

*Hurricane Ian September 28, 2022 at 19:15Z – NOAA/NESDIS/STAR GOES-E Band-13 satellite.*

## Hurricane Ian:

A major hurricane that brought wide-ranging catastrophic impacts to Florida

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Hurricane Ian was the 2nd major hurricane of the 2022 Atlantic hurricane season. Ian made landfall on Cayo Costa Island in southwest Florida on September 28th and made a second U.S. landfall near Georgetown, SC on the 30th. As a major category 4 storm when it struck Florida, Ian resulted in widespread and devastating impacts from southwest to northeast Florida due to high storm surge and waves, high winds, tornadoes, and inland flooding.

This report summarizes storm observation data and includes an overview of impacts felt across the state. It compiles observed rainfall, wind speeds, and preliminary high-water levels from different observing networks and resources. It also includes a list of additional resources for more data and information. As with other major hurricanes in recent years, Ian reignited important dialogue around risk communication, resilient coastal development, long-term recovery, and adaptation.



## Origination and Development

Hurricane Ian emerged in the Atlantic as a tropical wave and moved west toward the Caribbean. It was initially slow to develop due to interactions with Hurricane Fiona, which was a major category 4 hurricane at the time in the Atlantic Ocean. A large area of upper-level outflow from Fiona resulted in increased wind shear (Fig. 1), preventing then tropical depression (TD) 9 from organizing. As Fiona moved north on its approach toward Canada, its influence waned and TD9 moved into the central Caribbean and into more favorable conditions where sea surface temperatures were 1-2° C above normal. TD9 became Tropical Storm Ian on the 23rd and strengthened into a category 1 hurricane on the 26th.

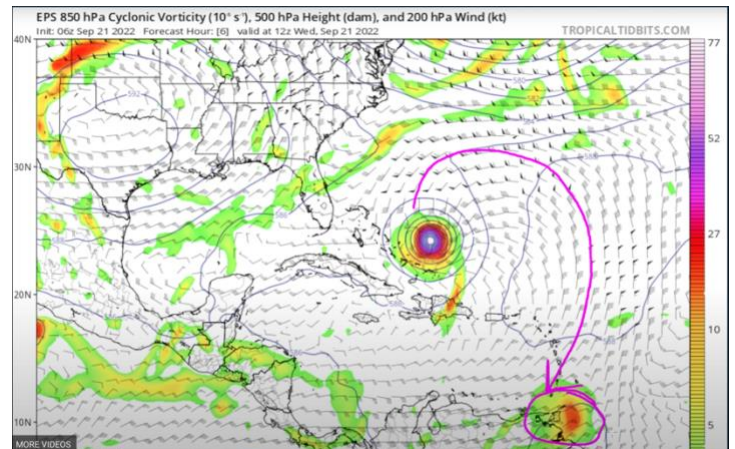


Figure 1. Map showing upper-level flow from Hurricane Fiona interacting with Ian as a tropical wave in the Atlantic on September 21, 2022 (credit: Dr. Levi Cowan, Tropicaltidbits.com).

## Rapid Intensification

Ian underwent multiple rapid intensification cycles during its life. As it approached Cuba, Ian strengthened from a category 1 to a category 3 hurricane in less than 24 hours, striking western Cuba with winds of around 125 mph. After crossing Cuba, Ian rapidly intensified again, developing into a high-end category 4 storm within 24 hours. It had maximum winds of 155 mph as it approached southwest Florida.

Ian underwent an eyewall replacement cycle at this time. At its maximum size, the eye was roughly 34 miles wide (Fig. 2). Hurricane Charley in 2004 was the most recent frame of reference for long-time residents of southwest Florida, as Charley was the last category 4 storm to hit this part of Florida with a very similar track and intensity. However, Ian moved much slower and its hurricane-force wind field extended over a much larger area compared to Charley's. These two factors combined to generate greater damages from wind, surge, and rain.

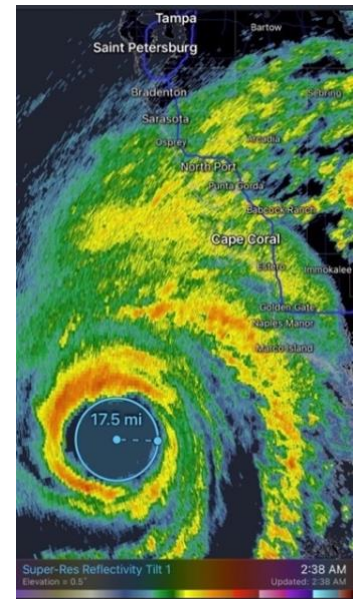


Figure 2. Ian's eye just before landfall. Credit: Dr. Rick Knabb (@DrRickKnabb)

## Landfall

Ian made landfall on the 28<sup>th</sup> at Cayo Costa and then near Fort Myers, where the triple threat of high winds, high storm surge and wave action, and heavy rain resulted in catastrophic damage and loss of life. Ian slowed down at landfall, prolonging the onslaught of high surge and winds and ultimately worsening impacts. While official high-water marks and peak surge levels are still under investigation, this region of Florida has likely not seen this level of combined high winds and storm surge since at least Hurricane Donna in 1960. As Ian crossed the state, heavy rain and high winds impacted central areas from Arcadia through Kissimmee and Orlando eastward. Places along the east coast from Daytona Beach to St. Augustine experienced heavy rain and surge as well.



