The Northern Nevada High Wind Event of March 30th, 2010

Jeremy Michael, Ray Christensen, and Clair Ketchum
NOAA/National Weather Service Forecast Office, Elko (LKN), Nevada

1. Introduction

Strong wind events characterized by wind advisory criteria speeds (sustained winds of 26-34 knots or gusts from 39-49 knots) frequent the County Warning Area (CWA) of Elko, Nevada typically on a winter to spring timeframe. Those events reaching high wind warning criteria (sustained wind speeds greater than 34 knots or wind gusts greater than 49 knots) occur with much less frequency. Even more so are those high wind warning events that affect the entire CWA. One such event occurred on 30 March 2010, where an anonymously cold and strong Pacific storm system produced strong damaging winds. During the late morning and early afternoon, a strong cold front pushed across northern Nevada, which translated strong winds aloft down to the surface. Many locations across the forecast area experienced wind gusts greater than 50 knots, with the highest wind gust of 70 knots reported by the Mather Remote Automated Weather Station (RAWS) site. Meanwhile, the National Weather Service (NWS), Elko office and the Elko airport both received a strong wind gust of 58 knots in the early afternoon hours. Damage reports and wind gusts greater than 49 knots from the event are listed below (Table 1) in the Local Storm Report (LSR), with a map of the damage locations in Figure 1. In addition, peak wind gusts for all locations were compiled and issued in a Public Information Statement (PNS). The PNS can be seen near the end of this manuscript in Appendix 1. Images of damage taken from within the city of Elko will be in Appendix 2.

```
PRELIMINARY LOCAL STORM REPORT...CORRECTED
NATIONAL WEATHER SERVICE ELKO NV
340 PM PDT TUE MAR 30 2010

 ..TIME...   ...EVENT...      ...CITY LOCATION...     ...LAT.LON...
 ..DATE...   ....MAG....      ..COUNTY LOCATION..ST.. ...SOURCE....
             ..REMARKS..

 0338 AM     NON-TSTM WND GST 13 WNW KINGS RIVER VALL 41.80N 118.45W
 03/30/2010  M70.00 MPH       HUMBOLDT           NV   MESONET

             TEXAS SPRINGS RAWS SITE. ELEVATION 5760 FEET MSL.

 1000 AM     NON-TSTM WND DMG ELKO                    40.84N 115.76W
 03/30/2010                   ELKO               NV   PUBLIC

             LARGE TREE BLOWN DOWN ACROSS FENCE.

 1130 AM     NON-TSTM WND DMG ELKO                    40.84N 115.76W
 03/30/2010                   ELKO               NV   PUBLIC

             FENCE BLOWN DOWN ON FREEPORT AVENUE.
```

1155 AM NON-TSTM WND DMG ELKO 40.84N 115.76W
03/30/2010 ELKO NV PUBLIC

2095 COLONIAL DRIVE TWO PIECES OF SIDING MEASURING 6 TO 8 FT IN LENGTH TORN OFF FROM SIDE OF HOUSE.

1156 AM NON-TSTM WND GST ELKO 40.84N 115.76W
03/30/2010 M67.00 MPH ELKO NV ASOS

ELKO AIRPORT

1204 PM NON-TSTM WND GST 2 NNW AUSTIN 39.50N 117.08W
03/30/2010 M62.00 MPH LANDER NV MESONET

AUSTIN RAWS SITE. ELEVATION 6310 FEET MSL.

1215 PM NON-TSTM WND DMG ELKO 40.84N 115.76W
03/30/2010 ELKO NV PUBLIC

LARGE TREE DOWN IN PARK ACROSS FROM BAPTIST CHURCH ON 5TH STREET.

1215 PM NON-TSTM WND DMG ELKO 40.84N 115.76W
03/30/2010 ELKO NV PUBLIC

FENCE BLOWN DOWN NEAR THE SEVEN DAY DENTAL BUILDING ON 5TH STREET.

1241 PM NON-TSTM WND GST 12 E PINTO SUMMIT 39.41N 115.70W
03/30/2010 M68.00 MPH WHITE PINE NV MESONET

PANCAKE SUMMIT NV DOT SITE. ELEVATION 6526 FEET MSL.

1242 PM NON-TSTM WND GST 15 N TUSCARORA 41.54N 116.22W
03/30/2010 M65.00 MPH ELKO NV MESONET

LONG HOLLOW RAWS SITE. ELEVATION 5820 FEET MSL.

1245 PM NON-TSTM WND GST ELKO 40.84N 115.76W
03/30/2010 M67.00 MPH ELKO NV OFFICIAL NWS OBS

NWS ELKO

0100 PM NON-TSTM WND GST 2 ESE WELLS 41.10N 114.91W
03/30/2010 M62.00 MPH ELKO NV MESONET

WELLS NV DOT SITE. ELEVATION 5875 FEET MSL.

0126 PM NON-TSTM WND DMG ELKO 40.84N 115.76W
03/30/2010 ELKO NV TRAINED SPOTTER

HOUSE HAD NUMEROUS SHINGLES AND SIDING BLOWN OFF.

0145 PM NON-TSTM WND GST KINGSTON 39.20N 117.08W
03/30/2010 E60.00 MPH LANDER NV CO-OP OBSERVER

STRONG WINDS FREQUENTLY GUSTING PAST 60 MPH WITH POWER

	OUTAGES.			
0210 PM	NON-TSTM WND GST	CHERRY CREEK		39.90N 114.88W
03/30/2010	M61.00 MPH	WHITE PINE	NV	CO-OP OBSERVER
0214 PM	NON-TSTM WND DMG	ELY		39.25N 114.88W
03/30/2010		WHITE PINE	NV	LAW ENFORCEMENT
	REPORTS OF SPORADIC POWER OUTAGES.			
0302 PM	NON-TSTM WND GST	2 NE EMIGRANT PASS		40.65N 116.28W
03/30/2010	M67.00 MPH	EUREKA	NV	MESONET
	EMIGRANT PASS NV DOT SITE. ELEVATION 6135 FEET MSL.			

Table 1: Local Storm Report (LSR) issued by WFO - Elko, NV on 30 March 2010.

Given the significance of this event, along with the widespread damage reported from across the CWA, a methodology for forecasting high winds in the western Great Basin will be presented using climatological anomalies. The purpose of this case study is to review the synoptic and mesoscale features, from roughly eighteen hours prior to the arrival of the event, to the onset of the event. In this fashion, we will be able to suggest criteria that can be best used to forecast similar high wind events in the future.

