

Prepared in cooperation with the Federal Emergency Management Agency
and U.S. Army Corps of Engineers

Monitoring Inland Storm Tide and Flooding from Hurricane Irene along the Atlantic Coast of the United States, August 2011



Open-File Report 2012–1022

U.S. Department of the Interior
U.S. Geological Survey

Cover photographs.

Top: House damaged by Hurricane Irene (Jonathan J. Graham, USGS)

Lower left: USGS employee deploying a storm-tide sensor (Frank Melendez, USGS)

Lower right: USGS employee programming a rapid-deployment gage (Andrew E. Knaak, USGS)

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U.S. Geological Survey

U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2012

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Monitoring Inland Storm Tide and Flooding from Hurricane Irene along the Atlantic Coast of the United States, August 2011

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The U.S. Geological Survey (USGS) deployed a temporary monitoring network of water-level sensors at 212 locations along the Atlantic coast from South Carolina to Maine during August 2011 to record the timing, areal extent, and magnitude of inland hurricane storm tide and coastal flooding generated by Hurricane Irene (table 1; fig. 1). Water-level sensor locations were selected to augment existing tide-gage networks to ensure adequate monitoring in areas forecasted to have substantial storm tide. As defined by the National Oceanic and Atmospheric Administration (NOAA; 2011a,b), storm tide is the water-level rise generated by a coastal storm as a result of the combination of storm surge and astronomical tide.

Hurricane Irene initially made landfall on the coast of North Carolina near Beaufort on August 27, 2011, as a category 1 hurricane on the Saffir-Simpson hurricane scale (National Hurricane Center, 2010), and after traversing the coast and Outer Banks of North Carolina, the storm went back out to sea and made a second landfall as a category 1 hurricane near Atlantic City, New Jersey, on August 28. Of the 212 locations monitored, 202 sensors recorded a storm tide. Three water-level sensors were lost or malfunctioned during the storm, and five sensors did not record storm tide because of either a lack of water-level rise above astronomical tide or a storm tide lower than the elevation of the sensor.

A typical storm tide sensor installation is shown in figure 2. At the 202 locations, these sensors were programmed to record water pressure at a 30-second interval, which was converted to water level in feet above the North American Vertical Datum of 1988 (NAVD 88). In addition, 75 of the 202 sites included a sensor to record barometric pressure at a 30-second interval, expressed in pounds per square inch. Water-level elevation and barometric pressure were recorded over time by the sensors during the storm, as shown by the example graph for a single location in figure 3. A high-water mark (HWM) was flagged and surveyed near each sensor in order to verify the peak value recorded by the sensor. Eight additional locations were instrumented with rapid deployment

gages, which were real-time water-level sensors that recorded water-level elevations every 15 minutes and updated hourly to USGS Web pages (table 1; fig. 4). Lastly, wave height was measured every 2 seconds at two locations near the mouth of Chesapeake Bay near Norfolk, Virginia. The total number of sensors deployed in each State are shown in table 1.

Data were collected and processed following protocols established by McGee and others (2005), which includes correcting water pressure for changes in barometric pressure and salinity. Quality-control checks were made by (1) co-locating water-level sensors at a subset of sites and comparing data from those sensors to water levels computed from recorded pressure data at the sites, and (2) comparing water levels computed from recorded pressure data to water levels recorded at nearby USGS streamgages in addition to nearby high-water marks, to the extent possible. In the aftermath of the storm, an additional 137 independent high-water mark locations were surveyed in relation to NAVD 88; 104 locations in North Carolina, 14 locations in New York and 19 locations in Virginia. Elevation surveys using survey-grade global positioning systems (fig. 5) and differential levels were conducted to relate all water-level data, HWM data, reference marks, new benchmarks, and sensor measuring points to NAVD 88.

The data from the Hurricane Irene storm-tide network constitute an extensive collection of continuous water-level records that document a single land-falling hurricane. The data can be used to evaluate the performance of storm-tide models for (1) maximum and incremental water level, (2) flood extent, and (3) site-specific effects of storm tide on natural and anthropogenic elements of the environment. The data from the temporarily deployed sensors are considered approved, while the streamgage or tidal gage data are being made available on a provisional basis because they are subject to the USGS annual data report approval process. All data are presented in tab-delineated, ASCII format for each sensor location by using a USGS interactive storm-tide mapper Web application available at <http://wim.usgs.gov/stormtidemapper/stormtidemapper.html#>.

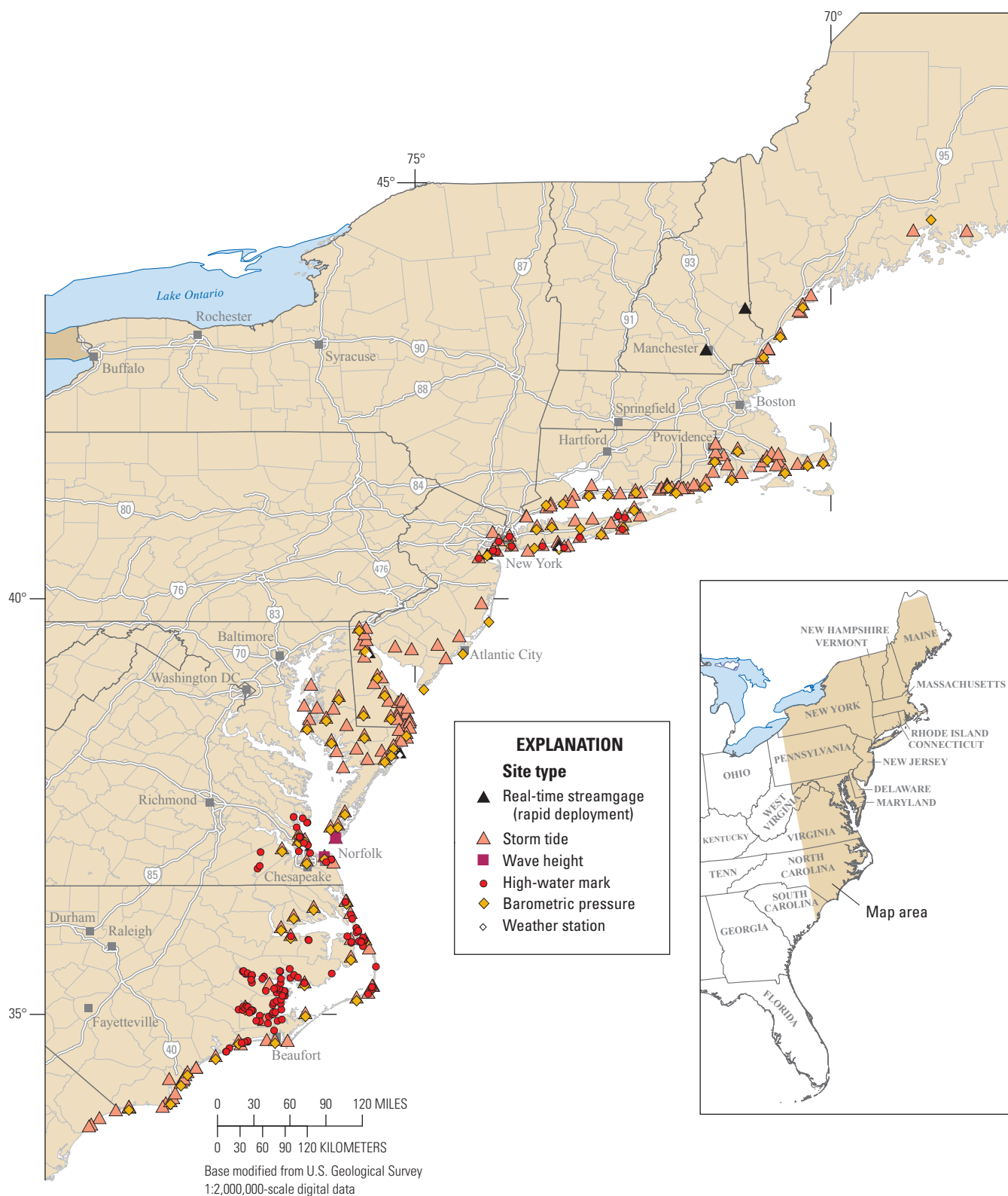


Figure 1. Locations of sensors and high-water mark data-collection sites to monitor the effects of Hurricane Irene, August 2011.

Table 1. U.S. Geological Survey data-collection sites equipped to monitor Hurricane Irene storm tide in 2011, by State.

State	Type and number of sensors deployed			
	Storm tide	Wave height	Real-time rapid deployment gages	Barometric pressure
South Carolina	4	0	0	0
North Carolina	42	0	1	19
Virginia	11	2	1	9
Maryland	25	0	0	9
Delaware	27	0	2	6
New Jersey	6	0	0	3
New York	25	0	2	10
Connecticut	21	0	0	6
Rhode Island	16	0	0	4
Massachusetts	14	0	0	5
New Hampshire	4	0	2	1
Maine	7	0	0	3
Total	202	2	8	75

Digital photographs of select locations also are available from the interactive mapper. Data for each sensor include location, date, time, water level, and barometric pressure and the data-processing date is provided in the file header. Data files for HWMs include location, type and quality of the mark, and elevation. The interactive mapper also includes wave-height data collected in collaboration with the North Carolina Sea Grant and The University of North Carolina, Institute of Marine Sciences.

A list of the 212 temporarily deployed storm-tide sensor locations and the peak storm-tide elevation recorded by each sensor are provided in table 2. Data-collection sites were categorized as surge, riverine, or wave height with respect to the interval of data collected and the site proximity to the coast. Riverine sites can be influenced by upstream runoff from inland flooding. Permanent monitoring network data at 80 locations that are operated by the USGS and were augmented by the temporary sensors are provided in table 3 and 46 locations that are operated by NOAA are provided in table 4. Additional NOAA water-level and meteorological data for Hurricane Irene that include affected areas outside the USGS deployment region were released recently by Fanelli and Fanelli (2011). A listing of the additional HWM data collected and surveyed following the passage of Hurricane Irene are presented in table 5.



Figure 2. USGS employee deploys storm-tide sensor at Wrightsville Beach, North Carolina, August 25, 2011 (photo by Frank Melendez, USGS).

