



# 2018 Meteorology Summary

New Jersey Department of Environmental Protection

## AIR POLLUTION AND METEOROLOGY

Meteorology plays an important role in the distribution of pollution throughout the troposphere, the layer of the atmosphere closest to the earth's surface. Atmospheric processes such as wind speed and wind direction affect the transport and dispersion of air pollution. Precipitation, solar radiation, and other weather phenomena influence chemical reactions and atmospheric transformations. By studying meteorological and air pollution data together, scientists and mathematicians have developed reasonably accurate models for predicting the fate of pollutants as they go through the stages of transport, dispersion, transformation, and removal. Air pollution models can assist in predicting pollutant concentrations for comparison to National Ambient Air Quality Standards (NAAQS), in determining the impacts of new and existing air pollution sources, and in designing ambient air monitoring networks.

The New Jersey Department of Environmental Protection (NJDEP) Bureau of Air Monitoring collects meteorological data at eight of its air monitoring stations. This data can be used by planners in preparing State Implementation Plans (SIPs) to reduce pollutant emissions; by engineers to design or evaluate air pollution permit applications; and by scientists to site air monitoring stations.

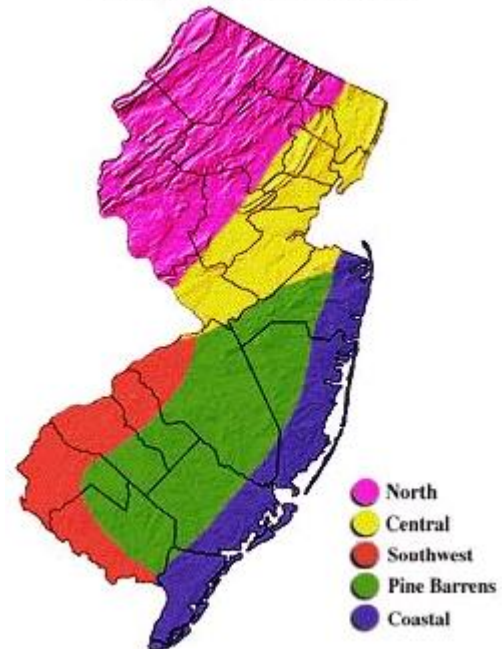
## CLIMATOLOGY IN NEW JERSEY

Although New Jersey is one of the smallest states in the country, with a land area of 7,836 square miles, it has five distinct climate zones, which are classified as the Northern, Central, Pine Barrens, Southwest, and Coastal Zones. The topography of the different zones, their distance from the Atlantic Ocean, and the prevailing atmospheric flow patterns affecting them produce distinct variations in the daily weather. This accounts for different results at our air monitoring stations. The climate zones are shown in Figure 11-1.

According to the New Jersey Weather & Climate Network, 2018 was the 11<sup>th</sup> warmest year on record (since 1895), with an average temperature of 54.2°F.

2018 was also the wettest calendar year on record in New Jersey. Statewide annual precipitation averaged 64.79 inches, 18.43 inches above average. There were 11 days which had four or more inches of rain recorded somewhere in the state.

**Figure 11-1**  
New Jersey Climate Zones



Source: Office of the New Jersey State Climatologist

## 2018 MONITORING LOCATIONS & RESULTS

NJDEP collected meteorological data at eight stations in its air monitoring network in 2018. Not all meteorological parameters were measured at each site. Problems with the rain instrument resulted in only partial data from Camden Spruce Street and Rider University. In July, the meteorological monitor at Newark Firehouse stopped functioning and needed to be repaired. Table 11-1 lists the parameters monitored at each station, and Figure 11-2 is a map of the 2018 meteorological monitoring network. In Tables 11-2 through 11-6, the 2018 meteorological data is summarized for temperature, rain, relative humidity, solar radiation, and barometric pressure. Figure 11-3 presents the average temperature for each monitoring site along with the statewide 30-year and 2018 averages. Figure 11-4 shows the monthly rainfall at each site, compared to the statewide 30-year and 2018 average total precipitation. The difference between our results and data from the Office of the New Jersey State Climatologist is most likely related to the method used at our monitoring stations to measure rainfall. Our instruments use sound, rather than a collection bucket, which could result in an underestimate, especially for light showers or snow.

