	11	6	16	16	15	15	14	26
Heights																													
TROP Hgt (ft):	36674	32526	32598	34675	34736	34806	34801	34779	45540	45659	45723	42534	45890	42778	46046	46033	46019	46088	42868	46035	46030	46058	46006	45921	45898	37467	37470	37455	39918
Wet Bulb 0 Hgt (ft):	6687	6615	6670	6934	7518	8102	8946	9156	9174	9227	9246	9269	9493	9922	10241	10165	9942	9925	9991	10061	10257	9882	9735	9689	9648	9627	9545	9419	9396
MU EQ Hgt (ft):	-	-	-	-	-	-	-	-	-	-	-	27267	18972	-	-	-	-	-	31199	32117	30556	25591	2194	2227	2766	23279	24485	35909	38348
MU LFC Hgt (ft):	-	-	-	-	-	-	-	-	-	-	-	15101	16485	-	-	-	-	-	11612	10105	11467	14470	1409	1411	2026	16041	1858	2793	3739
MU LCL Hgt (ft):	17315	15117	6632	8132	6674	14383	14226	14891	14290	15036	6460	7525	5556	16387	15445	15424	15453	8283	3852	4586	3966	3103	1409	1411	2026	4741	1858	2793	3360
Probabilities																													
Prob Precip (%):	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	52%	85%	75%	37%	0%	0%
Prob TSTM (%):	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	2%	15%	0%	0%
Prob Tornado (%):	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%	0%	0%
Prob Lightning (%):	0%	0%	0%	0%	1%	6%	8%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	32%	33%	33%	0%	33%	2%	1%	3%	55%	56%	56%
Winds																													
Conv Gust Spd (kt):	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0
T1 Gust (kt):	21	25	37	39	33	27	29	30	28	39	44	51	42	36	43	44	40	39	39	47	38	44	41	39	37	35	28	36	38
T2 Gust (kt):	33	31	40	42	36	30	29	30	31	30	39	44	37	30	30	30	30	30	38	42	37	32	32	31	30	30	33	37	38
Tornado Parameters																													
MU CAPE:	0	0	0	0	0	0	0	0	0	0	0	88	5	0	0	0	0	0	368	938	520	37	12	1	2	69	309	640	959
DCAPE:	33	41	206	452	521	491	423	318	191	47	231	321	318	270	188	33	285	293	314	430	312	273	245	179	242	252	293	433	546
Sig Torn Param:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6KM SHEAR (m/s):	22	21	16	16	21	22	17	13	15	16	16	16	15	15	16	17	17	15	13	16	20	18	17	14	11	11	11	13	14
0-1KM EHI:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0-4KM VGP:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0-1KM SRH (m2/s2):	134	91	62	17	59	114	95	41	18	18	51	80	119	134	86	45	-15	-9	59	106	137	122	58	16	57	75	67	53	13
0-2KM SRH (m2/s2):	102	64	22	59	175	267	227	97	38	17	51	99	175	165	113	64	3	15	66	111	182	163	107	54	46	31	28	44	66
0-3KM SRH (m2/s2):	117	104	74	99	199	291	240	104	50	45	64	110	198	197	132	72	9	27	88	143	223	190	127	67	49	31	34	56	69

