

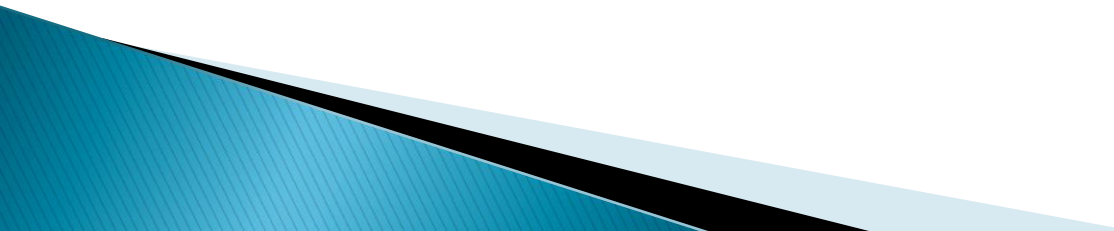
# A Few Environmental and Structural Aspects of the Interstate-80 Tornadic Supercell of 29 May 2008

James McCormick

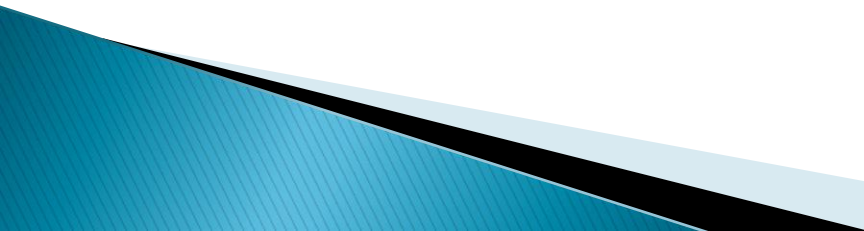
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Air Force Weather Agency

Prepared For:  
12<sup>th</sup> Annual High Plains Conference  
Hays, Kansas  
September 4<sup>th</sup>, 2008

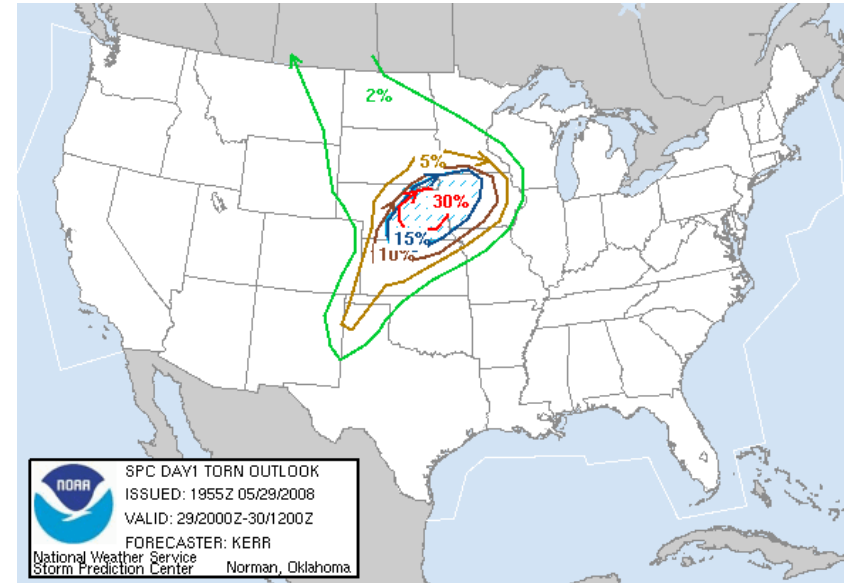
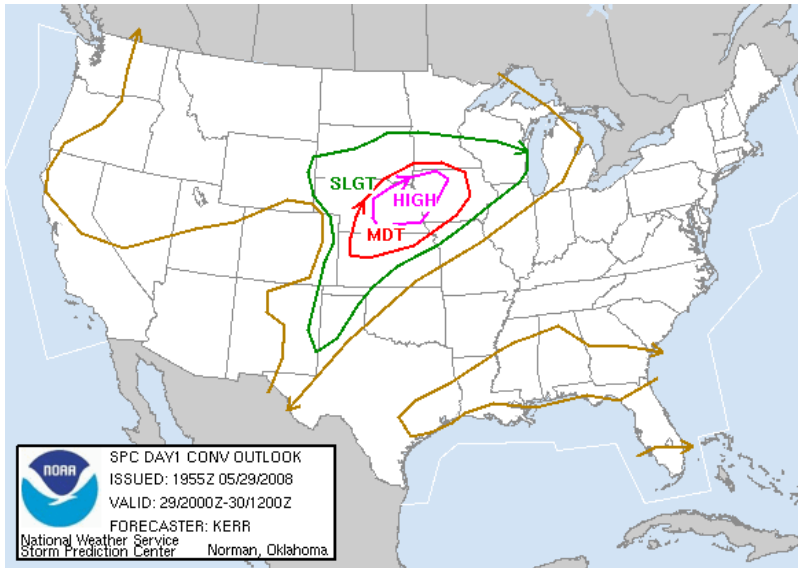
# Overview

- ▶ Reasons For Studying This Event
  - ▶ Forecasts Of Event
  - ▶ Brief Synoptic Overview
  - ▶ Radar and Evolution Of Convective Behavior
  - ▶ Conclusions and Summary
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# What Made This Storm Interesting?

- ▶ SPC 'High Risk' Convective Outlook
  - ▶ Hastings 'Weather Story' Included 'Tornadoes Likely' Wording
  - ▶ Part of a central plains tornado outbreak that included 71 Tornado LSRs in the central plains region
  - ▶ Dual low-level circulation behavior of tornadic supercell
  - ▶ Multiple tornadoes strike within city limits of Kearney
  - ▶ Kearney \*WAS\* a town with a fairly prominent belief that 'tornadoes cannot strike here'
  - ▶ Additional tornado later produced considerable damage south of Aurora along Interstate-80
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# SPC Forecast

