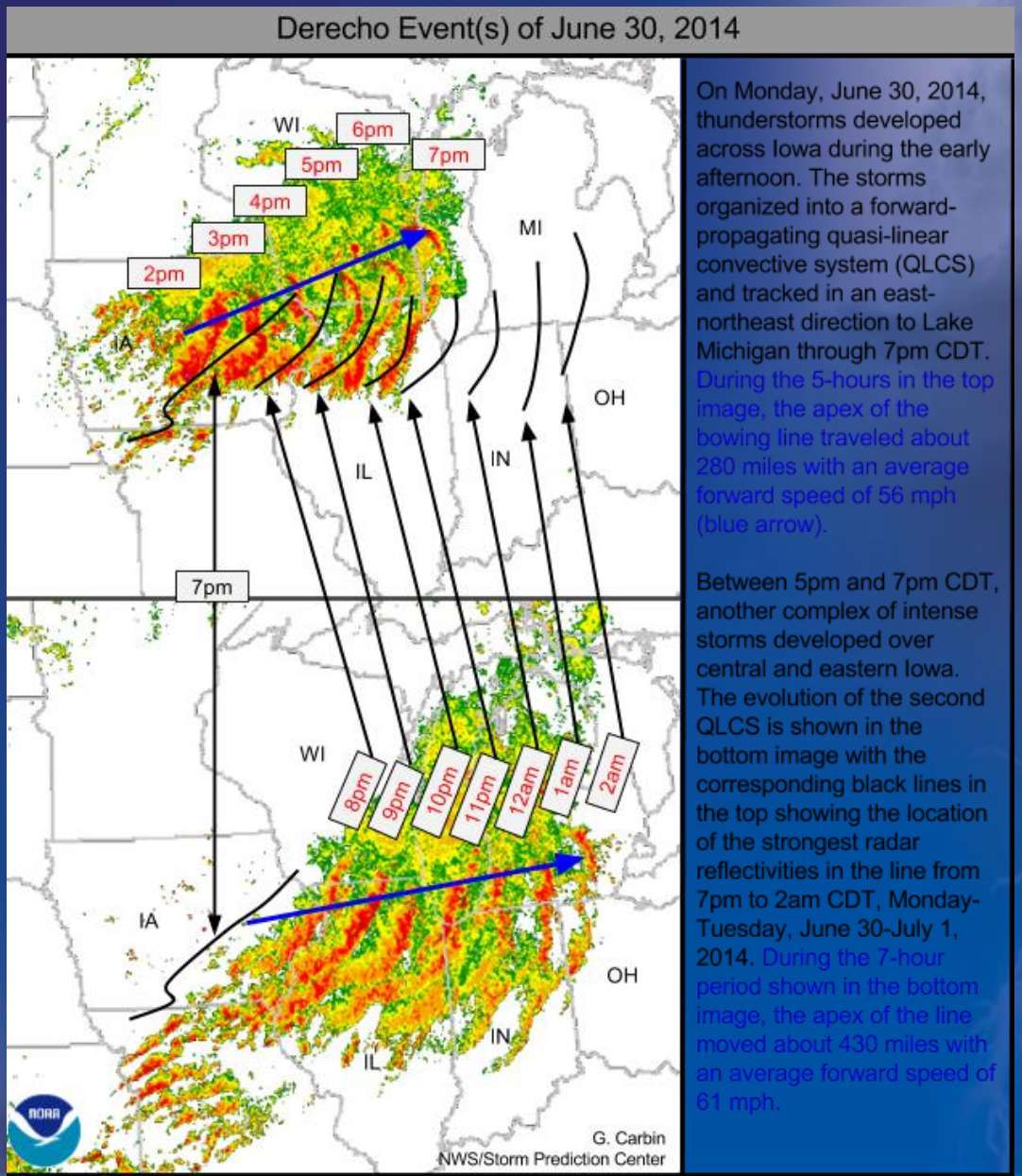
July 1st 2014 QLCS

Todd Holsten/Evan Bentley/Jeffery Logsdon

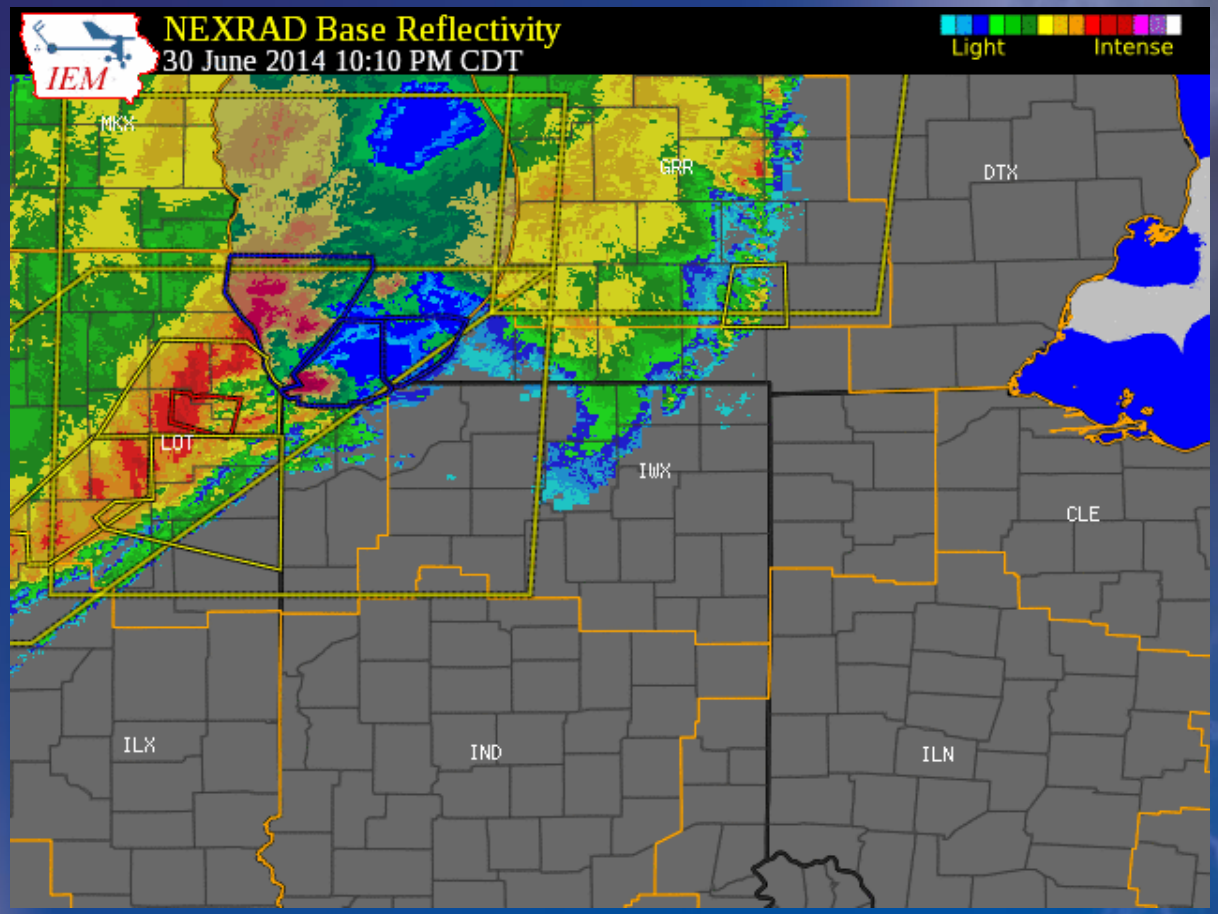
SPC Classification



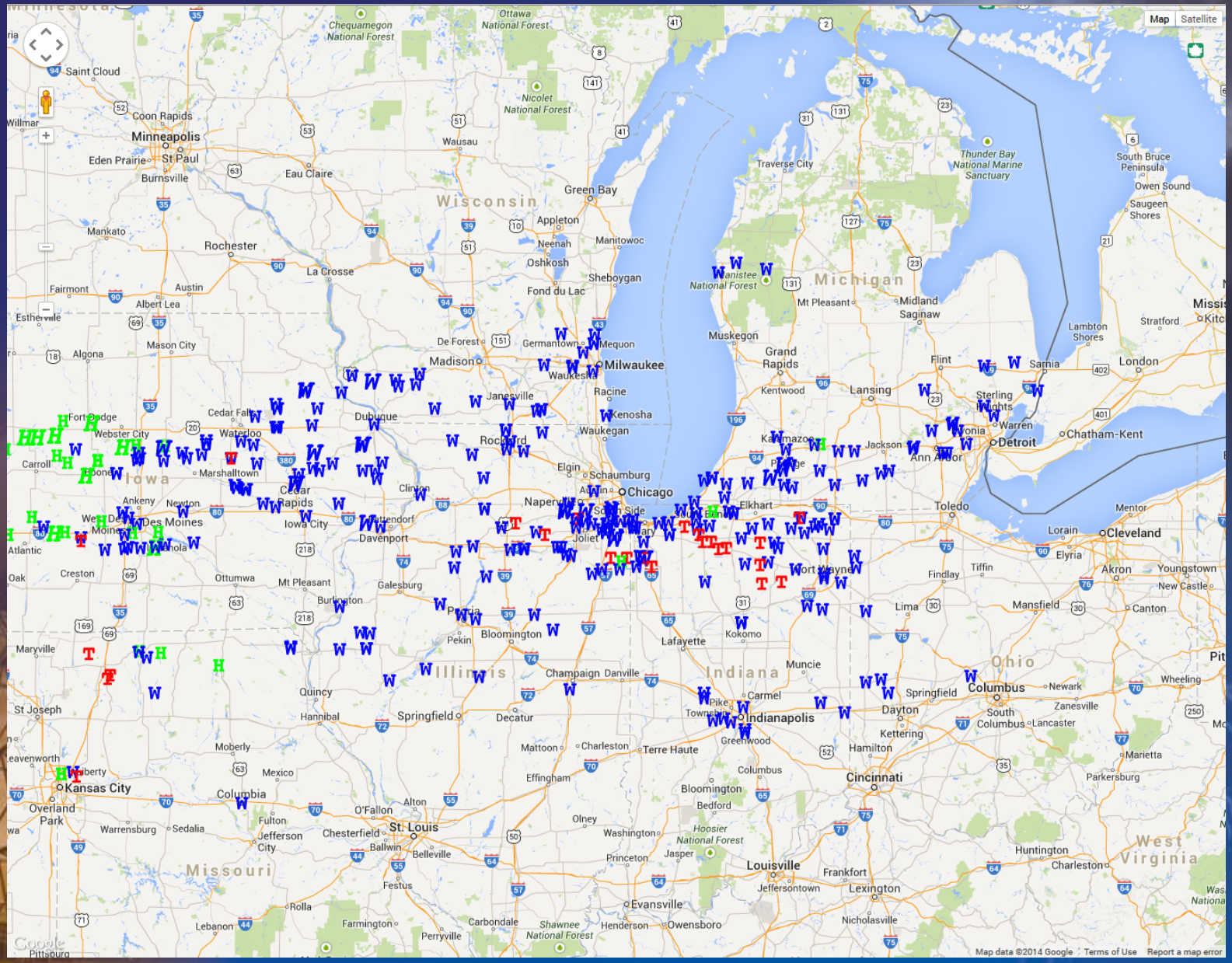
On Monday, June 30, 2014, thunderstorms developed across Iowa during the early afternoon. The storms organized into a forward-propagating quasi-linear convective system (QLCS) and tracked in an east-northeast direction to Lake Michigan through 7pm CDT. During the 5-hours in the top image, the apex of the bowing line traveled about 280 miles with an average forward speed of 56 mph (blue arrow).

Between 5pm and 7pm CDT, another complex of intense storms developed over central and eastern Iowa. The evolution of the second QLCS is shown in the bottom image with the corresponding black lines in the top showing the location of the strongest radar reflectivities in the line from 7pm to 2am CDT, Monday-Tuesday, June 30-July 1, 2014. During the 7-hour period shown in the bottom image, the apex of the line moved about 430 miles with an average forward speed of 61 mph.

