# Strong Wind Event of 18-19 February 2004

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## Introduction

During the evening of 18 February 2004, strong winds developed over much of the Phoenix CWA in association with the passage of a cold front. A wind advisory, with a lead time of 12 hours, was posted for far southeast California, and was verified at several locations. However, advisory-level winds (sustained 30 mph winds and/or peak gusts at or above 40 mph) also occurred over portions of southwest and south-central Arizona during the night; a second wind advisory, with a lead time less than 1 hour, was issued for a portion of south-central Arizona at 0630 UTC 19 February. This TA-Lite provides a synoptic overview of the event and a discussion of key factors which resulted in the high winds.

## Synoptic Overview

Above normal temperatures and below normal dew points were observed over the Phoenix CWA on 17 and 18 February as an upper level ridge existed over the southwest United States. However, by 1200 UTC on 18 February 2004, the ridge had migrated to the east of Arizona as a vigorous weather disturbance approached the southern California coast. All numerical guidance forecast this system to remain rather strong and progressive during the upcoming 24 hour period as it moved through the Phoenix CWA. Given the strength of the accompanying cold front, local climatology, and surface/low level wind forecasts from numerical models and MOS, the midshift forecaster on 18 February posted a wind advisory for southeast California and the Colorado River Valley for the night of 18-19 February, with the expectation that sustained west wind 20 to 35 mph, with gusts to near 45 mph, would develop, especially over Joshua Tree National Park and most of Imperial County, California, while gusts to 40 mph were forecast along the lower Colorado River. Elsewhere over the Phoenix CWA, sustained 15 to 25 mph winds were forecast for the night of 18-19 February. The HWO issued by WFO Phoenix the morning of 18 February highlighted the threat for high winds and blowing dust or sand in the wind advisory area during the upcoming evening, but also indicated no hazardous weather was expected over most of southwest as well as south-central Arizona.

The water vapor image valid at 1800 UTC 18 February (Figure 1) and visible satellite image valid at 2100 UTC 18 February (Figure 2) provide important details regarding the strength of the upper disturbance. The 12 hr forecast from the GFS, valid at 0600 UTC 19 February, highlights the pronounced 500 hPa fall-rise couplet, with a 220 dam height fall bullseye forecast over far southwest Arizona (Figure 3).

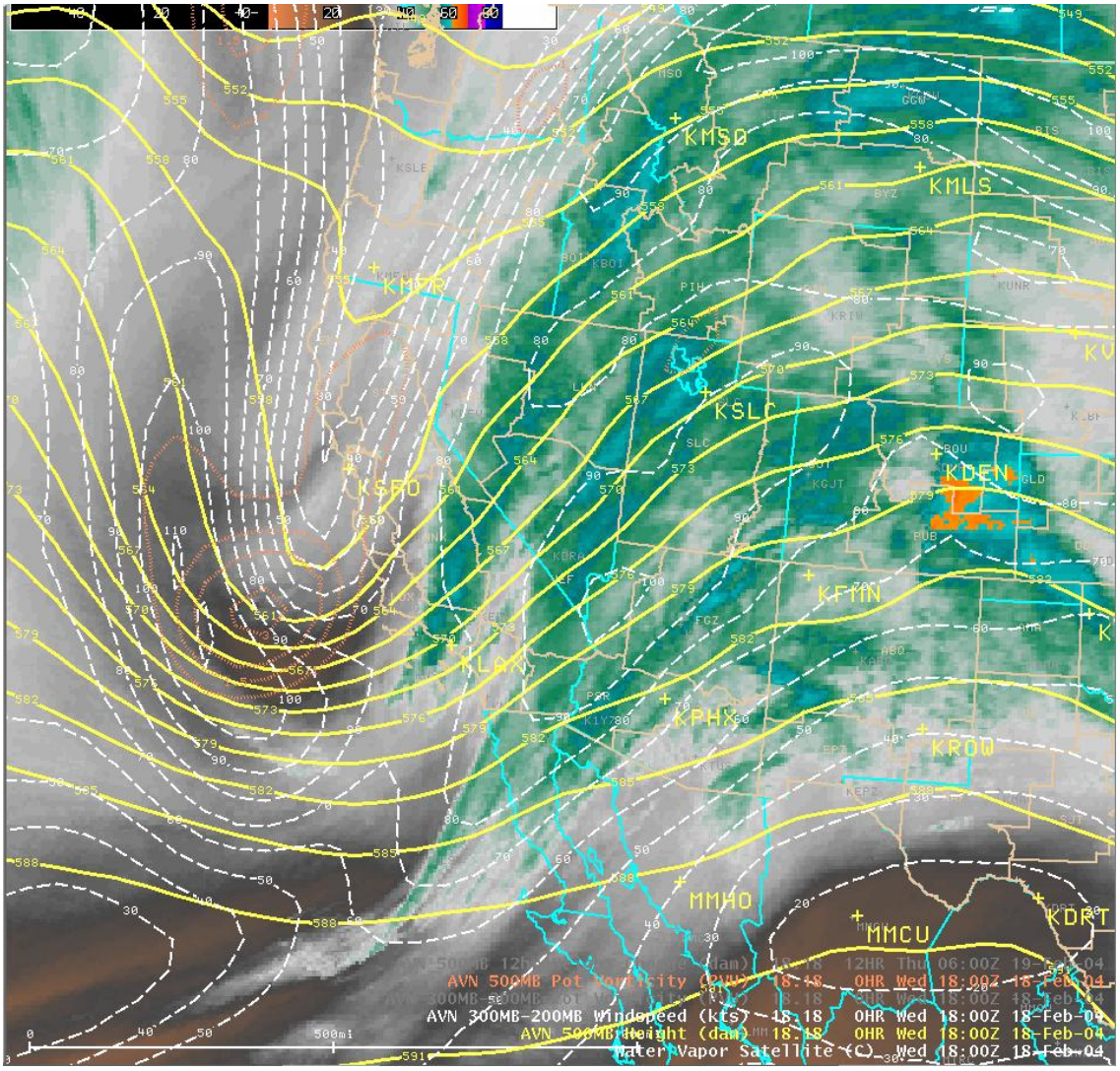


Figure 1. Water vapor image valid at 1800 UTC 18 February 2004. Note location of 500 hPa potential vorticity max with respect to 300-200 hPa speed max and dry intrusion.