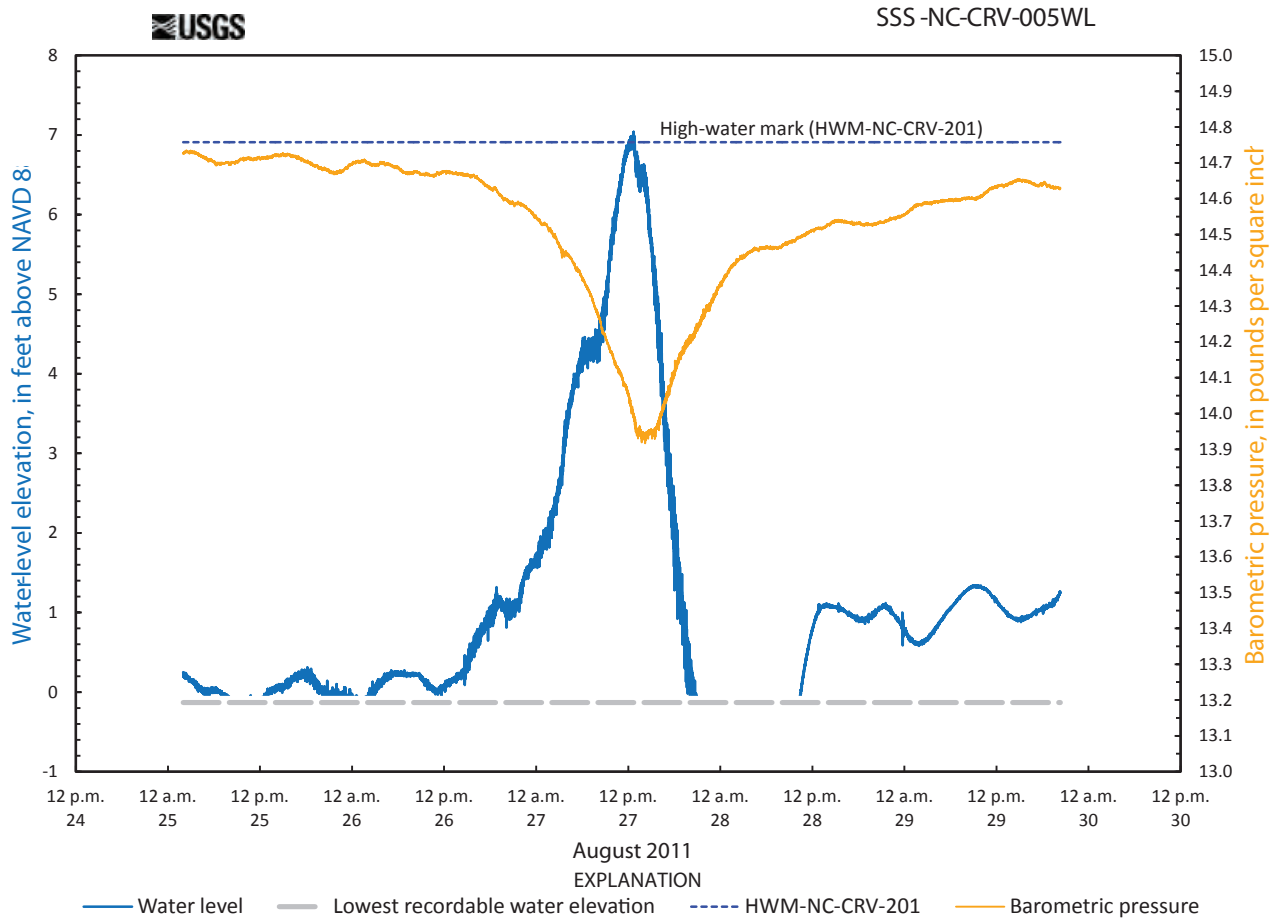


Figure 3. Example of storm-tide elevation hydrograph and barometric pressure recorded at the Bridgeport Hotel and Marina in Craven County, NC (SSS-NC-CRV-005WL), during Hurricane Irene in 2011, including nearby high-water mark elevations (HWM-NC-CRV-201).



Figure 4. USGS employee installing rapid deployment real-time water-level gage at a site near Norfolk, Virginia (photograph by Andrew E. Knaak, USGS).



Figure 5. Typical global positioning system equipment used to survey storm-tide elevation after Hurricane Irene (photograph by Jonathan J. Graham, USGS).

Acknowledgments

This report was prepared in cooperation with the Federal Emergency Management Agency and U.S. Army Corps of Engineers. The data in this report are the result of tireless hours by numerous staff in USGS Water Science Centers in South Carolina, North Carolina, Virginia, Maryland, Delaware, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, Maine, and Georgia. The authors would like to particularly highlight the leadership and dedication of USGS employees in North Carolina, Virginia, and Maryland in delivering valuable data to numerous stakeholders in a very timely and accurate manner.

References Cited

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Tables 2–5

Table 2. Hurricane Irene peak storm-tide data for 212 U.S. Geological Survey temporarily-deployed sites, by State.

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time; RDG, rapid-deployment gage]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Peak storm-tide date and time (GMT)
SSS-CT-FFD-001WL	Connecticut	Fairfield	40.99910	-73.65944	water level	storm tide	8.61	8/28/2011 14:31:00
SSS-CT-FFD-002WL	Connecticut	Fairfield	40.99483	-73.65903	water level	storm tide	8.81	8/28/2011 14:40:00
SSS-CT-FFD-003WL	Connecticut	Fairfield	41.09979	-73.41568	water level	storm tide	8.66	8/28/2011 14:36:00
SSS-CT-FFD-005WL	Connecticut	Fairfield	41.14762	-73.36481	water level	storm tide	9.22	8/28/2011 14:47:30
SSS-CT-FFD-006WL	Connecticut	Fairfield	41.12310	-73.36998	water level	storm tide	8.87	8/28/2011 14:52:00
SSS-CT-FFD-007WL	Connecticut	Fairfield	41.17593	-73.18581	water level	storm tide	8.52	8/28/2011 15:09:30
SSS-CT-FFD-009WL	Connecticut	Fairfield	41.25325	-73.08843	water level	riverine	9.96	8/28/2011 15:56:00
SSS-CT-FFD-010WL	Connecticut	Fairfield	41.16316	-73.10901	water level	storm tide	9.08	8/28/2011 15:12:00
SSS-CT-MSX-018WL	Connecticut	Middlesex	41.26919	-72.52936	water level	storm tide	6.72	8/28/2011 15:01:30
SSS-CT-MSX-019WL	Connecticut	Middlesex	41.28111	-72.35222	water level	storm tide	6.29	8/28/2011 14:33:00
SSS-CT-NHV-013WL	Connecticut	New Haven	41.27221	-72.90479	water level	storm tide	8.43	8/28/2011 15:30:00
SSS-CT-NHV-014WL	Connecticut	New Haven	41.36722	-72.87500	water level	riverine	6.66	8/28/2011 16:55:30
SSS-CT-NHV-017WL	Connecticut	New Haven	41.27178	-72.66361	water level	storm tide	8.03	8/28/2011 15:02:30
SSS-CT-NLD-022WL	Connecticut	New London	41.31250	-72.34608	water level	storm tide	5.99	8/28/2011 14:59:00
SSS-CT-NLD-023WL	Connecticut	New London	41.28428	-72.27758	water level	storm tide	6.99	8/28/2011 14:30:30
SSS-CT-NLD-025WL	Connecticut	New London	41.31675	-72.06092	water level	storm tide	5.07	8/28/2011 13:59:00
SSS-CT-NLD-026WL	Connecticut	New London	41.33497	-72.03550	water level	storm tide	4.38	8/28/2011 13:34:30
SSS-CT-NLD-027WL	Connecticut	New London	41.38081	-71.96792	water level	storm tide	4.56	8/28/2011 13:41:30
SSS-CT-NLD-028WL	Connecticut	New London	41.36028	-71.96467	water level	storm tide	4.58	8/28/2011 13:24:30
SSS-CT-NLD-029WL	Connecticut	New London	41.34667	-71.96767	water level	storm tide	4.41	8/28/2011 14:16:30
SSS-CT-NLD-030WL	Connecticut	New London	41.34433	-71.90947	water level	storm tide	4.57	8/28/2011 13:06:00
384031075041601	Delaware	Sussex	38.60822	-75.06317	real-time RDG	storm tide	3.20	8/28/2011 0:30:00

Table 2. Hurricane Irene peak storm-tide data for 212 U.S. Geological Survey temporarily-deployed sites, by State.—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time; RDG, rapid-deployment gage]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Peak storm-tide date and time (GMT)
392114075325901	Delaware	New Castle	39.35400	–75.54972	real-time RDG	storm tide	4.40	8/28/2011 4:30:00
SSS-DE-KEN-001WL	Delaware	Kent	39.08481	–75.45830	water level	riverine	4.68	8/28/2011 3:44:30
SSS-DE-KEN-002WL	Delaware	Kent	39.05853	–75.39781	water level	none	none	lost
SSS-DE-KEN-003WL	Delaware	Kent	38.98944	–75.49431	water level	riverine	5.03	8/28/2011 13:30:30
SSS-DE-NEW-001WL	Delaware	New Castle	39.30928	–75.60947	water level	storm tide	6.76	8/28/2011 9:48:30
SSS-DE-NEW-002WL	Delaware	New Castle	39.40531	–75.59861	water level	riverine	4.82	8/28/2011 6:29:30
SSS-DE-NEW-004WL	Delaware	New Castle	39.45258	–75.65453	water level	riverine	5.52	8/28/2011 4:59:00
SSS-DE-NEW-005WL	Delaware	New Castle	39.50494	–75.58025	water level	storm tide	5.77	8/28/2011 1:45:00
SSS-DE-NEW-006WL	Delaware	New Castle	39.57708	–75.60206	water level	storm tide	5.76	8/28/2011 2:20:30
SSS-DE-NEW-008WL	Delaware	Newcastle	39.65197	–75.58756	water level	storm tide	3.69	8/28/2011 10:08:00
SSS-DE-NEW-009WL	Delaware	Newcastle	39.65539	–75.66936	water level	riverine	16.83	8/28/2011 13:30:30
SSS-DE-SUS-004WL	Delaware	Sussex	38.87769	–75.35964	water level	riverine	3.30	8/28/2011 6:47:00
SSS-DE-SUS-006WL	Delaware	Sussex	38.77697	–75.31247	water level	riverine	4.82	8/28/2011 5:09:00
SSS-DE-SUS-007WL	Delaware	Sussex	38.76047	–75.20278	water level	riverine	3.57	8/28/2011 13:47:00
SSS-DE-SUS-008WL	Delaware	Sussex	38.79022	–75.16364	water level	storm tide	6.45	8/28/2011 0:50:00
SSS-DE-SUS-009WL	Delaware	Sussex	38.77564	–75.13825	water level	storm tide	4.72	8/28/2011 0:19:30
SSS-DE-SUS-010WL	Delaware	Sussex	38.69453	–75.08419	water level	storm tide	3.09	8/28/2011 3:27:30
SSS-DE-SUS-012WL	Delaware	Sussex	38.54131	–75.05983	water level	storm tide	2.38	8/28/2011 8:03:30
SSS-DE-SUS-014WL	Delaware	Sussex	38.51367	–75.06253	water level	storm tide	2.30	8/28/2011 14:14:00
SSS-DE-SUS-015WL	Delaware	Sussex	38.45489	–75.05814	water level	storm tide	2.72	8/28/2011 12:55:30
SSS-DE-SUS-030WL	Delaware	Sussex	38.70269	–75.16183	water level	riverine	3.29	8/28/2011 3:31:00
SSS-DE-SUS-031WL	Delaware	Sussex	38.67178	–75.18594	water level	riverine	3.55	8/28/2011 13:32:00