Figures 11-5 through 11-11 presents annual wind roses for Bayonne, Camden Spruce Street, Columbia, Elizabeth Lab, Flemington, Fort Lee Near Road, and Rider University, respectively. (There is no wind data from Newark Firehouse after June 30.) A wind rose shows, in a circular format, the frequency of winds blowing *from* a specific direction for a specified period. The length of each "spoke" around the circle is related to the frequency that the wind blows from a particular direction per unit time. Each concentric circle represents a different frequency, starting with zero at the center and increasing frequencies at the outer circles. Each spoke is broken down into color-coded bands that show wind speed ranges.

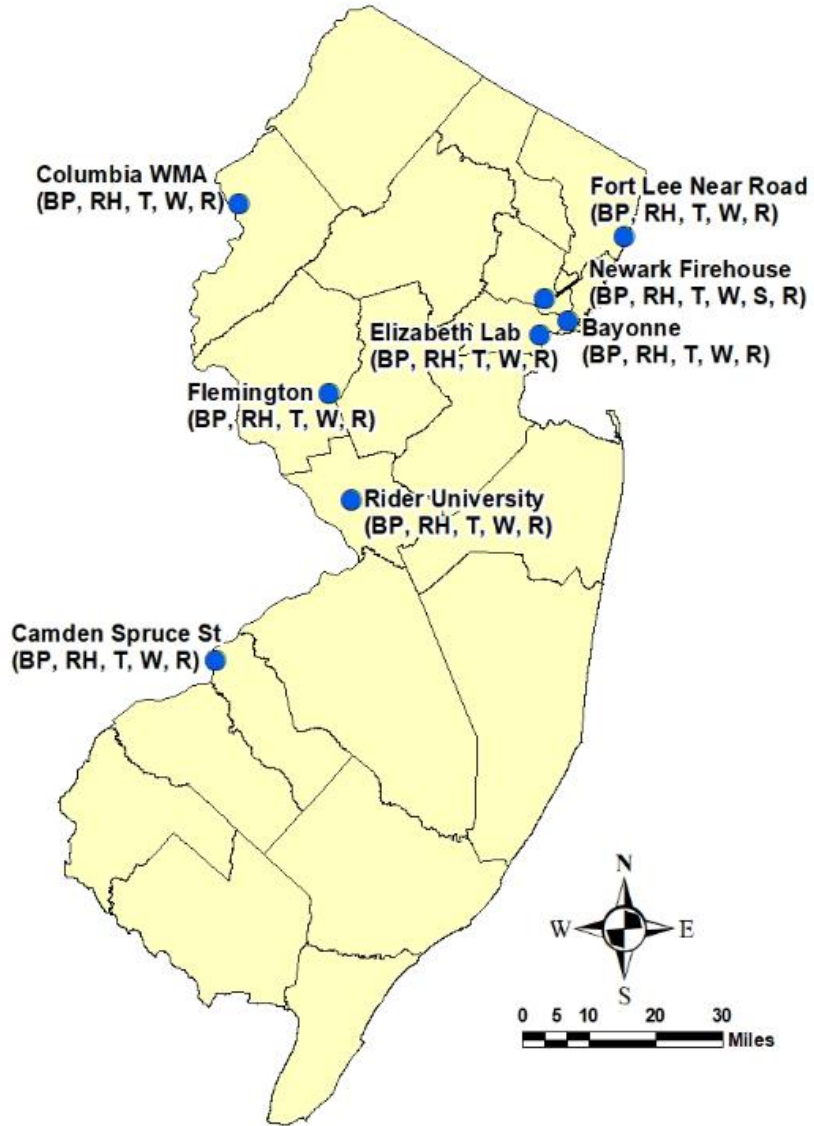
**Table 11-1**  
**2018 New Jersey Meteorological Monitoring Network**  
**Parameter Summary**

Site Name	Temperature	Relative Humidity	Wind Speed	Wind Direction	Barometric Pressure	Rain	Solar Radiation
Bayonne	X	X	X	X	X	X	
Camden Spruce Street	X	X	X	X	X	X*	
Columbia	X	X	X	X	X	X	
Elizabeth Lab	X	X	X	X	X	X	
Flemington	X	X	X	X	X	X	
Fort Lee Near Road	X	X	X	X	X	X	
Newark Firehouse	X*	X*	X*	X*	X*	X*	X
Rider University	X	X	X	X	X	X*	

\*Data available for part of year only:

- Newark Firehouse - no temperature, relative humidity, wind speed, wind direction, barometric pressure or rain data after 6/30/18.
- Camden Spruce Street - no rain data until 4/1/18.
- Rider University - no rain data until 6/16/18.

