Table 3.4-12: ADCIRC Simulated Storm Surge Stillwater Elevations

Rank	Storm ID (*Vmax, Vf, Rmax, CPD, θ*), Tide at IPEC	Peak Surge			
		The Battery	IPEC	The Battery	IPEC
		(feet, NAVD88)		(feet, NGVD29)	
1	14460 - (131kts Vmax, 20kts Vf, 20nm Rmax, 90mb, -20°), HT at IPEC	17.49	**18.08**	18.59	19.08
2	13915 - (134kts Vmax, 25kts Vf, 20nm Rmax, 90mb, -40°), HT at IPEC	23.26	**17.22**	24.36	18.22
3	11661 - (132kts Vmax, 35kts Vf, 28nm Rmax, 80mb, -30°), HT at IPEC	24.47	**17.20**	25.57	18.20
4	15385 - (134kts Vmax, 25kts Vf, 20nm Rmax, 90mb, 10°), HT at IPEC	15.32	**17.16**	16.42	18.16
5	14251 -(137kts Vmax, 30kts Vf, 20nm Rmax, 90mb, -30°), HT at IPEC	23.97	**17.11**	25.07	18.11
6	11367 - (124kts Vmax, 35kts Vf, 28nm Rmax, 80mb, -40°), HT at IPEC	24.46	**16.84**	25.56	17.84
7	11324 - (121kts Vmax, 30kts Vf, 28nm Rmax, 80mb, -40°), HT at IPEC	22.41	**16.50**	23.51	17.50
8	11611 - (125kts Vmax, 30kts Vf, 24nm Rmax, 80mb, -30°), HT at IPEC	21.39	**16.44**	22.49	17.44
9	11703 - (127kts Vmax, 40kts Vf, 28nm Rmax, 80mb, -30°), HT at IPEC	23.65	**16.37**	24.75	17.37
10	14790 - (138kts Vmax, 25kts Vf, 16nm Rmax, 90mb, -10°), HT at IPEC	17.91	**16.28**	19.01	17.28
11	11409 - (126kts Vmax, 40kts Vf, 28nm Rmax, 80mb, -40°), HT at IPEC	24.58	**16.24**	25.68	17.24
12	14881 - (140kts Vmax, 35kts Vf, 20nm Rmax, 90mb, -10°), HT at IPEC	20.96	**16.11**	22.06	17.11
13	11696 - (131kts Vmax, 40kts Vf, 24nm Rmax, 80mb, -30°), HT at IPEC	23.95	**15.99**	25.05	16.99
14	11996 - (126kts Vmax, 40kts Vf, 28nm Rmax, 80mb, -20°), HT at IPEC	22.47	**15.88**	23.57	16.88
15	14538 - (141kts Vmax, 30kts Vf, 16nm Rmax, 90mb, -20°), HT at IPEC	21.10	**15.88**	22.20	16.88
16	11451 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -40°), HT at IPEC	24.61	**15.85**	25.71	16.85
17	14292 - (140kts Vmax, 35kts Vf, 20nm Rmax, 90mb, -30°), HT at IPEC	24.84	**15.80**	25.94	16.80
18	11745 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -30°), HT at IPEC	23.62	**15.78**	24.72	16.78
19	14335 - (142kts Vmax, 40kts Vf, 20nm Rmax, 90mb, -30°), HT at IPEC	25.33	**15.77**	26.43	16.77
20	14586 - (140kts Vmax, 35kts Vf, 20nm Rmax, 90mb, -20°), HT at IPEC	23.56	**15.74**	24.66	16.74
21	11990 - (131kts Vmax, 40kts Vf, 24nm Rmax, 80mb, -20°), HT at IPEC	22.20	**15.58**	23.30	16.58
22	14832 - (141kts Vmax, 30kts Vf, 16nm Rmax, 90mb, -10°), HT at IPEC	19.68	**15.52**	20.78	16.52
23	11157 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -50°), HT at IPEC	25.23	**15.52**	26.33	16.52
24	14041 - (143kts Vmax, 40kts Vf, 20nm Rmax, 90mb, -40°), HT at IPEC	25.76	**15.52**	26.86	16.52
25	14377 - (145kts Vmax, 45kts Vf, 20nm Rmax, 90mb, -30°), HT at IPEC	25.49	**15.45**	26.59	16.45

Table 3.4-12: ADCIRC Simulated Storm Surge Stillwater Elevations (con't)

Rank	Storm ID (*Vmax, Vf, Rmax, CPD, θ*), Tide at IPEC	Peak Surge			
		The Battery	IPEC	The Battery	IPEC
		(feet, NAVD88)		(feet, NGVD29)	
26	14629 - (143kts Vmax, 40kts Vf, 20nm Rmax, 90mb, -20°), HT at IPEC	23.65	**15.34**	24.75	16.34
27	11408 - (126kts Vmax, 40kts Vf, 28nm Rmax, 80mb, -40°), HT at IPEC	23.85	**15.32**	24.95	16.32
28	12039 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -20°), HT at IPEC	21.64	**15.32**	22.74	16.32
29	10863 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -60°), HT at IPEC	25.10	**15.29**	26.20	16.29
30	14083 - (145kts Vmax, 45kts Vf, 20nm Rmax, 90mb, -40°), HT at IPEC	25.87	**15.29**	26.97	16.29
31	12032 - (134kts Vmax, 45kts Vf, 24nm Rmax, 80mb, -20°), HT at IPEC	22.69	**15.26**	23.79	16.26
32	11941 - (132kts Vmax, 35kts Vf, 20nm Rmax, 80mb, -20°), HT at IPEC	21.23	**15.22**	22.33	16.22
33	14923 - (143kts Vmax, 40kts Vf, 20nm Rmax, 90mb, -10°), HT at IPEC	21.65	**15.19**	22.75	16.19
34	14922 - (143kts Vmax, 40kts Vf, 20nm Rmax, 90mb, -10°), HT at IPEC	22.60	**15.18**	23.70	16.18
35	11744 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -30°), HT at IPEC	23.47	**15.12**	24.57	16.12
36	9057 - (119kts Vmax, 40kts Vf, 28nm Rmax, 70mb, -30°), HT at IPEC	20.93	**15.06**	22.03	16.06
37	14671 - (146kts Vmax, 45kts Vf, 20nm Rmax, 90mb, -20°), HT at IPEC	23.79	**15.02**	24.89	16.02
38	11450 - (129kts Vmax, 45kts Vf, 28nm Rmax, 80mb, -40°), HT at IPEC	23.90	**14.91**	25.00	15.91
39	11737 - (134kts Vmax, 45kts Vf, 24nm Rmax, 80mb, -30°), HT at IPEC	23.86	**14.72**	24.96	15.72
40	13789 - (145kts Vmax, 45kts Vf, 20nm Rmax, 90mb, -50°), HT at IPEC	26.03	**14.63**	27.13	15.63
41	8182 - (115kts Vmax, 40kts Vf, 32nm Rmax, 70mb, -60°), HT at IPEC	22.01	**14.47**	23.11	15.47
42	14040 - (143kts Vmax, 40kts Vf, 20nm Rmax, 90mb, -40°), HT at IPEC	25.00	**14.43**	26.10	15.43
43	9070 - (111kts Vmax, 40kts Vf, 36nm Rmax, 70mb, -30°), HT at IPEC	19.44	**14.41**	20.54	15.41
44	9358 - (115kts Vmax, 40kts Vf, 32nm Rmax, 70mb, -20°), HT at IPEC	17.89	**14.40**	18.99	15.40
45	14670 - (145kts Vmax, 45kts Vf, 20nm Rmax, 90mb, -20°), HT at IPEC	24.02	**14.38**	25.12	15.38
46	8217 - (122kts Vmax, 45kts Vf, 28nm Rmax, 70mb, -60°), HT at IPEC	22.60	**14.34**	23.70	15.34
47	8776 - (111kts Vmax, 40kts Vf, 36nm Rmax, 70mb, -40°), HT at IPEC	19.72	**14.21**	20.82	15.21
48	9393 - (122kts Vmax, 45kts Vf, 28nm Rmax, 70mb, -20°), HT at IPEC	19.46	**14.21**	20.56	15.21
49	14082 - (145kts Vmax, 45kts Vf, 20nm Rmax, 90mb, -40°), HT at IPEC	25.01	**14.14**	26.11	15.14
50	8517 - (118kts Vmax, 45kts Vf, 32nm Rmax, 70mb, -50°), HT at IPEC	21.13	**13.55**	22.23	14.55

Note: Rank shown in Table 3.4-12 based on the ADCIRC calculated maximum water levels at IPEC.

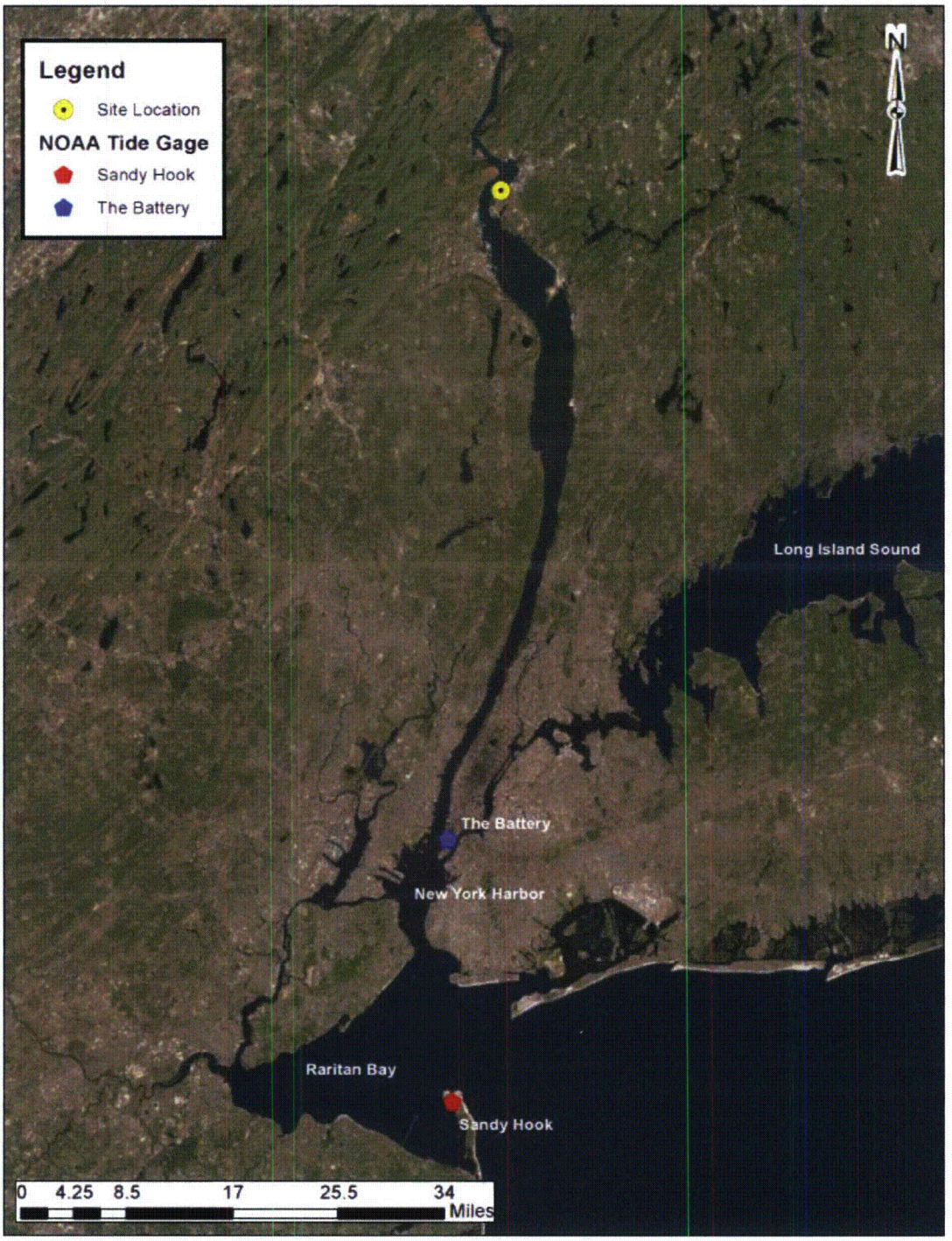


Figure 3.4-1: Location of NOAA Co-Op Stations in the Vicinity of IPEC

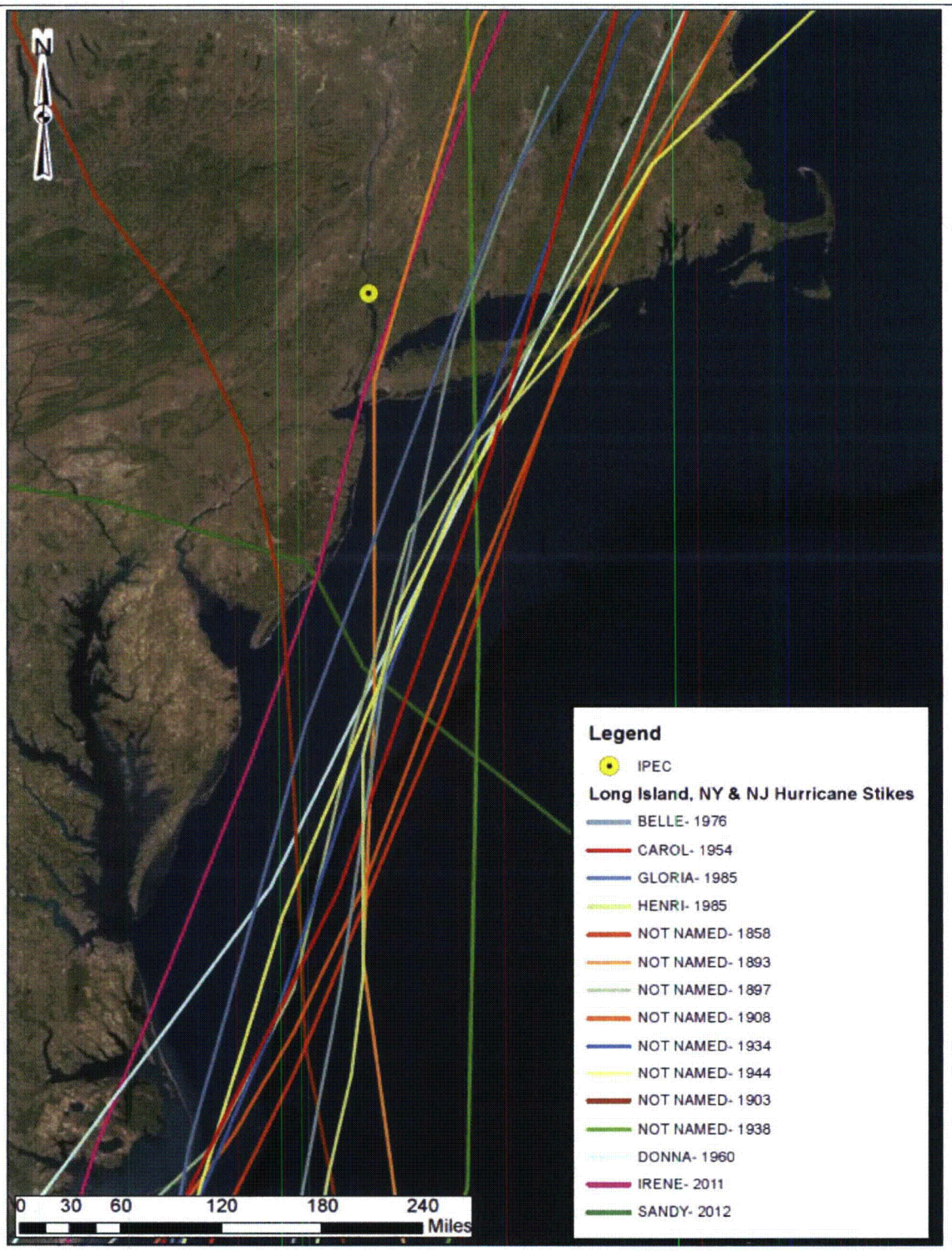


Figure 3.4-2: Hurricane Strikes to New York and New Jersey

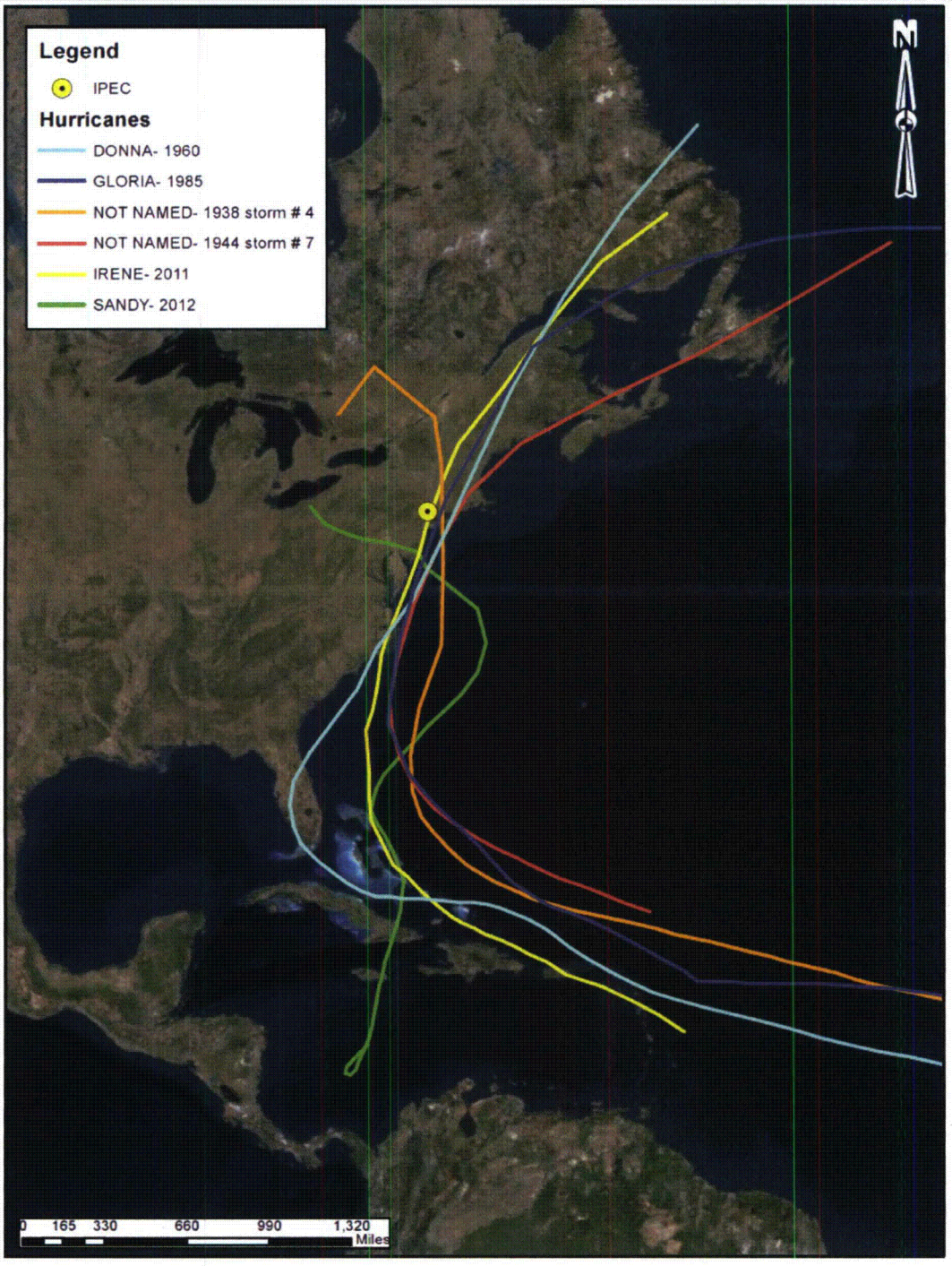


Figure 3.4-3: Hurricane Tracks of Recorded Extreme Water Levels at Sandy Hook, NJ and the Battery, NY

