


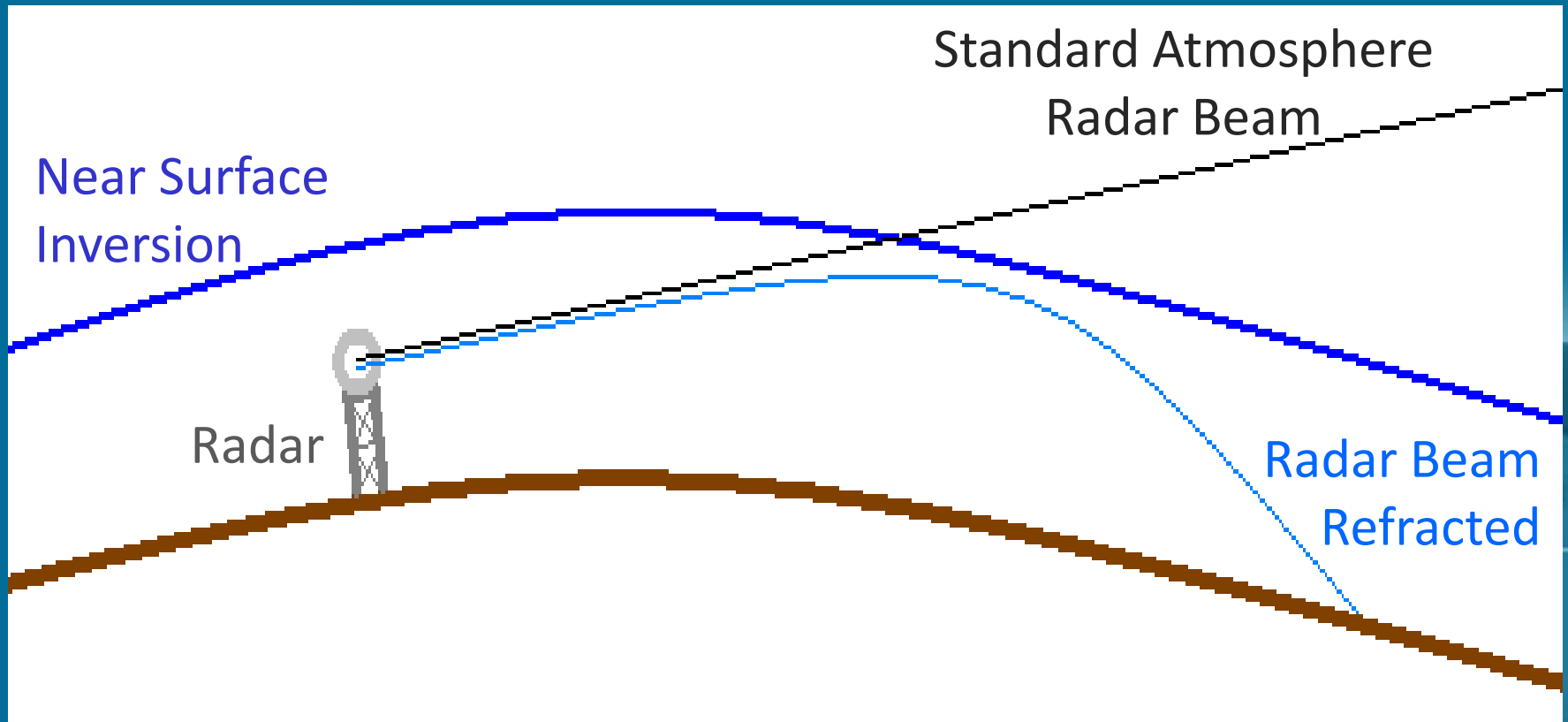
# Severe /Non- Severe Weather Case Study 17 September 2007

Matt Masek

# OUTLINE

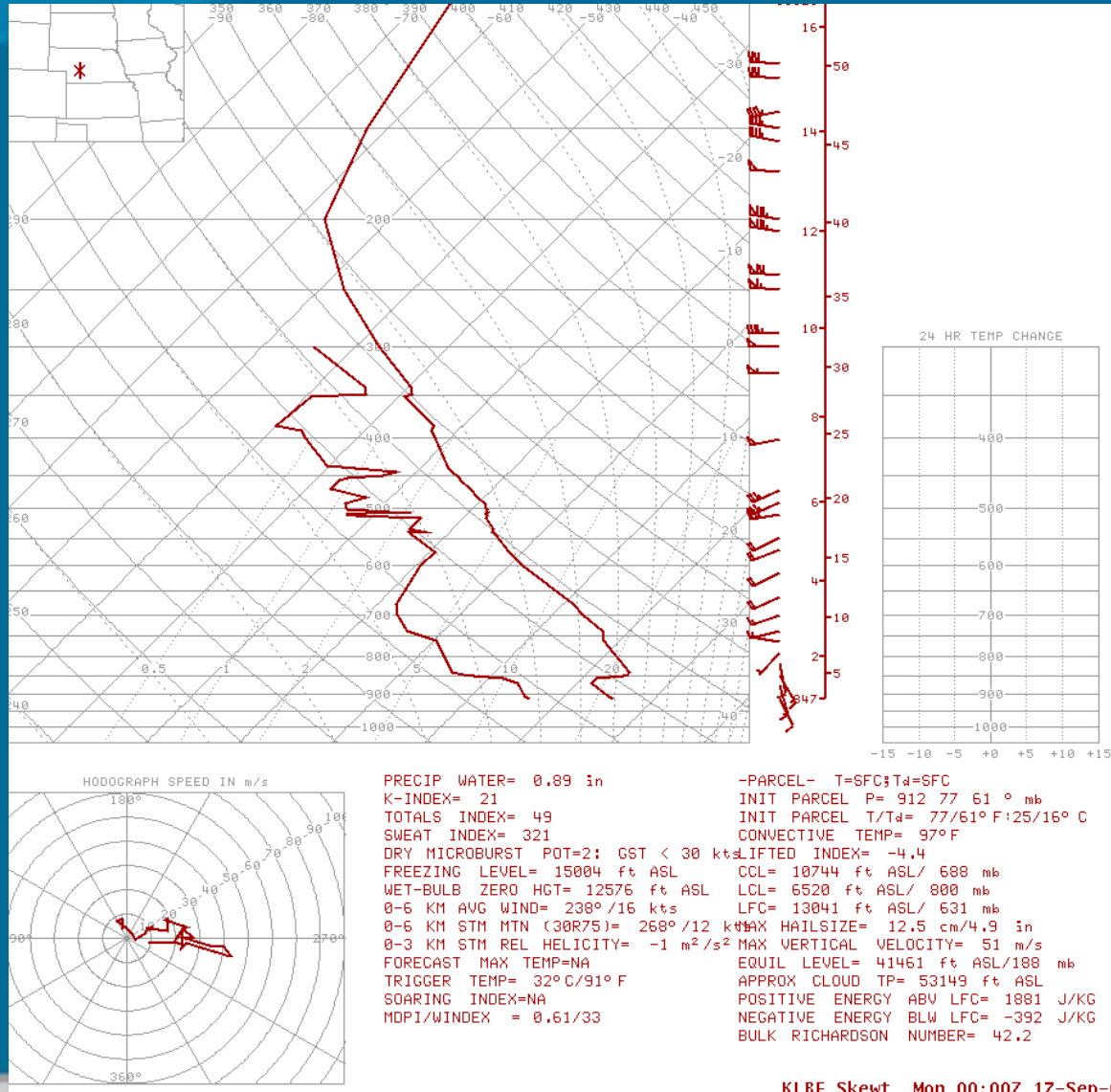
- Radar Physics (Super Refraction)
  - Soundings (Raob, RUC, LAPS)
  - Radar Loops (Ref, Vel)
  - Severe Weather Reports
  - Non Severe Weather Reports
  - Theory (Inversion Strength/Effect)
  - Conclusion
- 

