3.6 - Tornado Hazard Profile

The Mitigation Planning Team researched the tornado hazard and its effects on New York State. Contents of this section resulted from research and outreach including the following sources:

- The National Oceanic and Atmospheric Administration (NOAA), National Climatic Data Center web site, http://www.outlook.noaa.gov/tornadoes/
- The National Climatic Data Center, Storm Events Database website, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms
- TornadoProject.com, http://www.tornadoproject.com/

The following chart provides a few terms to know regarding a Tornado event

Term	Definition
Tornado	A local atmospheric storm, generally of short duration, formed by winds rotating at very high speeds, usually in counterclockwise direction. The vortex, up to several hundred yards wide, is visible to the observer as a whirlpool like column of winds rotating about a hollow cavity or funnel. Winds have been estimated to be in excess of 300 mph.
Tornado Watch	Tornadoes are possible. Remain alert for approaching storms. Watch the sky and stay tuned to NOAA Weather Radio, commercial radio, or television for information
Tornado Warning	A tornado has been sighted or indicated by weather radar. Take shelter immediately

It is common knowledge that New York State has a definite vulnerability to tornadoes. Research indicates that over 350 tornadoes ranging from F0 to F4 on the Fujita-Pearson Tornado Intensity Scale have occurred in New York State since 1952.

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground . Tornadoes are most often generated by thunderstorm activity (but they also result from hurricanes and other tropical storms) when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly.

The damage caused by a tornado is a result of the high wind velocity and wind-blown debris. The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction such as residential homes (particularly mobile homes). The *Enhanced Fujita Scale for Tornadoes* was developed to measure tornado strength (i.e., magnitude or intensity) and associated types of damages (see **Table 3-31** on the following page).

Table 3-31

1: Enhanced Fujita Scale for Tornadoes Table			
EF-Scale Number	**Intensity Phrase**	**3 Second Gust (MPH)**	**Type of Damage Done**
F0	GALE	65–85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
F1	MODERATE	86–110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	SIGNIFICANT	111–135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	SEVERE	136–165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
F4	DEVASTATING	166–200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	INCREDIBLE	Over 200	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.

Hazard Identification

The US Wind Zone Map (**Figure 3-102**) shows the areas affected by extreme windstorms. Developed by the US Army Corps of Engineers, it is based on the history of 40 years of tornadoes and 100 years of hurricanes.

Figure 3-102

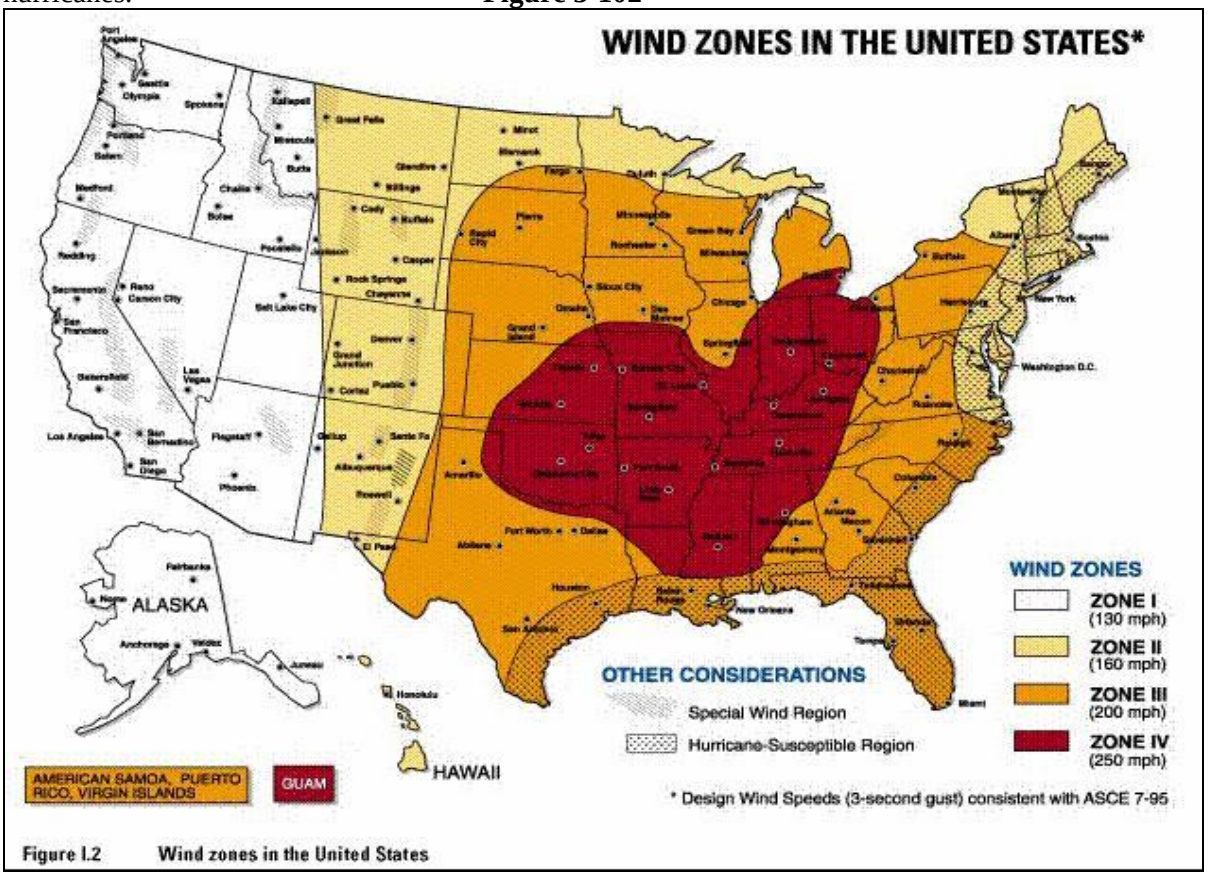


Figure I.2 Wind zones in the United States

To determine whether to identify tornado as a hazard:

- Locate your community on the US Wind Zone Map (**Figure 3-102,** previous page.).

- If you are located in one of the four colored zones or special wind regions on this map, then you probably do not need to identify tornado as a hazard. However, you should confirm your findings with your state meteorologist or emergency manager.