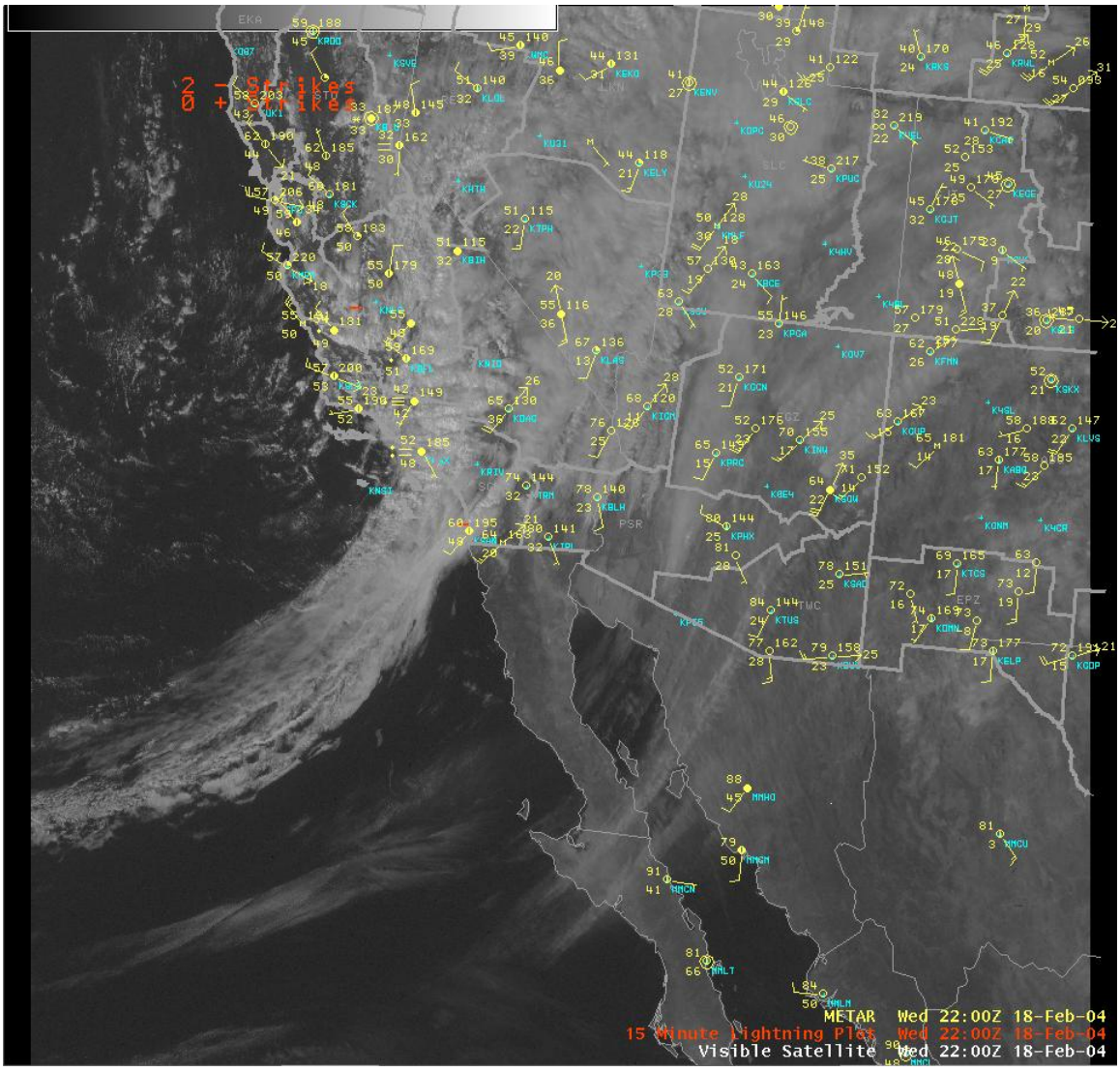


Figure 2. Visible satellite image valid at 2200 UTC 18 February. Note the well-defined frontal zone with isolated c-g lightning over far southern California. In advance of the cold front, the air mass over far southeast California and southwest Arizona was warmer and drier than “climatology”.

