Gap-Filling Mobile Radar Observations of a Snow Squall in the San Luis Valley

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1. Introduction

The Intermountain West of the U.S. has limited WSR-88D radar coverage, often due to terrain blockage.

Mitigating gaps in radar coverage is an area of ongoing research.

NSSL, the State of Colorado, and local stakeholders have collaborated to study mitigation of the radar gap caused by the terrain of the San Luis Valley (Figure 1).

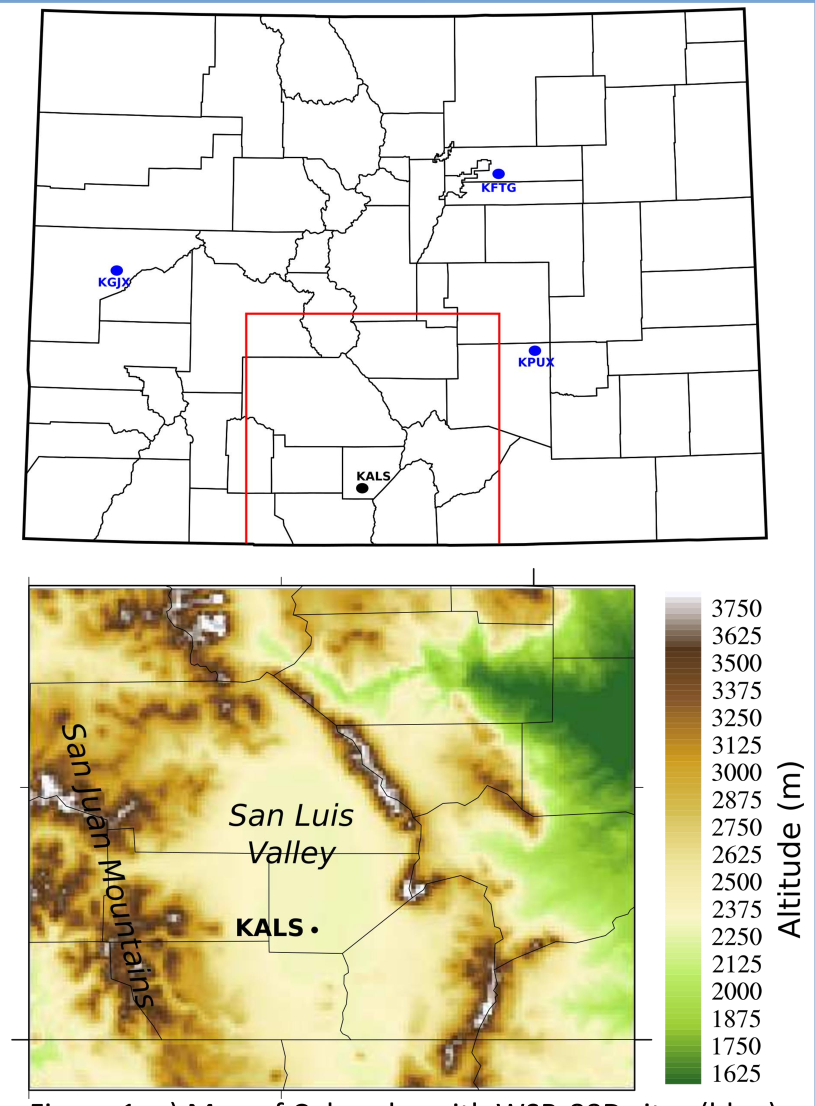

Figure 1: a) Map of Colorado, with WSR-88D sites (blue) and San Luis Valley Regional Airport (KALS, black) indicated. b) Topographic map of region in red box in a).

2. Data

NOXP radar was deployed at the airport in Alamosa, CO (KALS) to study the benefits and viability of a gap-filling radar in the San Luis Valley.

Wavelength	3 cm
Beamwidth	0.9°
Scanning VCP	0.5°, 0.9°, 1.3°, 1.8°, 2.4°, 3.1°, 4.0°, 5.1°, 6.4°, 8.0°, 10.0°, 12.0°
Volume Scan Time	~4 minutes, 10 seconds
Peak Power	250 kW
Operational Range	130 km
Ground Clutter Filter	SIGMET "GMAP" notch filter
Polarization*	Simultaneous horizontal and vertical translation

Table 1: Specifications for the NOAA X-pol (NOXP) radar used in this study. *Reliable dual-polarization variables not available due to hardware issues.