Table 2. Hurricane Irene peak storm-tide data for 212 U.S. Geological Survey temporarily-deployed sites, by State.—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time; RDG, rapid-deployment gage]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Peak storm-tide date and time (GMT)
SSS-DE-SUS-032WL	Delaware	Sussex	38.62542	-75.09992	water level	storm tide	3.18	8/28/2011 3:06:00
SSS-DE-SUS-033WL	Delaware	Sussex	38.59164	-75.21197	water level	riverine	5.01	8/28/2011 2:13:00
SSS-DE-SUS-034WL	Delaware	Sussex	38.59450	-75.28919	water level	riverine	4.49	8/28/2011 2:44:30
SSS-DE-SUS-036WL	Delaware	Sussex	38.55647	-75.20306	water level	riverine	4.31	8/28/2011 2:08:30
SSS-DE-SUS-037WL	Delaware	Sussex	38.48369	-75.11911	water level	riverine	2.15	8/28/2011 5:51:00
SSS-DE-SUS-038WL	Delaware	Sussex	38.63331	-75.61814	water level	riverine	2.51	8/28/2011 11:51:00
SSS-ME-CUM-001WL	Maine	Cumberland	43.65361	-70.23639	water level	storm tide	6.97	8/29/2011 3:27:30
SSS-ME-CUM-002WL	Maine	Cumberland	43.54472	-70.33389	water level	storm tide	6.68	8/29/2011 3:37:00
SSS-ME-HAN-001WL	Maine	Hancock	44.42278	-68.36417	water level	storm tide	7.67	8/29/2011 3:00:00
SSS-ME-WAL-001WL	Maine	Waldo	44.42917	-69.00583	water level	storm tide	2.78	8/29/2011 3:26:00
SSS-ME-YOR-001WL	Maine	York	43.44667	-70.35611	water level	storm tide	8.17	8/29/2011 2:49:00
SSS-ME-YOR-002WL	Maine	York	43.46222	-70.38194	water level	storm tide	6.73	8/29/2011 2:57:30
SSS-ME-YOR-003WL	Maine	York	43.18861	-70.60556	water level	storm tide	5.92	8/29/2011 3:14:00
SSS-MD-DOR-007WL	Maryland	Dorchester	38.57392	-76.06733	water level	storm tide	2.61	8/28/2011 7:09:30
SSS-MD-DOR-009WL	Maryland	Dorchester	38.55689	-76.27133	water level	storm tide	1.76	8/28/2011 4:04:00
SSS-MD-DOR-010WL	Maryland	Dorchester	38.48339	-75.82292	water level	riverine	2.01	8/28/2011 10:34:30
SSS-MD-DOR-033WL	Maryland	Dorchester	38.30058	-76.00547	water level	storm tide	1.42	8/28/2011 4:09:00
SSS-MD-DOR-034WL	Maryland	Dorchester	38.46956	-76.29333	water level	storm tide	2.08	8/28/2011 6:38:30
SSS-MD-QUA-001WL	Maryland	Queen Annes	38.97150	-76.24839	water level	storm tide	1.56	8/27/2011 23:43:00
SSS-MD-SOM-030WL	Maryland	Somerset	38.20375	-75.69992	water level	riverine	2.28	8/28/2011 9:15:00
SSS-MD-SOM-031WL	Maryland	Somerset	37.97794	-75.86300	water level	storm tide	3.48	8/28/2011 6:58:30
SSS-MD-SOM-032WL	Maryland	Somerset	38.16997	-75.94308	water level	storm tide	2.73	8/28/2011 5:07:00

Table 2. Hurricane Irene peak storm-tide data for 212 U.S. Geological Survey temporarily-deployed sites, by State.—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time; RDG, rapid-deployment gage]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Peak storm-tide date and time (GMT)
SSS-MD-TAL-002WL	Maryland	Talbot	38.71978	–76.33258	water level	storm tide	1.67	8/27/2011 22:23:30
SSS-MD-TAL-003WL	Maryland	Talbot	38.83164	–75.91442	water level	riverine	1.74	8/28/2011 14:22:30
SSS-MD-TAL-005WL	Maryland	Talbot	38.69381	–76.17406	water level	storm tide	2.13	8/28/2011 5:40:30
SSS-MD-TAL-006WL	Maryland	Talbot	38.68403	–75.97483	water level	riverine	3.69	8/27/2011 22:28:00
SSS-MD-WIC-011WL	Maryland	Wicomico	38.36308	–75.60711	water level	riverine	3.31	8/28/2011 7:54:00
SSS-MD-WOR-013WL	Maryland	Worcester	38.07642	–75.57061	water level	riverine	2.99	8/28/2011 13:33:00
SSS-MD-WOR-014WL	Maryland	Worcester	38.17564	–75.39992	water level	riverine	2.73	8/28/2011 16:38:30
SSS-MD-WOR-016WL	Maryland	Worcester	38.38775	–75.10350	water level	storm tide	2.66	8/28/2011 3:22:30
SSS-MD-WOR-018WL	Maryland	Worcester	38.35664	–75.16053	water level	storm tide	3.18	8/28/2011 3:09:00
SSS-MD-WOR-019WL	Maryland	Worcester	38.33881	–75.12989	water level	storm tide	2.87	8/28/2011 3:20:30
SSS-MD-WOR-020WL	Maryland	Worcester	38.33456	–75.09836	water level	storm tide	3.01	8/27/2011 23:43:00
SSS-MD-WOR-022WL	Maryland	Worcester	38.29453	–75.16256	water level	riverine	2.30	8/28/2011 16:01:00
SSS-MD-WOR-024WL	Maryland	Worcester	38.23733	–75.25722	water level	storm tide	1.68	8/28/2011 15:57:30
SSS-MD-WOR-025WL	Maryland	Worcester	38.15117	–75.28597	water level	storm tide	2.66	8/28/2011 14:04:30
SSS-MD-WOR-026WL	Maryland	Worcester	38.07642	–75.36439	water level	storm tide	2.19	8/28/2011 2:54:00
SSS-MD-WOR-030WL	Maryland	Worcester	38.42411	–75.18769	water level	riverine	2.94	8/28/2011 2:08:30
SSS-MA-BAR-022WL	Massachusetts	Barnstable	41.71486	–70.61680	water level	storm tide	4.91	8/29/2011 0:21:30
SSS-MA-BAR-023WL	Massachusetts	Barnstable	41.65638	–70.62355	water level	storm tide	4.81	8/29/2011 0:18:00
SSS-MA-BAR-024WL	Massachusetts	Barnstable	41.60618	–70.65186	water level	storm tide	6.80	8/29/2011 0:46:00
SSS-MA-BAR-025WL	Massachusetts	Barnstable	41.55283	–70.54864	water level	storm tide	3.47	8/28/2011 15:48:00
SSS-MA-BAR-026WL	Massachusetts	Barnstable	41.62131	–70.39557	water level	storm tide	4.10	8/28/2011 16:20:00
SSS-MA-BAR-027WL	Massachusetts	Barnstable	41.66752	–70.08976	water level	storm tide	3.93	8/28/2011 15:37:30

Table 2. Hurricane Irene peak storm-tide data for 212 U.S. Geological Survey temporarily-deployed sites, by State.—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time; RDG, rapid-deployment gage]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Peak storm-tide date and time (GMT)
SSS-MA-BAR-028WL	Massachusetts	Barnstable	41.63949	-70.27664	water level	storm tide	4.20	8/28/2011 15:30:00
SSS-MA-BRI-016WL	Massachusetts	Bristol	41.51626	-71.07168	water level	storm tide	4.60	8/28/2011 13:24:00
SSS-MA-BRI-017WL	Massachusetts	Bristol	41.59597	-70.84321	water level	storm tide	4.81	8/28/2011 12:14:30
SSS-MA-BRI-029WL	Massachusetts	Bristol	41.81314	-71.11641	water level	riverine	5.20	8/28/2011 12:11:30
SSS-MA-PLY-018WL	Massachusetts	Plymouth	41.65608	-70.81283	water level	storm tide	6.46	8/28/2011 11:44:30
SSS-MA-PLY-019WL	Massachusetts	Plymouth	41.71257	-70.76535	water level	storm tide	4.70	8/28/2011 14:14:30
SSS-MA-PLY-020WL	Massachusetts	Plymouth	41.75490	-70.70988	water level	storm tide	4.49	8/29/2011 0:28:00
SSS-MA-PLY-021WL	Massachusetts	Plymouth	41.74369	-70.62779	water level	storm tide	4.69	8/29/2011 0:50:00
01071540	New Hampshire	Strafford	43.49425	-71.02645	real-time RDG	storm tide	3.65	8/29/2011 18:15:00
01091750	New Hampshire	Hillsborough	42.99286	-71.49562	real-time RDG	storm tide	3.04	8/29/2011 7:45:00
SSS-NH-ROC-002WL	New Hampshire	Rockingham	42.99960	-70.74800	water level	storm tide	6.84	8/29/2011 3:13:00
SSS-NH-ROC-003WL	New Hampshire	Rockingham	43.00350	-70.74930	water level	storm tide	6.28	8/29/2011 3:33:00
SSS-NH-ROC-004WL	New Hampshire	Rockingham	42.89820	-70.81700	water level	storm tide	5.98	8/28/2011 15:33:30
SSS-NH-ROC-005WL	New Hampshire	Rockingham	42.92180	-70.82330	water level	storm tide	5.65	8/28/2011 16:01:30
SSS-NJ-ATL-001WL	New Jersey	Atlantic	39.55333	-74.46278	water level	riverine	3.83	8/28/2011 10:50:00
SSS-NJ-ATL-002WL	New Jersey	Atlantic	39.44861	-74.72694	water level	riverine	4.58	8/28/2011 3:22:00
SSS-NJ-CPM-001WL	New Jersey	Cape May	39.28833	-74.62750	water level	storm tide	4.82	8/28/2011 0:19:00
SSS-NJ-CUM-001WL	New Jersey	Cumberland	39.39528	-75.04083	water level	riverine	4.82	8/29/2011 14:42:00
SSS-NJ-CUM-002WL	New Jersey	Cumberland	39.42917	-75.23694	water level	riverine	6.02	8/28/2011 4:45:00
SSS-NJ-OCN-001WL	New Jersey	Ocean	39.95028	-74.19889	water level	riverine	3.18	8/28/2011 14:11:00
403836073154801	New York	Suffolk	40.64328	-73.26334	real-time RDG	storm tide	3.43	8/28/2011 13:30:00
01378626	New York	Hudson	40.80472	-74.06530	water level	none	none	lost
SSS-NY-KIN-001WL	New York	Kings	40.58000	-74.01161	water level	storm tide	8.10	8/28/2011 12:53:00

