Severe Hazards Analysis and Verification Experiment (SHAVE)

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Why SHAVE?

- Verification of gridded, high resolution, multi-radar, multi-sensor hail products
  - Need verification data at similar scale of products
  - *Storm Data*
    - Scale is similar to NWS warnings (~1 per county, per hour)
  - Hail products at 1 km, up to 1 min resolution
- Non-severe and null reports are important for verification
  - Not available through *Storm Data*

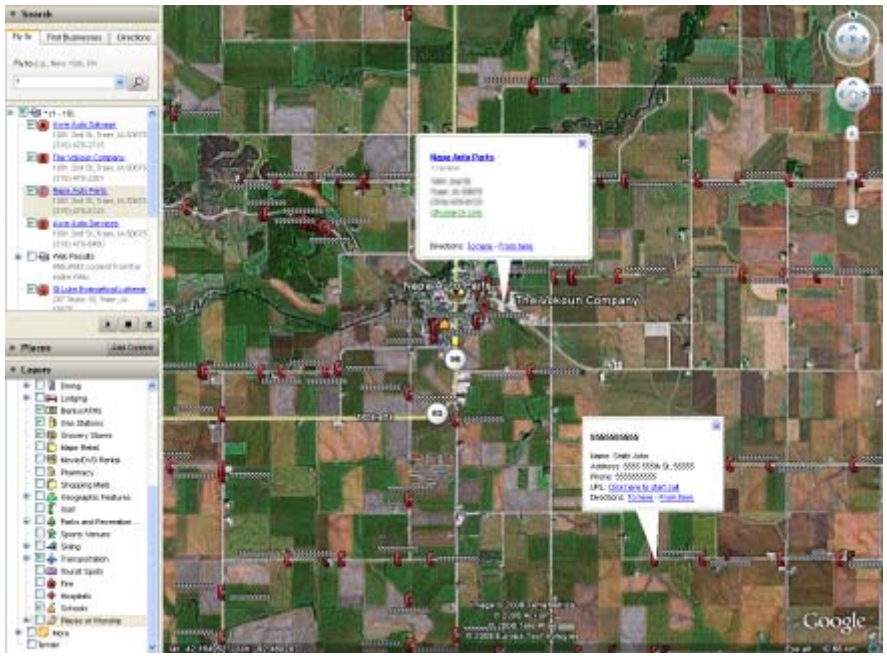
New Tools and Integrations

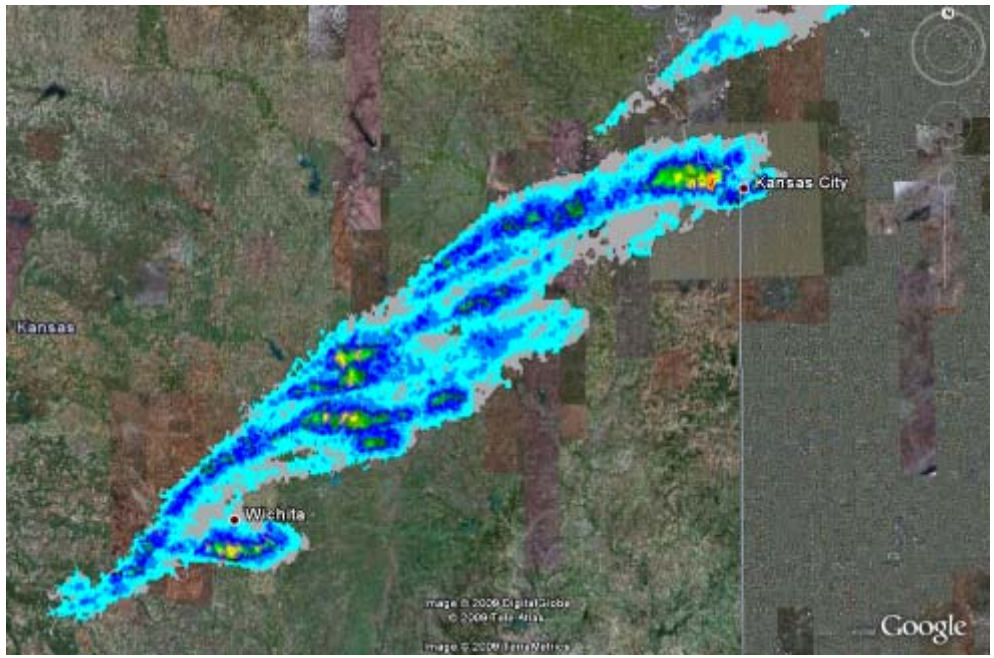
2006 introduced several new tools and integrations

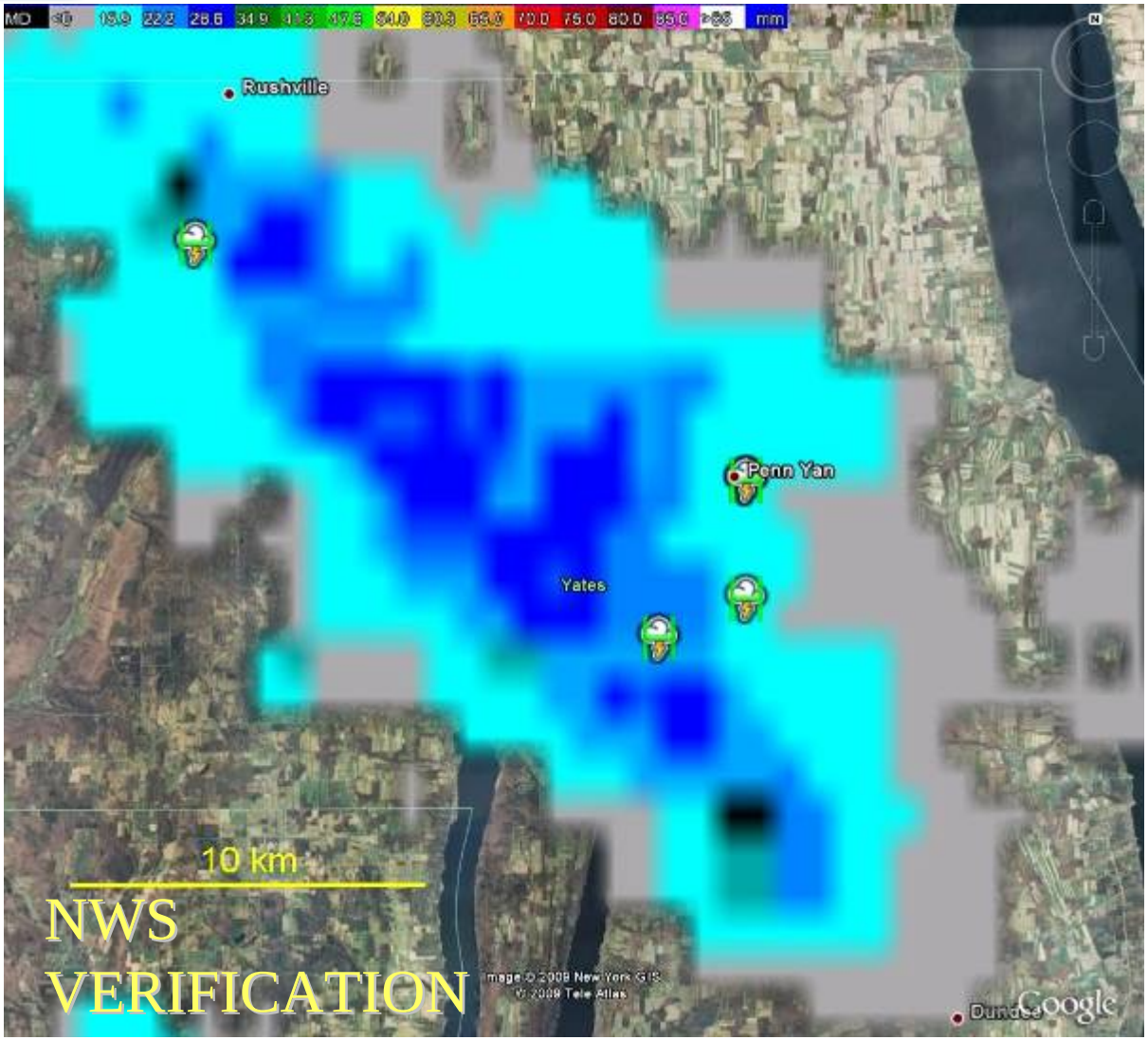
Warning Decision Support System—Integrated Information (WDSS-II)