# SUPER REFRACTION



# 00z RAOB SOUNDINGS

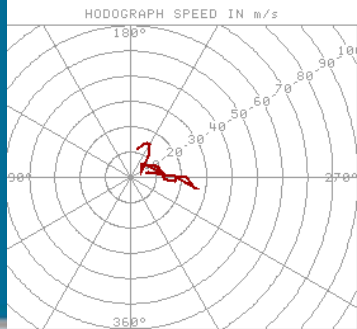
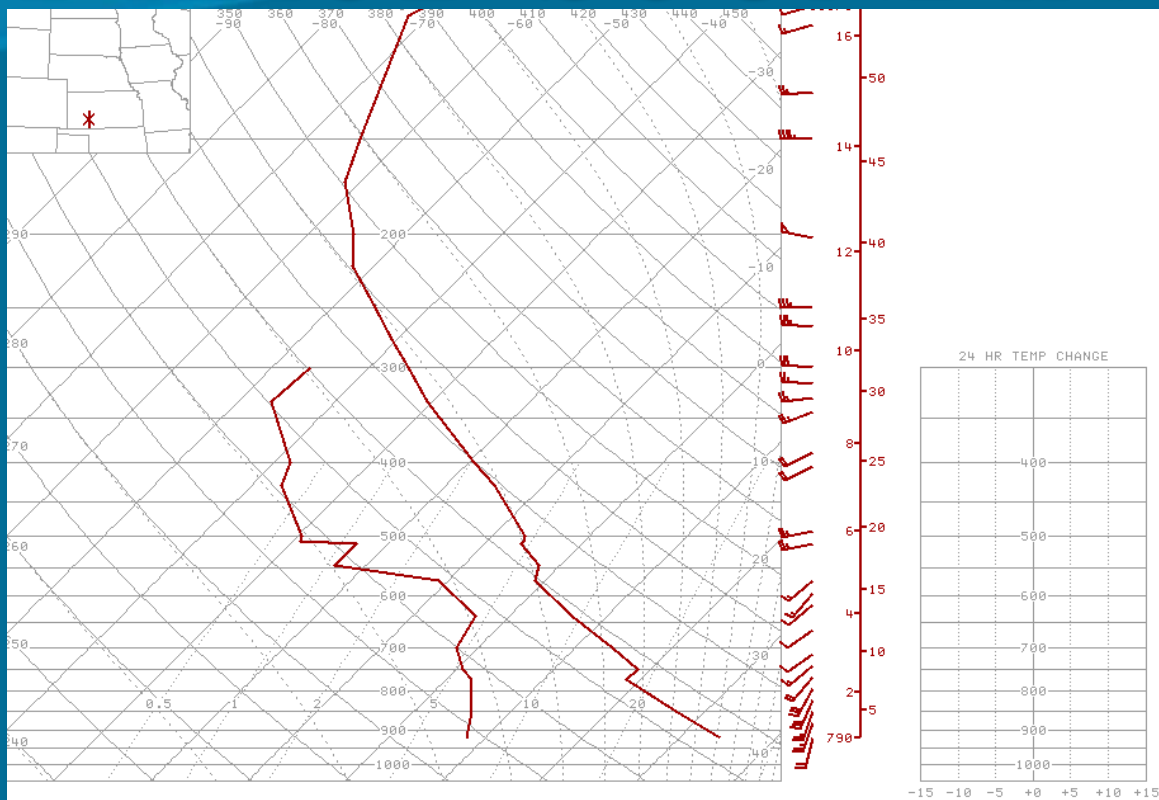
LBF