Table 2. Hurricane Irene peak storm-tide data for 212 U.S. Geological Survey temporarily-deployed sites, by State.—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time; RDG, rapid-deployment gage]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Peak storm-tide date and time (GMT)
SSS-NY-KIN-002WL	New York	Kings	40.70458	–73.98832	water level	storm tide	6.22	8/28/2011 13:19:00
SSS-NY-NAS-001WL	New York	Nassau	40.87791	–73.53057	water level	storm tide	8.20	8/28/2011 14:54:30
SSS-NY-NAS-004WL	New York	Nassau	40.58275	–73.64068	water level	storm tide	9.72	8/28/2011 11:13:00
SSS-NY-NAS-005WL	New York	Nassau	40.64733	–73.46234	water level	storm tide	6.24	8/28/2011 13:13:00
SSS-NY-QUE-001WL	New York	Queens	40.76229	–73.85828	water level	storm tide	8.03	8/28/2011 13:52:30
SSS-NY-QUE-002WL	New York	Queens	40.64533	–73.83638	water level	storm tide	7.04	8/28/2011 13:16:30
SSS-NY-RIC-001WL	New York	Richmond	40.59388	–74.05985	water level	storm tide	8.86	8/28/2011 12:33:30
SSS-NY-RIC-003WL	New York	Richmond	40.50188	–74.23034	water level	storm tide	8.36	8/28/2011 11:52:30
SSS-NY-SUF-001WL	New York	Suffolk	41.01259	–72.55828	water level	storm tide	6.94	8/28/2011 15:35:30
SSS-NY-SUF-002WL	New York	Suffolk	40.96438	–72.86320	water level	storm tide	8.05	8/28/2011 15:35:00
SSS-NY-SUF-003WL	New York	Suffolk	40.94617	–73.07227	water level	storm tide	7.54	8/28/2011 15:13:30
SSS-NY-SUF-004WL	New York	Suffolk	40.78712	–72.75025	water level	storm tide	5.93	8/28/2011 13:33:30
SSS-NY-SUF-005WL	New York	Suffolk	40.91608	–72.63774	water level	storm tide	4.10	8/28/2011 15:09:00
SSS-NY-SUF-006WL	New York	Suffolk	40.84887	–72.50285	water level	storm tide	6.13	8/28/2011 11:57:00
SSS-NY-SUF-008WL	New York	Suffolk	40.89331	–72.50300	water level	storm tide	3.94	8/28/2011 15:05:30
SSS-NY-SUF-009WL	New York	Suffolk	41.00197	–72.29030	water level	storm tide	3.72	8/28/2011 13:37:30
SSS-NY-SUF-011WL	New York	Suffolk	40.90048	–73.35304	water level	storm tide	8.09	8/28/2011 15:05:00
SSS-NY-SUF-014WL	New York	Suffolk	40.99070	–72.47074	water level	storm tide	4.99	8/28/2011 15:59:00
SSS-NY-SUF-015WL	New York	Suffolk	41.10104	–72.36144	water level	storm tide	4.41	8/28/2011 14:06:00
SSS-NY-SUF-017WL	New York	Suffolk	40.64316	–73.15750	water level	storm tide	9.32	8/28/2011 10:55:30
SSS-NY-SUF-018WL	New York	Suffolk	40.63473	–73.20216	water level	storm tide	6.33	8/28/2011 11:40:30
SSS-NY-SUF-019WL	New York	Suffolk	40.65932	–73.26486	water level	storm tide	3.16	8/28/2011 13:18:30

Table 2. Hurricane Irene peak storm-tide data for 212 U.S. Geological Survey temporarily-deployed sites, by State.—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time; RDG, rapid-deployment gage]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Peak storm-tide date and time (GMT)
SSS-NY-SUF-021WL	New York	Suffolk	40.74918	-73.01338	water level	storm tide	4.37	8/28/2011 15:15:00
SSS-NY-SUF-022WL	New York	Suffolk	40.68523	-73.27990	water level	storm tide	4.52	8/28/2011 13:35:30
02092162	North Carolina	Craven	35.10499	-77.03467	real-time RDG	storm tide	7.34	8/27/2011 12:30:00
SSS-NC-BEA-001WL	North Carolina	Beaufort	35.37638	-76.74786	water level	storm tide	9.05	8/27/2011 15:24:30
SSS-NC-BRU-010WL	North Carolina	Brunswick	33.93493	-77.99339	water level	storm tide	3.11	8/26/2011 23:11:30
SSS-NC-BRU-011WL	North Carolina	Brunswick	33.89370	-78.03347	water level	storm tide	3.45	8/26/2011 23:21:00
SSS-NC-BRU-012WL	North Carolina	Brunswick	33.88649	-78.43587	water level	storm tide	7.63	8/26/2011 21:22:30
SSS-NC-BRU-013WL	North Carolina	Brunswick	33.89244	-78.43788	water level	storm tide	4.24	8/26/2011 22:56:00
SSS-NC-BRU-014WL	North Carolina	Brunswick	33.89514	-78.43939	water level	storm tide	4.18	8/26/2011 22:52:30
SSS-NC-CAM-001WL	North Carolina	Camden	36.30053	-76.21797	water level	riverine	3.02	8/27/2011 15:23:00
SSS-NC-CHO-001WL	North Carolina	Chowan	36.05587	-76.60942	water level	storm tide	4.98	8/27/2011 15:48:30
SSS-NC-CRT-001WL	North Carolina	Carteret	34.68598	-76.53169	water level	storm tide	4.08	8/27/2011 12:59:00
SSS-NC-CRT-004WL	North Carolina	Carteret	35.01903	-76.31474	water level	storm tide	3.70	8/27/2011 12:07:30
SSS-NC-CRT-005WL	North Carolina	Carteret	34.64806	-77.09556	water level	storm tide	4.56	8/27/2011 9:45:30
SSS-NC-CRT-006WL	North Carolina	Carteret	34.69668	-76.78122	water level	storm tide	8.29	8/27/2011 9:59:30
SSS-NC-CRT-007WL	North Carolina	Carteret	34.69715	-76.68161	water level	storm tide	4.50	8/27/2011 10:23:30
SSS-NC-CRV-003WL	North Carolina	Craven	34.93810	-76.81044	water level	storm tide	10.70	8/27/2011 11:50:30
SSS-NC-CRV-005WL	North Carolina	Craven	35.09922	-77.03958	water level	riverine	7.04	8/27/2011 12:42:00
SSS-NC-CUR-001WL	North Carolina	Currituck	36.37192	-75.82282	water level	storm tide	9.38	8/27/2011 20:58:30
SSS-NC-CUR-002WL	North Carolina	Currituck	36.37357	-75.83351	water level	storm tide	4.03	8/28/2011 5:54:00
SSS-NC-DAR-001WL	North Carolina	Dare	35.20791	-75.70284	water level	storm tide	3.95	8/28/2011 2:50:30
SSS-NC-DAR-002WL	North Carolina	Dare	35.26655	-75.55758	water level	storm tide	6.71	8/28/2011 2:55:30

Table 2. Hurricane Irene peak storm-tide data for 212 U.S. Geological Survey temporarily-deployed sites, by State.—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time; RDG, rapid-deployment gage]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Peak storm-tide date and time (GMT)
SSS-NC-DAR-003WL	North Carolina	Dare	35.34731	–75.50072	water level	storm tide	7.27	8/27/2011 11:29:30
SSS-NC-DAR-004WL	North Carolina	Dare	35.35025	–75.51196	water level	storm tide	7.05	8/28/2011 2:26:00
SSS-NC-DAR-005WL	North Carolina	Dare	35.79618	–75.54950	water level	storm tide	7.09	8/28/2011 3:49:00
SSS-NC-DAR-008WL	North Carolina	Dare	36.22331	–75.77248	water level	storm tide	6.31	8/28/2011 5:29:00
SSS-NC-DAR-009WL	North Carolina	Dare	35.91026	–75.59498	water level	none	none	lost
SSS-NC-DAR-010WL	North Carolina	Dare	35.69831	–75.77044	water level	storm tide	5.14	8/28/2011 4:15:30
SSS-NC-DAR-011WL	North Carolina	Dare	35.91217	–75.76828	water level	storm tide	5.46	8/28/2011 0:46:00
SSS-NC-HYD-001WL	North Carolina	Hyde	35.39345	–76.32847	water level	storm tide	5.67	8/27/2011 15:20:00
SSS-NC-NHA-001WL	North Carolina	New Hanover	34.22772	–77.95404	water level	riverine	2.29	8/26/2011 23:57:30
SSS-NC-NHA-002WL	North Carolina	New Hanover	33.96136	–77.93973	water level	storm tide	3.57	8/26/2011 23:12:30
SSS-NC-NHA-003WL	North Carolina	New Hanover	33.99789	–77.90535	water level	storm tide	8.02	8/26/2011 22:21:00
SSS-NC-NHA-004WL	North Carolina	New Hanover	34.05685	–77.88097	water level	storm tide	7.73	8/26/2011 22:48:00
SSS-NC-NHA-005WL	North Carolina	New Hanover	34.18906	–77.81263	water level	storm tide	4.49	8/26/2011 22:43:00
SSS-NC-NHA-006WL	North Carolina	New Hanover	34.21418	–77.78834	water level	storm tide	8.09	8/26/2011 21:39:30
SSS-NC-NHA-007WL	North Carolina	New Hanover	34.27499	–77.76071	water level	storm tide	4.43	8/26/2011 22:44:30
SSS-NC-NHA-008WL	North Carolina	New Hanover	34.23500	–77.77692	water level	storm tide	5.10	8/27/2011 10:36:30
SSS-NC-ONS-001WL	North Carolina	Onslow	34.68734	–77.11723	water level	storm tide	3.69	8/27/2011 10:46:00
SSS-NC-ONS-002WL	North Carolina	Onslow	34.50276	–77.39646	water level	storm tide	7.21	8/27/2011 7:50:00
SSS-NC-PEN-001WL	North Carolina	Pender	34.31131	–77.73229	water level	storm tide	4.52	8/26/2011 23:11:00
SSS-NC-PEN-002WL	North Carolina	Pender	34.36520	–77.63177	water level	storm tide	3.87	8/26/2011 22:44:00
SSS-NC-PEN-003WL	North Carolina	Pender	34.36542	–77.62815	water level	storm tide	8.10	8/26/2011 21:16:30
SSS-NC-PER-001WL	North Carolina	Perquimans	36.19300	–76.45458	water level	riverine	2.50	8/28/2011 7:40:30