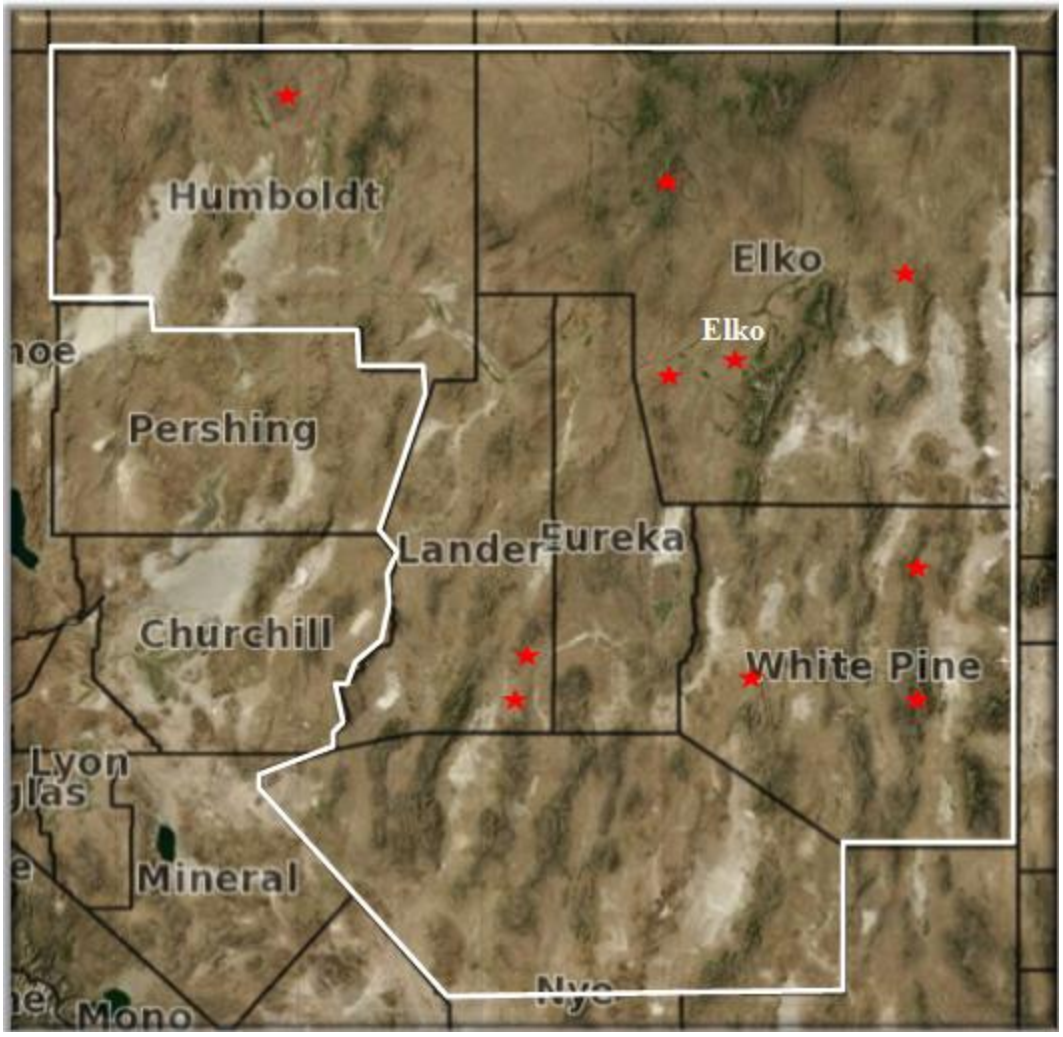

Figure 1. Map of Elko's CWA, with the bold white line highlighting its boundaries. Red stars indicate locations of LSRs. Elko is highlighted in white as multiple LSRs were reported in and around the city. County names in the CWA (Humboldt, Elko, Lander, Eureka, White Pine and northern Nye) will be used throughout the paper.

2. Data and Methodology

Surface charts were supplied by the Weather Prediction Center (WPC) leading up to this event. Upper air charts were taken from the Storm Prediction Center's (SPC) archive web site (http://www.spc.noaa.gov/exper/ma_archive/). Short Range Ensemble Forecast (SREF) model data were taken from the Pennsylvania State University's website (http://cms.met.psu.edu/sref/ensembles/). The Global Ensembles Forecast System (GEFS) model data were saved from the NWS Salt Lake City's website (http://www.slc.noaa.gov/slc/projects/anomalies/Forecast/GEFS/EPS_loops_archive.html). Standardized climatological anomalies on SREF and GEFS charts were calculated using a 30-year NCEP climatology and the NCEP-NCAR global reanalysis data (Graham and Grumm, 2010). Storm survey images and storm damage reports were collected by the staff from trained weather spotters around the Elko CWA. Wind measurements were taken from a variety of sources across the CWA: the Automated Surface Observing System (ASOS) and Automated

Weather Observing System (AWOS), as well as sites maintained by the Nevada Department of Transportation (NDOT), RAWS, and Desert Research Institute (DRI) observing sites. Sounding data was taken from the Plymouth State Weather Center's website (http://vortex.plymouth.edu/raob_conus-u.html).

3. Upper Air Analysis

a. 300 hPa Analysis

A strong 300 hPa jet can be seen barrelling across northern California, southern Oregon, and extreme northwestern Nevada in Figure 2a below. Wind speeds of approximately 150 knots pushed across southwest Orgeon at this time, with wind speeds of 100 to 120 knots across the northern half of Nevada by 0600 UTC 30 March. The upper level jet's speed increased significantly over the next six hours, with a maximum speed above 160 knots across northern California and northwest Nevada. The area of winds greater than 120 knots extended further east and south and had encroached into Elko's western CWA, as seen in Figure 2b. The jet core can be seen encompassing much of Elko's CWA by 1800 UTC (Figure 2c), with the highest wind speeds near 150 knots over Humboldt and western Elko counties.

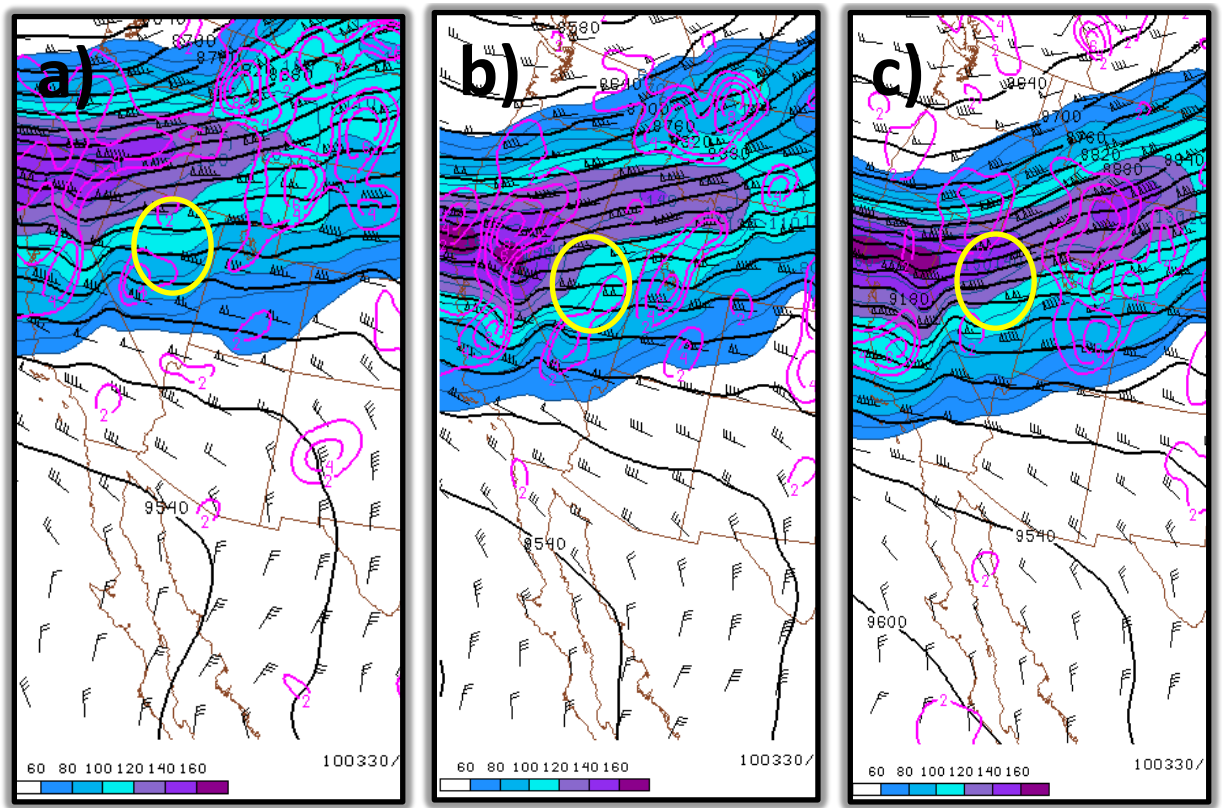

Figure 2: SPC 300 hPa heights (solid lines, black), wind speed (barbs and image), and divergence (solid lines, magenta) composite taken at a) 0600 UTC 30 March 2010; b) 1200 UTC 30 March 2010; and c) 1800 UTC 30 March 2010. Yellow circle highlights Elko's CWA.

b. 500 hPa Analysis

The strong winds aloft continued in the mid-level portion of the atmosphere. Depicted below in Figure 3a are the 500 hPa winds for the 0600 UTC time frame on 30 March. Winds in excess of 80 knots are shown streaming in from the west, with signficantly stronger winds pushing eastward across northern California and entering extreme northwest Nevada. By 1200 UTC, 500 hPa winds have increased slightly to just over 90 knots across a majority of northern Nevada, with nearly all of Elko's CWA experiencing wind speeds in excess of 80 knots, as seen in Figure 3b. A very tight thermal gradient began to set up across the forecast area with very cold temperatures of -32°C shown across northern Oregon and southern Washington State. Figure 3c shows the 500 hPa winds increasing substantially, with a jet streak of 100+ knots centered over northern Nevada. The temperature gradient continued to strengthen across this level, especially across northwest Nevada, with a northwest-southeast temperature difference of roughly 14°C across the CWA.