# 00z RAOB SOUNDINGS

DDC

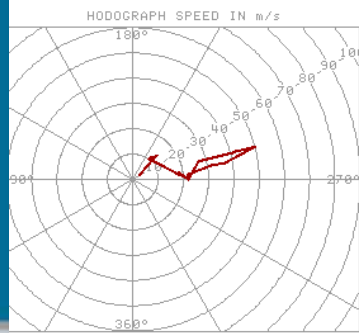
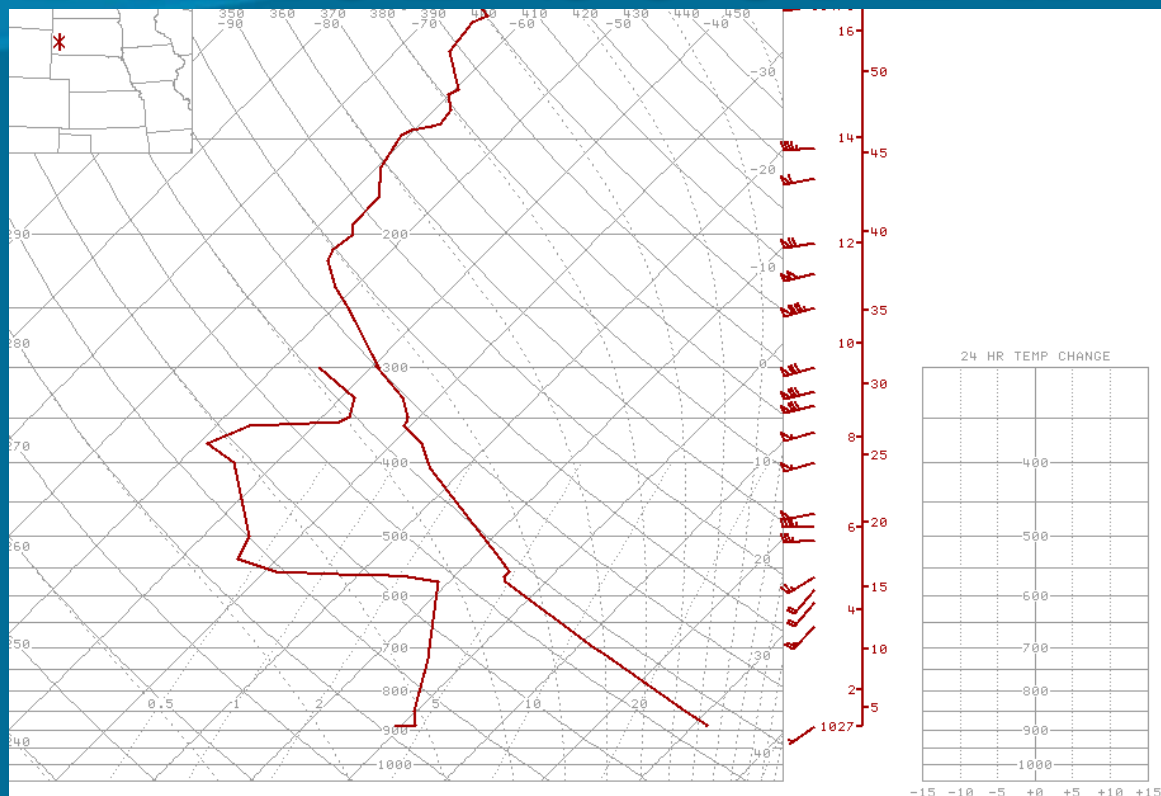


PRECIP WATER= 0.04 in  
 K-INDEX= 23  
 TOTALS INDEX= 46  
 SWEAT INDEX= 279  
 DRY MICROBURST POT=4: GST > 40 kts  
 FREEZING LEVEL= 15391 ft ASL  
 WET-BULB ZERO HGT= 13537 ft ASL  
 0-6 KM AVG WIND= 225°/17 kts  
 0-6 KM STM MTN (30R75)= 255°/13 kts  
 0-3 KM STM REL HELICITY= 43 m<sup>2</sup>/s<sup>2</sup>  
 FORECAST MAX TEMP=NA  
 TRIGGER TEMP= 33° C/92° F  
 SOARING INDEX=NA  
 MDPI/WINDEX = 0.36/47

-PARCEL- T=SFC;Td=SFC  
 INIT PARCEL P= 920 93 46 ° mb  
 INIT PARCEL T/Td= 93/46° F:34/8° C  
 CONVECTIVE TEMP= 101° F  
 LIFTED INDEX= 1.0  
 CCL= 14640 ft ASL/ 596 mb  
 LCL= 13133 ft ASL/ 631 mb  
 LFCs= 23539 ft ASL/ 422 mb,  
 23627 ft ASL/ 421 mb  
 MAX HAILSIZE= 0.9 cm/0.4 in  
 MAX VERTICAL VELOCITY= 14 m/s  
 EQUIL LEVEL= 34366 ft ASL/265 mb  
 APPROX CLOUD TP= 41010 ft ASL  
 POSITIVE ENERGY ABV LFC= 124 J/KG  
 NEGATIVE ENERGY BLW LFC= -250 J/KG  
 BULK RICHARDSON NUMBER= 6.9