3. NOXP Radar Observations – 0.5° EL PPI

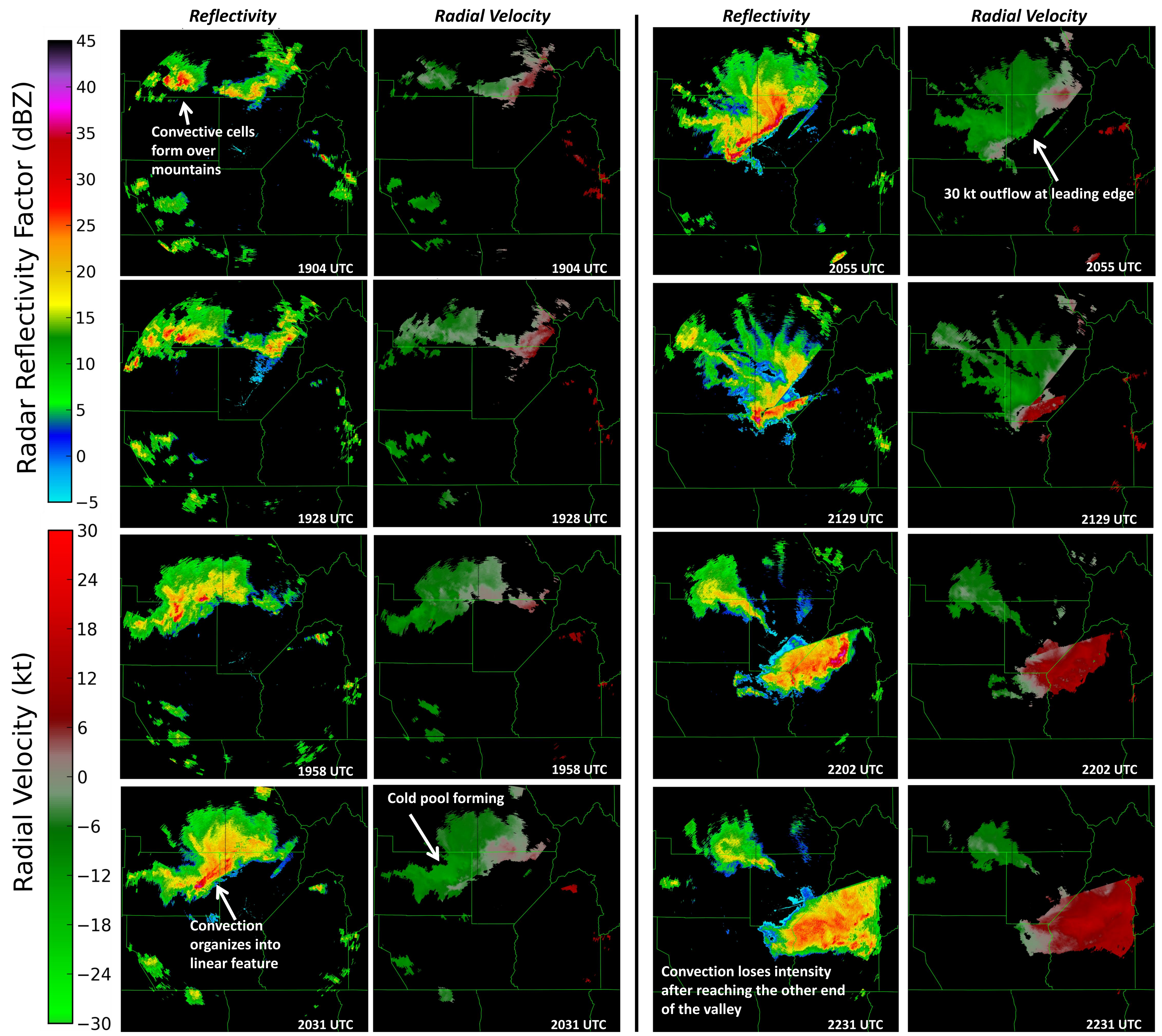

Figure 2: NOXP 0.5° elevation PPI images of the snow squall. Time of each image as indicated. Radar was located at KALS, shown in Figure 1.