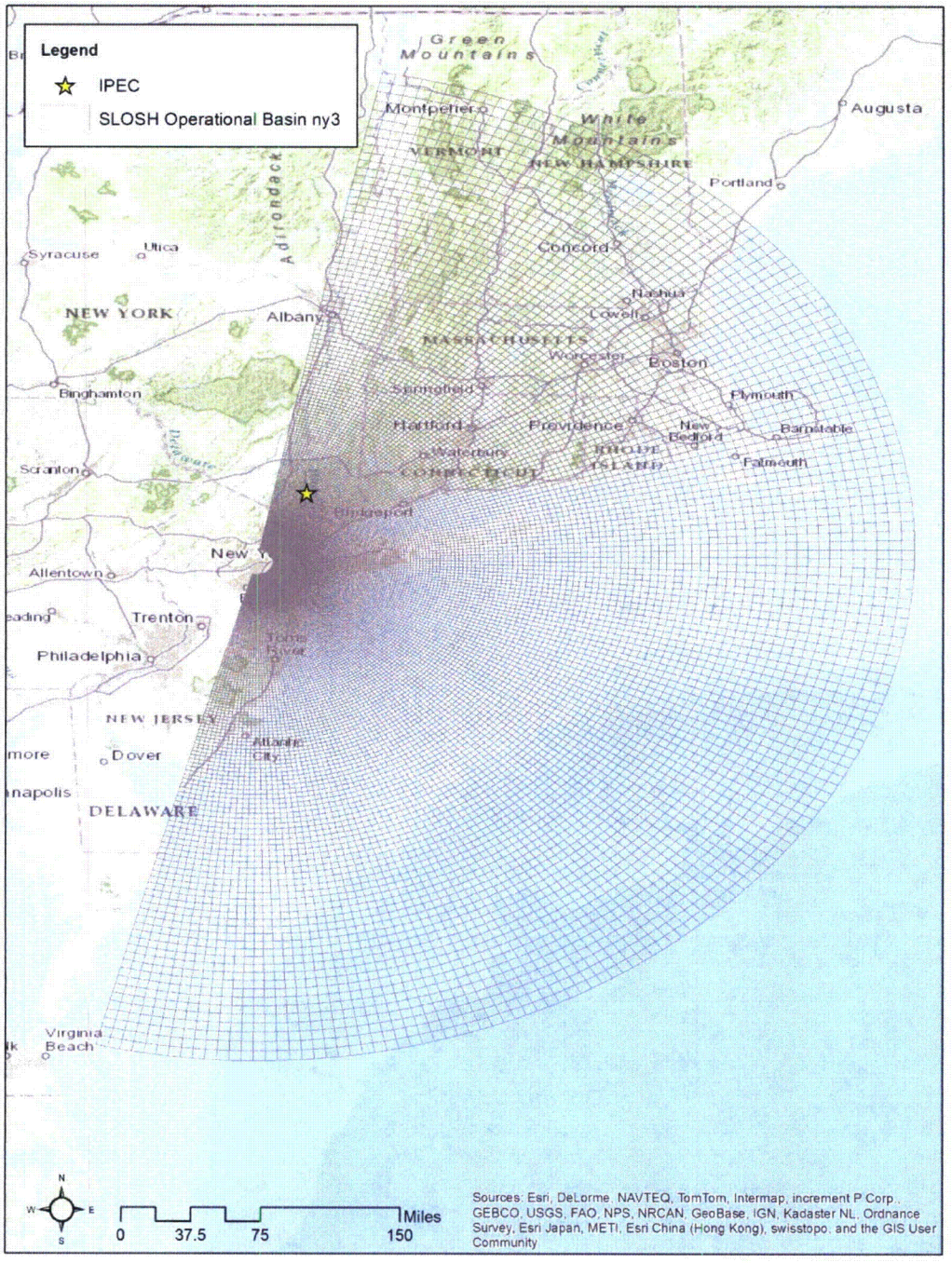


Figure 3.4-4: New York, Version 3 (ny3) SLOSH 3.97 Model Grid

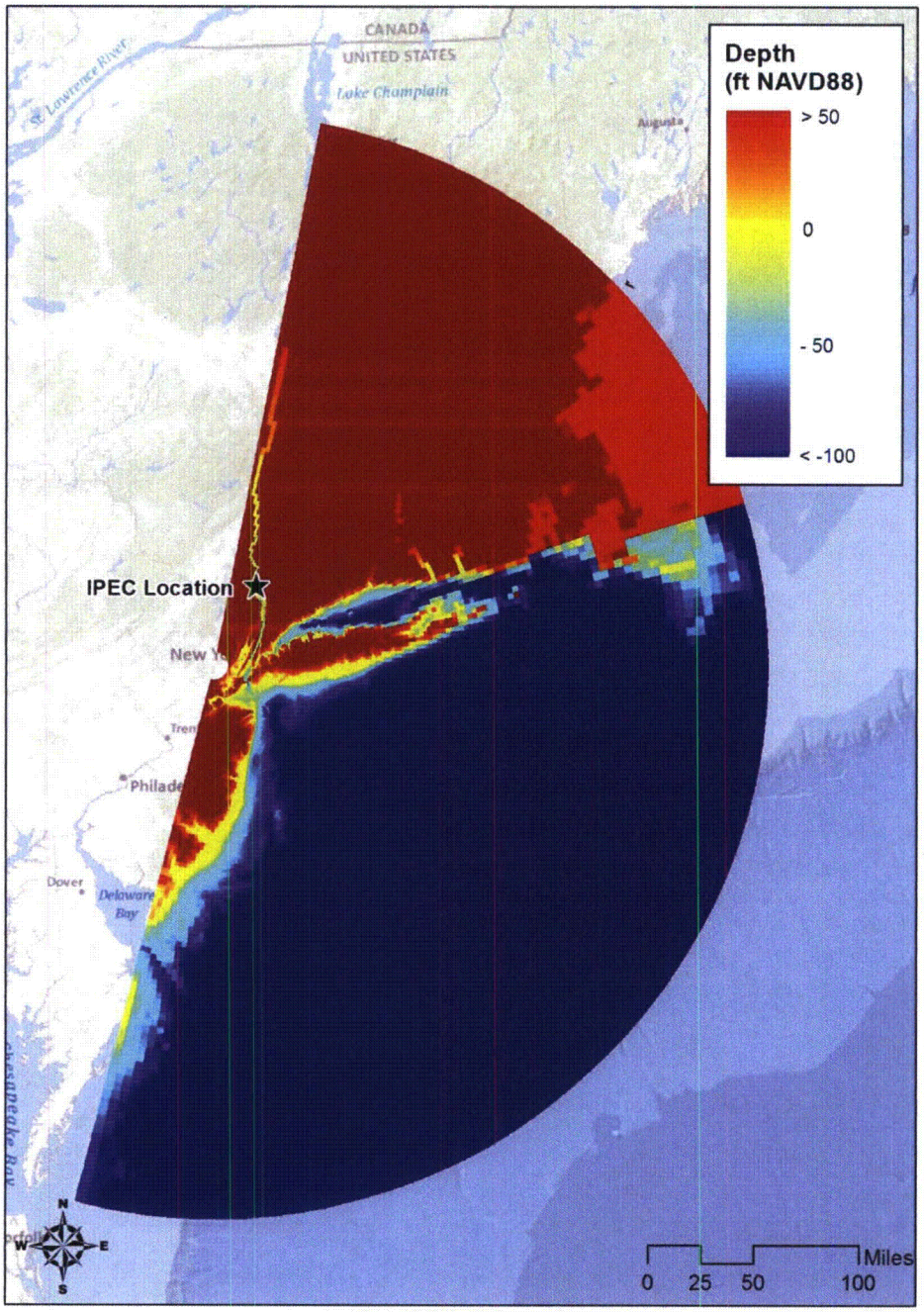


Figure 3.4-5: New York, Version 3 (ny3) Basin Digital Elevation Model (DEM) Defining Base of Model Domain

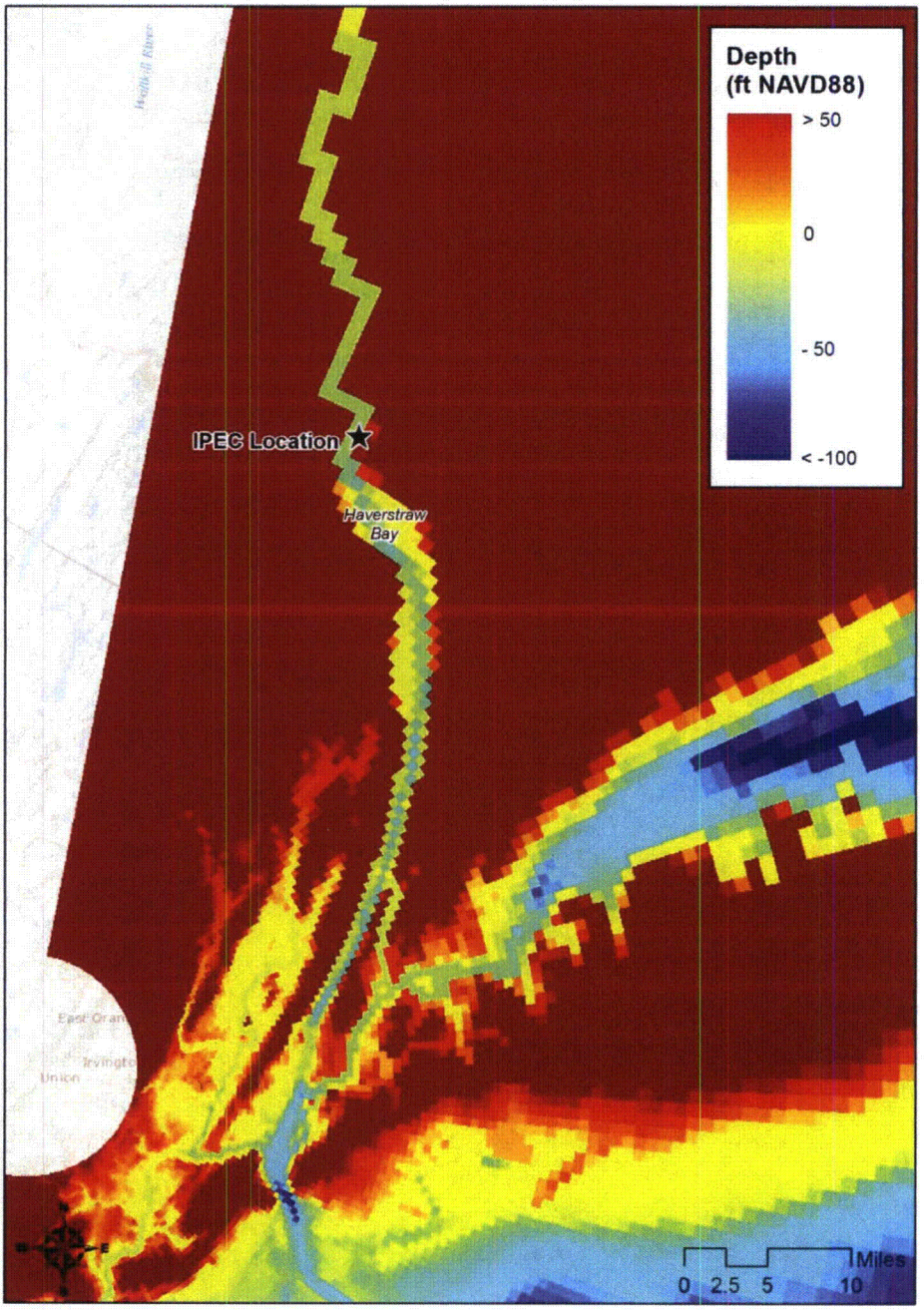


Figure 3.4-6: New York, Version 3 (ny3) Basin Digital Elevation Model (DEM) Defining Base of Model Domain in IPEC Vicinity (Upper Bay, New York and Hudson River)

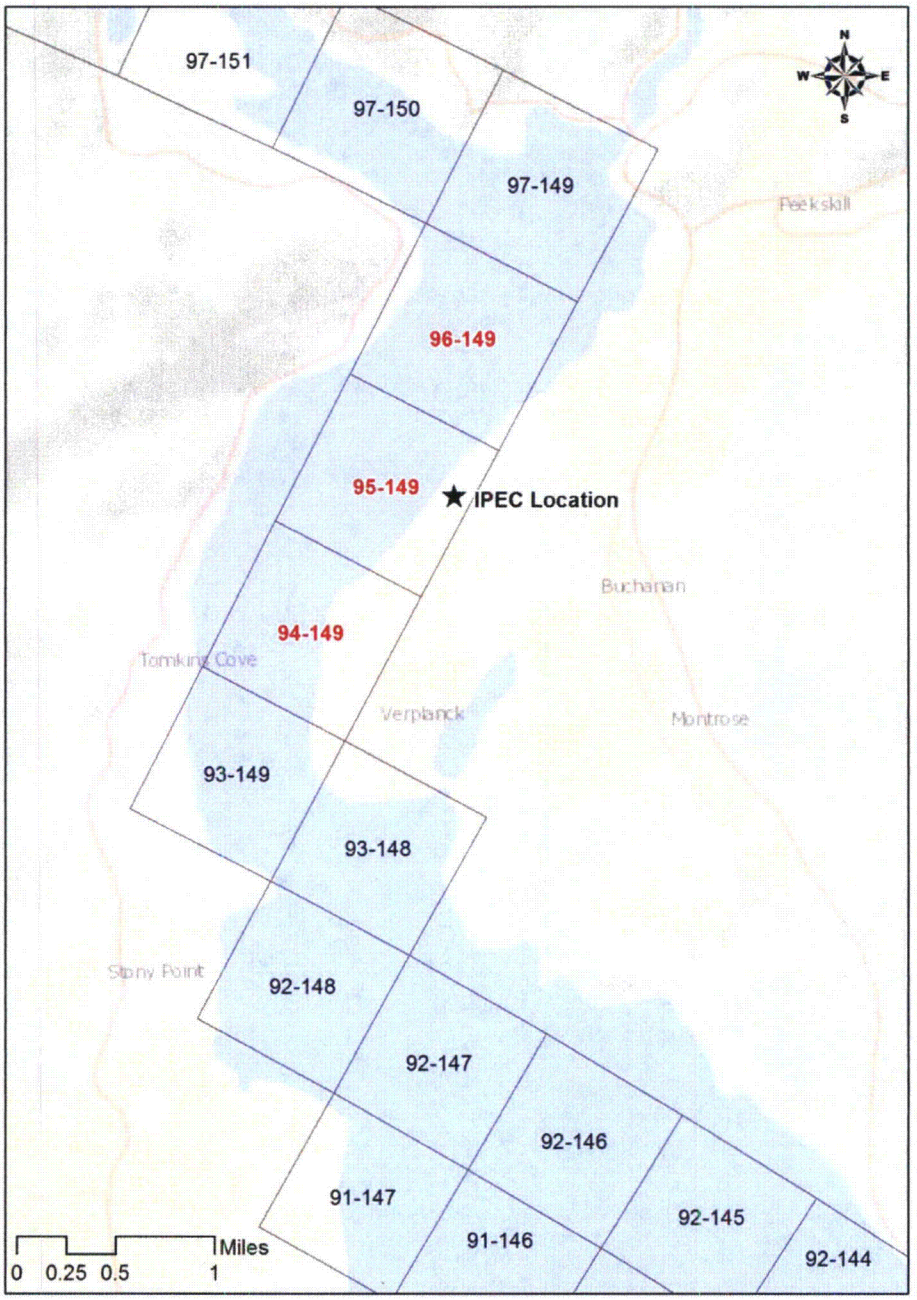


Figure 3.4-7: New York, Version 3 (ny3) Grid Cells Corresponding to the IPEC River Frontage

