WSR-88D Observations of an Extreme Hail Event Impacting Abilene, TX on 12 June 2014

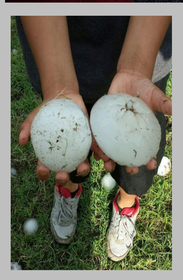
Arthur Witt[1] and Mike Johnson[2]

[1]NOAA/National Severe Storms Laboratory, Norman, OK

[2]NOAA/National Weather Service, Memphis, TN

Introduction

- On 12 June 2014, an intense supercell thunderstorm with hail to at least 12 cm in diameter impacted Abilene, Texas
- The storm produced widespread damage to vehicles, homes, and businesses, costing an estimated 400 million dollars; several minor injuries also occurred
- NSSL's Severe Hazards Analysis and Verification Experiment (SHAVE), together with reports to the NWS and social media sources, combined to produce an impressive ground truth data set for this event, including 38 observations of hail ≥70 mm, 25 observations of hail 51–64 mm, and 22 observations of hail 18–44 mm in diameter (85 total observations of hail ≥ 18 mm)
- The storm occurred within 100 km of the KDYX WSR-88D
- This study examined the character and evolution of the Abilene hailstorm from 2100–2359 UTC, as seen by KDYX, in terms of overall storm intensity, along with the low-altitude dual polarization observations associated with the 85 severe hail reports



Storm intensity radar parameters examined

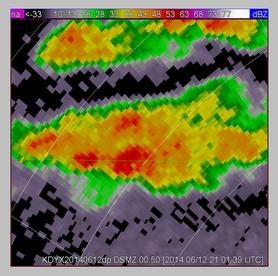
- Maximum reflectivity at the −20°C height (Z_{253K})
- Vertically integrated liquid (VIL)
- Maximum expected size of hail (MESH)
- Storm-top divergence (STD)
- Mid-altitude rotational velocity (MRV)

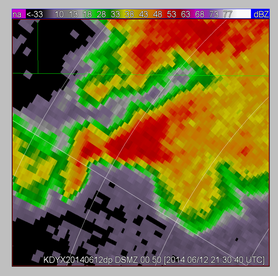
Conclusions

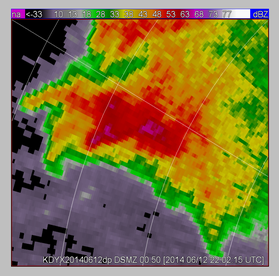
- For the radar parameters used to assess storm intensity:
  1) The MESH did an excellent job at predicting the hail threat via a peak value of 113 mm around an hour prior to several softball-size (114 mm) hail observations
  2) The STD briefly exceeded 100 m s^{-1} (maximum STD of 102 m s^{-1}) within several minutes of the softball-size hail observations
  3) The MRV occasionally exceeded 30 m s^{-1} between 20–40 min prior to the maximum in STD
- The low-altitude dual polarization observations show that most of the large hail was associated with high reflectivity (Z ≥ 54 dBZ), low Z_{DR} (<1 dB), and a fairly wide range of H_{DR} (–5 – 40), ρ_{HV} (0.9 – 1.0) and K_{DP} (0 – 5° km^{-1})
- For the three hail size ranges examined, the H_{DR} and Z_{DR} showed the best discrimination, with minimal differences for Z, ρ_{HV} and K_{DP}
- Extreme severe-weather events have become better documented thanks to social media sources and efforts such as NSSL's Severe Hazards Analysis and Verification Experiment (SHAVE)

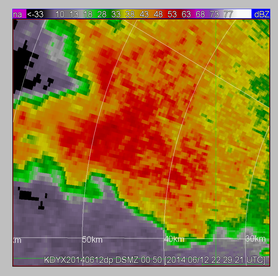
KDYX observations of storm intensity

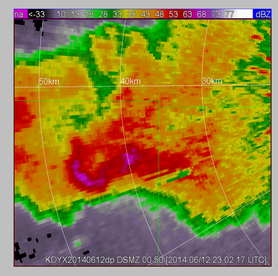
Reflectivity images from the 0.52° elevation scan at ~30 min intervals

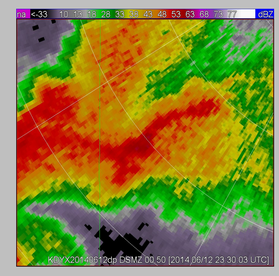




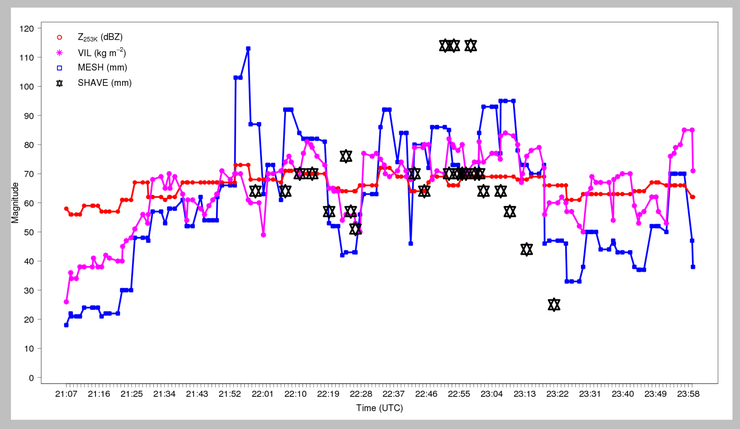




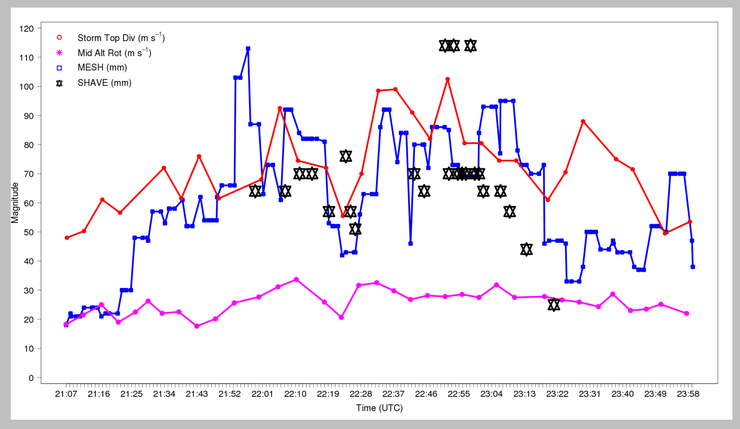




Time series of Z_{253K} , VIL and MESH



Time series of STD, MRV and MESH



KDYX dual-polarization observations above the locations of the hailstone reports

Reflectivity (Z) , differential reflectivity (Z_{DR}), hail differential reflectivity (H_{DR}), cross-correlation coefficient (ρ_{HV}) and specific differential phase (K_{DP}) from the 0.52° elevation scan for a 1° x 1 km window (median of 8 values) above the locations of the hail reports