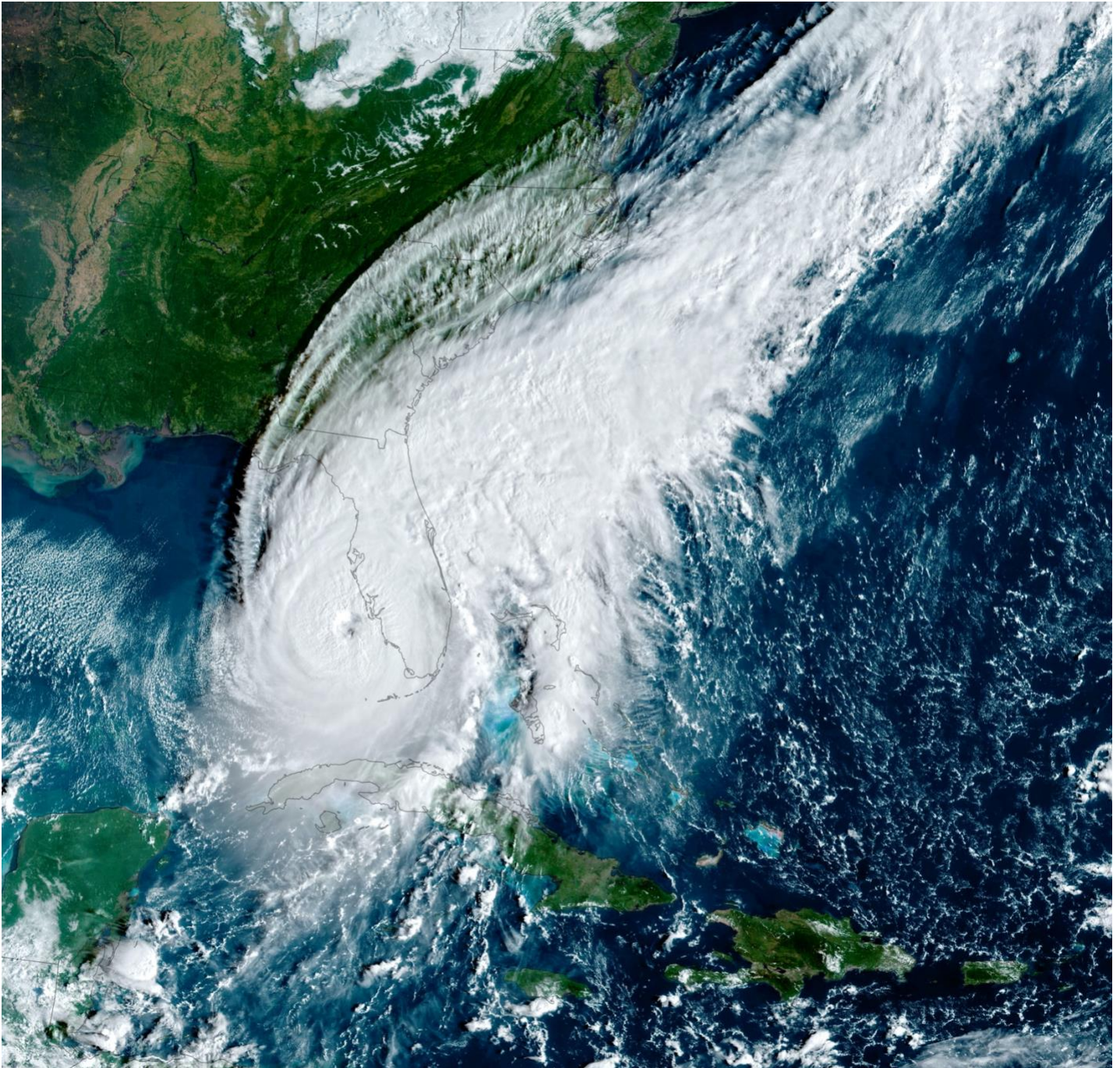


Figure 3. Hurricane Ian approaching southwest Florida on September 28, 2022, with sustained winds of 155 mph and cloud bands covering much of Florida. Image from NASA Earth Observatory's Joshua Stevens using GOES 16 imagery courtesy of NOAA and NESDIS.

## Storm Rankings and Statistics

- Hurricane Ian tied as the **5<sup>th</sup>-strongest hurricane to make landfall in the U.S.** with multiple other storms based on maximum sustained winds at landfall (8-way tie, including the most recent Hurricanes Ida in 2021, Laura in 2020, and Charley in 2004) (Table 1).

Table 1. Strongest landfalling hurricanes (category 4 and 5 with winds 150+ mph) on record (Credit: Philip Klotzbach, CSU).

Rank	Year	Month	Day	Storm Name	Landfall Wind (mph)	Landfall Pressure (hPa)	State
1	1935	9	3	Labor Day	185	892	FL
2	1969	8	18	Camille	175	900	MS
3	1992	8	24	Andrew	165	922	FL
4	2018	10	10	Michael	160	919	FL
T-5	1856	8	10	Last Island	150	934	LA
T-5	1886	8	20	Indianola	150	925	TX
T-5	1919	9	10	Florida Keys	150	927	FL
T-5	1932	8	14	Freeport	150	935	TX
T-5	2004	8	13	Charley	150	941	FL
T-5	2020	8	27	Laura	150	939	LA
T-5	2021	8	29	Ida	150	931	LA
T-5	2022	9	28	Ian	150	940	FL
<b>T represents a tie with other years</b>							

- Ian ranks in a 3-way tie for the **4<sup>th</sup>-strongest storm to make landfall in Florida** based on maximum sustained winds. The top 3 strongest storms to ever make landfall in Florida are: the Labor Day Hurricane of 1935 (185 mph), Andrew in 1992 (165 mph), and Michael in 2018 (160 mph).
- The strongest storm on record to ever hit the U.S. was the Labor Day Hurricane of 1935, which made landfall in the Florida Keys as a high-end Category 5 hurricane with sustained winds of 185 mph and a central pressure of 892 mb.
- Hurricane Ian is the **9<sup>th</sup> tropical cyclone to directly strike Lee County, Florida over the historic hurricane record.** Table 2 lists the past hurricanes and tropical storms that have made a direct landfall in Lee County since the late 1800s. Several more tropical cyclones have made a close pass by Lee County or made landfall directly north or south of the county, which are not included in the table.
- The death toll from Ian is currently 131, making it the **4<sup>th</sup>-deadliest hurricane in the U.S. since 1980**, according to NOAA/NCEI's billion-dollar storm statistics (Table 3), and the 2nd-deadliest tropical cyclone to ever strike Florida. The deadliest storm in Florida's history was the Okeechobee Hurricane of 1928, with estimated fatalities of at least 2,500, according to a National Hurricane Center report (<https://www.nhc.noaa.gov/pdf/nws-nhc-6.pdf>).



Table 2. Tropical cyclones that have made a direct landfall in Lee County, Florida over the historic record.

Date	Name	Category	Winds	Landfall location
October 7, 1873	Unnamed	3	115 mph	Captiva, Pine Island
September 25, 1894	Unnamed	2	104 mph	Between Sanibel and Fort Myers Beach
October 18, 1910	Unnamed	2	109 mph	Between Sanibel and Fort Myers Beach
October 9, 1953	Hazel	1	86 mph	Cayo Costa
June 4, 1968	Abby	TS	63 mph	Boca Grande
July 23, 1985	Bob	TS	46 mph	Estero Island
November 16, 1994	Gordon	TS	52 mph	Fort Myers Beach
August 13, 2004	Charley	4	150 mph	Captiva
September 28, 2022	Ian	4	150 mph	Cayo Costa

Table 3. Deadliest hurricanes since 1980 (source: NOAA/NCEI U.S. Billion-Dollar Weather & Climate Disasters).

Storm	Year	Fatalities
Maria	2017	2,981
Katrina	2005	1,833
Sandy	2012	159
Ian	2022	131
Rita	2005	119
Ike	2008	112

- **Insured losses from Ian are estimated at roughly \$67 billion**, according to preliminary estimates by RMS, an international risk modeling company. This would make it **the costliest disaster in Florida’s historic record**, surpassing 2004 as the costliest disaster year in Florida since 1980 when Florida was impacted by Hurricanes Charley, Frances, Ivan, and Jeanne (Fig. 4).
- Since 1980, five hurricanes have resulted in \$20 billion or more in damage in Florida, including Andrew (1992), Charley (2004), Wilma (2005), Irma (2017), and Michael (2018). Irma and Andrew each produced roughly \$50 billion in damages in Florida. **Losses from Ian will likely surpass both Irma and Andrew.**

## Extreme Rain and Winds

Water was a major hazard associated with Ian. Heavy rainfall and flash flooding affected many areas in Ian’s path. Rainfall from Ian was especially rare. Table 4 compares the 6- and 12-hour rainfall totals from Ian to the 100-year average recurrence intervals for these same durations, based on NOAA Atlas 14 data. The storm **produced nearly double the amount of rain expected in a 100-year storm** in some locations. In addition, the map in Figure 5 shows total rainfall over the past month since Ian as percent of normal rainfall, with some areas over 300% of normal due to the storm.