26 OWS Severe Weather Analysis Overlay



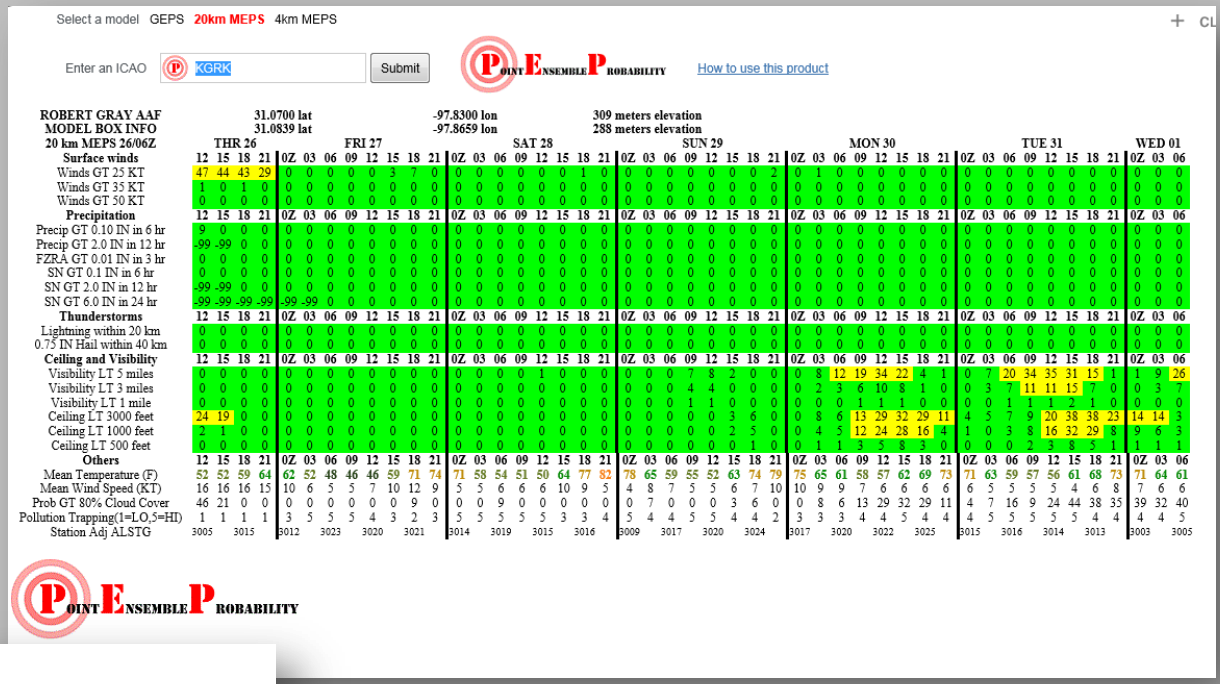


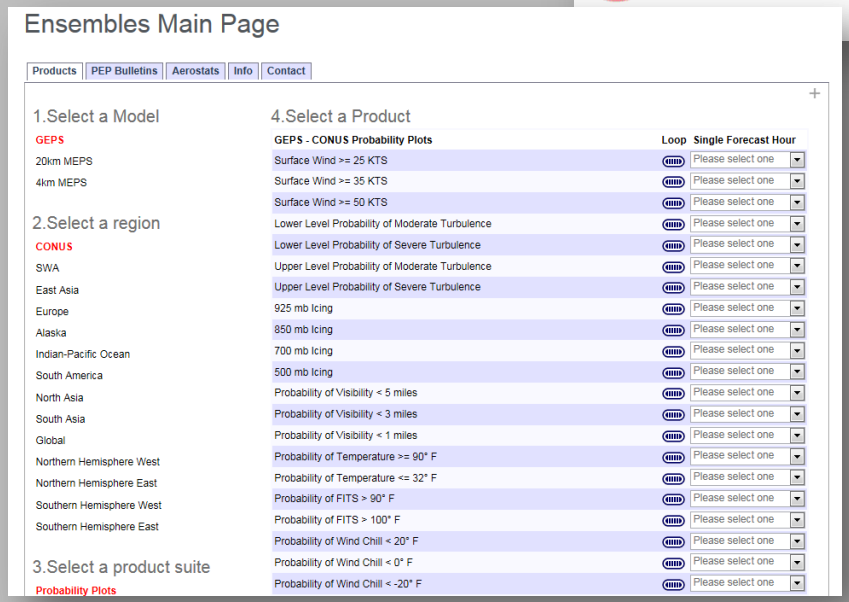
*Click the **Severe** button*

*Provides an easy to use tool when evaluating parameters from **AFWA/TN-98/002 Table 3-5**

AFWA Ensembles

Point Ensemble Probability is a great long range and first look at severe potential



