A Study on Convective Modes Associated with Tornadoes in Central New York and Northeast Pennsylvania

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Outline

• Climatology
• Storm Environments
• Null Events
• Radar Study
• Conclusions
Climatology

52 Tornadoes

2000 – May 2011
Tornadoes by Convective Mode
2000 - 2011

- Supercell: 28, 54%
- QLCS: 16, 31%
- Multicell: 5, 9%
- Cellular: 3, 6%
Storm Environment

• Synoptic Environment (2000 – 2011)
  – NOAA Earth System Research Laboratory

• Mesoscale Environment (2005 – 2011)
  – Storm Prediction Center (SPC) Mesoanalysis Archive
Mesoscale Environment

- SPC Mesoanalysis Archive (2005-2011)
- **36** Tornado Events
- **19** Thermodynamic, Shear, & Composite Parameters
Surface Based CAPE By Convective Mode

Joules/kilogram (J/kg)
0 – 6 km Bulk Shear

- **Supercell**
- **QLCS**
- **Multicell**

- **Knots (kt)**

- **Median**
- **Min**
- **Max**
0 – 3km Energy-Helicity Index (EHI)
<table>
<thead>
<tr>
<th>Storm Environment</th>
<th>CAPE</th>
<th>LCL Height</th>
<th>Shear</th>
<th>Helicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supercell</td>
<td>Moderate</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Multicell</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>QLCS</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>
Null Events

Iowa Environmental Mesonet (IEM) Cow Application

21 Null Events
Supercell 0 – 1 km SRH

- Verified
- Null

Meters \(^2/\) Seconds \(^2\) (m\(^2/s^2\))

Median

Min

Max
Radar Study

Rotational Velocity (Vr)

Shear

Spectrum Width

Normalized Rotation (NROT)
Supercells
Verified Median Rotational Velocity (Vr)

Graph showing the verified median rotational velocity (Vr) over time from T-9 to T-0. The graph features lines representing different velocity factors: 0.5 Vr (red), 0.9 Vr (green), 1.4 Vr (blue), and 1.9 Vr (black). The velocities range from approximately 5 kts to 35 kts.
QLCSs
Null Median Shear

Shear \( (s^{-1}) \)

Shear values for different time points (T-8 to T-0):
- 0.5 Shear
- 0.9 Shear
- 1.4 Shear
- 1.9 Shear

Graph showing the change in shear over time.
<table>
<thead>
<tr>
<th>Supercells</th>
<th>QLCSs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotation “spins down” to the surface</td>
<td>Rotation “spins up” from surface</td>
</tr>
<tr>
<td>Uniform shear in lowest elevation angles</td>
<td>Spikes in shear in lowest elevation angles</td>
</tr>
<tr>
<td>Low level rotation: ~20 min</td>
<td>Low level rotation: ~12 min</td>
</tr>
</tbody>
</table>
Supercell Rotational Velocity ($V_r$)

0.5 nm $V_r$ (kts) vs. 0 - 1 km SRH ($m^2 / s^2$)

- Blue diamonds: Verified
- Red triangles: Null
Supercell/QLCS Vr

![Graph showing the relationship between 0.5 nm Vr (kts) and 0 - 1 km SRH (m^2 / s^2). The graph includes data points for 'Verified' and 'Null.'](image_url)
Conclusions

• Majority of tornadoes associated with supercells
• Supercell tornadoes appeared dependent on mesoscale conditions
• QLCS had little difference in mesoscale conditions
• Low level helicity a good discriminator between verified and null events
References:


Questions?

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