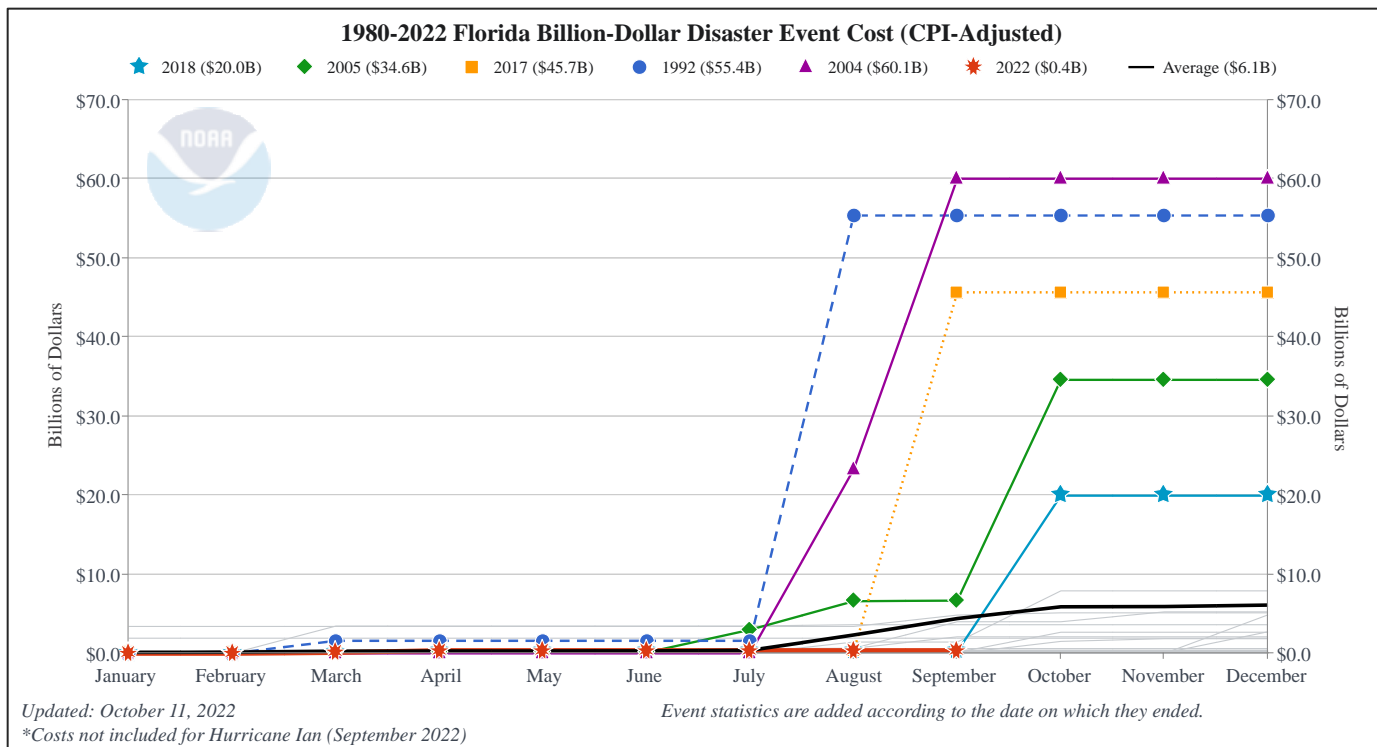


Figure 4. Billion-dollar disasters affecting Florida from 1980 to 2022, excluding costs from Ian (source: NOAA/NCEI).

Table 4. The 6- and 12-hour rainfall totals for select stations and average recurrence intervals. Station rainfall data are from the Florida Automated Weather Network; average recurrence intervals are from the Strategic Environmental Research and Development Program.

Location	Duration (hours)	100-year precipitation frequency estimates (in.)	Rainfall from Ian (in.)
Arcadia	6	6.70	10.80
Ona	6	6.80	11.53
Joshua	12	8.26	16.54
North Port	12	9.06	11.10

Many locations saw **more than a month's worth of rain in a matter of hours**. Some areas, especially near Port Charlotte and Sarasota, far exceeded the 100-year storm, or the amount of rain that can be expected on average every 100 years. **Ona** recorded over 11.5 inches in just 6 hours, and **Arcadia** reported over 10 inches of rain in 6 hours. **Joshua** received over 15 inches in 8 hours. Table 5 provides additional observations from the Florida Automated Weather Network (FAWN), including 3-day rainfall totals and maximum wind speeds observed during the storm at select stations. Rainfall ranged from as low as 1.5 inches to as much as 19.3 inches, with maximum wind speeds over 70 mph at some stations. Peak wind gusts were highest in areas near the point of landfall, with wind reported as 140 mph at **Cape Coral**, 135 mph at **Punta Gorda**, 112 mph at **Pelican Bay**, 105 mph at **Naples**, and 100 mph in **Fort Myers**, according to the Weather Prediction Center. Table 6 shows the highest wind gusts reported across East Central Florida from the National Weather Service Melbourne Weather Forecast Office.

CoCoRaHS (Community Collaborative Rain, Hail, and Snow Network) reporters further documented extreme rainfall and conditions during Ian. Many observers reported having full or overflowing rain gauges with 11+ inches in 24 hours or less. Some stated having issues accurately reporting rainfall totals due to the horizontal nature of the rain likely missing gauges, gauges leaning over due to strong winds or being knocked by flying debris, or from debris that had blocked the gauge. In these cases, rainfall totals may far underrepresent the actual total rainfall that fell during the storm.

Table 7 provides select Florida CoCoRaHS observations submitted through daily reports during the storm, including rainfall and comments. These show some of the localized impacts and experiences from eyewitness accounts on the ground. These near real-time observations are a valuable resource to weather forecasters during an event, and they add value to immediate recovery activities and long-term resilience planning and decision making. While flooding from Hurricane Ian impacted large areas, these comments show how localized the impacts were in some areas.

*“Between 11:30 PM and 7:30 AM, we got 10.31 inches. Glad I emptied the gauge before bed. Not that I got much sleep.”*  
*- CoCoRaHS observer, Edgewater*

### Riverine Flooding

Once the storm left the state, floodwaters were slow to recede and rivers continued to rise to record flood stages, leading to additional riverine flooding in the days and weeks following Ian’s landfall. Ian caused rivers to swell beyond their banks, flooding surrounding areas for weeks following the storm. The Kissimmee, Peace, and St. Johns Rivers were especially impacted with unprecedented flooding from Ian’s rainfall and from runoff following the storm. **Lake Okeechobee has been absorbing runoff from Ian and has since rebounded by over 2 feet.**

### Rivers reach record flood stage

Many rivers broke all-time record flood stage levels. Figure 6 shows the status of rivers across the state as of September 29, shortly after Ian’s passage. Most water bodies in Ian’s path experienced moderate to major flooding (indicated by red and purple circles). **Parts of the St. Johns River continue to be in flood stage one month later.** Figure 7 shows imagery of Lake Henry and St. Johns River before Ian

Table 5. Total 3-day precipitation (inches) during Ian from September 28 – 30 and the hourly maximum wind speed (mph) for select Florida Automated Weather Network (FAWN) stations.