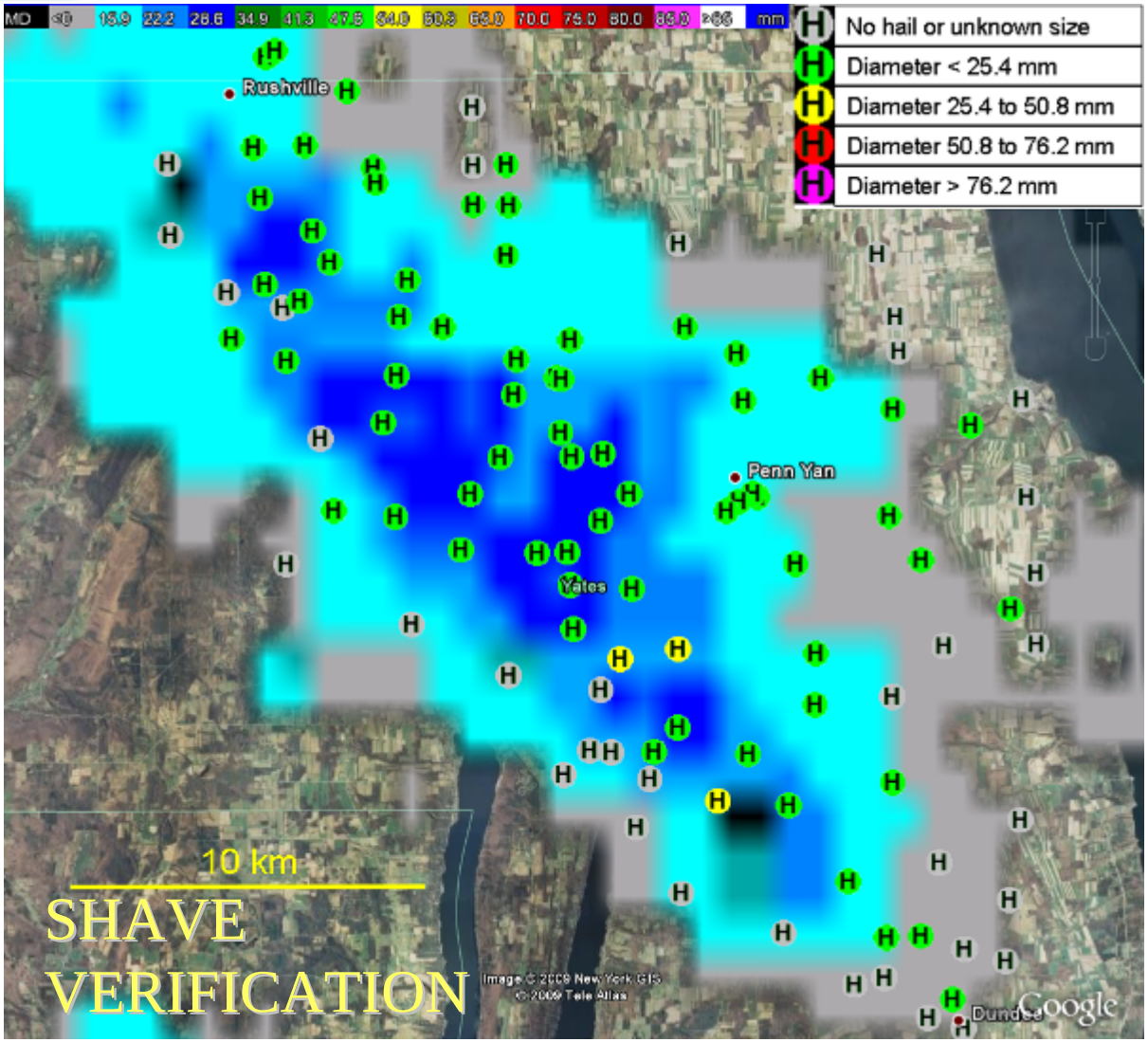
GIS Integration

- GIS information in Google Earth™
  - Geo-based phone number listings
  - Add info from outside sources (Delorme, plat maps)
- Georeferenced images from WDSS-II