Event Overview



Aftermath


Map
Satellite
Saint Cloud
Minneapolis
St Paul
Rochester
La Crosse
Eau Claire
Wausau
Green Bay
Appleton
Oshkosh
Fond du Lac
Sheboxygan
Manitowoc
Madison
Milwaukee
Racine
Kenosha
Waukegan
Chicago
Rockford
Janesville
Dubuque
Waterloo
Cedar Rapids
Iowa City
Davenport
Des Moines
Ottumwa
Burlington
Galesburg
Peoria
Bloomington
Springfield
Decatur
Champaign
Danville
Lafayette
Kokomo
Terre Haute
Indianapolis
Muncie
Fort Wayne
Toledo
Detroit
Ann Arbor
Flint
Lansing
Grand Rapids
Kalamazoo
Muskegon
Traverse City
Mt Pleasant
Midland
Saginaw
Sarnia
London
Cleveland
Akron
Youngstown
Columbus
Dayton
Springfield
Cincinnati
Hamilton
Louisville
Lexington
Frankfort
Evansville
Owensboro
Henderson
Kansas City
St. Louis
Columbia
Jefferson City
Springfield
Missouri
Indiana
Ohio
West Virginia
Michigan
Wisconsin
Illinois
Iowa
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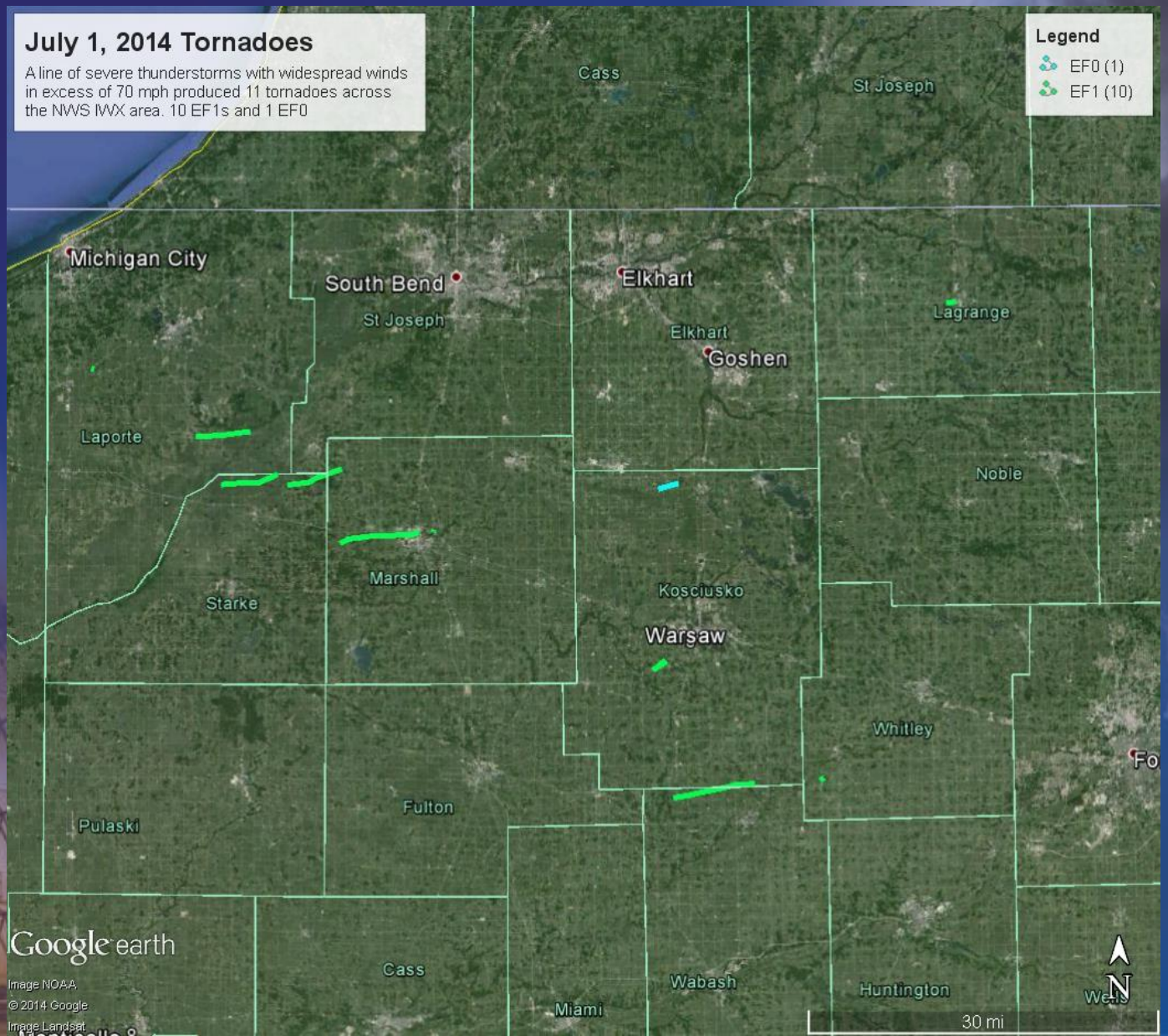
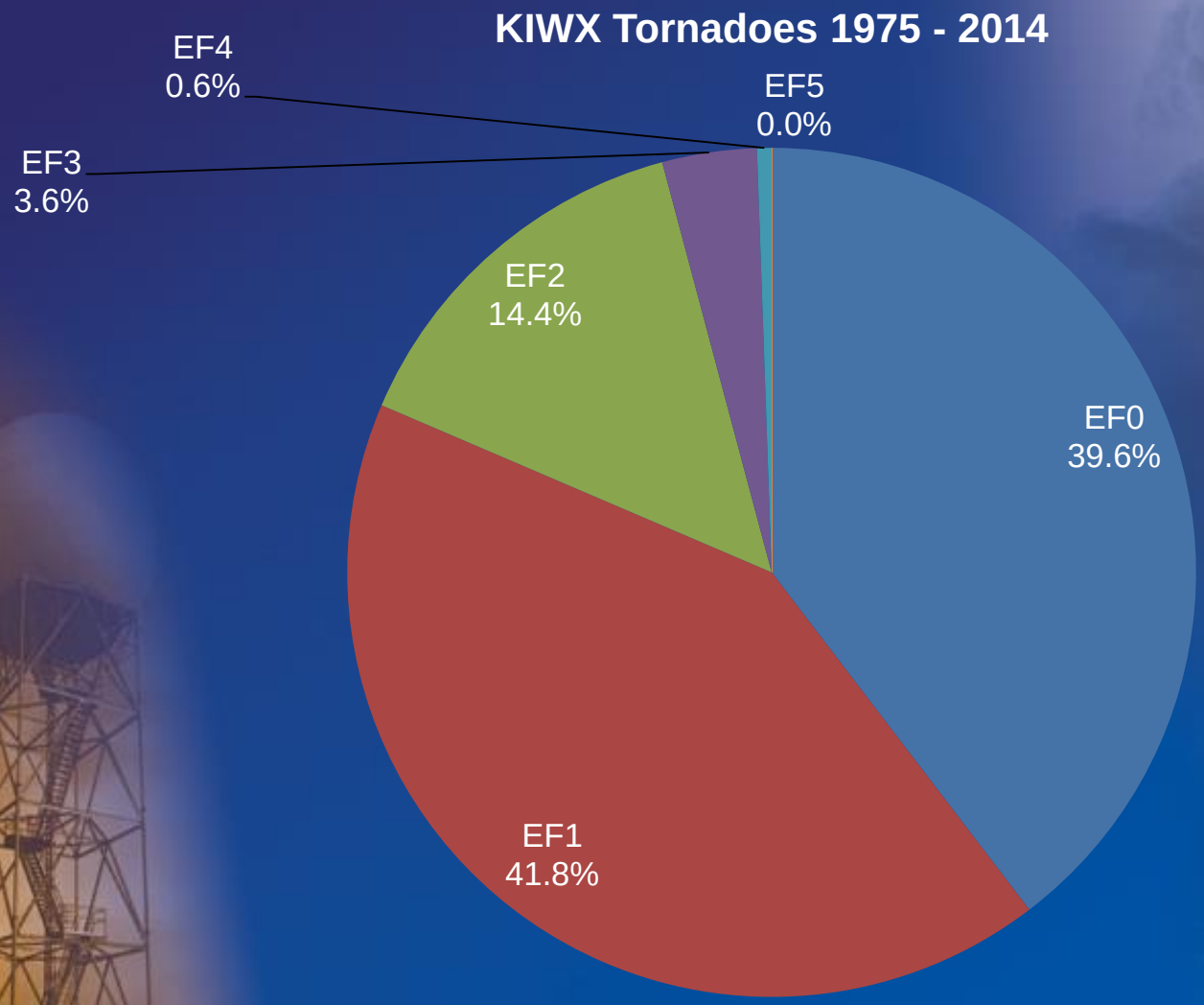
Aftermath