Station Name	3-day Precipitation (in.)	Max Wind (mph)
Apopka	10.07	61.31
Arcadia	12.83	85.80
Avalon	8.08	55.29
Babson Park	13.00	65.65
Balm	5.55	66.60
Clewiston	1.92	66.57
Dade City	2.98	41.70
Dover	4.11	37.2
Fort Pierce	3.15	56.71
Hastings	8.90	43.42
Immokalee	1.51	63.17
Joshua	19.31	88.50
Kenansville	6.19	34.83
Lake Alfred	8.75	51.52
North Port	13.67	69.30
Ocklawaha	2.77	27.27
Okeechobee	2.26	72.10
Ona	17.31	45.09
Palmdale	3.18	60.43
Pierson	10.99	33.07
Putnam Hall	1.96	41.70
Sebring	6.42	45.20
St. Lucie West	2.98	57.60
Umatilla	6.48	34.49
Wellington	2.55	47.30

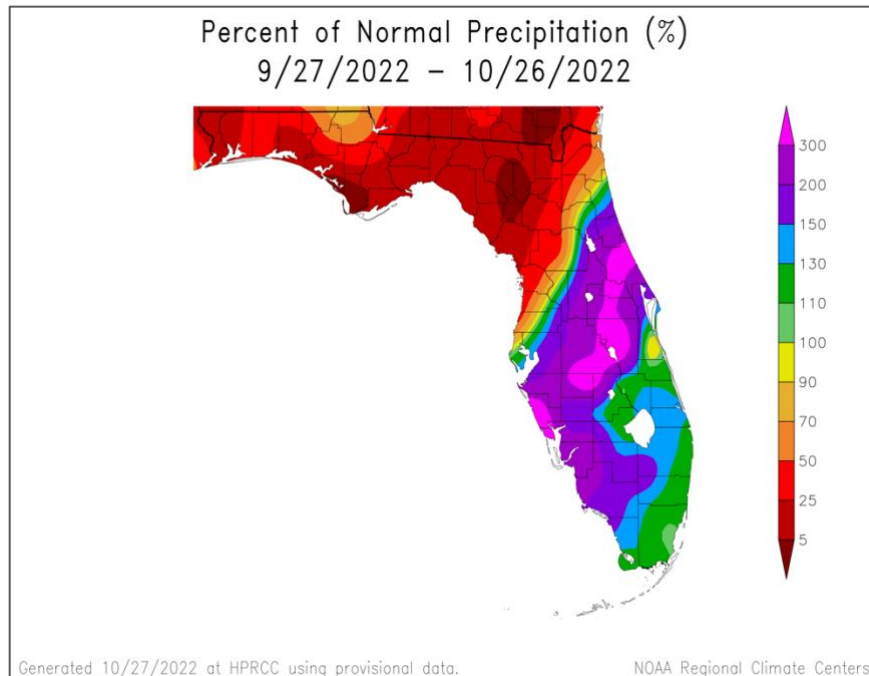


Figure 5. Percent of normal rainfall observed over past 30 days, from September 27 to October 26, 2022.

and shortly following Ian on September 30th. The slow-moving flow of the river from south to north with little elevation change makes it slow to drain excess rainfall. Hydrographs for select locations during and following the storm are also shown in Figure 8. Several locations reached record flood stage, including along Horse Creek near Arcadia, Haw Creek, Myakka River, Peace River, and St. Johns River.

Table 6. Highest observed wind gusts, in miles per hour, reported during Hurricane Ian across East Central Florida, from the National Weather Service Melbourne Weather Forecast Office.

Location	Speed	Time	Date
<b>Brevard County</b>			
Melbourne Beach Barrier Isla	81 MPH	1156 PM	28-Sep
Cape Canaveral (KXMR)	73 MPH	0244 PM	29-Sep
Cocoa Beach Club	67 MPH	0157 AM	29-Sep
Patrick AFB Coco (KCOF)	66 MPH	0233 PM	29-Sep
Melbourne Intl Apt (KMLB)	66 MPH	0144 PM	29-Sep
2.7 SE Haulover Canal (JSCNA	63 MPH	0615 PM	28-Sep
Merritt Island	59 MPH	0205 PM	29-Sep
<b>Indian River County</b>			
Vero Beach Reg Apt (KVRB)	66 MPH	0120 AM	29-Sep
Sebastian Mun Apt (KX26)	54 MPH	1155 PM	28-Sep
Fswn Indian River Merrill Ba	52 MPH	1210 AM	29-Sep
Vero City	52 MPH	0114 AM	29-Sep
<b>Lake County</b>			
Leesburg Intl Apt (KLEE)	56 MPH	0541 AM	29-Sep



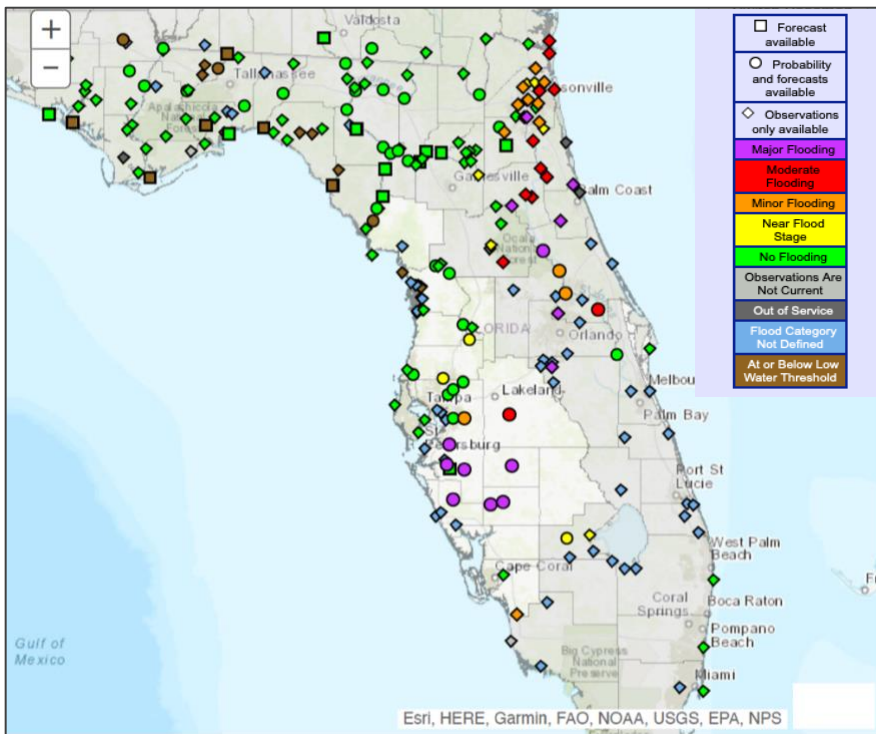
Leesburg	47 MPH	0746 AM	29-Sep
<b>Martin County</b>			
Fswn House Of Refuge	65 MPH	0210 AM	29-Sep
Fswn Jensen Beach Oceanfront	50 MPH	1250 AM	29-Sep
<b>Okeechobee County</b>			
Fswn Lake Okeechobee	75 MPH	1010 PM	28-Sep
Okeechobee Apt (KOB)	74 MPH	0935 PM	28-Sep
Fswn Okeechobee Kissimmee Pr	65 MPH	0930 PM	28-Sep
Okeechobee (WEATHERSTEM)	57 MPH	0750 PM	28-Sep
<b>Orange County</b>			
Orlando Intl Apt (KMCO)	74 MPH	1004 AM	29-Sep
4.1 W Lake Mary Jane (WEATHE	61 MPH	1030 AM	29-Sep
Reedy Lake	58 MPH	0326 AM	29-Sep
1.9 NW University Park (WEAT	57 MPH	1010 AM	29-Sep
Maitland (WEATHERSTEM)	57 MPH	0820 AM	29-Sep
Orlando	57 MPH	1025 AM	29-Sep
Windermere Preparatory Schoo	53 MPH	0430 AM	29-Sep
<b>Osceola County</b>			
Fswn Osceola Heritage Park	56 MPH	0200 AM	29-Sep
Kissimmee Apt (KISM)	55 MPH	0653 AM	29-Sep
2.3 SE Intercession City (WE	54 MPH	1220 AM	29-Sep
<b>Seminole County</b>			
Sanford Intl Apt (KSFB)	69 MPH	0850 AM	29-Sep
1 NE Sanford	68 MPH	0940 AM	29-Sep
Spring Lake	68 MPH	1033 AM	29-Sep
Winter Springs High School	61 MPH	1010 AM	29-Sep
<b>St. Lucie County</b>			
Fort Pierce (KFPR)	66 MPH	1216 AM	29-Sep
St. Lucie Plant	57 MPH	1108 PM	28-Sep
Port St. Lucie	54 MPH	0232 AM	29-Sep
<b>Volusia County</b>			
New Smyrna Beach	85 MPH	1126 AM	29-Sep
Daytona Intl Apt (KDAB)	81 MPH	1112 AM	29-Sep
1.4 E Daytona Beach Intl (WE	67 MPH	0900 AM	29-Sep
1 E Ormond Beach	66 MPH	0610 AM	29-Sep
Deland	55 MPH	1000 AM	29-Sep
2.6 SE Deltona (WEATHERSTEM)	53 MPH	0810 AM	29-Sep