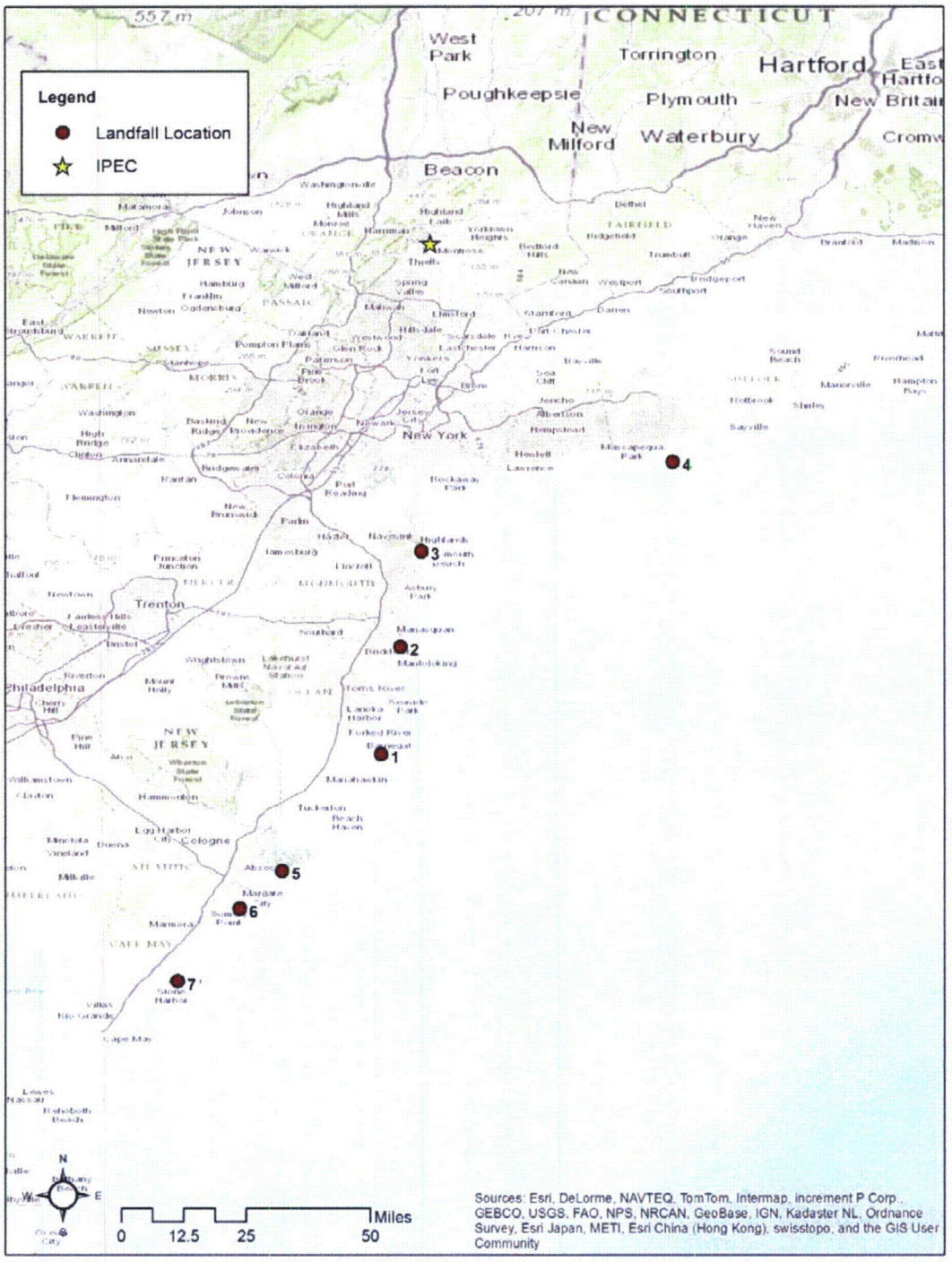


Figure 3.4-8: Landfall Points for SLOSH 3.97 Storm Tracks

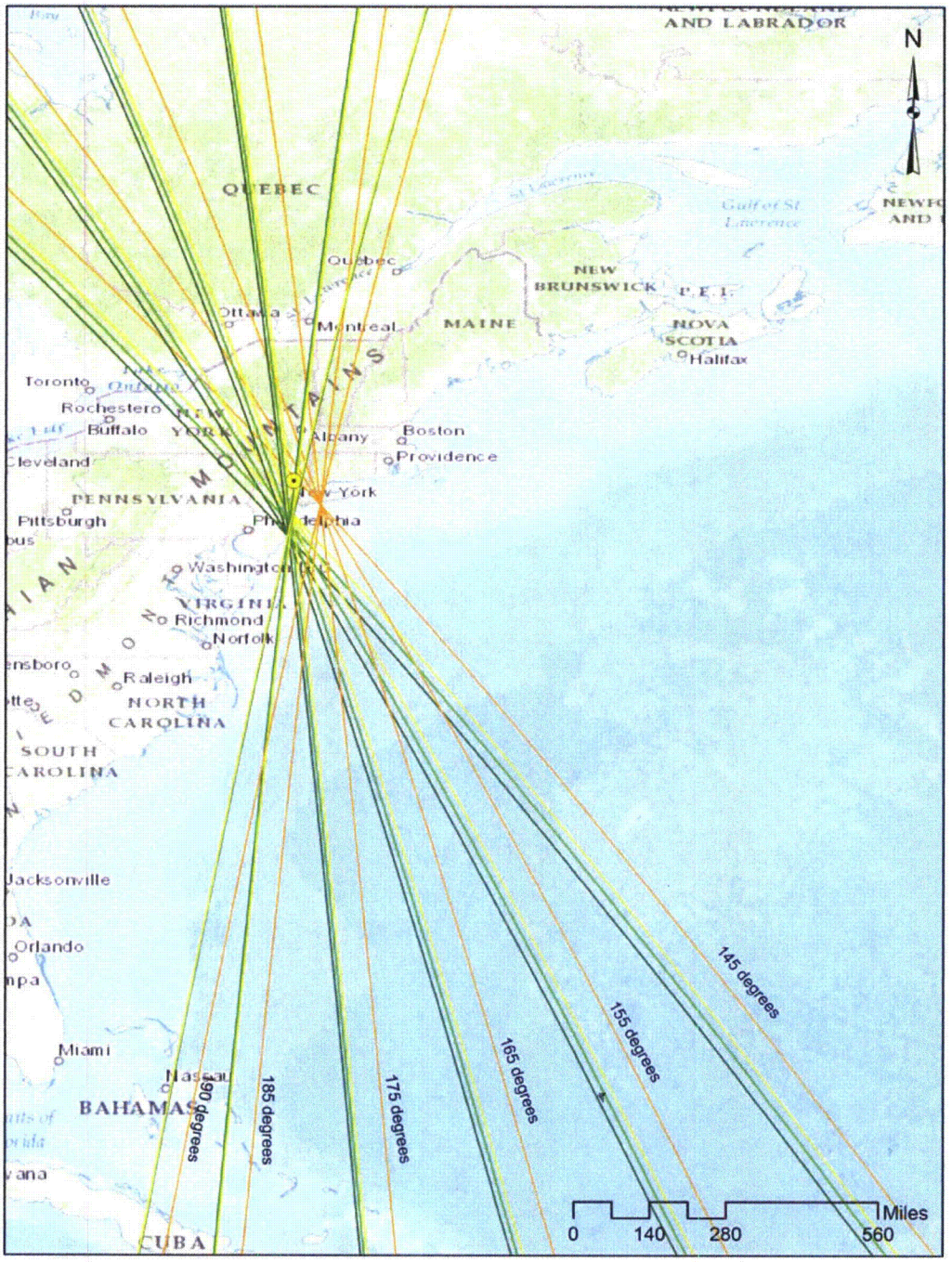


Figure 3.4-9: SLOSH 3.97 Bearing Range for Northerly Storm Tracks

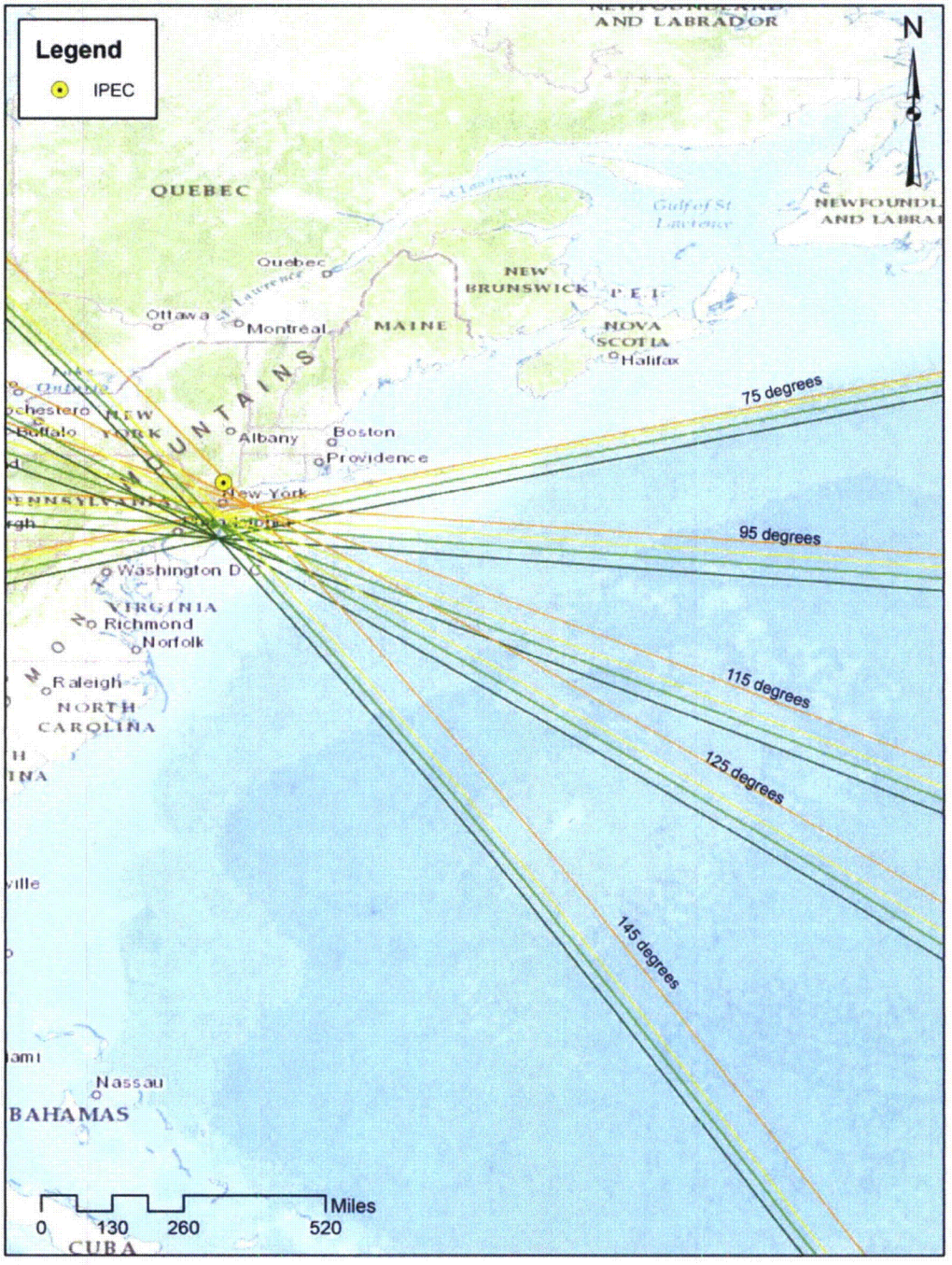


Figure 3.4-10: SLOSH 3.97 Bearing Range for Westerly Storm Tracks

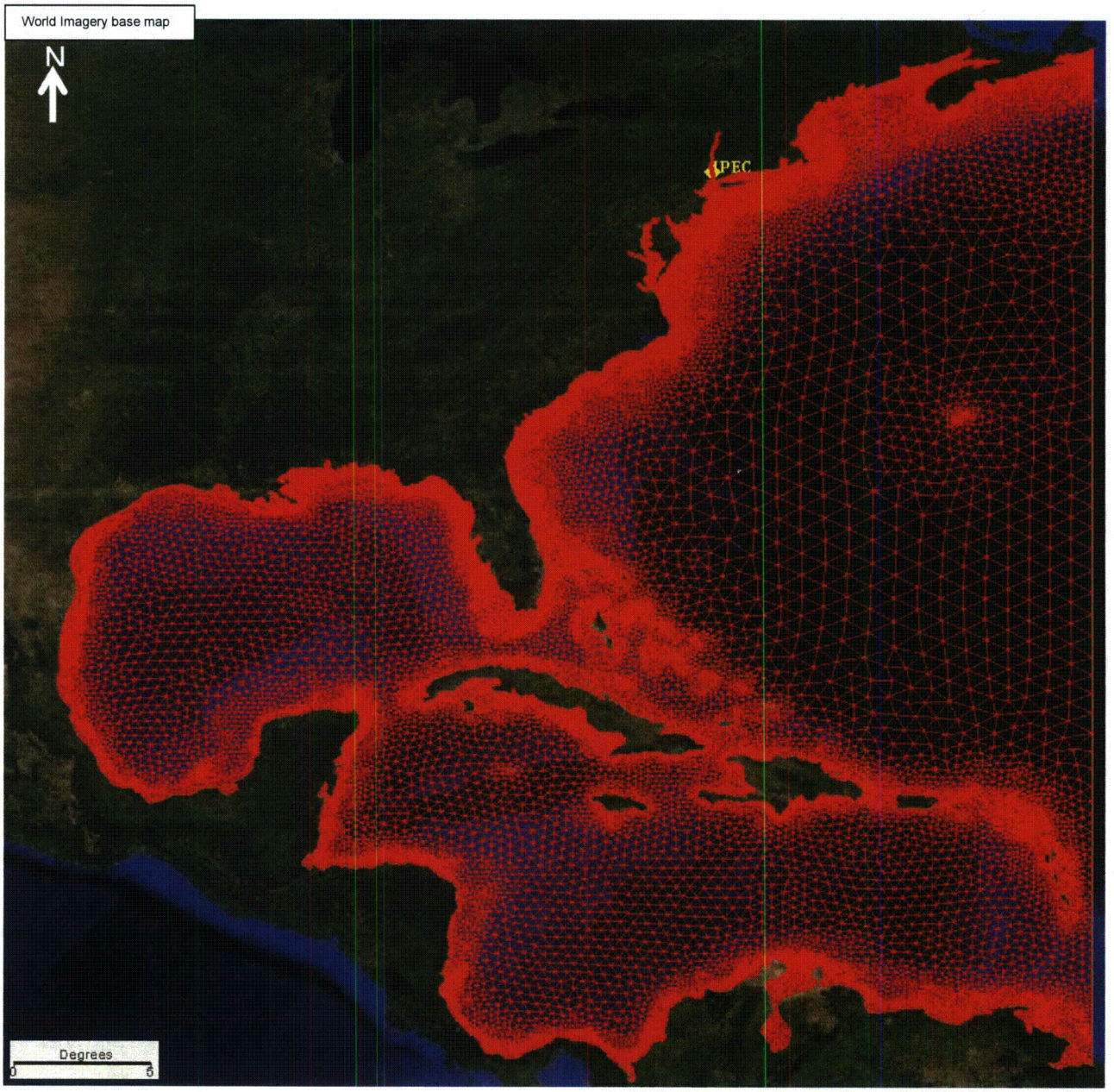


Figure 3.4-11: ADCIRC FEMA Region II Finite Element Mesh – Northern Atlantic

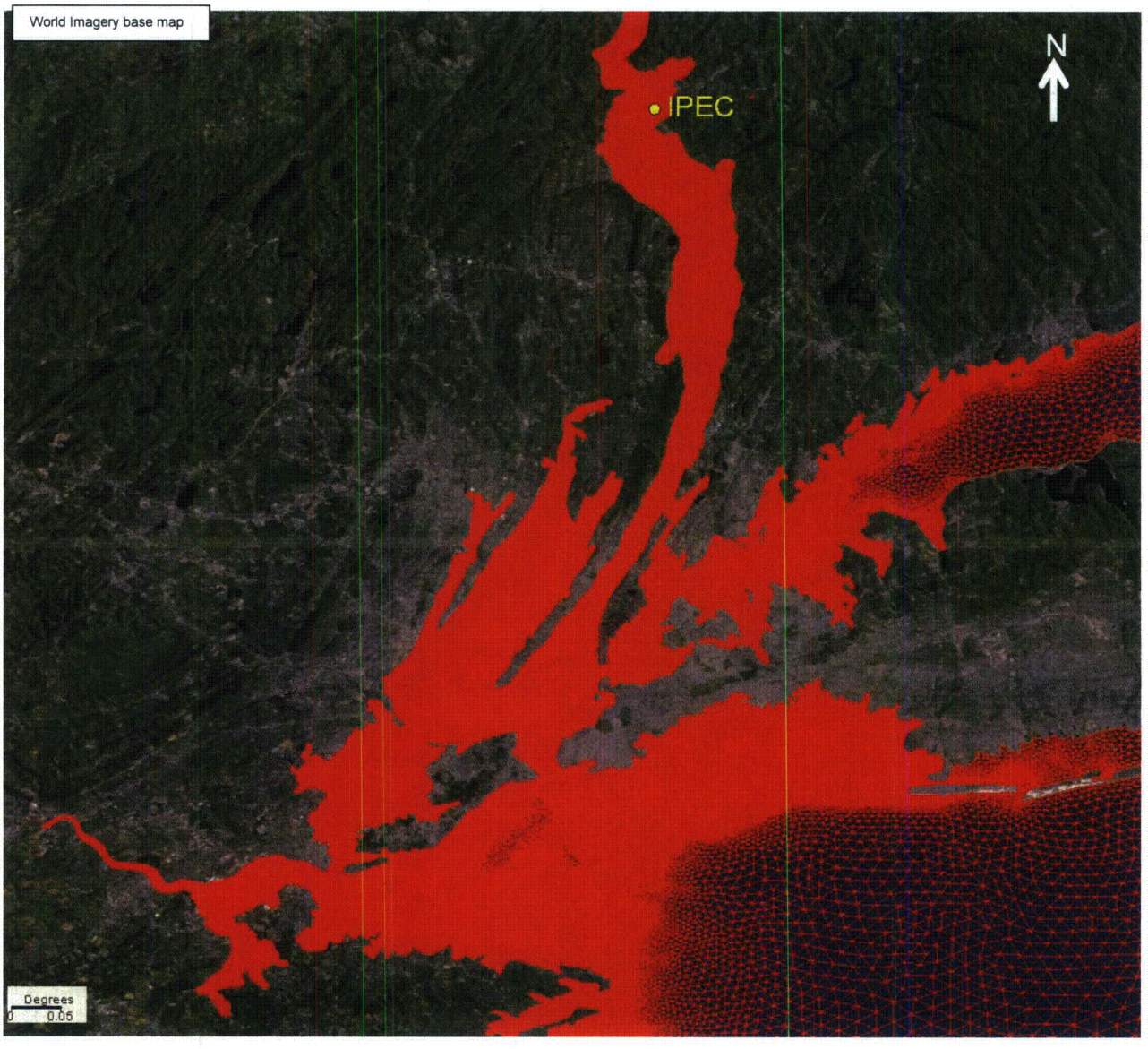


Figure 3.4-12: ADCIRC FEMA Region II Finite Element Mesh – New Jersey/New York

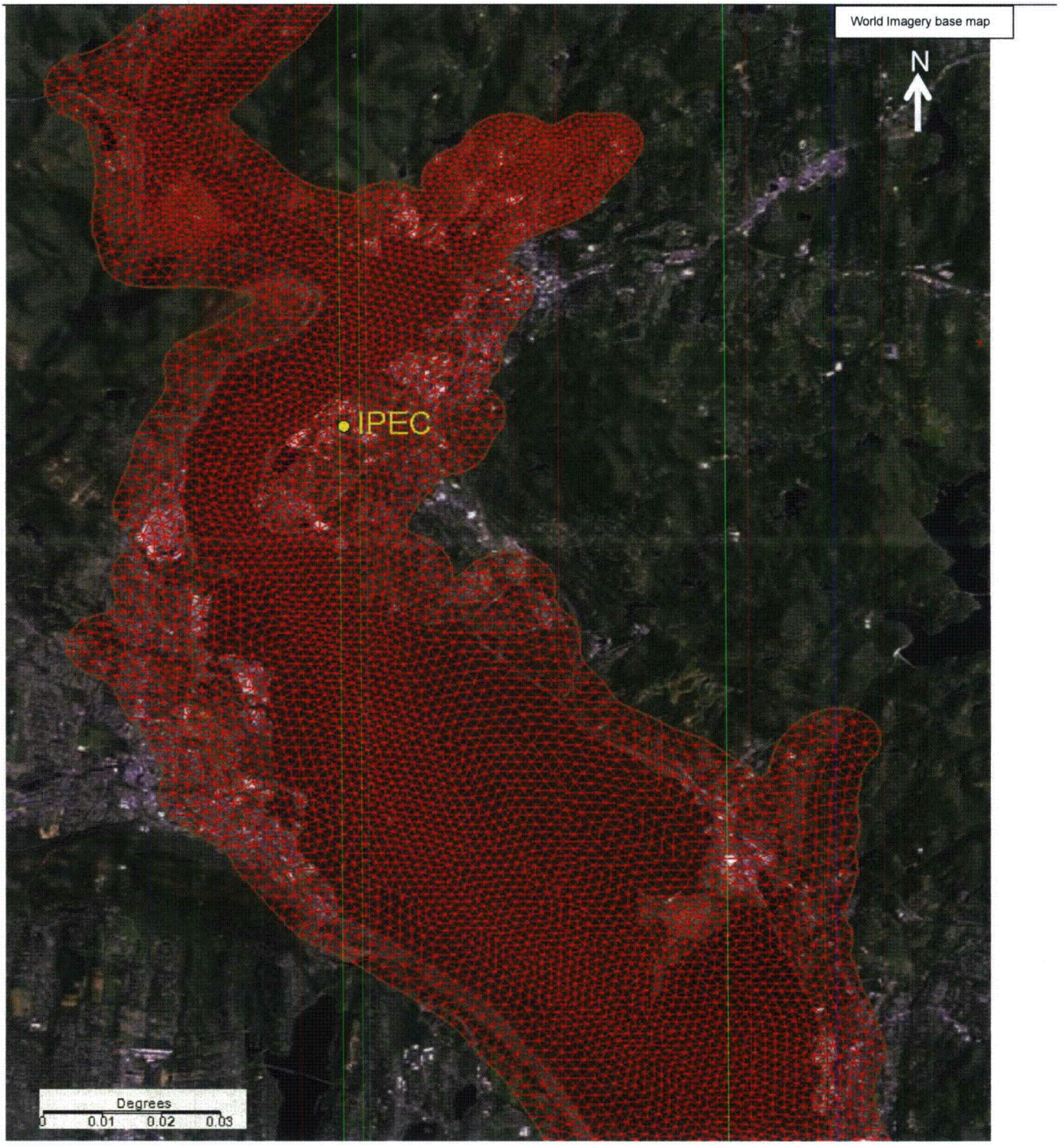


Figure 3.4-13: ADCIRC FEMA Region II Finite Element Mesh – IPEC Vicinity

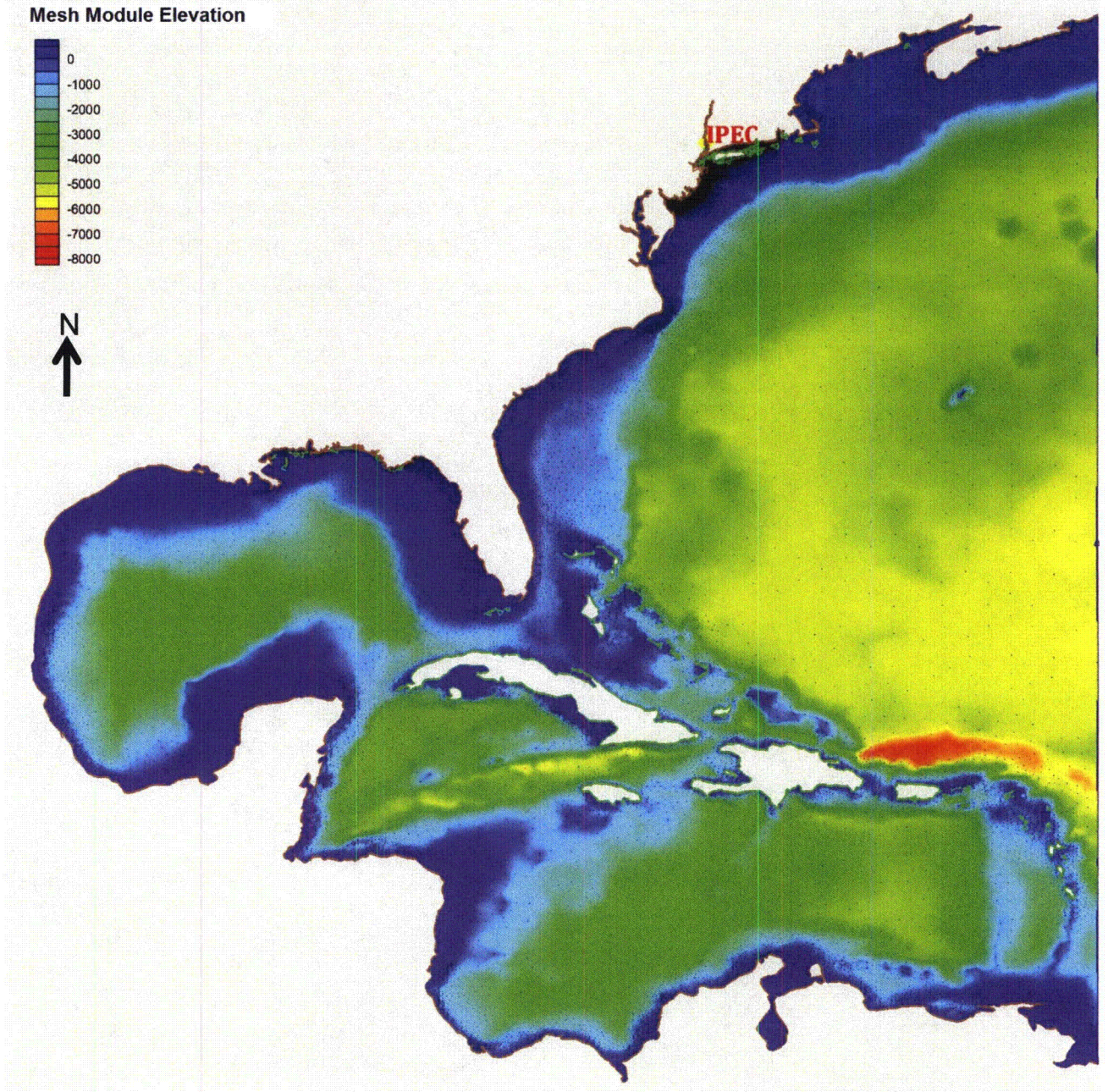


Figure 3.4-14: ADCIRC Module Mesh Elevation (m, NAVD88) – Northern Atlantic

World Imagery base map

Figure 3.4-15: ADCIRC Mesh Model Elevation (m, NAVD88) -- New Jersey / New York

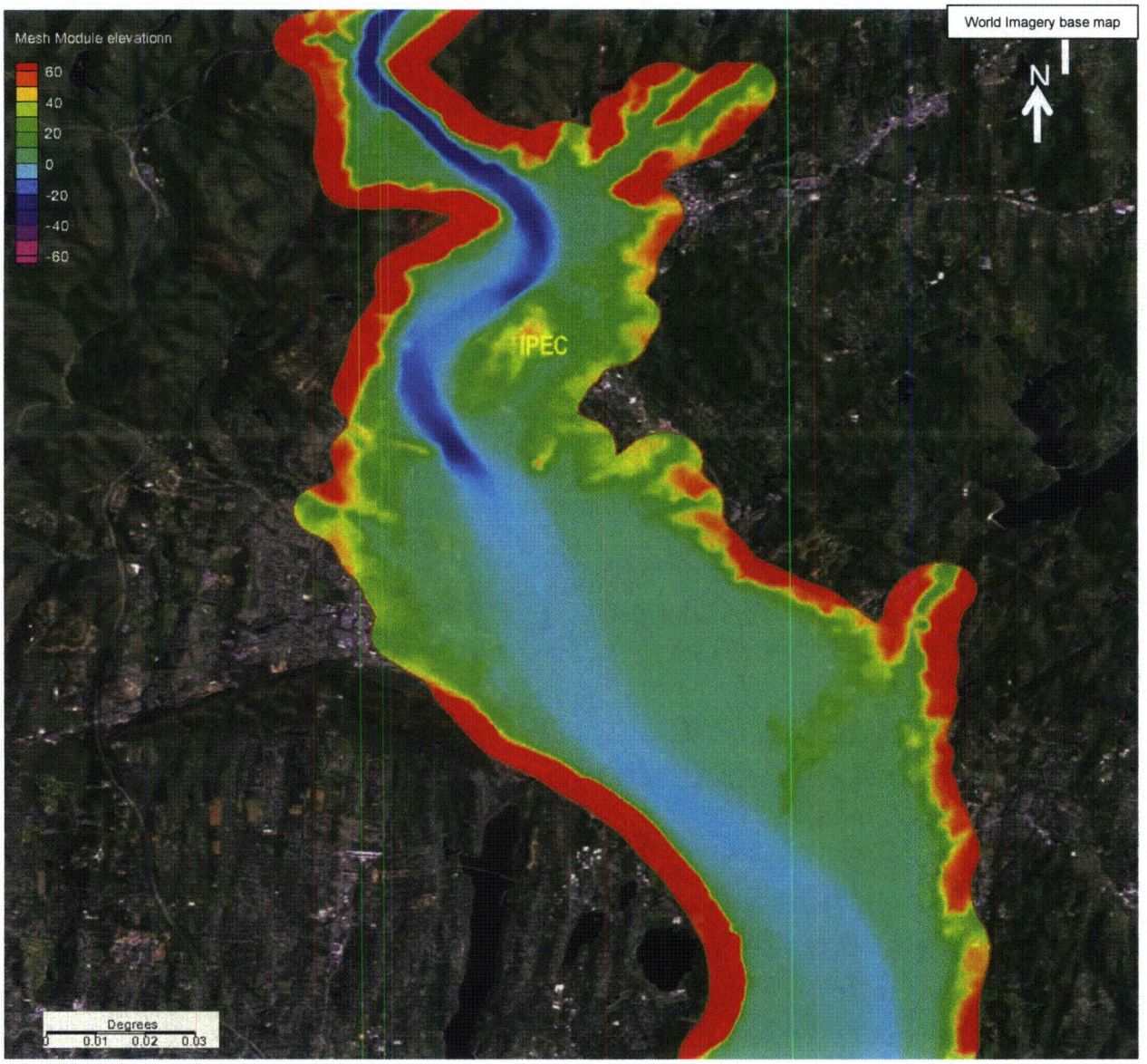