July 1, 2014 Tornadoes
A line of severe thunderstorms with widespread winds in excess of 70 mph produced 11 tornadoes across the NWS IWX area. 10 EF1s and 1 EF0
Legend
EF0 (1)
EF1 (10)
Cass
St Joseph
Michigan City
South Bend
St Joseph
Elkhart
Elkhart
Goshen
Lagrange
Laporte
Noble
Marshall
Starke
Kosciusko
Warsaw
Whitley
Pulaski
Fulton
Cass
Miami
Wabash
Huntington
Google earth
Image NOAA
© 2014 Google
Image Landsat
30 mi
N

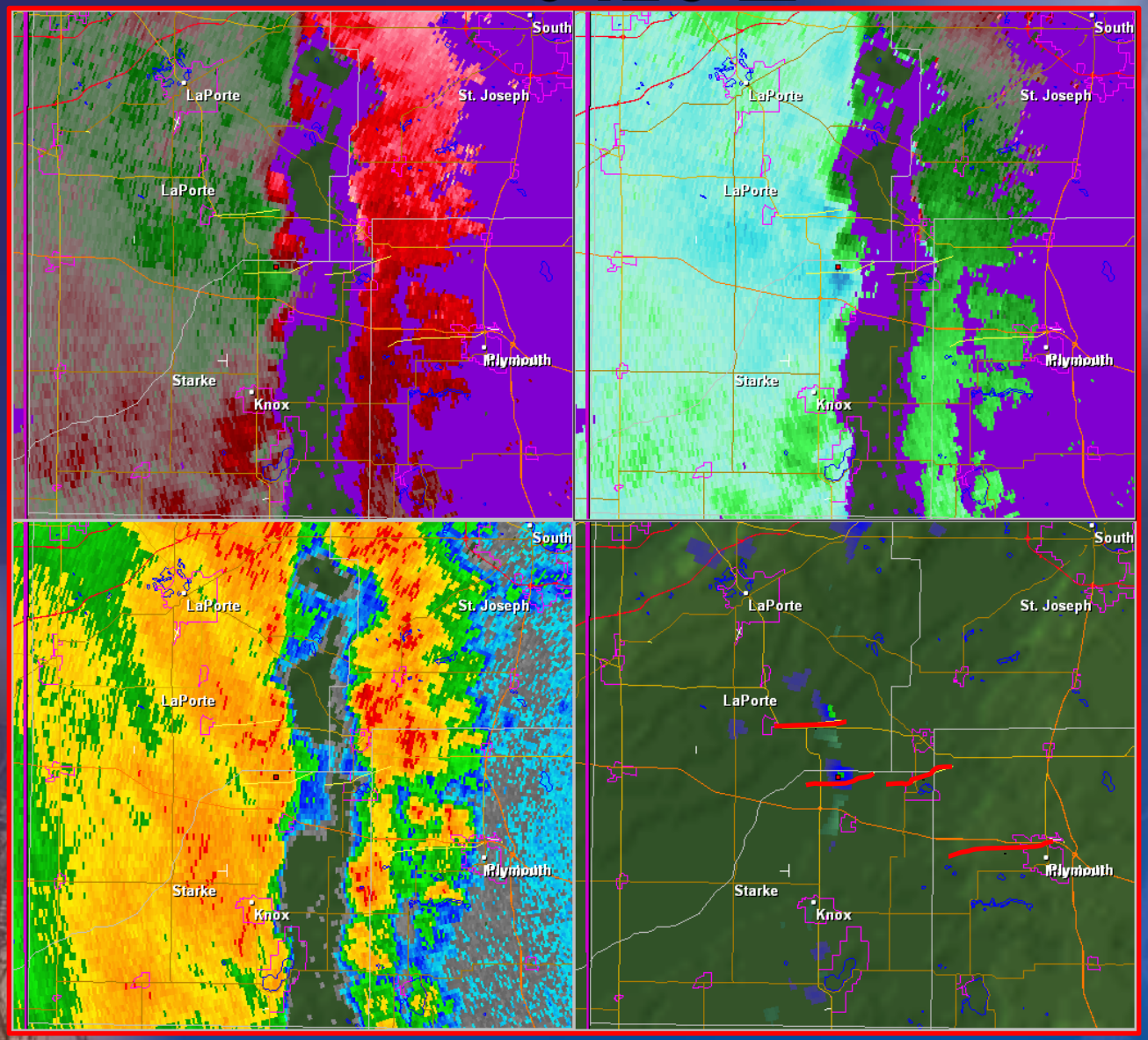
Past recent QLCS tornado events

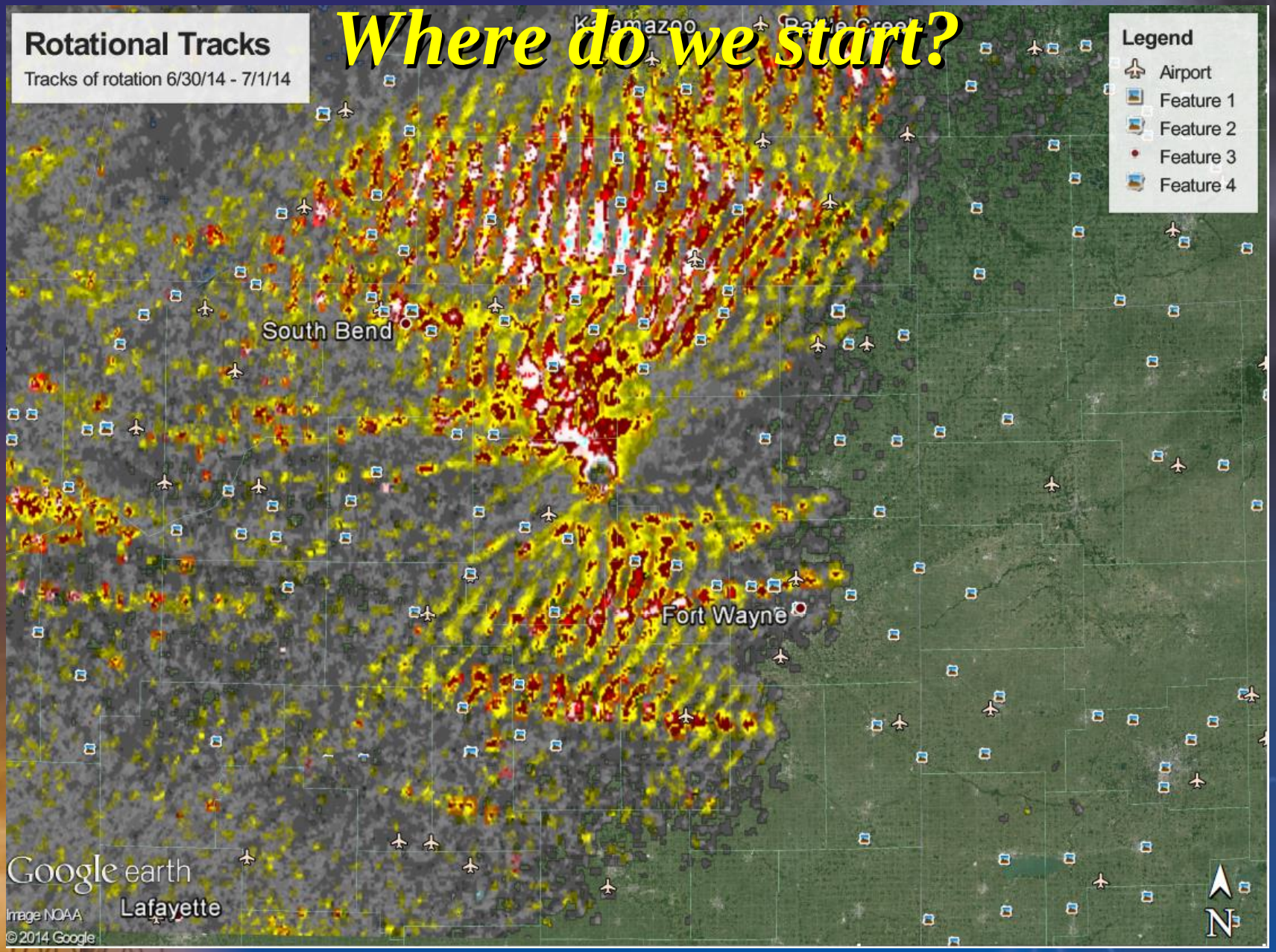
- 06/30/14 – 11 tornadoes
- 11/17/13 – 17 tornadoes *
  - ** 2nd highest IN statewide tornado count*
- 10/26/10 – 13 tornadoes *
  - ** Ranks as 1st in total calendar year tornadoes for IWX*
- 10/24/01 – 10 tornadoes
- 06/05/10 – 8 tornadoes
- 06/23/10 – 7 tornadoes
- 04/19/11 – 6 tornadoes *
  - ** 3rd highest IN statewide tornado count*