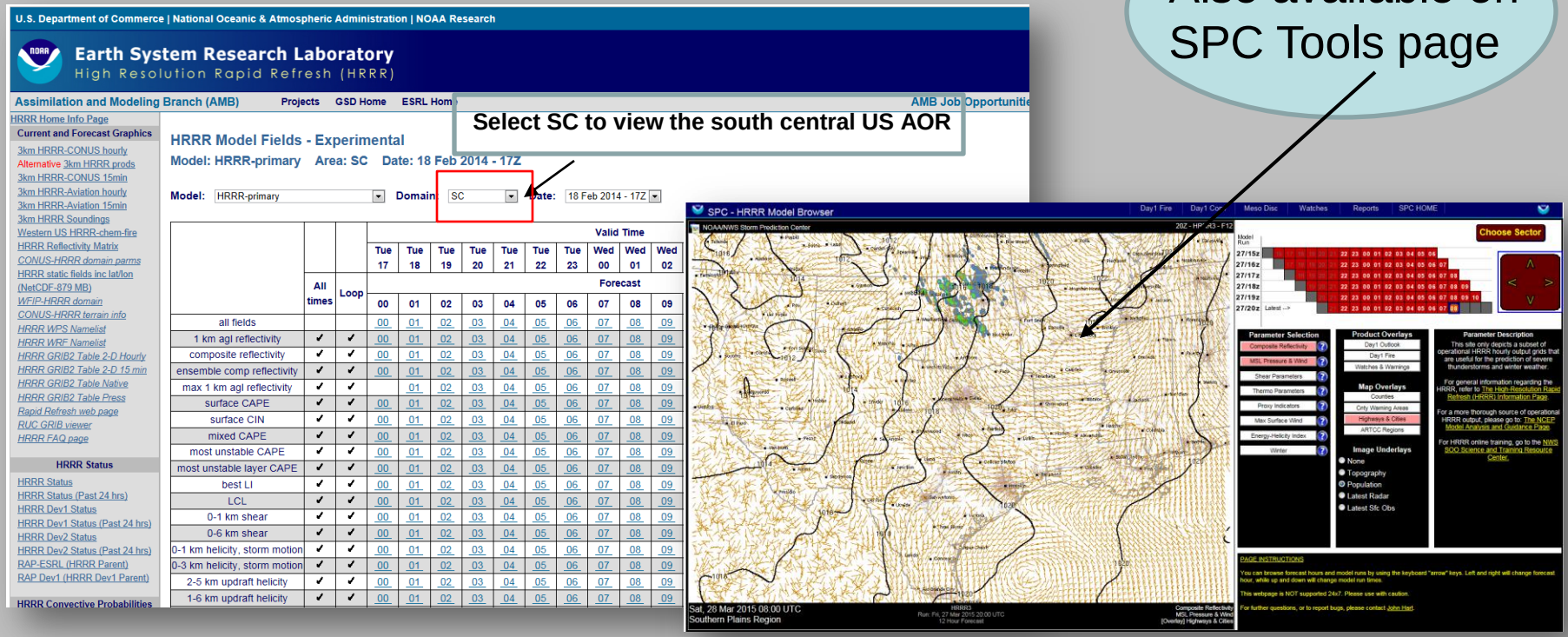


High Resolution Rapid Refresh (HRRR)

- Experimental NOAA real-time 3-km resolution, **hourly updated**, cloud-resolving atmospheric model, initialized by 3km grids with 3km radar assimilation over a 1-hr period
- Designed to provide rapidly updated model guidance on convective storms for air traffic management, severe weather forecasting, and NOAA National Weather Service Warn-On Forecast

http://rapidrefresh.noaa.gov/HRRR/

Also available on SPC Tools page



Summary

- Know the threats--Fort Hood WWAs
- How do you respond--SWAP
- Know the significant impacts to Fort Hood operations
- Understand automated vs augmented observations and how to supplement when required
- Understand basic severe weather indicies and indicators
- Identify/forecast the threat—exploit 26 OWS and NWS products/expertise and evaluate the various products available to increase your confidence in the forecast

Remember--as soon as the <u>potential</u> of thunderstorms is expected, use available tools and resources to evaluate how strong those storms will become

References

AFMAN15-111 IC-1 (13Jan2015)

FHR115-1 (21Feb13)

FHR95-1 (1Apr13)

AFWA/TN-98/002

http://www.theweatherprediction.com/

DRYLINE MAGIC by Tim Marshall,
http://www.southalabama.edu/meteorology/rwade/Notes/Severe%20Weather%20Soundings.pdf

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