# High-Resolution Tornado Damage Surveys Compared to Doppler Velocity-derived Rotational Strength Parameters

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Poster 178
AMS – Severe Local Storms
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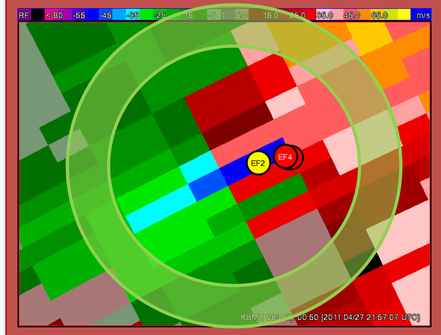
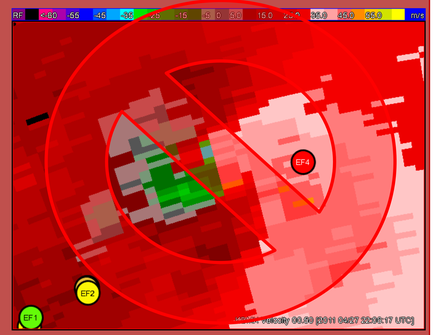
## Introduction

- Can we compare tornado damage points to velocity derived rotational strength parameters?
- Is there a relationship?



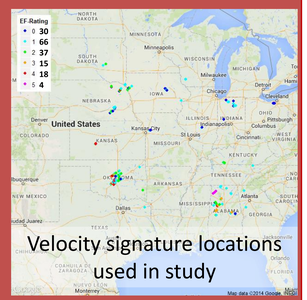

Matched damage points within the velocity couplet (at 0.5°)




Damage points outside of couplet, scan was not included

- Radar, Scan time
- Range/Beam Height
- Lat/Lon, Storm Motion
- Max out/inbound velocities
- # Gates b/w max velocities
- EF Rating, DI & tornado width*

*Width was determined using DAT contours or from *Storm Data* if no contours available




Velocity signature locations used in study

$$P = \frac{\pi \rho c_D v^3 r^2}{4}$$

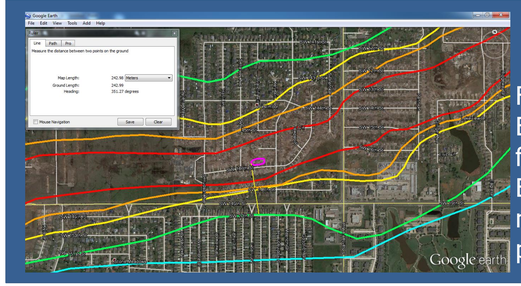
$v$ mean EF velocity rotational velocity

$r$ radius of damage radius of V signature

$\rho = 1.2$ kg m$^{-3}$ $C_D = 10^{-2}$

### Calculated Properties

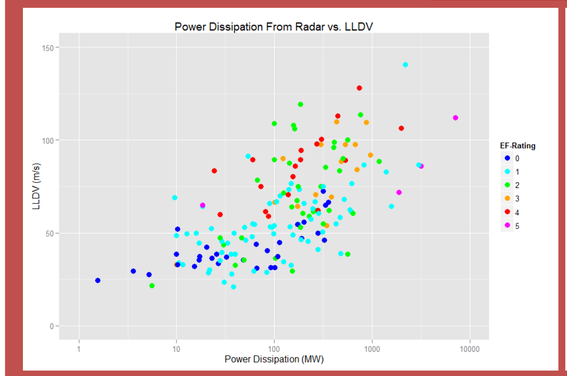
| | |
|---|---|
| Differential Velocity | Power Dissipation (using Doppler Velocity signature) |
| Rotational Velocity | |
| Rotational+Forward Velocity | Power Dissipation (using tornado width and max. EF) |