4. KALS Surface Observations

Prior to 2050 UTC, winds were light (< 5 m s^{-1}) and generally easterly or southeasterly.

As the squall approached, winds ramped up to 7 m s^{-1} and became southwesterly.

After gust front passage, winds became northwesterly and gusty up to 12 m s^{-1}. Visibility was reduced to 1.4 km after the onset of precipitation.

After passage of the squall, winds became light (< 5 m s^{-1}) again. Winds remained light with later snow showers.

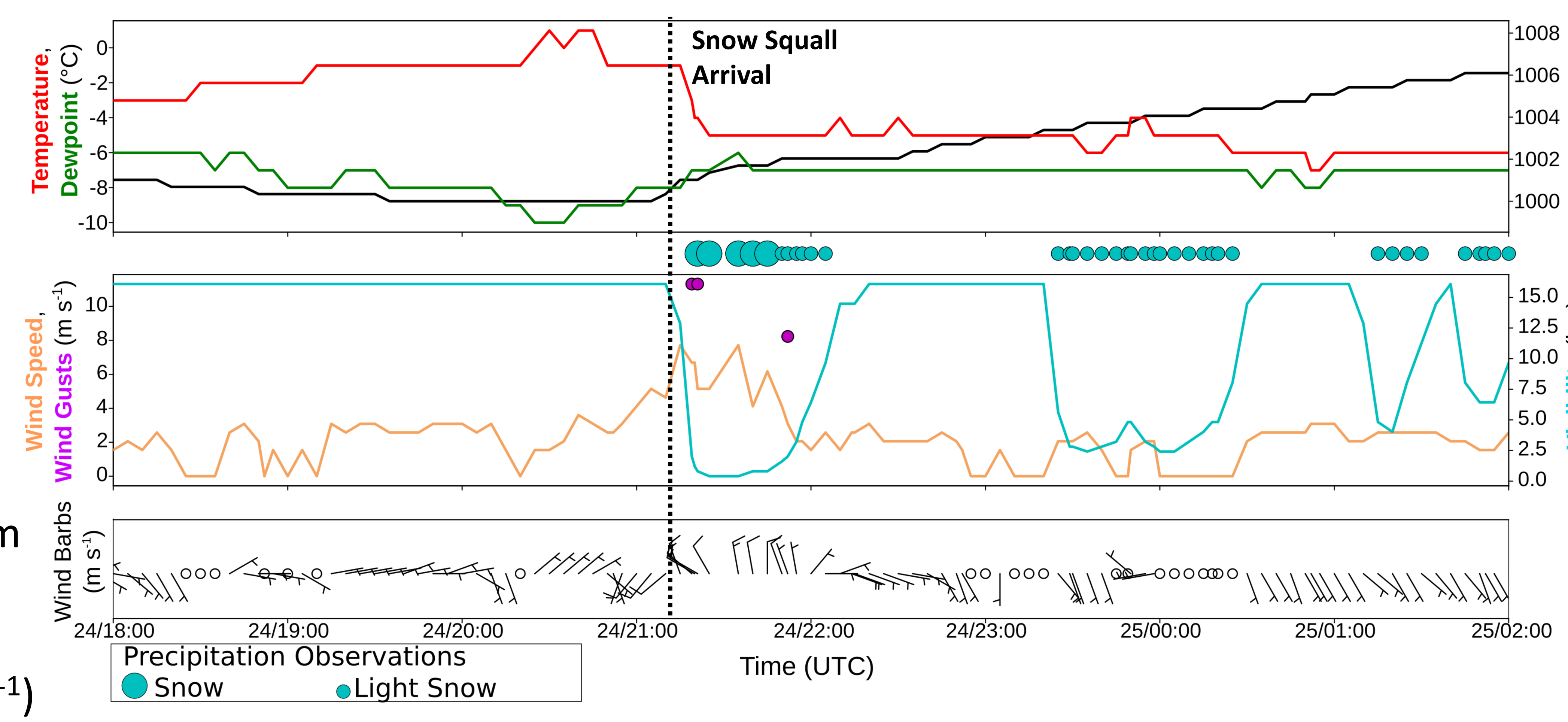

Figure 3: Surface observations from the KALS ASOS on January 24-25, 2017. A small barb indicates 2.5 m s^{-1}, and a large barb indicates 5 m s^{-1}.