MD
mm
Rushville
Penn Yan
Yates
10 km
NWS
VERIFICATION
Google

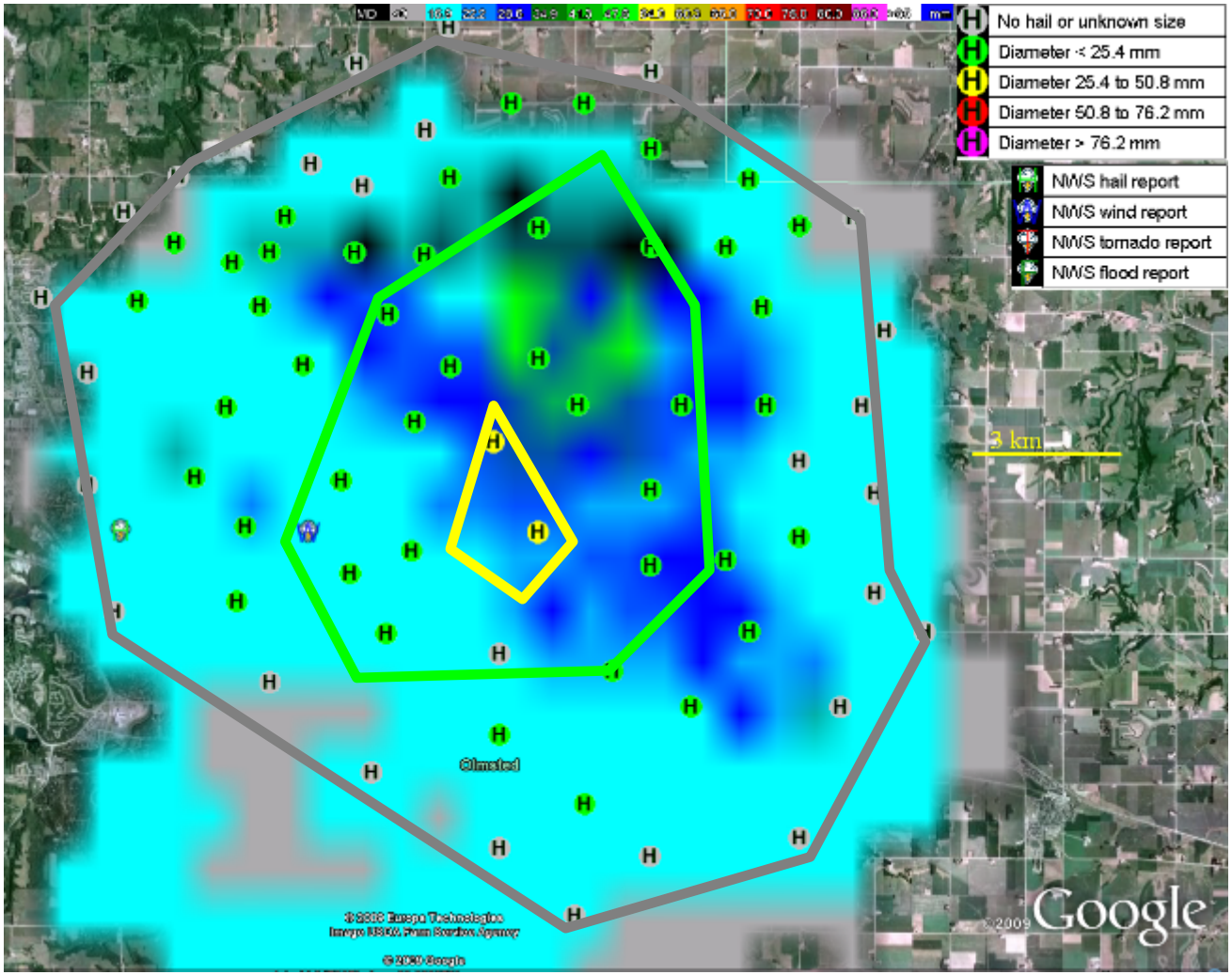

MD
mm
No hail or unknown size
Diameter < 25.4 mm
Diameter 25.4 to 50.8 mm
Diameter 50.8 to 76.2 mm
Diameter > 76.2 mm
Rushville
Penn Yan
Yates
Dundee
10 km
SHAVE
VERIFICATION
Google

SHAVE Goals

- Goals
  - High resolution reports
    - Including non-severe and null
  - Verification of gridded severe weather products
    - Multi-radar, multi-sensor hail and rotation products
    - Gridded flash flood guidance
  - Verification of new radar technologies (PAR, dual-pol)
  - Hazardous Weather Testbed/Experimental Warning Program support
  - **Future warnings – very specific – need very specific verification!**
- Severe weather threats
  - Hail
  - Wind damage
  - Flash flooding

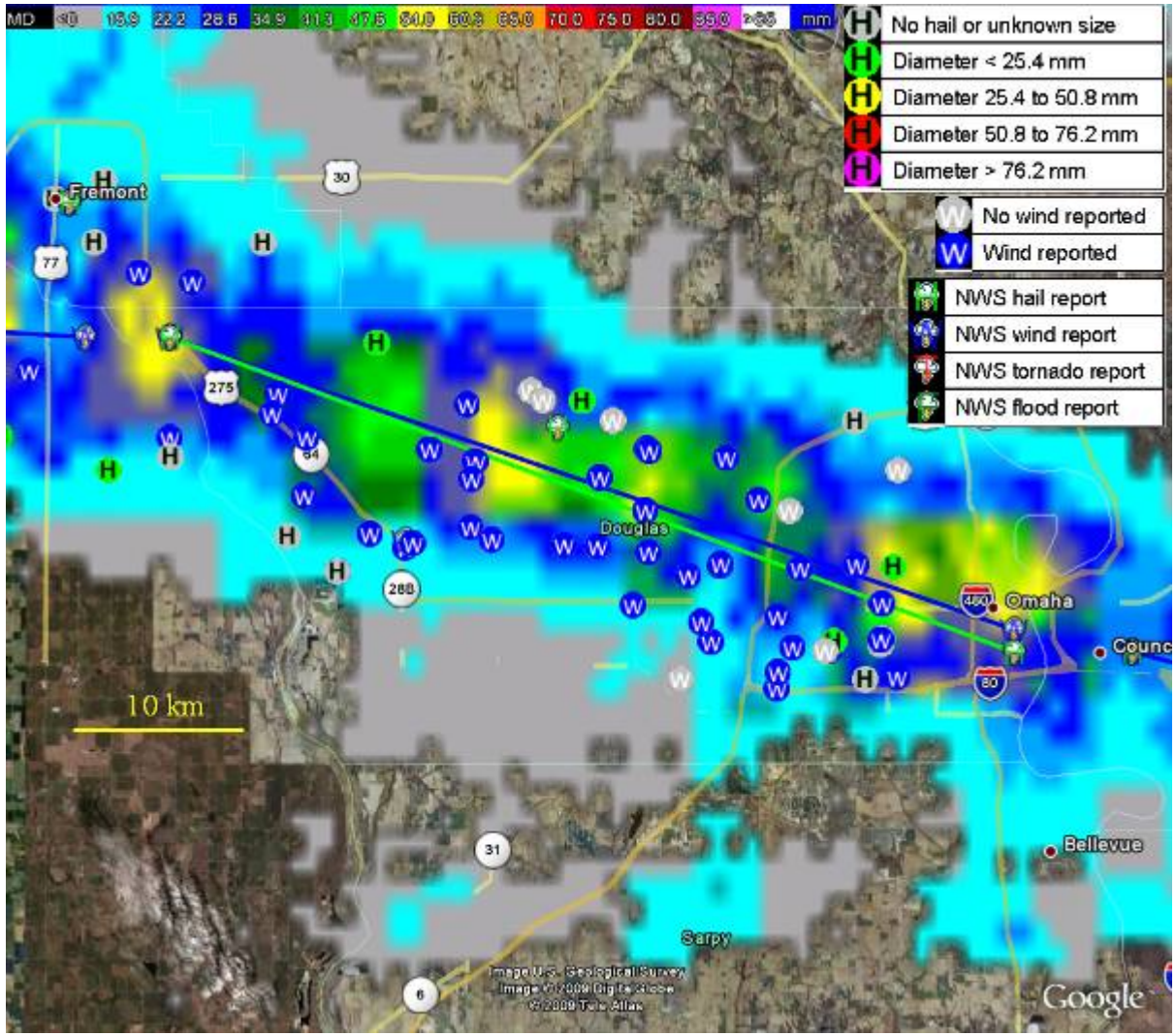
SHAVE Goals: Hail

- Focus on the beginnings of hail swaths
  - Product lead times
  - No hail boundaries important
- Accurate hail estimates
  - ±0.25 in
- Maximum and most common hail size
- Measurements (if available)