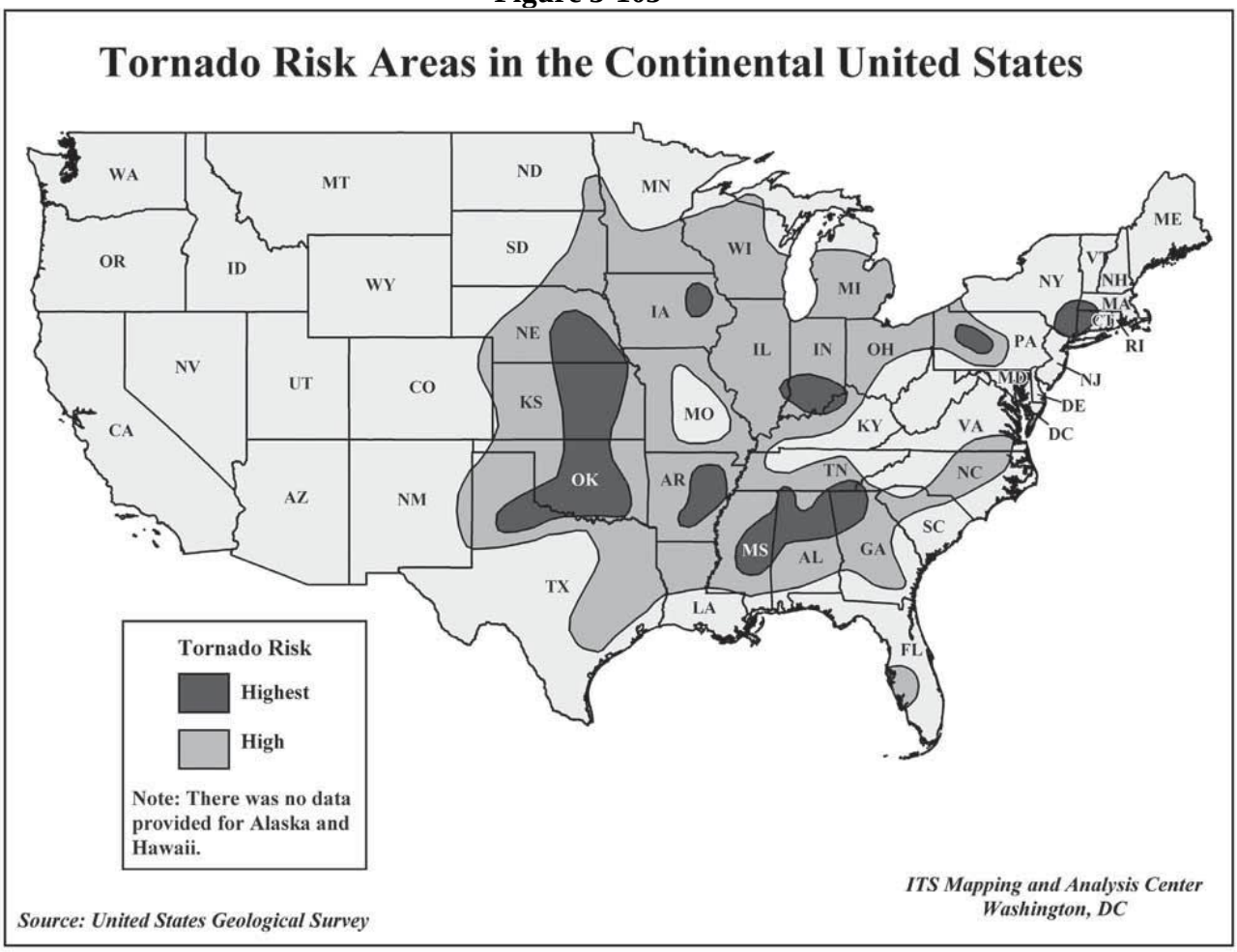
- If you are located in one of the four colored zones or special wind regions on this map, then note the zone and/or region special wind and identify tornado as a hazard affecting your community. For example, New Jersey is located in wind zone II which is associated with winds up to 160 mph. It is also in a hurricane-susceptible region where tornadoes may be generated.

- Note that all identified hazards must be profiled, their vulnerability assessed, and mitigation actions developed for reducing their risk. However, in areas like New York and New Jersey, the mitigation strategy requirement for tornadoes may be met with countywide actions involving multiple hazards such as a public awareness and education program.

Geographic Location/Extent/Severity – Tornado Hazard

Tornadoes can occur in any state but are more frequent in the Midwest, Southeast, and Southwest. The states of Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Mississippi, Missouri, Nebraska, Oklahoma, South Dakota, and Texas are at greatest risk. In New York State, tornadoes can occur in any area of the State.

Figure 3-103


Tornado Risk Areas in the Continental United States
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
GA
SC
NC
VA
PA
NY
ME
VT
NH
MA
CT
RI
NJ
MD
DE
DC
FL
Tornado Risk
Highest
High
Note: There was no data provided for Alaska and Hawaii.
Source: United States Geological Survey
ITS Mapping and Analysis Center
Washington, DC

Historical Occurrences

Between 1950 and 2009 New York State has seen a total of 376 Tornadoes; in all, these events have caused 21 deaths, 307 injuries, roughly $820,000 in crop damages and $422,000,000 in property damages. **Table 3-32 and Figure 3-104** summarizes historical tornado events by County according to the NOAA NCDC and Local mitigation plans.

Table 3-32
TORNADO EVENTS (by County) - 1950 to 2009

Location or County	Date	Mag	Dth	Inj	PrD	CrD
1 ESSEX	05/06/1952	F2	0	0	25K	0
2 YATES	07/14/1954	F1	0	0	2.5M	0
3 ST. LAWRENCE	09/19/1954	F2	0	0	25K	0
4 SCHUYLER	08/30/1955	F3	0	0	25K	0
5 YATES	07/01/1956	F1	0	0	0K	0
6 ERIE	04/25/1957	F1	0	0	25K	0
7 OTSEGO	08/10/1958	F1	0	0	25K	0
8 SUFFOLK	09/08/1958	F0	0	0	0K	0
9 ESSEX	10/16/1958	F1	0	0	25K	0
10 CHAUTAUQUA	06/12/1959	F0	0	3	250K	0
11 JEFFERSON	07/01/1959	F1	0	0	25K	0
12 FULTON	07/12/1959	F0	0	0	25K	0
13 LIVINGSTON	05/22/1960	F0	0	0	25K	0
14 SCHENECTADY	06/24/1960	F3	0	9	25.0M	0
15 ONEIDA	06/29/1960	F1	0	0	250K	0
16 OSWEGO	09/09/1960	F1	0	0	0K	0
17 SULLIVAN	05/09/1961	F2	0	4	2.5M	0
18 CATTARAUGUS	05/15/1961	F3	0	0	250K	0
19 ERIE	07/07/1961	F2	0	0	250K	0
20 OTSEGO	08/16/1961	F0	0	0	25K	0
21 TOMPKINS	08/25/1961	F0	0	0	25K	0
22 BROOME	09/10/1962	F0	0	0	0K	0
23 ONONDAGA	06/11/1963	F0	0	0	3K	0
24 CHAUTAUQUA	07/02/1963	F1	0	0	3K	0
25 NIAGARA	09/03/1963	F1	0	0	3K	0

