

2021 Weather in Review: Colonial National Historical Park

Weather and climate play significant roles in driving both physical and ecological processes. For example, the active processes that shape the North Atlantic shoreline are largely the result of meteorological events such as wind-driven waves. For research and long-term ecological monitoring, weather and climate data provide the potential for correlations to be made with observed physical and ecological pattern data. This resource brief provides a summary of both historic and current (2021) weather data for Colonial National Historical Park (COLO), Virginia (VA). Because tide levels and wind can be significant for coastal parks, the annual water level and wind data are included.

Temperature

James City County

Overall, 2021 was the 12th warmest year on record, with an average temperature of 60.3°F — 1.7 degrees above the average annual temperature (Table 1). Nine out of twelve months had above average monthly temperatures, with December having the greatest increase in temperatures at 8 degrees above average. Only February, May, and November had lower than average monthly temperatures. Seasonally, autumn fell within "much above normal" temperatures, summer fell within "above normal" temperatures, and spring and winter fell within "near normal" temperatures (Figure 1).

Table 1. James City County, Virginia average monthly, average annual, and departures from long-term average temperatures. Departures from average are based on a comparison of 2021 average temperatures to relevant averages from 1895-2020. Data are available at the NOAA National Centers for Environmental Information, Climate at a Glance: County Time Series website.

Month (2021)	Average temperature (°F)	Departure from long-term average temperature (°F)
January	39.3	+0.6
February	39.0	-1.2
March	51.2	+3.1
April	58.5	+1.3
May	65.4	-1.2
June	75.5	+1.0
July	79.0	+0.5
August	79.6	+2.6
September	72.4	+1.2
October	66.1	+5.8
November	48.4	-1.4
December	49.1	+8.0
Annual	**60.3**	**+1.7**

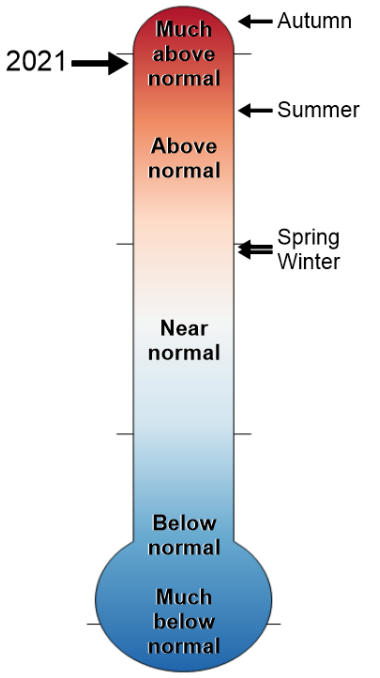


Figure 1. James City County, Virginia annual and seasonal temperature rankings from 1895-2021. Of the 127 records, 2021 was the 12th warmest year. Seasonally, it was the 48th warmest winter, 47th coldest spring, 21st warmest summer, and the 4th warmest autumn. Data are available at the NOAA National Centers for Environmental Information, Climate at a Glance: County Time Series website.

York County

Overall, 2021 was the 13th warmest year on record, with an average temperature of 60.5°F — 1.7 degrees above the average annual temperature (Table 2). Nine out of twelve months had higher than average monthly temperatures, with November having the greatest increase in temperature at 7.7 degrees above average. Only February, May, and November had lower than average monthly temperatures. Seasonally, autumn fell within "much above normal" temperatures, summer and spring fell within "above normal" temperatures, and winter fell within "near normal" temperatures (Figure 2).

Table 2. York County, Virginia average monthly, average annual, and departures from long-term average temperatures. Departures from average are based on a comparison of 2021 average temperatures to relevant averages from 1895-2020. Data are available at the NOAA National Centers for Environmental Information, Climate at a Glance: County Time Series website.