5. Environment Summary

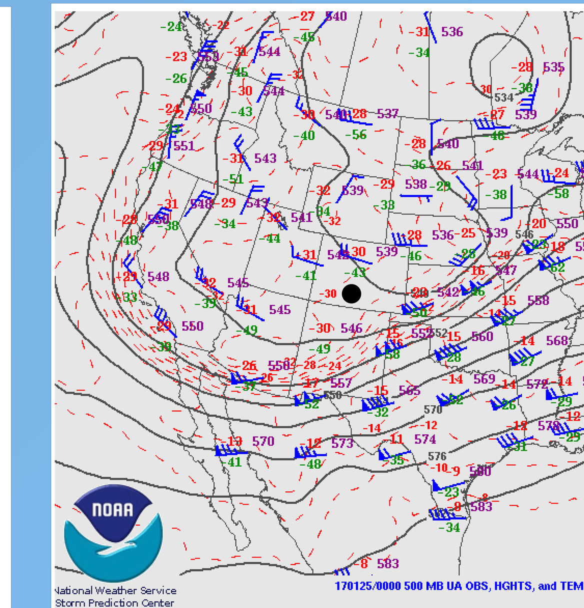

Figure 4: 500 hPa analysis valid 0000 UTC 25 January 2017. The dot indicates the location of KALS.

Squall formed beneath upper-level trough. Cold mid-levels contributed to positive CAPE with light (≤ 30 kt) westerly flow.

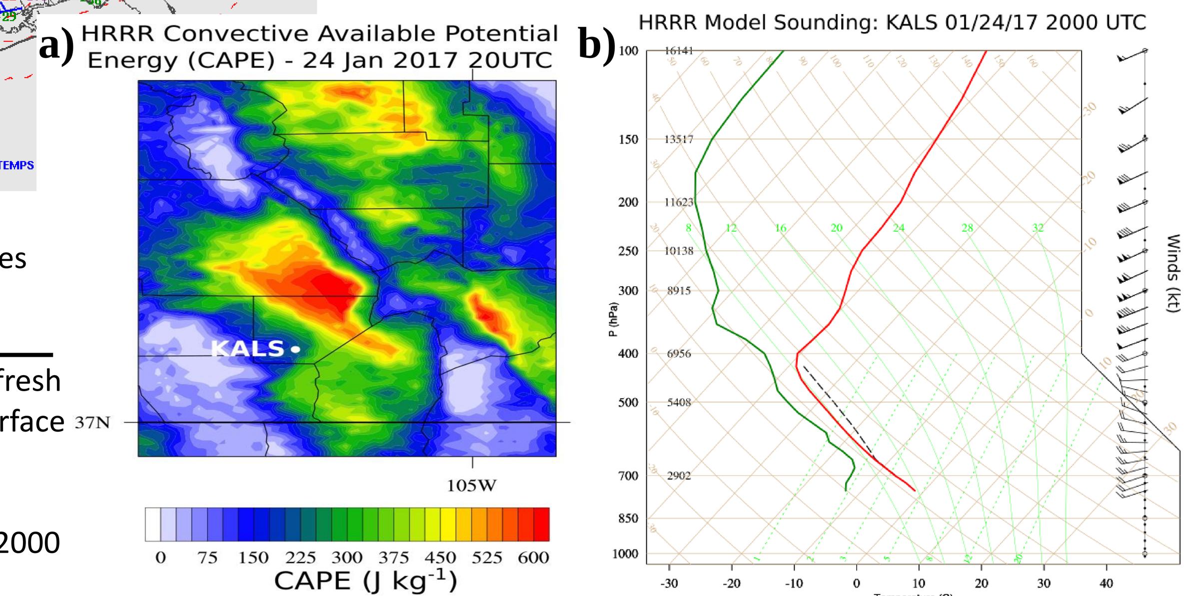

Figure 5: a) High Resolution Rapid Refresh (HRRR) 2000 UTC 24 January 2017 Surface Based Convective Available Potential Energy (SBCAPE).
b) HRRR model sounding for KALS at 2000 UTC on 24 January 2017.