26 SCHUYLER	06/15/1964	F1	0	0	25K	0
27 CHAUTAUQUA	05/16/1965	F2	0	3	250K	0
28 WYOMING	07/07/1965	F1	0	0	25K	0
29 ONEIDA	08/02/1965	F0	0	0	3K	0
30 CATTARAUGUS	08/17/1965	F0	0	0	3K	0
31 CHAUTAUQUA	09/09/1965	F	0	0	25K	0
32 ERIE	06/09/1966	F0	0	0	3K	0
33 ONEIDA	07/01/1967	F	0	0	0K	0
34 CATTARAUGUS	07/24/1967	F3	0	0	25K	0
35 CHAUTAUQUA	08/06/1968	F2	0	4	250K	0
36 PUTNAM	08/09/1968	F1	0	0	25K	0
37 CHAUTAUQUA	05/17/1969	F2	0	1	250K	0
38 CHAUTAUQUA	06/02/1969	F	0	0	0K	0
39 CAYUGA	06/02/1969	F	0	0	250K	0
40 CHAUTAUQUA	06/20/1969	F3	0	0	2.5M	0
41 CHAUTAUQUA	06/20/1969	F3	0	0	0K	0
42 TOMPKINS	06/20/1969	F1	0	0	25K	0
43 LEWIS	07/12/1969	F1	0	0	25K	0
44 ORANGE	07/25/1969	F	0	0	3K	0
45 NIAGARA	07/26/1969	F1	0	0	25K	0
46 HERKIMER	06/18/1970	F	1	1	250K	0
47 CHAUTAUQUA	07/15/1970	F	0	0	25K	0
48 ERIE	08/19/1970	F3	0	3	250K	0
49 NASSAU	09/27/1970	F2	0	0	250K	0
50 ORANGE	07/29/1971	F2	0	0	250K	0
51 PUTNAM	07/29/1971	F2	0	0	250K	0
52 WESTCHESTER	08/11/1971	F1	0	0	25K	0
53 SCHENECTADY	08/21/1971	F0	0	0	0K	0
54 ERIE	08/23/1971	F2	0	0	25K	0
55 ERIE	05/02/1972	F2	0	0	250K	0
56 OSWEGO	05/30/1972	F0	0	0	25K	0
57 SULLIVAN	06/09/1972	F2	0	2	250K	0
58 WASHINGTON	07/25/1972	F0	0	0	3K	0

59 STEUBEN	08/07/1972	F1	1	2	25K	0
60 ST. LAWRENCE	08/07/1972	F1	0	0	25K	0
61 ALBANY	06/30/1973	F1	0	2	25K	0
62 HAMILTON	08/28/1973	F2	0	0	0K	0
63 RENSSELAER	08/28/1973	F2	0	1	25K	0
64 COLUMBIA	08/28/1973	F4	0	0	25K	0
65 SUFFOLK	09/18/1973	F1	0	0	0K	0
66 NASSAU	09/18/1973	F2	0	0	0K	0
67 CHAUTAUQUA	04/03/1974	F1	0	0	0K	0
68 GREENE	06/16/1974	F3	0	0	2.5M	0
69 ALBANY	06/16/1974	F3	0	0	0K	0
70 SARATOGA	06/16/1974	F3	0	0	0K	0
71 ORANGE	06/16/1974	F2	0	0	0K	0
72 SARATOGA	07/29/1974	F1	0	0	0K	0
73 RENSSELAER	08/27/1974	F1	0	0	25K	0
74 WESTCHESTER	09/01/1974	F1	0	0	250K	0
75 CATTARAUGUS	02/24/1975	F1	0	2	250K	0
76 CATTARAUGUS	06/05/1975	F0	0	0	0K	0
77 ULSTER	09/20/1975	F1	0	1	25K	0
78 COLUMBIA	09/20/1975	F1	0	2	25K	0
79 ULSTER	03/21/1976	F2	0	0	0K	0
80 ULSTER	03/21/1976	F1	0	0	25K	0
81 NASSAU	06/01/1976	F0	0	0	3K	0
82 WASHINGTON	06/11/1976	F2	0	0	250K	0
83 OTSEGO	06/16/1976	F2	0	0	250K	0
84 CHAUTAUQUA	06/30/1976	F1	0	0	0K	0
85 ERIE	06/30/1976	F1	0	0	0K	0
86 ULSTER	06/30/1976	F1	0	0	25K	0
87 GREENE	04/02/1977	F1	0	0	25K	0
88 TOMPKINS	06/18/1977	F	0	0	3K	0
89 MADISON	09/18/1977	F2	0	1	250K	0
90 CATTARAUGUS	09/18/1977	F1	0	0	2.5M	0
91 WESTCHESTER	09/26/1977	F	0	0	25K	0