Figure 3.4-16: ADCIRC Mesh Model Elevation (m, NAVD88) – IPEC Vicinity

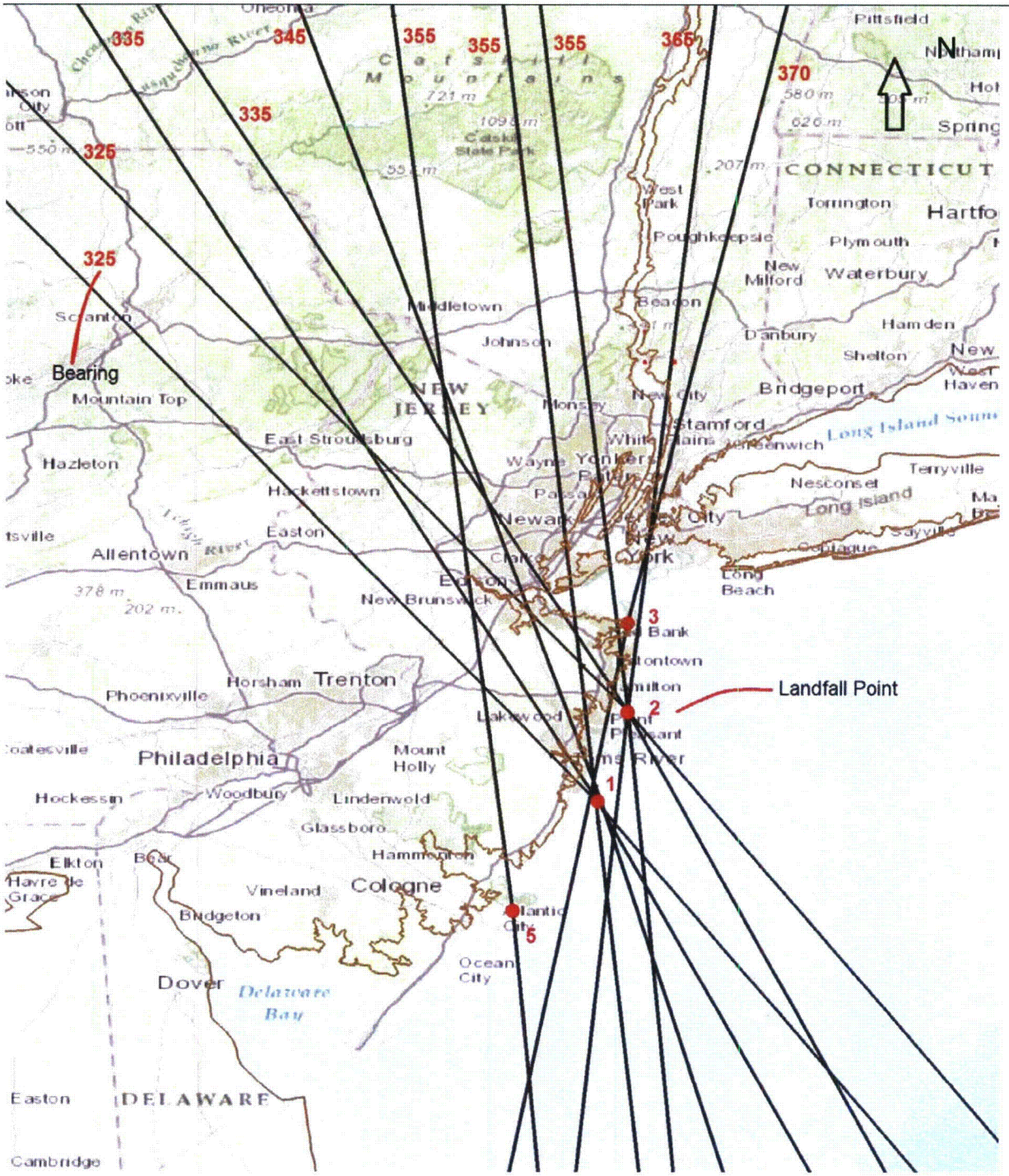


Figure 3.4-17: Track Directions and Landfall Locations for ADCIRC Simulations

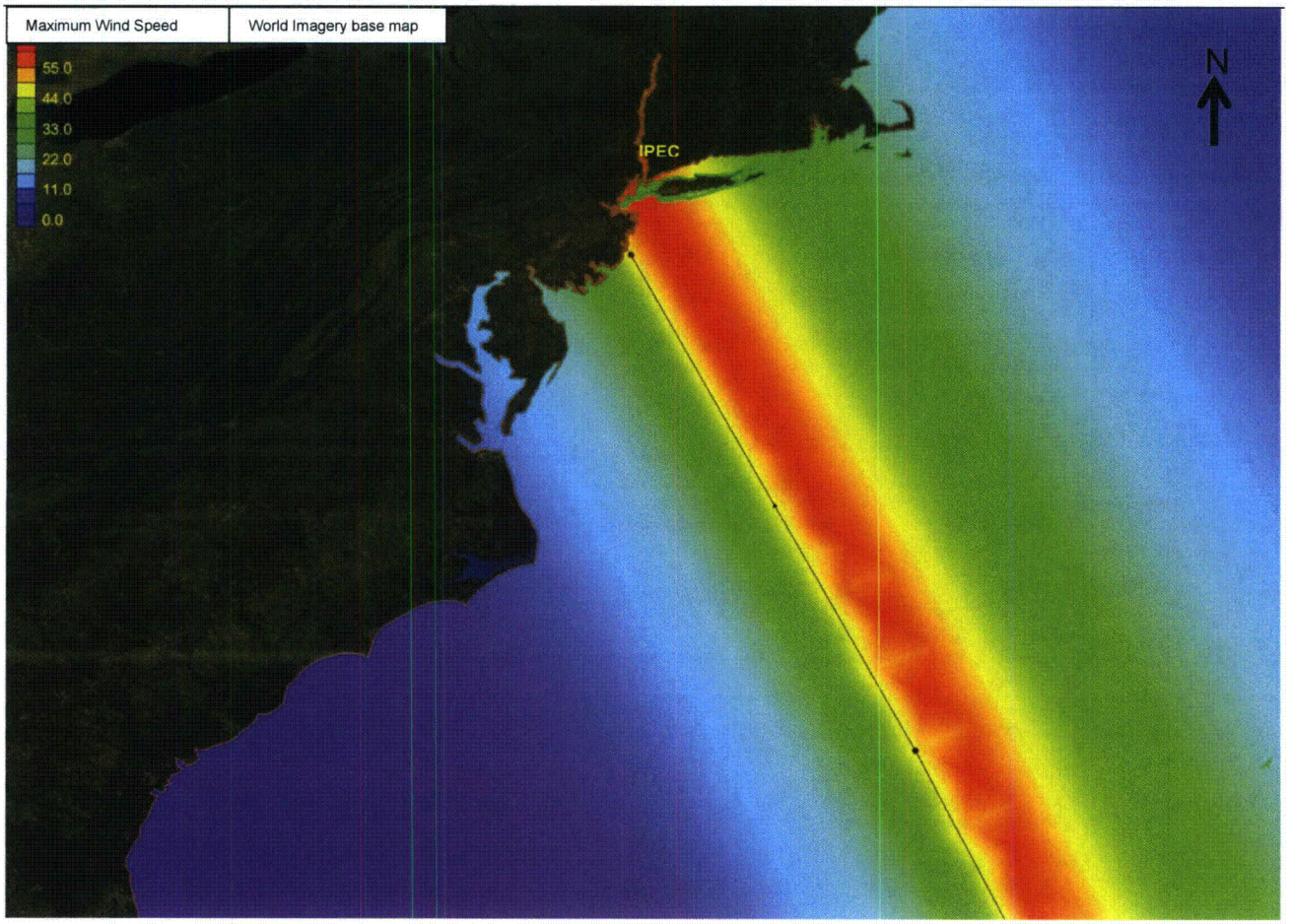


Figure 3.4-18: ADCIRC Envelope of Maximum Winds (m/s) of Storm No. 941

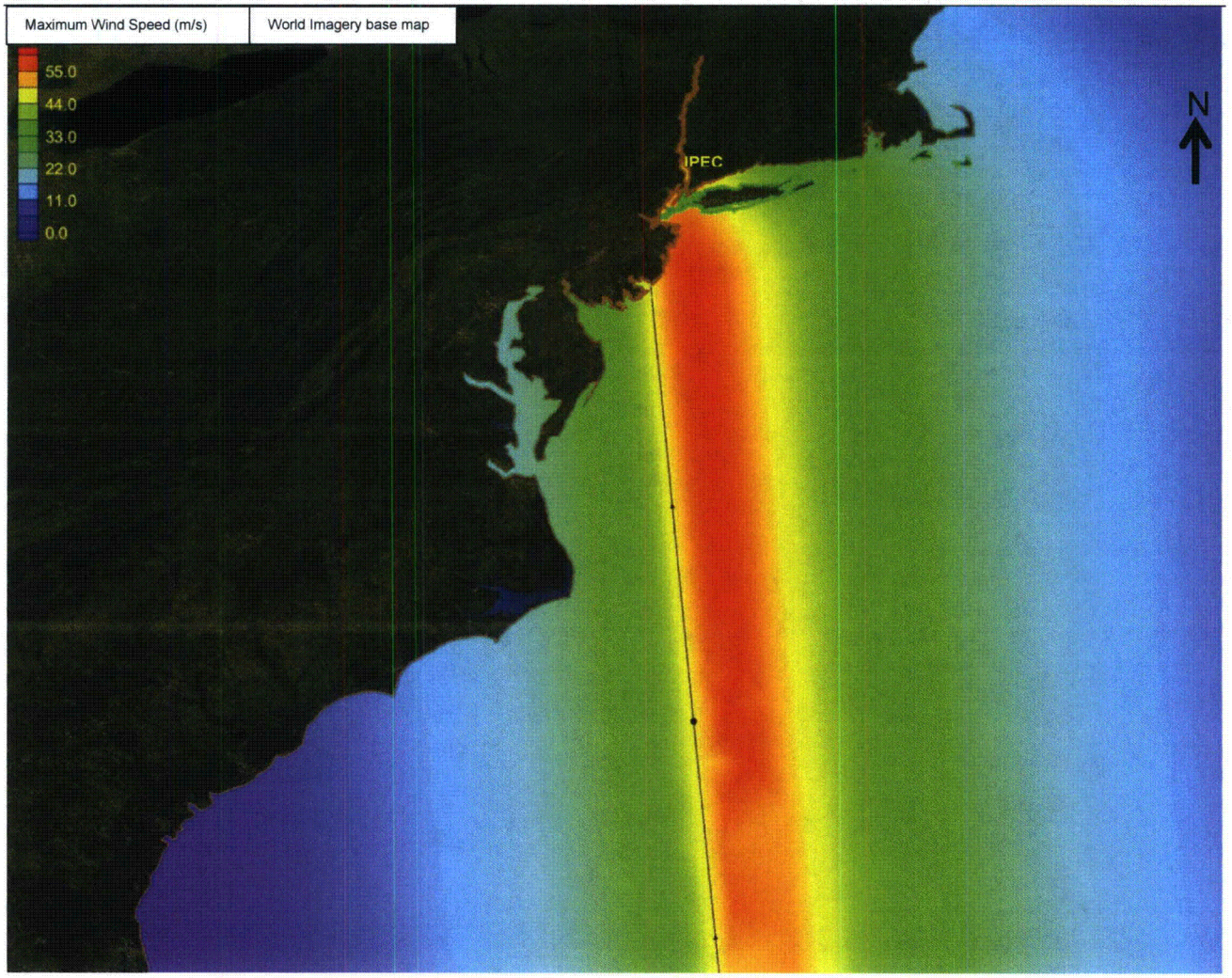


Figure 3.4-19: ADCIRC Envelope of Maximum Winds (m/s) of Storm No. 985*

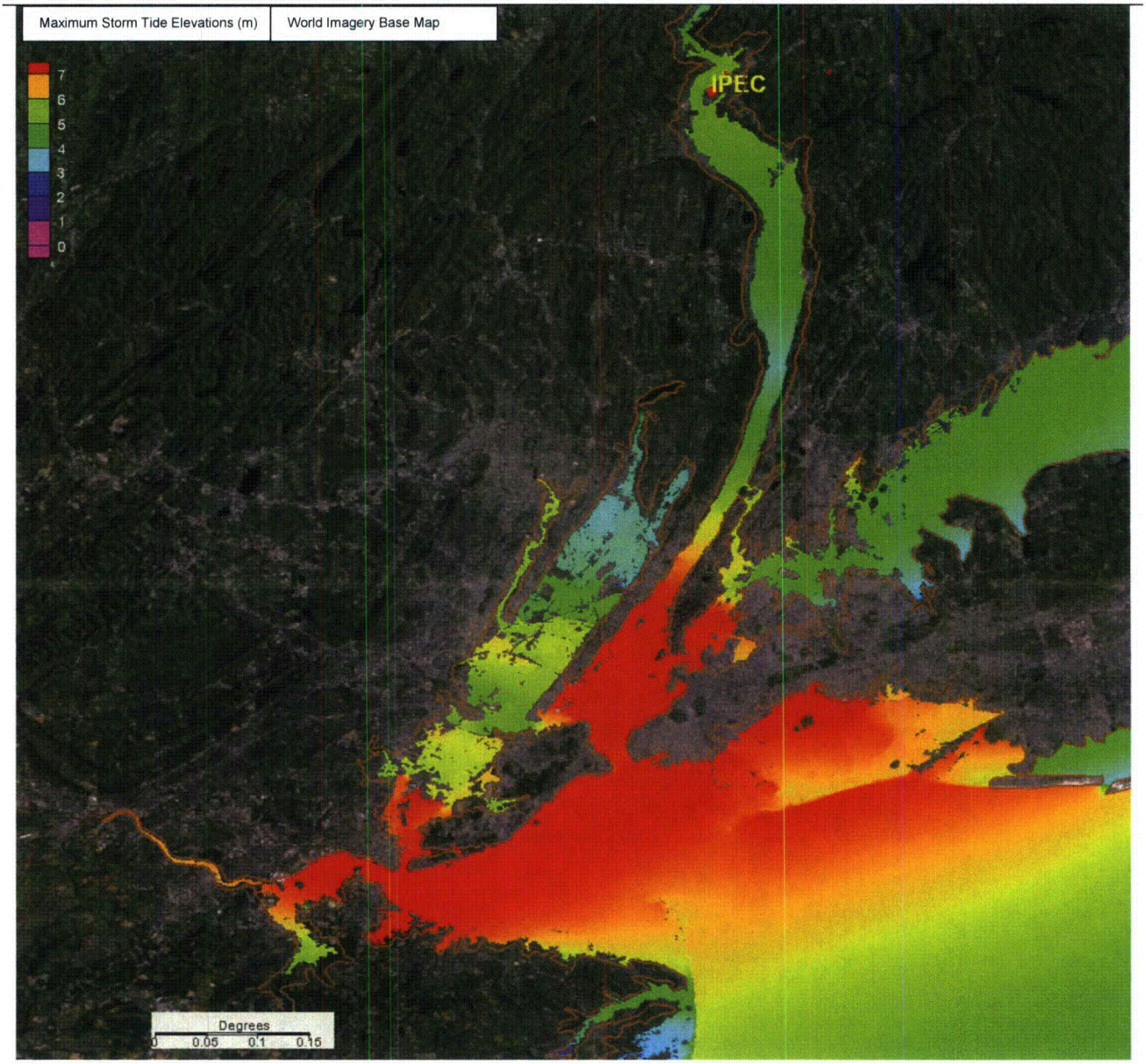


Figure 3.4-20: ADCIRC Maximum Storm Tide Stillwater Elevations (m, NAVD88) of Storm No. 941

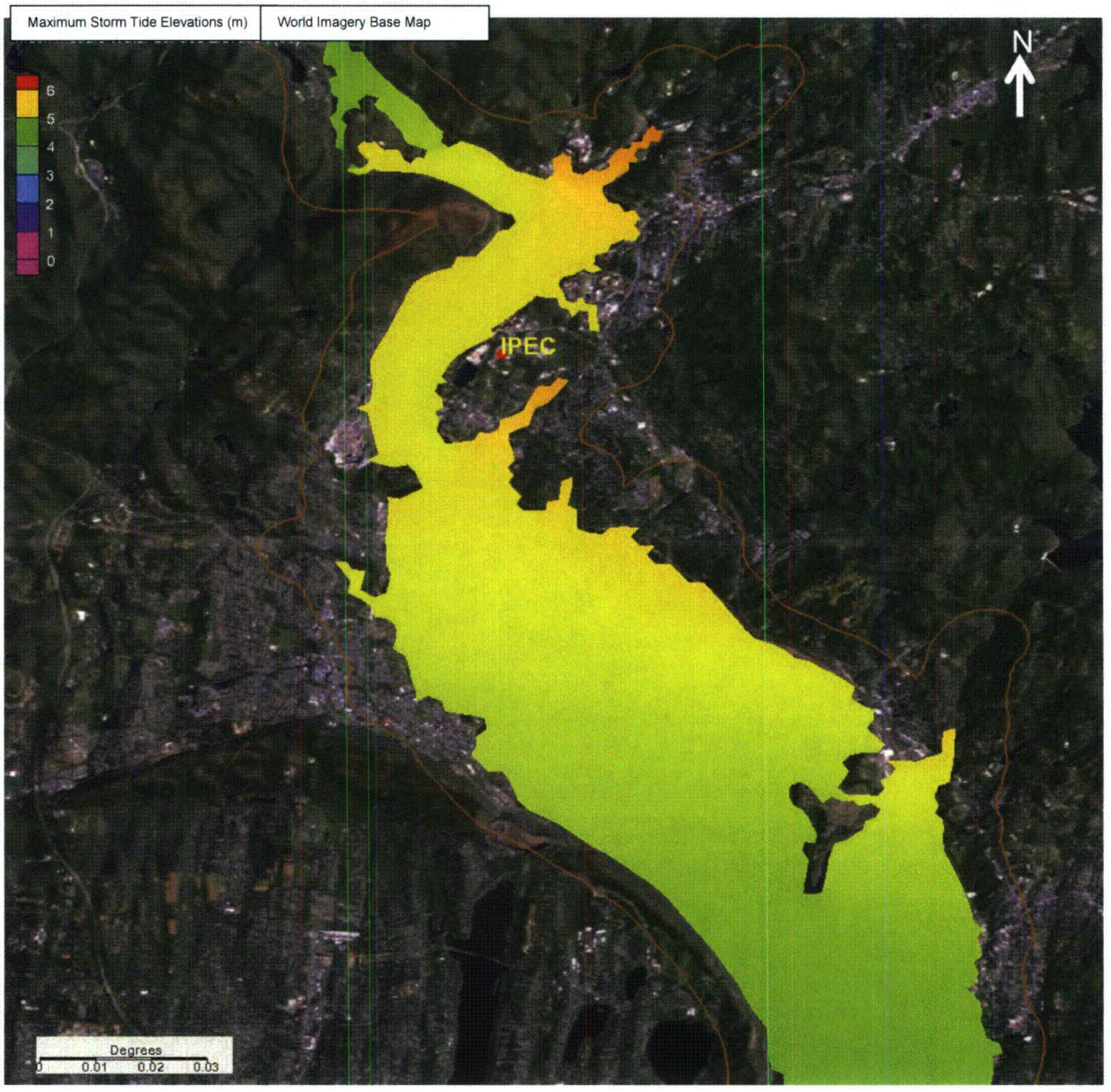


Figure 3.4-21: ADCIRC Maximum Storm Tide Stillwater Elevations (m, NAVD88) of Storm No. 941 – IPEC Vicinity

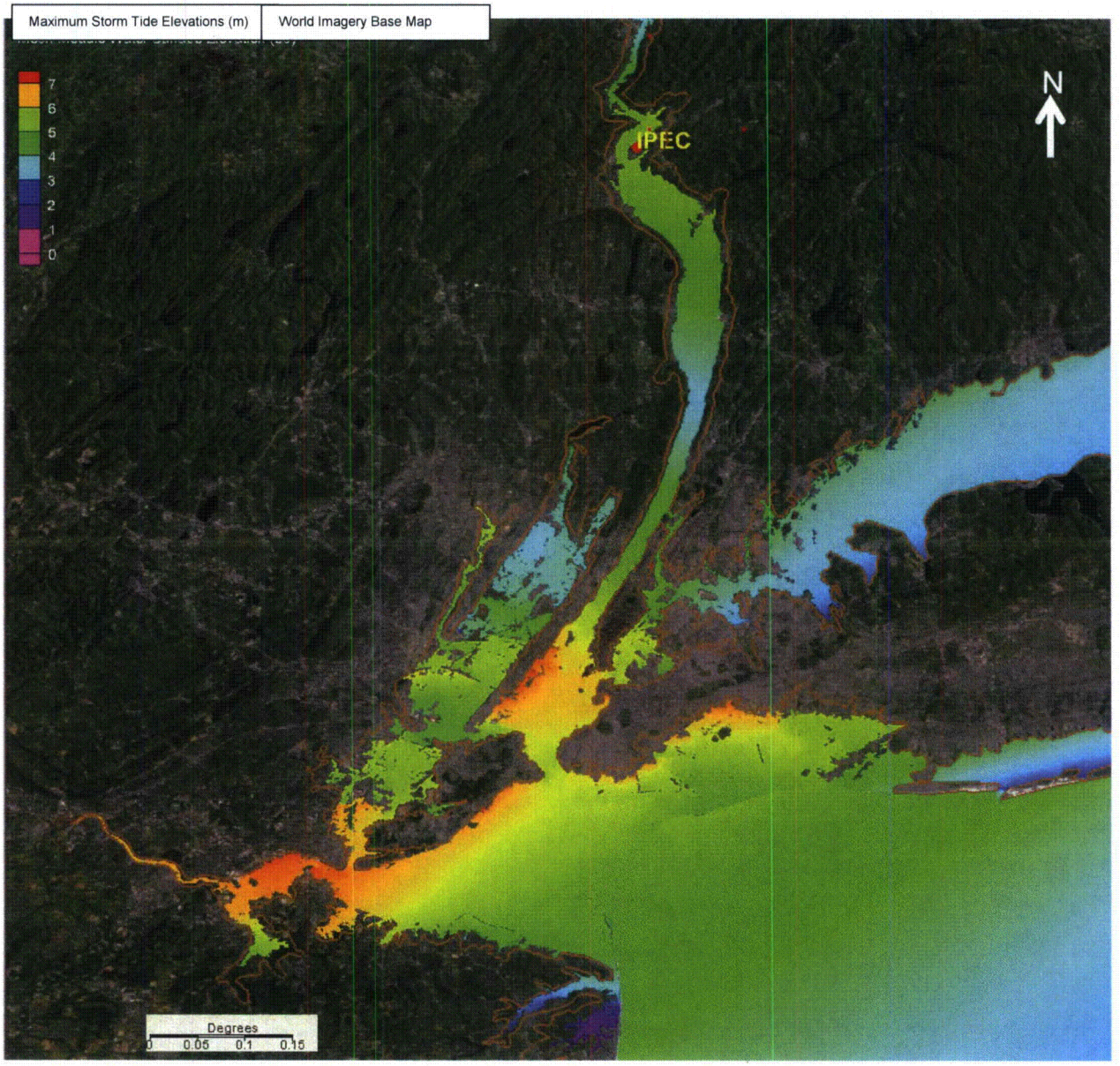


Figure 3.4-22: ADCIRC Maximum Storm Tide Stillwater Elevations (m, NAVD88) of Storm No. 985*

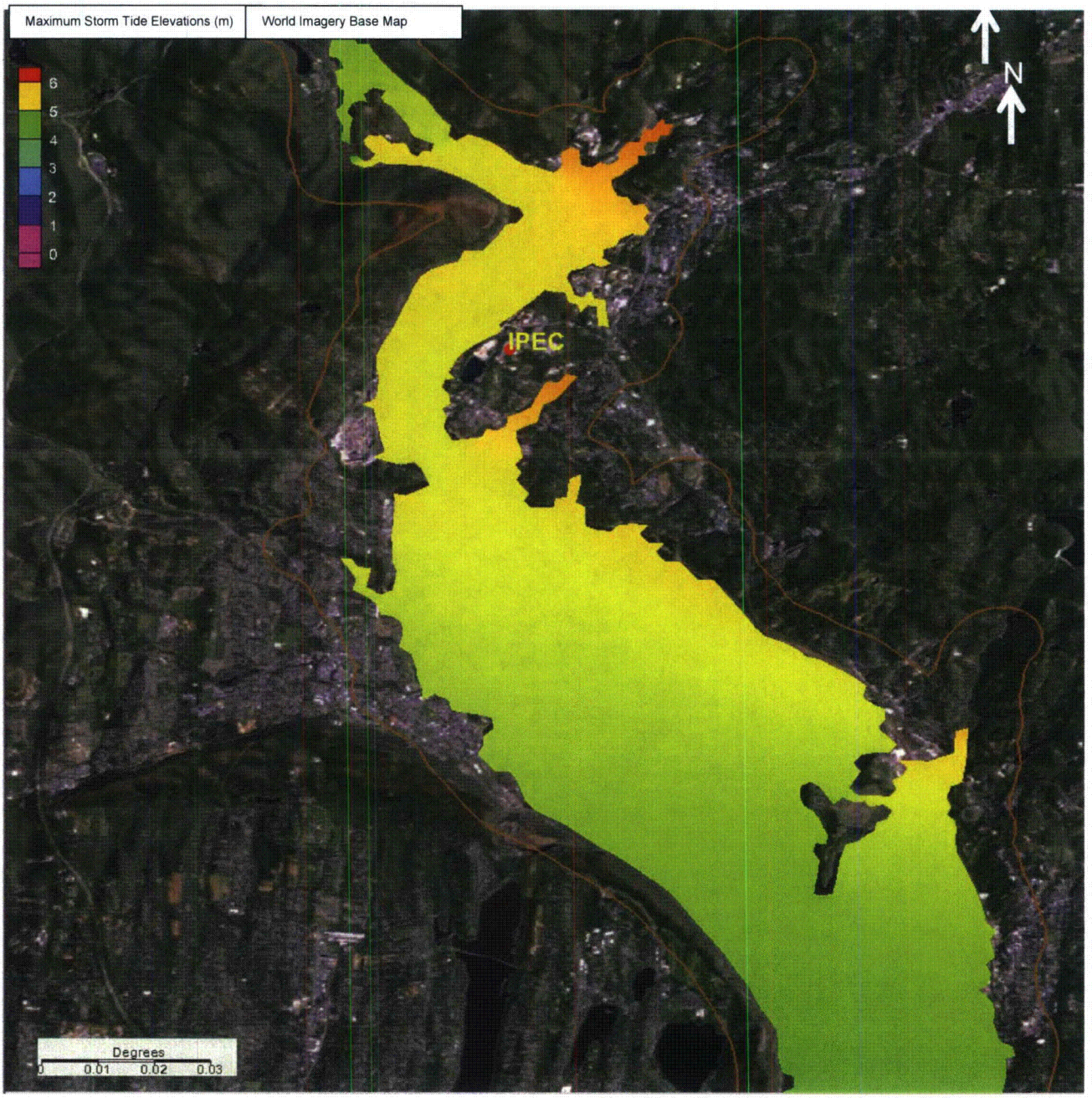


Figure 3.4-23: Maximum Storm Tide Stillwater Elevations (m, NAVD88) of Storm No. 985* - IPEC Vicinity