Table 2. Hurricane Irene peak storm-tide data for 212 U.S. Geological Survey temporarily-deployed sites, by State.—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time; RDG, rapid-deployment gage]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Peak storm-tide date and time (GMT)
SSS-NC-WAS-001WL	North Carolina	Washington	35.95885	-76.49151	water level	storm tide	5.70	8/27/2011 15:43:00
SSS-RI-BRI-013WL	Rhode Island	Bristol	41.72614	-71.28590	water level	storm tide	4.97	8/28/2011 13:29:00
SSS-RI-KEN-011WL	Rhode Island	Kent	41.68673	-71.39166	water level	storm tide	5.04	8/28/2011 13:15:00
SSS-RI-NEW-014WL	Rhode Island	Newport	41.61965	-71.24000	water level	storm tide	5.52	8/28/2011 12:27:30
SSS-RI-NEW-015WL	Rhode Island	Newport	41.46496	-71.19241	water level	storm tide	4.96	8/28/2011 12:57:00
SSS-RI-PRO-010WL	Rhode Island	Providence	41.76290	-71.38529	water level	storm tide	5.65	8/28/2011 11:46:00
SSS-RI-PRO-030WL	Rhode Island	Providence	41.86923	-71.38023	water level	storm tide	6.13	8/28/2011 14:14:00
SSS-RI-WAS-001WL	Rhode Island	Washington	41.31029	-71.85914	water level	storm tide	4.30	8/28/2011 13:05:30
SSS-RI-WAS-002WL	Rhode Island	Washington	41.33236	-71.71779	water level	storm tide	3.33	8/28/2011 14:12:30
SSS-RI-WAS-003WL	Rhode Island	Washington	41.36451	-71.60520	water level	none	none	no surge recorded
SSS-RI-WAS-004WL	Rhode Island	Washington	41.34789	-71.82788	water level	storm tide	4.26	8/28/2011 12:48:00
SSS-RI-WAS-005WL	Rhode Island	Washington	41.33482	-71.76663	water level	storm tide	3.78	8/28/2011 14:08:00
SSS-RI-WAS-006WL	Rhode Island	Washington	41.33231	-71.78789	water level	storm tide	3.73	8/28/2011 14:10:30
SSS-RI-WAS-007WL	Rhode Island	Washington	41.38102	-71.64473	water level	storm tide	2.27	8/28/2011 14:57:00
SSS-RI-WAS-008WL	Rhode Island	Washington	41.37726	-71.51472	water level	storm tide	4.62	8/28/2011 12:18:30
SSS-RI-WAS-009WL	Rhode Island	Washington	41.42775	-71.49559	water level	storm tide	4.65	8/28/2011 12:50:00
SSS-RI-WAS-012WL	Rhode Island	Washington	41.52809	-71.41637	water level	storm tide	5.09	8/28/2011 12:27:00
SSS-SC-HOR-001WL	South Carolina	Horry	33.85278	-78.59389	water level	storm tide	3.58	8/26/2011 19:03:00
SSS-SC-HOR-002WL	South Carolina	Horry	33.75844	-78.79261	water level	none	none	no surge recorded
SSS-SC-HOR-003WL	South Carolina	Horry	33.68111	-78.89167	water level	none	none	no surge recorded
SSS-SC-HOR-005WL	South Carolina	Horry	33.65985	-78.91776	water level	none	none	no surge recorded
370230076201100	Virginia	Hampton	37.04167	-76.33639	real-time RDG	none	none	no surge recorded

Table 2. Hurricane Irene peak storm-tide data for 212 U.S. Geological Survey temporarily-deployed sites, by State.—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time; RDG, rapid-deployment gage]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Peak storm-tide date and time (GMT)
SSS-VA-HAM-001WL	Virginia	York	37.10861	–76.39306	water level	storm tide	5.32	8/28/2011 0:31:00
SSS-VA-NFK-001WL	Virginia	Norfolk	36.85881	–76.29864	water level	storm tide	5.94	8/28/2011 0:30:00
SSS-VA-NOR-001WL	Virginia	Northampton	37.44528	–75.84186	water level	storm tide	6.37	8/28/2011 0:25:30
SSS-VA-NOR-002WL	Virginia	Northampton	37.28789	–75.92556	water level	storm tide	6.89	8/27/2011 23:52:36
SSS-VA-NOR-003WL	Virginia	Northampton	37.26492	–76.01628	water level	storm tide	4.67	8/27/2011 23:59:36
SSS-VA-NOR-004WL	Virginia	Northampton	37.12811	–75.94944	water level	storm tide	5.97	8/27/2011 23:41:06
SSS-VA-IOW-001WL	Virginia	Isle of Wight	37.00536	–76.60017	water level	storm tide	6.26	8/28/2011 1:07:30
SSS-VA-VAB-001WL	Virginia	Virginia Beach	36.90683	–76.08825	water level	storm tide	5.44	8/28/2011 0:12:30
SSS-VA-VAB-003WL	Virginia	Virginia Beach	36.83128	–75.97783	water level	storm tide	6.50	8/27/2011 23:02:00
SSS-VA-YOR-001WL	Virginia	York	37.17833	–76.39694	water level	storm tide	5.54	8/27/2011 23:54:30
SSS-VA-YOR-003WL	Virginia	Poquoson	37.11061	–76.31944	water level	storm tide	5.30	8/27/2011 23:54:00
SSS-VA-NOR-004WV	Virginia	Northampton	37.12811	–75.94944	wave height	storm tide	6.01	8/27/2011 23:35:54
SSS-VA-VAB-001WV	Virginia	Virginia Beach	36.90683	–76.08825	wave height	storm tide	5.52	8/28/2011 0:12:30

Table 3. Hurricane Irene peak storm-tide data recorded at U.S. Geological Survey permanent monitoring sites, by State.

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time]

Site identifi- cation	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Gage altitude datum	Peak storm-tide date and time (GMT)
01193000	Connecticut	Middlesex	41.56121	-72.61121	real-time streamgage	riverine	8.52	NGVD29	8/28/2011 16:00:00
01193050	Connecticut	Middlesex	41.54177	-72.55315	real-time streamgage	riverine	8.61	NGVD29	8/28/2011 15:45:00
01194750	Connecticut	Middlesex	41.35139	-72.38556	real-time streamgage	riverine	6.99	NGVD29	8/28/2011 04:00:00
01194796	Connecticut	New London	41.31260	-72.34592	real-time streamgage	riverine	6.91	NGVD29	8/28/2011 13:50:00
01484080	Delaware	Kent	39.01122	-75.45908	real-time streamgage	riverine	5.20	NGVD29	8/28/2011 04:24:00
01484085	Delaware	Kent	39.05831	-75.39761	real-time tide gage	storm tide	6.43	NAVD88	8/28/2011 01:06:00
01037050	Maine	Penobscot	44.79639	-68.76778	real-time streamgage	riverine	10.67	NAVD88	8/29/2011 04:00:00
01049320	Maine	Kennebec	44.31861	-69.77167	real-time streamgage	riverine	9.32	NGVD29	8/29/2011 09:30:00
01049505	Maine	Kennebec	44.23028	-69.76945	real-time streamgage	riverine	7.45	NGVD29	8/29/2011 07:30:00
01059555	Maine	Sagadahoc	43.92472	-69.79250	real-time streamgage	riverine	6.42	NAVD88	8/29/2011 05:00:00
010228955	Maine	Hancock	44.25291	-68.34920	real-time streamgage	riverine	13.46	NAVD88	8/29/2011 18:45:00
01108410	Massachusetts	Bristol	41.89982	-71.08949	real-time streamgage	riverine	5.82	NGVD29	8/28/2011 15:45:00
011058837	Massachusetts	Barnstable	41.59233	-70.50780	real-time streamgage	riverine	4.44	NGVD29	8/28/2011 17:30:00
01406710	New Jersey	Middlesex	40.49222	-74.28139	real-time tide gage	storm tide	7.58	NAVD88	8/28/2011 11:42:00
01407081	New Jersey	Monmouth	40.44917	-74.14750	real-time tide gage	storm tide	7.14	NAVD88	8/28/2011 13:06:00
01407600	New Jersey	Monmouth	40.36555	-73.97472	real-time tide gage	storm tide	6.29	NAVD88	8/28/2011 12:30:00
01407770	New Jersey	Monmouth	40.17944	-74.03861	real-time tide gage	storm tide	6.28	NAVD88	8/28/2011 12:30:00
01408050	New Jersey	Monmouth	40.10167	-74.03750	real-time tide gage	storm tide	5.85	NAVD88	8/28/2011 13:18:00
01408168	New Jersey	Ocean	40.04000	-74.05222	real-time tide gage	storm tide	3.56	NAVD88	8/28/2011 15:36:00
01408750	New Jersey	Ocean	39.93833	-74.08222	real-time tide gage	storm tide	3.28	NAVD88	8/28/2011 15:18:00
01409110	New Jersey	Ocean	39.79111	-74.18195	real-time tide gage	storm tide	2.48	NAVD88	8/28/2011 11:36:00
01409125	New Jersey	Ocean	39.76111	-74.10806	real-time tide gage	storm tide	3.84	NAVD88	8/28/2011 11:54:00

Table 3. Hurricane Irene peak storm-tide data recorded at U.S. Geological Survey permanent monitoring sites, by State.—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time]

