AUTOMATING PROCEDURE FOR TORNADO WARNING LEAD TIMES

Tim Loftus | BI Analyst, Meteorologist

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AGENDA

• SKYGUARD®
• Current Process
  – Manual calculation
• Automating Lead Time Calculation
  – Model Builder/Python Script
• Forecast Improvements
  – Utilizing ESRI tools
• Findings
SKYGUARD®

Severe Weather Forecasted

Meteorologists issue customized SkyGuard® warnings to clients.

Warnings are sent using the most effective methods for your organization. Email, phone, text, and smartphone notifications are all available.

Confirmations are monitored and if necessary, follow-up phone calls are made by SkyGuard® meteorologists.
## SKYGUARD® VS. COMPETITORS

<table>
<thead>
<tr>
<th>ACCUWEATHER ENTERPRISE SOLUTIONS</th>
<th>COMPETITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customized weather warnings based upon your specific lead time, thresholds, criteria, and latitude/longitude</td>
<td>NWS tornado warnings based upon NWS thresholds for the general public</td>
</tr>
<tr>
<td>Warnings created to integrate with your emergency procedures</td>
<td>Large area polygon warnings, not based upon your lead times</td>
</tr>
<tr>
<td>ACCUWEATHER ENTERPRISE SOLUTIONS</td>
<td>COMPETITION</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Reduced false alarm rate</td>
<td>Average false alarm rate is 70-80%</td>
</tr>
<tr>
<td>Over 20 minutes of lead time</td>
<td>Not enough lead time (13 minutes)</td>
</tr>
<tr>
<td>Specific warning verification to confirm you received the warning</td>
<td>County-wide tornado sirens</td>
</tr>
</tbody>
</table>
CURRENT PROCESS IN CALCULATING TORNADO LEAD TIMES
MANUAL LEAD TIME CALCULATION

- Storm Warning Meteorologist manually look up which county and NWS WFO each client/potential client location in
- Enter findings in a spread sheet with all client issued SKYGUARD® warnings
  - Issued/Expired times
  - Client/Potential Client radius
  - Reported tornado track data from Storm Events Database or the Damage Assessment toolkit
MANUAL LEAD TIME CALCULATION

- The tornado tracks are then compared to the location of the potential or current SKYGUARD® client to determine if the tornado verified within the client’s tornado warning radius.
- If the track falls within the radius, the lead time is calculated as the difference between the issue time and when the tornado occurred within the warning radius.
- The process is done for each location and a series of aggregations are performed per location including average lead time.
MANUAL LEAD TIME CALCULATION

- Manual entry and calculation
- Time consuming
- Multiple resources
AUTOMATING LEAD TIME CALCULATION
AUTOMATION PROCESS – SKYGUARD®

- Tornado Track Shapefile / Client Location with Buffer Zone in File Geodatabase
- Convert Time Field
  - yyyyMMddHHmmss
- Intersect/Dissolve features
- Calculation of Lead Times
- Calculation of Flagged Variables
- Summary Statistics
MODEL BUILDER PROCESS

- Buffer Geoprocessing Tool
  - Client Lat/Lon Point / Radius
  - Tornado Polyline / ‘wid’
- Convert Time Field
- Issued/Expired Dates
- Calculate Field
  - DateDiff(“n”, Issued, Expired)
- Intersect and Dissolve Geoprocessing Tools
- Track and Client Warnings
MODEL BUILDER PROCESS

- Join dissolved feature to original client polygon
- Calculate Lead Time
- Perform a series of IF/ELSE python statements to identify confirmed SkyGuard ® Warnings
  - IF Report is None…
  - IF Report is within duration of warning
MODEL BUILDER PROCESS

- Table Selection
- SQL Statement
- Summary Statistics
- MEAN Lead Time by Client ID
- Display shows confirmed client location with track data
AUTOMATION PROCESS – NWS

- Tornado Track Shapefile / NWS Polygon Warning in File Geodatabase
- Convert Time Field
  - yyyyMMddHHmm
- Intersect/Dissolve features with US County
- Proximity Analysis – Closest 5 tracks
- Calculation of Lead Times
- Calculation of Flagged Variables
- Summary Statistics
MODEL BUILDER PROCESS
SEASONAL FORECAST IMPROVEMENTS UTILIZING ESRI TOOLS
SUMMER 2017 ANALOGS

- Analog Years
  - 2012
  - 2009
  - 2006
  - 2002
  - 1991

- Forecasters use analogs as a historical comparison to current weather observations
SUMMER 2017 SEVERE OUTLOOK

• Overall, below average tornado season
• Favored areas include lower Mississippi Valley and Mountain West
• May – Hail/Wind
• June – Tornados to pick up
MARCH 2017 TORNADO ANALOGS
FINDINGS
# 2016 Average Lead Times by Client

<table>
<thead>
<tr>
<th>OBJECTID</th>
<th>CLIENT_ID</th>
<th>FREQUENCY</th>
<th>MEAN_LEAD_TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>74</td>
<td>3</td>
<td>17.00</td>
</tr>
<tr>
<td>2</td>
<td>110</td>
<td>2</td>
<td>28.50</td>
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<td>3</td>
<td>132</td>
<td>3</td>
<td>22.33</td>
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<td>4</td>
<td>1152</td>
<td>1</td>
<td>9.00</td>
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<td>5</td>
<td>309</td>
<td>3</td>
<td>26.00</td>
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<tr>
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<td>583</td>
<td>1</td>
<td>15.00</td>
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<tr>
<td>8</td>
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<tr>
<td>9</td>
<td>665</td>
<td>12</td>
<td>54.00</td>
</tr>
<tr>
<td>10</td>
<td>703</td>
<td>8</td>
<td>34.00</td>
</tr>
<tr>
<td>11</td>
<td>768</td>
<td>2</td>
<td>33.00</td>
</tr>
</tbody>
</table>
MARCH 2017 TORNADO ACTUALS

March 2017 Analogs
Track Density

March 2017 Tornado Tracks

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MARCH 2017 TORNADO ACTUALS

March 2017 Departures
Track Density
- High: 4.15
- Low: -2.00

March 2017 Tornado Tracks
BENEFITS FROM ESRI TOOLS & ANALYSIS

- Support system for AccuWeather Meteorologists
  - Reduces time and resources
  - Visualization tool to locate areas of opportunity
- Seasonal Outlook products and services
- Promotes client loyalty
THANK YOU!

Tim.Loftus@accuweather.com

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