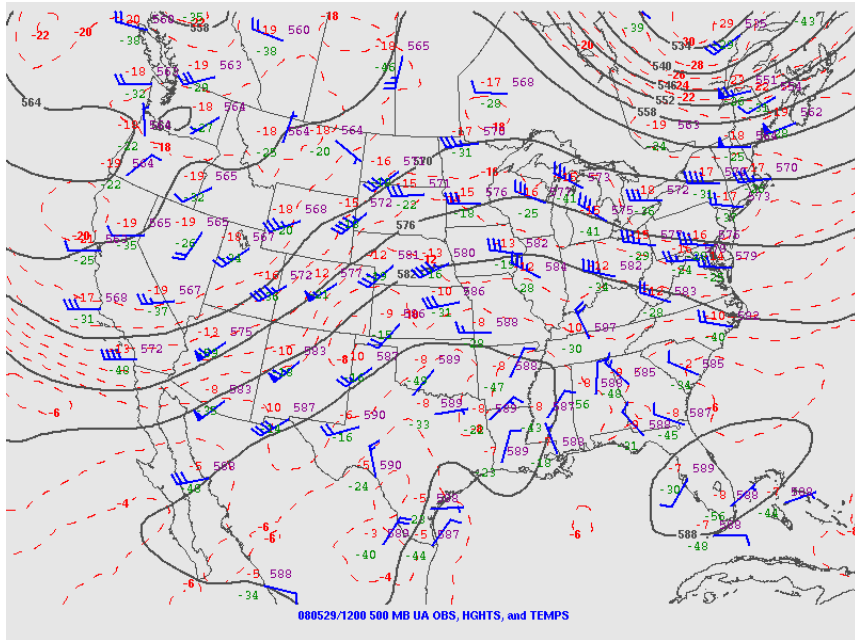


ACTIVITY WILL EVENTUALLY ENCOUNTER BETTER LOW-LEVEL MOISTURE... ROUGHLY NORTH/EAST OF HILL CITY KS INTO NORTH CENTRAL NEBRASKA... WHERE FURTHER INTENSIFICATION WILL OCCUR...AND NEW STORMS WILL DEVELOP...WITH INCREASING TORNADIC POTENTIAL ALONG A 40-60 KT SOUTH SOUTHWESTERLY LOW-LEVEL JET AXIS BY/SHORTLY AFTER 30/00Z. WITHIN THE PRESENCE OF STRONG DEEP LAYER SHEAR...LARGE CLOCKWISE CURVED LOW-LEVEL HODOGRAPHS...AND MIXED LAYER CAPE OF 2000-3000 J/KG...**POTENTIAL EXISTS FOR A FEW STRONG TORNADOES IN LONG-LIVED SUPERCELLS.**

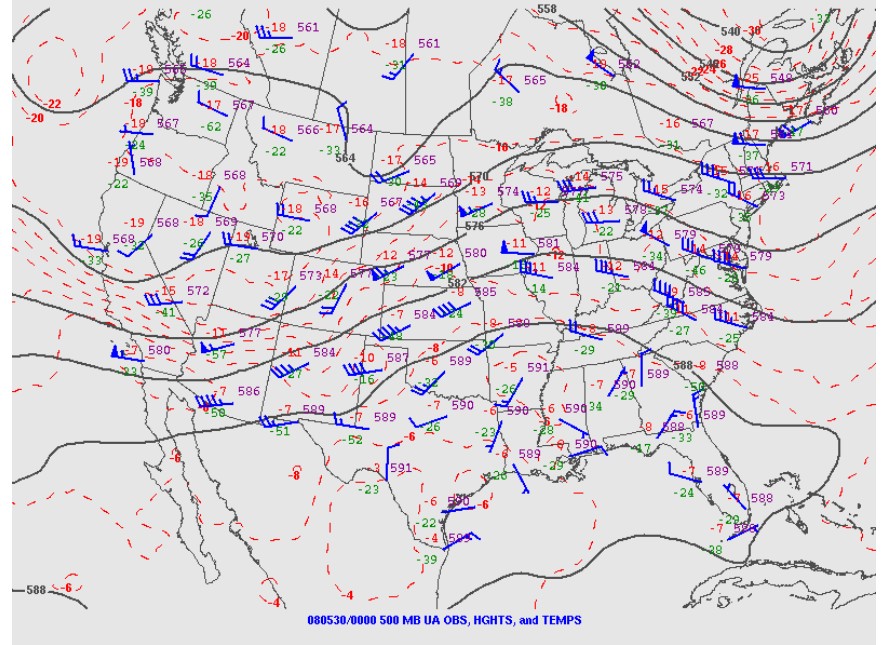
# Hastings AFD Highlights

- ▶ DISCUSSION...ALL ATTENTION IS ON THE WEATHER TODAY AS IT IS SHAPING UP TO BE A **SIGNIFICANT SEVERE WEATHER OUTBREAK** LATER THIS AFTERNOON INTO THE EVENING.
- ▶ THE MOISTURE AXIS IS ORIENTED ACROSS CENTRAL AND EASTERN NEBRASKA AND KANSAS WITH DPS WELL INTO THE 60S. INSTABILITY INCREASES DURING THE AFTERNOON WITH MU CAPES ON THE ORDER OF 3000 J/KG AND EFFECTIVE BULK SHEAR OF 50KTS. SUPERCCELL THUNDERSTORMS ARE THEREFORE LIKELY IN THIS ENVIRONMENT. THE STORMS SHOULD INITIATE IN THE VICINITY OF THE SURFACE LOW...TO OUR WEST INITIALLY...ALONG THE DRYLINE AND TROUGH. THE STORMS WILL THEN DEVELOP/MOVE INTO OUR CWA WITH THE ADVANCING BOUNDARIES. THE STORMS WILL **RAPIDLY BECOME SEVERE** GIVEN THE STORM ENVIRONMENT. LCL HEIGHTS WILL BE LOW ALONG THE CLEARING LINE AND LOWLEVEL WINDS WILL BACK ALONG THE ADVANCING SURFACE LOW MOVING INTO NORTH CENTRAL KANSAS. **POTENTIAL EXISTS FOR NASTY STORMS IN THE SEVERE WEATHER OUTBREAK** WHICH WILL UNFOLD LATER TODAY WITH VERY LARGE HAIL...DESTRUCTIVE WINDS AND TORNADOES ALL PROBABLE. THE STORMS WILL BE CAPABLE OF PRODUCING VERY HEAVY RAINFALL DESPITE A PROGRESSIVE NATURE OF THE STORM MOVEMENT.

