Dual-Pol Experiences at WFO Phoenix

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Hydrometeor classification algorithm might result in noticeably improved precipitation estimates.

CC should aid in determining melting layer and snow level, as well as confirming the existence of a damaging tornado.

ZDR should help identify stronger updrafts and hail-producing storms.

KDP will highlight areas of greatest liquid water content, and should identify areas experiencing locally heavy rainfall.
Interesting Weather Cases where Dual Pol Data Added Value...

- 5 July intense dust storm over south-central Arizona
- 31 July microbursts over and near Phoenix
- 12 August microburst over southern Gila County
- 14 February snow over/near Globe in southern Gila County
Initially, it wasn’t intuitively obvious how dual pol information would help WFO Phoenix forecasters better identify the existence and intensity of dust storms.

Base velocity data, spotter reports, and pattern recognition techniques have served forecasters rather well for many years.

Interestingly, Phoenix became the ‘dust storm capital’ of the country during summer 2011, due in part to a long-term drought over southeast Arizona.

- Intense dust storm…one of the worst ever observed… occurred on 5 July
- At least 6 other significant dust events occurred between mid-July and early September, at least twice the long-term average
- Let’s take a look at the 5 July 2011 dust storm via reflectivity, velocity and CC fields…
0.5 degree CC at 0154Z 6 July

Gust front

CC generally 0.4 to 0.7
Many summer severe weather events in the Phoenix CWA are downbursts/microbursts generated by evaporating or melting precipitation through a deep, dry sub-cloud layer.

Scharfenberg et al (2005) noted that ZDR, used in conjunction with Z,V and KDP, might help warning forecasters identify where microburst production is most likely by identifying areas of melting hail.

Let’s look at a couple of microburst cases, one over the higher terrain and the other over/near Phoenix…
12 August 2011 Case

- Downburst affected San Carlos, AZ
- Approx. 70 miles east of KIWA 88D, 3000 foot elevation, partial 0.5 deg beam blockage
- Trees downed, numerous power poles broken
- Some roofs damaged by falling trees/poles
- Hail of unknown size reported in town
0.9 Deg Reflectivity

2323 UTC
Approx. 9500 ft. MSL, 6500 ft. AGL

2327 UTC
2327 UTC 2.4 Deg Dual-Pol

Beam ~19,000 ft MSL
FZL ~ 15,700 ft MSL

San Carlos
2327 UTC 1.3 Deg Dual-Pol

Beam ~12,000 ft MSL
FZL ~ 15,700 ft MSL

San Carlos
2327 UTC 0.9 Deg Dual-Pol

Beam ~9,500 ft MSL
FZL ~ 15,700 ft MSL

San Carlos
TPHX radar really helped us identify degree of threat posed by isolated thunderstorms over the west and central portions of the Greater Phoenix area

- Two (or three) damaging microburst-producing storms, triggered by outflows from previous storms, occurred between 8 and 915 pm MST. Low level winds were best observed via the TPHX radar.
- Dust storm was in progress over much of the Phoenix area
Snow Event

- Melting layer algorithm and CC should help forecasters determine the snow level.
- Snow level can be a very high-impact weather variable. Higher precipitation rate and a drier subcloud layer can combine to dramatically lower snow level...sometimes by a couple thousand feet.
- Let’s briefly examine a modest event...the 14 February snow over and near Globe, AZ [several inches of wet snow accumulated between 1800Z and 2100Z (11 am to 2 pm MST)]
Hydrometeor classification algorithm provides a best-guess regarding the makeup of particles in each sample volume.

Improved precipitation estimates should be obtainable.

Let’s compare and contrast legacy and dual pol precipitation estimates for one of the most widespread rain events over Phoenix during summer 2011, which occurred during the predawn hours on 11 July.
Flood Control District ALERT rain gauge data for the 1 hour period ending 1030Z 11 July 2011.

For this case, it appears the legacy precipitation estimates were slightly more accurate than the dual pol estimates, though both estimates were decent...with heaviest rainfall just southeast of Paradise Valley.
Summary

- CC may be useful to help confirm the presence of various sizes/types of airborne targets due to strong/severe wind (e.g., the 5 July 2011 dust storm)
- CC and melting layer algorithm can definitely help forecasters determine how the snow level is evolving
- Some thunderstorm warning decision-making support is provided by dual pol variables during weak shear, low CAPE environments
  - Warning lead times for pulse severe storms can be increased by a few minutes, if proper interrogation techniques are employed
- Dual Pol precipitation estimates may or may not be more accurate than legacy precipitation estimates. Haven’t had too many decent rain events…need to examine more cases.