Site identifi- cation	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Gage altitude datum	Peak storm-tide date and time (GMT)
01409146	New Jersey	Ocean	39.65389	–74.18584	real-time tide gage	storm tide	3.17	NAVD88	8/28/2011 13:48:00
01409335	New Jersey	Ocean	39.50889	–74.32472	real-time tide gage	storm tide	4.11	NAVD88	8/28/2011 11:18:00
01410510	New Jersey	Atlantic	39.42305	–74.50000	real-time tide gage	storm tide	5.03	NAVD88	8/28/2011 02:54:00
01410560	New Jersey	Atlantic	39.35333	–74.45667	real-time tide gage	storm tide	4.46	NAVD88	8/28/2011 01:48:00
01410600	New Jersey	Atlantic	39.37750	–74.42333	real-time tide gage	storm tide	4.98	NAVD88	8/28/2011 01:36:00
01411320	New Jersey	Cape May	39.28417	–74.57777	real-time tide gage	storm tide	4.80	NAVD88	8/28/2011 01:48:00
01411330	New Jersey	Atlantic	39.33750	–74.51305	real-time tide gage	storm tide	4.69	NAVD88	8/28/2011 02:12:00
01411350	New Jersey	Cape May	39.15750	–74.69778	real-time tide gage	storm tide	5.10	NAVD88	8/28/2011 01:24:00
01411355	New Jersey	Cape May	39.11083	–74.73389	real-time tide gage	storm tide	5.00	NAVD88	8/28/2011 01:24:00
01411360	New Jersey	Cape May	39.05667	–74.76417	real-time tide gage	storm tide	5.30	NAVD88	8/28/2011 01:36:00
01411390	New Jersey	Cape May	38.94861	–74.89056	real-time tide gage	storm tide	5.15	NAVD88	8/28/2011 12:24:00
01411435	New Jersey	Cape May	39.16167	–74.83195	real-time tide gage	storm tide	3.66	NAVD88	8/28/2011 04:00:00
01412150	New Jersey	Cumberland	39.23167	–75.03306	real-time tide gage	storm tide	5.56	NAVD88	8/28/2011 02:18:00
01392650	New Jersey	Essex	40.71317	–74.12305	real-time tide gage	riverine	7.21	NAVD88	8/28/2011 12:54:00
01406710	New Jersey	Middlesex	40.49222	–74.28139	real-time tide gage	riverine	7.58	NAVD88	8/28/2011 11:42:00
01407081	New Jersey	Monmouth	40.44917	–74.14750	real-time tide gage	riverine	7.14	NAVD88	8/28/2011 11:48:00
01407600	New Jersey	Monmouth	40.36555	–73.97472	real-time tide gage	riverine	6.29	NAVD88	8/28/2011 01:06:00
01411390	New Jersey	Cape May	38.94861	–74.89056	real-time tide gage	riverine	5.15	NAVD88	8/27/2011 12:24:00
01302050	New York	Queens	40.75583	–73.74639	real-time streamgage	riverine	9.46	NGVD29	8/28/2011 13:15:00
01302250	New York	Nassau	40.86622	–73.71020	real-time tide gage	storm tide	9.48	NGVD29	8/28/2011 13:30:00
01302600	New York	Nassau	40.88856	–73.63800	real-time tide gage	storm tide	9.30	NGVD29	8/28/2011 13:30:00
01302845	New York	Nassau	40.90511	–73.59319	real-time tide gage	storm tide	9.13	NGVD29	8/28/2011 14:24:00

Table 3. Hurricane Irene peak storm-tide data recorded at U.S. Geological Survey permanent monitoring sites, by State.—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time]

Site identifi- cation	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Gage altitude datum	Peak storm-tide date and time (GMT)
01303500	New York	Nassau	40.85722	-73.46389	real-time streamgage	riverine	9.14	NGVD29	8/28/2011 13:45:00
01304057	New York	Suffolk	40.96286	-73.14317	real-time tide gage	storm tide	8.88	NGVD29	8/28/2011 14:06:00
01304705	New York	Suffolk	40.93333	-72.225	real-time streamgage	riverine	7.67	NGVD29	8/28/2011 14:45:00
01309225	New York	Suffolk	40.66927	-73.35567	real-time tide gage	storm tide	5.27	NGVD29	8/28/2011 12:30:00
01310521	New York	Nassau	40.62760	-73.57541	real-time tide gage	storm tide	7.35	NGVD29	8/28/2011 11:36:00
01310740	New York	Nassau	40.59344	-73.58374	real-time tide gage	storm tide	7.07	NGVD29	8/28/2011 11:18:00
01311143	New York	Nassau	40.60883	-73.65611	real-time tide gage	storm tide	7.75	NGVD29	8/28/2011 11:48:00
01311145	New York	Nassau	40.59316	-73.73736	real-time tide gage	storm tide	7.43	NGVD29	8/28/2011 11:18:00
01311850	New York	Queens	40.61733	-73.75791	real-time tide gage	storm tide	7.52	NGVD29	8/28/2011 12:24:00
01311875	New York	Queens	40.57372	-73.88514	real-time tide gage	storm tide	7.58	NGVD29	8/28/2011 11:30:00
01374019	New York	Putnam	41.38620	-73.95514	real-time streamgage	riverine	7.65	NGVD29	8/28/2011 14:45:00
01376269	New York	Rockland	41.04319	-73.89606	real-time streamgage	riverine	7.56	NGVD29	8/28/2011 13:30:00
01392650	New York	Essex	40.71317	-74.12305	real-time tide gage	storm tide	7.21	NAVD88	8/28/2011 12:54:00
01302050	New York	Queens	40.75583	-73.74639	real-time streamgage	riverine	9.46	NGVD29	8/28/2011 01:15:00
01303500	New York	Nassau	40.85722	-73.46389	real-time streamgage	riverine	9.14	NGVD29	8/28/2011 01:45:00
01304705	New York	Suffolk	40.93333	-72.22500	real-time streamgage	riverine	7.67	NGVD29	8/28/2011 02:45:00
02084472	North Carolina	Beaufort	35.54334	-77.06194	real-time streamgage	riverine	6.53	NAVD88	8/27/2011 17:45:00
0208114150	North Carolina	Washington	35.91500	-76.72278	real-time streamgage	riverine	6.49	NGVD29	8/27/2011 18:00:00
0208436195	North Carolina	Beaufort	35.56306	-77.08611	real-time streamgage	riverine	6.22	NAVD88	8/27/2011 18:00:00
0209303205	North Carolina	Onslow	34.74889	-77.43777	real-time streamgage	riverine	1.81	NAVD88	8/27/2011 18:00:00
01118500	Rhode Island	Washington	41.38371	-71.83312	real-time streamgage	riverine	4.76	NAVD88	8/28/2011 05:00:00
02110725	South Carolina	Horry	33.68712	-79.00476	real-time streamgage	riverine	3.31	NGVD29	8/27/2011 02:00:00

Table 3. Hurricane Irene peak storm-tide data recorded at U.S. Geological Survey permanent monitoring sites, by State.—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time]

Site identifi- cation	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Gage altitude datum	Peak storm-tide date and time (GMT)
02110777	South Carolina	Horry	33.85156	–78.65585	real-time streamgage	riverine	4.98	NGVD29	8/26/2011 22:15:00
02110802	South Carolina	Horry	33.64906	–79.09421	real-time streamgage	riverine	3.49	NGVD29	8/27/2011 03:00:00
02110815	South Carolina	Georgetown	33.44461	–79.17393	real-time streamgage	riverine	4.73	NGVD29	8/27/2011 00:00:00
02171700	South Carolina	Williams- burg	33.30489	–79.67813	real-time streamgage	riverine	4.03	NGVD29	8/27/2011 02:15:00
02171800	South Carolina	Georgetown	33.20850	–79.38256	real-time streamgage	riverine	4.39	NGVD29	8/26/2011 23:00:00
02171850	South Carolina	Charleston	33.18406	–79.40589	real-time streamgage	riverine	4.41	NGVD29	8/26/2011 22:45:00
02171905	South Carolina	Charleston	33.15433	–79.35422	real-time streamgage	riverine	5.46	NGVD29	8/26/2011 22:30:00
02172020	South Carolina	Berkeley	33.09350	–79.94897	real-time streamgage	riverine	4.77	NGVD29	8/27/2011 01:15:00
02172040	South Carolina	Berkeley	33.06378	–79.95703	real-time streamgage	riverine	4.05	NGVD29	8/27/2011 01:45:00
02172050	South Carolina	Berkeley	33.05767	–79.93619	real-time streamgage	riverine	4.77	NGVD29	8/27/2011 00:30:00
02172053	South Carolina	Berkeley	32.98351	–79.92286	real-time streamgage	riverine	5.14	NGVD29	8/26/2011 23:30:00
021720698	South Carolina	Berkeley	32.85906	–79.89620	real-time streamgage	riverine	5.28	NGVD29	8/26/2011 22:00:00
021720711	South Carolina	Charleston	32.78045	–79.92370	real-time streamgage	riverine	5.52	NGVD29	8/26/2011 22:00:00
021720869	South Carolina	Charleston	32.83462	–80.02370	real-time streamgage	riverine	5.53	NGVD29	8/26/2011 22:45:00

Table 4. Hurricane Irene peak storm-tide data recorded at National Oceanic and Atmospheric Administration permanent monitoring sites, by State (NOAA, 2011).

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Peak storm-tide date and time (GMT)
8461490	Connecticut	New London	41.36139	-72.08997	real-time tide gage	storm tide	4.72	8/28/2011 13:24:00
8467150	Connecticut	Fairfield	41.17330	-73.18170	real-time tide gage	storm tide	8.28	8/28/2011 15:06:00
8551910	Delaware	New Castle	39.55831	-75.57331	real-time tide gage	riverine	5.06	8/28/2011 3:30:00
8557380	Delaware	Sussex	38.78169	-75.12000	real-time tide gage	storm tide	5.57	8/28/2011 0:06:00
8594900	District of Columbia	District of Columbia	38.87333	-77.02167	real-time tide gage	riverine	2.48	8/25/2011 9:06:00
8720030	Florida	Nassau	30.67170	-81.46500	real-time tide gage	storm tide	4.88	8/27/2011 0:00:00
8720218	Florida	Duval	30.39670	-81.43000	real-time tide gage	storm tide	3.74	8/26/2011 23:30:00
8720357	Florida	Duval	30.19170	-81.69170	real-time tide gage	riverine	1.82	8/27/2011 14:00:00
8721604	Florida	Brevard	28.41580	-80.59310	real-time tide gage	storm tide	3.05	8/26/2011 22:42:00
8722670	Florida	Palm Beach	26.61170	-80.03330	real-time tide gage	storm tide	1.95	8/28/2011 0:00:00
8723214	Florida	Miami-Dade	25.73140	-80.16180	real-time tide gage	storm tide	1.45	8/29/2011 13:54:00
8670870	Georgia	Chatham	32.03330	-80.90170	real-time tide gage	storm tide	5.06	8/26/2011 23:00:00
8410140	Maine	Washington	44.90460	-66.98290	real-time tide gage	storm tide	12.11	8/29/2011 3:06:00
8413320	Maine	Hancock	44.39170	-68.20500	real-time tide gage	storm tide	7.67	8/29/2011 3:12:00
8418150	Maine	Cumberland	43.65670	-70.24670	real-time tide gage	storm tide	6.70	8/29/2011 3:06:00
8419317	Maine	York	43.32000	-70.56331	real-time tide gage	storm tide	6.23	8/29/2011 3:30:00
8570283	Maryland	Worcester	38.32833	-75.09167	real-time tide gage	storm tide	3.05	8/27/2011 23:48:00
8571892	Maryland	Dorchester	38.57330	-76.06830	real-time tide gage	storm tide	1.99	8/28/2011 7:06:00
8574680	Maryland	Baltimore	39.26667	-76.57833	real-time tide gage	storm tide	2.15	8/25/2011 9:06:00
8575512	Maryland	Anne Arundel	38.98328	-76.48156	real-time tide gage	storm tide	1.78	8/25/2011 7:24:00
8577330	Maryland	Calvert	38.31667	-76.45167	real-time tide gage	storm tide	2.84	8/28/2011 3:48:00
8447435	Massachusetts	Barnstable	41.68847	-69.95108	real-time tide gage	storm tide	4.07	8/28/2011 16:12:00
8447930	Massachusetts	Barnstable	41.52330	-70.67170	real-time tide gage	storm tide	3.25	8/28/2011 13:36:00

