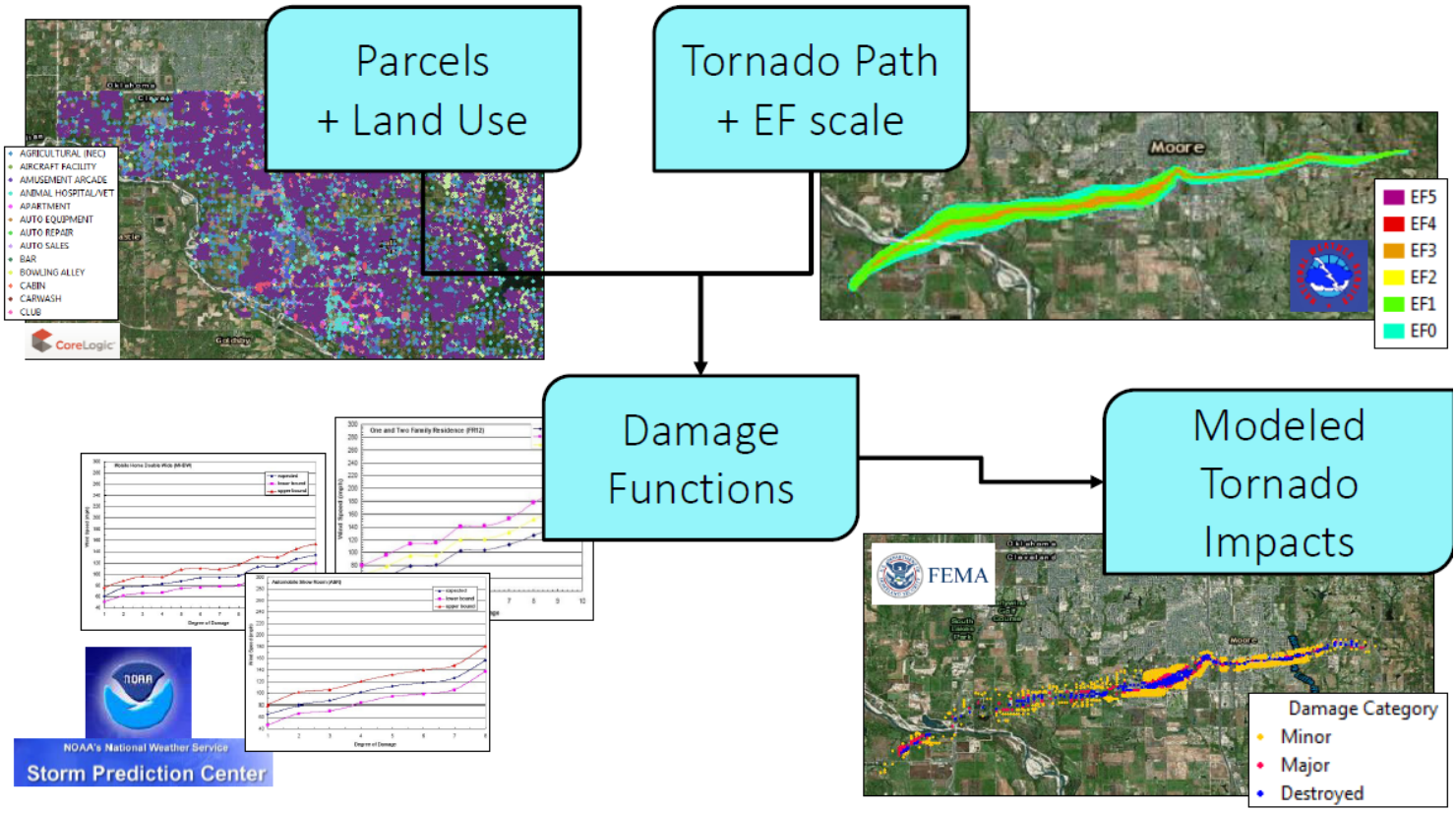
FEMA's Tornado Incident Journal
Damage Assessment Model

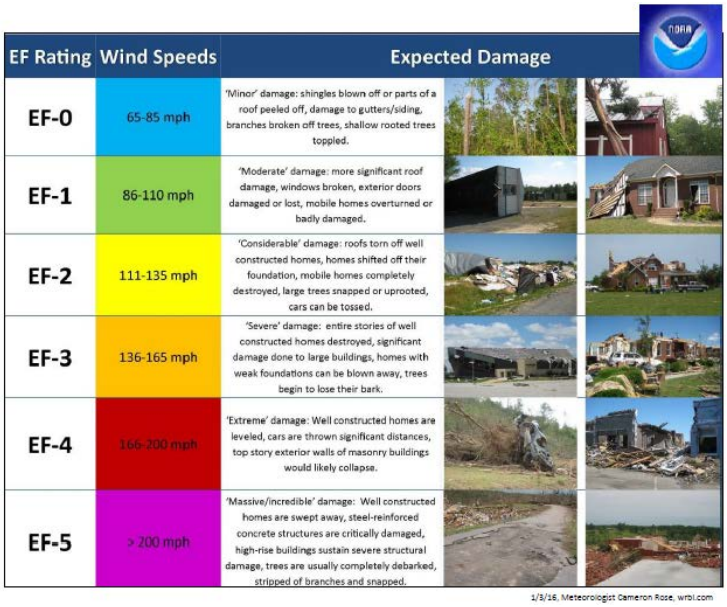
Data Sources:

- NOAA NWS SPC Damage Assessment Toolkit (DAT): https://apps.dat.noaa.gov/StormDamage/DamageViewer/
- National Parcel Dataset: http://www.corelogic.com/products/parcelpoint.aspx
- NOAA Enhanced Fujita Scale: http://www.spc.noaa.gov/faq/tornado/ef-scale.html



Methodology:

1. The Enhanced Fujita Scale is a set of wind estimates based on observed damages. It uses 3-second gusts estimated at the point of damage based on a judgment of level of damage. The EF scale tornado path polygons are available through the Damage Assessment Toolkit (DAT) typically 24-72 hours following a tornado.