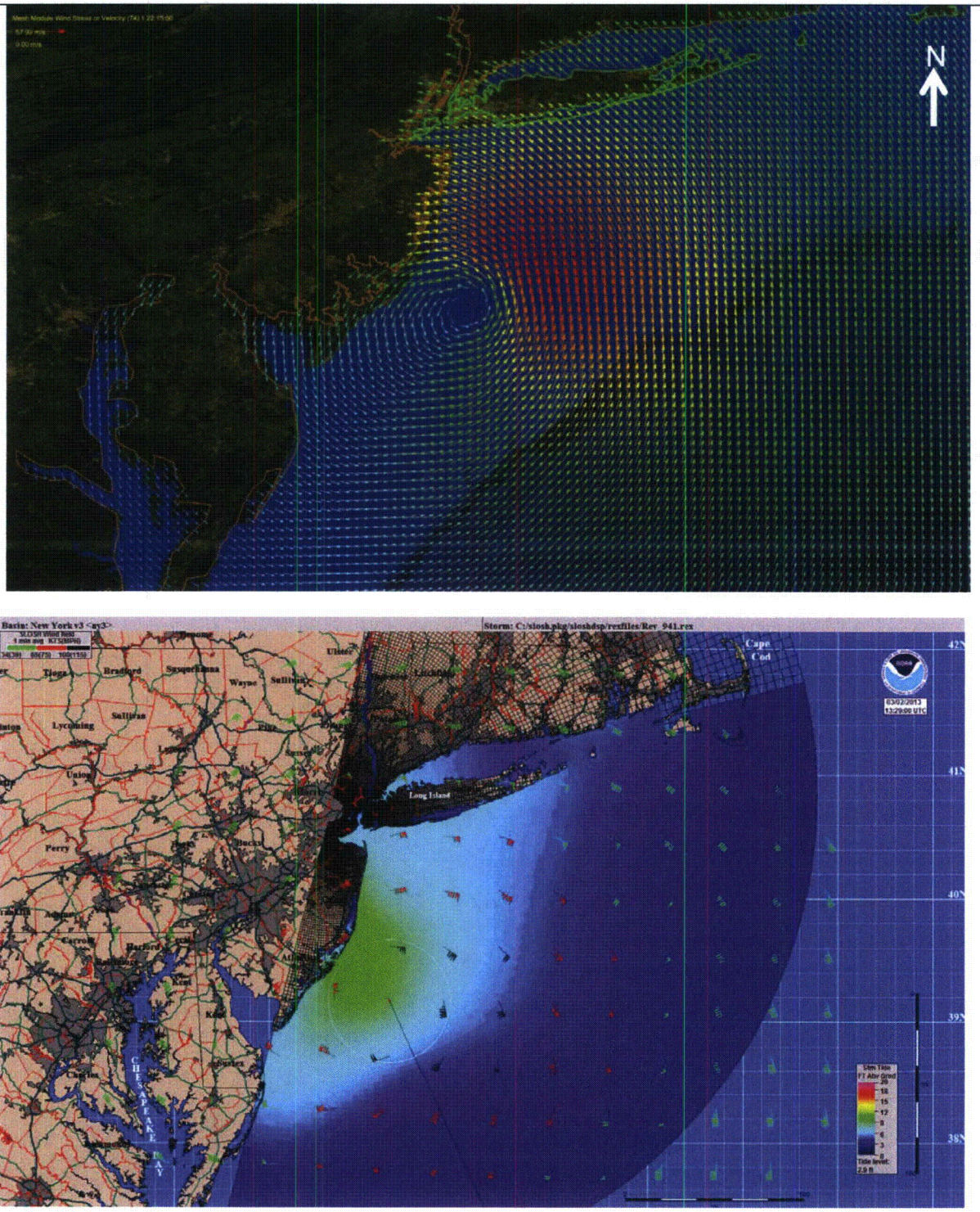


Figure 3.4-24: Comparison of Wind Field of ADCIRC and SLOSH Models – Storm No. 941

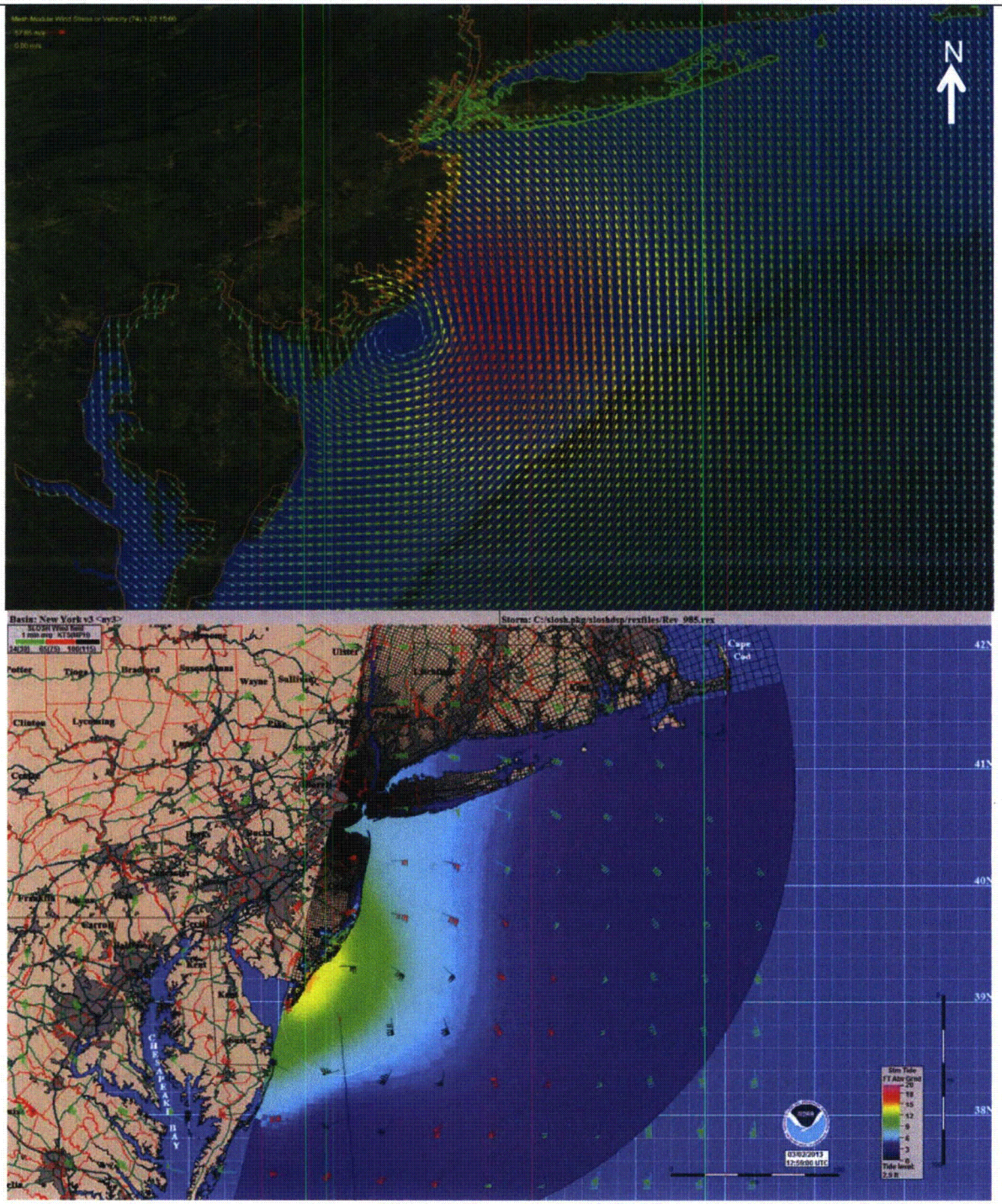


Figure 3.4-25: Comparison of Wind Field of ADCIRC and SLOSH Models – Storm No. 985*

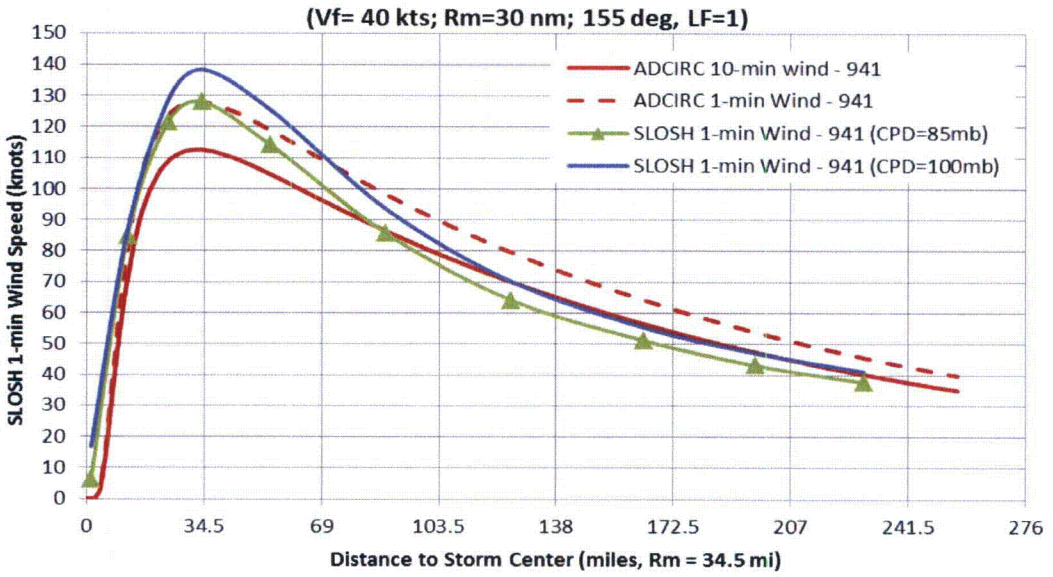


Figure 3.4-26: Comparison of Wind Profiles of ADCIRC and SLOSH Models – Storm No. 941

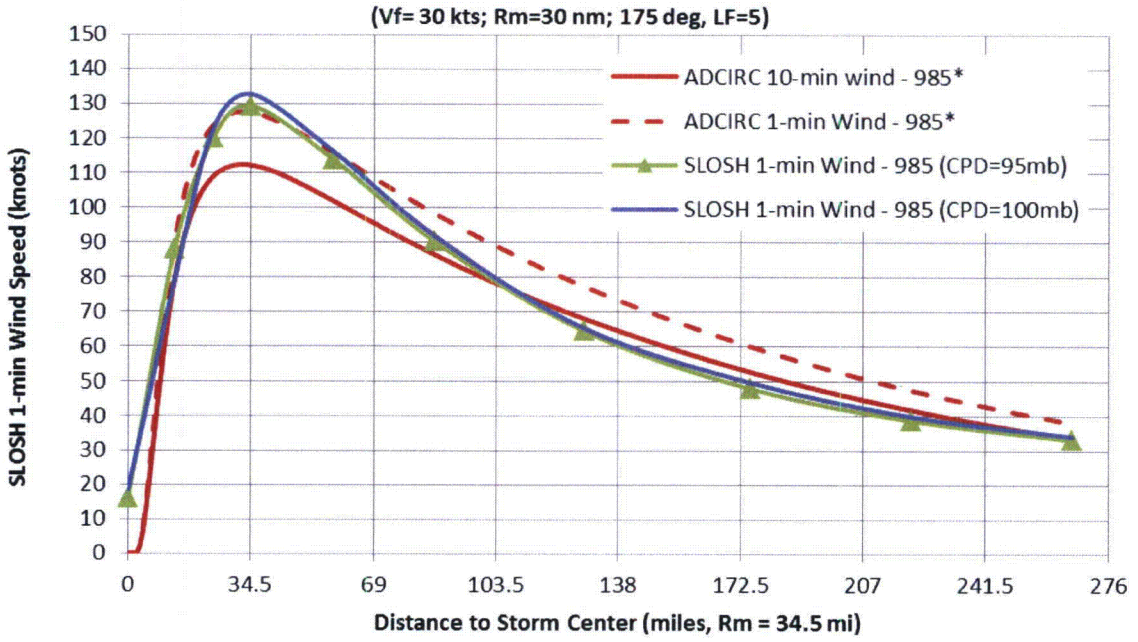


Figure 3.4-27: Comparison of Wind Profiles of ADCIRC and SLOSH Models – Storm No. 985*

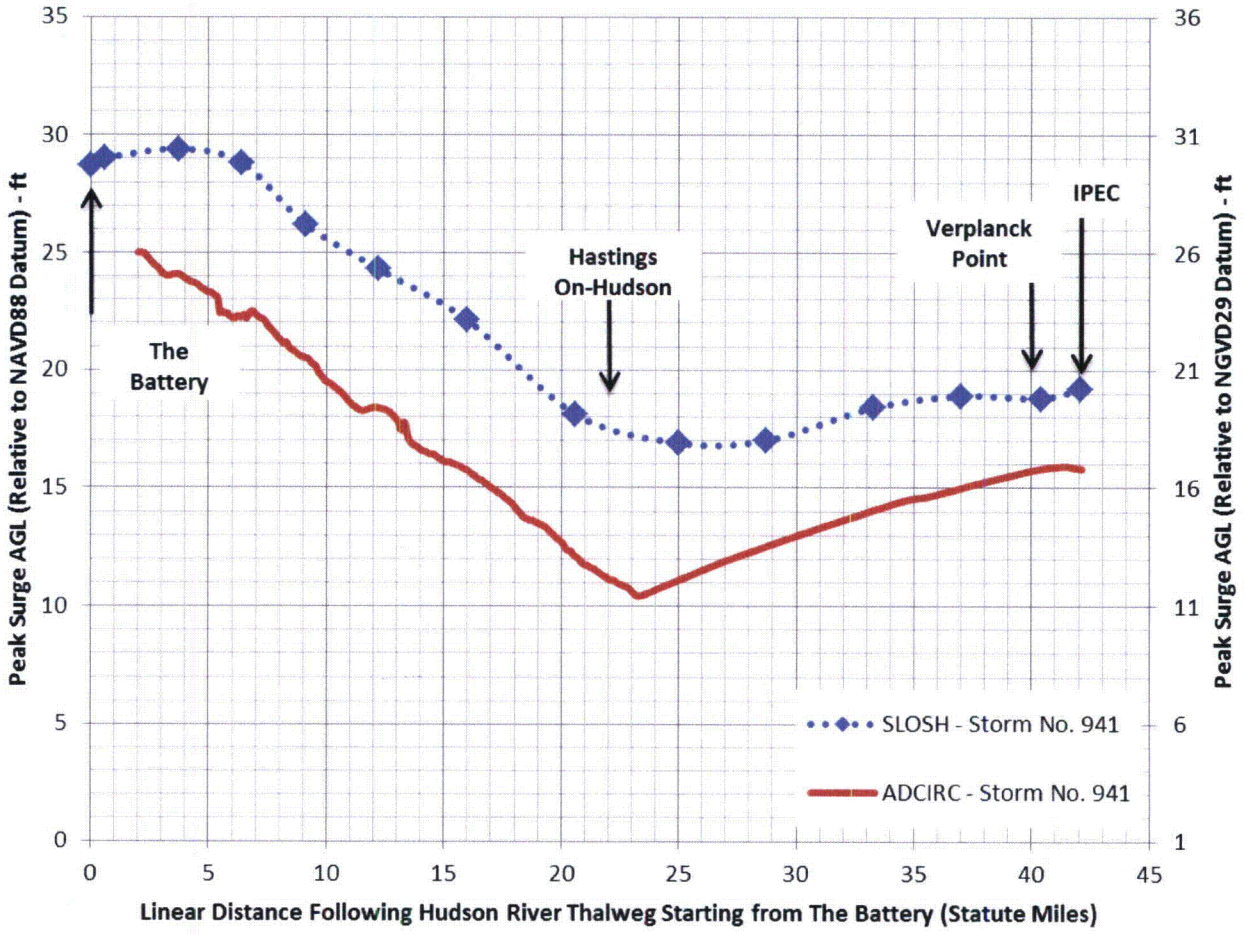


Figure 3.4-28: Comparison of Water Levels on Hudson River of ADCIRC and SLOSH Models – Storm 941

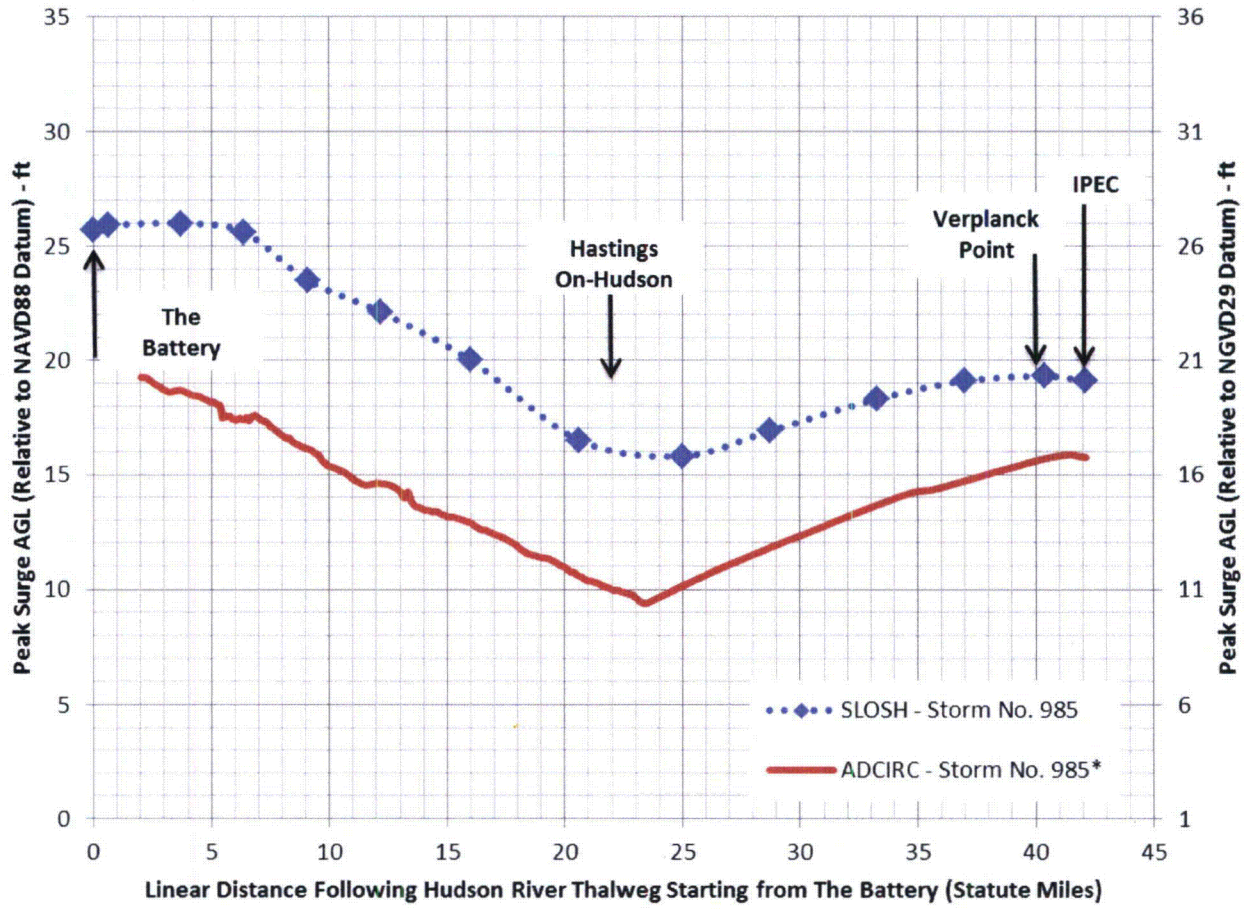
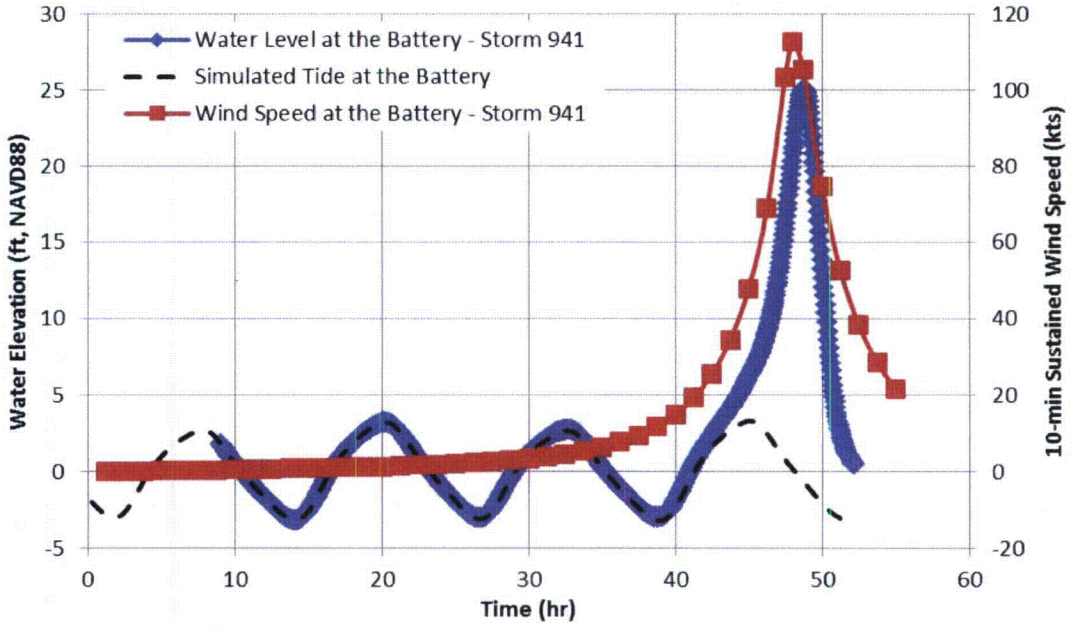
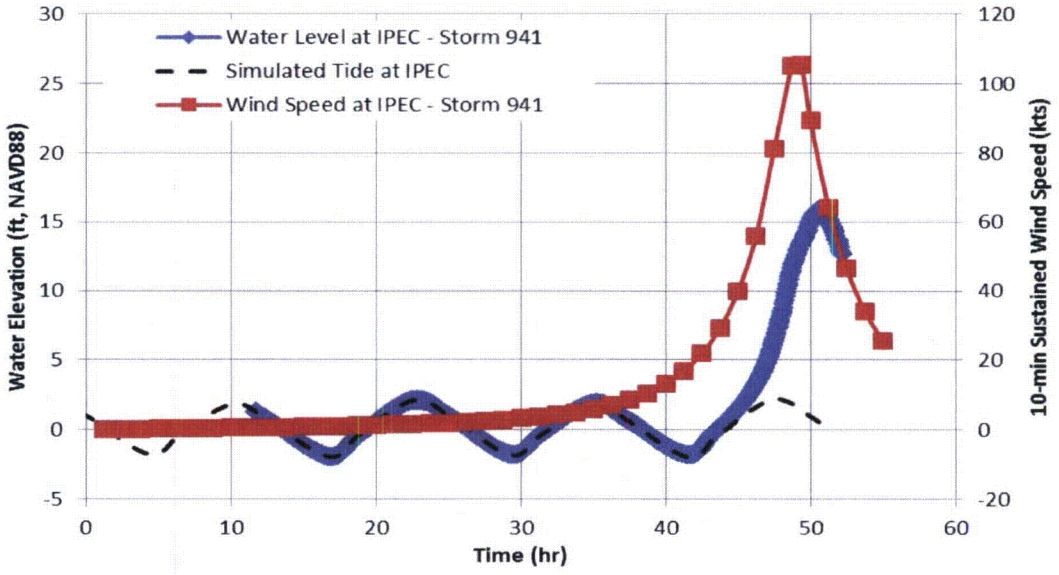


Figure 3.4-29: Comparison of Water Levels on Hudson River of ADCIRC and SLOSH Models – Storm 985*



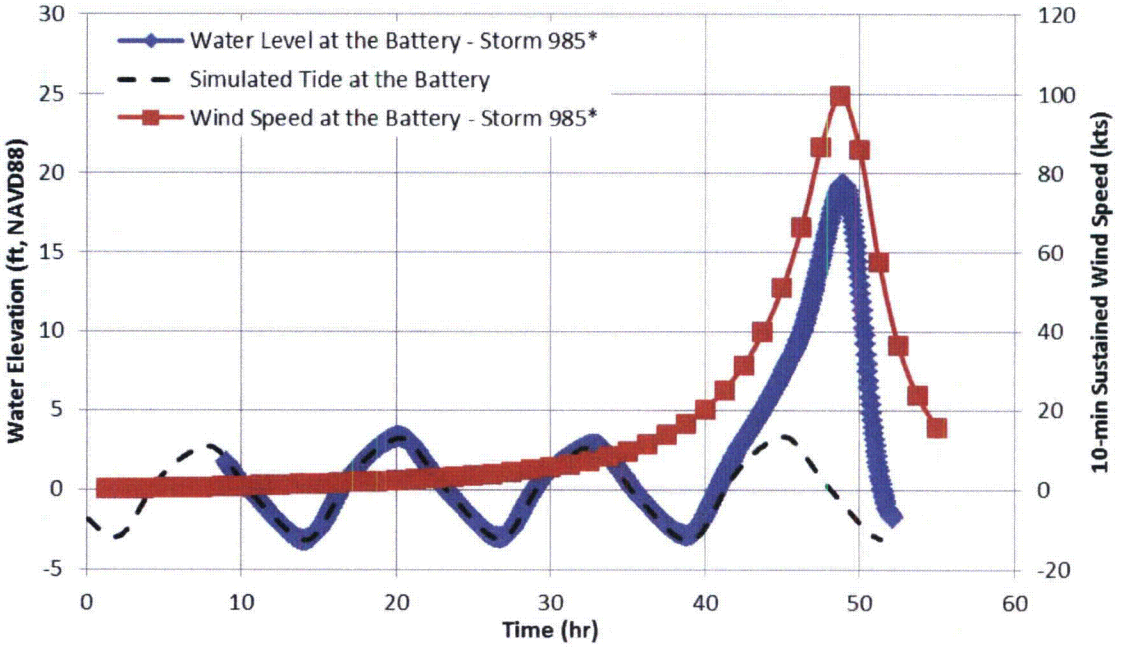
(a) The Battery



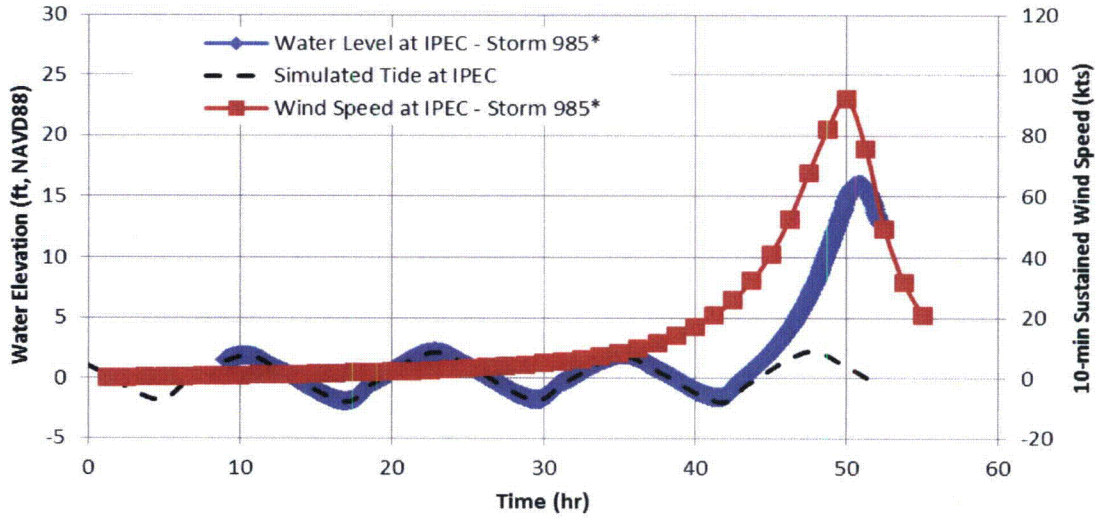
(b) IPEC

Figure 3.4-30: Time Series of Wind and Storm Tide Stillwater Elevation – Storm No. 941

Note: Hurricane (wind) decay after landfall not applied for Storm No. 941.