*"Our property sustained line damage of down branches. We are very lucky. A couple of blocks away, completely submerged and there are flood rescue efforts going on."*

*- CoCoRaHS observer, Winter Springs*

Table 7. Select CoCoRaHS daily reports submitted during Hurricane Ian, including daily rainfall totals in inches (typically observed at 7:00 am for the preceding 24 hours) and comments.

Date	Station name	City	Daily rainfall (in.)	Comments
9/28/2022	FL-SL-50	Port St. Lucie	5.88	Outer feeder rain bands from Hurricane Ian...mostly overnight and early AM hours. Street flooding. 5.88" was still raining at time of reading at 8am.
9/28/2022	FL-MD-26	Miami Lakes	3.25	Lake is up 6 sandbags. Lake is lapping at all the docks but not over the docks yet.
9/29/2022	FL-HB-128	Ruskin	3.95	Potential tornado activity. Subdivision has a PVC privacy fence behind my house, completely blown over by Ian; businesses 3/4 mile to my NE had their roofs blown off their buildings and in E. College Ave. trees down, blocking traffic on E. Shellpoint Rd.; 27th St. SE in the 1100 block; and on Cortaro.
9/29/2022	FL-OR-73	Apopka	8.50	It's still coming down in buckets. Still very windy. My umbrella broke! My yard up to the fence is ok. From the fence to the street is flooded.
9/29/2022	FL-OS-31	Campbell	15.17	Hurricane Ian Street flooding, retention ponds completely overtopped.
9/29/2022	FL-SL-54	Jensen Beach	1.76	The beach (sand) just replenished this Apr-May now features a 42-48" drop-off, where strong northward flowing current (longshore) on Thurs washed away the sand. Distance from the base of the dunes to the 'drop-off' estimated at about 50-70'.
9/29/2022	FL-VL-6	Edgewater	16.27	Between 11:30 PM and 730 AM we got 10.31 inches. Glad I emptied the gauge before bed. Not that I got much sleep.
9/29/2022	FL-CT-26	Hernando	11.80	Major flooding down by the fishing pier.
9/29/2022 and 9/30/2022	FL-SM-43	Winter Springs	13.65 and 0.81	The most damaging winds were starting Thursday morning about 9 AM. Our property sustained line damage of down branches. We are very lucky, a couple blocks of ways, completely submerged, and there are flood rescue efforts.
9/30/2022	FL-FL-24	Palm Coast	2.26	Still no power from Ian. Total rain for storm 7.89". Canal level peaked at 33" above bulkhead (5.33' above MSL).
10/1/2022	FL-SL-17	Tradition	0.00	Last month, September 2022, was the most precipitation, 17.67", at this site since I have been recording in late 2008.
10/1/2022	FL-BV-13	Rockledge	0.00	For September, 21.23", the 3rd highest in my 40+ years here for any month. For the year, 61.05", which is above avg by some 16".



Flooding in DeLand along the St. Johns River weeks following Ian's landfall (source: Jennifer Gray, Melissa Alonso, Angela Fritz, CNN).

Figure 6. Riverine flooding as of September 29, 2022. Source: NWS Advanced Hydrologic Prediction Service.



Figure 7. Lake Harney and the St. John River before (left) and after (right) Hurricane Ian, from [eyeonlakeo.com](http://eyeonlakeo.com).

## Storm Surge

Areas of coastal southwestern Florida to the east, or right, of the eyewall incurred the most devastating impacts from storm surge. First-hand accounts described the surge as rising very quickly within a matter of minutes. According to the National Hurricane Center, preliminary post-storm analyses show **peak water levels likely reached 10-15 feet above normally dry ground at Fort Myers Beach**. The National Hurricane Center (NHC) is expected to release a report on Ian in the coming months with official peak surge heights.