# 500 MB Charts

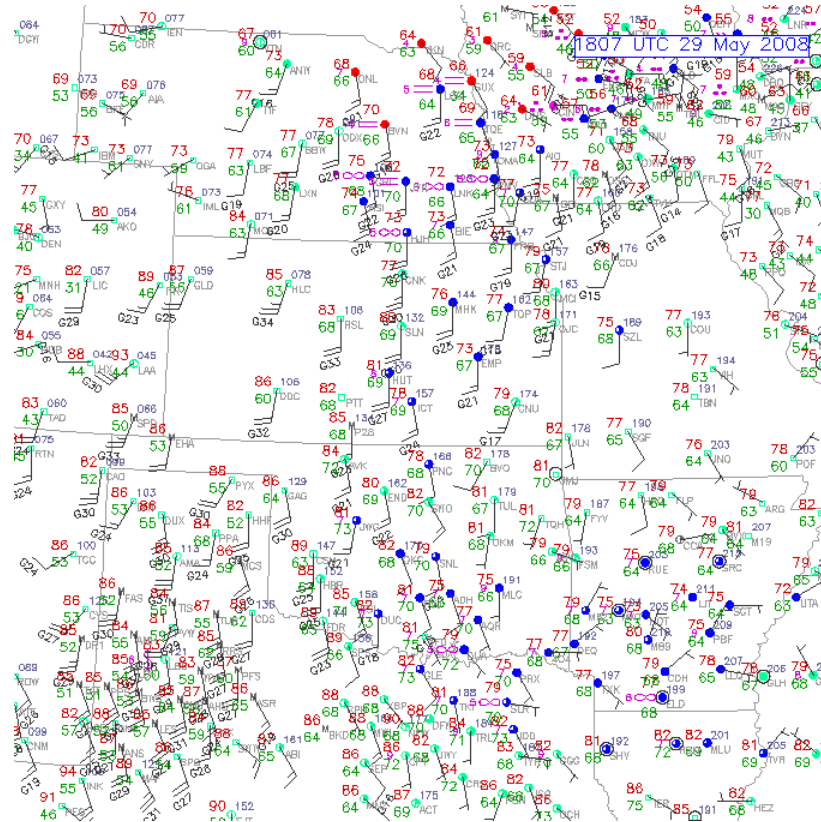


12 Z 29 May 2008

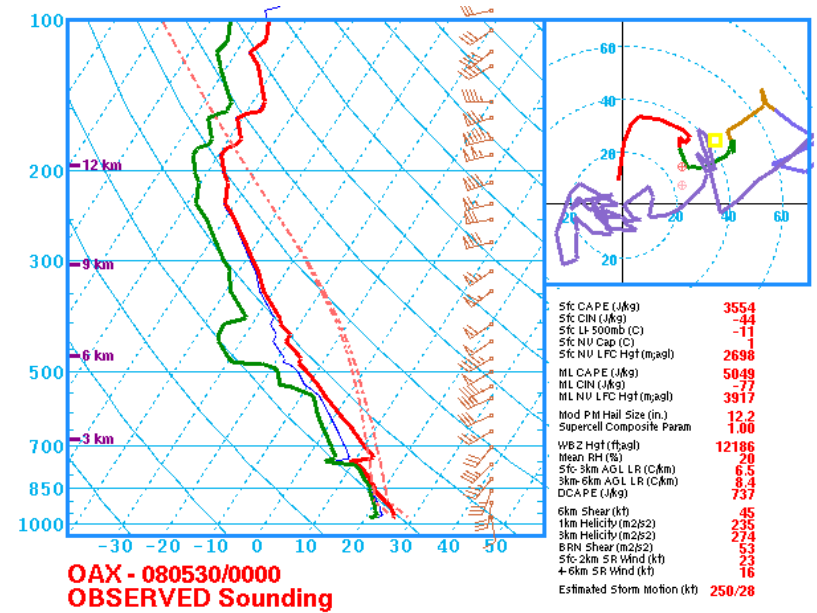
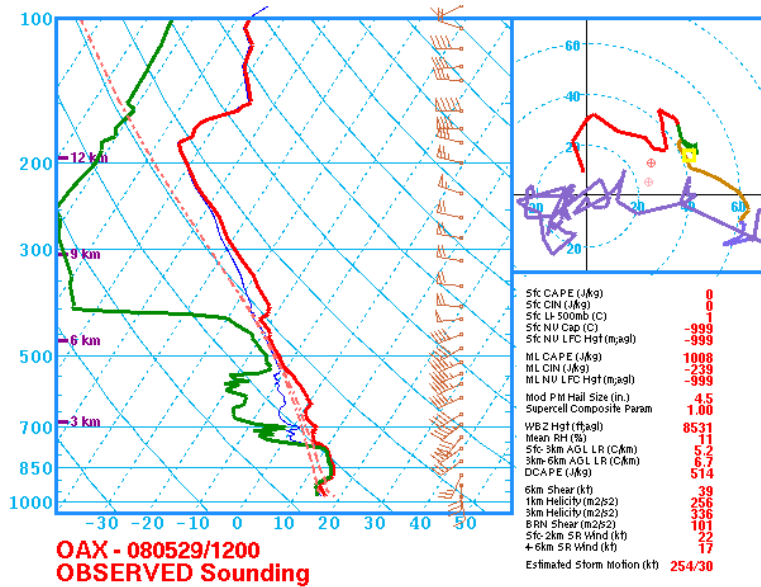


00 Z 30 May 2008

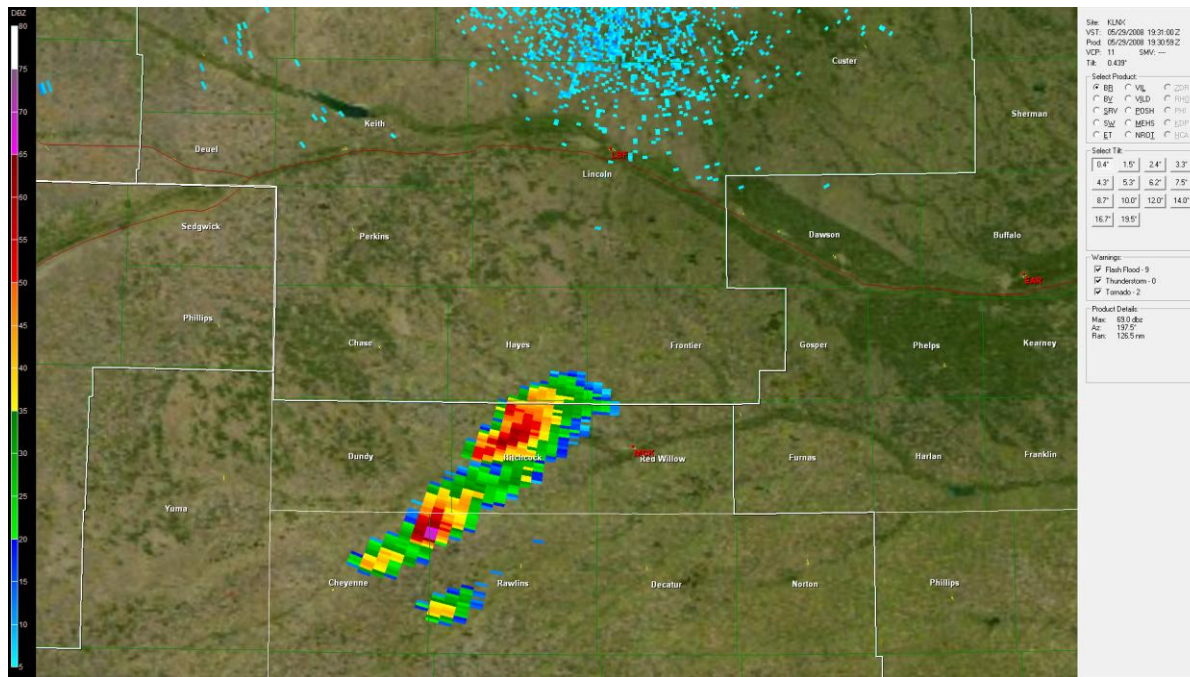
# Surface Map - 1807 Z



# OAX Soundings



# Initial Convection: KLNKX Radar 1931 Z



BULLETIN - EAS ACTIVATION  
REQUESTED  
SEVERE THUNDERSTORM WARNING  
NATIONAL WEATHER SERVICE  
GOODLAND KS  
219 PM CDT THU MAY 29 2008

THE NATIONAL WEATHER SERVICE  
IN GOODLAND HAS ISSUED A  
\* SEVERE THUNDERSTORM  
WARNING FOR...