**Figure 11-2  
2018 Meteorological Monitoring Network**



**Legend**

<span style="color: blue;">●</span>	Meteorological Site
BP	Barometric Pressure
RH	Relative Humidity
S	Solar Radiation
T	Temperature
W	Wind Speed & Direction
R	Rain

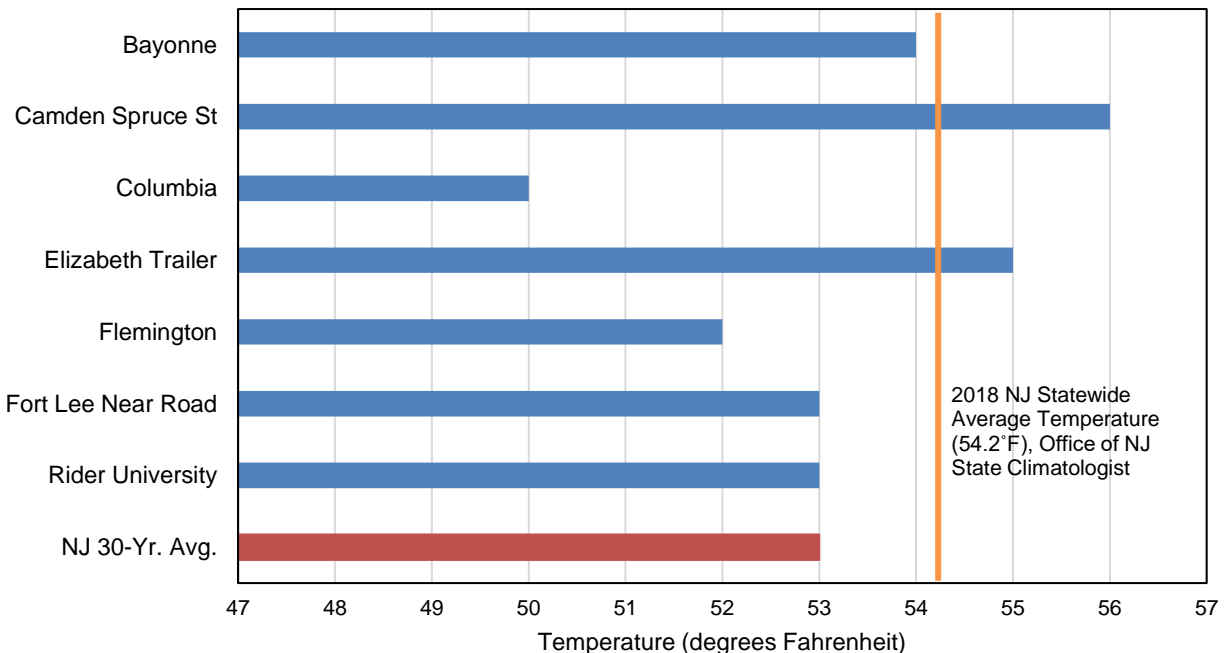
**Table 11-2**  
**2018 Temperature Data (in Degrees Fahrenheit)**  
**from NJ's Air Monitoring Sites**

SITE		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Bayonne	Mean	30	39	38	47	64	70	77	77	70	57	43	39	54
	Minimum	5	17	28	32	46	51	61	64	55	37	16	25	5
	Maximum	63	72	58	78	87	93	97	94	93	81	72	60	97
Camden Spruce St	Mean	33	42	39	50	67	73	78	78	71	59	44	41	56
	Minimum	7	18	30	32	47	52	61	64	55	40	17	24	7
	Maximum	64	76	74	83	90	97	98	95	96	84	72	64	98
Columbia	Mean	25	35	35	44	63	67	72	72	65	52	39	35	50
	Minimum	-4	10	22	24	35	45	50	54	46	31	9	17	-4
	Maximum	62	76	58	83	89	90	94	91	90	80	70	60	94
Elizabeth Trailer	Mean	29	40	38	47	65	71	77	78	70	57	43	39	55
	Minimum	4	16	27	31	47	51	60	61	54	34	14	23	4
	Maximum	62	78	59	83	91	94	96	95	95	83	73	61	96
Flemington	Mean	28	37	36	46	64	68	74	74	67	54	40	36	52
	Minimum	-1	13	21	22	40	44	51	54	46	29	9	15	-1
	Maximum	61	78	59	82	89	93	94	93	93	81	72	62	94
Fort Lee Near Road	Mean	29	39	37	46	64	70	76	77	69	55	42	37	53
	Minimum	3	14	25	30	45	56	61	63	53	36	13	22	3
	Maximum	60	76	56	79	90	93	95	94	92	79	70	59	95
Newark Firehouse	Mean	30	40	38	47	65	70	ND	ND	ND	ND	ND	ND	*
	Minimum	5	15	27	31	45	51	ND	ND	ND	ND	ND	ND	5
	Maximum	63	77	59	81	90	92	ND	ND	ND	ND	ND	ND	95
Rider University	Mean	29	39	37	46	64	69	74	75	68	55	41	37	53
	Minimum	-3	13	24	25	38	46	52	55	50	31	10	17	-3
	Maximum	64	76	66	76	90	93	97	94	94	82	72	62	97