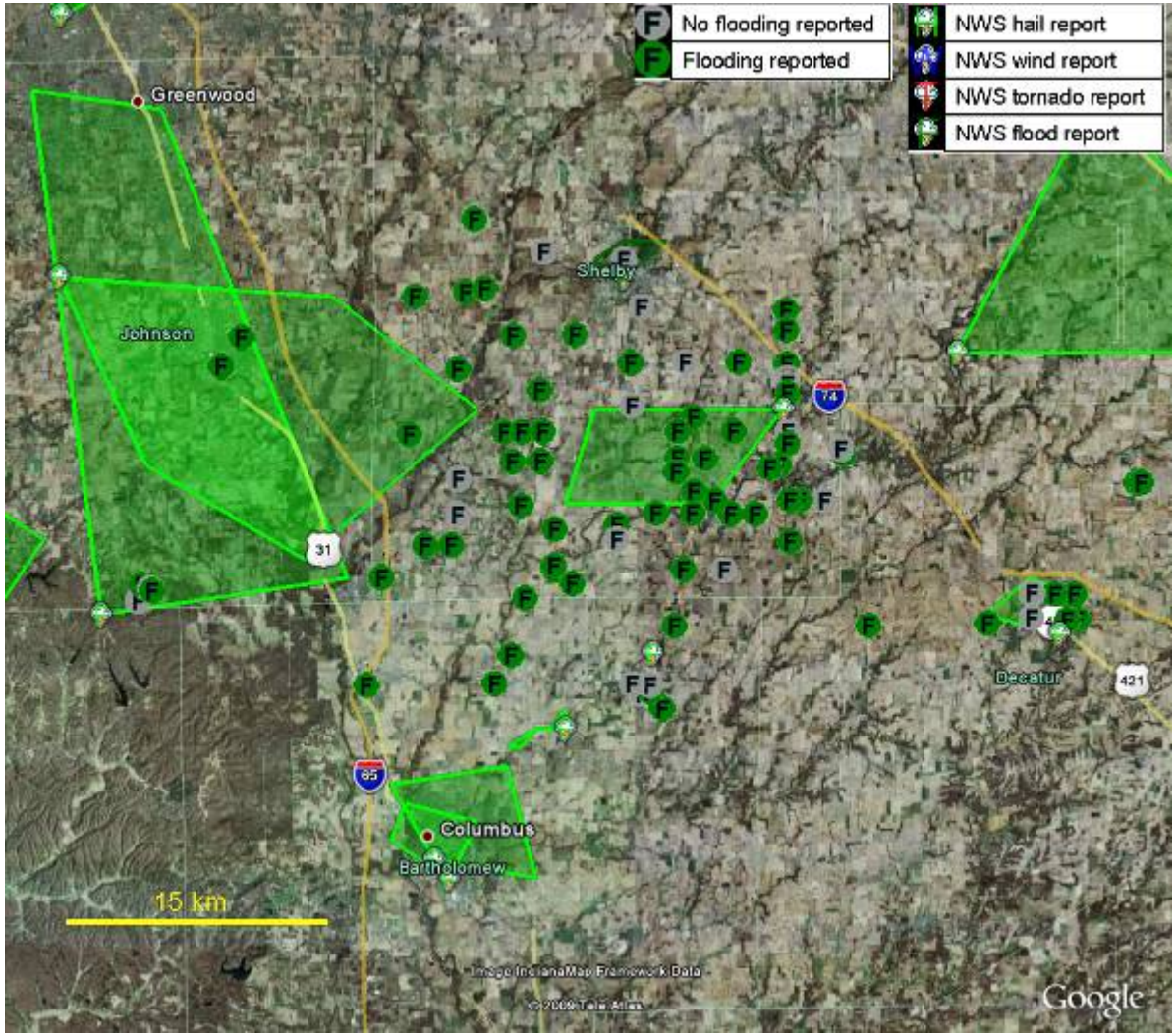
SHAVE Goals: Wind

- Most freeform verification
  - Looking for wind damage
  - Add-on to hail questions
- Focused wind damage calls
  - Next day
  - Obvious wind storms
- Details, details, details
  - Tree snapped—what kind?
  - Was the tree dead or still living?
  - What was the shed made out of?



SHAVE Goals: Flash Flooding

- Evaluate gridded flash flood guidance grids
- Detailed information
  - Flooded area
    - Field, street, etc.
  - Flooding depth
  - Lateral extent
  - Moving or standing?
  - Flooding frequency