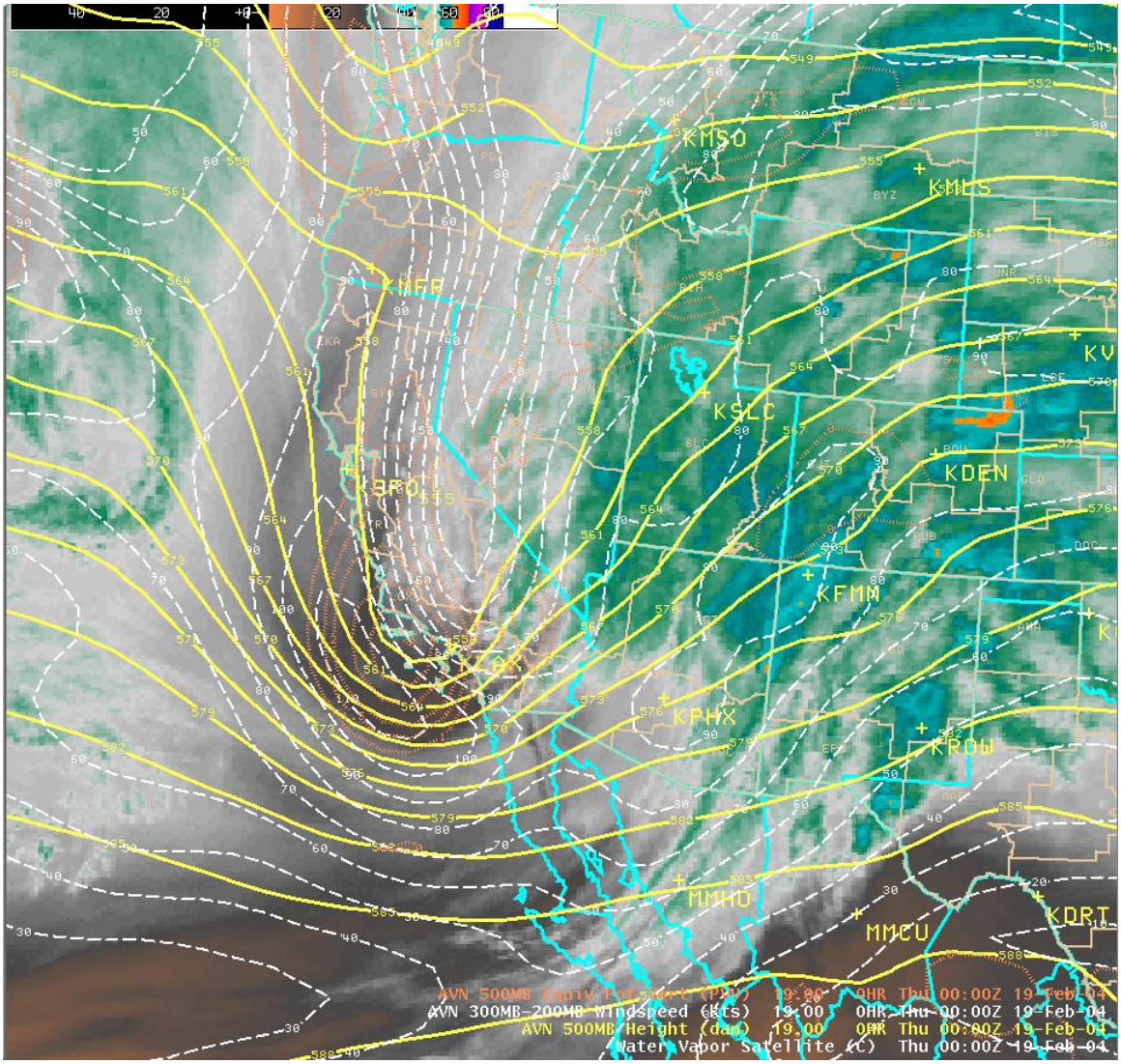


Figure 3. Water vapor image valid at 0000 UTC 19 February. 500 hPa heights fell 60 dam over Phoenix during the past 6 hours. Magnitude of the 500 hPa potential vorticity maximum has increased as trough reached the southern California coast.

In addition to the strong winds, a slight chance for showers (10-20%) was forecast over all of the Phoenix CWA during the night of 18-19 February. Indeed, during the late afternoon of 18 February, high-based, light rain showers developed over portions of far southeast California (Fig. 4), then propagated over southwest and south-central Arizona during the night. Low surface dew points and dry low levels (sfc-600 hPa layer) provided an environment favorable for significant evaporational cooling and downward momentum transport. Figures 5-8 show the progression of showers and surface winds across far southeast California during the early evening of 18-19 February. Maximum sustained wind (peak wind gust) over the advisory area included 31 knots (42 knots at 0237Z) at Imperial, 35 knots (44 knots at 0357Z) at Blythe, and 25 knots (39 knots at 0451Z) at Yuma.