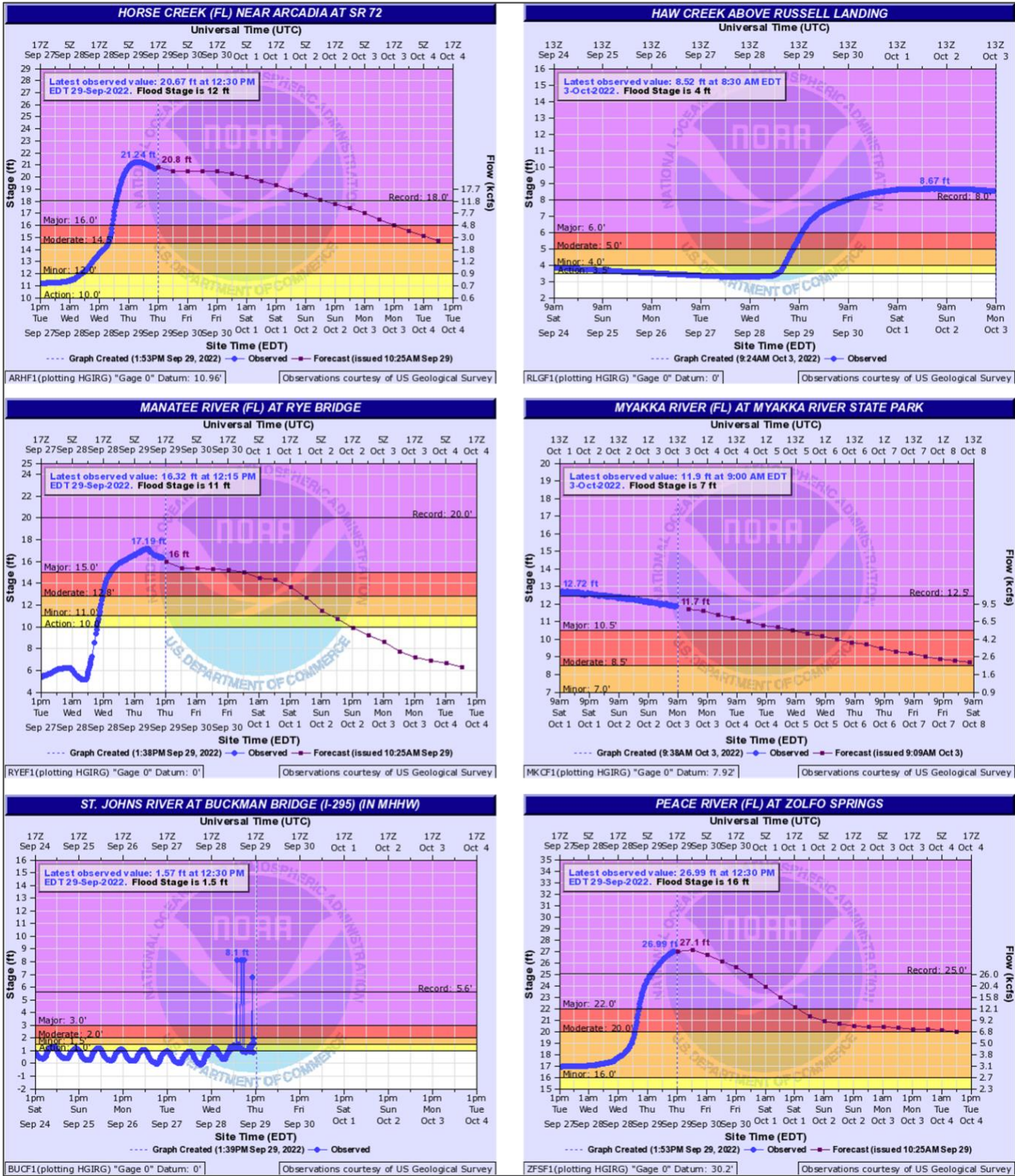
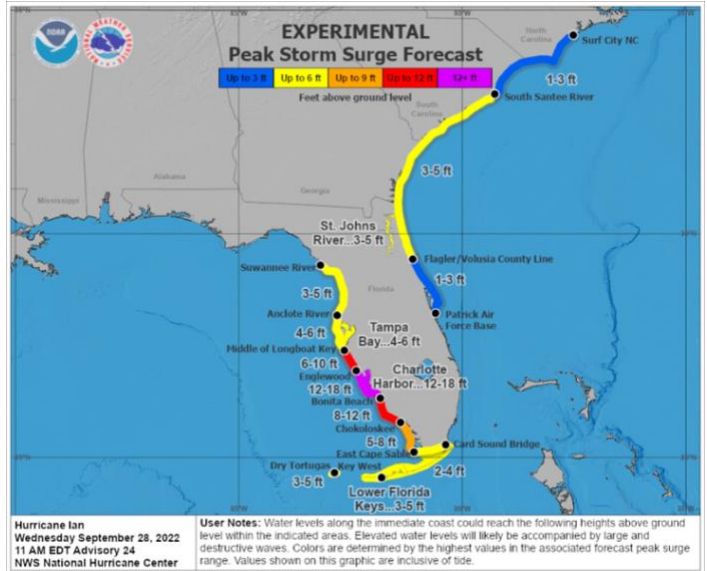


Figure 8. River stage level observations during Hurricane Ian from the NWS Advanced Hydrologic Prediction Service.

The NHC launched a new experimental storm surge forecast product in 2017 for tropical cyclones expected to cause life-threatening surge impacts. This product depicts the expected peak storm surge inundation values for coastal areas, represented as the peak height above normally dry ground. For Hurricane Ian, the forecasted peak storm surge in southwest Florida from Bonita Beach north to around Englewood was 12-18 feet, with 6-12 feet in areas just north and south of the peak surge (Fig. 9). These graphics convey critical safety information and help fill a need in communicating the potential life-threatening storm surge risks associated with tropical cyclones.



### How did Ian's surge likely compare to past storms?

Figures 10a and b show high water levels during the storm measured at tide gauges along the southwest and northeast coasts, respectively. Preliminary high-water marks along Sanibel east toward the Caloosahatchee River range from 6.9 to 13.8 feet NAVD88 (Figure 10a). Debris lines observed along the second story walls of buildings in and near Fort Myers provide additional evidence that surge heights were likely 10 feet or higher. To explore these data, visit the [USGS Flood Event Viewer](#) tool.

Figure 9. Peak storm surge forecast for Hurricane Ian issued by the NHC on September 28 at 11am EDT.

**The last known storm that produced significant storm surge in southwest Florida was Hurricane Donna in 1960**, which made landfall in the Florida Keys as a category 4 hurricane and again just south of Naples as a category 3 hurricane. Peak surge during Donna was estimated to have been as high as 11 feet along Florida's southwest coast and 13 feet in the Florida Keys based on data records including from paleotempestology records collected from this part of the coast. Hurricane Charley produced roughly 9 feet of surge (NGVD) in southwest Florida.



Tide gauges captured high water levels, but some gauges became inoperable during the storm before reaching peak heights (e.g., Fort Myers and Naples tide gauges in Figures 11 and 12). **Many areas to the west or north of the storm's center with prolonged offshore winds observed negative storm surge by several feet**, temporarily emptying parts of Tampa Bay, Cedar Key, and as far north near St. Marks and Apalachicola Bay. This was captured by several tide gauges (Fig. 13).

Flooding at Fort Myers Beach from Twitter user @itsbethbooker.