SHAVE Data Summary

Summary

- 243 days of operations
- 95413 phone calls
- 32039 data points

Hail

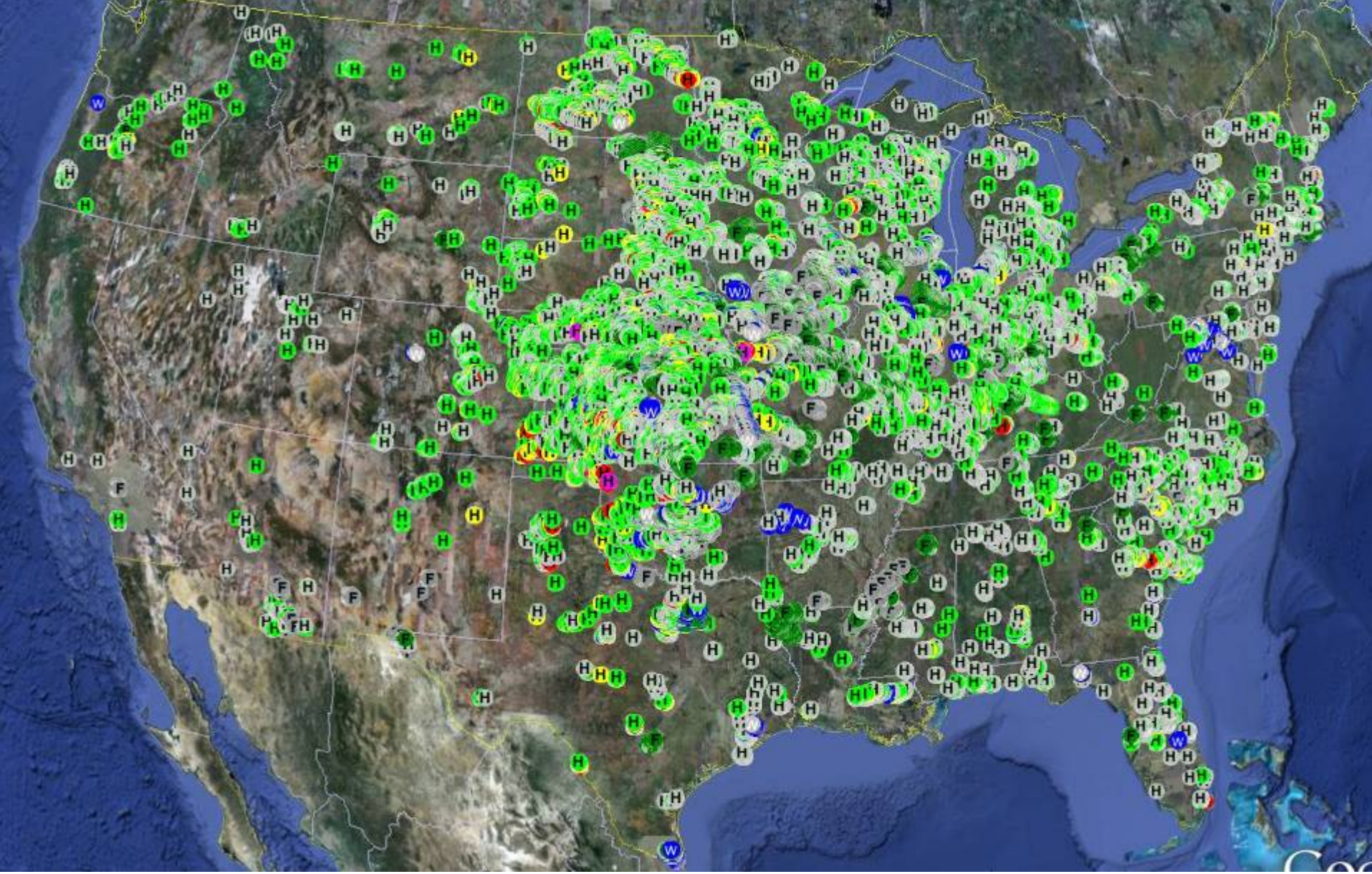
- 23720 total
- 9692 ‘no hail’
- 6191 non-severe hail
- 6956 severe* hail
- 524 significant-severe hail

Wind

- 2479 total
- 735 ‘no wind’

Flash flooding

- 5840 total
- 4165 ‘no flooding’



SHAVE Data Coverage (2006-2009)