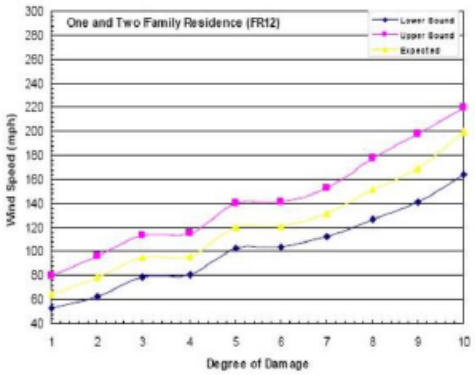
EF Rating	Wind Speeds	Expected Damage
EF-0	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.
EF-1	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.
EF-2	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.
EF-3	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.
EF-4	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.
EF-5	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.

1/5/16, Meteorologist Cameron Rose, wrbl.com

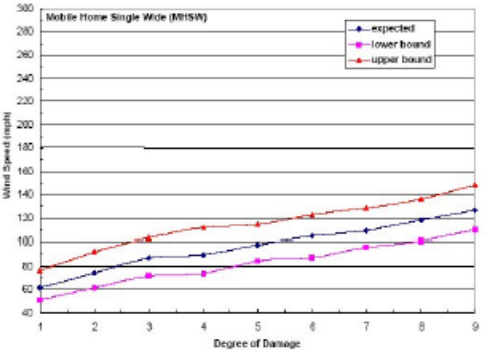
2. The EF scale attributes of the DAT polygons are associated with varying Degrees of Damage for 28 different Damage Indicators.

NUMBER (Details Linked)	DAMAGE INDICATOR	ABBREVIATION
1	Small barns, farm outbuildings	SBO
2	One- or two-family residences	FR12
3	Single-wide mobile home (MHSW)	MHSW
4	Double-wide mobile home	MHDW
5	Apt, condo, townhouse (3 stories or less)	ACT
6	Motel	M
7	Masonry apt. or motel	MAM
8	Small retail bldg. (fast food)	SRB
9	Small professional (doctor office, branch bank)	SPB
10	Strip mall	SM
11	Large shopping mall	LSM
12	Large, isolated ("big box") retail bldg.	LIRB
13	Automobile showroom	ASR
14	Automotive service building	ASB
15	School - 1-story elementary (interior or exterior halls)	ES
16	School - jr. or sr. high school	JHSH
17	Low-rise (1-4 story) bldg.	LRB
18	Mid-rise (5-20 story) bldg.	MRB
19	High-rise (over 20 stories)	HRB
20	Institutional bldg. (hospital, govt. or university)	IB
21	Metal building system	MBS
22	Service station canopy	SSC
23	Warehouse (tilt-up walls or heavy timber)	WHB
24	Transmission line tower	TLT
25	Free-standing tower	FST
26	Free standing pole (light, flag, luminary)	FSP
27	Tree - hardwood	TH
28	Tree - softwood	TS

Single Family Residence



Manufactured Home



3. The Property Indicators and the Land Use Codes of the National Parcel Dataset are used to assume a Structure Type for the parcels. Additionally, vacant parcels and duplicate parcel points are removed from the analysis.

4. The Degrees of Damage for each Damage Indicator are categorized into FEMA Damage Categories, and then applied to the parcel dataset according to each parcel's Structure Type.

EF Number	Wind Speed (mph)	FARMS, BUILDINGS, BARNS	MANUFACTURED HOME	SERVICE STATION	SMALL GENERAL BUILDING	1- OR 2-FAMILY RESIDENCES	WAREHOUSES, INDUSTRIAL FACILITIES, SMALL ARENAS	LARGE BUILDING
0	65-85	Minor	Minor	Affected	Affected	Affected	Affected	Affected
1	86-110	Major	Major	Minor	Minor	Minor	Minor	Minor
2	111-135	Destroyed	Destroyed	Major	Major	Major	Major	Major
3	136-165	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed	Major	Major
4	166-200	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed
5	200+	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed

MOTEL	SCHOOL	LOW RISE (1-4 STORIES)	APARTMENT, CONDO, TOWNHOME	MID RISE (5-20 STORIES)	HIGH RISE (20+ STORIES)	HOSPITALS, GOVT, JAILS
Affected	Affected	Affected	Affected	Affected	Affected	Affected
Minor	Minor	Minor	Minor	Minor	Minor	Minor
Major	Major	Minor	Minor	Minor	Minor	Minor
Major	Major	Major	Major	Major	Major	Minor
Destroyed	Destroyed	Destroyed	Major	Major	Major	Major
Destroyed	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed

5. Parcels are intersected with the DAT tornado path polygons in ArcGIS, and assigned a damage category based on the EF scale of the tornado path. These damage counts can be used for preliminary situational awareness and should be replaced by field verified information when it becomes available.