ND = no data

\*Not able to determine an annual statistic because of missing data.

**Figure 11-3**  
**2018 Average Temperatures at NJDEP Air Monitoring Sites**  
**Compared to the Statewide 30-Year Average**



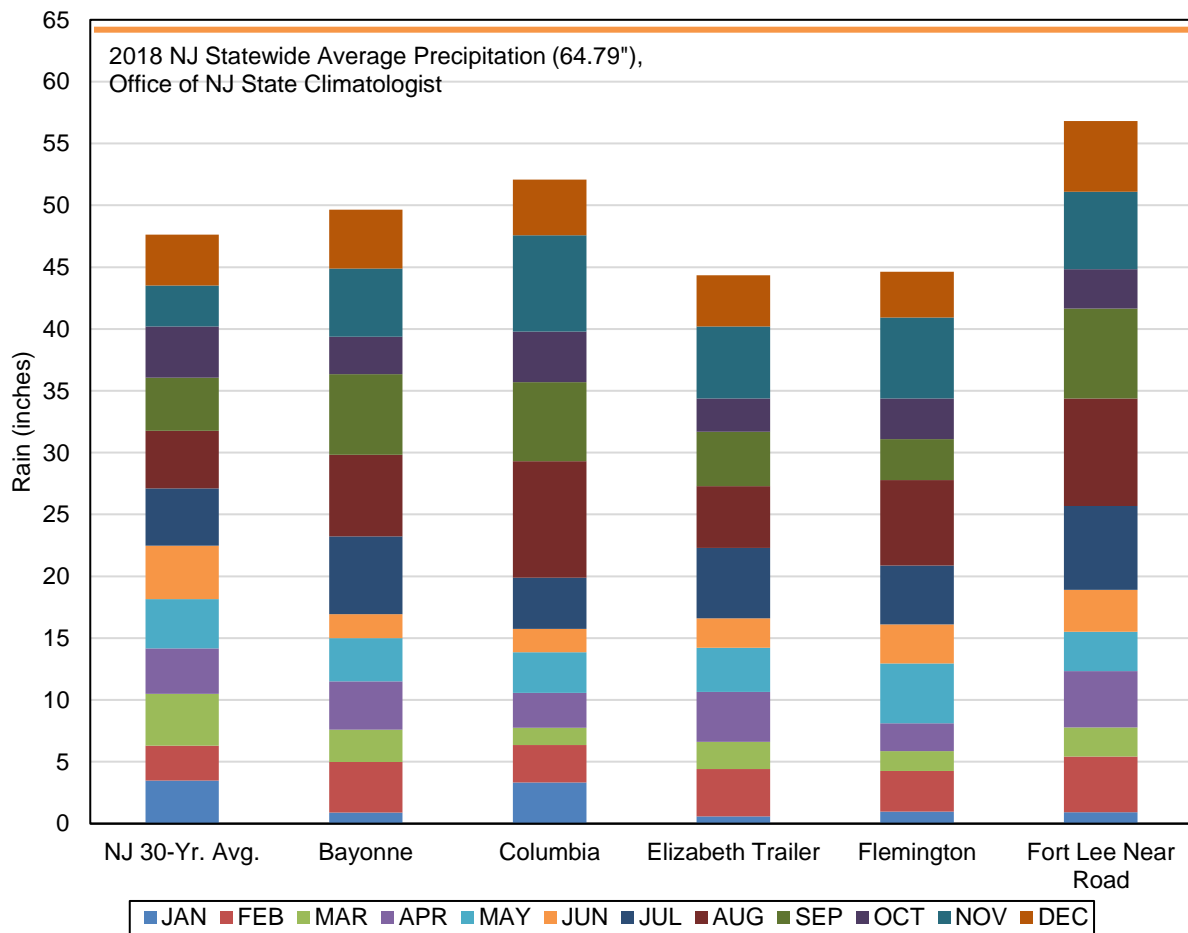
**Table 11-3**  
**2018 Rain Data (Inches) from NJ's Air Monitoring Sites**