How SHAVE works

Delorme Street Atlas Plus

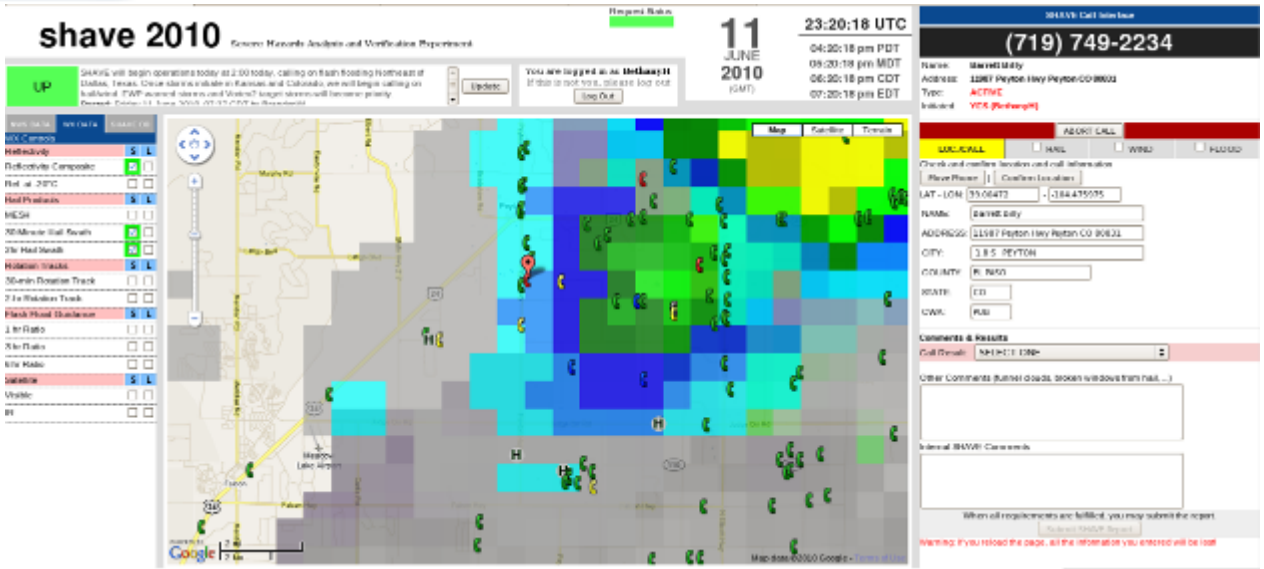
- Phone number data base

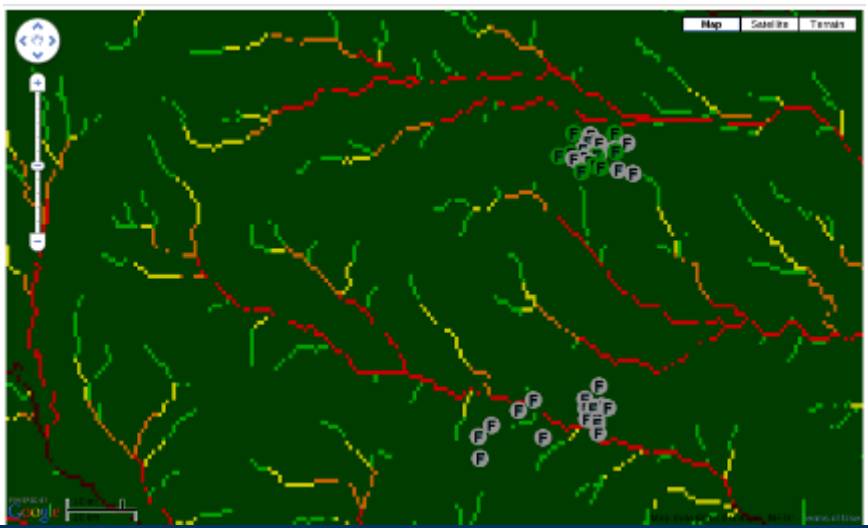
Google Maps interface for data entry

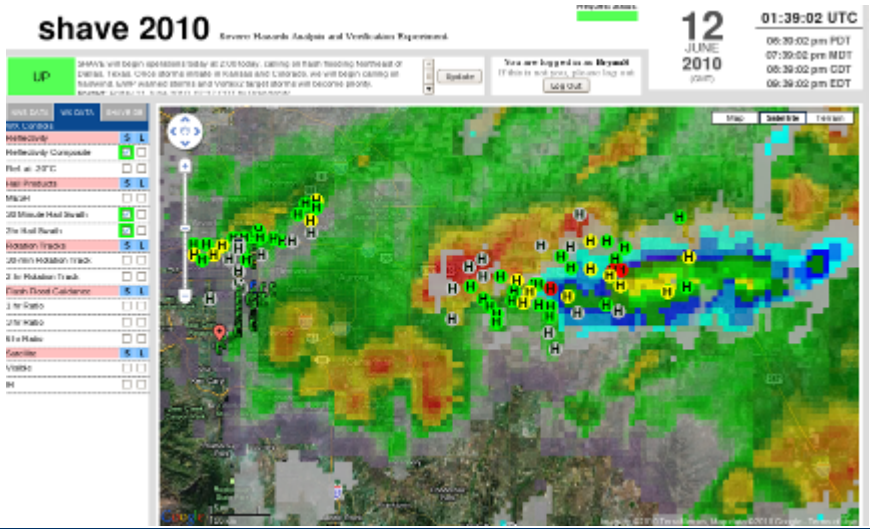
Day-to-day ops:
Student-led, student-run

7 students ended up in year-round positions

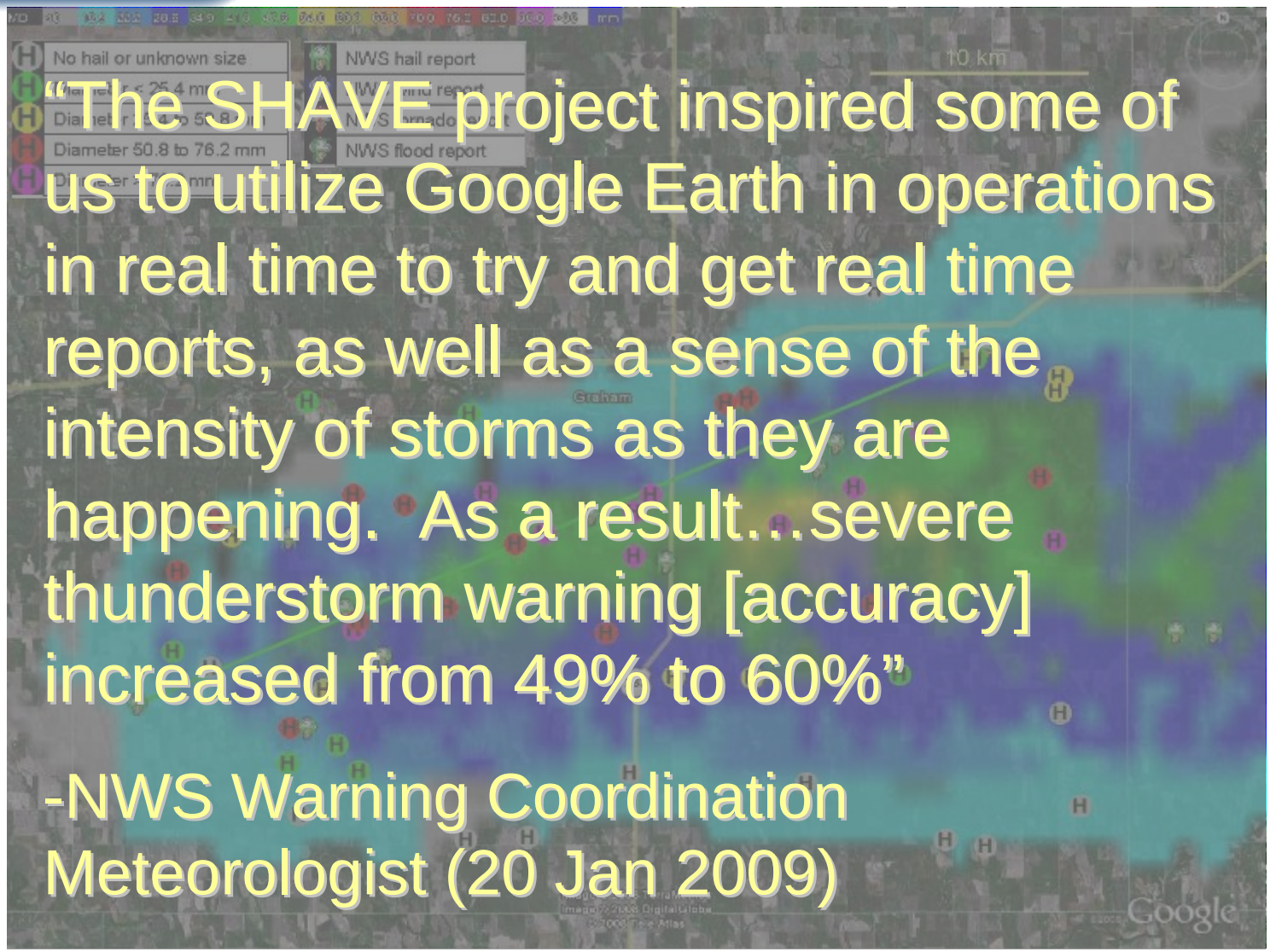
Data Entry


shave 2010
11 JUNE 2010
23:20:18 UTC
(719) 749-2234




shave 2010
12 JUNE 2010
01:39:02 UTC

SHAVE effects on NWS?

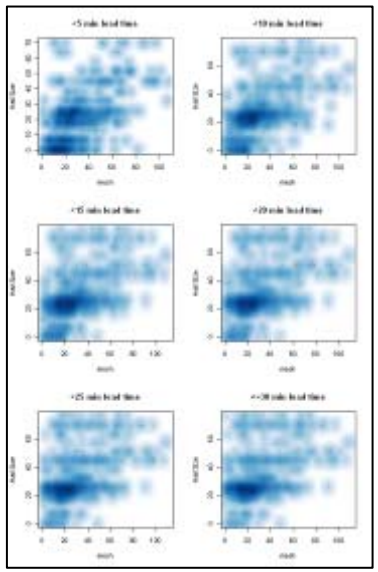


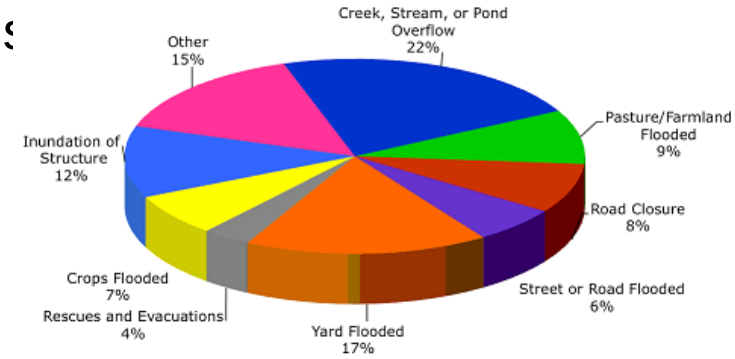
"The SHAVE project inspired some of us to utilize Google Earth in operations in real time to try and get real time reports, as well as a sense of the intensity of storms as they are happening. As a result…severe thunderstorm warning [accuracy] increased from 49% to 60%"