# 00z RAOB SOUNDINGS

UNR

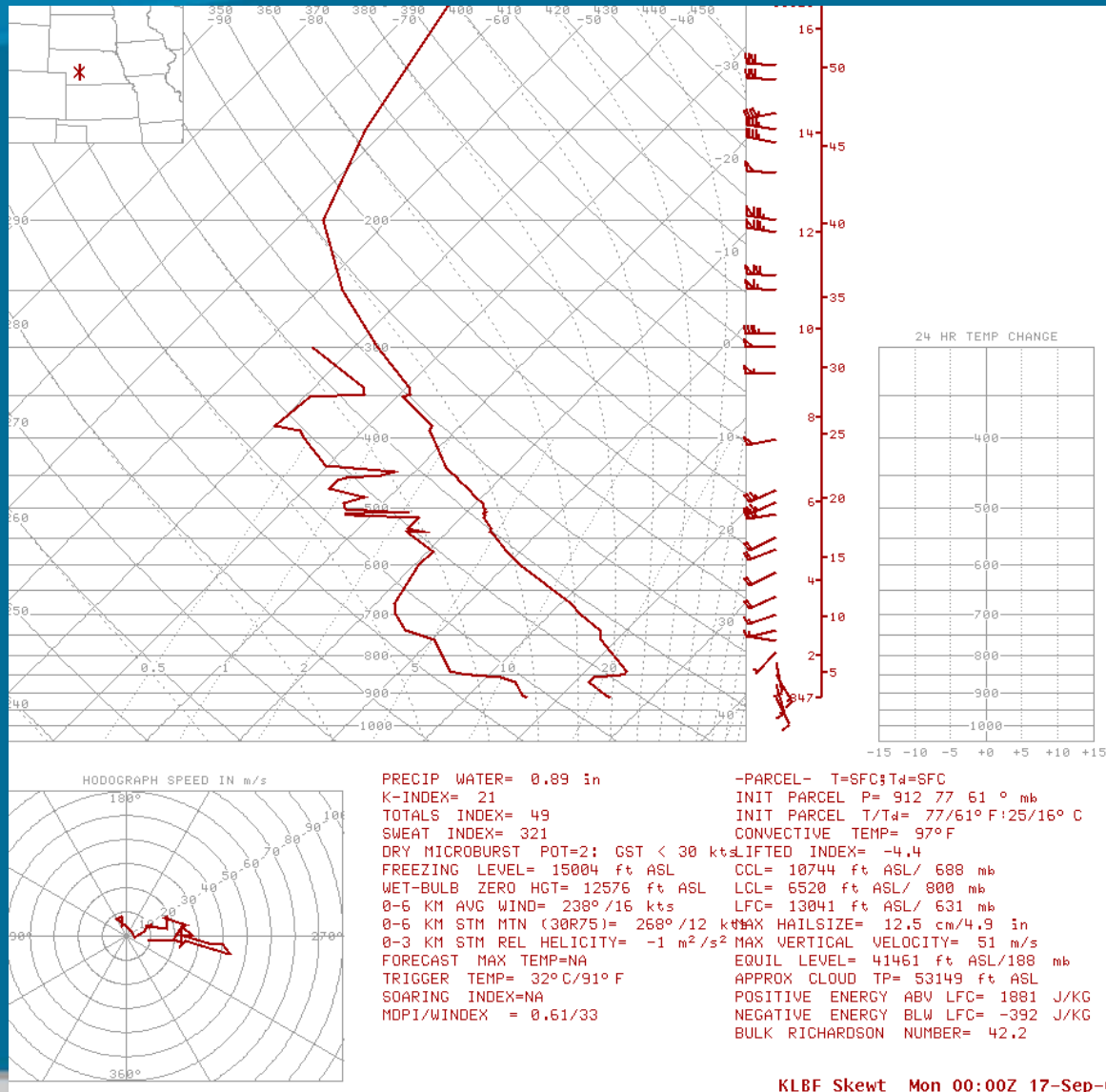


PRECIP WATER= 0.53 in  
 K-INDEX= 15  
 TOTALS INDEX= 43  
 SWEAT INDEX= 63  
 DRY MICROBURST POT=4: GST > 40 kts  
 FREEZING LEVEL= 14054 ft ASL  
 WET-BULB ZERO HGT= 12095 ft ASL  
 0-6 KM AVG WIND= 243°/22 kts  
 0-6 KM STM MTN (30R75)= 273°/17 kts  
 0-3 KM STM REL HELICITY= 46 m<sup>2</sup>/s<sup>2</sup>  
 FORECAST MAX TEMP=NA  
 TRIGGER TEMP= 31°C/89° F  
 SOARING INDEX=NA  
 MDPI/WINDEX = 0.34/40

-PARCEL- T=SFC;Td=SFC  
 INIT PARCEL P= 889 88 30 ° mb  
 INIT PARCEL T/Td= 88/30° F:31/0° C  
 CONVECTIVE TEMP= 94° F  
 LIFTED INDEX= 1.0  
 CCL= 17429 ft ASL/ 530 mb  
 LCL= 16219 ft ASL/ 555 mb  
 LFCs= 22063 ft ASL/ 441 mb,  
 22227 ft ASL/ 438 mb  
 MAX HAILSIZE= 0.1 cm/0.0 in  
 MAX VERTICAL VELOCITY= 4 m/s  
 EQUIL LEVEL= 25016 ft ASL/390 mb  
 APPROX CLOUD TP= 28379 ft ASL  
 POSITIVE ENERGY ABV LFC= 7 J/KG  
 NEGATIVE ENERGY BLW LFC= -131 J/KG  
 BULK RICHARDSON NUMBER=NONE

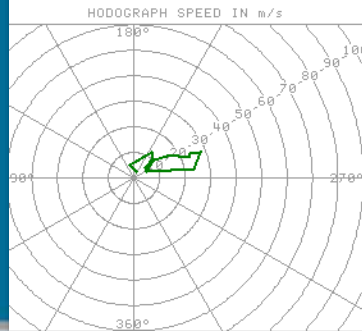
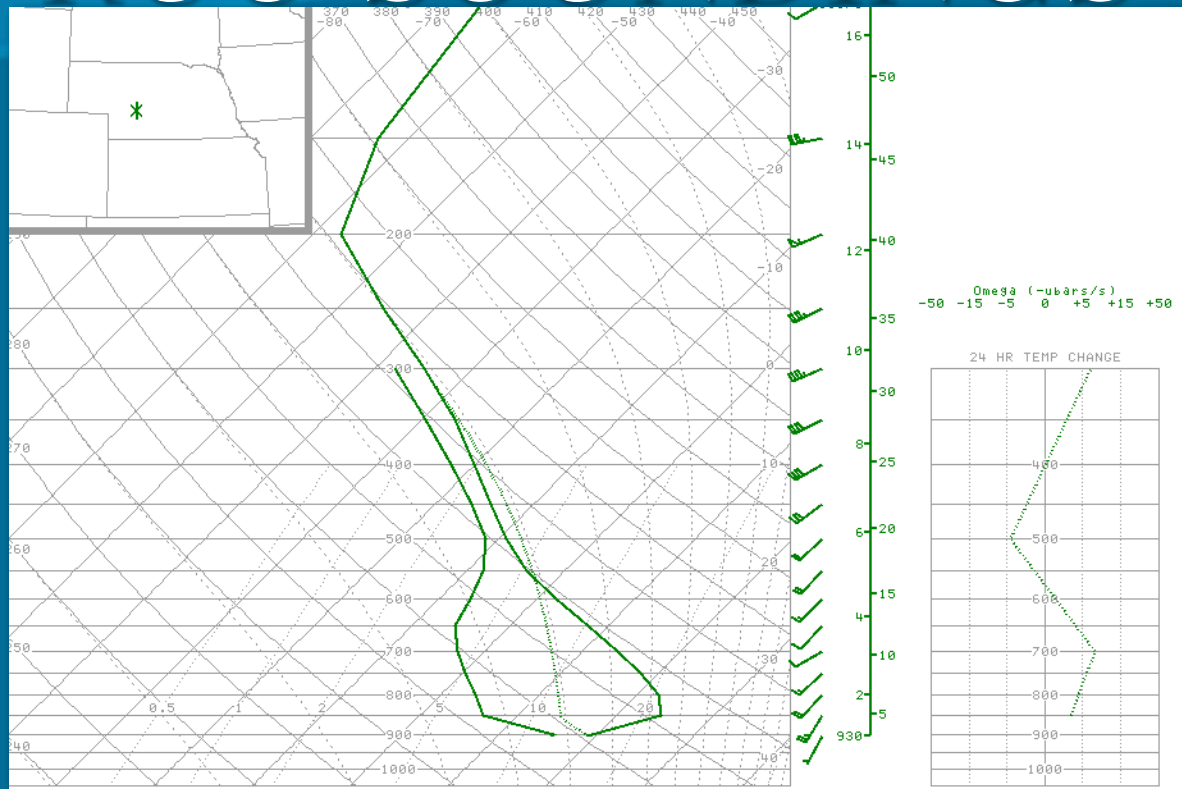
# 00z RAOB SOUNDINGS