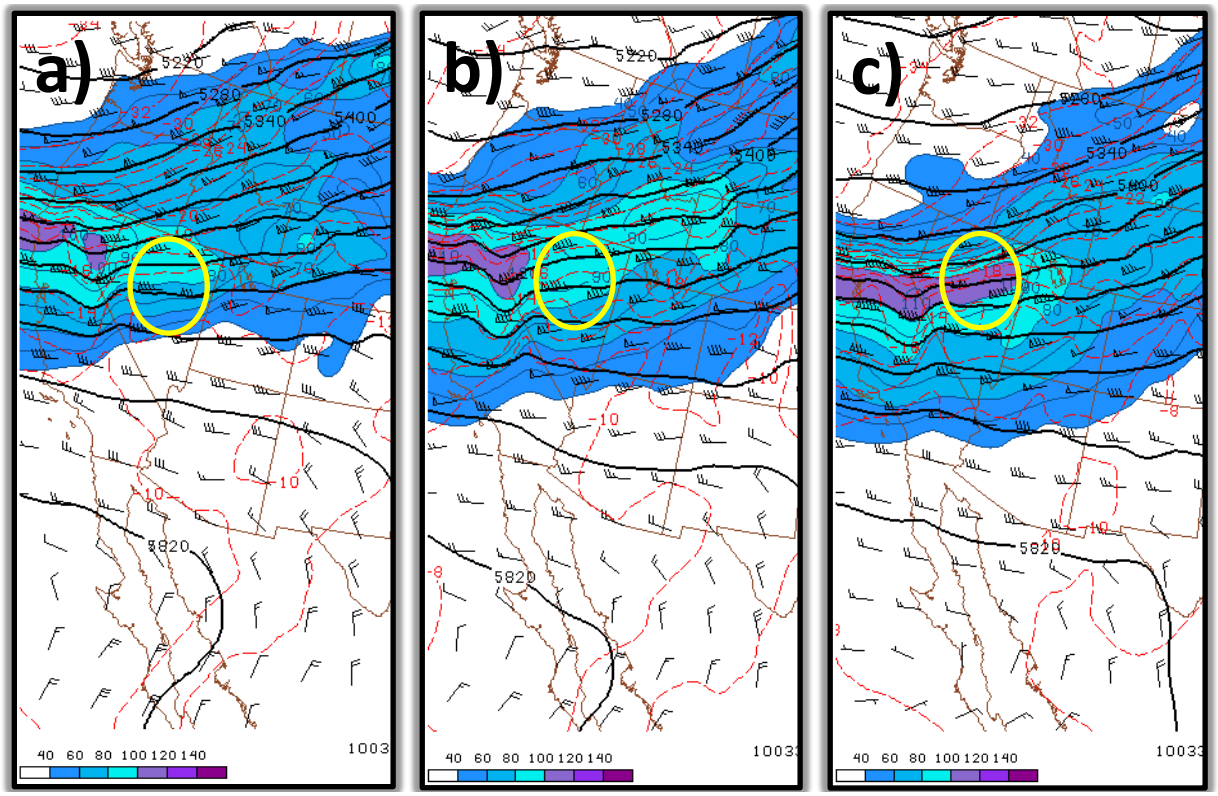

Figure 3: SPC 500 hPa heights (solid lines, black), wind speed (black barbs and image), and temperature (dashed lines, red) composite valid a) 0600 UTC 30 March 2010; b) 1200 UTC 30 March 2010; and c) 1800 UTC 30 March 2010. Yellow circle highlights Elko's CWA.

c. 700 hPa Analysis

A tight height and temperature gradient in the 700 hPa fields can be seen in Figures 4a through d. In Figure 4a, strong winds of 50 to 70 knots can be seen across northern Nevada with a strong thermal gradient running almost due northwest to southeast, with the -6°C isotherm across northern Humboldt County and the 2°C line over White Pine County to the southeast. The differences in heights are equally impressive, with a change of roughly 75 meters from

Humboldt County to White Pine County. In Figures 4b and c, winds continued to remain strong at this level with magnitudes of 45 to 65 knots seen over the forecast area. The height and thermal gradient remained rather compact, with cold temperatures of -12°C entering extreme northwest Nevada by 1800 UTC. The height gradient increased slightly to roughly 90 meters at this time. By 0000 UTC (Figure 4d), the temperature gradient across the forecast area increased substantially, as strong CAA continued across the state leading to rapid deepening of the surface low. Wind magnitudes decreased at this time with wind speeds of 35 to 45 knots.

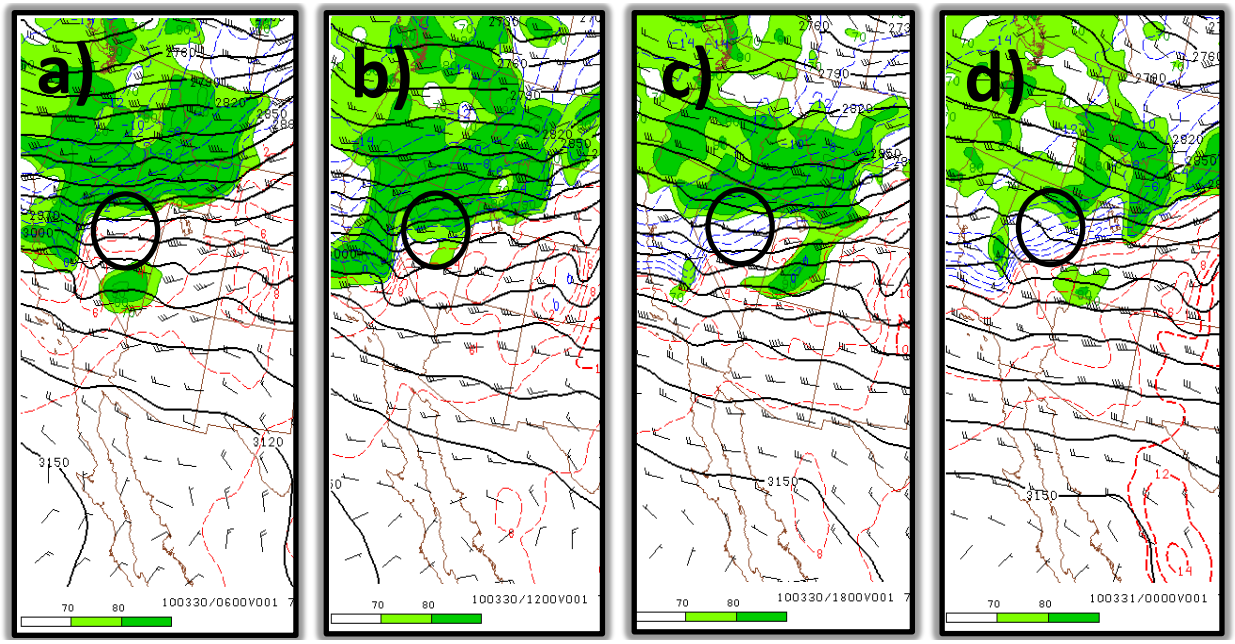

Figure 4: SPC 700 hPa heights (solid lines, black), wind speed (barbs, black), relative humidity (image) and temperature (red indicating positive, blue indicating zero and below; dashed line) composite valid at a) 0600 UTC 30 March 2010; b) 1200 UTC 30 March; c) 1800 UTC 30 March; and d) 0000 UTC 31 March. Black circle highlights Elko's CWA.

4. Surface Analysis

Figure 5a below depicts the surface chart from the evening of 29 March. The most notable features are the surface cold front that is stretched across the Pacific Northwest and the 1014 hPa surface high pressure system located over the Four Corners region. Approximately 12 hours later (see figure 5b below), the sensible weather elements at the surface changed very little, with the cold front still draped over northern California and low pressure (about 996 hPa) developing in southern Oregon. However, the surface high over the Four Corners area weakened, resulting in the surface pressure at the Ely, NV ASOS (KELY) site dropping nearly 7 hPa in 12 hours (from 1003 hPa to 996 hPa).