-NWS Warning Coordination Meteorologist (20 Jan 2009)

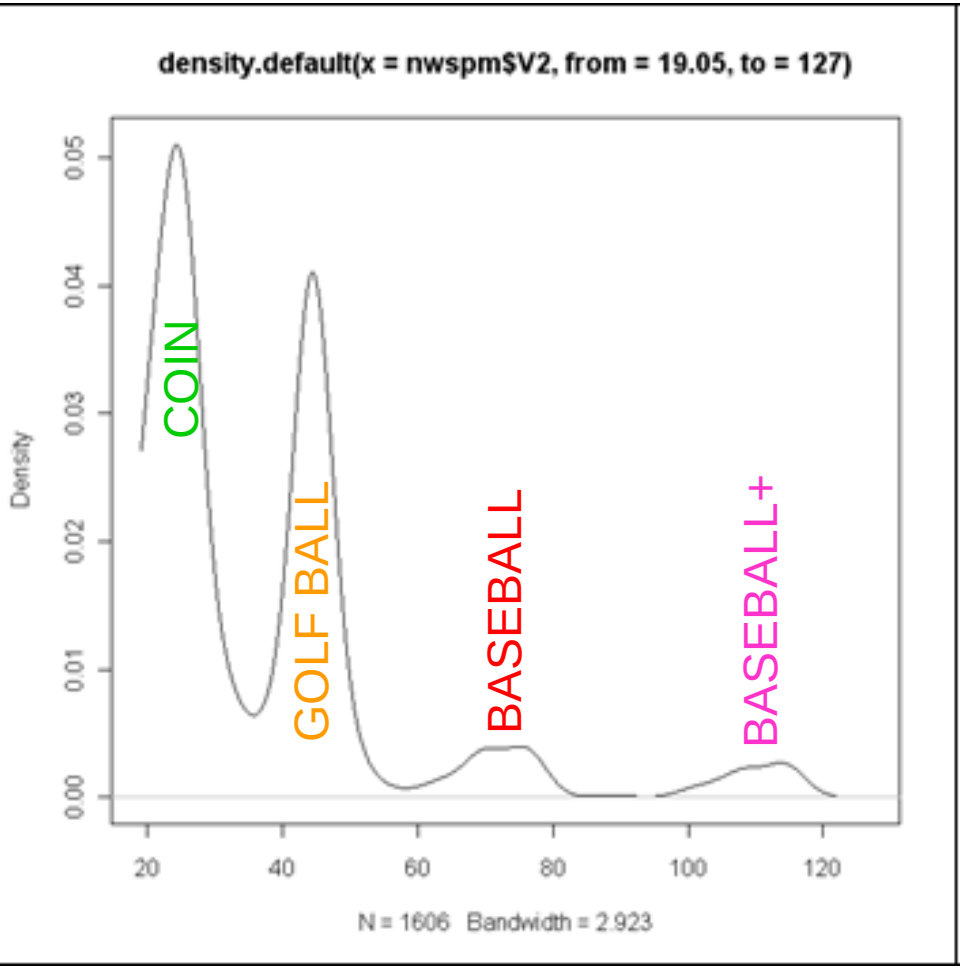
Not just a data collection project

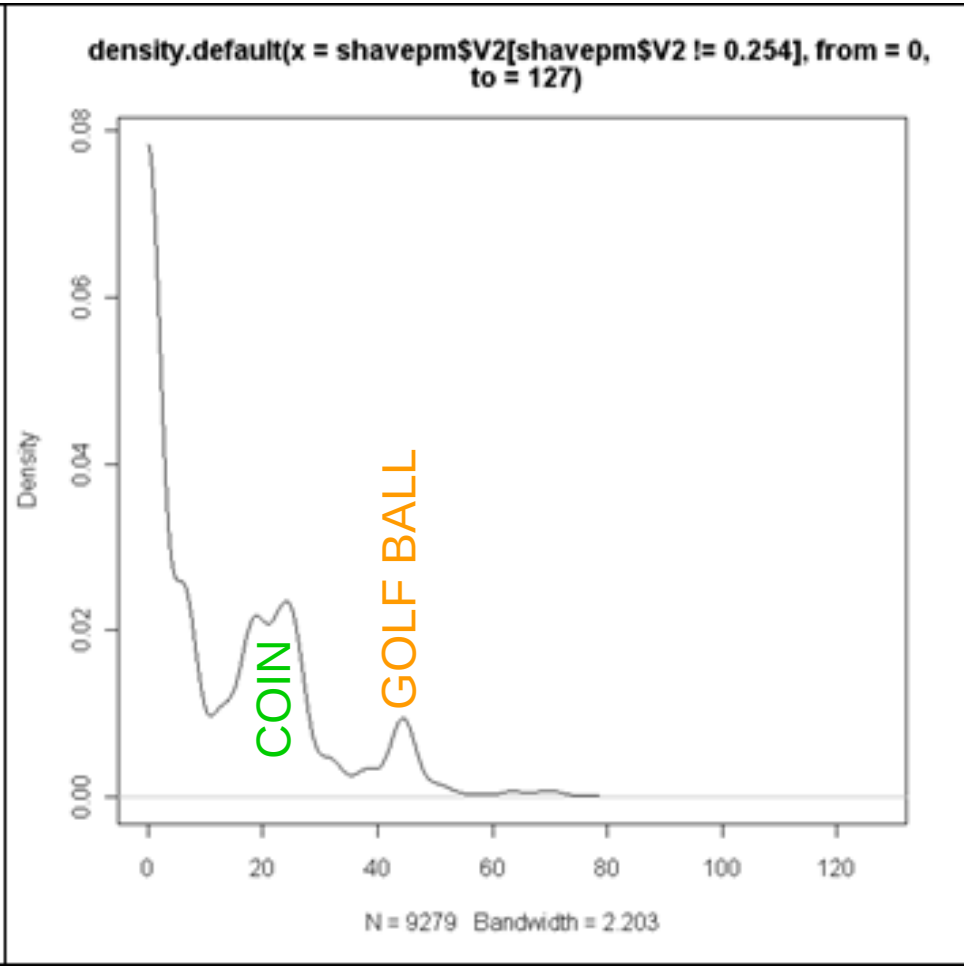
- SHAVE scientists also lead data analysis projects
- SHAVE students usually undertake these projects
- All reports
  - Hazard grids for warning verification
- Hail
  - Three body-scatter spike evaluation
  - Reflectivity height investigation
- Wind
  - Storm signatures leading to severe winds
- Flash flooding
  - Investigating the information collected
    - What is “severe” flooding?
  - Gridded flash flood guidance