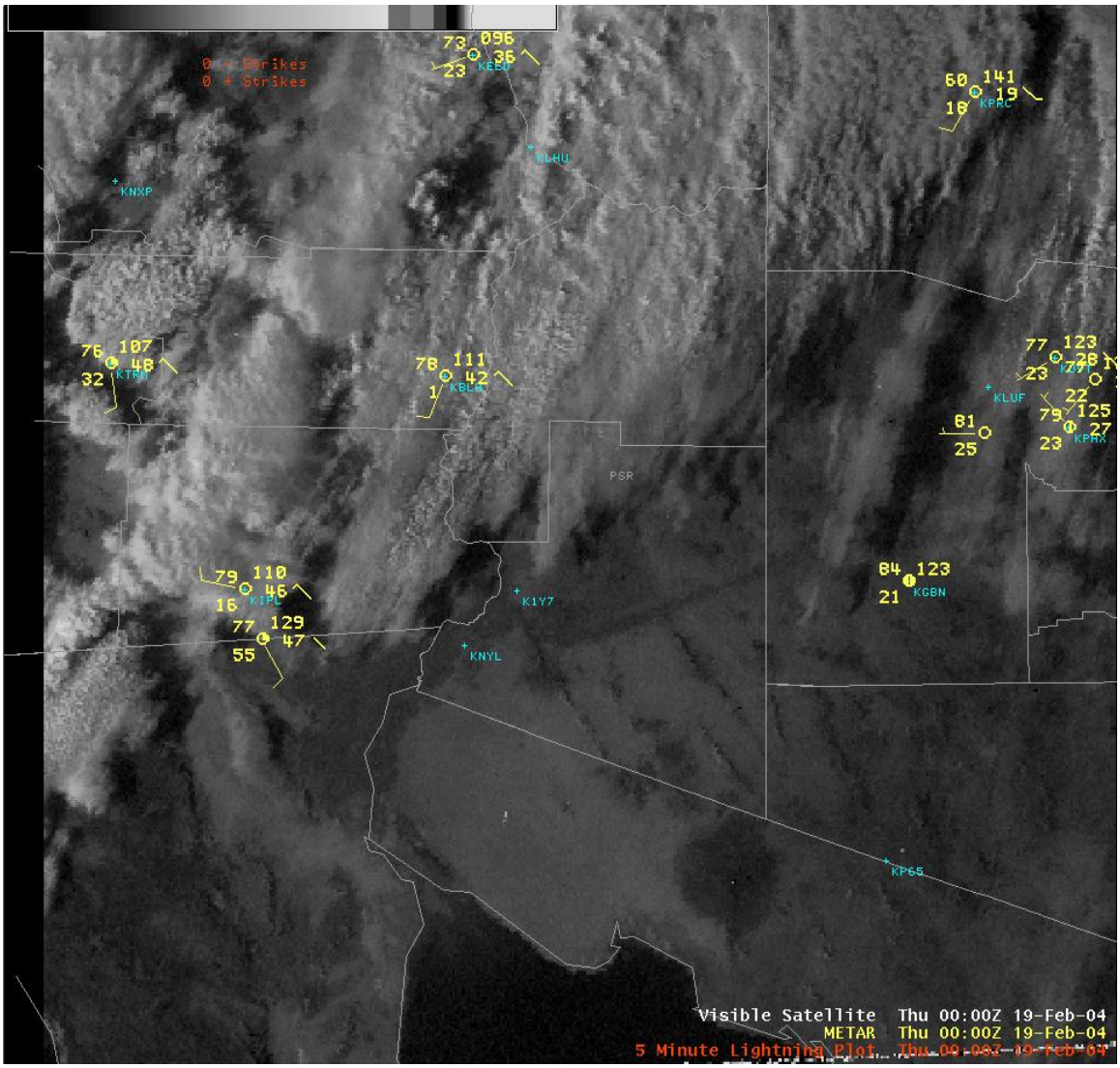


Figure 4. Visible image valid at 0000 UTC 19 February 2004. Light, high-based showers were affecting portions of eastern Riverside County and western Imperial County in far southeast California.