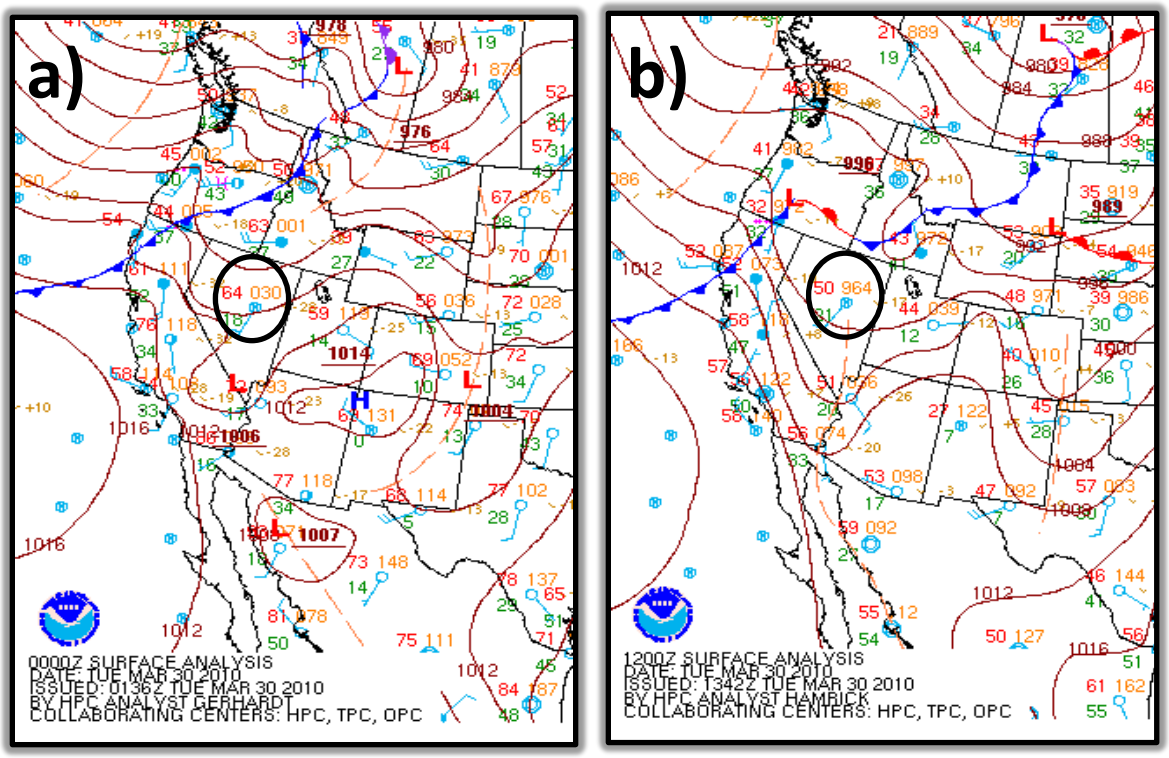

Figure 5: WPC surface analysis valid at a) 0000 UTC 30 Mar 2010 and b) 1200 UTC 30 Mar 2010. Isobars are every 4 hPa, standard meteorological frontal symbols and surface station model apply. Black circle highlights Elko's CWA.

Figure 6a below shows the eastward progression of the surface low pressure system across south-central Idaho, concomitant with the cold front across northern Nevada. By 1800 UTC, the surface low deepened to 993 hPa across southwest Idaho. This resulted in rapid pressure falls and a tightening of the surface pressure gradient across the CWA, with a 10 hPa difference depicted between KELY and the Winnemucca, NV ASOS (KWMC), as seen in Figure 6b. It should be noted the first reports of wind damage in Elko County occurred around the 1700 UTC 30 March time frame.

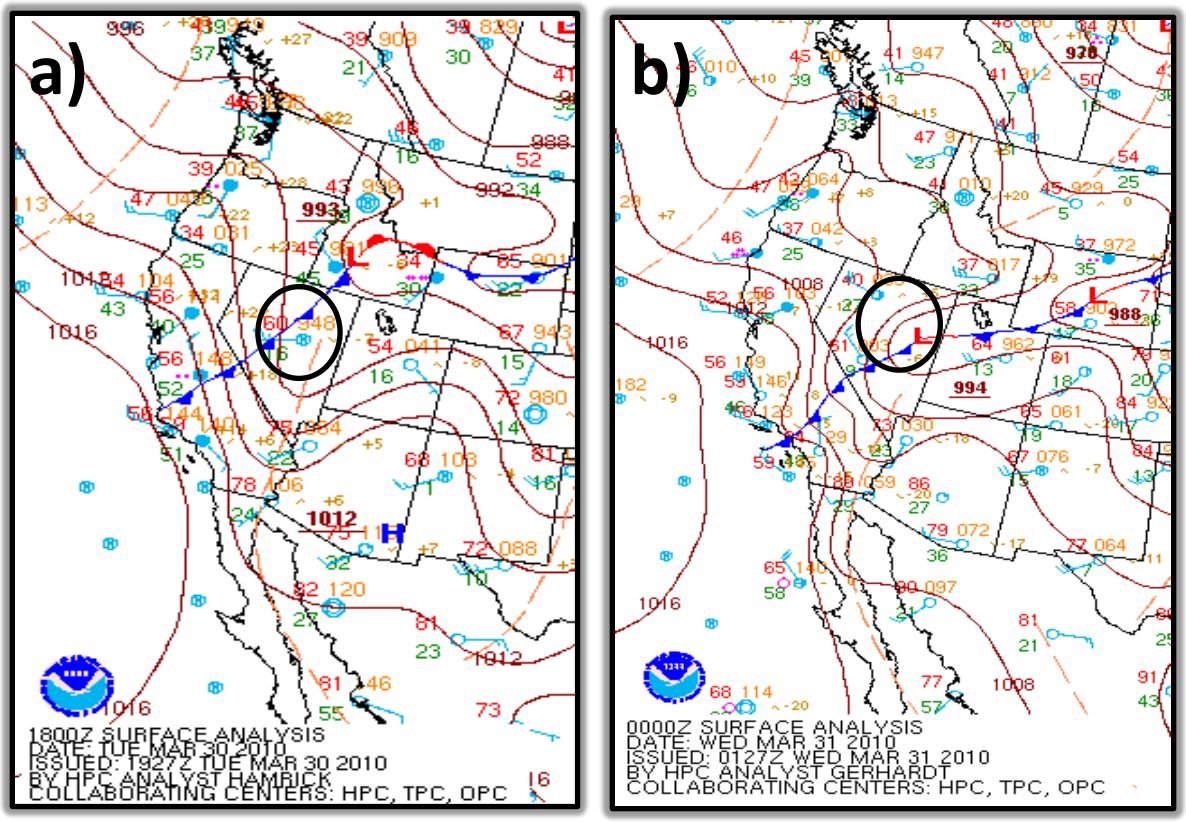

Figure 6: Same as figure 5a except time is a) 1800 UTC 30 March 2010; b) 0000 UTC 31 Mar 2010.

Temperature advection played a key role in the strong winds and cyclogenesis that occurred on 30 March. Figure 7a showed that cold air advection (CAA) at 850 hPa (can be considered the surface for all the major cities in northern Nevada, due to the high elevation nature of Elko's CWA) began by 1800 UTC, which led to strong frontogenetical forcing. By 0000 UTC 31 March (Figure 7b), the temperature gradient at the 850 hPa level increased, enabling the strong winds from aloft to mix down to the surface.