(a) The Battery



(b) IPEC

Figure 3.4-31: Time Series of Wind and Storm Tide Stillwater Elevation – Storm No. 985*

Note: Hurricane (wind) decay after landfall applied for Storm No. 985*.

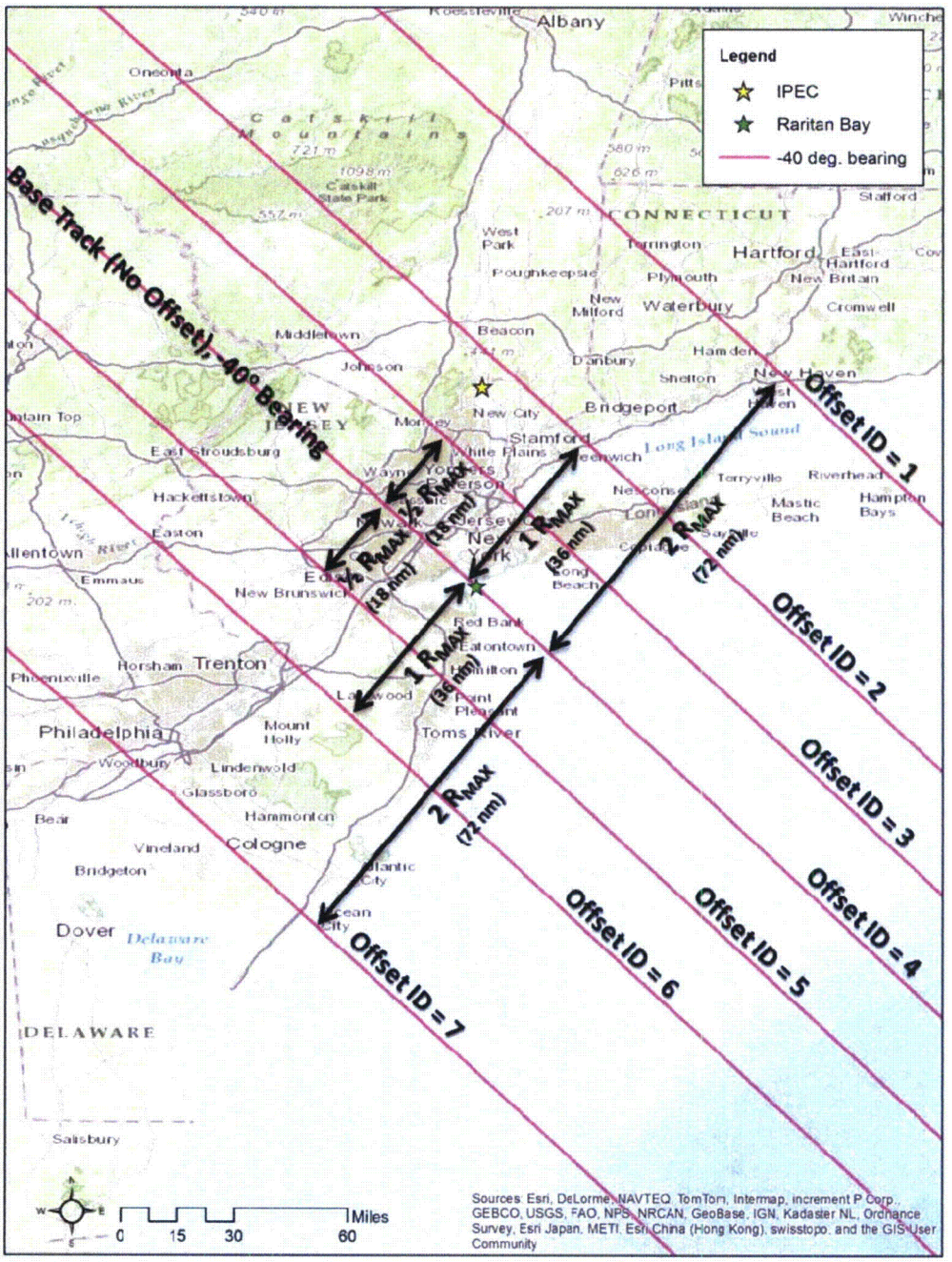


Figure 3.4-32: Example Storm Tracks (θ=-40 degree bearing) with Offset Calculation (Offset IDs Indicated) from Base Track

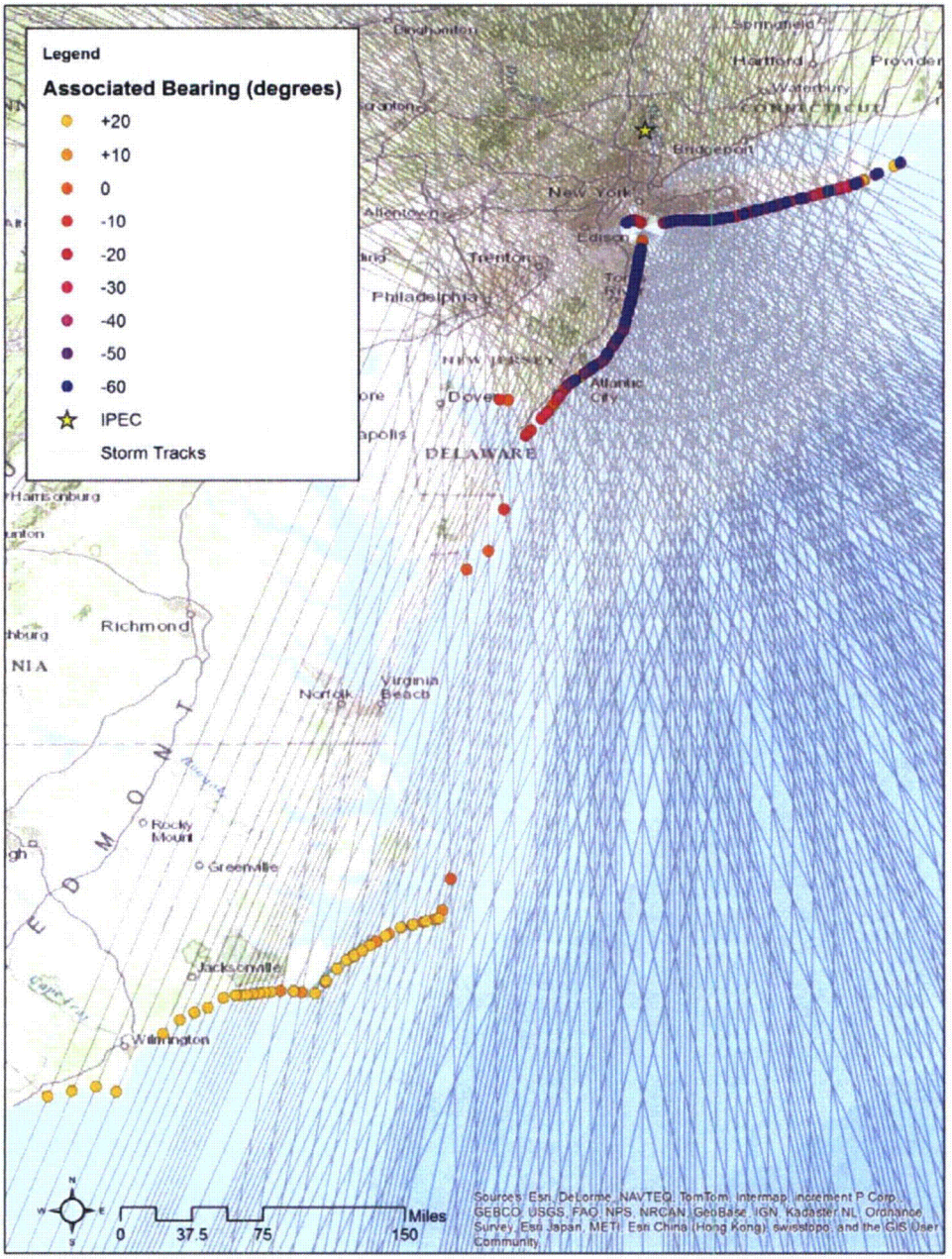


Figure 3.4-33: Landfall Points for the JPM Synthetic Storms Shown by Associated Storm Track Bearing (θ) in Degrees

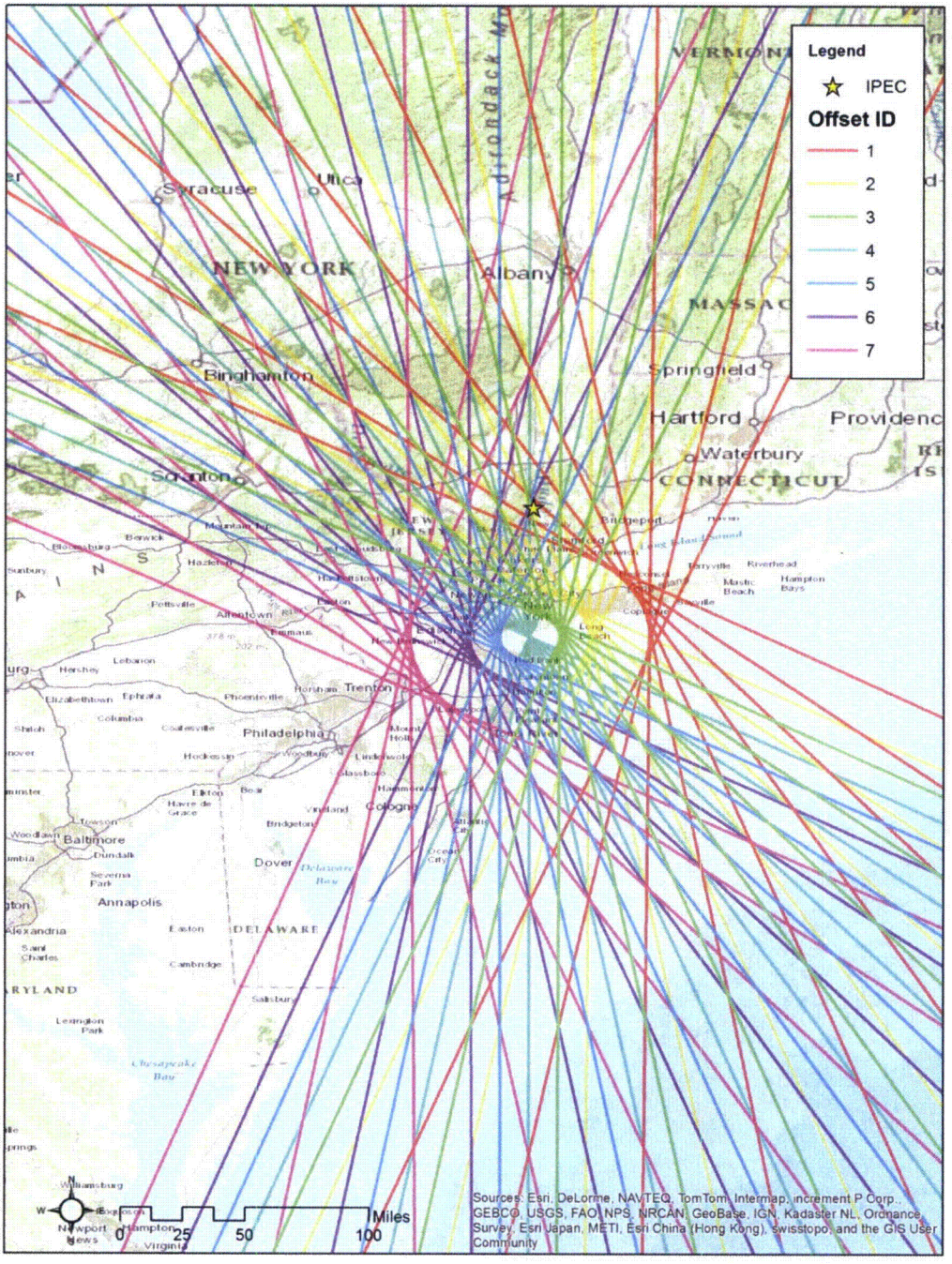


Figure 3.4-34: Storm Tracks (R_{max} = 16 nautical miles) for the JPM Synthetic Storms

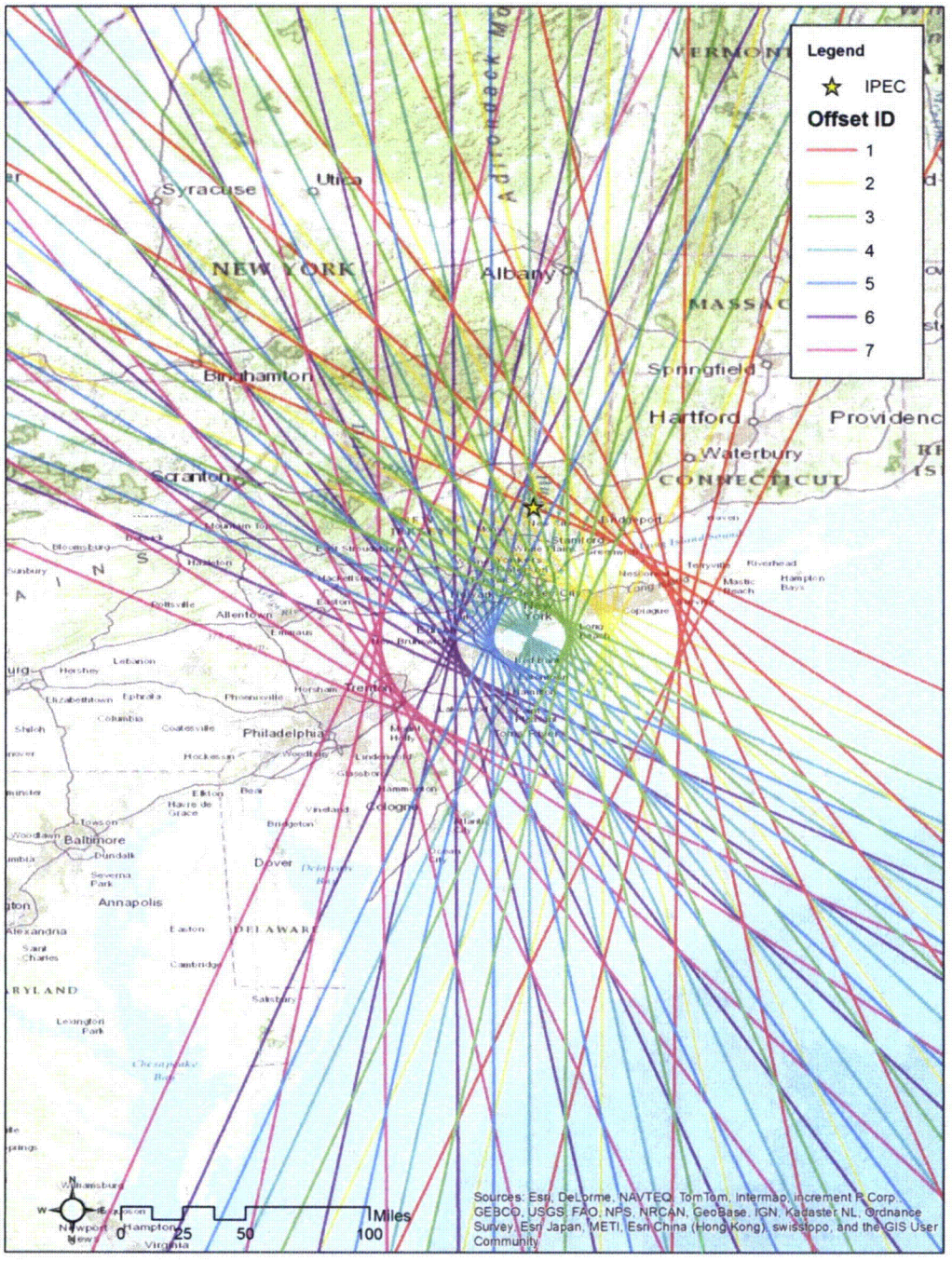


Figure 3.4-35: Storm Tracks (R_{max} = 20 nautical miles) for the JPM Synthetic Storms

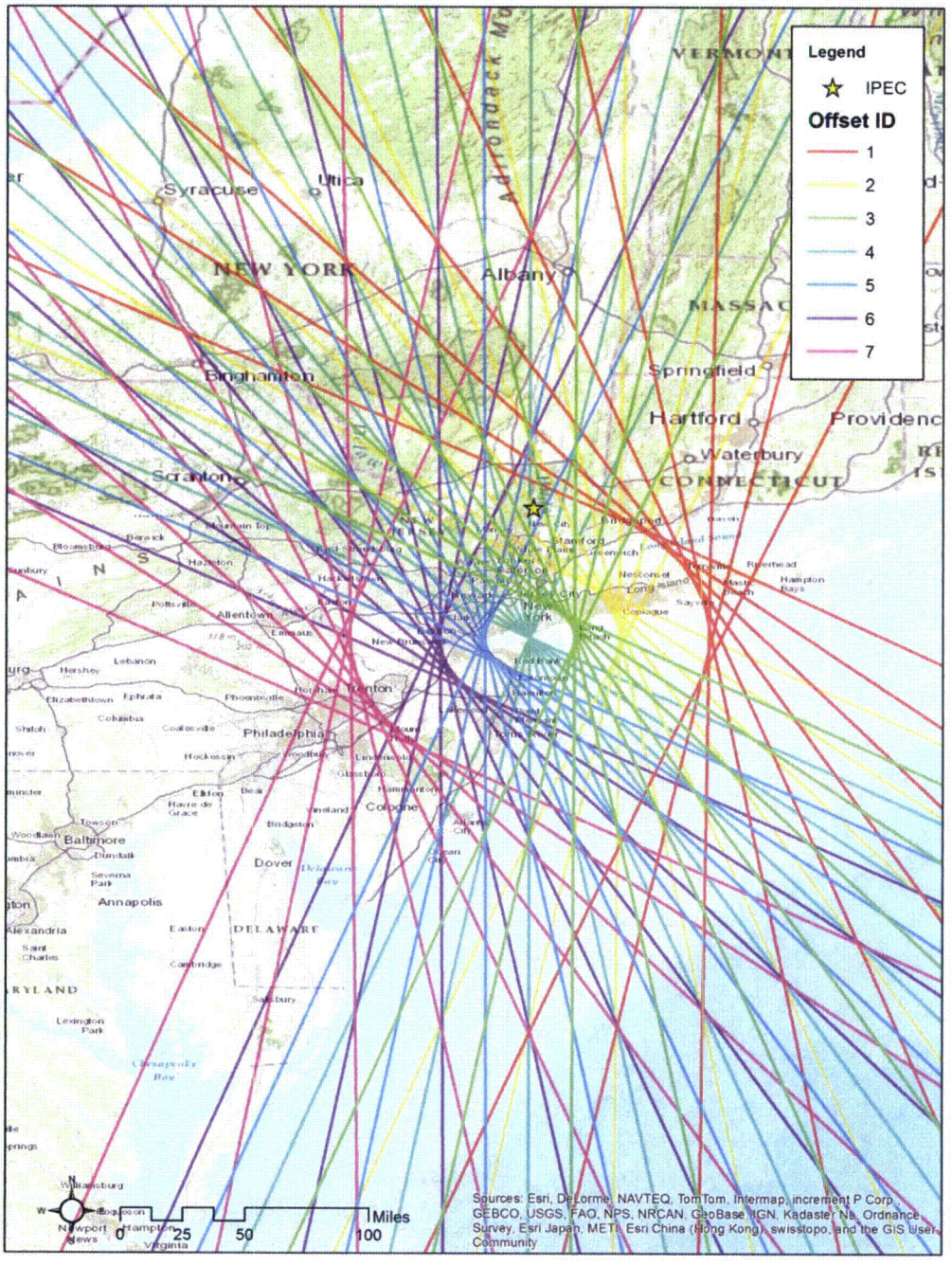


Figure 3.4-36: Storm Tracks (R_{max} = 24 nautical miles) for the JPM Synthetic Storms