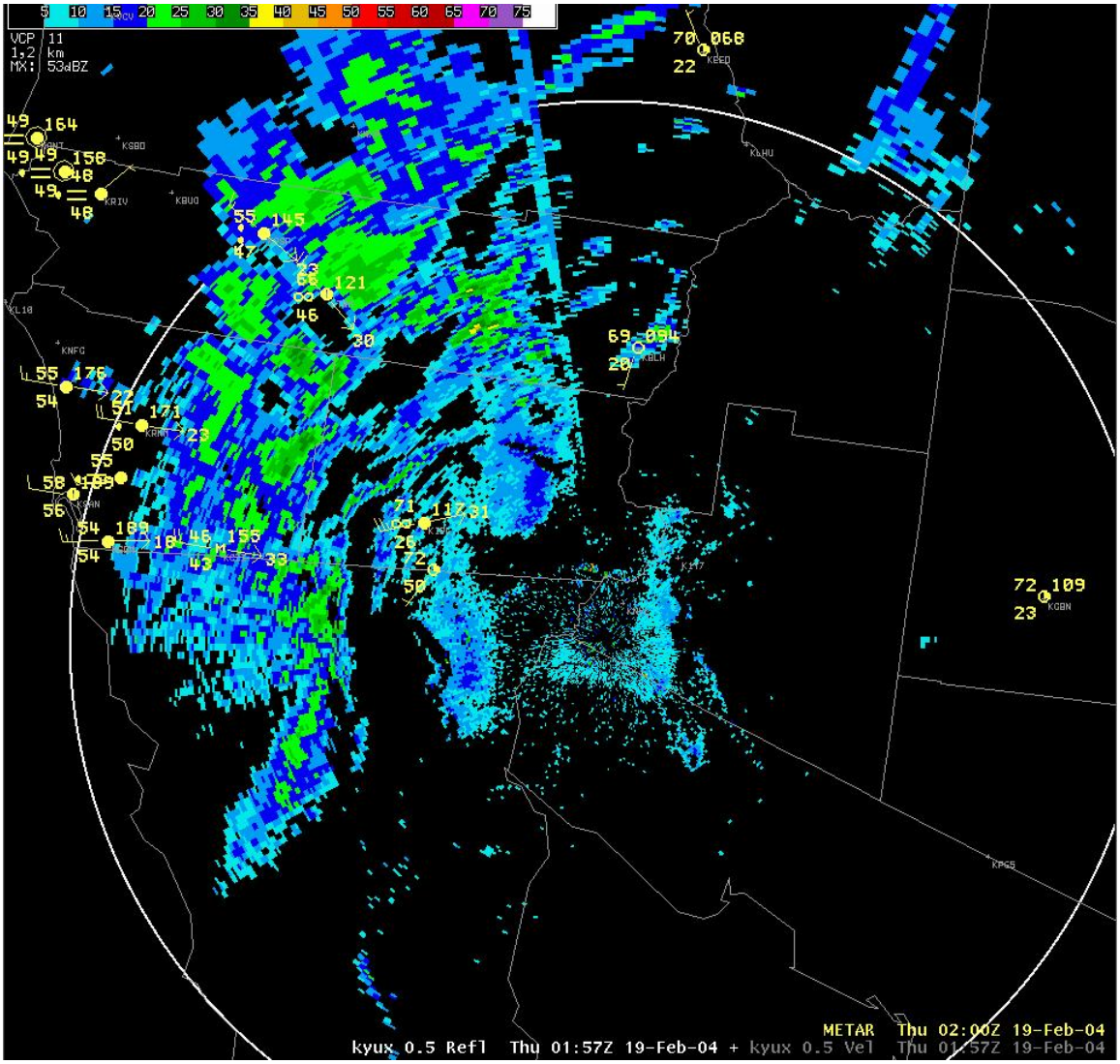


Figure 5. KYUX 0.5 degree base reflectivity and METARs valid at 0200 UTC 19 February 2004. Advisory winds, along with dense blowing sand, was occurring at Imperial California.

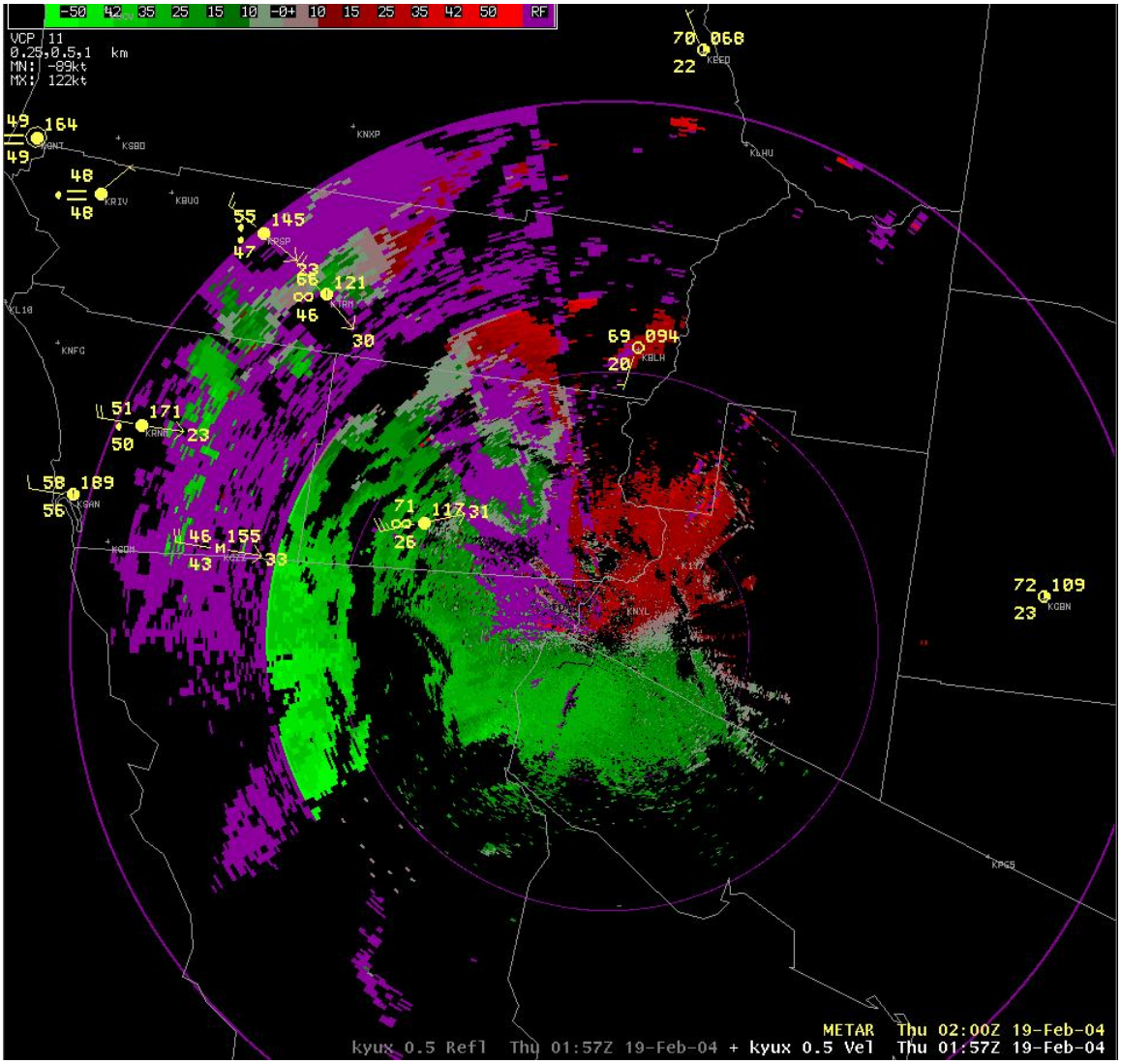


Figure 6. KYUX 0.5 degree base velocity and METAR plots at 0200 UTC 19 February 2004.