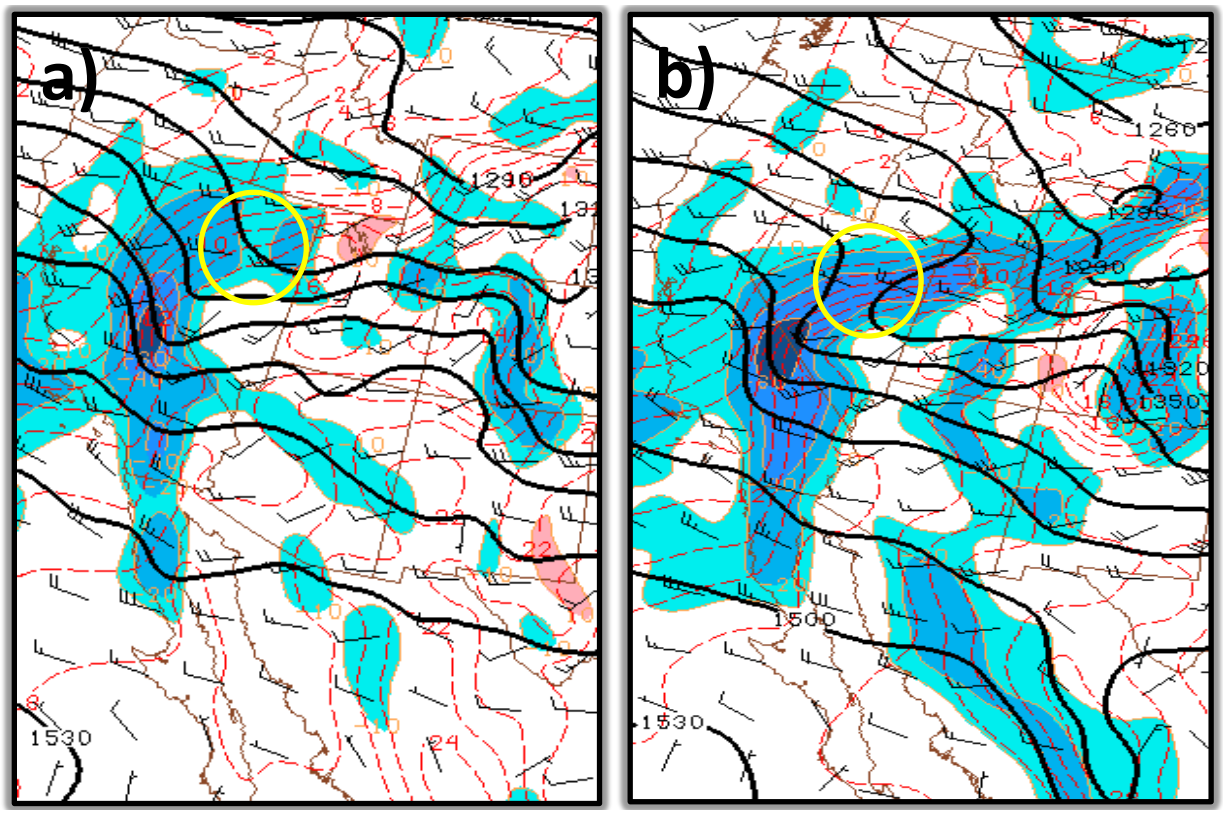

Figure 7: SPC 850 hPa geopotential heights, temperature, wind, and temperature advection (image) for a) 1800 UTC 30 March 2010 and b) 0000 UTC 31 March 2010. Black flags indicate wind speed (half barb = 5 kt, full barb = 10 kt, triangle = 50 kt). Geopotential heights are in black and bold lines. Temperatures are in red, dashed lines. CAA is shown in cooler colors, warm air advection (WAA) in warmer colors. Yellow circle highlights Elko's CWA.

5. Upper Air Soundings

Sounding data from LKN was taken from the morning of 30 March before the cold frontal passage, as well as the post-frontal environment. Figure 8a highlights the pre-frontal environment; a steep low-level lapse rate exists from the surface up to 650 hPa. Wind speeds of 65 knots are evident in the mixed layer, supported by a 145 knot jet at 250 hPa. By late afternoon at 0000 UTC (Figure 8b), the surface cold front had pushed through Elko. Lapse rates have steepened from the surface to 650 hPa to nearly a dry adiabatic lapse rate, with 50 knots seen at 650 hPa. Another interesting feature was this frontal passage was mostly dry, which allowed for steeper low-level lapse rates and deeper mixing. When combining the low level cold advection with steep low level lapse rates, it creates conditions similar to what was written in Bluestein (1993) where "the lapse rates may be nearly dry adiabatic, and hence there is turbulent vertical mixing that creates gusty surface winds".

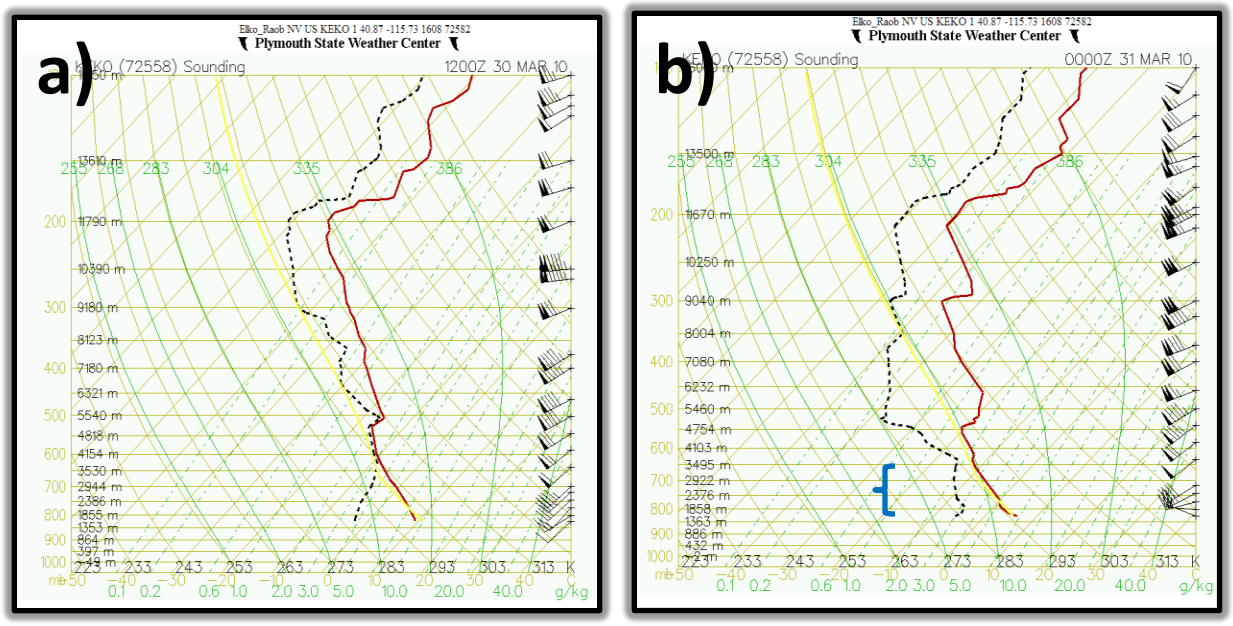

Figure 8: Upper air sounding at LKN taken at: a) 1200 UTC 30 March 2010 and b) 0000 UTC 31 March 2010. The blue bracket depicts a nearly dry adiabatic mixed layer from 650 hPa to the surface.

6. Analysis of Ensemble Forecasts

This section will present anomalies and wind speed forecasts from the SREF and GFS ensemble forecast models. Data for 30 March was saved from the forecasts created on the 28th and 29th for purposes of comparing each forecast with the actual event, and will be discussed in further detail below.

a. SREF Forecast of 250 hPa U-wind

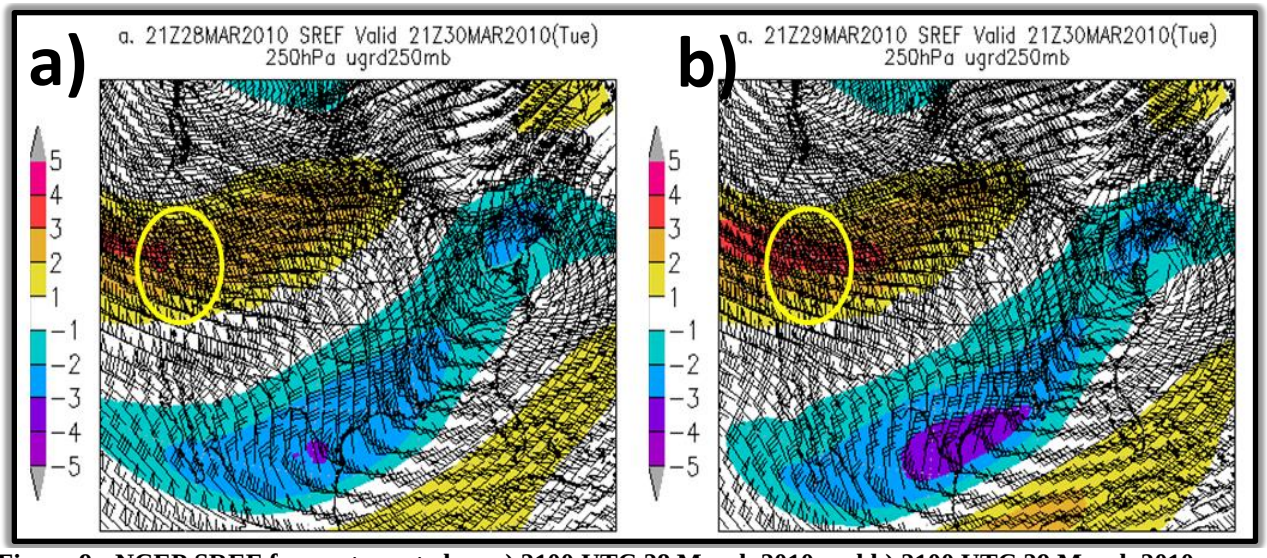

Figure 9: NCEP SREF forecast created on a) 2100 UTC 28 March 2010 and b) 2100 UTC 29 March 2010 depicting 250 hPa wind speeds valid at 2100 UTC 30 March 2010. Black flags indicate wind speed (half barb = 5 kt, full barb = 10 kt, triangle = 50 kt). Climatological anomalies shown are defined in the left side scale (cooler colors represent below normal anomalies). Yellow circle highlights the state of Nevada.

