Storm Interrogation

AWOC Severe Track

ICSvr 3-V-C

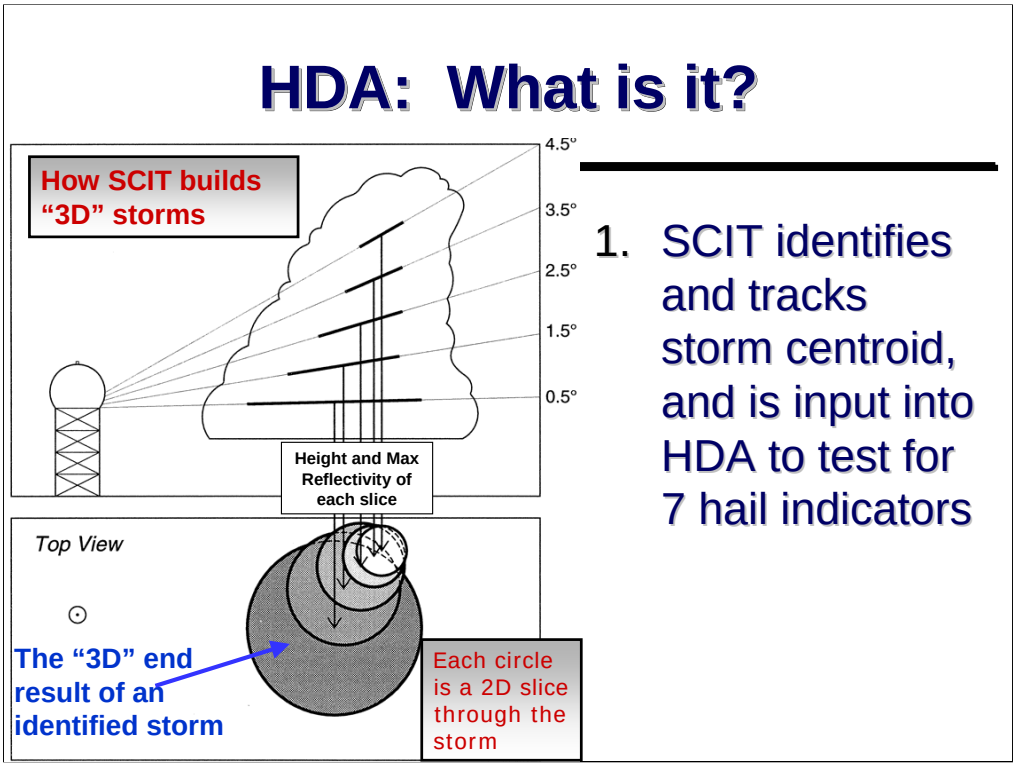
The Hail Diagnosis Algorithm (HDA)

NSSL is recommending a change in the name of the “D” in HDA, from Detection to Diagnosis, since single polarized radar can’t really “detect” hail in a storm, it can only be inferred or “diagnosed”

The HDA

Objectives:

- Understand how the HDA produces severe hail probabilities and sizes
- Know how to best utilize the HDA, including ways to improve upon it



SCIT looks at the height and maximum reflectivity for each slice (top portion of the figure), stacks these regions of maximum reflectivity, giving a 3D depiction of an identificed storm (bottom portion). This 3D depiction is input into the HDA

HDA: 2. Severe Hail Index

- 2 Weighting functions to determine severity of hail *aloft* (SHI):
  1. *Reflectivity* weighted, adaptable with upper and lower defaults set at 40 and 50 dBZ
  2. *Location* of reflectivity weighted, with ORPG HCI 0°C and –20°C height inputs

- SHI=severe hail index.
- Cell based rather than grid based, much better computationally with fewer data artifacts
- Upper and lower defaults delineate what is taken to be hail and what is taken to be rain. For example with the defaults, anything less than 40 dBZ is taken to be rain, while anything greater than 50 dBZ is taken to be hail (all of this assumes temperatures above the environmental freezing level). Values in between are weighted in a linear fashion from near 0 at 40 to near 1 at 50 dBZ.
- The other weighting function looks at the location of the reflectivity. Anything located below freezing the function is set to 0. Anything above –20°C and a max weight of 1 is given, thus any reflectivity that fits the first threshold is given full weight if above –20°C. In between 0 and –20oC it is again a linear weighting function with near 0 at 0oC and nearly 1 near –20°C.
- Thus, using the default settings, 50 dBZ at –20°C is given the maximum weighting possible, and anything below 40 dBZ or 0oC is given no weight at all in the SHI

HDA: 3. POSH

- Uses empirical probability formula with SHI and "warning threshold" (WT) selection model

  -- WT incorporates the height of the hail core MSL relative to the ORPG 0°C and –20°C input heights

POSH=Probability of Severe Hail. POSH has many different threshold values with which to warn/not warn, they are not worth mentioning. Every office may have a different threshold that they like to use.

HDA: 4. MEHS

- Maximum expected hail size (MEHS) employs an empirical formula with SHI the only input
- Tends to overpredict at smaller hail sizes (melting not accounted for and verification efficiency issues)
- Again, can be used as a consistency check and to assist in wording of your SVR/TOR

Most of the algorithms output depends on the accuracy of SHI

Newer versions of the HDA (EHDA) will incorporate melting using a variety of RUC inputs

Verification efficiency issues would be related to population density, undereporting of smaller but still severe hail, spotter quality, etc.

One of the biggest problems with FAR is that the largest hail within a storm is typically not reported because the area in which these fall are often extremely small even within the context of the hail shaft as a whole

HDA Usage

- Works best in the Central/Southern Plains and for significant hail events

- Useful to compare to base data as a consistency check
- POD generally greater than 80% for 1.00 inch hail in a nationwide study, although FAR also quite high
  - verification efficiency due to population density, Witt et al., 2000
  - POD over 90% for 2.00 inch hail

HDA is especially useful if you want to have a high POD and don't care too much about FAR even if it isn't the fault of the HDA, which is actually an okay thing concerning hail.

How to “beat” HDA

- Anytime SCIT misidentifies the vertical structure of a storm (strongly tilted)
- Knowledge of storm structure (meso, divergence, convergence, etc.)
- HDA needs a full volume scan of data before computing statistics
- When thermo. Environment characteristics change quickly or vary widely across radar umbrella

The HDA does not directly handle melting, which we showed in Severe IC1 that smaller sizes are highly affected by melting. Thus in areas with very moist environments HDA will overpredict sizes and POSH

•You can write a warning and send it out after viewing the bottom 2 radar scans in the time it takes the HDA to produce statistics from that volume scan

•Of course, with VCP 12 that time is decreased to about 4 minutes now.

•Knowing that a storm has rotation (HDA can’t account for that), BWER, other supercell characteristics is useful, especially in the early going before the hail cores really develop

Investigate On Your Own

- Check out how the HDA works for yourself:

  Click Here

  – Or enter into any browser window:
  http://wdtb.noaa.gov/courses/awoc/ICSvr3/jobsheet.html

This link takes you to the HDA/VIL jobsheet exercise. It's very informative.