LBF



# RUC SOUNDINGS

LBF  
04z

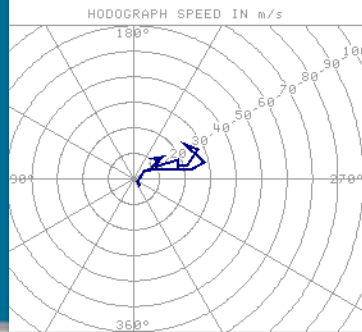
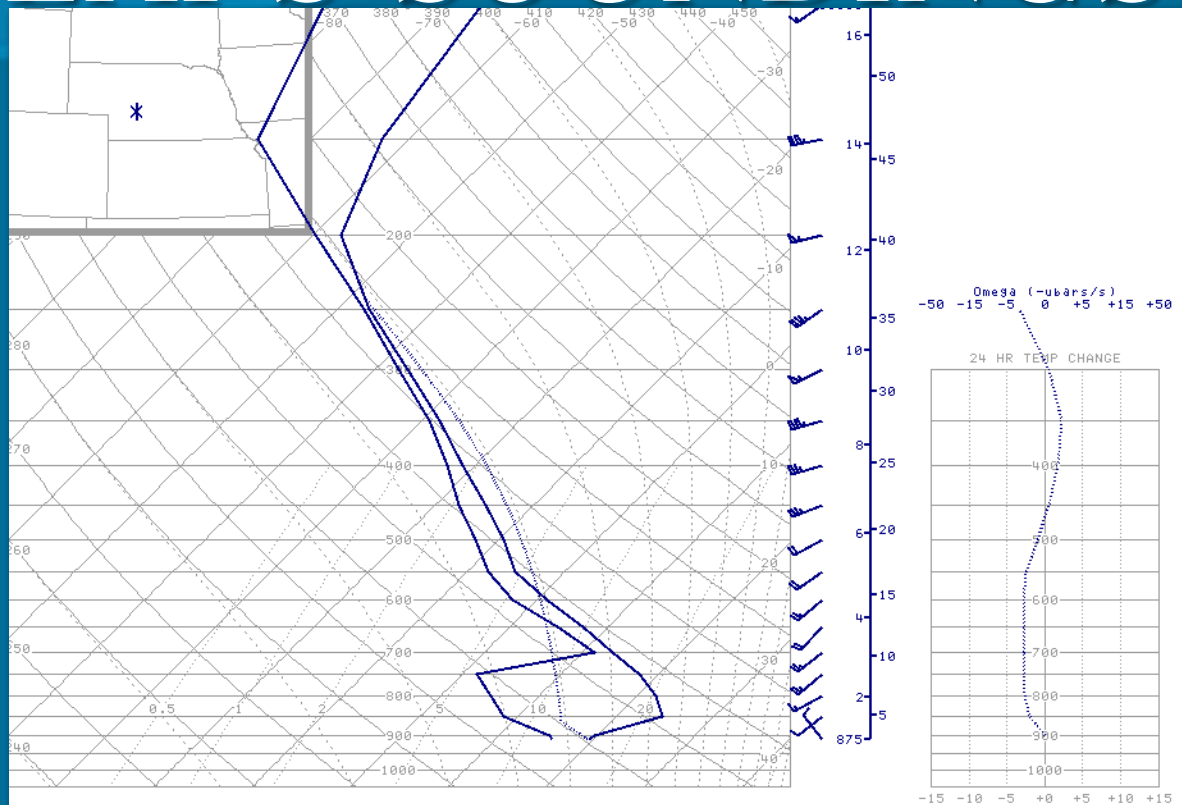


PRECIP WATER= 1.00 in  
 K-INDEX= 24  
 TOTALS INDEX= 49  
 SWEAT INDEX= 205  
 DRY MICROBURST POT=2; GST < 30 kt  
 FREEZING LEVEL= 15291 ft ASL  
 WET-BULB ZERO HGT= 13440 ft ASL  
 0-6 KM AVG WIND= 226°/17 kts  
 0-6 KM STM MTN (30R75)= 256°/13 kt  
 0-3 KM STM REL HELICITY= 83 m<sup>2</sup>/s<sup>2</sup>  
 FORECAST MAX TEMP=NA  
 TRIGGER TEMP= 33°C/92° F  
 SOARING INDEX=NA  
 MDPI/WINDEX = 0.21/0

-PARCEL- T=SFC;Td=SFC  
 INIT PARCEL P= 905 66 59 ° mb  
 INIT PARCEL T/Td= 66/59° F:19/15° C  
 CONVECTIVE TEMP= 96°F  
 LIFTED INDEX= -1.5  
 CCL= 11236 ft ASL/ 677 mb  
 LCL= 4634 ft ASL/ 856 mb  
 LFC= 16158 ft ASL/ 563 mb  
 MAX HAILSIZE= 1.2 cm/0.5 in  
 MAX VERTICAL VELOCITY= 16 m/s  
 EQUIL LEVEL= 30593 ft ASL/312 mb  
 APPROX CLOUD TP=NA  
 POSITIVE ENERGY ABV LFC= 173 J/KG  
 NEGATIVE ENERGY BLW LFC= -795 J/KG  
 BULK RICHARDSON NUMBER= 16.1