NORTHEASTERN CHEYENNE  
COUNTY IN NORTHWEST KANSAS...  
NORTHWESTERN RAWLINS  
COUNTY IN NORTHWEST KANSAS...

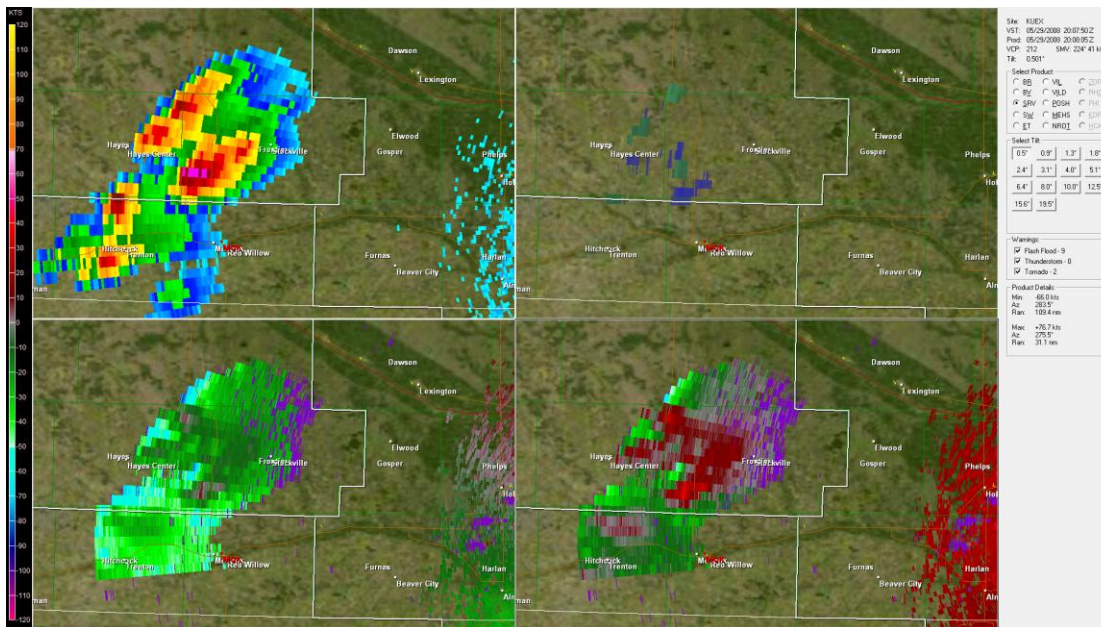
EASTERN DUNDY COUNTY IN  
SOUTHWEST NEBRASKA...  
HITCHCOCK COUNTY IN  
SOUTHWEST NEBRASKA...

•UNTIL 315 PM CDT/215 PM MDT/

\* AT 214 PM CDT...NATIONAL  
WEATHER SERVICE DOPPLER  
RADAR INDICATED A  
SEVERE THUNDERSTORM  
PRODUCING QUARTER SIZE  
HAIL...AND DAMAGING  
WINDS IN EXCESS OF 60 MPH. THIS  
STORM WAS LOCATED 13 MILES  
SOUTH