Month (2021)	Average temperature (°F)	Departure from long-term average temperature (°F)
January	39.6	+0.5
February	39.3	-1.1
March	51.5	+3.3
April	58.5	+1.4
May	65.4	-1.1
June	75.6	+1.1
July	79.2	+0.5
August	79.6	+2.4
September	72.6	+1.1
October	66.4	+5.6
November	49.1	-1.2
December	49.4	+7.7
Annual	**60.5**	**+1.7**

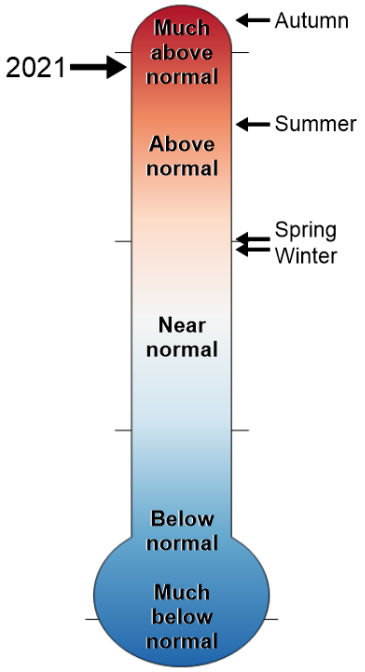


Figure 2. York County, Virginia annual and seasonal temperature rankings from 1895-2021. Of the 127 records, 2021 was the 13th warmest year. Seasonally, it was the 48th warmest winter, 46th coolest spring, 24th warmest summer, and the 4th warmest autumn. Data are available at the NOAA National Centers for Environmental Information, Climate at a Glance: County Time Series website.



Precipitation

James City County

Overall, 2021 was the 35th wettest year on record with a total of 48.56 inches of precipitation — 3.4 inches above average annual precipitation levels (Table 3). Seven of twelve months had a higher than average monthly precipitation levels, with July having the highest at 7.75 inches — 2.54 inches above average. November was the driest month with 0.79 inches — 2.05 inches below average. Seasonally, winter and summer fell within "above normal" levels of precipitation, while spring fell within "near normal" levels and autumn fell within "below normal" levels (Figure 3).

Table 3. James City County, Virginia monthly and annual total precipitation and departures from long-term average totals. Departures from average are based on a comparison of 2021 precipitation levels to relevant averages from 1895-2020. Data are available at the NOAA National Centers for Environmental Information, Climate at a Glance: County Time Series website.

Month (2021)	Total precipitation (in)	Departure from long-term average precipitation (in)
January	3.90	+0.50
February	5.98	+2.81
March	4.18	+0.30
April	1.84	-1.47
May	2.10	-1.80
June	6.23	+2.02
July	7.75	+2.54
August	7.28	+2.46
September	2.81	-1.11
October	4.22	+1.01
November	0.79	-2.05
December	1.48	-1.82
Annual	**48.56**	**+3.40**

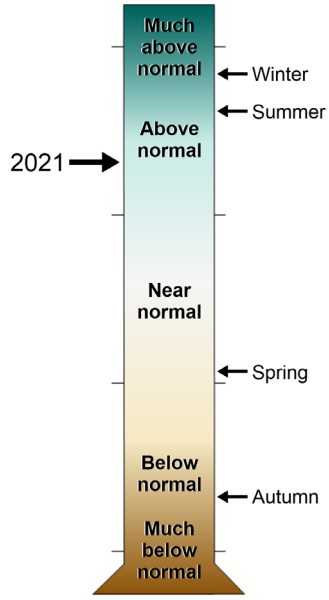


Figure 3. James City County, Virginia annual and seasonal precipitation rankings from 1895-2021. Of the 127 records, 2021 was the 35th wettest year on record. Seasonally, it was the 16th wettest winter, 48th driest spring, 24th wettest summer, and 21st driest autumn. Data are available at the NOAA National Centers for Environmental Information, Climate at a Glance: County Time Series website.

York County

Overall, 2021 was the 43rd wettest year on record, with 47.11 inches of precipitation — 1.98 inches above average annual precipitation levels (Table 3). August had the highest amount at 7.4 inches — 2.25 inches above average. November was the driest month with 0.89 inches — 1.94 inches below average. Seasonally, summer fell within "above normal" levels of precipitation, while spring "near normal" levels, and autumn and winter fell within "below normal" levels.