# LAPS SOUNDINGS

LBF  
04z



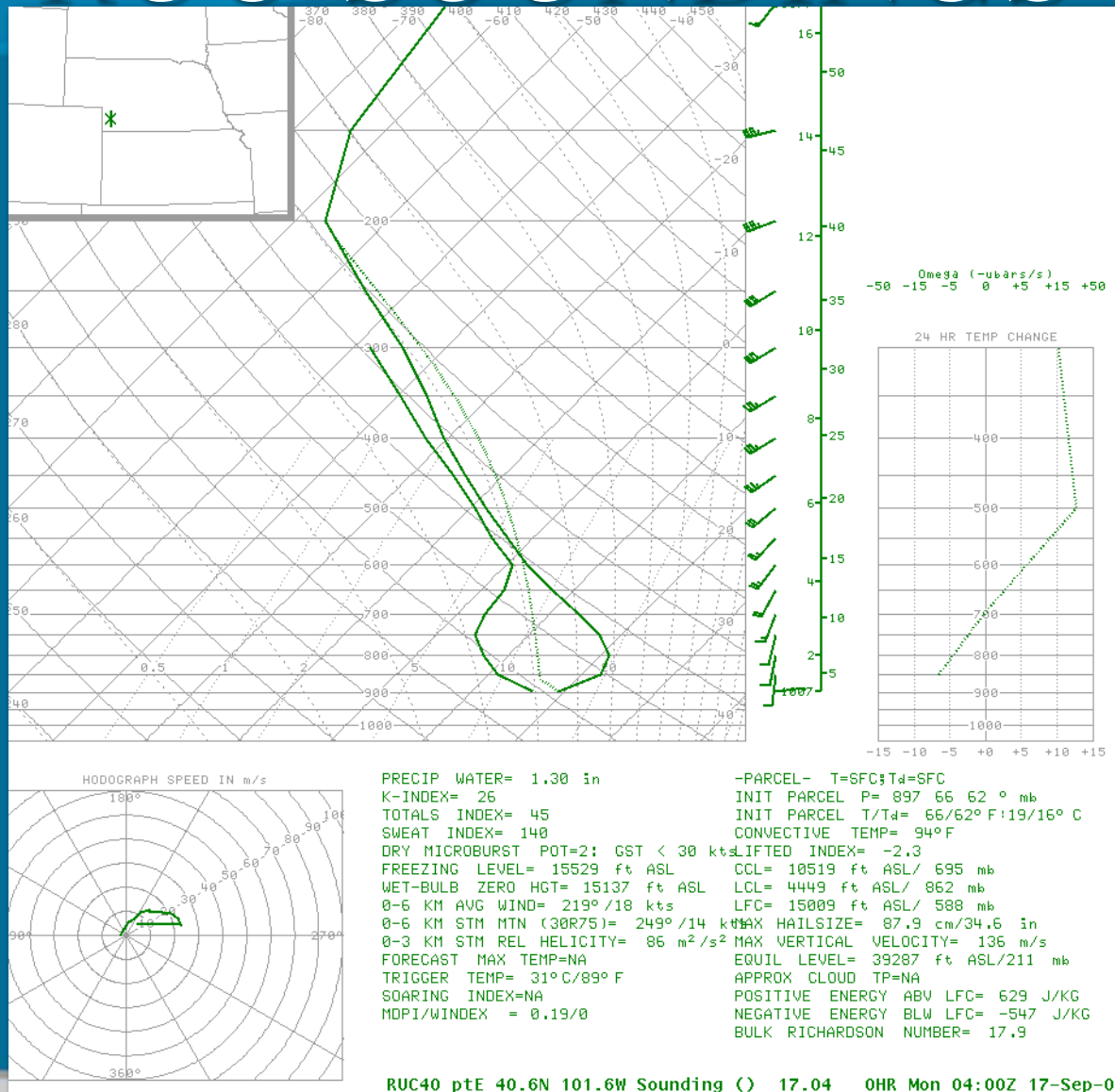
PRECIP WATER= 1.34 in  
K-INDEX= 41  
TOTALS INDEX= 52  
SWEAT INDEX= 206  
DRY MICROBURST POT=2; GST < 30 kt  
FREEZING LEVEL= 14971 ft ASL  
WET-BULB ZERO HGT= 14356 ft ASL  
0-6 KM AVG WIND= 236°/20 kts  
0-6 KM STM MTN (30R75)= 266°/15 kts  
0-3 KM STM REL HELICITY= 44 m<sup>2</sup>/s<sup>2</sup>  
FORECAST MAX TEMP=NA  
TRIGGER TEMP= 33°C/92° F  
SOARING INDEX=NA  
MDPI/WINDEX = 0.21/0

-PARCEL- T=SFC;Td=SFC  
INIT PARCEL P= 912 67 60 ° mb  
INIT PARCEL T/Td= 67/60° F;19/15° C  
CONVECTIVE TEMP= 97°F  
LIFTED INDEX=-1.8  
CCL= 11011 ft ASL/ 683 mb  
LCL= 4470 ft ASL/ 862 mb  
LFC= 15173 ft ASL/ 585 mb  
MAX HAILSIZE= 2.8 cm/1.1 in  
MAX VERTICAL VELOCITY= 24 m/s  
EQUIL LEVEL= 36171 ft ASL/243 mb  
APPROX CLOUD TP= 44455 ft ASL  
POSITIVE ENERGY ABV LFC= 417 J/KG  
NEGATIVE ENERGY BLW LFC= -754 J/KG  
BULK RICHARDSON NUMBER= 10.9

# RUC SOUNDINGS

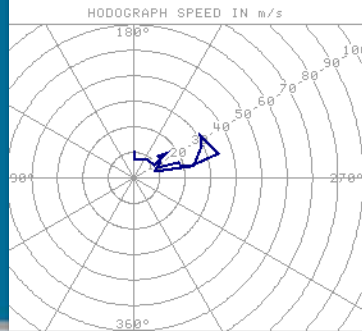
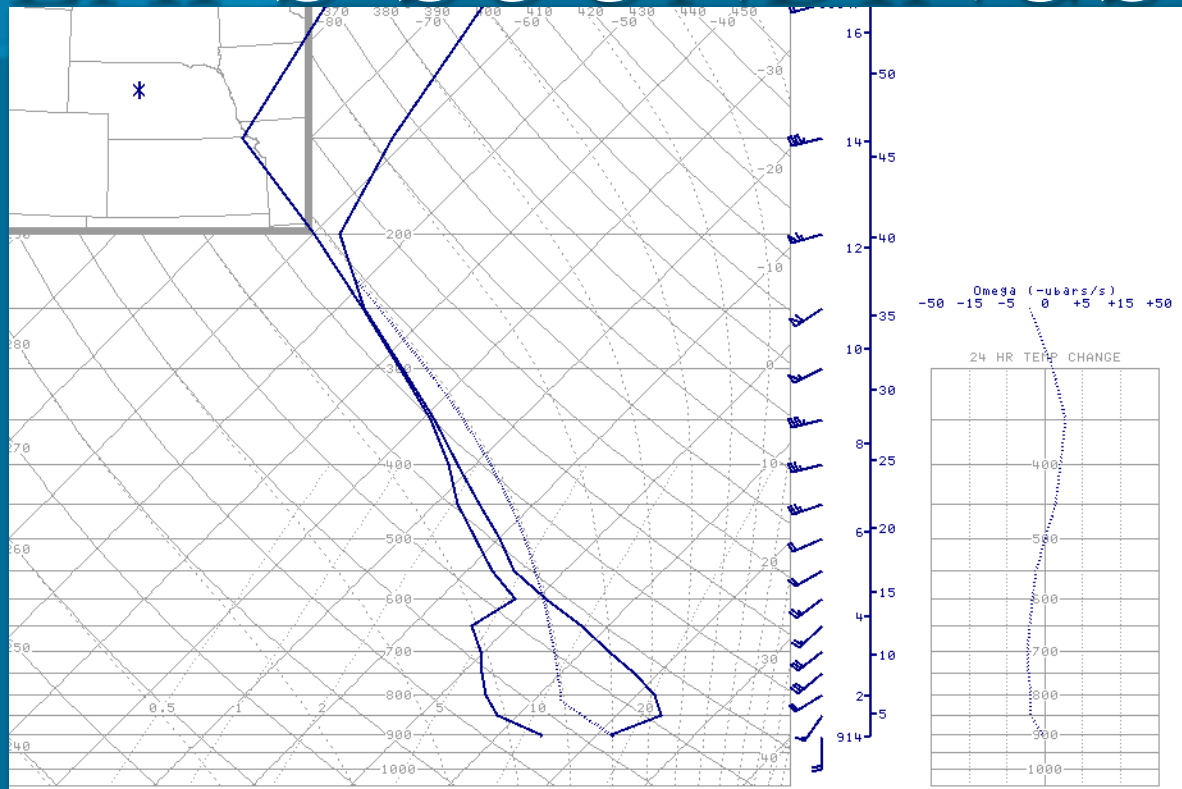
IML