OF BENKELMAN... **MOVING  
NORTHEAST AT 32 MPH**

# First tornado warning: KLNX Radar - 2007 Z

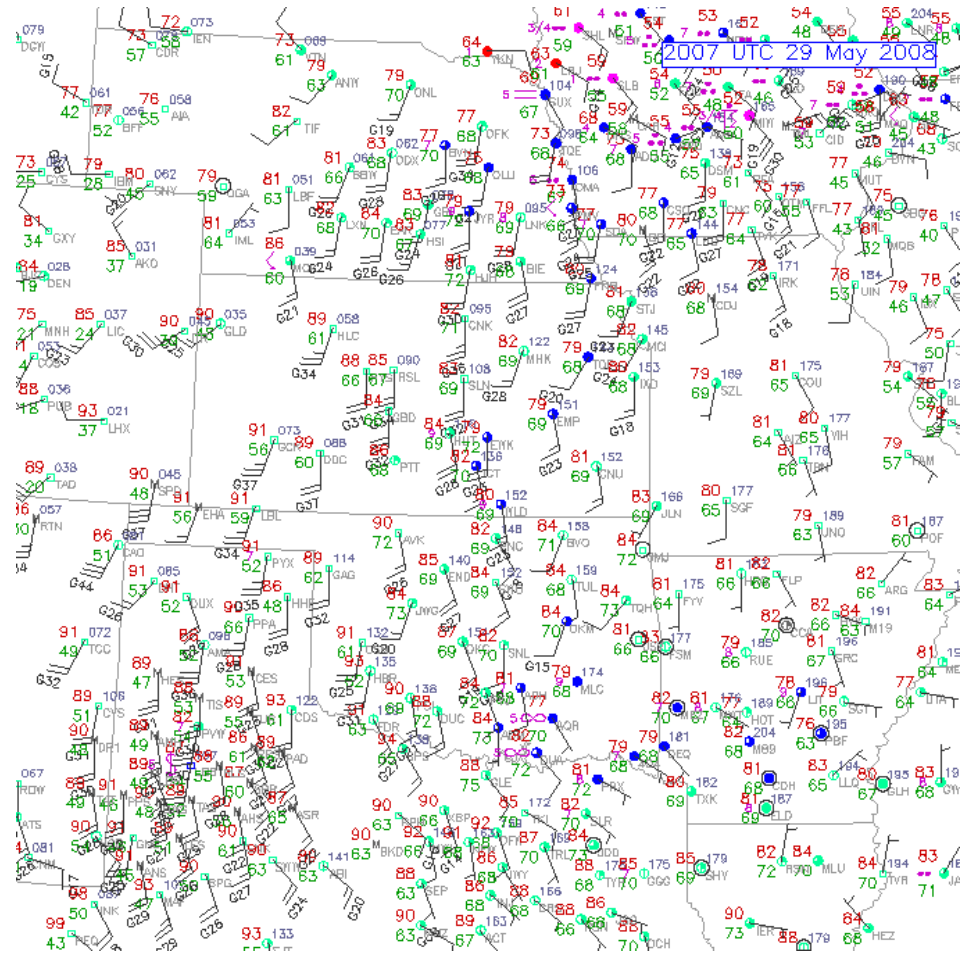


TORNADO WARNING  
NATIONAL WEATHER SERVICE  
NORTH PLATTE NE

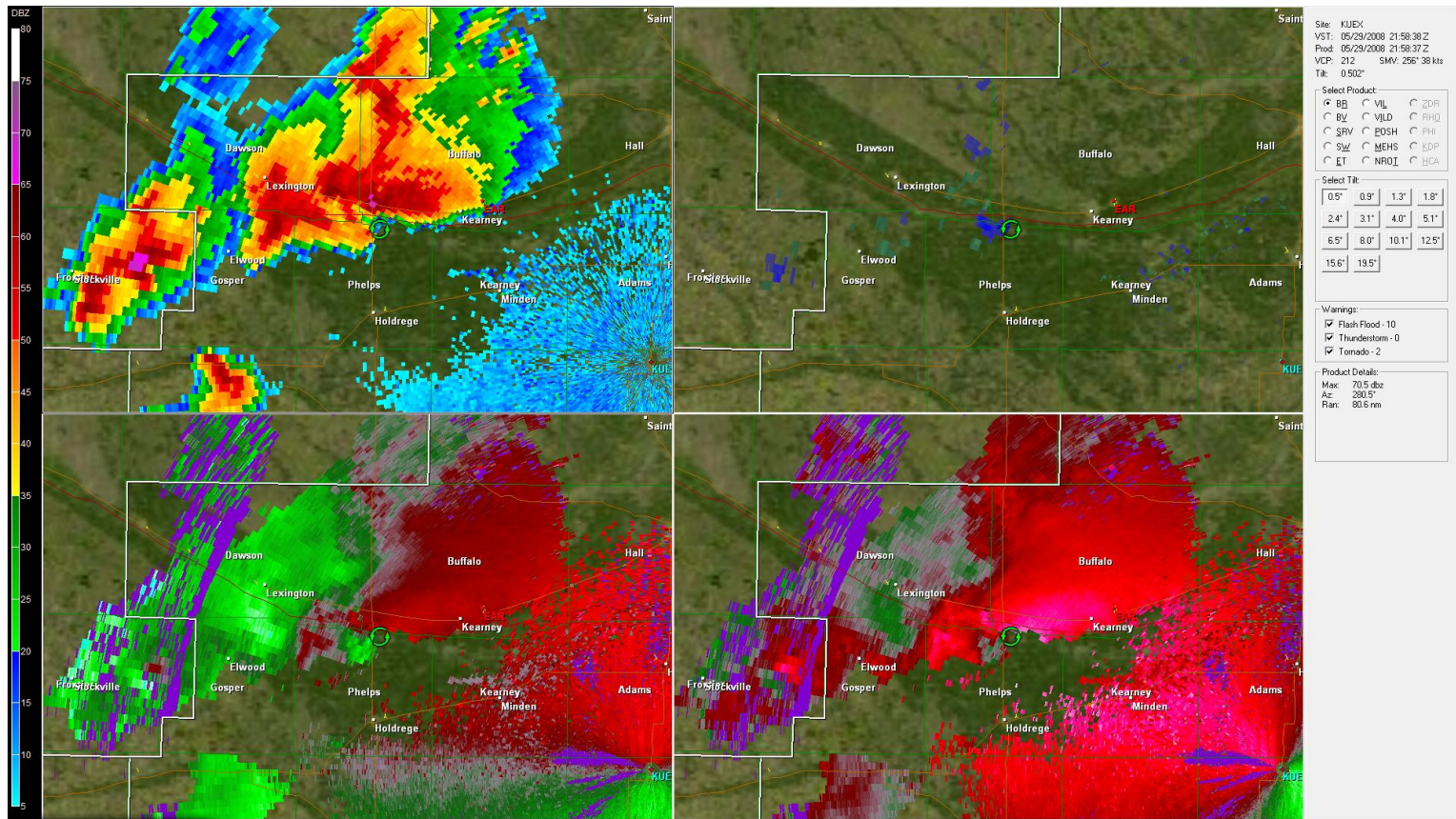
350 PM CDT THU MAY 29 2008  
THE NATIONAL WEATHER  
SERVICE IN NORTH PLATTE HAS  
ISSUED A

\* TORNADO WARNING FOR...  
EASTERN FRONTIER COUNTY  
IN SOUTHWEST NEBRASKA...  
\* UNTIL 430 PM CDT  
\* AT 347 PM CDT...NATIONAL  
WEATHER SERVICE DOPPLER  
RADAR INDICATED A  
SEVERE THUNDERSTORM  
CAPABLE OF PRODUCING A  
TORNADO 7 MILES NORTH OF  
MEDICINE CREEK RESERVOIR  
STATE RECREATION AREA...OR  
18 MILES  
SOUTHEAST OF  
CURTIS...**MOVING EAST AT 45  
MPH.**