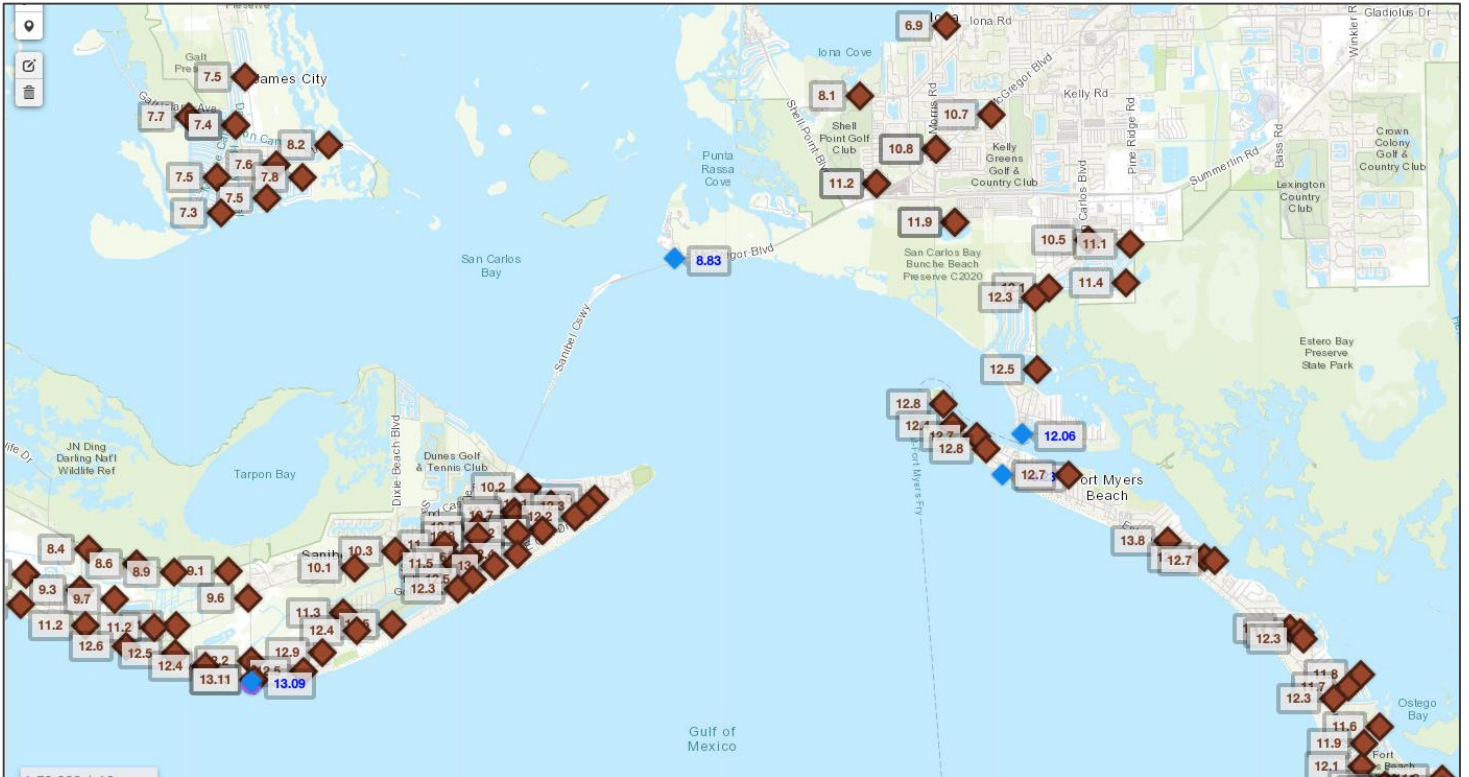


Figure 10a. Preliminary high water marks from following Ian in Southwest Florida (source: USGS Flood Event Viewer).



Negative surge in Tampa Bay (from Twitter @SpataTimes via Tampa Bay Times, Sept. 28).



Negative surge in Ochlockonee Bay just north of Alligator Point on Sep. 29 (credit: Lou Kelly, Tallahassee Democrat).



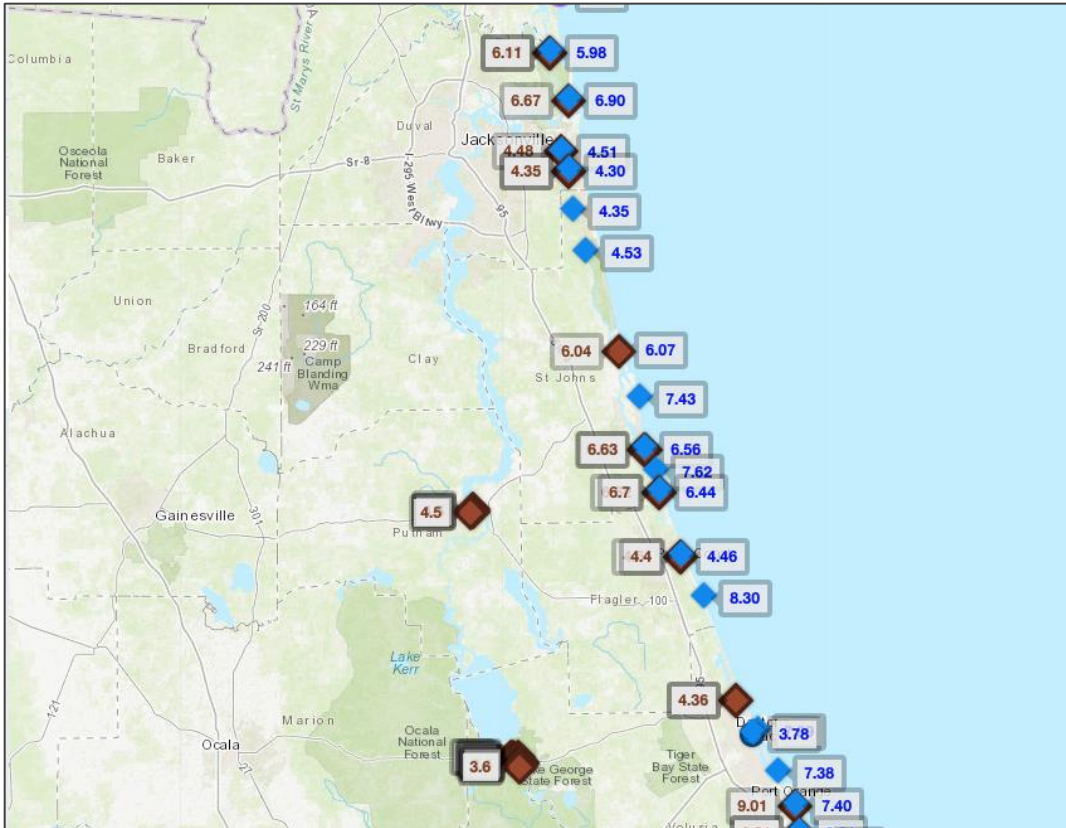


Figure 10b. Preliminary high water marks from Hurricane Ian in Northeast Florida (source: USGS Flood Event Viewer).

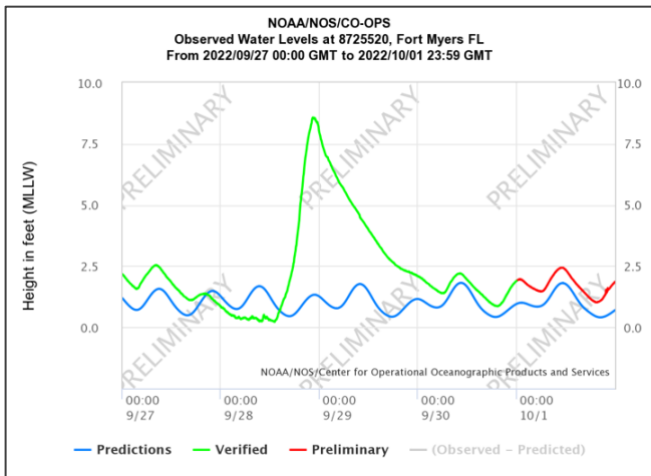


Figure 11. NOAA tide gauge at Fort Myers, 9/27 – 10/1.

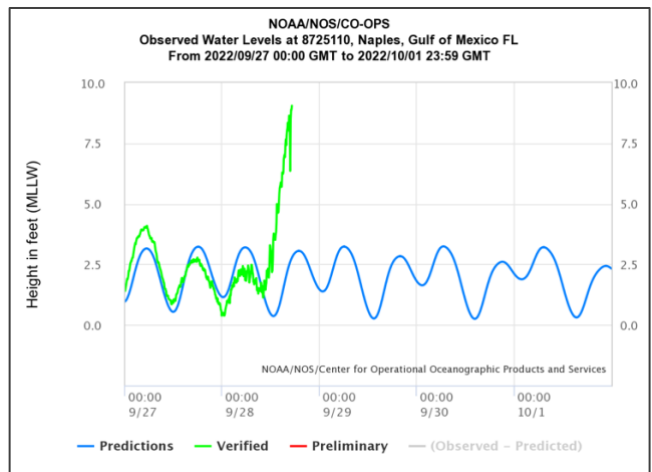


Figure 12. NOAA tide gauge at Naples, 9/27 – 10/1.