92 WARREN	05/09/1978	F1	0	0	250K	0
93 SARATOGA	05/09/1978	F	0	0	0K	0
94 ESSEX	05/09/1978	F	0	0	0K	0
95 YATES	06/27/1978	F1	0	0	2.5M	0
96 FULTON	06/27/1978	F1	0	0	250K	0
97 COLUMBIA	07/10/1978	F1	0	0	25K	0
98 DUTCHESS	08/07/1978	F	0	0	25K	0
99 NASSAU	08/12/1978	F	0	0	3K	0
100 MONROE	04/06/1979	F0	0	0	25K	0
101 HAMILTON	07/21/1979	F0	0	1	250K	0
102 SUFFOLK	08/10/1979	F1	0	0	0K	0
103 WAYNE	06/09/1980	F1	0	0	2.5M	0
104 CATTARAUGUS	06/29/1980	F1	0	0	25K	0
105 ALBANY	07/11/1980	F0	0	0	3K	0
106 ONEIDA	07/21/1980	F1	0	0	250K	0
107 SUFFOLK	08/05/1981	F1	0	0	250K	0
108 MONROE	09/08/1981	F1	0	0	3K	0
109 OSWEGO	09/08/1981	F1	0	0	3K	0
110 CHAUTAUQUA	07/28/1982	F1	0	0	250K	0
111 CHAUTAUQUA	07/28/1982	F0	0	1	0K	0
112 SUFFOLK	08/25/1982	F0	0	0	0K	0
113 CHAUTAUQUA	05/02/1983	F3	2	0	2.5M	0
114 CHEMUNG	05/02/1983	F3	0	6	2.5M	0
115 TIOGA	05/02/1983	F3	0	1	2.5M	0
116 TIOGA	05/02/1983	F3	0	0	2.5M	0
117 CAYUGA	05/02/1983	F3	1	0	2.5M	0
118 OSWEGO	05/02/1983	F3	0	0	250K	0
119 ONONDAGA	05/02/1983	F3	0	0	2.5M	0
120 ONEIDA	05/02/1983	F3	0	0	25.0M	0
121 ULSTER	07/21/1983	F0	0	0	25K	0
122 JEFFERSON	08/28/1983	F1	0	1	2.5M	0
123 ALBANY	05/12/1984	F0	0	13	25K	0
124 DUTCHESS	05/12/1984	F0	0	0	25K	0

125 ULSTER	05/12/1984	F0	0	0	25K	0
126 ONEIDA	07/11/1984	F0	0	0	250K	0
127 ONEIDA	07/11/1984	F0	0	0	250K	0
128 HERKIMER	07/11/1984	F0	0	0	3K	0
129 WARREN	04/18/1985	F0	0	0	3K	0
130 CHAUTAUQUA	05/31/1985	F4	0	0	2.5M	0
131 CHAUTAUQUA	05/31/1985	F3	0	10	2.5M	0
132 ST. LAWRENCE	05/31/1985	F1	0	0	250K	0
133 OTSEGO	07/26/1985	F1	0	0	3K	0
134 SUFFOLK	08/30/1985	F1	0	0	0K	0
135 ULSTER	10/05/1985	F1	0	0	250K	0
136 QUEENS	10/05/1985	F1	0	6	0K	0
137 SULLIVAN	06/16/1986	F1	0	2	250K	0
138 OTSEGO	06/16/1986	F0	0	0	250K	0
139 OSWEGO	07/13/1986	F1	0	0	250K	0
140 ONONDAGA	07/13/1986	F1	0	5	250K	0
141 FRANKLIN	07/26/1986	F1	0	0	250K	0
142 ULSTER	07/26/1986	F2	0	2	2.5M	0
143 ST. LAWRENCE	08/15/1986	F2	1	3	250K	0
144 FULTON	08/23/1986	F1	0	1	25K	0
145 ORLEANS	09/29/1986	F1	0	0	25K	0
146 DELAWARE	10/01/1986	F2	0	0	250K	0
147 LEWIS	06/04/1987	F0	0	0	25K	0
148 OTSEGO	06/22/1987	F0	0	0	25K	0
149 ST. LAWRENCE	07/24/1987	F0	0	0	250K	0
150 OTSEGO	07/25/1987	F0	0	0	25K	0
151 DUTCHESS	07/25/1987	F0	0	0	250K	0
152 ERIE	07/30/1987	F2	0	1	2.5M	0
153 ORANGE	07/14/1988	F3	0	1	2.5M	0
154 DUTCHESS	07/21/1988	F1	0	0	25K	0
155 ST. LAWRENCE	08/09/1988	F0	0	0	3K	0
156 TIOGA	08/27/1988	F1	0	0	2.5M	0
157 SCHUYLER	08/28/1988	F1	1	1	250K	0

158 TOMPKINS	08/28/1988	F1	0	0	250K	0
159 ONEIDA	06/24/1989	F1	0	0	3K	0
160 ST. LAWRENCE	07/10/1989	F1	0	1	25K	0
161 MONTGOMERY	07/10/1989	F4	0	0	25.0M	0
162 SCHOHARIE	07/10/1989	F4	0	20	25.0M	0
163 ALBANY	07/10/1989	F4	0	0	25.0M	0
164 GREENE	07/10/1989	F4	0	0	25.0M	0
165 PUTNAM	07/10/1989	F2	0	5	25.0M	0
166 SUFFOLK	07/10/1989	F2	0	1	0K	0
167 CHAUTAUQUA	07/19/1989	F0	0	0	3K	0
168 CHENANGO	10/14/1989	F2	2	3	25K	0
169 MADISON	11/16/1989	F0	0	0	250K	0
170 WESTCHESTER	11/16/1989	F0	0	0	0K	0
171 SULLIVAN	11/16/1989	F1	0	0	25.0M	0
172 ORANGE	11/16/1989	F1	9	18	25.0M	0
173 HAMILTON	11/16/1989	F0	0	0	0K	0
174 SARATOGA	11/16/1989	F1	0	1	250K	0
175 SARATOGA	11/16/1989	F0	0	0	25K	0
176 RENSSELAER	11/16/1989	F0	0	0	25K	0
177 GREENE	04/28/1990	F0	0	1	25K	0
178 HERKIMER	05/17/1990	F0	0	1	250K	0
179 DELAWARE	06/09/1990	F0	0	0	250K	0
180 DELAWARE	06/21/1990	F1	0	0	250K	0
181 ORANGE	06/29/1990	F0	0	0	250K	0
182 PUTNAM	06/29/1990	F0	0	0	25K	0
183 ONEIDA	07/23/1990	F2	0	0	25K	0
184 RICHMOND	08/10/1990	F0	0	3	0K	0
185 CHAUTAUQUA	08/28/1990	F0	0	0	250K	0
186 CATTARAUGUS	08/28/1990	F0	0	2	25K	0
187 SCHUYLER	08/28/1990	F2	0	0	250K	0
188 ONONDAGA	08/28/1990	F0	0	0	25K	0
189 HERKIMER	08/28/1990	F1	0	3	2.5M	0
190 ALBANY	08/28/1990	F0	0	0	250K	0