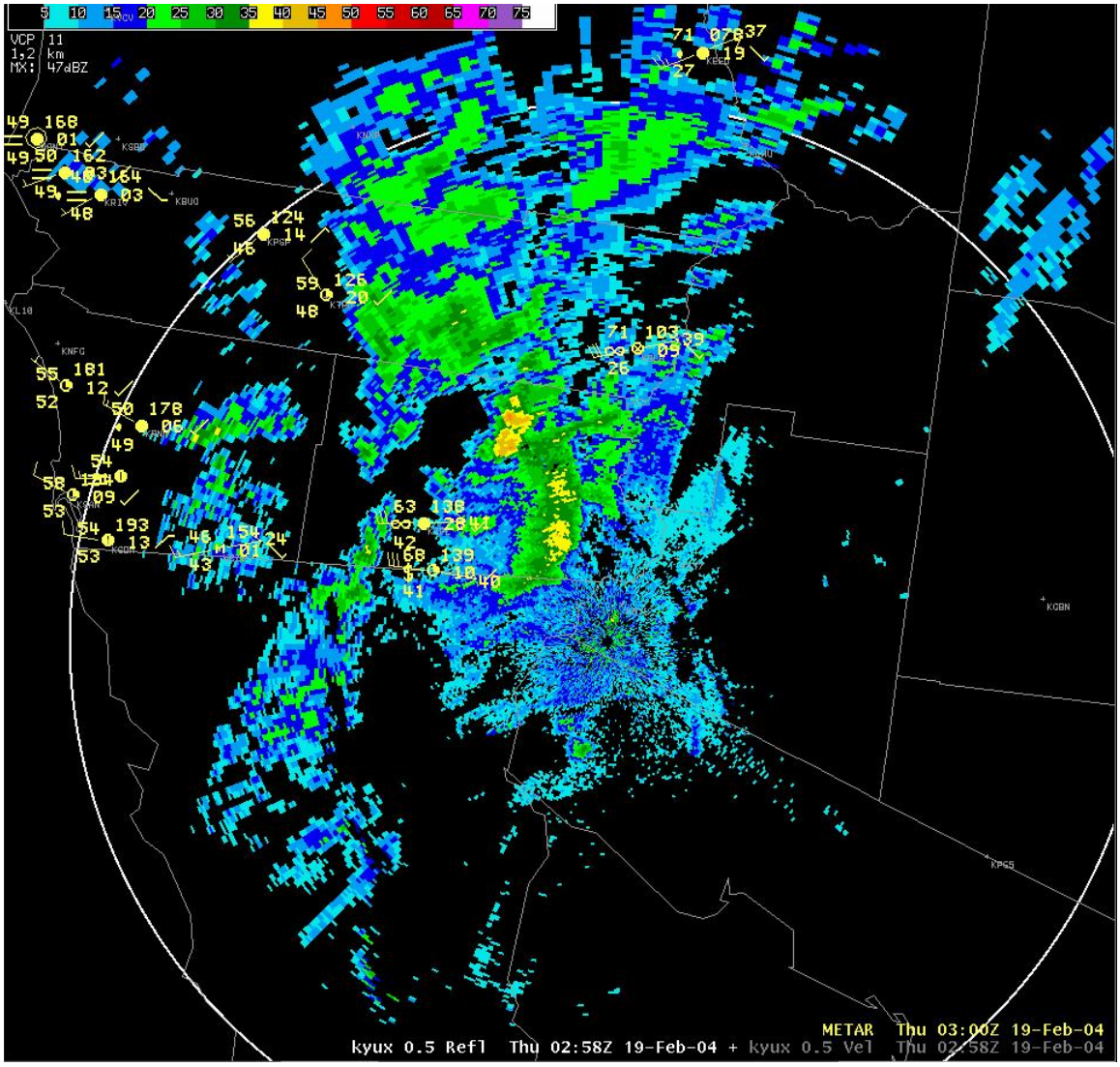


Figure 7. Same as figure 5, except at 0300 UTC 19 February 2004.

