Hail Size Distribution Mapping

Localized-Weather Forecasting and Measurement

A 3-D weather radar visualization software program was developed and implemented as part of an experimental Launch Pad 39 Hail Monitor System. 3DRadPlot, a radar-plotting program, is one of several software modules that form building blocks of the hail data processing and analysis system (the complete software processing system under development). The spatial and temporal mapping algorithms were originally developed through research at the University of Central Florida, funded by NASA's Tropical Rainfall Measurement Mission (TRMM), where the goal was to merge National Weather Service (NWS) Next-Generation Weather Radar (NEXRAD) volume reflectivity data with drop size distribution data acquired from a cluster of raindrop disdrometers. In this current work, we adapted these algorithms to process data from a cluster of hail disdrometers positioned around Launch Pads 39A or 39B, along with the corresponding NWS radar data. Radar data from all NWS NEXRAD sites is archived at the National Climatic Data Center (NCDC). That data can be readily accessed at <*http://www.ncdc.noaa.gov /nexradin/*>.

3DRadPlot plots Level III reflectivity data at four scan elevations (this software is available at Open Channel Software, <http://www.openchannelfoundation.org/projects/3DRadPlot>). By using spatial and temporal interpolation/extrapolation based on hydrometeor fall dynamics, we can merge the hail disdrometer array data coupled with local Weather Surveillance Radar-1988, Doppler (WSR-88D) radial velocity and reflectivity data into a 4-D (3-D space and time) picture of hail size distributions. Hail flux maps can then be generated and used for damage prediction and assessment over specific surfaces corresponding to structures within the disdrometer array volume. Immediately following a hail storm, specific damage areas and degree of damage can be identified for inspection crews.

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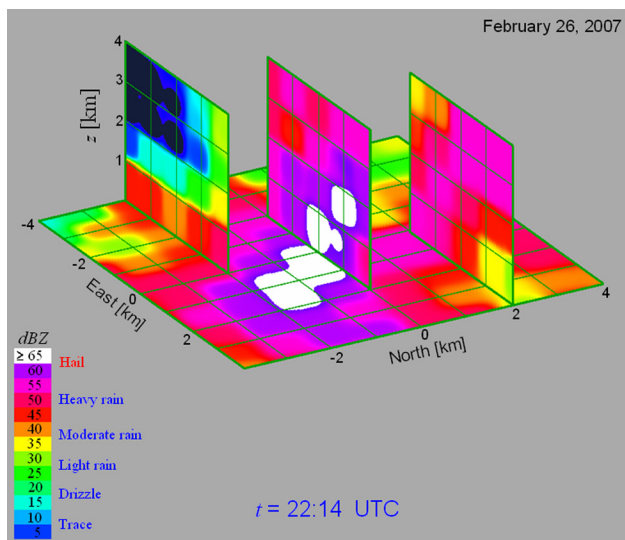*Participating Organization: NASA-KSC (Dr. Robert C. Youngquist)*

Figure 1a. Three-dimensional radar display plot, 8 km × 8 km × 4 km, centered on Pad 39A. Each grid line is 1 km. This reflectivity data corresponds to the severe hail event of February 26, 2007, which resulted in a 3-month delay of the launch of STS-117.
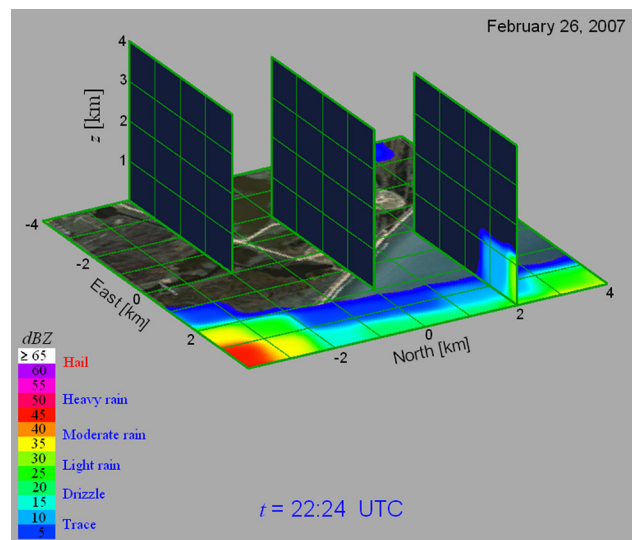