191 SULLIVAN	10/13/1990	F1	0	0	250K	0
192 ROCKLAND	10/18/1990	F0	0	1	0K	0
193 CHAUTAUQUA	04/09/1991	F0	0	0	25K	0
194 ERIE	04/09/1991	F1	0	0	25K	0
195 LIVINGSTON	04/09/1991	F1	0	0	250K	0
196 CAYUGA	04/30/1991	F1	0	0	250K	0
197 ERIE	05/01/1991	F0	0	0	250K	0
198 WYOMING	05/01/1991	F1	0	0	25K	0
199 FULTON	05/01/1991	F1	0	0	3K	0
200 WESTCHESTER	06/12/1991	F0	1	0	25K	0
201 SUFFOLK	08/19/1991	F1	0	0	0K	0
202 SUFFOLK	08/19/1991	F1	0	0	0K	0
203 CHENANGO	05/02/1992	F0	0	0	25K	0
204 CHENANGO	05/02/1992	F1	0	0	250K	0
205 SCHOHARIE	05/02/1992	F1	0	0	250K	0
206 RENSSELAER	05/02/1992	F1	0	0	25K	0
207 RENSSELAER	05/02/1992	F1	0	0	250K	0
208 MONTGOMERY	06/24/1992	F1	0	0	250K	0
209 FULTON	07/05/1992	F0	0	0	25K	0
210 FULTON	07/05/1992	F0	0	0	25K	0
211 SARATOGA	07/05/1992	F0	0	0	25K	0
212 SARATOGA	07/05/1992	F0	0	0	25K	0
213 DUTCHESS	07/05/1992	F0	0	0	250K	0
214 OTSEGO	07/05/1992	F1	0	0	2.5M	0
215 CORTLAND	07/05/1992	F0	0	0	25K	0
216 CHAUTAUQUA	07/12/1992	F2	0	0	2.5M	0
217 ERIE	07/12/1992	F1	0	0	0K	0
218 BROOME	07/14/1992	F1	0	0	25K	0
219 CATTARAUGUS	07/17/1992	F1	0	0	25K	0
220 CORTLAND	07/31/1992	F1	0	0	25K	0
221 DUTCHESS	07/31/1992	F1	0	0	2.5M	0
222 WASHINGTON	08/04/1992	F1	0	0	25K	0
223 HERKIMER	08/04/1992	F0	0	0	25K	0

224 ONEIDA	09/03/1992	F0	0	0	25K	0
225 BROOME	09/03/1992	F1	0	6	2.5M	0
226 WESTCHESTER	09/03/1992	F0	0	0	0K	0
227 TIOGA	09/03/1992	F0	0	0	250K	0
228 Holland Patent	05/15/1993	F0	0	0	50K	0
229 Otselic	05/15/1993	F1	0	2	500K	0
230 Mexico	08/02/1993	F0	0	0	50K	0
231 Syracuse	08/24/1993	F1	0	0	500K	0
232 Clarence	08/31/1993	F1	0	0	500K	0
233 Batavia	09/03/1993	F1	2	0	500K	0
234 Angelica	09/03/1993	F2	0	0	500K	0
235 Prattsburg	09/03/1993	F0	0	0	500K	0
236 To 10 Ne	09/03/1993	F1	0	0	0	500K
237 Saugerties	09/10/1993	F1	0	0	50K	0
238 Grand Island	09/23/1993	F0	0	0	50K	0
239 Eagle Bridge	04/27/1994	F1	0	0	50K	0
240 Central Square	05/26/1994	F0	0	0	50K	0
241 Freedom	06/13/1994	F1	0	0	500K	0
242 Ellington To	06/13/1994	F2	0	1	500K	0
243 Angola	06/24/1994	F0	0	0	50K	0
244 Geneva	08/21/1994	F1	0	0	500K	0
245 Dryden	08/21/1994	F0	0	0	500K	0
246 Fort Miller	08/21/1994	F1	0	1	500K	0
247 Lockport	08/25/1994	F0	0	0	50K	0
248 Lockport	08/28/1994	F0	0	0	50K	0
249 Amherst	08/28/1994	F0	0	0	50K	0
250 Fredonia	08/28/1994	F1	0	2	500K	0
251 Stewart Ap	05/29/1995	F0	0	0	5K	0
252 Hudson To	05/29/1995	F2	0	5	10.0M	0
253 NASSAU	07/23/1995	F1	0	0	0	0
254 N. Babylon	07/23/1995	F0	0	0	500K	0
255 NEW YORK	08/31/1995	F0	0	1	30K	0
256 New Dorp Beach	10/28/1995	F1	0	0	0.5M	0

257 Middletown	04/30/1996	F0	0	0	0	0
258 South Bristol	06/22/1996	F1	0	0	50K	15K
259 Middlesex	06/22/1996	F1	0	0	75K	0K
260 Granby	07/15/1996	F0	0	3	35K	0
261 Victor	07/15/1996	F1	0	0	30K	0
262 Canaseraga	07/30/1996	F0	0	0	22K	0
263 Verona	08/26/1996	F0	0	0	0	0
264 Monticello	09/28/1996	F1	0	1	500K	0
265 Monticello	09/28/1996	F1	0	1	500K	0
266 Oxford	11/08/1996	F0	0	0	75K	0
267 Oxford	11/08/1996	F0	0	0	75K	0
268 Fire Island	06/26/1997	F0	0	0	0	0
269 Copake Falls	07/03/1997	F1	0	0	60K	0
270 Canaan	07/03/1997	F1	0	0	150K	0
271 Canaan	07/03/1997	F2	0	0	550K	20K
272 Stannards	07/08/1997	F0	0	0	35K	15K
273 Evans Center	09/25/1997	F0	0	0	15K	0
274 Ushers	05/31/1998	F3	0	68	60.0M	0
275 Reynolds	05/31/1998	F2	0	0	10.0M	200K
276 Colonie	05/31/1998	F1	0	0	25K	0
277 Davenport	05/31/1998	F0	0	0	150K	0
278 Brocton	05/31/1998	F1	0	2	75K	15K
279 Apalachin	05/31/1998	F0	0	0	50K	0
280 Vestal	05/31/1998	F3	0	12	1.5M	0
281 Plymouth	05/31/1998	F2	0	0	500K	0
282 North Norwich	05/31/1998	F0	0	0	135K	0
283 Portlandville	05/31/1998	F0	0	0	75K	0
284 Laurens	05/31/1998	F3	0	3	800K	0
285 Deposit	05/31/1998	F3	0	0	1.0M	0
286 East Schodack	05/31/1998	F2	0	0	175K	0
287 Orangeville Center	06/02/1998	F2	0	0	1.0M	0
288 Cincinnatus	06/02/1998	F1	0	0	150K	0
289 Pitcher	06/02/1998	F1	0	0	250K	0