04z



# LAPS SOUNDINGS

TIF  
04z



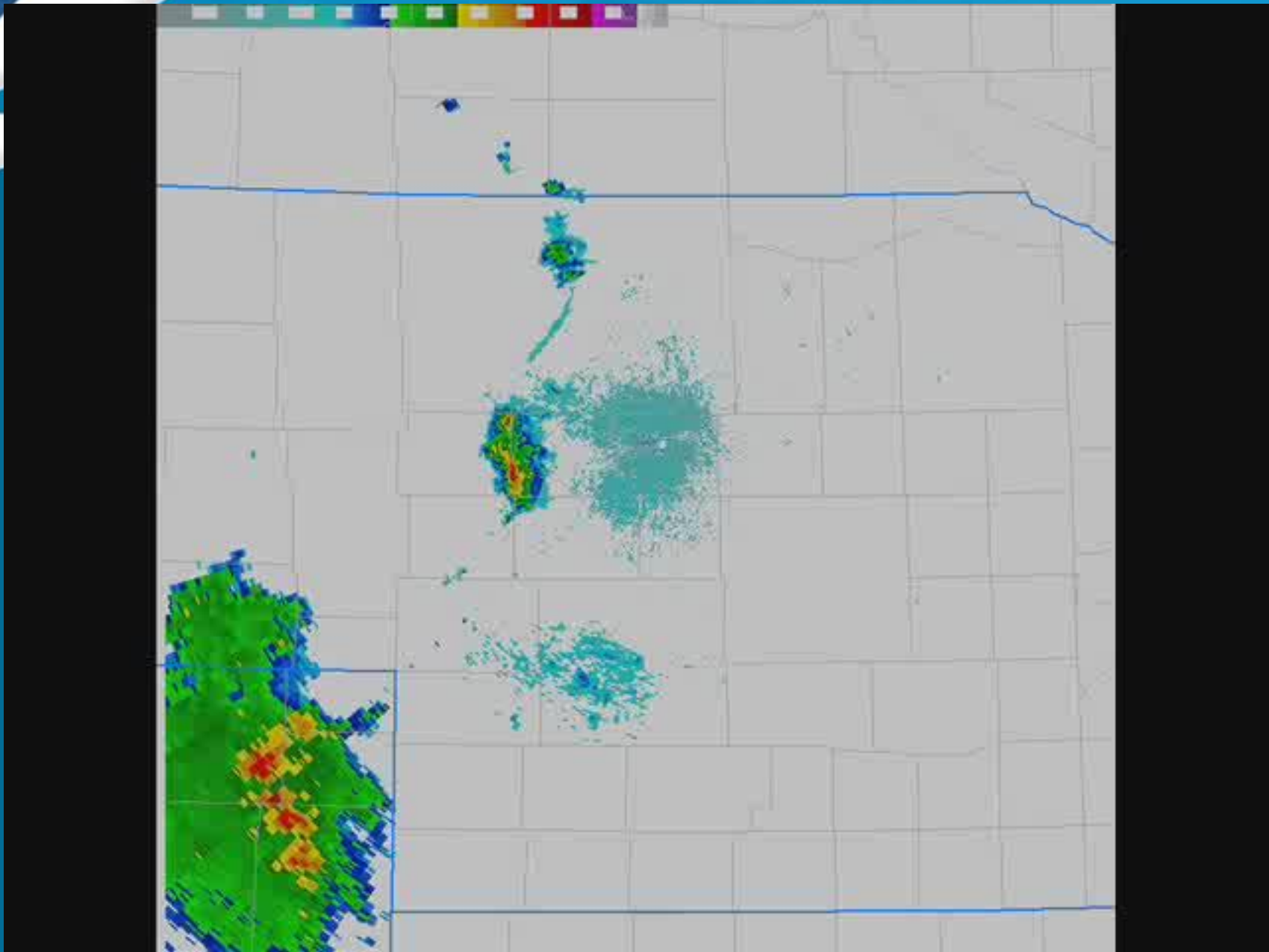
PRECIP WATER= 1.10 in  
 K-INDEX= 29  
 TOTALS INDEX= 52  
 SWEAT INDEX= 299  
 DRY MICROBURST POT=2; GST < 30 kt  
 FREEZING LEVEL= 14867 ft ASL  
 WET-BULB ZERO HGT= 14079 ft ASL  
 0-6 KM AVG WIND= 234°/22 kts  
 0-6 KM STM MTN (30R75)= 264°/17 kt  
 0-3 KM STM REL HELICITY= 14 m<sup>2</sup>/s<sup>2</sup>  
 FORECAST MAX TEMP=NA  
 TRIGGER TEMP= 33°C/91°F  
 SOARING INDEX=NA  
 MPI/WINDEX = 0.21/0