SREF model data depicted an anomalously strong jet pushing across the eastern Pacific and into Oregon and northern Nevada. As Figure 9b illustrates, the latest forecast solution indicated a much stronger jet coming ashore, with the 2100 UTC 29 March forecast depicting a +3 to +4 standard deviation (SD) upper jet across northern Nevada. In contrast, the previous day's solution was forecasting an anomaly of +2 to +3 SD (Figure 9a).

b. GEFS Forecast of 250 hPa U-wind

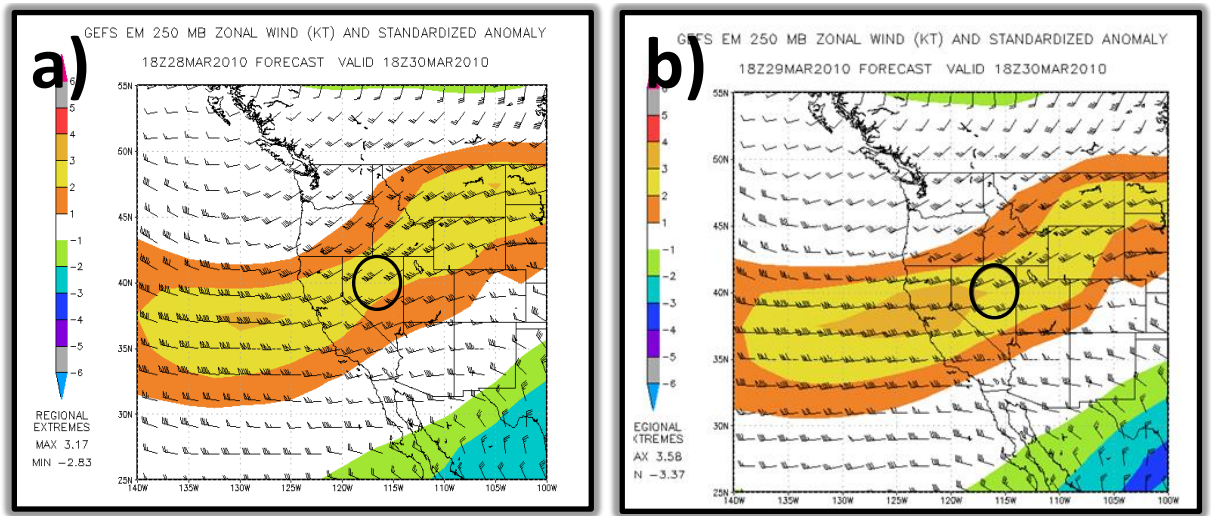

Figure 10: GFS ensemble forecast depicting 250 hPa wind speeds created on a) 1800 UTC 28 March 2010 forecast and b) 1800 UTC 29 March 2010 forecast valid at 1800 UTC 30 March 2010. Black flags indicate wind speed (half barb = 5 kt, full barb = 10 kt, triangle = 50 kt). Climatological anomalies shown are defined in the scale on the left side of the images (cooler colors represent below normal anomalies). Black circle highlights Elko's CWA.

GEFS model data mimics the SREF in depicting a strong and anomalous upper jet over northern Nevada. Figure 10 above clearly shows higher anomalies being forecast, especially on 1800 UTC 30 March where anomalies of +3 to 4 SDs are seen entering central Nevada.

c. GEFS Forecast of 700 hPa U-wind

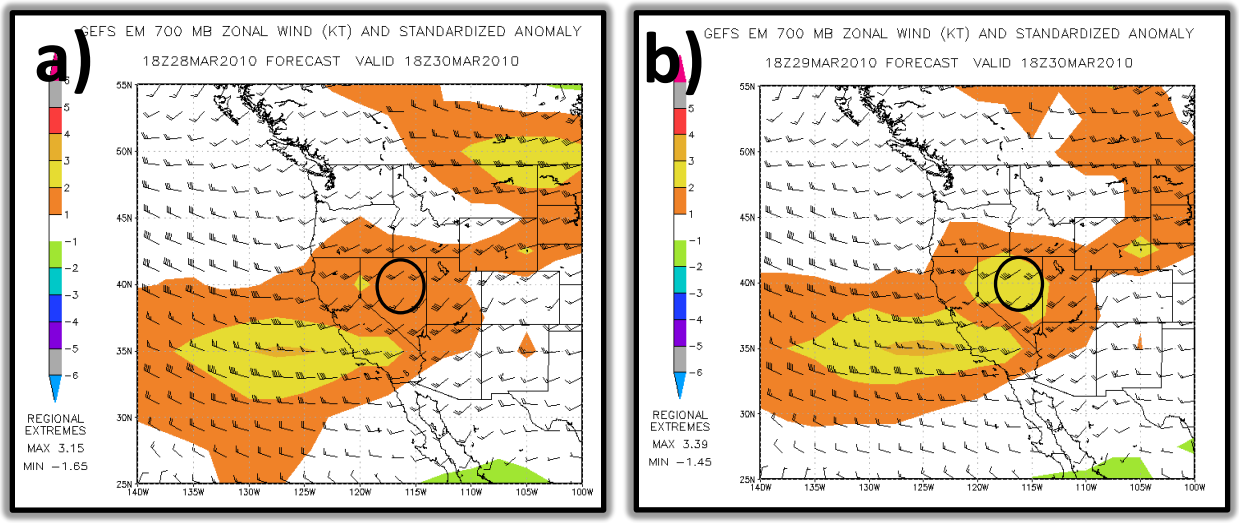

Figure 11: GFS ensemble forecast created on a) 1800 UTC 28 March 2010 and b) 1800 UTC 29 March 2010 depicting 700 hPa wind speeds valid 1800 UTC 30 March. Black flags indicate wind speed (half barb = 5 kt, full barb = 10 kt, triangle = 50 kt). Climatological anomalies shown are defined in the scale on the left side of the images (cooler colors represent below normal anomalies). Black circle highlights Elko's CWA.

A similar pattern in the magnitude of anomalies appears in the 700 hPa level, seen above in Figure 11, consistent with the previously discussed levels. Winds are forecast to be stronger during the day in Figure 11b, as evidenced in the slightly higher anomalies.

d. SREF forecast 850 hPa U-wind

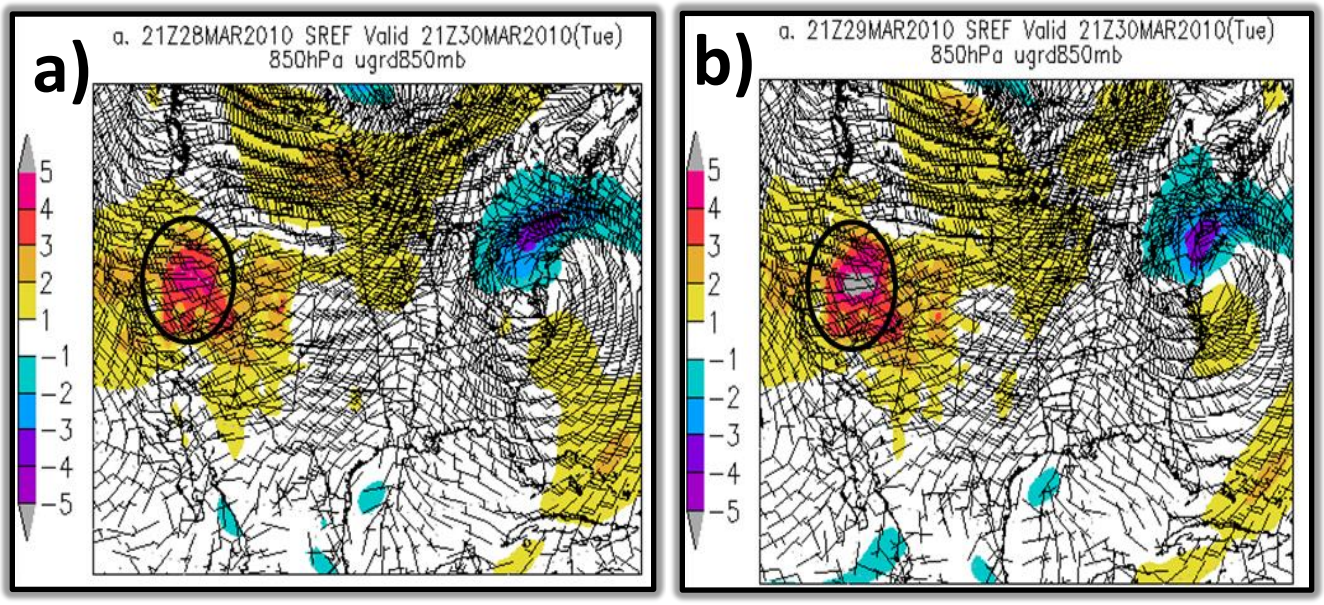

Figure 12: SREF forecast created on a) 2100 UTC 28 March 2010 and b) 2100 UTC 29 March 2010 depicting 850 hPa wind speeds valid 2100 UTC 30 March 2010. Black flags indicate wind speed (half barb = 5 kt, full barb = 10 kt, triangle = 50 kt). Climatological anomalies shown are defined in the scale on the left side of the images (cooler colors represent below normal anomalies). Black circle highlights the state of Nevada.