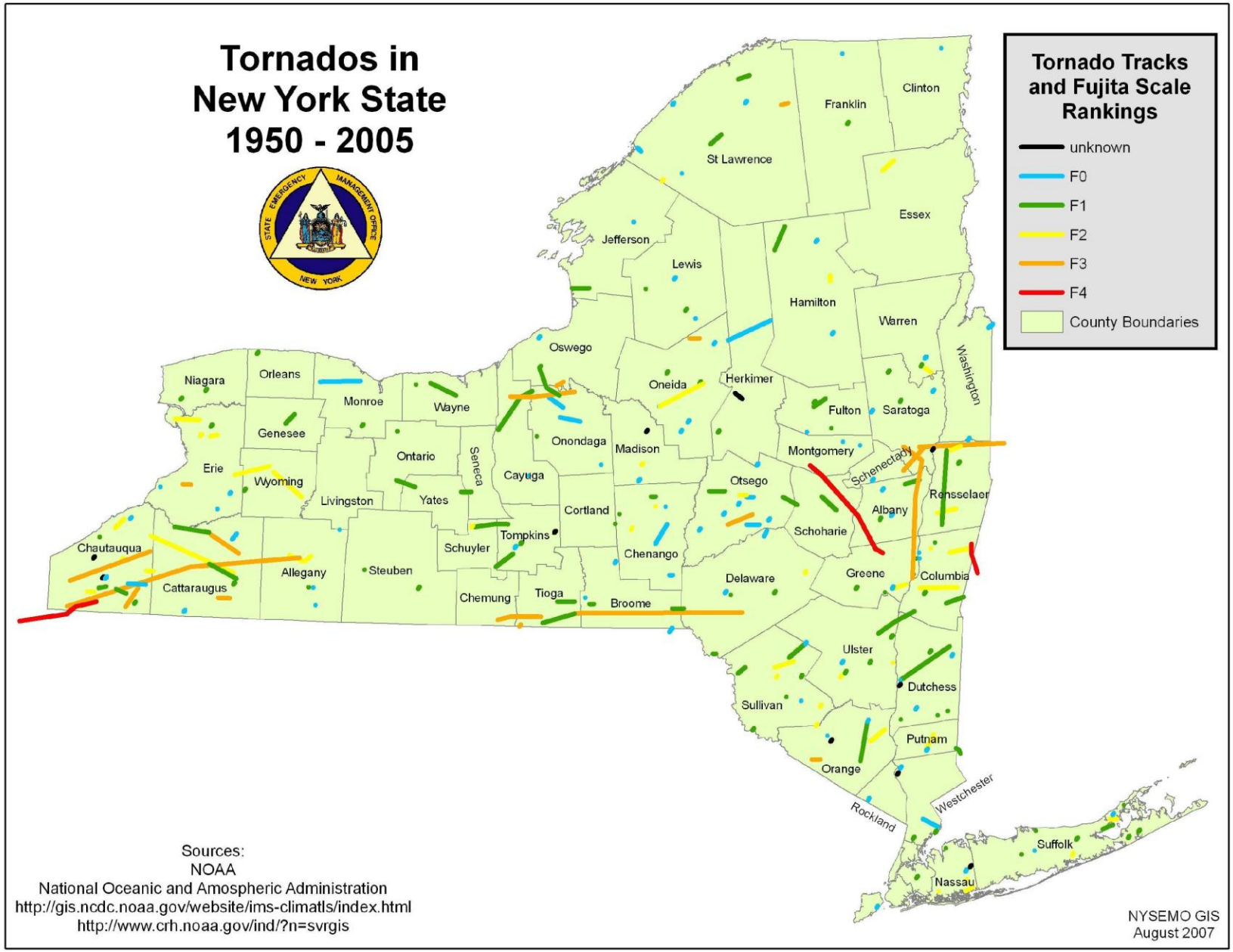
290 New Berlin	06/26/1998	F0	0	0	1K	0
291 Colchester	06/26/1998	F1	0	0	250K	0
292 Turnwood	06/26/1998	F1	0	0	150K	0
293 Lake Ronkonkoma	06/30/1998	F1	0	0	0	0
294 Selden	06/30/1998	F0	0	0	0	0
295 Mt Sinai	06/30/1998	F1	0	0	0	0
296 Lynbrook	09/07/1998	F2	0	6	1.0M	0
297 Mattituck	08/08/1999	F2	0	1	1.0M	0
298 Esopus	05/18/2000	F2	0	0	50K	0
299 Poughkeepsie	05/18/2000	F0	0	0	70K	0
300 Rock Hill	06/02/2000	F0	0	0	250K	0
301 Peekskill	06/02/2000	F1	0	2	0	0
302 Southold	09/15/2000	F1	0	0	0	0
303 Hampton Bays	07/01/2001	F0	0	0	0	0
304 Shinnecock Hills	07/01/2001	F0	0	0	0	0
305 Fabius	09/24/2001	F0	0	0	1K	0
306 East Concord	04/28/2002	F0	0	0	35K	0
307 Belfast	04/28/2002	F2	0	0	500K	0
308 Owego	05/31/2002	F1	0	7	600K	0
309 Endicott	05/31/2002	F0	0	0	5K	0
310 Deposit	05/31/2002	F0	0	0	10K	0
311 Cooperstown	05/31/2002	F0	0	0	10K	0
312 Lordville	05/31/2002	F1	0	1	10K	0
313 Whaley Lake	05/31/2002	F1	0	0	35K	0
314 Johnstown	05/31/2002	F1	0	0	200K	0
315 Bainbridge	06/05/2002	F0	0	0	50K	0
316 Pawling	06/16/2002	F1	0	0	20K	0
317 Amsterdam	06/16/2002	F0	0	0	75K	0
318 Mottville	07/28/2002	F1	0	0	2.0M	0
319 Scio	08/22/2002	F1	0	0	35K	0
320 Tribes Hill	05/01/2003	F0	0	0	25K	0
321 Ontario	05/11/2003	F1	0	0	150K	0
322 Aden	07/21/2003	F1	0	0	100K	0