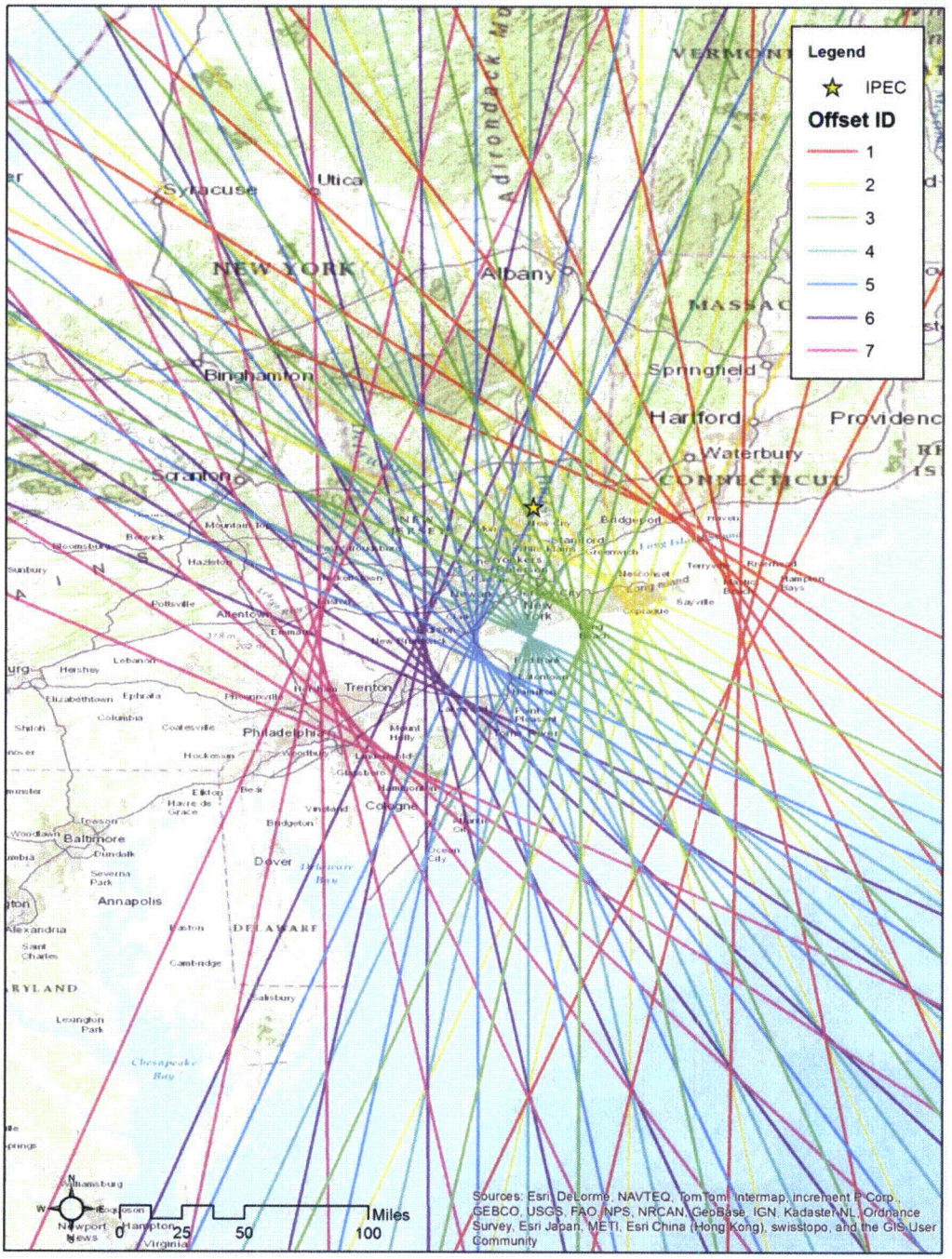


Figure 3.4-37: Storm Tracks (R_{max} = 28 nautical miles) for the JPM Synthetic Storms

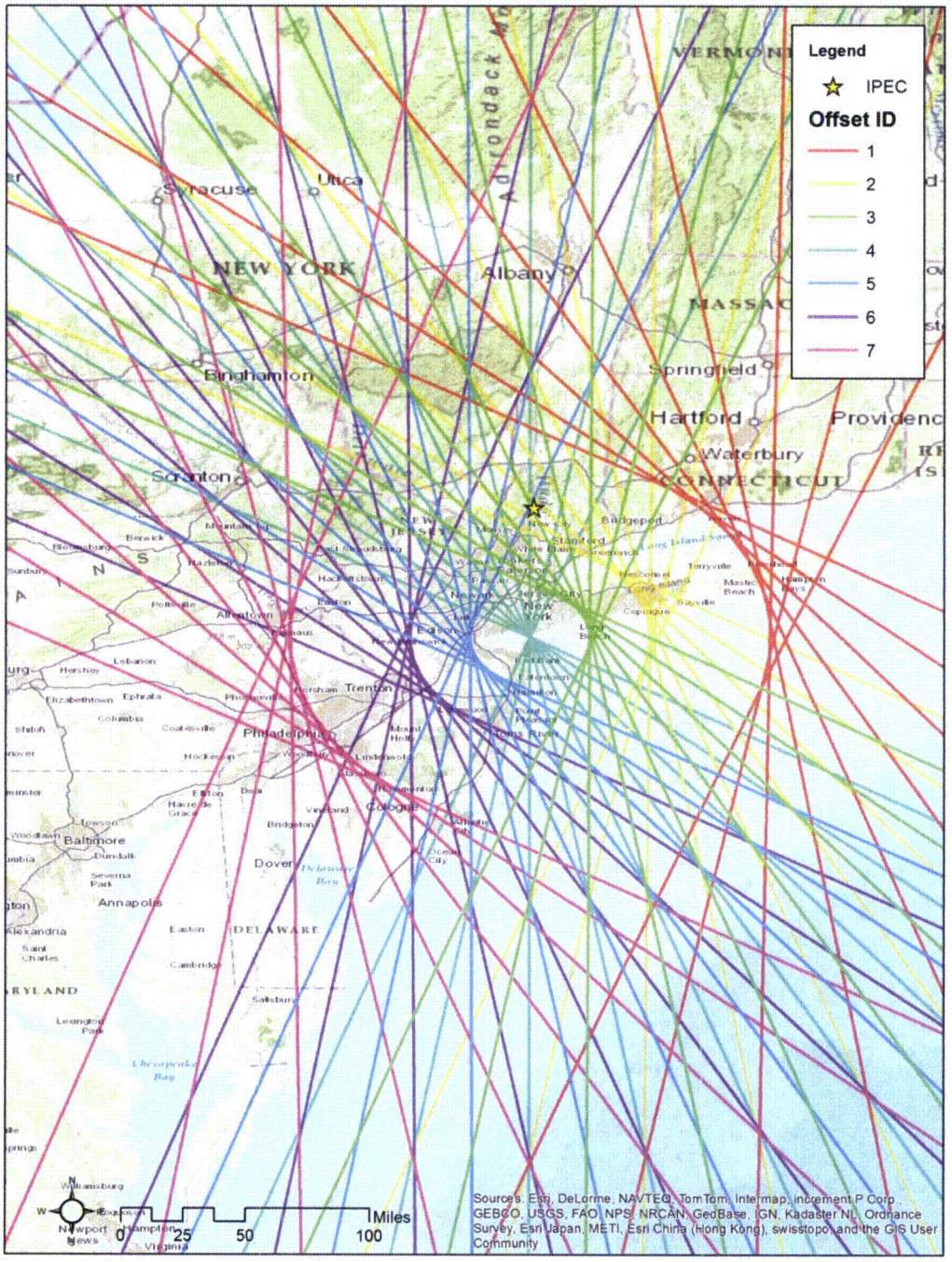


Figure 3.4-38: Storm Tracks (R_{max} = 32 nautical miles) for the JPM Synthetic Storms

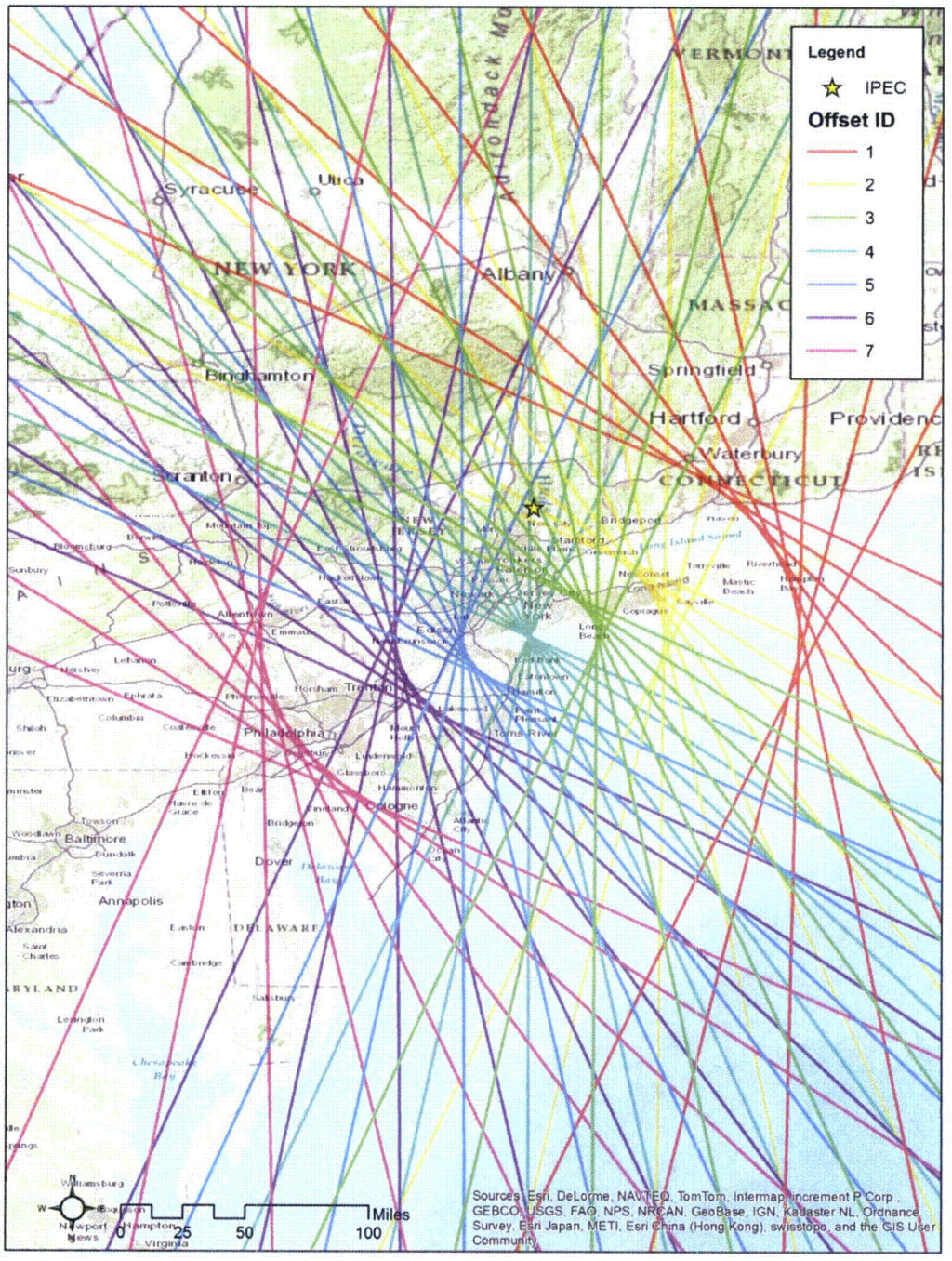


Figure 3.4-39: Storm Tracks (R_{max} = 36 nautical miles) for the JPM Synthetic Storms

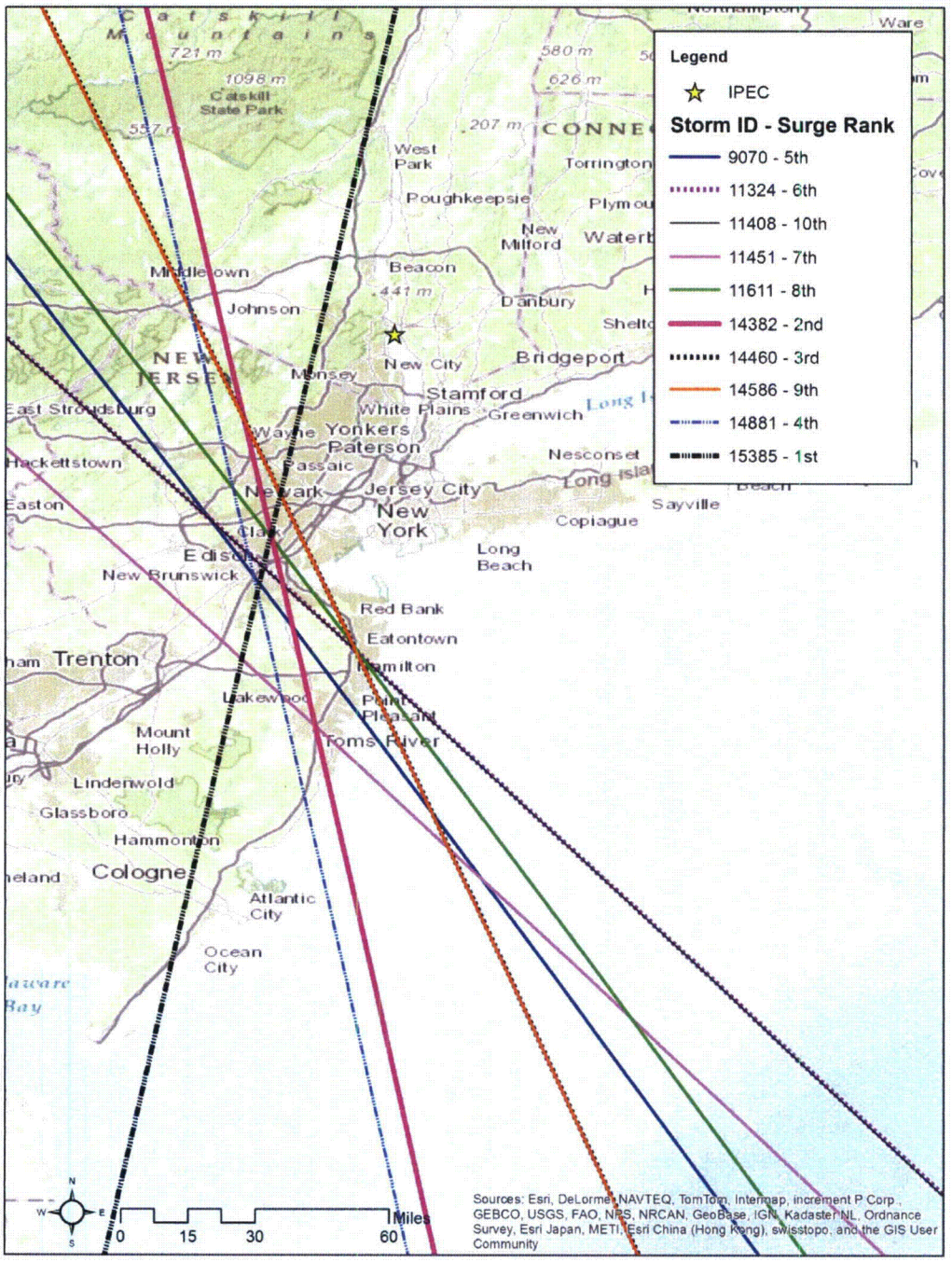


Figure 3.4-40: Tracks for Top 10 SLOSH-Calculated Surge Events at IPEC Shown by Numeric Storm Identification and Surge Ranking

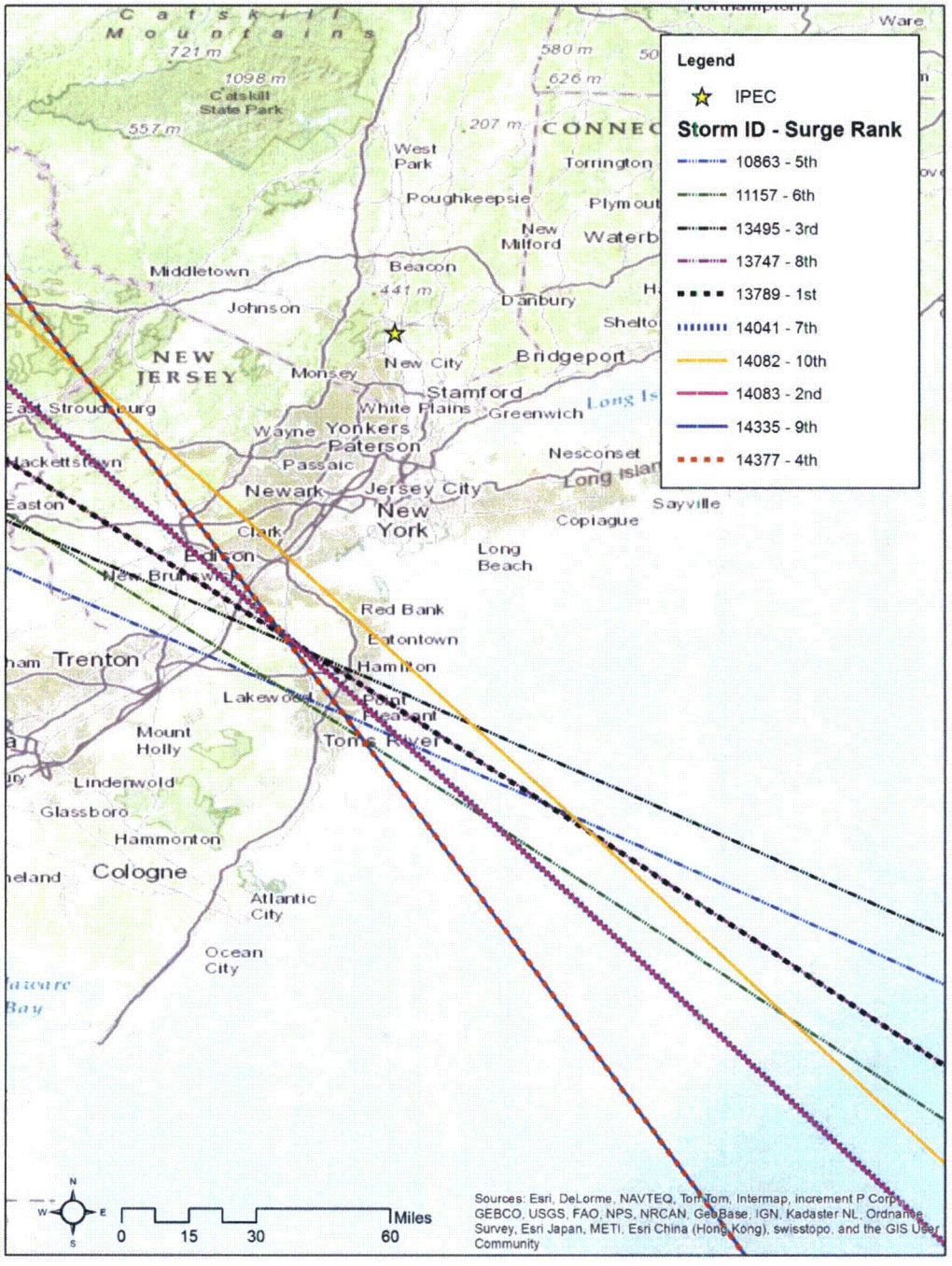


Figure 3.4-41: Tracks for Top 10 SLOSH-Calculated Surge Events at The Battery Shown by Numeric Storm Identification and Surge Ranking