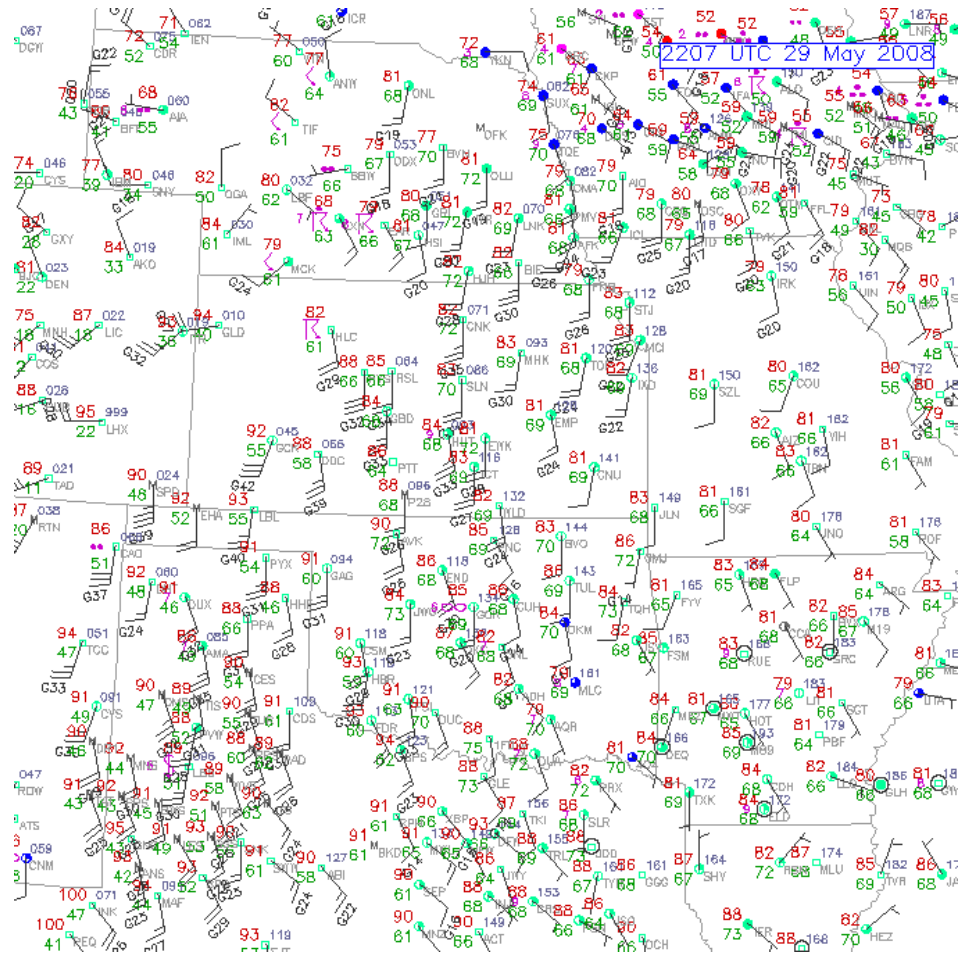
# Surface Map - 2007 Z



# KUEX Radar - 2158 Z



# Surface Map - 2207 Z

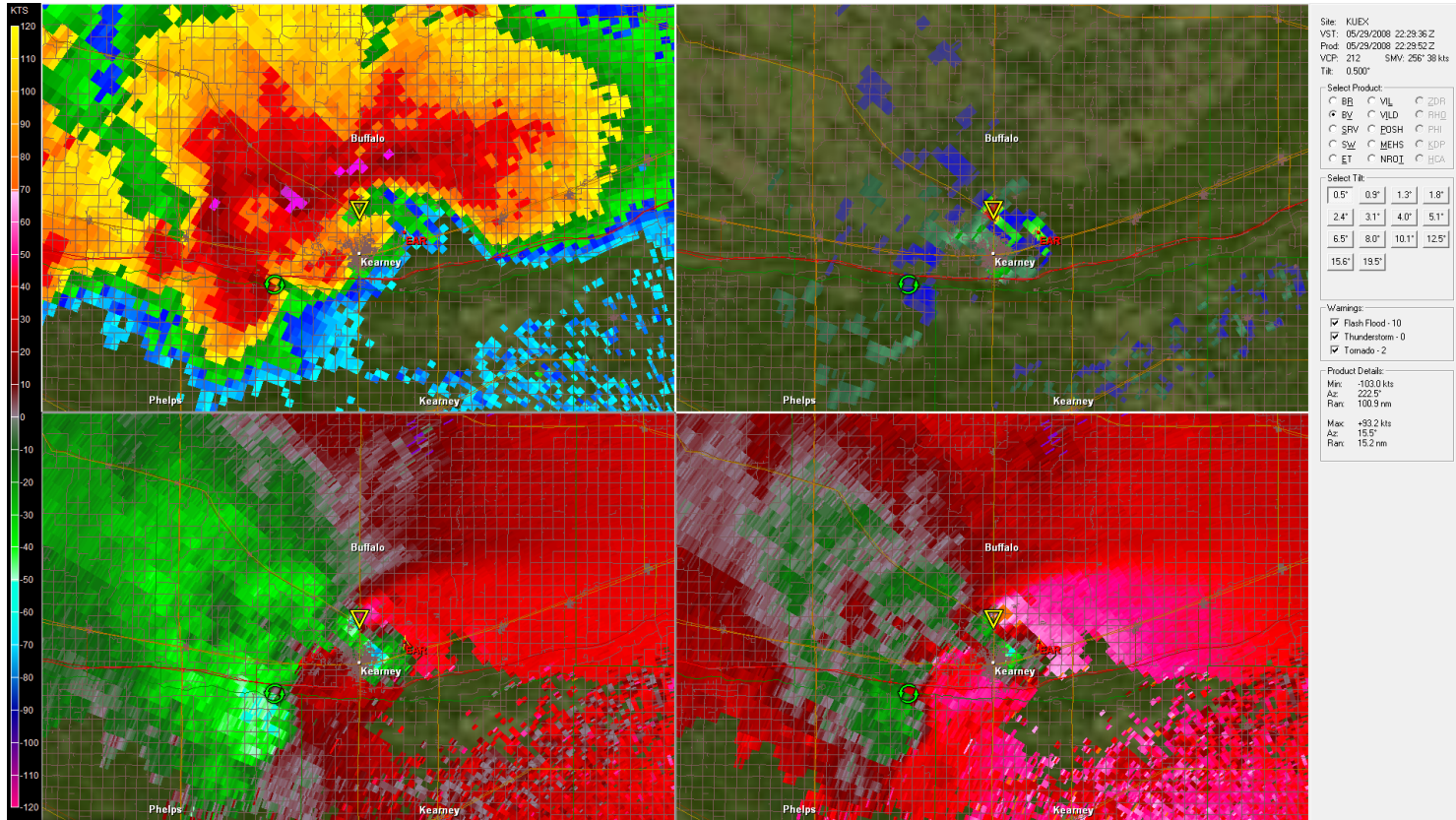


# Visual View

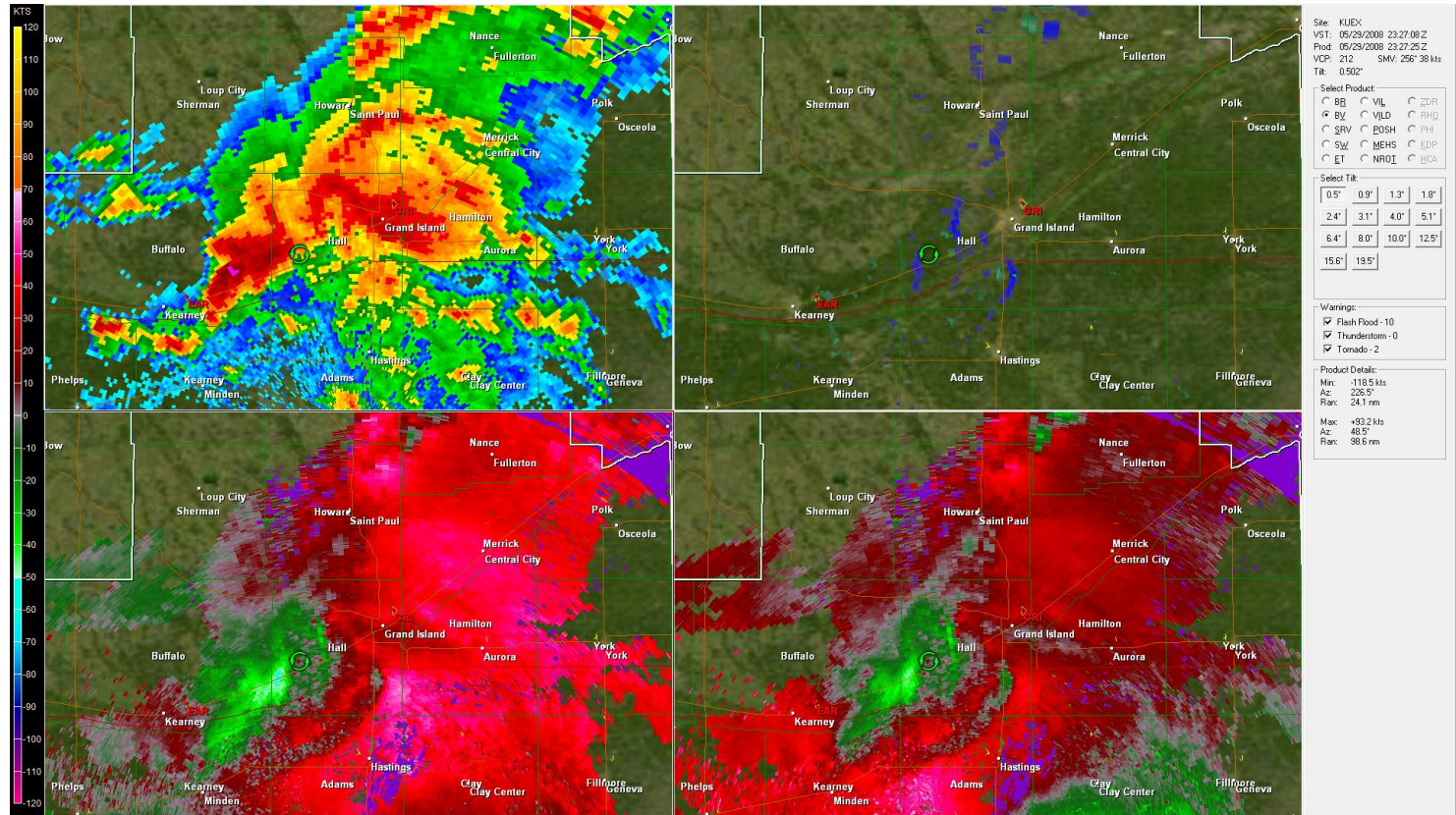


Looking west from the intersection of the 746 and Odessa Roads

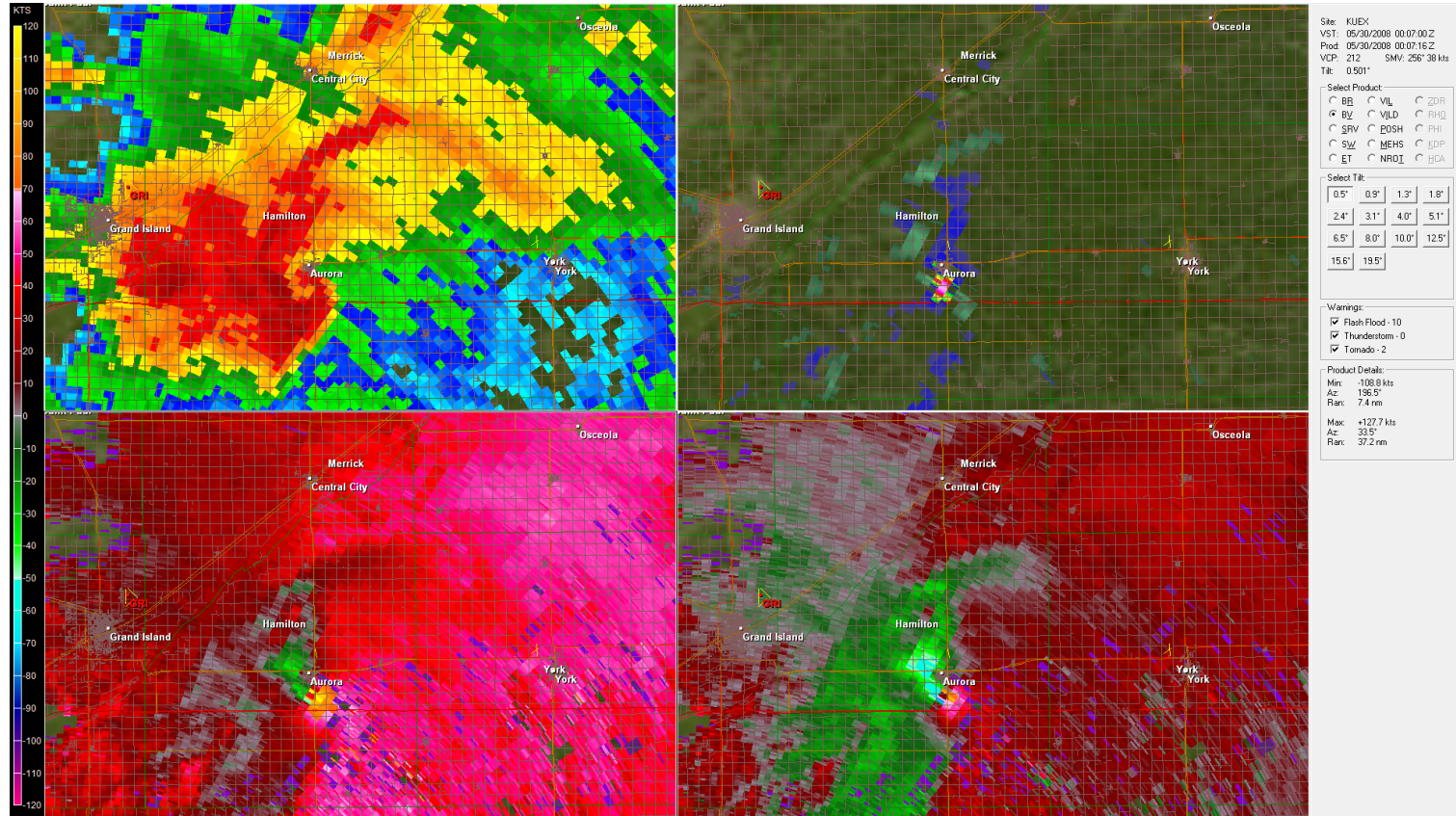
# KUEX Radar - 2229 Z



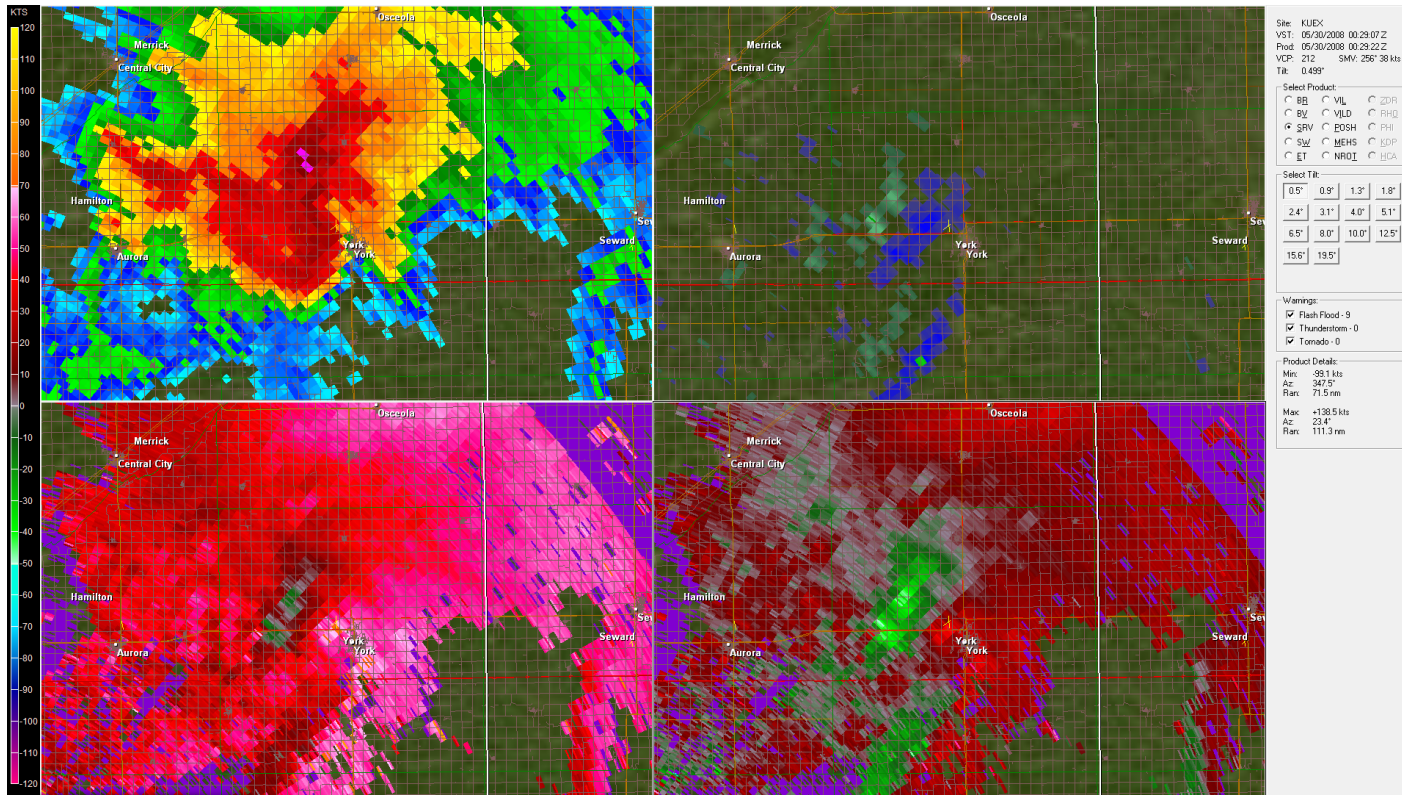
# KUEX Radar - 2327 Z



# KUEX Radar - 0007 Z



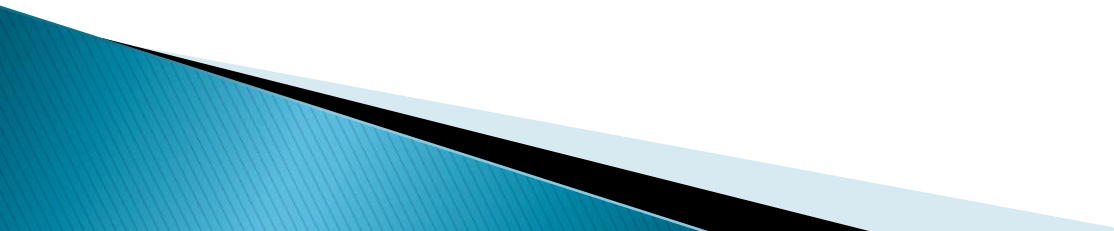
# KUEX Radar - 0029 Z



# Summary – Convective Behavior

- ▶ Well advertised, well forecast tornado outbreak across portions of central Nebraska, among many other places
- ▶ Conditions favored the development of strong supercells:
  - Strong low level flow throughout the day
  - Surface dew point temperatures in mid 60s
  - 2 mb 3-hr pressure drops
  - Surface flow backed to southeasterly in response to pressure drops
  - Underneath fairly strong southwesterly flow aloft