Table 4. Hurricane Irene peak storm-tide data recorded at National Oceanic and Atmospheric Administration permanent monitoring sites, by State (NOAA, 2011).—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Site type	Type of data recorded	Peak storm-tide elevation, feet above NAVD 88	Peak storm-tide date and time (GMT)
8423898	New Hampshire	Rockingham	43.07170	–70.71170	real-time tide gage	storm tide	5.98	8/29/2011 3:36:00
8443970	New Hampshire	Suffolk	42.35480	–71.05340	real-time tide gage	storm tide	6.44	8/28/2011 15:06:00
8531680	New Jersey	Monmouth	40.46690	–74.00940	real-time tide gage	storm tide	6.99	8/28/2011 12:36:00
8534720	New Jersey	Atlantic	39.35500	–74.41830	real-time tide gage	storm tide	4.34	8/28/2011 0:00:00
8536110	New Jersey	Cape May	38.96833	–74.96000	real-time tide gage	storm tide	5.53	8/28/2011 0:06:00
8510560	New York	Suffolk	41.04830	–71.96000	real-time tide gage	storm tide	4.08	8/28/2011 13:12:00
8518750	New York	New York	40.70060	–74.01420	real-time tide gage	storm tide	6.70	8/28/2011 12:42:00
8519483	New York	Richmond	40.63670	–74.14170	real-time tide gage	storm tide	7.26	8/28/2011 12:42:00
8651370	North Carolina	Dare	36.18333	–75.74667	real-time tide gage	storm tide	3.03	8/27/2011 21:00:00
8652587	North Carolina	Dare	35.79500	–75.54830	real-time tide gage	storm tide	6.22	8/28/2011 3:54:00
8658120	North Carolina	New Hanover	34.22670	–77.95330	real-time tide gage	storm tide	2.79	8/29/2011 2:00:00
8658163	North Carolina	New Hanover	34.21330	–77.78670	real-time tide gage	storm tide	4.32	8/26/2011 21:48:00
8545240	Pennsylvania	Philadelphia	39.93333	–75.14167	real-time tide gage	riverine	6.80	8/28/2011 5:48:00
8452660	Rhode Island	Newport	41.50500	–71.32670	real-time tide gage	storm tide	4.50	8/28/2011 11:54:00
8454000	Rhode Island	Providence	41.80710	–71.40120	real-time tide gage	storm tide	5.78	8/28/2011 13:54:00
8661070	South Carolina	Horry	33.65500	–78.91830	real-time tide gage	storm tide	4.50	8/26/2011 22:00:00
8662245	South Carolina	Georgetown	33.35170	–79.18670	real-time tide gage	storm tide	4.83	8/26/2011 23:06:00
8665530	South Carolina	Charleston	32.78170	–79.92500	real-time tide gage	storm tide	4.50	8/26/2011 22:54:00
8632200	Virginia	Northampton	37.16519	–75.98844	real-time tide gage	storm tide	4.58	8/27/2011 23:36:00
8635750	Virginia	Northumberland	37.99611	–76.46444	real-time tide gage	storm tide	3.71	8/28/2011 3:30:00
8636580	Virginia	Lancaster	37.61620	–76.29000	real-time tide gage	storm tide	3.78	8/28/2011 1:42:00
8638610	Virginia	Norfolk	36.94667	–76.33000	real-time tide gage	storm tide	5.91	8/27/2011 23:54:00
8639348	Virginia	Chesapeake	36.77830	–76.30170	real-time tide gage	riverine	6.64	8/28/2011 0:54:00

Table 5. High-water-mark data collected and surveyed by U.S. Geological Survey following the passage of Hurricane Irene in 2011.

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Peak storm-tide el- elevation, feet above NAVD 88	Peak storm- tide estimated date (GMT)
HWM-NC-BEA-201	North Carolina	Beaufort	35.54133	-76.62411	5.72	8/27/11
HWM-NC-BEA-530	North Carolina	Beaufort	35.28105	-76.66259	7.29	8/27/11
HWM-NC-BEA-531	North Carolina	Beaufort	35.31868	-76.63290	7.35	8/27/11
HWM-NC-BEA-532	North Carolina	Beaufort	35.33292	-76.62736	7.32	8/27/11
HWM-NC-BEA-533	North Carolina	Beaufort	35.34344	-76.66281	9.23	8/27/11
HWM-NC-BEA-534	North Carolina	Beaufort	35.33119	-76.69381	8.31	8/27/11
HWM-NC-BEA-535	North Carolina	Beaufort	35.30463	-76.78906	8.85	8/27/11
HWM-NC-BEA-536	North Carolina	Beaufort	35.40336	-76.95994	9.05	8/27/11
HWM-NC-BEA-537	North Carolina	Beaufort	35.43708	-76.97058	8.85	8/27/11
HWM-NC-BEA-601	North Carolina	Beaufort	35.53739	-77.06540	6.64	8/27/11
HWM-NC-BEA-602	North Carolina	Beaufort	35.53686	-77.06645	6.60	8/27/11
HWM-NC-BEA-603	North Carolina	Beaufort	35.50839	-77.03127	7.11	8/27/11
HWM-NC-BEA-604	North Carolina	Beaufort	35.51678	-77.03933	7.10	8/27/11
HWM-NC-BEA-605	North Carolina	Beaufort	35.54123	-77.05525	6.75	8/27/11
HWM-NC-BEA-606	North Carolina	Beaufort	35.51438	-77.00973	7.54	8/27/11
HWM-NC-BEA-607	North Carolina	Beaufort	35.48642	-76.96023	7.70	8/27/11
HWM-NC-BEA-608	North Carolina	Beaufort	35.48494	-76.97059	7.78	8/27/11
HWM-NC-BEA-609	North Carolina	Beaufort	35.49707	-76.95929	7.85	8/27/11
HWM-NC-BEA-610	North Carolina	Beaufort	35.47643	-76.81429	8.00	8/27/11
HWM-NC-BEA-611	North Carolina	Beaufort	35.44862	-76.83120	9.19	8/27/11
HWM-NC-BEA-612	North Carolina	Beaufort	35.53848	-76.62128	5.66	8/27/11
HWM-NC-BEA-613	North Carolina	Beaufort	35.53777	-76.62098	5.65	8/27/11
HWM-NC-BEA-614	North Carolina	Beaufort	35.57040	-76.50311	4.93	8/27/11
HWM-NC-BEA-620	North Carolina	Beaufort	35.39750	-76.61598	7.57	8/27/11
HWM-NC-BEA-621	North Carolina	Beaufort	35.44881	-76.60994	5.81	8/27/11
HWM-NC-CRT-401	North Carolina	Carteret	34.69450	-77.00800	4.27	8/27/11
HWM-NC-CRT-402	North Carolina	Carteret	34.69463	-77.00810	4.30	8/27/11
HWM-NC-CRT-403	North Carolina	Carteret	34.70273	-77.01162	4.19	8/27/11
HWM-NC-CRT-404	North Carolina	Carteret	34.68673	-77.04570	3.19	8/27/11
HWM-NC-CRT-405	North Carolina	Carteret	34.67693	-77.08063	4.20	8/27/11
HWM-NC-CRT-539	North Carolina	Carteret	34.82663	-76.69040	4.65	8/27/11
HWM-NC-CRT-540	North Carolina	Carteret	34.94108	-76.65077	7.87	8/27/11
HWM-NC-CRT-541	North Carolina	Carteret	34.96006	-76.59972	6.89	8/27/11
HWM-NC-CRV-501	North Carolina	Craven	35.07862	-77.12161	4.82	8/27/11
HWM-NC-CRV-502	North Carolina	Craven	35.07522	-77.06899	7.58	8/27/11
HWM-NC-CRV-503	North Carolina	Craven	35.11342	-77.03755	7.01	8/27/11

Table 5. High-water-mark data collected and surveyed by U.S. Geological Survey following the passage of Hurricane Irene in 2011.
—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Peak storm-tide el- elevation, feet above NAVD 88	Peak storm- tide estimated date (GMT)
HWM-NC-CRV-504	North Carolina	Craven	35.11374	−77.06014	6.19	8/27/11
HWM-NC-CRV-505	North Carolina	Craven	35.09692	−77.03869	7.23	8/27/11
HWM-NC-CRV-506	North Carolina	Craven	35.12045	−77.02141	7.05	8/27/11
HWM-NC-CRV-507	North Carolina	Craven	35.10802	−77.00485	6.99	8/27/11
HWM-NC-CRV-508	North Carolina	Craven	35.07443	−76.96793	7.84	8/27/11
HWM-NC-CRV-509	North Carolina	Craven	35.05771	−76.95716	7.84	8/27/11
HWM-NC-CRV-510	North Carolina	Craven	35.06631	−76.94806	7.86	8/27/11
HWM-NC-CRV-511	North Carolina	Craven	35.06577	−76.96493	7.62	8/27/11
HWM-NC-CRV-538	North Carolina	Craven	34.90951	−76.76278	8.70	8/27/11
HWM-NC-CRV-542	North Carolina	Craven	34.93706	−76.85925	12.58	8/27/11
HWM-NC-CRV-543	North Carolina	Craven	34.94451	−76.90320	10.04	8/27/11
HWM-NC-CRV-544	North Carolina	Craven	35.04071	−76.98877	7.68	8/27/11
HWM-NC-CUR-501	North Carolina	Currituck	36.37356	−75.83117	3.76	8/28/11
HWM-NC-CUR-502	North Carolina	Currituck	36.37408	−75.83144	3.72	8/28/11
HWM-NC-DAR-203	North Carolina	Dare	35.89725	−75.61950	6.24	8/28/11
HWM-NC-DAR-204	North Carolina	Dare	35.89892	−75.61419	6.33	8/28/11
HWM-NC-DAR-205	North Carolina	Dare	35.91494	−75.60375	6.51	8/28/11
HWM-NC-DAR-206	North Carolina	Dare	35.92033	−75.60950	6.67	8/28/11
HWM-NC-DAR-207	North Carolina	Dare	35.94297	−75.62292	6.60	8/28/11
HWM-NC-DAR-208	North Carolina	Dare	35.90342	−75.64453	6.12	8/28/11
HWM-NC-DAR-209	North Carolina	Dare	35.89411	−75.64506	6.05	8/28/11
HWM-NC-DAR-303	North Carolina	Dare	35.26503	−75.55758	5.75	8/28/11
HWM-NC-DAR-304	North Carolina	Dare	35.35158	−75.51136	6.96	8/28/11
HWM-NC-DAR-305	North Carolina	Dare	35.35108	−75.51256	6.75	8/28/11
HWM-NC-DAR-306	North Carolina	Dare	35.32325	−75.51197	6.83	8/28/11
HWM-NC-DAR-307	North Carolina	Dare	35.59536	−75.46808	8.50	8/28/11
HWM-NC-DAR-501	North Carolina	Dare	36.22250	−75.77081	6.09	8/28/11
HWM-NC-DAR-502	North Carolina	Dare	36.16711	−75.75483	6.07	8/28/11
HWM-NC-DAR-503	North Carolina	Dare	36.06103	−75.70086	6.93	8/28/11
HWM-NC-DAR-504	North Carolina	Dare	36.06142	−75.70019	7.12	8/28/11
HWM-NC-DAR-624	North Carolina	Dare	35.88374	−75.76517	4.74	8/28/11
HWM-NC-DAR-625	North Carolina	Dare	35.88948	−75.76501	6.62	8/28/11
HWM-NC-DAR-626	North Carolina	Dare	35.90245	−75.67069	5.71	8/28/11
HWM-NC-DAR-627	North Carolina	Dare	35.83970	−75.62394	6.31	8/28/11
HWM-NC-DAR-628	North Carolina	Dare	35.89418	−75.64408	6.88	8/28/11
HWM-NC-DAR-629	North Carolina	Dare	36.01480	−75.67889	6.55	8/28/11