The SREF wind forecast at the 850 hPa level (Figure 12) was archived as it was the lowest level constant pressure field available on the website at the time of forecast. Similar to the 250 hPa forecast, the climatological anomalies on the 2100 UTC 29 March panel for the forecast valid at 2100 UTC 30 March indicates highly anomalous 850 hPa wind speeds in excess of +5 SD (Figure 12b). The previous day's forecast (Figure 12a) showed a large area of +2 to +3 SD above normal, significantly less anomalous than the forecast on 29 March. The GEFS output seen in Figure 13 below continues this trend with much higher anomalies being forecast, with +4 to 5 SD seen in the 1800 UTC 29 March forecast (figure 13b).

e. GEFS Forecast 850 hPa U-wind

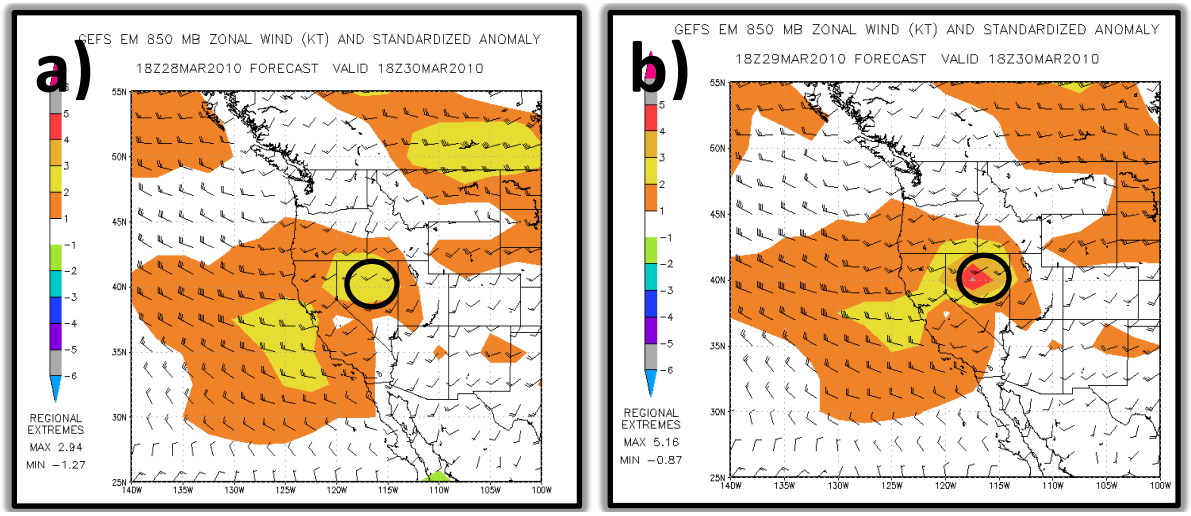

Figure 13: GFS ensemble forecast for 2100 UTC 28 March 2010 (top image) and 2100 UTC 29 March 2010 (bottom image) depicting 250 hPa wind speeds valid 2100 UTC 30 March 2010. Black flags indicate wind speed (half barb = 5 kt, full barb = 10 kt, triangle = 50 kt). Climatological anomalies shown are defined in the scale on the left side of the images (cooler colors represent below normal anomalies). Black circle highlights Elko's CWA.

f. SREF Forecast of MSLP

Figure 14 below shows the SREF MSLP forecast for the afternoon of 30 March. The SREF was consistent in forecasting an anonomously strong -3 to -4 SD surface low pressure system for the Great Basin. There are minute differences in the forecast pressure fields, especially across Wyoming and Idaho, where a deeper surface low is forecast by the 2100 UTC 29 March SREF run. This slight deepening created a much tighter pressure gradient across northern Nevada.

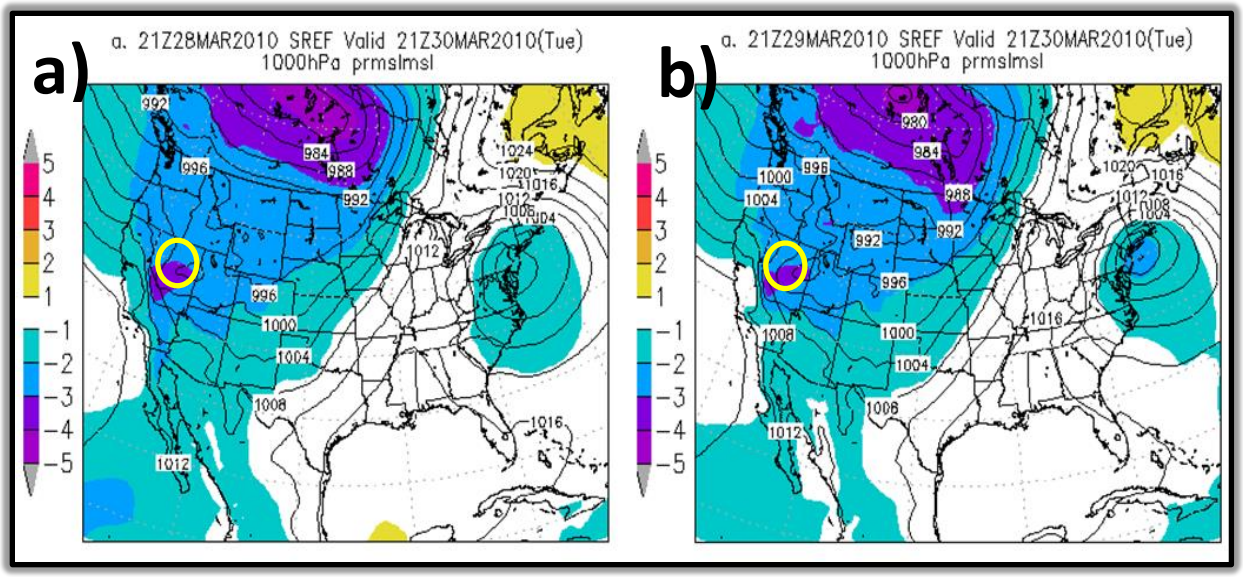

Figure 14: NCEP SREF forecast beginning at a) 2100 UTC 28 March 2010 and b) 2100 UTC 29 March 2010 depicting MSLP valid for 2100 UTC 30 March 2010. Thin black lines are lines of equal surface pressure every 4 hPa. Climatological anomalies shown are defined in the scale on the left side of the images (cooler colors represent below normal anomalies). Yellow circle highlights Elko's CWA.

7. Conclusions and Operational Rules of Thumb

A strong low pressure system and attendant cold front pushed across northern Nevada during the late morning and afternoon hours of 30 March 2010. Pressure gradient forcing combined with strong winds from the upper levels of the atmosphere, which were translated to the surface via turbulent mixing in the planetary boundary layer, resulted in wind gust speeds exceeding high wind warning criteria (gusts greater than 49 knots) over all zones across northern Nevada.

This was an extremely strong wind event in our CWA, which helped to verify previously used rules of thumb (rules of thumb were developed from a study of 6 high wind cases). What made this case special were the large anomalies displayed by the GEFS and SREF models. For high wind events, using anomalies can give forecasters additional confidence in issuing high wind warnings. The only caveat with using anomalies for wind forecasting in the Great Basin -- the wind direction component needs to be from the predominant (in this case, westerly) direction. Large anomalies from a non-predominant direction (for the Great Basin, this would be easterly component winds) have not been fully studied.

The criteria that can be used to help forecasters determine future high wind events across the western Great Basin are included below:

- 300 hPa winds of $\geq$ 120 knots
- 500 hPa winds of $\geq$ 80 knots
- 700 hPa winds of $\geq$ 50 knots
- An east to west MSLP gradient $\geq$ 11 hPa from northwest Humboldt County to southeast White Pine County
- MSLP $\leq$ -3 SD

- SREF anomalies – 850 hPa wind anomalies ≥ +4 SD
  250 hPa wind anomalies ≥ +3 SD
- GEFS anomalies – 250 hPa wind anomalies ≥ +3 SD
  700 hPa wind anomalies ≥ +3 SD
- Adequate mechanism to mix winds down to the surface (frontal passage, diabatic heating, etc).