Table 4. York County, Virginia monthly and annual total precipitation and departures from long-term average totals. Departures from average are based on a comparison of 2021 precipitation levels to relevant averages from 1895-2020. Data are available at the NOAA National Centers for Environmental Information, Climate at a Glance: County Time Series website.

Month (2021)	Total precipitation (in)	Departure from long-term average precipitation (in)
January	3.88	+0.50
February	6.02	+2.77
March	3.79	-0.09
April	1.96	-1.31
May	2.18	-1.61
June	6.22	+2.10
July	6.49	+1.20
August	7.40	+2.52
September	2.70	-1.23
October	3.91	+0.70
November	0.89	-1.94
December	1.67	-1.64
Annual	**47.11**	**+1.98**

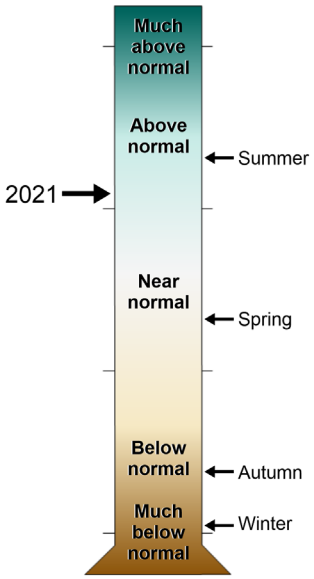


Figure 4. York County, Virginia annual and seasonal precipitation rankings from 1895-2021. Of the 127 records, 2021 was the 43rd wettest year. Seasonally, it was the 17th wettest winter, 57th driest spring, 35th wettest summer, and 23rd driest autumn. Data are available at the NOAA National Centers for Environmental Information, Climate at a Glance: County Time Series website.

Temperature and Precipitation Trends (1895–2021)

Temperature and precipitation data are gathered from the U.S. Climate Divisional Database, which stores data from January 1895 through 2021, and can be accessed via the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) website (Figures 5 and 6). Users can choose different geographic scales (i.e., global, national, statewide), different temporal scales, and display them in various types of graphical formats. Temperature and precipitation data presented in this brief are for James City and York Counties, VA.

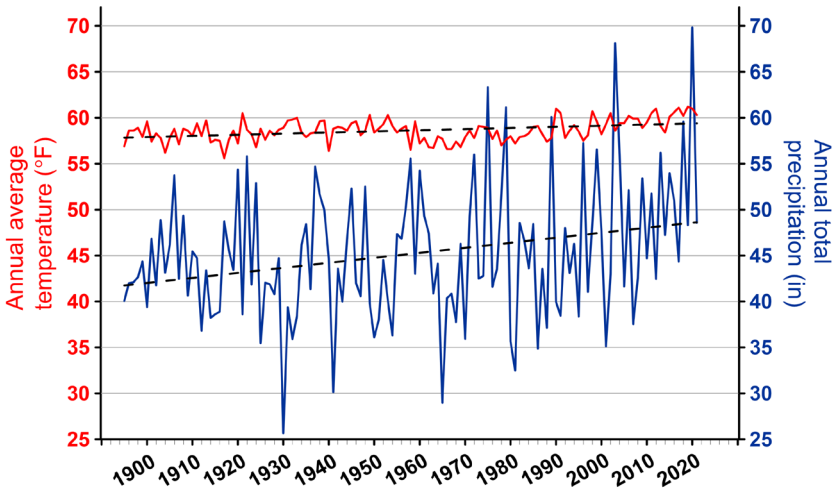


Figure 5. James City County, Virginia yearly average temperature and precipitation levels from 1895 to 2021. Dashed lines represent the 1895-2021 trend for each parameter; +0.1°F/decade increase for temperature and +0.55 in/decade increase for precipitation. Data are available at the NOAA National Centers for Environmental Information, Climate at a Glance: County Time Series website.