Table 5. High-water-mark data collected and surveyed by U.S. Geological Survey following the passage of Hurricane Irene in 2011.
—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Peak storm-tide el- evation, feet above NAVD 88	Peak storm- tide estimated date (GMT)
HWM-NC-DAR-630	North Carolina	Dare	36.00805	-75.70143	6.17	8/28/11
HWM-NC-DAR-631	North Carolina	Dare	36.02739	-75.68166	6.73	8/28/11
HWM-NC-DAR-632	North Carolina	Dare	35.95770	-75.81220	4.65	8/28/11
HWM-NC-HYD-201	North Carolina	Hyde	35.39489	-76.32661	5.45	8/27/11
HWM-NC-HYD-615	North Carolina	Hyde	35.46145	-76.49176	5.38	8/27/11
HWM-NC-HYD-616	North Carolina	Hyde	35.49567	-76.45218	5.98	8/27/11
HWM-NC-HYD-617	North Carolina	Hyde	35.50942	-75.99673	2.79	8/27/11
HWM-NC-HYD-618	North Carolina	Hyde	35.40524	-76.33318	4.68	8/27/11
HWM-NC-HYD-619	North Carolina	Hyde	35.46224	-76.40307	8.17	8/27/11
HWM-NC-ONS-406	North Carolina	Onslow	34.61222	-77.22754	4.34	8/27/11
HWM-NC-ONS-408	North Carolina	Onslow	34.57292	-77.26595	10.44	8/27/11
HWM-NC-PAM-512	North Carolina	Pamlico	35.00313	-76.86466	11.01	8/27/11
HWM-NC-PAM-513	North Carolina	Pamlico	34.99328	-76.75489	8.59	8/27/11
HWM-NC-PAM-514	North Carolina	Pamlico	35.01967	-76.71353	8.26	8/27/11
HWM-NC-PAM-515	North Carolina	Pamlico	35.02513	-76.69736	8.13	8/27/11
HWM-NC-PAM-516	North Carolina	Pamlico	35.04931	-76.69994	8.13	8/27/11
HWM-NC-PAM-517	North Carolina	Pamlico	35.04709	-76.67361	7.77	8/27/11
HWM-NC-PAM-518	North Carolina	Pamlico	35.08081	-76.60425	7.42	8/27/11
HWM-NC-PAM-519	North Carolina	Pamlico	35.15006	-76.61544	7.98	8/27/11
HWM-NC-PAM-520	North Carolina	Pamlico	35.13637	-76.70881	8.49	8/27/11
HWM-NC-PAM-521	North Carolina	Pamlico	35.16352	-76.69661	8.16	8/27/11
HWM-NC-PAM-522	North Carolina	Pamlico	35.18316	-76.66260	8.14	8/27/11
HWM-NC-PAM-523	North Carolina	Pamlico	35.19931	-76.60848	8.06	8/27/11
HWM-NC-PAM-524	North Carolina	Pamlico	35.24553	-76.56406	7.26	8/27/11
HWM-NC-PAM-525	North Carolina	Pamlico	35.26094	-76.57520	6.50	8/27/11
HWM-NC-PAM-526	North Carolina	Pamlico	35.29567	-76.56053	7.09	8/27/11
HWM-NC-PAM-527	North Carolina	Pamlico	35.30925	-76.59153	7.15	8/27/11
HWM-NC-PAM-528	North Carolina	Pamlico	35.30112	-76.57170	6.93	8/27/11
HWM-NC-PAM-529	North Carolina	Pamlico	35.24297	-76.59094	7.08	8/27/11
HWM-NC-TYR-622	North Carolina	Tyrrell	35.91576	-76.27752	4.97	8/27/11
HWM-NC-TYR-623	North Carolina	Tyrrell	35.91548	-76.27680	4.96	8/27/11
HWM-NC-WAS-201	North Carolina	Washington	35.95936	-76.48897	5.15	8/27/11
HWM-NY-KIN-001	New York	Kings	40.58026	-74.01005	9.50	8/28/11
HWM-NY-KIN-002	New York	Kings	40.70473	-73.98951	6.74	8/28/11
HWM-NY-NAS-001	New York	Nassau	40.64742	-73.46229	6.68	8/28/11
HWM-NY-NAS-002	New York	Nassau	40.58396	-73.63749	20.77	8/28/11

Table 5. High-water-mark data collected and surveyed by U.S. Geological Survey following the passage of Hurricane Irene in 2011.
—Continued

[NAVD 88, North American Vertical Datum of 1988; GMT, Greenwich meridian time]

Site identification	State	County	Latitude north, decimal degrees	Longitude west, decimal degrees	Peak storm-tide el- evation, feet above NAVD 88	Peak storm- tide estimated date (GMT)
HWM-NY-NAS-003	New York	Nassau	40.88760	−73.56374	8.40	8/28/11
HWM-NY-QUE-001	New York	Queens	40.76184	−73.85864	8.23	8/28/11
HWM-NY-QUE-002	New York	Queens	40.64572	−73.83648	7.20	8/28/11
HWM-NY-RIC-001	New York	Richmond	40.59436	−74.06024	7.84	8/28/11
HWM-NY-RIC-002	New York	Richmond	40.50200	−74.23027	8.59	8/28/11
HWM-NY-SUF-001	New York	Suffolk	41.01207	−72.55773	6.92	8/28/11
HWM-NY-SUF-002	New York	Suffolk	40.84913	−72.50310	5.57	8/28/11
HWM-NY-SUF-003	New York	Suffolk	40.99074	−72.47138	5.12	8/28/11
HWM-NY-SUF-004	New York	Suffolk	40.63473	−73.20216	5.17	8/28/11
HWM-NY-SUF-005	New York	Suffolk	40.75018	−73.01311	4.33	8/28/11
HWM-VA-GLO-054	Virginia	Gloucester	37.39183	−76.45578	4.47	8/27/11
HWM-VA-GLO-055	Virginia	Gloucester	37.26806	−76.42228	4.37	8/27/11
HWM-VA-HAM-005	Virginia	Hampton	37.05678	−76.28361	8.28	8/27/11
HWM-VA-HAM-006	Virginia	Hampton	37.07892	−76.33067	5.94	8/27/11
HWM-VA-IW-061	Virginia	Isle of Wight	36.77225	−76.88889	15.80	8/27/11
HWM-VA-IW-062	Virginia	Isle of Wight	36.80406	−76.86200	17.92	8/27/11
HWM-VA-IW-063	Virginia	Isle of Wight	36.97339	−76.85125	34.39	8/27/11
HWM-VA-MAT-051	Virginia	Mathews	37.32586	−76.29278	4.40	8/27/11
HWM-VA-MAT-052	Virginia	Mathews	37.32572	−76.29581	4.61	8/27/11
HWM-VA-MAT-053	Virginia	Mathews	37.37742	−76.34803	4.46	8/27/11
HWM-VA-NOR-011	Virginia	Norfolk	36.95944	−76.25903	8.29	8/27/11
HWM-VA-NPN-004	Virginia	Newport News	36.98306	−76.39689	5.89	8/27/11
HWM-VA-POQ-001	Virginia	Poquoson	37.15503	−76.38575	5.43	8/27/11
HWM-VA-POQ-002	Virginia	Poquoson	37.15503	−76.38575	5.60	8/27/11
HWM-VA-POQ-003	Virginia	Poquoson	37.15503	−76.38575	5.50	8/27/11
HWM-VA-VAB-007	Virginia	Virginia Beach	36.88447	−76.00089	4.94	8/27/11
HWM-VA-VAB-008	Virginia	Virginia Beach	36.88447	−76.00089	4.90	8/27/11
HWM-VA-VAB-009	Virginia	Virginia Beach	36.88447	−76.00089	4.92	8/27/11
HWM-VA-VAB-010	Virginia	Virginia Beach	36.85208	−76.06442	6.18	8/27/11

Glossary

EDT Eastern daylight time

Elevation Refers to distance above the vertical datum.

EST Eastern standard time.

Gage Altitude Datum Refers to the vertical datum that a streamgage is surveyed to.

GMT Greenwich meridian time.

HWM High-water mark.

NAVD 88 North American Vertical Datum of 1988.

NGVD 29 National Geodetic Vertical Datum of 1929.

NOAA National Oceanic and Atmospheric Administration.

RDG Rapid-deployment gage.

storm surge Additional water-level rise caused by a storm higher than the predicted astronomical tide.

storm tide Water-level rise due to the combination of storm surge and the astronomical tide.

streamgage Shelter or housing containing instrumentation used to measure inland water level.

tide gage Shelter or housing containing instrumentation used to measure coastal water level.

USGS U.S. Geological Survey.

Conversion Factors and Datums

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
mile, nautical (nmi)	1.852	kilometer (km)

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88) unless otherwise noted.

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83) unless otherwise noted.

Elevation, as used in this report, refers to distance above the vertical datum.

Gage Altitude Datum, as used in this report, refers to the vertical datum that a streamgage is surveyed to.

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Edited by Rebecca J. Deckard

Layout by Caryl J. Wipperfurth

For more information about this publication, contact:

Chief, Office of Surface Water
U.S. Geological Survey
415 National Center, MS 415
Reston, VA 20192

<http://water.usgs.gov/osw>