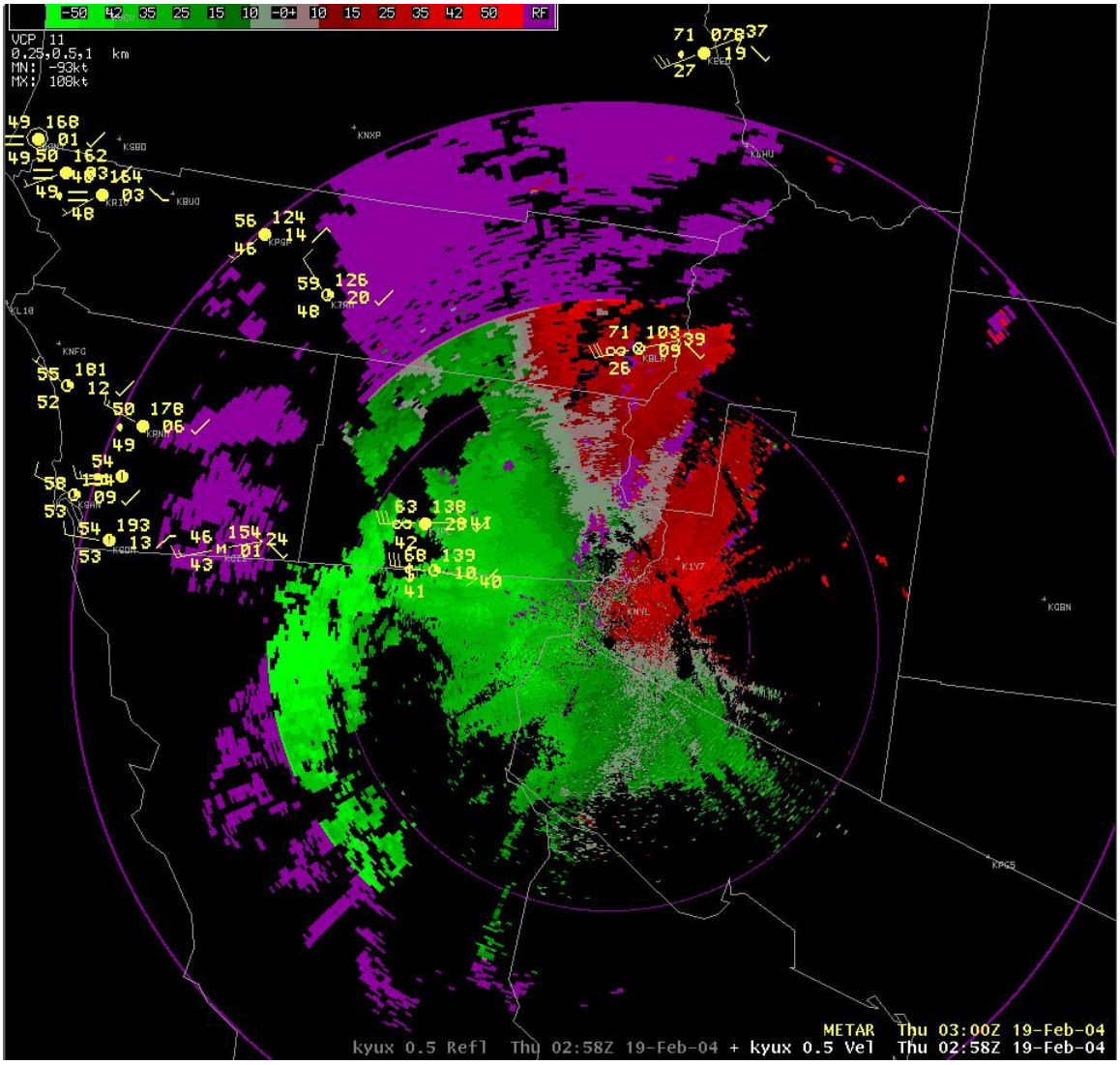


Figure 8. Same as Figure 6, except at 0300 UTC 19 February 2004.

Typically, even with a strong weather system such as this, advisory level winds are not often observed over the south-central Arizona desert during the middle of the night; this case was an exception. Figures 9-10 show the progression of showers and surface winds across south-central Arizona between 0600 and 0700 UTC 19 February. At 0620Z, a spotter in Wittman, a small town west of the Greater Phoenix area, reported a sudden increase in wind, with a peak gust of 48 mph at 0615Z; based on this report, and good situational awareness, a wind advisory was posted for much of south central Arizona until 1100Z. The leading edge of strong gusty winds, created in part by evaporational cooling, moved across the Phoenix area between 0630Z and 0730Z: at 0600Z, Phoenix Sky Harbor reported an east wind at 9 knots; at 0653Z, the airport reported a 30 knot sustained west wind with a peak gust of 37 knots. At 0600Z, Casa Grande reported a south-southwest wind at 9 knots; at 0700Z, Casa Grande reported 27 knot sustained west wind with a peak gust of 34 knots. As was the case over far southeast California and the

lower Colorado River valley, advisory level winds persisted for about 2 hours over south-central Arizona.