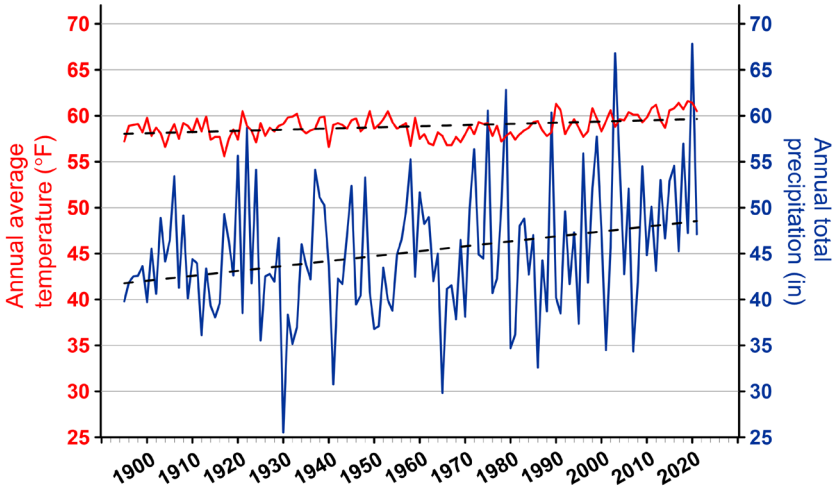


Figure 6. York County, Virginia yearly average temperature and precipitation levels from 1895 to 2021. Dashed lines represent the 1895-2021 trend for each parameter; +0.1°F/decade increase for temperature and +0.54 in/decade increase for precipitation. Data are available at the NOAA National Centers for Environmental Information, Climate at a Glance: County Time Series website.



Wind

Wind-generated waves can impact shorelines differently depending on wind speed and direction. Wind data are collected from a weather station at Williamsburg Jamestown Airport, VA, and made available through the NOAA NCEI website (Figure 7), and at the NOAA National Water Level Observation Network (NWLON) station 8637689, located at the Yorktown USCG Training Center, VA (Figure 8). Each direction is divided into categories called bins that are color coated to represent the frequency of a certain wind speed. The length of the bin represents the number of times wind comes from a given direction as well as the speed of the wind. The longer the length of the bin, the more frequent the given speed was recorded. The difference in appearance between figures 7 and 8 is due to the Jamestown station only recording readings every hour, while the Yorktown station records data every six minutes.