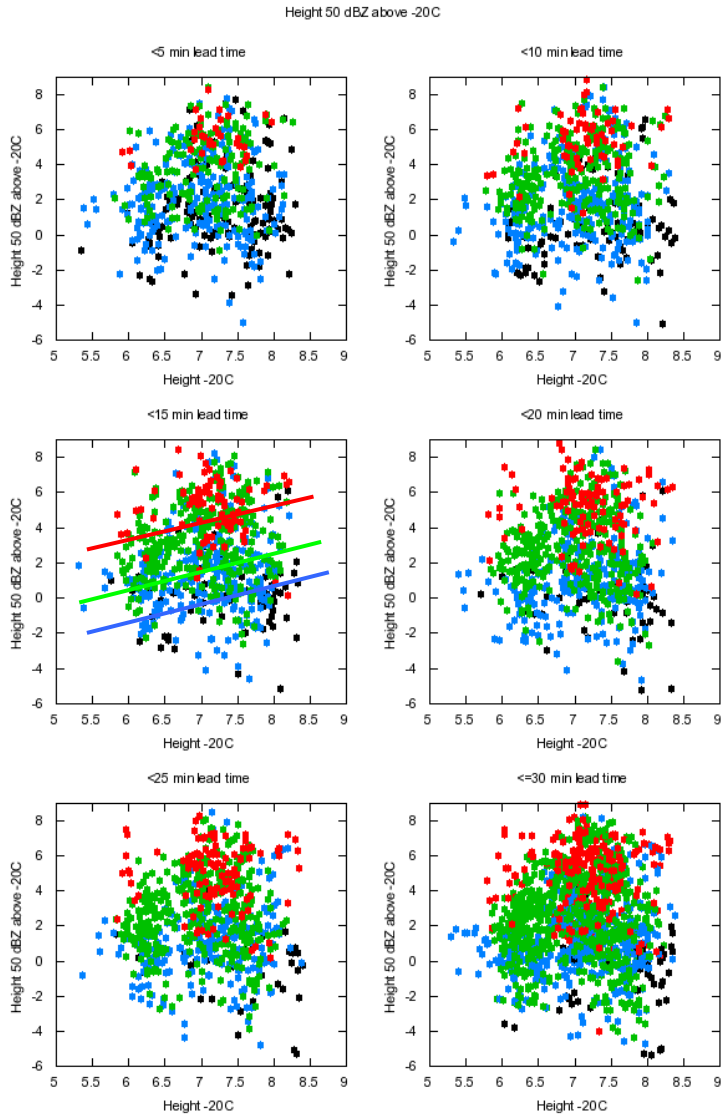
Storm Data compared to SHAVE: Hail reports





Reflectivity Heights

- No hail boundaries
  - Allows for a complete investigation of lead times
- Highlight for the “up to 15 min”-lead time graph
  - Approx. lines for hail thresholds for the height of the 50 dBZ echo above -20°C compared to the height of -20°C



Tech Transfer of SHAVE?

- "Monkey see, monkey do" – already happening
  - Some NWSFOs are already using enhanced GIS and phone datasets to call individual citizens or businesses for verification.
- Independent – high-resolution – high density
  - Much more difficult, but required to improve future warnings
  - Requires a "verification office" independent of any specific NWSFO
  - Support the inevitable paradigm shift in warnings to the public: warn-on-forecast; probabilistic hazard information; translating warning polygons

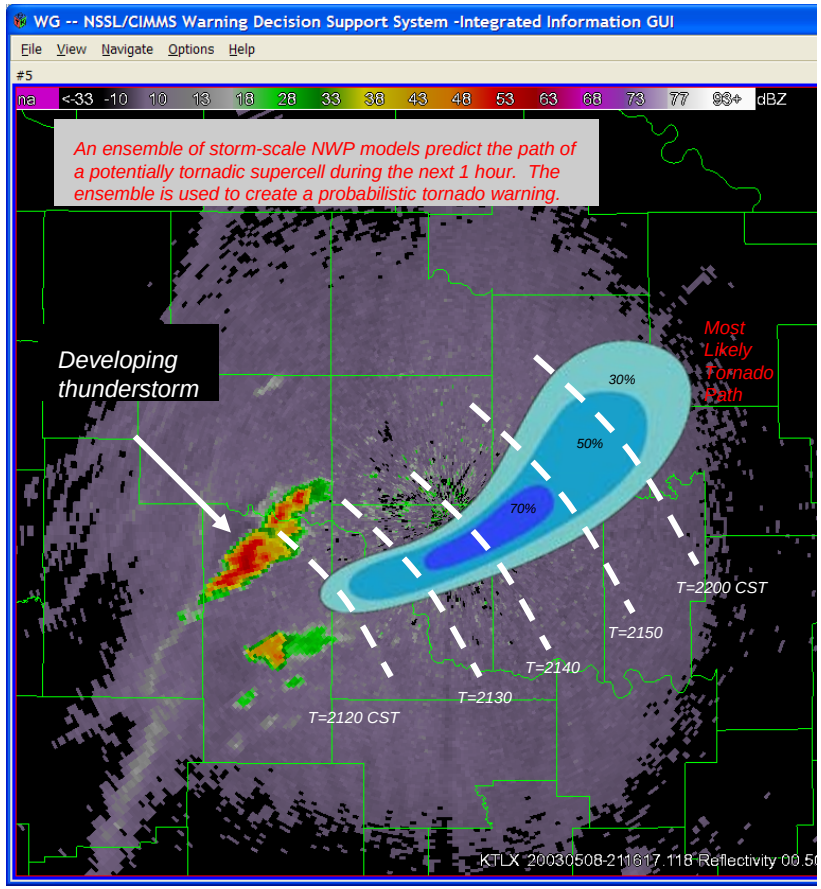
The path to Warn-on-Forecast

Probabilistic Hazard Information (PHI) is coming

- initially based on multi-sensor / multi-radar analysis and data mining for entire WSR-88D era (1995-now)
- storm-scale model ensemble

First WoF test – Spring 2010:

- Real-time assimilation @ 1km w/ 5-min updates (3DVAR)



Courtesy Lou Wicker, NSSL

Thank you and Questions?

- Project Scientists
  - J. J. Gourley, Kevin Manross, Kiel Ortega, Kevin Scharfenberg, Travis Smith, Arthur Witt
- Student callers
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  - Steve Irwin, Brett Roberts
  - Jenifer Bowen, Jessica Erlingis, Margaret Frey, Tiffany Meyer, Kelsey Mulder
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  - Bethany Hardzinski, Abe Frei-Pearson, Bryan Salsieder, Brian Squitieri, Brandon Wesbury
- Collaborators
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