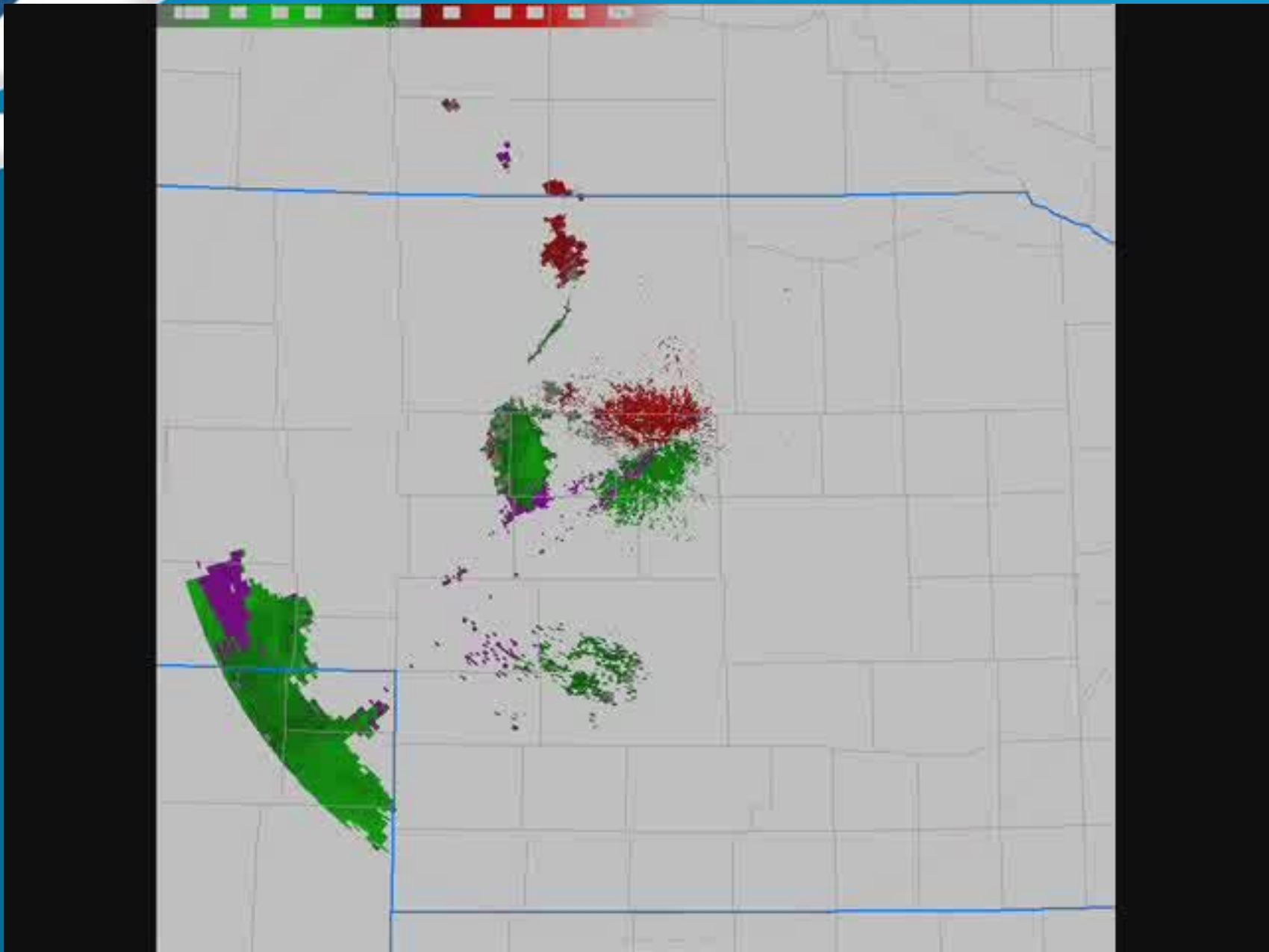
-PARCEL- T=SFC;Td=SFC  
 INIT PARCEL P= 907 71 58 ° mb  
 INIT PARCEL T/Td= 71/58° F:22/14° C  
 CONVECTIVE TEMP= 95°F  
 LIFTED INDEX=-2.6  
 CCL= 11277 ft ASL/ 676 mb  
 LCL= 6110 ft ASL/ 814 mb  
 LFC= 14681 ft ASL/ 595 mb  
 MAX HAILSIZE= 4.3 cm/1.7 in  
 MAX VERTICAL VELOCITY= 30 m/s  
 EQUIL LEVEL= 37483 ft ASL/227 mb  
 APPROX CLOUD TP= 46095 ft ASL  
 POSITIVE ENERGY ABV LFC= 658 J/KG  
 NEGATIVE ENERGY BLW LFC= -653 J/KG  
 BULK RICHARDSON NUMBER= 23.5

# KLNX RADAR LOOP

- Starts at 00z, Ends at 04z
- Focus is Southwest Nebraska
- Line of Thunderstorms that Eventually Produce an Outflow Boundary Moving NE
- Ground Clutter Around Radar
- First 0.5 Degree Reflectivity
- Then 0.5 Degree Base Velocity







# Severe Wind Gust Reports

- Adams County, CO (Storm Chaser)
  - 2123z (58 kts/67 mph)
- Jackson County, CO (Trained Spotter - Damage)
  - 2345z (61 kts/70 mph)
- Yuma County, CO (Mesonet - Blowing Dirt)
  - 2345z (55 kts/63 mph)
- Chase County, NE (IML ASOS - Damage)
  - 0116z (55 kts/63 mph)

# Then

- Thunderstorms Produced an Outflow Boundary (Seen on KLNK Radar 0.5 Degrees)
- Progressed East Northeast
  - Eventually Crossing KLNK Radar Site
- Thunderstorms Continue to Pulse, However a General Trend of Weakening Was Observed

# Outflow Boundary Produced

- 0.5 Degree Base Velocity Radar Readings (AGL)
  - 50 kts at 3000 ft
  - 50 kts at 1000 ft
  - 45 kts at 700 ft
  - 40 kts at 500 ft
  - ~20 kts at Surface
    - 18 kts @ LBF ASOS
    - 17 kts @ TIF AWOS



# Thunderstorms Produced

- Keith County, NE (Public - No Damage)
  - ~0200z (48 kts/55 mph)
- Lincoln County, NE (LBF ASOS)
  - 0331z (29 kts/33 mph)
- Thomas County, NE (TIF AWOS)
  - 0410z (38 kts/44 mph)



# Why?

- Inversion too Strong for Outflow Boundary Winds to Mix to the Surface Once Ahead of Thunderstorms
- Weak Thunderstorms Produced Downdrafts Capable of Marginal Mixing



# REGIONAL RADAR LOOP

- Ground Clutter Expansion Universal
- Helps Discount KLNK Clutter Expansion Being Caused by Decaying Thunderstorm in Vicinity of Radar Site
- Reinforces Outflow Boundary Near Thunderstorms at IML





# CONCLUSION

- Inversion Played Key Role
- Outflow Boundary More Effected
- Inversion Strengthening Coincided with Expansion of Ground Clutter on Radars
- High Velocity Data at 0.5 Degrees, Yet NO Severe Weather Reported
- Only One Case, Need to Look at More



?? QUESTIONS ??