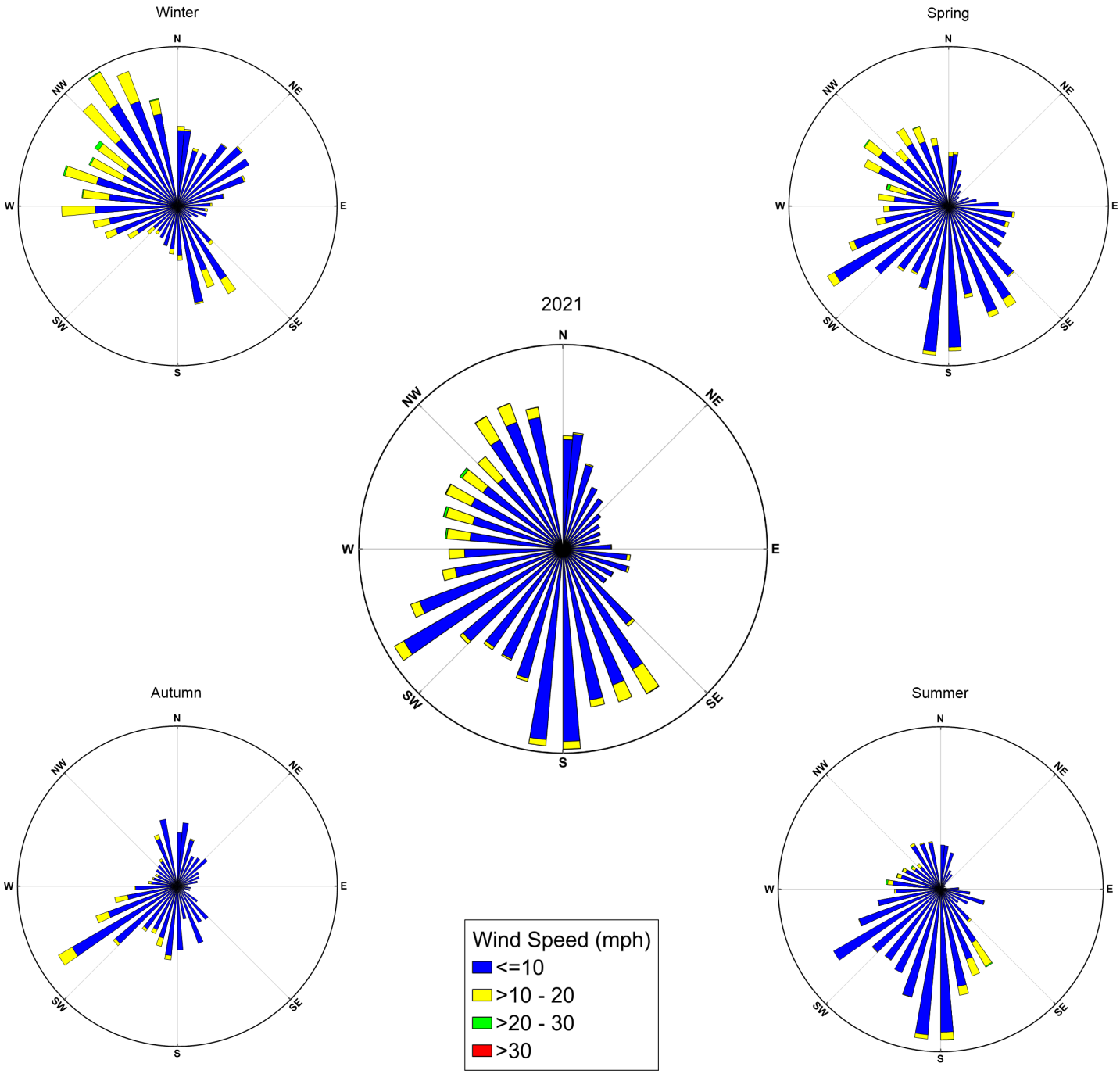


Figure 7. Wind charts reflecting both the seasonal and annual wind direction and speed at the Williamsburg Jamestown Airport, Virginia during 2021. Each direction is divided into categories called bins that are color coated to represent the frequency of a certain wind speed. The length of the bin represents the number of times wind comes from a given direction as well as the speed of the wind. The longer the length of the bin, the more frequent the given speed was recorded. Data are available at the NOAA National Centers for Environmental Information, Climate Data Online website.