  - Hodographs indicated veering in low levels, suggesting potential for strong, dominate right moving supercells
- ▶ The right–turning split of Storm ‘A’ initially earned a tornado warning in a radar hole as it pushed to the northeast through Frontier County
- ▶ The left moving split produced a string of hail reports; no tornadoes
- ▶ Right moving cell slowed and was ‘caught’ by a developing thunderstorm with rotation
- ▶ Storm merger behavior created a supercell that maintained two distinctly different regions of strong low level rotation, both of which produced tornadoes
  - Both updrafts maintained significant, ‘unspoiled’ inflow layers
  - Neither storm had shown any appearance of a dominant outflow pattern
  - Near storm inflow increased dramatically as storm became tornadic

# Summary – Event Results

- ▶ 3 main tornado paths occurred in and around the city of Kearney
  - ▶ Nearly simultaneous tornadoes developed with separate regions of low level rotation near the town of Odessa shortly after 5 PM CDT
  - ▶ Strongest Kearney tornado developed just north of the US-30 tornado
  - ▶ No fatalities or major injuries reported
  - ▶ Tornado damage rated up to strong EF-2 in and near Kearney... but did storm behavior prevent a stronger, perhaps catastrophic tornado event given the location?
    - ▶ (Consider a 60 mile tornado track producing violent damage just north of I-80 from central Kearney through Grand Island)
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# Thanks...

- ▶ Donald Van Dyke, Department of Meteorology, FSU... help with images and countless hours of discussion made this talk possible
- ▶ Rebecca Selin, Pamela Murray, and Andy Elliott, Air Force Weather Agency... and Clark Evans, DoM, FSU... for hours of discussion before, during, and after the event
- ▶ Data Archives From:
  - National Climatic Data Center
  - National Weather Service – Hastings
  - Storm Prediction Center
  - UCAR