Tornadoes by EF scale



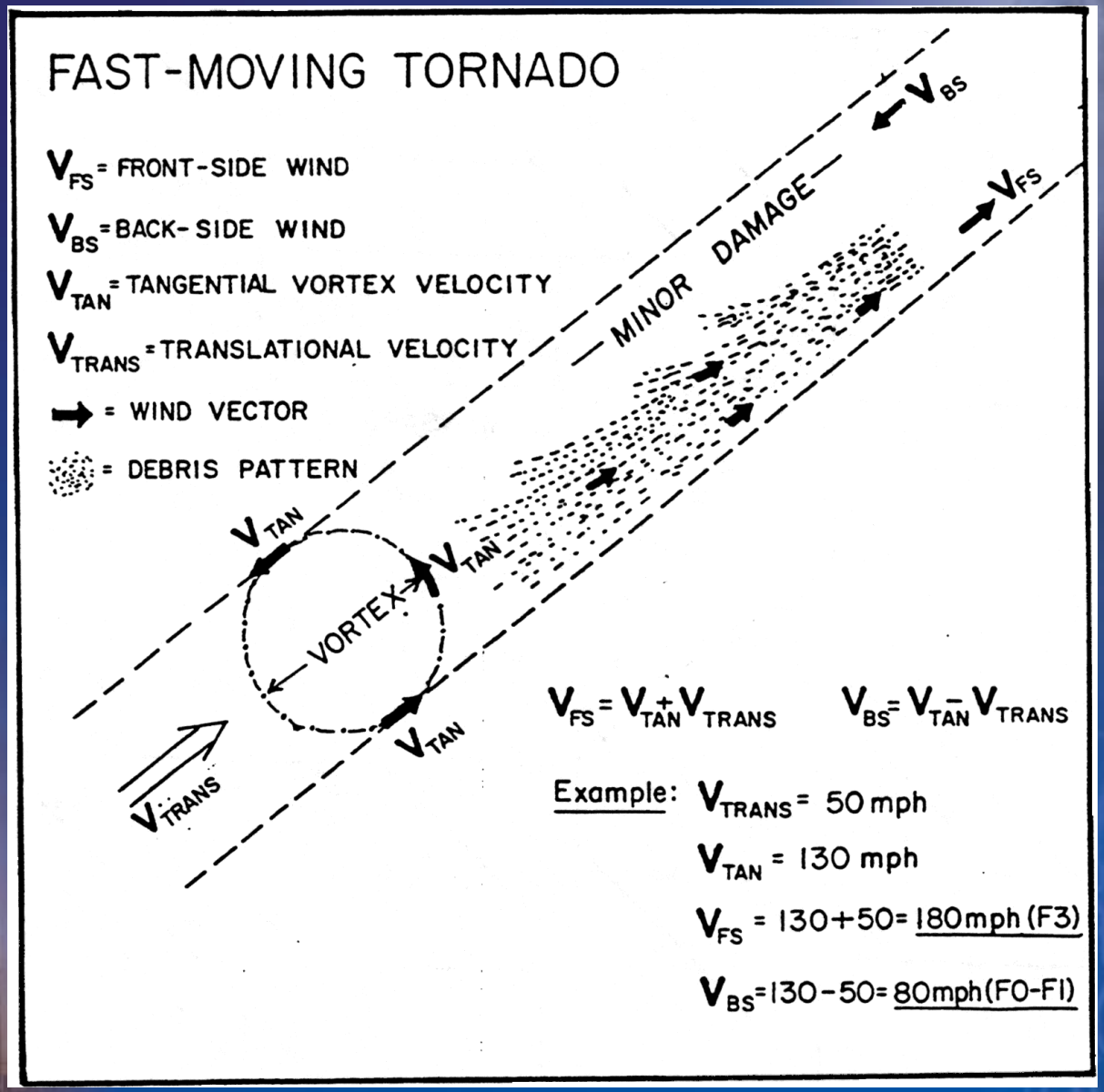
0426 Z


South
LaPorte
St. Joseph
LaPorte
Plymouth
Starke
Knox
South
LaPorte
St. Joseph
LaPorte
Plymouth
Starke
Knox
South
LaPorte
St. Joseph
LaPorte
Plymouth
Starke
Knox
South
LaPorte
St. Joseph
LaPorte
Plymouth
Starke
Knox