8. Acknowledgements

The authors wish to thank Donald Dumont, Science and Operations Officer, WFO – Elko for his patience and assistance in providing comments to make this manuscript better. We would also like to thank Michael Staudenmaier, Deputy Chief, WRHQ Science and Technology Infusion Division for his comments and guidance.

9. References

Bluestein, Howard B., 1993: *Synoptic-Dynamic Meteorology in Midlatitudes, Volume II*. Oxford University Press, 594 pp.

Graham, Randall A., and Richard H. Grumm, 2010: Utilizing Normalized Anomalies to Assess Synoptic-Scale Weather Events in the Western United States. *Wea. Forecasting*, **25**, 428-445

Appendix 1 – LSR issued the evening of 30 March 2010.

PNSLKN
NVZ013-030>037-311445-

PUBLIC INFORMATION STATEMENT
NATIONAL WEATHER SERVICE ELKO NV
731 PM PDT TUE MAR 30 2010

...PUBLIC INFORMATION STATEMENT...

PEAK WIND GUSTS OVER THE PAST 24 HRS AS OF 7 PM PDT ON 30 MARCH 2010...

LOCATION	WIND GUST (MPH)		LOCATION	WIND GUST (MPH)
RUBY MOUNTAINS/EAST HUMBOLDT RANGE			**NORTHERN ELKO COUNTY**	**WIND GUST (MPH)**
RUBY VALLEY (RAWS)	71 MPH.		ANTELOPE LAKE (RAWS)	57 MPH.
RUBY LAKE (RAWS)	46 MPH.		O`NEIL (RAWS)	49 MPH.
			LONG HOLLOW (RAWS)	65 MPH.
SOUTHWEST AND SOUTH CENTRAL ELKO COUNTY			STAG MOUNTAIN (RAWS)	59 MPH.
ELKO REGIONAL ARPT (ASOS)	67 MPH.		**NORTHERN NYE COUNTY**	
WARM SPRINGS (RAWS)	55 MPH.			
PEQUOP SUMMIT (NDOT)	50 MPH.		WARM SPRINGS SUMMIT (RAWS)	75 MPH.
WELLS/MOOR GRADE (NDOT)	66 MPH.		CURRANT CREEK (RAWS)	60 MPH.
ELKO SUMMIT (NDOT)	62 MPH.		CURRANT SUMMIT (RAWS)	65 MPH.
HALLECK JUNCTION (NDOT)	61 MPH.		NYALA (RAWS)	50 MPH.
			TONOPAH AIRPORT (ASOS)	47 MPH.
SOUTHERN LANDER AND EUREKA COUNTIES			QUIMA PEAK (RAWS)	75 MPH.
AUSTIN SUMMIT(NDOT)	72 MPH.		**WHITE PINE COUNTY**	
BEAN FLAT MONITOR (NDOT)	63 MPH.			
PINTO SUMMIT (NDOT)	52 MPH.		MATHER (RAWS)	81 MPH.
DESATOYA MOUNTAIN (RAWS)	52 MPH.		PANCAKE SUMMIT (RAWS)	68 MPH.
COMBS CANYON (RAWS)	54 MPH.		ALLIGATOR RIDGE (RAWS)	61 MPH.
RED BUTTE (RAWS)	56 MPH.		ELY AIRPORT (ASOS)	59 MPH.
			SCHELL CREEK ELK (RAWS)	58 MPH.
EXTREME EASTERN ELKO COUNTY			CONNERS SUMMIT (RAWS)	45 MPH.
			CEDAR PASS (RAWS)	53 MPH.
SPRING GULCH (RAWS)	50 MPH.		MURRAY SUMMIT (RAWS)	60 MPH.
PILOT PEAK JUNCTION (NDOT)	50 MPH.		BAKER FLAT (RAWS)	40 MPH.
			SACRAMENTO SUMMIT (RAWS)	59 MPH.
HUMBOLDT COUNTY				
			NORTHERN LANDER AND EUREKA COUNTIES	
WINNEMUCCA (ASOS)	49 MPH.			
MOREY CREEK (RAWS)	57 MPH.		BATTLE MOUNTAIN (NDOT)	51 MPH.
GOLCONDA SUMMIT (RAWS)	60 MPH.		EMIGRANT PASS (NDOT)	67 MPH.
ROSE CREEK (RAWS)	56 MPH.		BEACON LIGHT (RAWS)	46 MPH.

Table 2. PNS for strong winds across northern and central Nevada (severe wind gusts greater than 57 mph highlighted in red).

Appendix 2 – Images of damage taken from within the city of Elko.

Figure 15. Uprooted tree within the city of Elko during the high wind event. Photo courtesy of NWS employee.

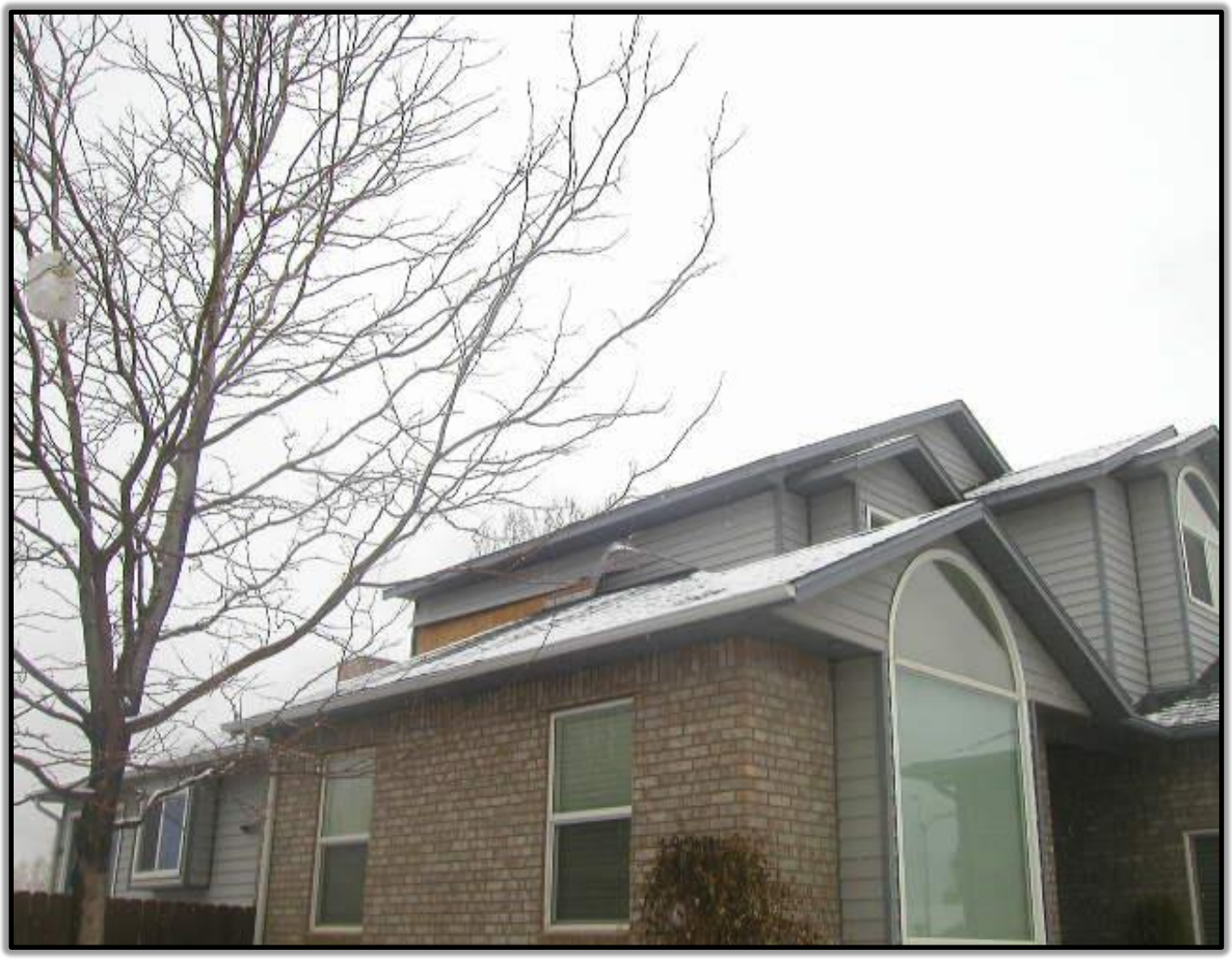

Figure 16. Lost siding from a home in Elko during the high wind event. Photo courtesy of NWS employee.

Figure 17. Partially fallen fence in Elko during the 30 March 2010 high wind event. Photo courtesy of NWS employee.