Figure 1b. Same 8-km × 8-km × 4-km view shown in Figure 1a but 10 minutes later, when Pad 39A was clear of hail and rain.
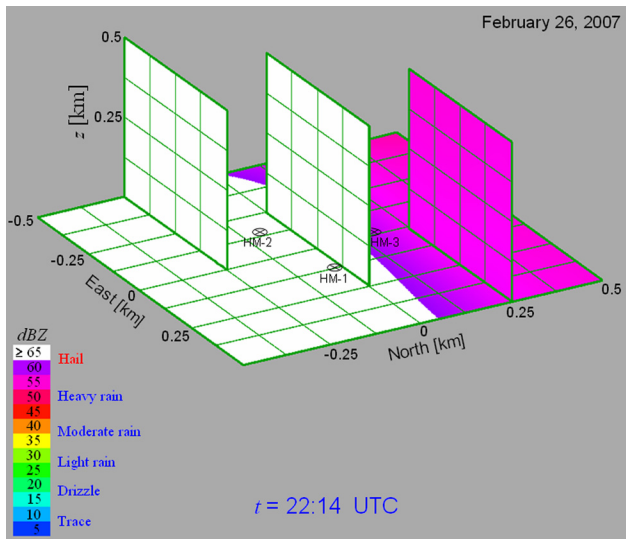
Figure 2a. Three-dimensional radar display plot, 1 km × 1 km × 0.5 km, centered on Pad 39A. Each grid line is 125 m. This NWS radar reflectivity data corresponds to the same time shown in Figure 1a.
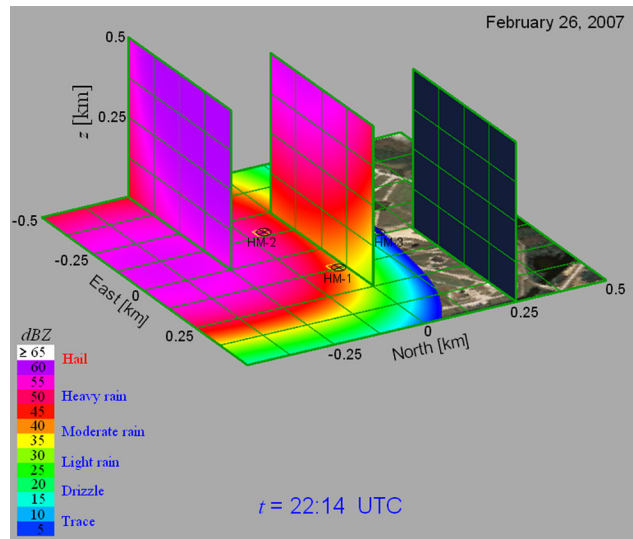

Figure 2b. Same 1-km × 1-km × 0.5-km 3-D view as shown in Figure 2a. This data is generated by the three hail monitor stations and is the equivalent hail reflectivity (minus rainfall background) that would be seen by radar if only hail were in the air.
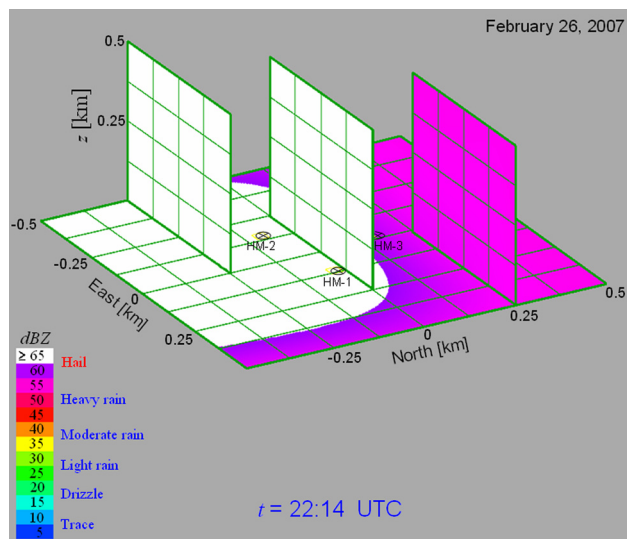

Figure 2c. Same plot as shown in Figure 2b, with a constant rain background added to the hail monitor data. The rain background is an estimate of what radar would see if only rain were in the air.
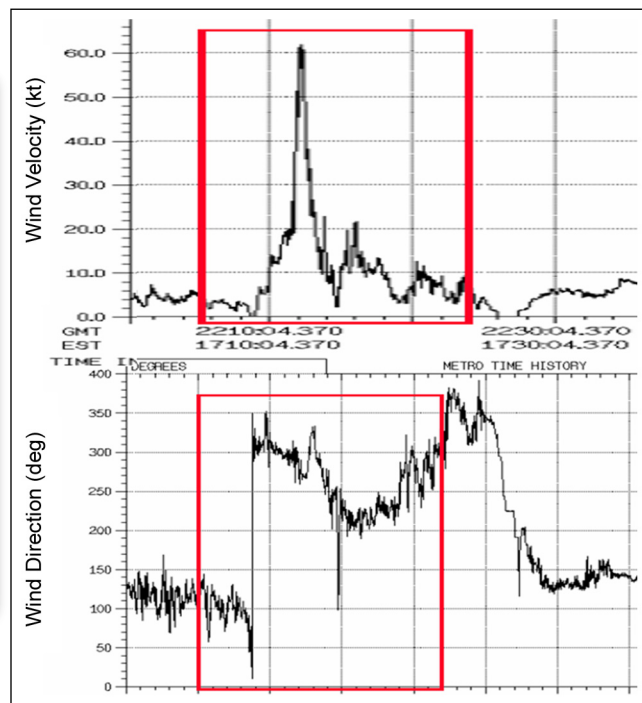

Figure 3. Wind tower data near Pad 39A, showing wind speed and direction. The wind speed peaked at over 60 kt during the hail event. The wind peak was very short (on the order of a minute). The entire hail event was on the order of 10 minutes, whereas the entire rain event was less than 1 hour.