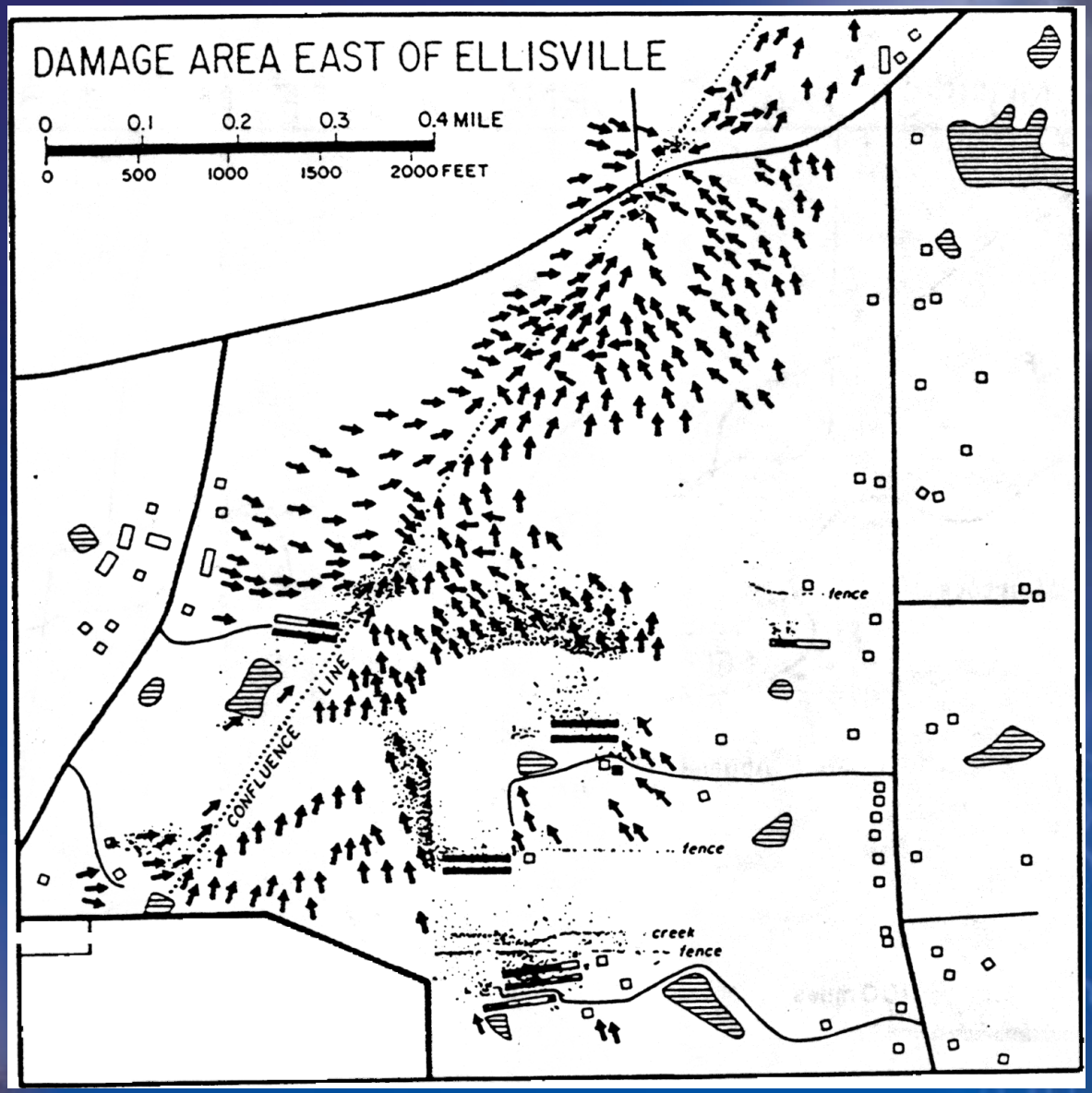

Rotational Tracks
Tracks of rotation 6/30/14 - 7/1/14
Where do we start?
Legend
Airport
Feature 1
Feature 2
Feature 3
Feature 4
South Bend
Fort Wayne
Lafayette
Google earth
Image NOAA
© 2014 Google
N

Storm Surveys

Storm Surveys

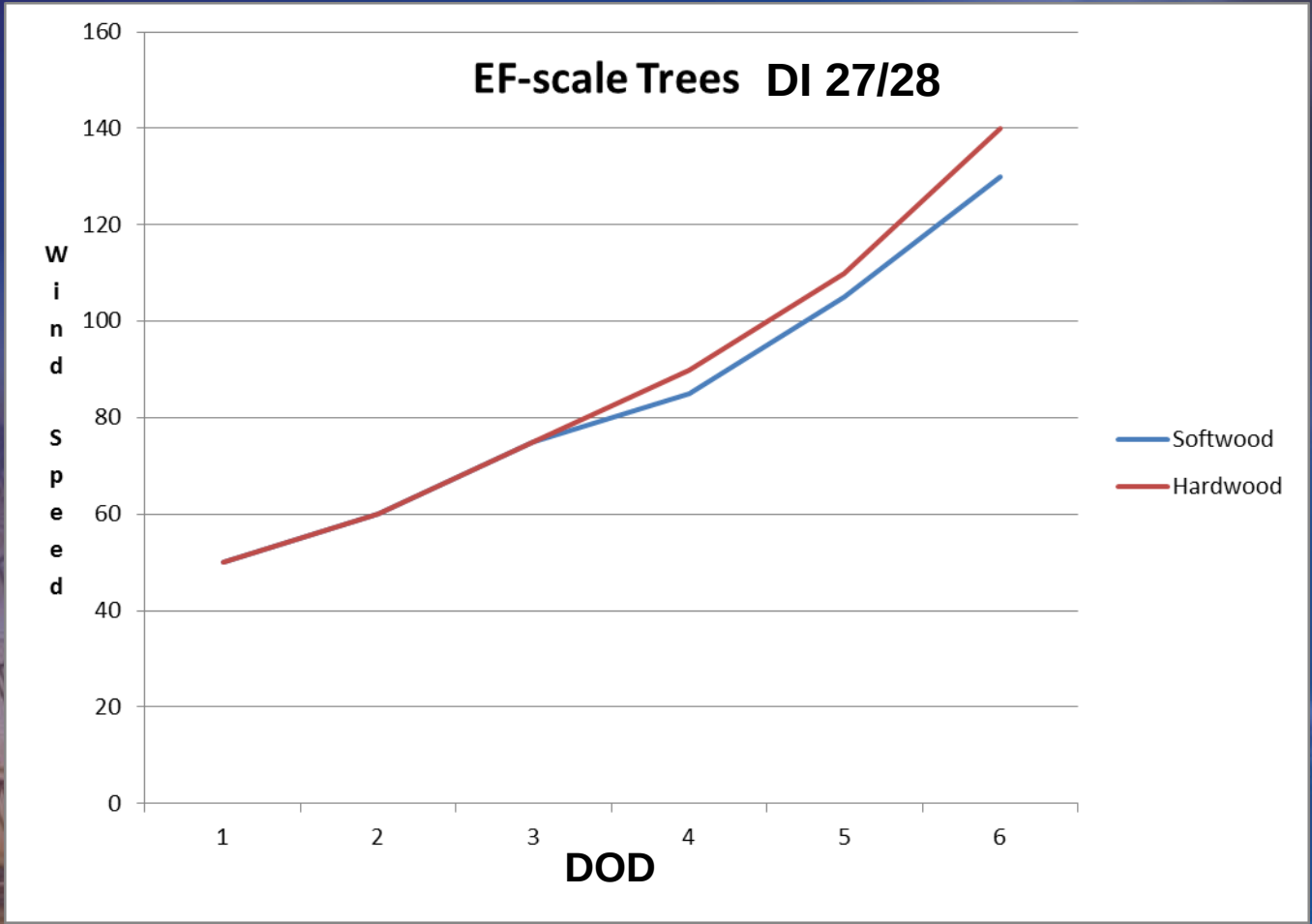


"If in doubt, vector it out"



First a word about trees…

- Windthrow (uprooting/snapping of trees during high wind) is typically the most common damage indicator available in storm surveys