6. MRMS Integration

The ability of forecasters and stakeholders to access data from a gap-filling radar is important to maximizing the radar's impact.

NSSL's Multi-Radar Multi-Sensor (MRMS) system is designed to integrate radars of differing characteristics into its gridded mosaic.

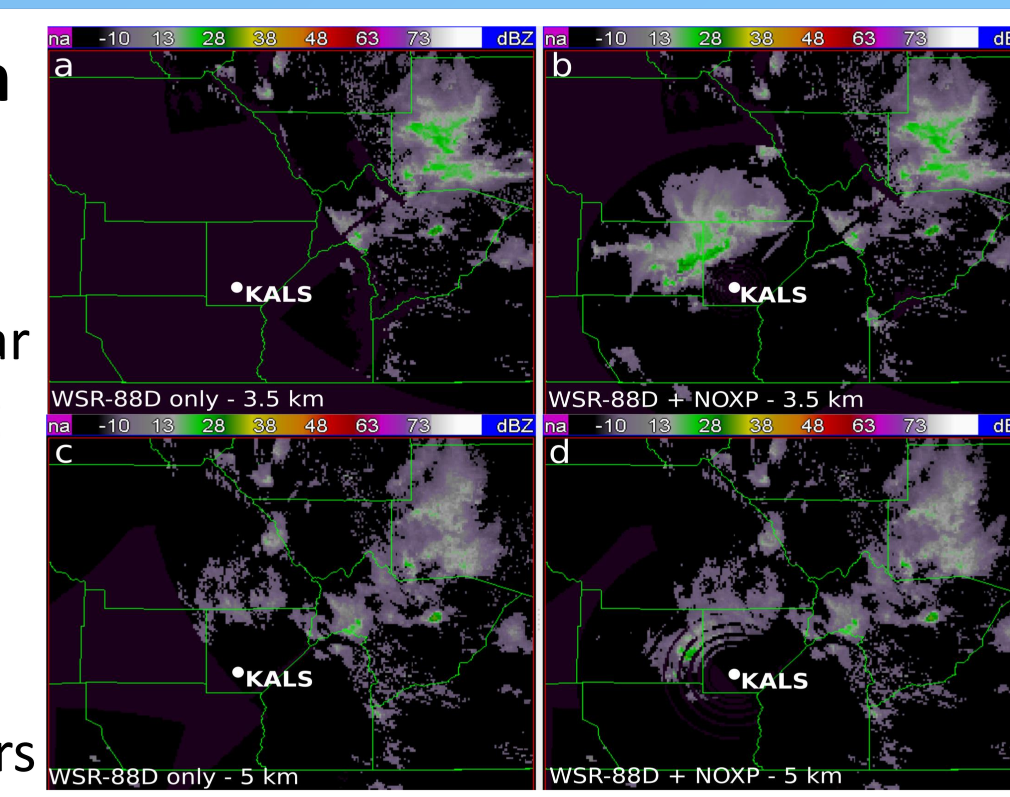

Figure 6: MRMS CAPPI radar composites at a,b) 3.5 km MSL and c,d) 5 km MSL. Plots a,c) are using only WSR-88D data; plots b,d) contain WSR-88D and NOXP data.

7. Conclusions

- Gap-filling radar observed a convective snow squall that was largely missed by the operational radar network.
- Squall organized from individual cells into a linear convective feature with radar maximum observed winds of 15 m s^{-1}.
- Squall produced varying gusty winds, low visibilities at KALS airport with no advance notice.
- MRMS allows the merging of gap-filling radar data with existing radar networks to improve decision making.

8. Acknowledgements

Funding for this work provided by the Colorado Department of Natural Resources and the City and County of Alamosa (Colorado). The authors would like to thank Joe Busto of the CO DNR and Dustin Allinger of San Luis Valley Regional Airport. This work was prepared with funding provided by NOAA/Office of Oceanic and Atmospheric Research under NOAA-University of Oklahoma Cooperative Agreement #NA11OAR4320072, U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of NOAA or the U.S. Department of Commerce. Radar plots in Figure 2 were made with the Python ARM Radar Toolkit (Py-ART). 500 hPa plot in Figure 4 courtesy Storm Prediction Center. HRRR data used for plots in section 5 courtesy University of Utah MesoWest HRRR Archive.