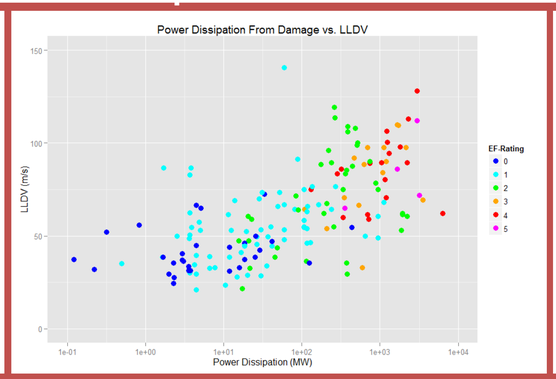


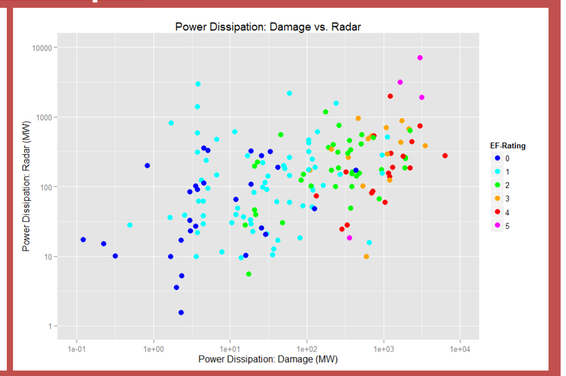

### Integrated Power Calculation

For 20 May 2013 Moore EF5, the power dissipation for each EF-contour (up to EF4) was calculated for a more precise calculation of power dissipation.

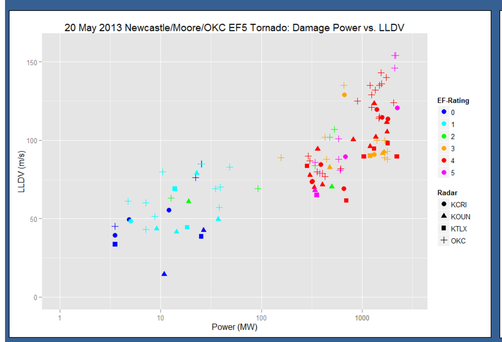
## Power Dissipation Relationships

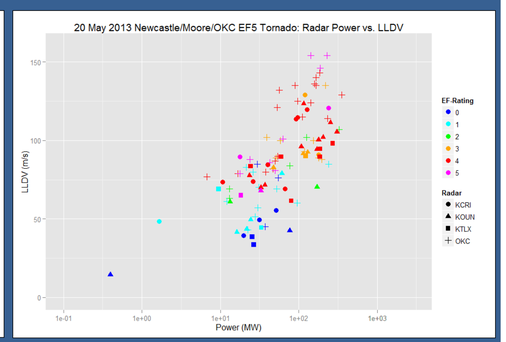


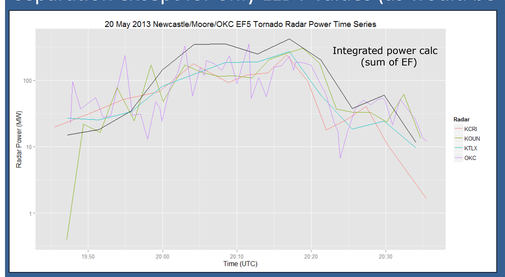



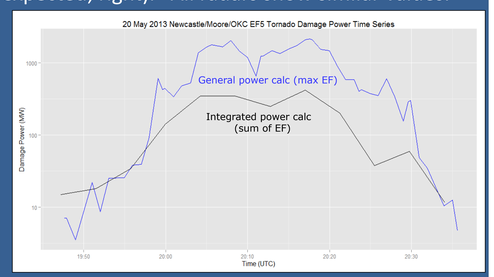

## 20 May 2013 (Moore, OK)




The generalized power dissipation calculations separate damage intensity well, as would be expected and better than just LLDV (left). However, power dissipation based upon the radar shows little separation except for only LLDV values (as would be expected; right). All radars show similar values.




The integrated power dissipation for each time step matches well with the power dissipation estimation from the nearby radars (left). The general power calculation is higher than the general integrated calculation, yet the general trends match nicely.

## Discussion

- Fairly good general relationship between LLDV and generalized damage power dissipation values
  - Power dissipation from damage is complex, dependent on multiple variables—EF-rating (which is dependent on structures damaged), tornado width, drag coefficient choice & survey quality
- However, relationship of LLDV and power dissipation is muddled when using radar to calculate power dissipation
- From Moore: More specific, integrated damage power dissipation calculations agree very closely with radar damage power dissipation estimations
  - Needs more investigation; highly detailed surveys like Moore needed
- From Moore: Radars of different resolution and distance from tornado have similar power dissipation values
- Need to separate out EF-ratings by DI; will relationships hold/improve?
- Investigation of outliers needed

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