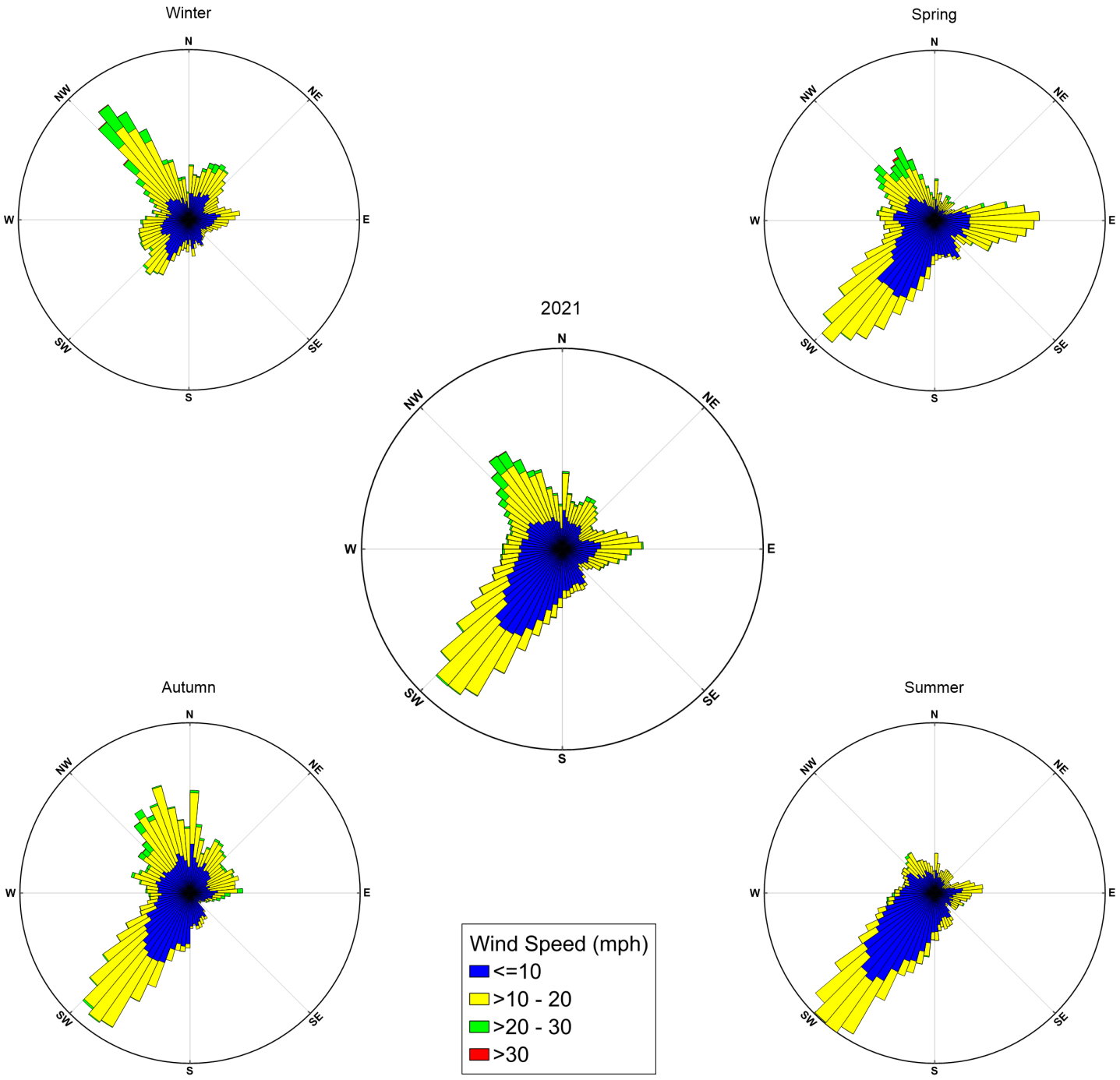


Figure 8. Wind charts reflecting both the seasonal and annual wind direction and speed at the NOAA NWLON station 8637689 located at the Yorktown USCG Training Center, Virginia during 2021. Each direction is divided into categories called bins that are color coated to represent the frequency of a certain wind speed. The length of the bin represents the number of times wind comes from a given direction as well as the speed of the wind. The longer the length of the bin, the more frequent the given speed was recorded. Data are available at the NOAA Tides & Currents website.



Tide Levels

The extent of Colonial National Historical Park's shoreline falls along the James and York Rivers, and each has unique tidal characteristics. Therefore, two sources of water level data are used to reflect this dynamic. Water level data are obtained from NOAA station 8637712 located at Jamestown Ferry Wharf, VA, and from NOAA station 8637689 located at the Yorktown U.S. Coast Guard (USCG) Training Center, VA. The station at Jamestown Ferry Wharf began collecting data in 2010, while the station at USCG Training Center has records dating back to 2004.

The data are graphed to show the difference in the predicted tide level versus what was observed (Figures 9 and 10). The offsets in height reflect the effect of storm surge on the normal, astronomically driven tide level.