323 Palenville	07/21/2003	F1	0	0	25K	0
324 Kiskatom	07/21/2003	F2	0	7	1.0M	0
325 Athens	07/21/2003	F1	0	0	10K	0
326 Coxsackie	07/21/2003	F1	0	0	100K	0
327 Niverville	07/21/2003	F1	0	0	150K	0
328 Newton Hook	07/21/2003	F0	0	0	5K	0
329 Stuyvesant	07/21/2003	F0	0	0	10K	0
330 Kinderhook	07/21/2003	F0	0	0	20K	0
331 Stuyvesant	07/21/2003	F0	0	0	5K	0
332 Kinderhook	07/21/2003	F2	0	1	200K	0
333 Nassau	07/21/2003	F1	0	0	50K	0
334 Le Raysville	08/05/2003	F0	0	0	4K	0
335 Beaver Meadow	08/29/2003	F1	0	0	100K	0
336 Fishkill	09/28/2003	F1	0	0	10K	0
337 Willowbrook	10/27/2003	F0	0	0	0	0
338 Edgewater	04/18/2004	F0	0	0	100K	0
339 Sanford	05/24/2004	F1	0	0	50K	0
340 Deposit	05/24/2004	F1	0	0	50K	0
341 Constable	06/01/2004	F0	0	0	10K	0
342 Chippewa Bay	06/09/2004	F0	0	0	25K	0
343 Gouverneur	06/09/2004	F0	0	0	25K	0
344 Mooers	07/08/2004	F0	0	0	30K	0
345 Ephratah	08/03/2004	F0	0	0	25K	0
346 Port Leyden	10/02/2004	F0	0	0	15K	0
347 Barnes Corners	08/01/2005	F1	0	0	30K	0
348 Wellsville	08/12/2005	F0	0	0	15K	0
349 Canisteo	08/12/2005	F1	0	0	50K	5K
350 Glen Cove	08/12/2005	F1	0	0	135K	0
351 La Grange	06/25/2006	F1	0	0	0	0
352 Cheektowaga	06/30/2006	F1	0	2	250K	0
353 Grand View On Hudson	07/12/2006	F1	0	0	0	0
354 Tarrytown	07/12/2006	F2	0	6	10.1M	0

355 Utica	07/29/2006	F0	0	0	2K	0
356 Marcellus	07/29/2006	F0	0	0	10K	0
357 Massapequa Park	08/25/2006	F0	0	0	0	0
358 Amityville	08/25/2006	F0	0	0	0	0
359 Erin	11/16/2006	F1	0	0	10K	0K
360 Sheldrake	06/21/2007	F1	0	0	10K	0K
361 Islip Terrace	07/18/2007	F1	0	0	0K	0K
362 Castleton Corners	08/08/2007	F1	0	0	0K	0K
363 Coney Is	08/08/2007	F2	0	9	0K	0K
364 Camden	05/17/2008	F0	0	0	5K	0K
365 Orange Lake	06/16/2008	F0	0	0	40K	0K
366 Cuyler	05/16/2009	F0	0	0	5K	0K
367 Quaker Settlement	05/16/2009	F2	0	1	50K	0K
368 Owego Tioga Fld Arpt	05/16/2009	F0	0	0	10K	0K
369 Fargo	07/25/2009	F1	0	0	2.0M	0K
370 Parma Center	07/25/2009	F0	0	0	75K	0K
371 Onoville	07/26/2009	F1	0	0	300K	0K
372 Irvine Mills	07/26/2009	F0	0	0	20K	0K
373 Unionville	07/29/2009	F0	0	0	75K	0K
374 Kirkwood	08/02/2009	F0	0	0	1K	0K
375 Rawson	08/09/2009	F1	0	0	200K	50K
376 Vincent	08/29/2009	F0	0	0	500K	0K
Total			**21**	**307**	**422.815M**	**820K**

Source: National Climate Data Center

Figure 3-104


Tornados in
New York State
1950 - 2005
Tornado Tracks and Fujita Scale Rankings
unknown
F0
F1
F2
F3
F4
County Boundaries
Clinton
Franklin
St Lawrence
Essex
Jefferson
Lewis
Hamilton
Warren
Washington
Oswego
Herkimer
Oneida
Fulton
Saratoga
Niagara
Orleans
Monroe
Wayne
Genesee
Onondaga
Madison
Montgomery
Schenectady
Erie
Wyoming
Ontario
Seneca
Cayuga
Otsego
Rensselaer
Albany
Livingston
Yates
Cortland
Schoharie
Chautauqua
Tompkins
Schuyler
Chenango
Allegany
Steuben
Greene
Columbia
Cattaraugus
Delaware
Chemung
Tioga
Broome
Ulster
Dutchess
Sullivan
Putnam
Orange
Rockland
Westchester
Suffolk
Nassau
Sources:
NOAA
National Oceanic and Amospheric Administration
http://gis.ncdc.noaa.gov/website/ims-climatls/index.html
http://www.crh.noaa.gov/ind/?n=svrgis
NYSEMO GIS
August 2007

According to statistics, nearly 3 in 4 tornadoes occurring in New York State are classified as magnitude F0 or F1 on the Fujita-Pearson Scale. A significant number, approximately 1 in 3, are classified as F0. Magnitude F0 indicates a tornado wind speed range of 40-72 mph. F0 wind velocity typically produces only minor damage to property. A slim majority of tornados occurring in NYS produce winds ranging from 73-112 mph (F1 on Fujita scale), strong enough to move mobile homes from foundations. **Table 3-33** provides a summary of the number of tornadoes in New York for each Fujita scale classification. **Table 3-34** lists those tornadoes on record resulting in loss of life to 2 or more people.