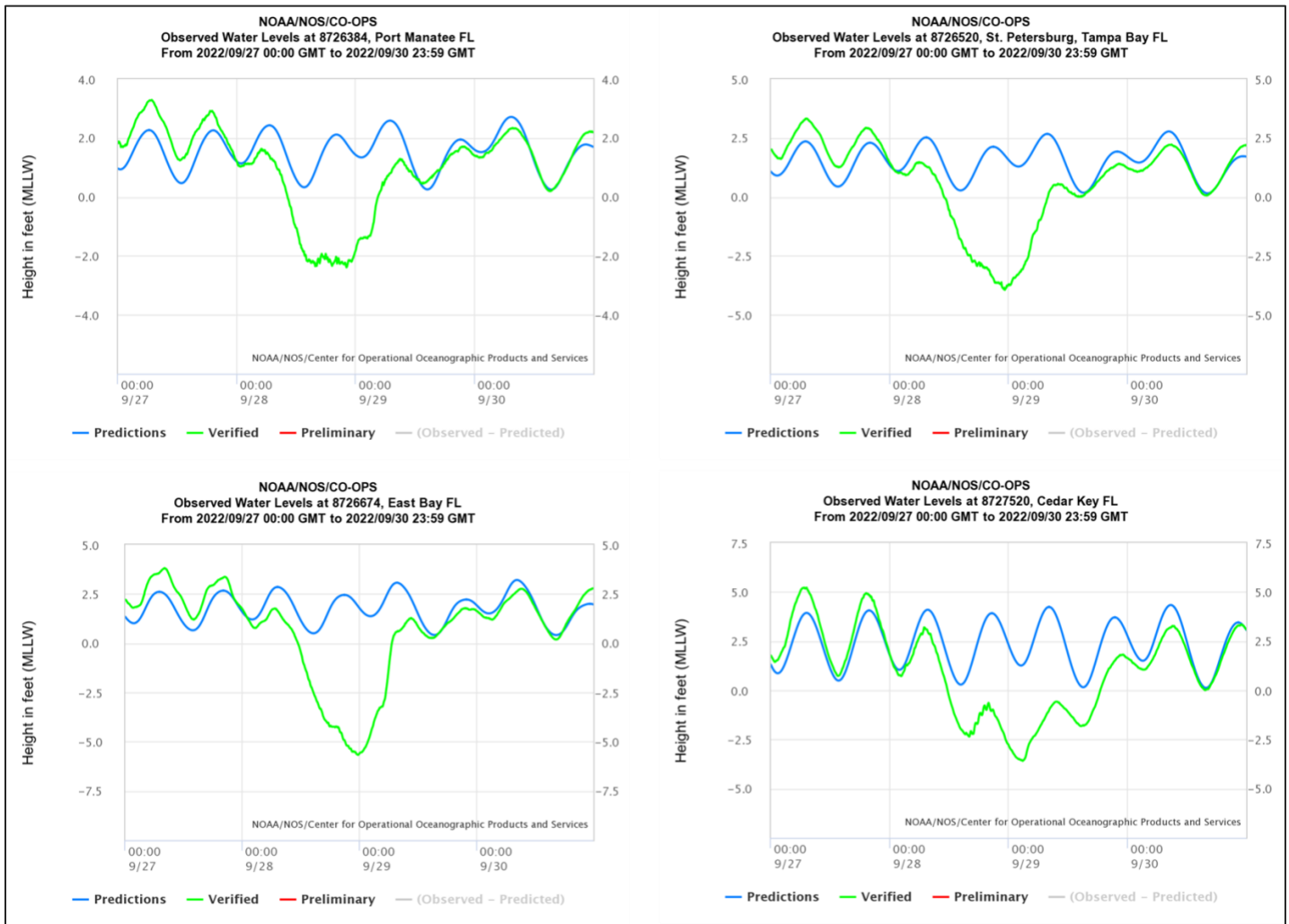


Figure 13. Select tide gauge stations that show negative storm surge during Ian (source: NOAA Tides & Currents).

## Ian's Impacts

Ian caused billions in damages to the state, uprooted people's lives and livelihoods, and impacted key economic sectors. **Several waterbodies continue to be impacted by flooding**, including the St. Johns River which is still in flood stage due to rainfall runoff and slow drainage. These long-lasting impacts continue to disrupt lives, as some homes remain inaccessible a month following the storm.

Agricultural impacts were severe. Ian affected the seafood industry, livestock and pastures, citrus crops, and other vegetable crops. Preliminary (and only partial) damage estimates for **agricultural losses have been estimated between \$1.18 billion to \$1.89 billion**, which includes losses from crop and animal products, production, and infrastructure, according to assessments by UF/IFAS and the Florida Department of Agriculture and Consumer Services (FDACS).

In terms of ecological impacts, the storm stirred up large amounts of sediment in the Gulf of Mexico and in estuaries across southwest Florida, with satellite imagery capturing large plumes of brown fresh water draining from rivers into coastal estuaries (Fig. 14). Ian likely caused severe damage to the state's

natural assets. Damage assessments are underway to identify how the storm impacted critical natural resources such as coral reefs in the Dry Tortugas National Park, which received a direct hit from Ian. However, the full scale of ecological impacts from Ian will take months or years to fully understand.



Figure 14. Southwest Florida coastline on September 30, 2022 showing the effects of Ian on sediment and water redistribution, from NASA's Earth Observatory acquired by the European Space Agency's Sentinel-2 mission.

Ian may further be remembered for reigniting important conversations around **risk communication**, **disaster complacency**, and **(re-)development** in coastal hazardous areas. The factors that influence disaster risk perceptions and individual decision making are myriad and complex. As one CoCoRaHS observer suggested, disaster fatigue may be an increasing challenge as tropical cyclones become wetter, slower moving, rapidly intensify, and ultimately more costly.

*“Unfortunately, this is the 2nd major evacuation of close to a million people where the storms have veered. I worry that we will never get a 3rd evacuation for the next storm because of having the forecast being wrong about a Tampa landfall. ... Once again, people evacuated inland, and the storm shifted into the inland part of the state near Orlando. I worry that many more will die the next time due to complacency (“see, there is something magical about the coastline here that protects us. It never happens here”).”*

*- CoCoRaHS observer*



## Additional Resources

[NWS Miami Weather Forecast Office Post-Ian Report](#) [[LINK](#)]

[NWS Melbourne Weather Forecast Office Highest Observed Wind Gust Reports from Ian Across East Central Florida](#) [[LINK](#)]

[The Weather Prediction Center Storm Summary](#) [[LINK](#)]

[NOAA National Centers for Environmental Information's Summary of Ian](#) [[LINK](#)]

[FDCAS Hurricane Ian's Preliminary Estimates of Damages to Florida Agriculture](#) [[LINK](#)]

[UF/IFAS Preliminary Assessment of Agricultural Losses Resulting from Hurricane Ian](#) [[LINK](#)]

[NOAA's National Geodetic Survey Post-Ian Storm Imagery](#) [[LINK](#)]

[NHC Hurricane Ian Advisory Archive](#) [[LINK](#)]

[Eye On the Lake Before and After Imagery of Waterbodies in Florida](#) [[LINK](#)]

[Florida Department of Environmental Protection's Hurricane Ian and Hurricane Nicole Preliminary Post-Storm Beach Conditions and Coastal Impact Report](#) [[LINK](#)]