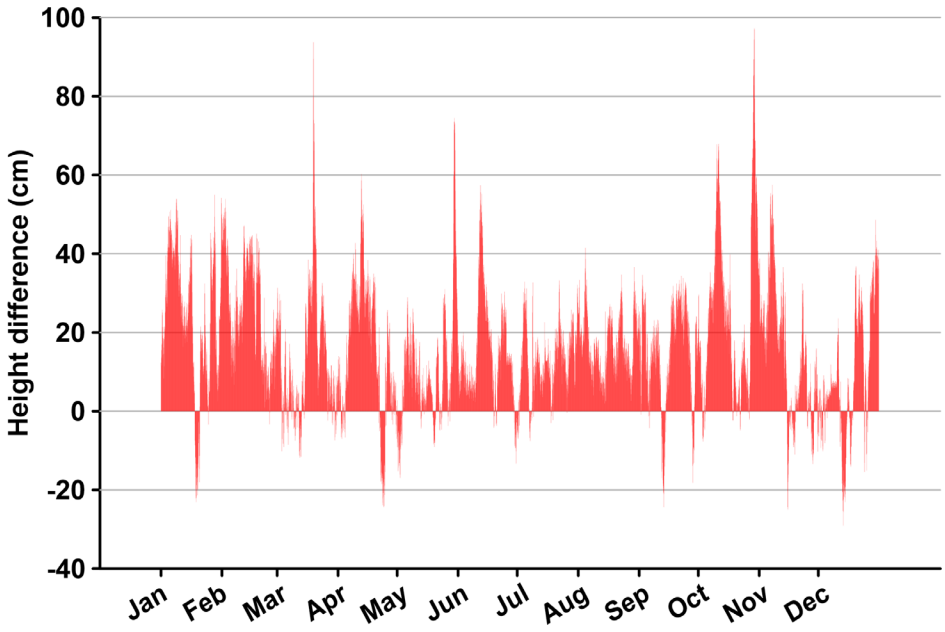


Figure 9. The difference in the predicted and observed tide levels at the NOAA station 8637712 located at Jamestown Ferry Wharf, Jamestown, Virginia for 2021. Data are available at the NOAA Tides & Currents website.

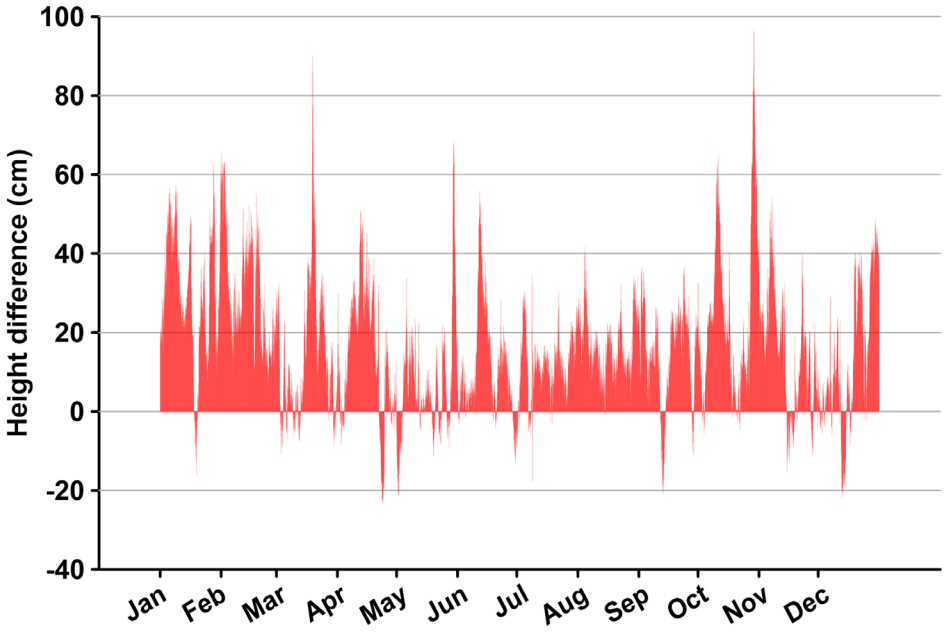


Figure 10. The difference in the predicted and observed tide levels at the NOAA station 8637689 located at the Yorktown U.S. Coast Guard Training Center, Virginia for 2021. Data are available at the NOAA Tides & Currents website.

Northeast Coastal and Barrier Network
University of Rhode Island
Dept. Natural Resources Science
Coastal Institute, Room 105
1 Greenhouse Road, Kingston, RI 02881
https://www.nps.gov/im/ncbn/index.htm