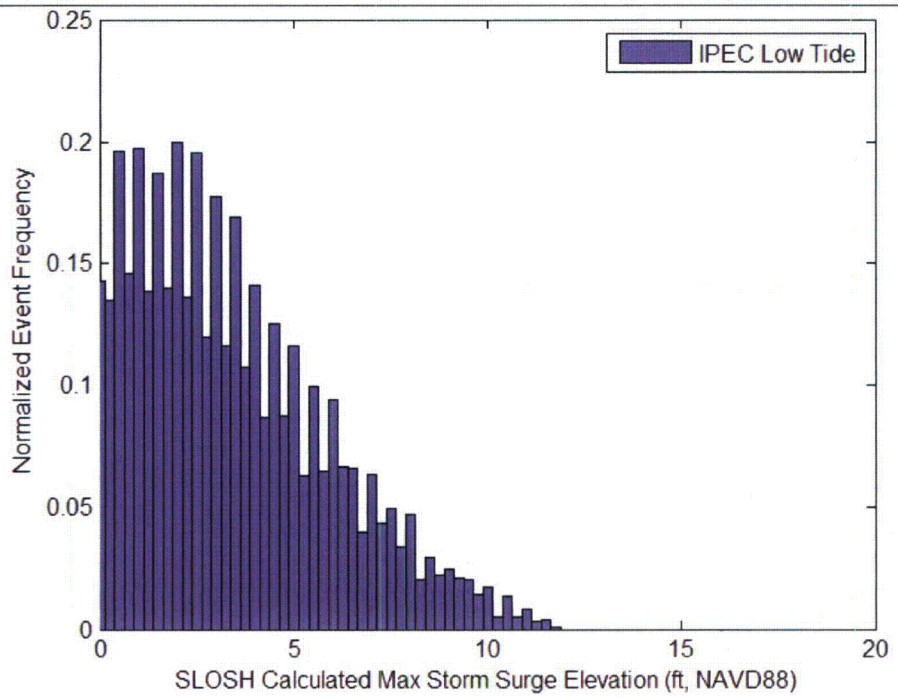


Figure 3.4-42: Histogram of Maximum Storm Surge at IPEC at Low Tide

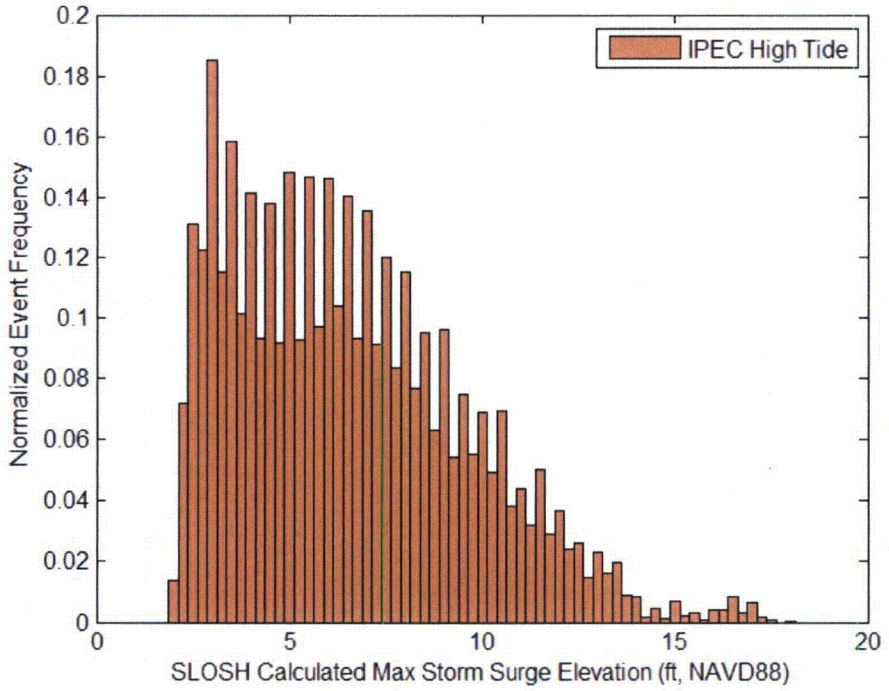


Figure 3.4-43: Histogram of Maximum Storm Surge at IPEC at High Tide

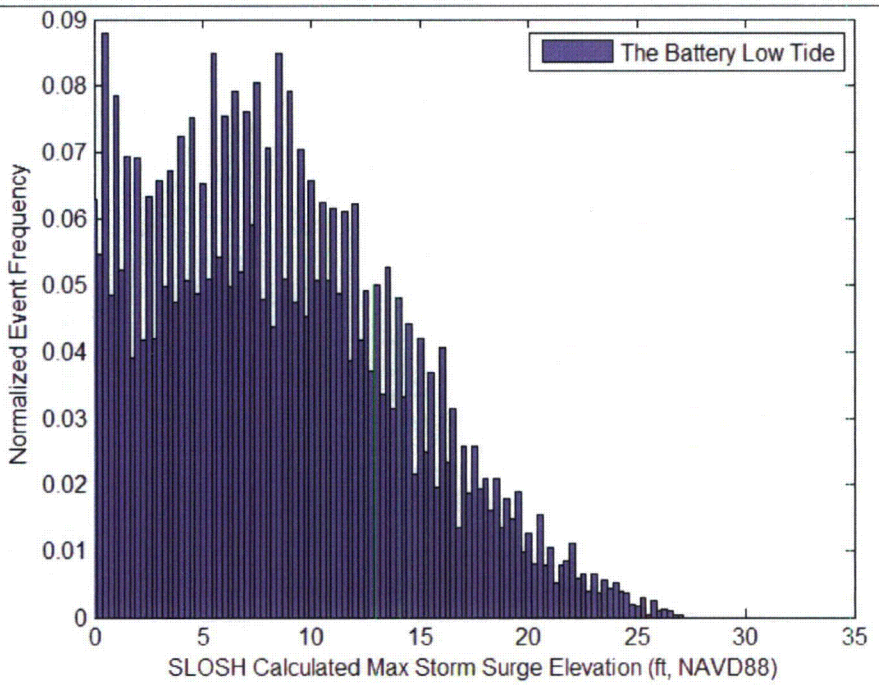


Figure 3.4-44: Histogram of Maximum Storm Surge at The Battery at Low Tide

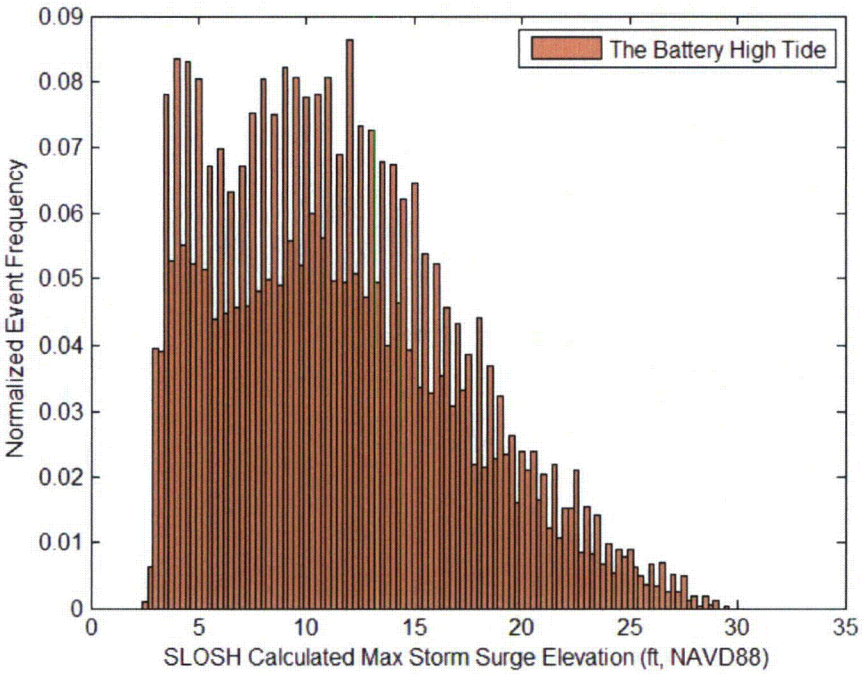


Figure 3.4-45: Histogram of Maximum Storm Surge at The Battery at High Tide

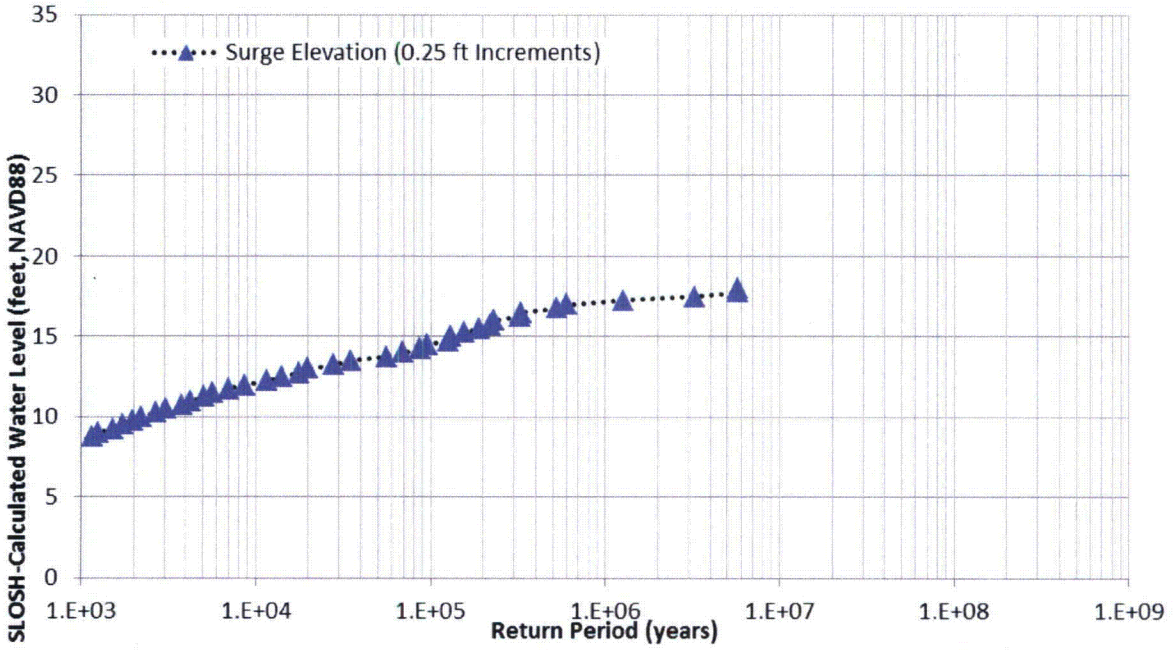


Figure 3.4-46: SLOSH-Calculated Storm Tide (Stillwater) Stage-Frequency Curve at IPEC

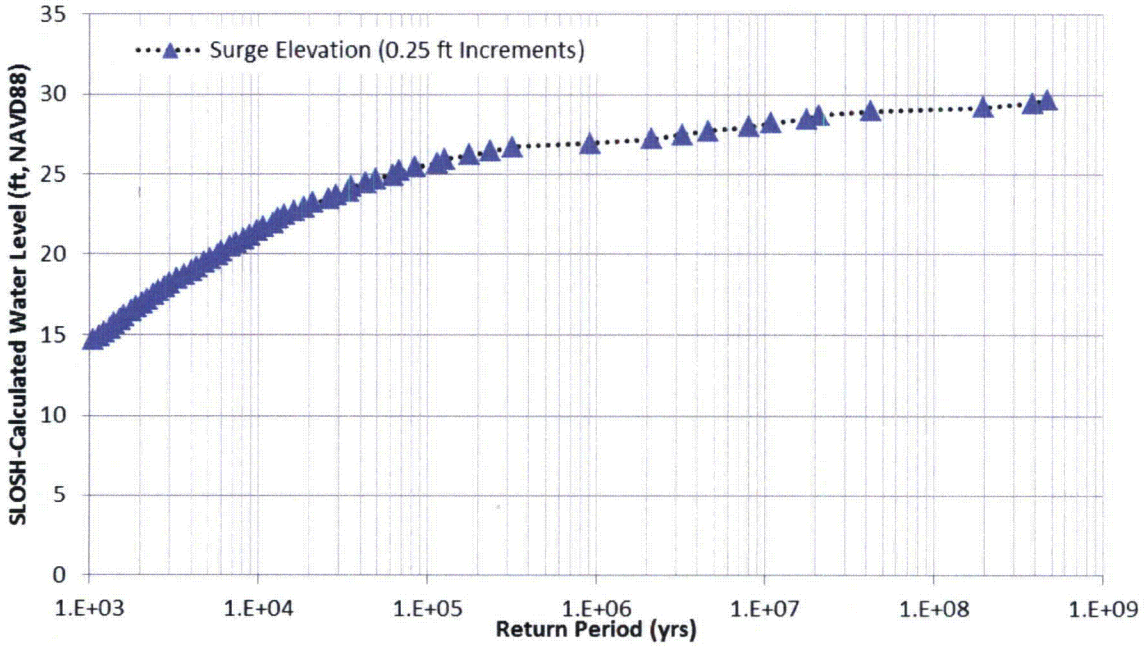


Figure 3.4-47: SLOSH-Calculated Storm Tide (Stillwater) Stage-Frequency Curve at The Battery

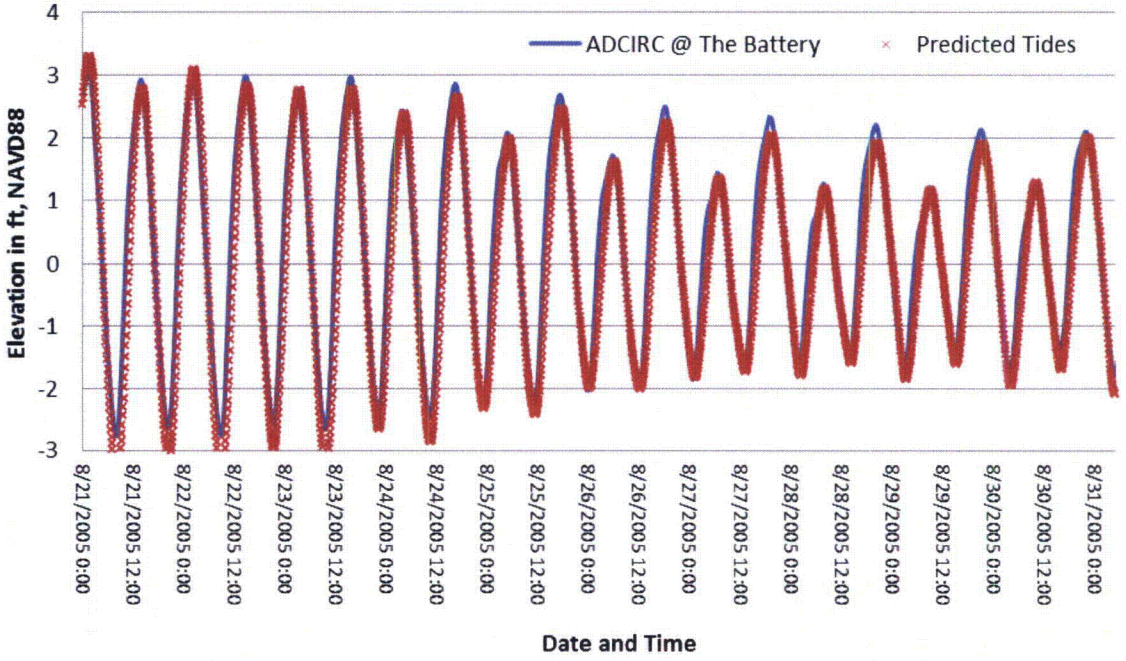


Figure 3.4-48: Comparison of ADCIRC Tidal Results to Predicted Tides at The Battery

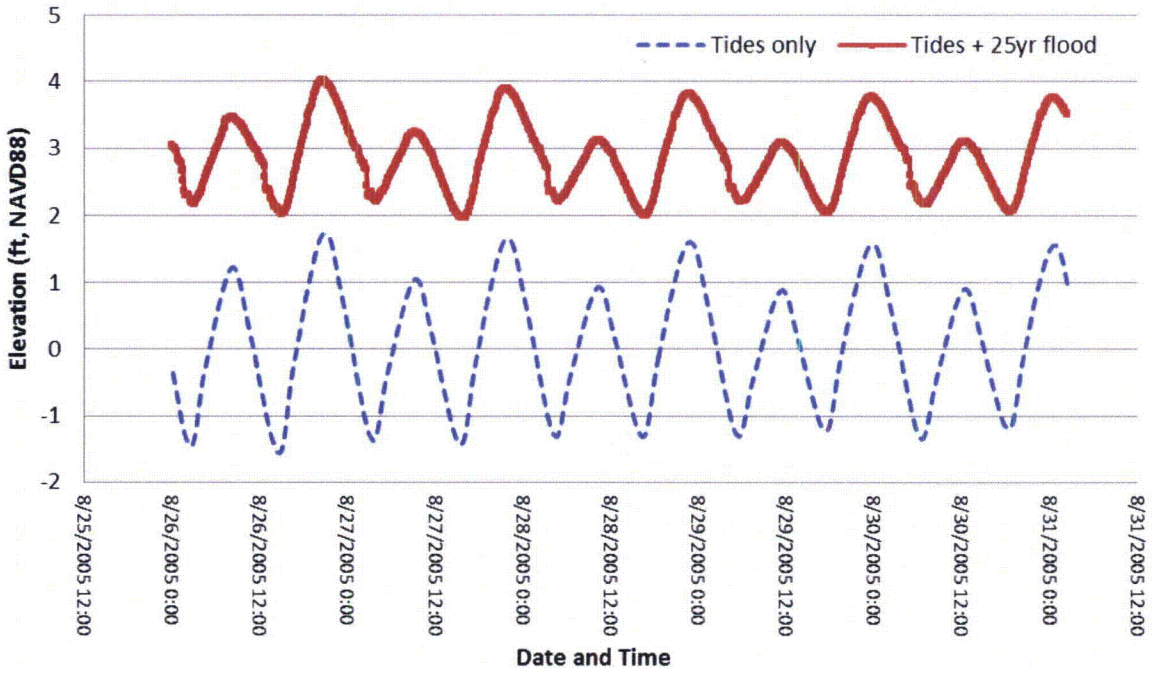


Figure 3.4-49: ADCIRC Tidal Results with 25-year Flood in the Hudson River at IPEC

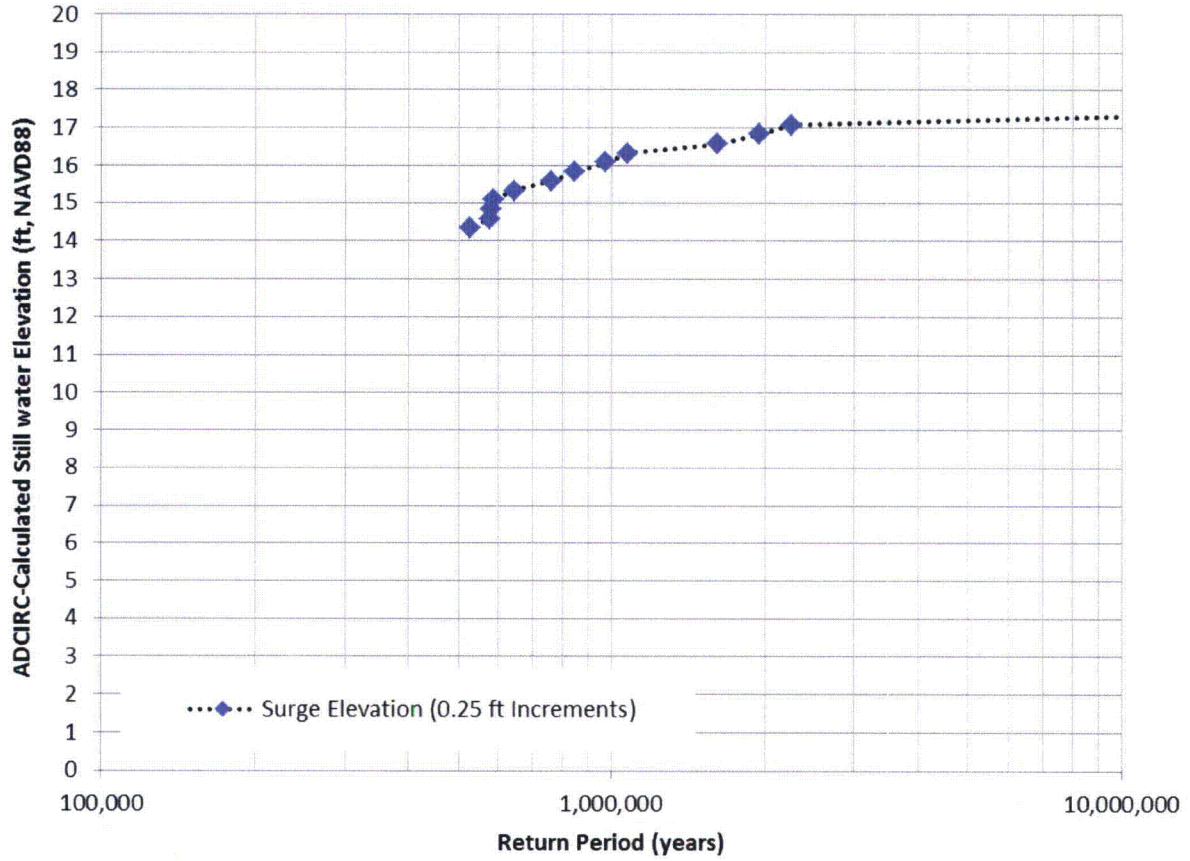
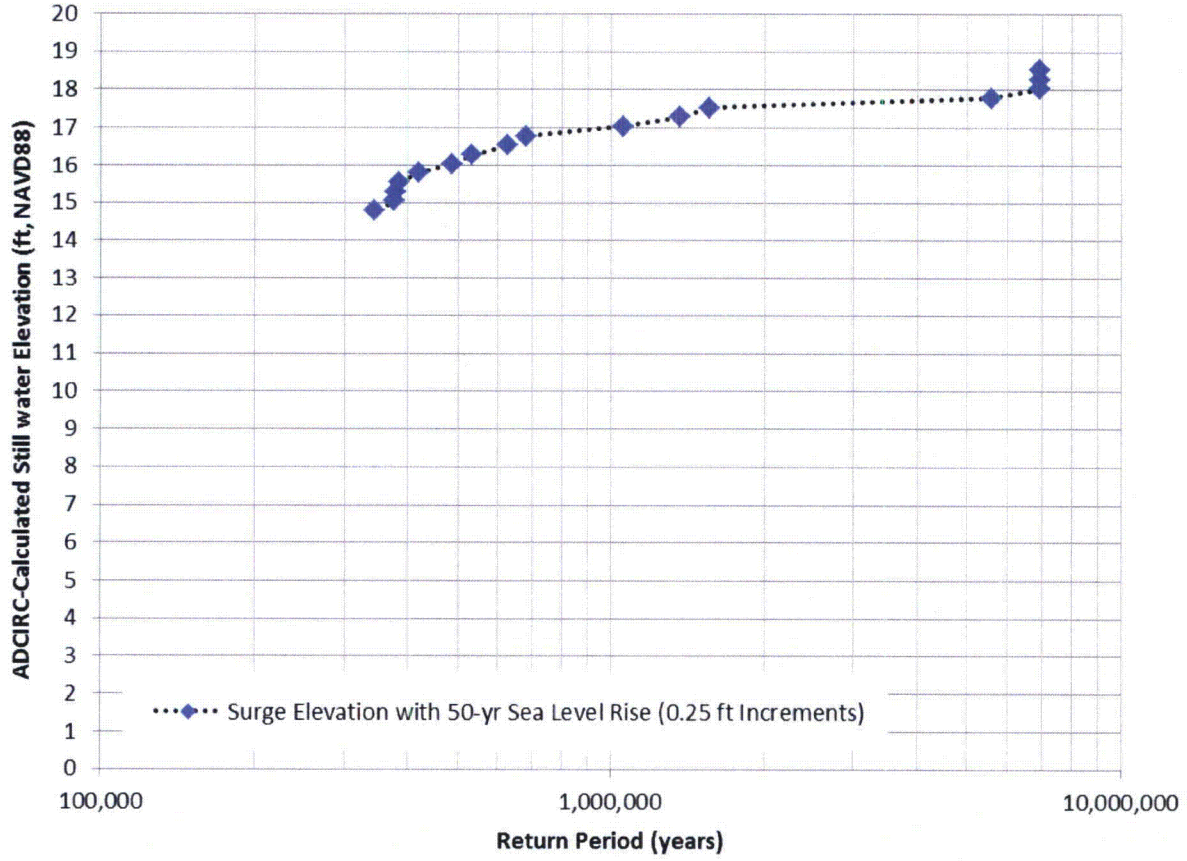


Figure 3.4-50: ADCIRC-Calculated Storm Tide (Stillwater) Stage-Frequency Curve at IPEC without Sea Level Rise



Notes:

1. On Figure 51, each data point represents a set of storm simulations that falls within each surge increment.
2. Point stacking at the return period around $7x10^6$ years is due to the gap between calculated storm tide values of 18.08 feet and 17.22 feet NAVD88.

Figure 51: ADCIRC-Calculated Storm Tide (Stillwater) Stage-Frequency Curve at IPEC with Sea Level Rise

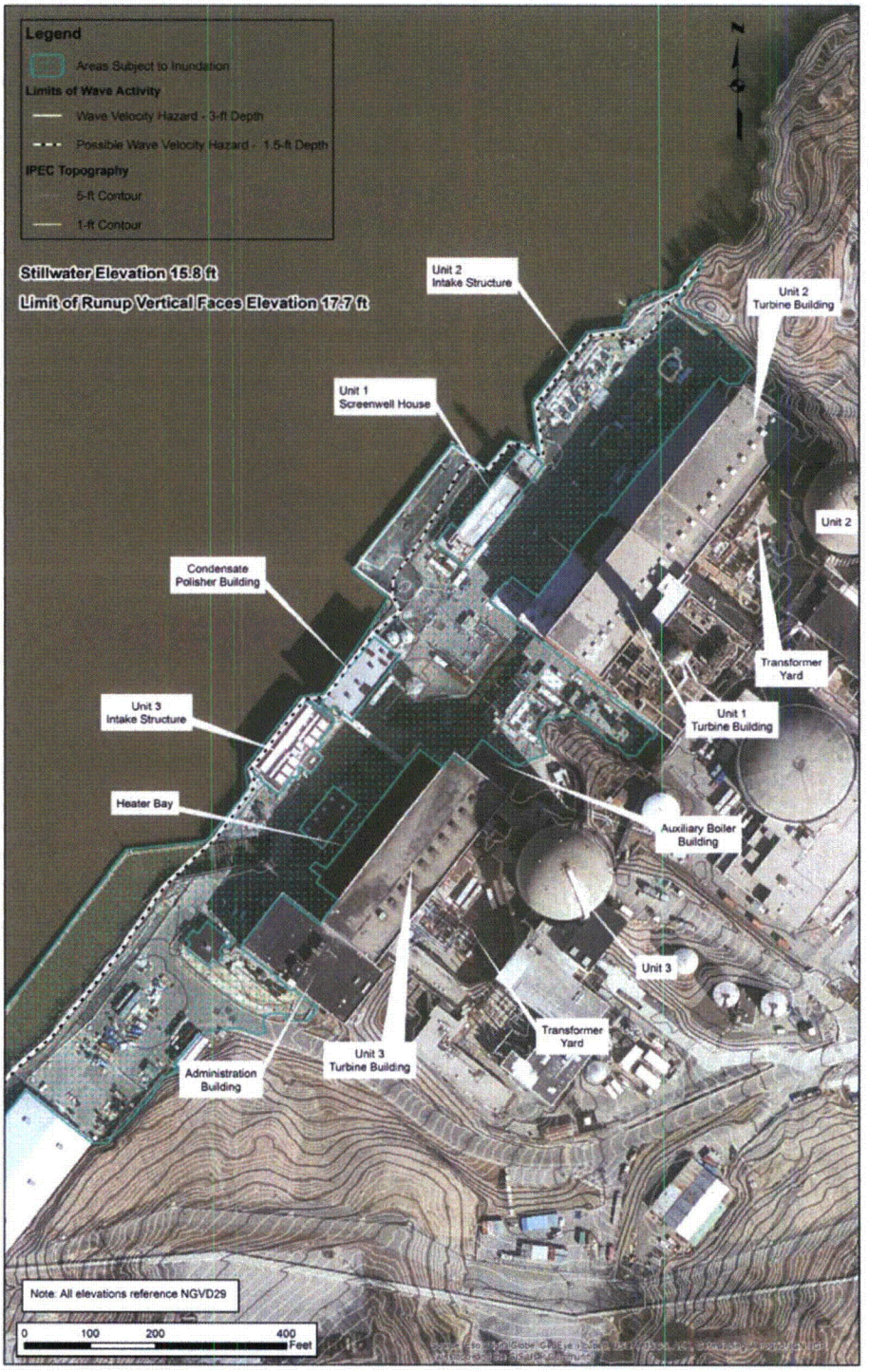


Figure 3.4-52: Inundation Map – Combined Effect Flood - Probabilistic Storm Surge