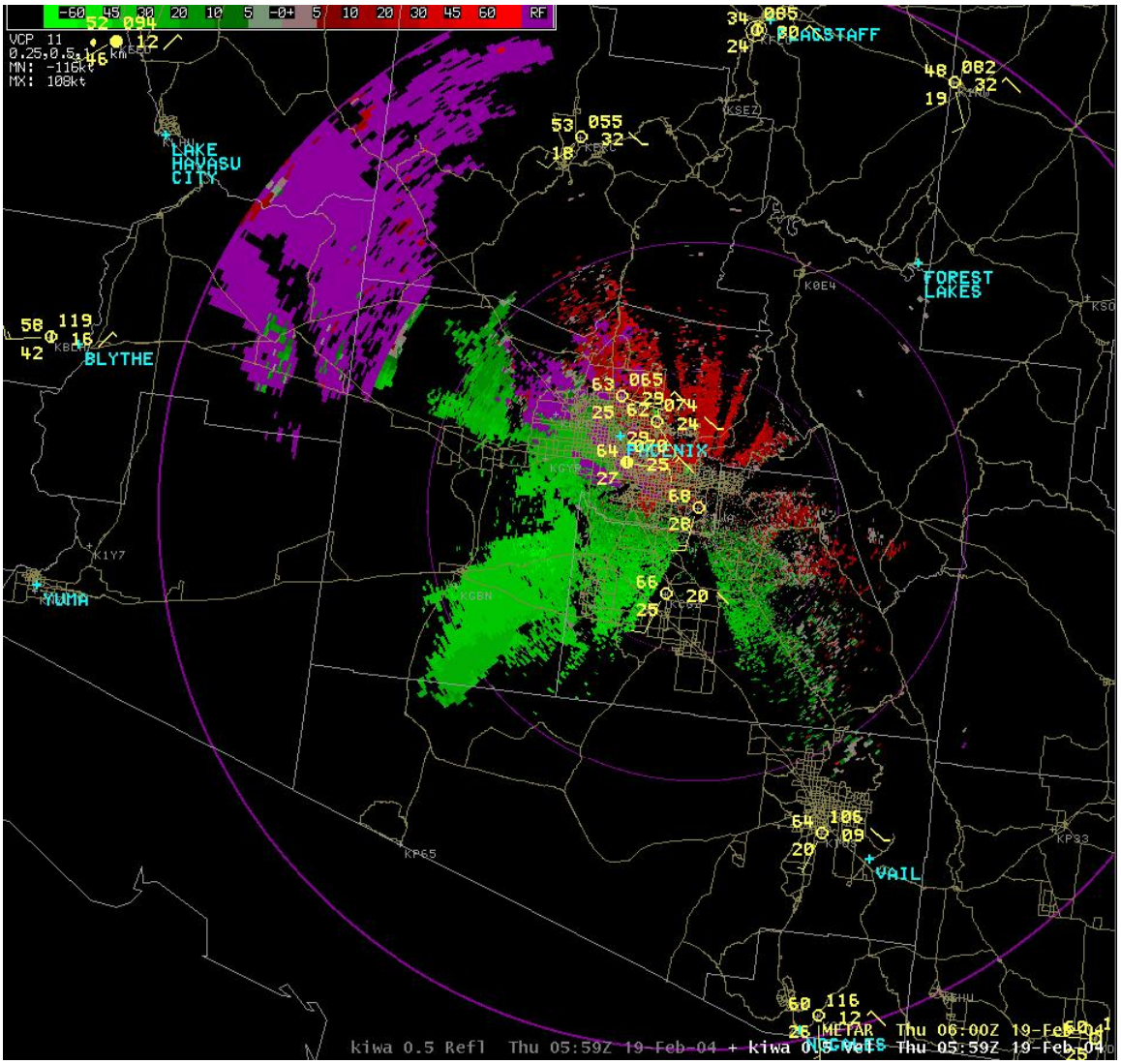


Figure 9. KIWA 0.5 degree base velocity and METAR data valid at 0600 UTC 19 February 2004. Leading edge of strong gusty winds was just west of the Greater Phoenix area at this time, and appears to have been associated with high-based showers/virga.

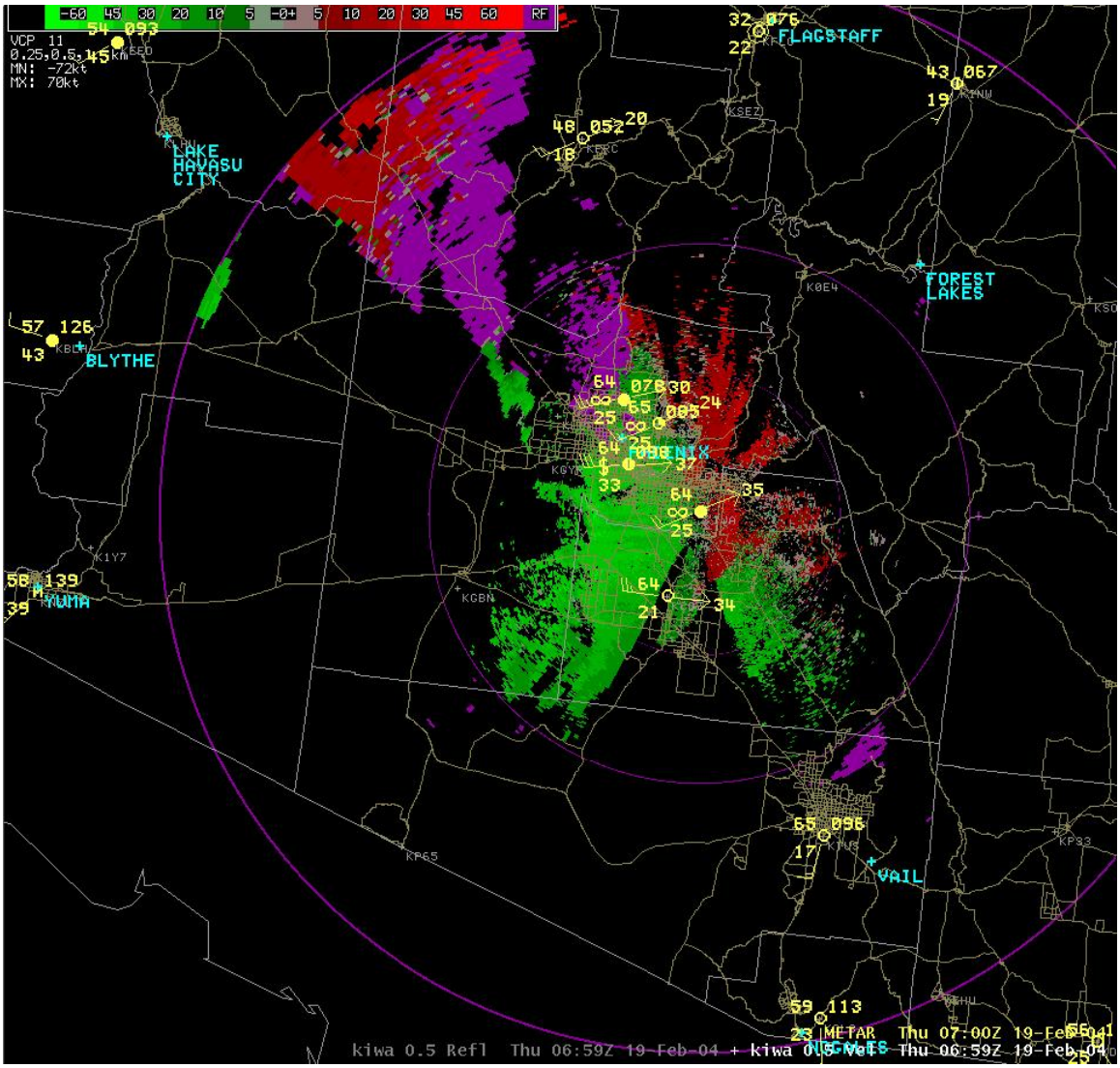


Figure 10. KIWA 0.5 degree base velocity image and METAR data valid at 0700 UTC 19 February 2004.

The WES case will focus on the forecast strength of the low-level wind and the correlation between the intensity/location of the rain showers and the strength of the surface wind. This case highlighted the well-known fact that convection and the downward momentum transfer from evaporational cooling can be critically important in potentially strong wind situations, even when gradient flow is expected to be the primary factor.

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