Table 3-33
Frequency and Magnitude of Past Tornado Events in New York State

Fujita Scale	Number of Events
F0 (40-72 mph)	125
F1 (73-112 mph)	145
F2 (113-157 mph)	46
F3 (158-206 mph)	24
F4 (207-260 mph)	6
Magnitude not determined	29

NOAA/NCDC

Table 3-34
Tornadoes in New York State Causing Two or More Deaths

DATE/TIME	RESULTS
JUN 13, 1857 4:00 pm	2 dead; 1 injured What was called a "funnel-shaped black moving body of nebulous character" hit the edge of Utica.
SEP 28, 1884 5:20 pm	3 dead; 31 injured A balloon-shaped tornado ripped apart the east half of Shongo, Allegany County.
SEP 15, 1912 5:25 pm	3 dead; 40 injured This tornado moved from the outlet of Onondaga Lake, and passed just north of the Syracuse City limits.
JULY 19, 1935 3:30 pm	2 dead; 2 injured A mother and daughter were killed as their farmhouse was destroyed near Philadelphia, Jefferson County.
MAY 2, 1983 4:05 pm	2 dead; 2 injured A tornado destroyed 100 buildings after moving over Chautauqua Lake.
NOV 16, 1989 12:05 pm	9 dead; 18 injured 9 children were killed at the Coldenham School in Orange County when a cafeteria wall was blown over.
SEP 03, 1993 1:15pm	2 dead, 0 injured Near Batavia, a delivery van was dropped onto an oncoming tractor trailer. Both drivers were killed. The following event was called a tornado by the NWS. However, experts in severe storm analysis later concluded that it was a microburst, not a tornado. The event continues to be erroneously listed as a tornado by the NWS.

Source: NOAA NCDC

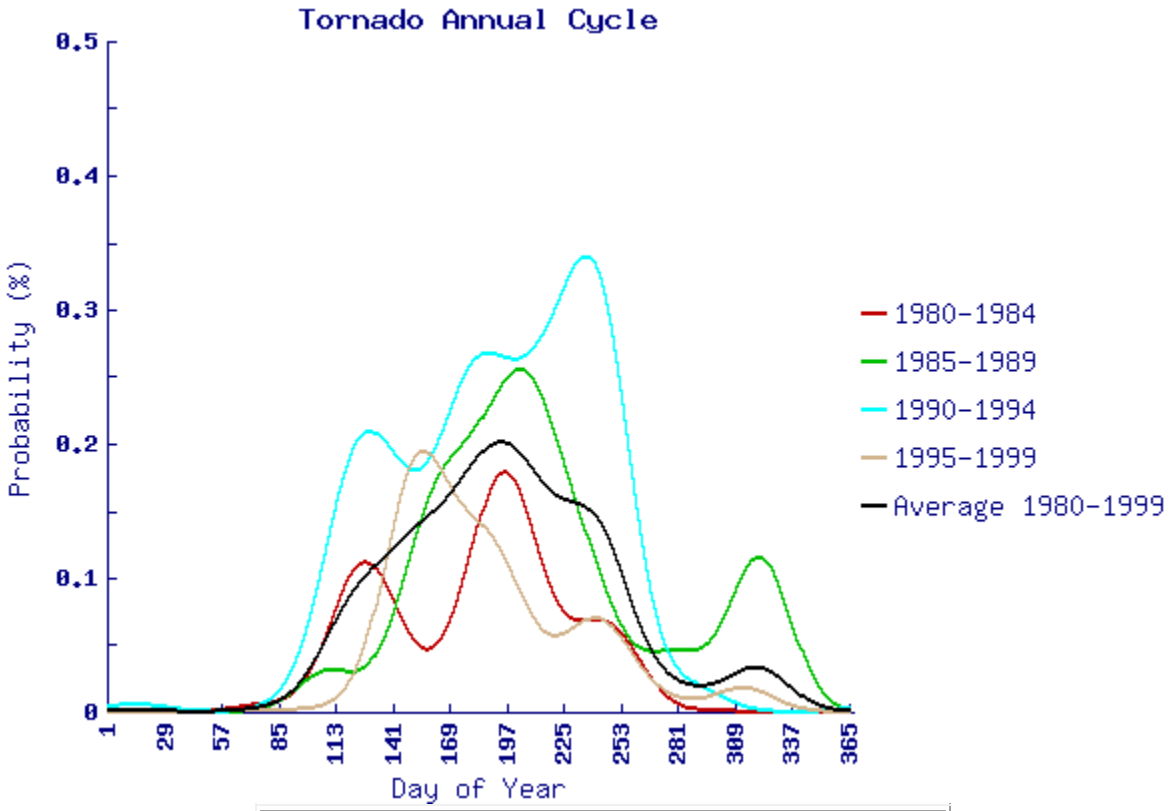
Probability of Future Events:

Time Series of Tornado Annual Cycle Probability

The graph below shows the probability of a tornado event occurring on any given day for New York State. For example, a y value of 2 would indicate a two percent chance of a tornado event on the date indicated by the x-axis value.

Figure 3-104.1

Probability of a Tornado Event in NYS



Weather Type and Max Scale Values		
Tornado	Significant Tornado	Violent Tornado
0.5% or 2.5%	0.6%	0.1%

Source: http://www.nssl.noaa.gov/cgi-bin/hazgraph3.pl

Jurisdictions Most Threatened by and Vulnerable to Tornado Hazard and Estimating Potential Losses

At the local level, Jurisdictions have recognized their susceptibility to the occurrence of a Tornado event. Although some Counties seem to have higher occurrences than others, the mitigating trend appears to be strictly enforcing building codes and instituting new measures that would call for the use of high wind-resistant materials, hurricane clips, and wind shutters. For Instance Nassau County has assessed their risk and exposure and although the likelihood of a Tornado hitting Nassau is low, their exposure is very high. They plan to limit their exposure to wind damage by strictly enforcing their building codes. Another step they are considering is requiring safe rooms in mobile home parks.

The tornado hazard was included in the severe wind hazard vulnerability assessment. See the associated Hurricane section narrative for jurisdiction and state facility vulnerability assessment and loss estimation results.

Location, Magnitude and Probability

A recent study from NOAA's National Severe Storms Laboratory provided highly accurate and accessible estimates of the long-term threat from tornadoes. Using historical data, the NSSL estimated the daily probability of a tornado occurring near any location in the U.S for any tornado no matter how strong or weak (i.e., no matter what its magnitude). The NSSL map below (**Figure 3-104.2**) can be used to obtain these estimates. For example, the NSSL estimates a probability for any tornado of about 1.3 days per year in south-central Oklahoma, and 0.4 to 0.6 days per year in southern New York.

Figure 3-104.2