Windthrow susceptibility

- **Site characteristics**
  - *Topography (Big Long Lake)*
  - *Seasonal wind exposure (leaves in growing season)*
  - *Soil type/rooting conditions (wet spring in northwest IN)*
  - *Disease, insect damage*
- **Tree characteristics**
  - *Rooting depth (species dependent), trunk diameter*
  - *Crown size and shape, stand density*
- **All of the above can change the midrange bound of expected DI based Tree DOD damage**
  - *Most mature trees reach their structural limit at 45-49 m/s (~100-110 mph), (Hedden et al. 1995)*
  - *Greater uprooting relative to trunk breakage with increasing wind speed*

Tree survival mechanisms

- **Streamlining**
  - *Can reduce frontal exposure to 20-40% HW, 45-65% SW*
- **Branch shedding**
  - *Increases streamlining effect, lessens crown area*
- **Strong and/or flexible wood**
  - *Tree hollowing (hollow to radius ratio > 0.7) can lead to increased flexibility*
- **Lower center of gravity (height to diameter ratio)**
  - *Root buttressing*

EF Scale Tree DI DOD's

- **Hardwood (HW)**

DOD*	Damage description	EXP	LB	UB
1	Small limbs broken (up to 1" diameter)	60	48	72
2	Large branches broken (1"-3" diameter)	74	61	88
3	Trees uprooted	91	76	118
4	Trunks snapped	110	93	134
5	Trees debarked with only stubs of largest branches remaining	143	123	167

* Degree of Damage

- **Softwood (SW)**

DOD	Damage description	EXP	LB	UB
1	Small limbs broken (up to 1" diameter)	60	48	72
2	Large branches broken (1" – 3" diameter)	75	62	88
3	Trees uprooted	87	73	113
4	Trunks snapped	104	88	128
5	Trees debarked with only stubs of largest branches remaining	131	112	153

* Degree of Damage

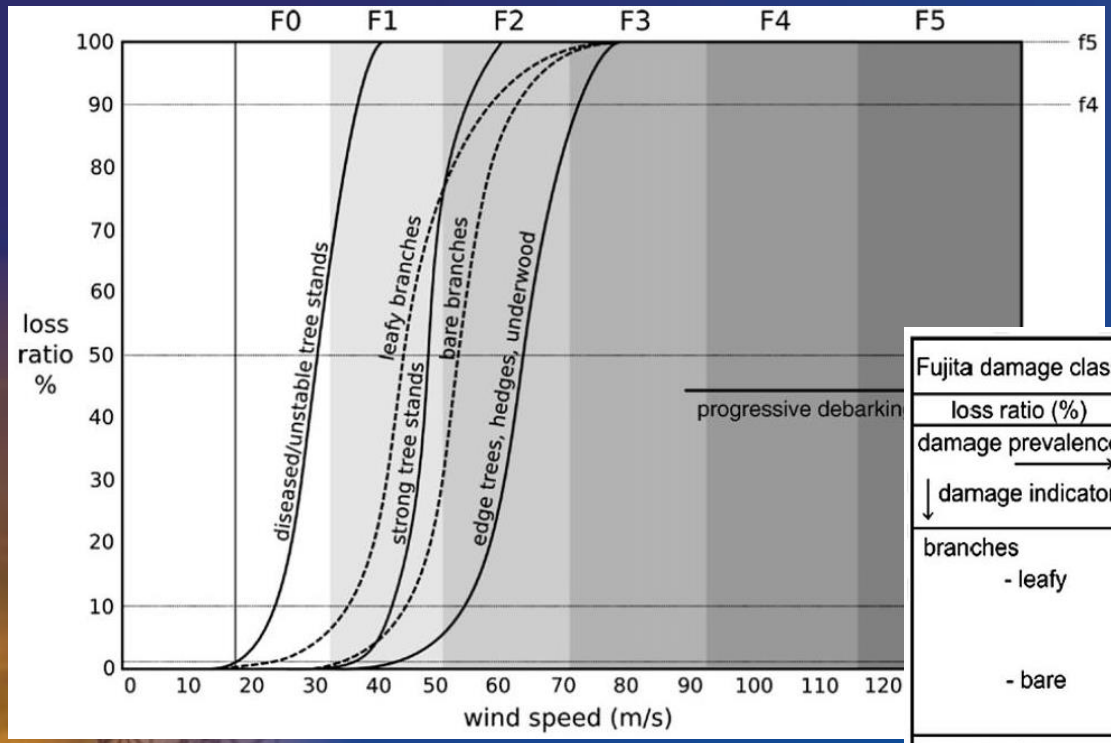
Environment Canada EF Scale Combined Tree DI DOD's

C-2. Trees (C-T)

DOD	Damage Description	EXP	LB	UB
1	Small limbs broken (< 1" diameter)	44	34	53
2	Large branches broken (1-3" diameter)	56	41	69
3	Up to 20% of mature trees snapped and/or uprooted	72	50	94
4	More than 20% of mature trees snapped and/or uprooted	94	66	119
5	More than 50% of mature trees snapped and/or uprooted	119	91	144
6	More than 80% of mature trees snapped and/or uprooted; numerous trees may be denuded/debarked by missles with only stubs of largest branches remaining	147	119	172

(mph)

European Severe Storms Lab



Fujita damage class	f0	f1	f2	f3	f4	f5
loss ratio (%)	0.1	1	10	50	90	100
damage prevalence → / ↓ damage indicator	extremely isolated	isolated	significant	frequent	prevalent	total
branches						
- leafy	< F0	F0+	F1-	F1+	F2-	F3-
- bare	F0-	F1-	F1+	F2-	F2-	F3-
tree stands						
- diseased/ unstable	< F0	F0-	F0+	F0+	F1-	F1-
- strong	F0+	F1-	F1+	F1+	F2-	F2-
edge trees, hedges, underwood	F1-	F1+	F2-	F2+	F3-	F3-

Storm Surveys

- NSSL rotational tracks were critical as a first guess to potential tornadic track damage areas
- GR2 data loaded on laptop can be used in the field to precisely locate potential damage tracks
- Criss-cross suspect couplet paths for damage
  - *Can be a tiring process for long track features*
    - However significant damage can be missed otherwise which could affect final EF scale rating and tornado count
    - Additional surveys may be needed

"The Future"

“We could have seen this…”

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