SITE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL TOTAL
Bayonne	0.90	4.08	2.63	3.92	3.47	1.95	6.29	6.59	6.53	3.01	5.53	4.76	49.66
Camden Spruce St	ND	ND	ND	3.32	3.92	6.31	4.68	5.71	8.37	4.06	7.73	4.75	*
Columbia	3.33	3.03	1.40	2.81	3.28	1.90	4.15	9.41	6.39	4.10	7.79	4.50	52.08
Elizabeth Trailer	0.58	3.82	2.20	4.05	3.57	2.37	5.70	4.99	4.39	2.71	5.80	4.15	44.34
Flemington	0.97	3.30	1.60	2.24	4.84	3.16	4.76	6.92	3.30	3.29	6.55	3.71	44.64
Fort Lee Near Road	0.93	4.49	2.36	4.56	3.18	3.40	6.77	8.70	7.27	3.17	6.26	5.73	56.83
Newark Firehouse	1.17	5.28	3.15	5.48	4.08	2.38	ND	ND	ND	ND	ND	ND	*
Rider University	ND	ND	ND	ND	ND	1.33	6.29	3.31	7.46	3.55	8.37	3.53	*

ND = no data

\*Not able to determine an annual statistic because of missing data.

**Figure 11-4**  
**2018 Total Rainfall at NJDEP Air Monitoring Sites**  
**Compared to the Statewide 30-Year Average**



NOTE: Camden Spruce Street, Newark Firehouse and Rider University are not included in this graph because they have incomplete rain data for 2018.

**Table 11-4**  
**2018 Relative Humidity Data (%) from NJ's Air Monitoring Sites**

SITE		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Bayonne	Mean	58	64	55	55	62	59	61	65	71	65	61	63	62
	Minimum	28	29	23	16	16	23	26	32	39	32	29	37	16
	Maximum	89	89	89	89	90	90	88	89	90	88	89	89	90
Camden Spruce St	Mean	54	63	52	49	61	58	58	64	72	63	59	61	59
	Minimum	23	24	20	13	15	23	21	29	36	27	24	31	13
	Maximum	88	90	89	90	89	90	89	90	91	89	89	89	91
Columbia	Mean	62	70	56	58	68	69	72	79	82	74	67	70	69
	Minimum	27	25	18	13	13	25	28	39	46	27	22	36	13
	Maximum	91	92	91	91	92	92	92	92	93	93	92	92	93
Elizabeth Trailer	Mean	53	63	53	54	61	58	61	65	71	65	60	61	60
	Minimum	20	26	16	13	12	23	27	32	39	25	24	29	12
	Maximum	91	91	90	91	91	91	90	90	91	90	90	90	91
Flemington	Mean	60	69	58	58	68	67	69	75	79	74	68	70	68
	Minimum	28	28	19	15	15	26	30	34	42	32	20	35	15
	Maximum	92	93	91	92	93	92	92	93	94	93	93	93	94
Fort Lee Near Road	Mean	56	63	55	53	60	56	60	64	72	65	61	63	61
	Minimum	23	27	17	14	14	23	24	29	43	27	25	33	14
	Maximum	91	91	91	91	92	92	91	91	91	91	91	91	92
Newark Firehouse	Mean	54	62	53	53	61	57	ND	ND	ND	ND	ND	ND	*
	Minimum	20	27	16	13	12	24	ND	ND	ND	ND	ND	ND	12
	Maximum	91	90	90	90	91	91	ND	ND	ND	ND	ND	ND	91
Rider University	Mean	61	70	59	59	69	67	70	75	80	74	67	69	68
	Minimum	27	29	21	18	18	27	32	36	41	33	24	35	18
	Maximum	94	94	93	94	95	94	94	94	94	94	93	93	95

ND = no data

\*Not able to determine an annual statistic because of missing data.

**Table 11-5**  
**2018 Solar Radiation Data (in Langleys) from NJ's Air Monitoring Sites**

SITE		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Newark Firehouse	Mean	0.11	0.12	0.21	0.26	0.29	0.36	0.37	0.30	0.18	0.15	0.10	0.08	0.21
	Maximum	0.75	0.96	1.23	1.37	1.41	1.42	1.43	1.32	1.20	1.02	0.79	0.63	1.43

**Table 11-6**  
**2018 Average Barometric Pressure Data (in inches of Hg)**  
**from NJ's Air Monitoring Sites**

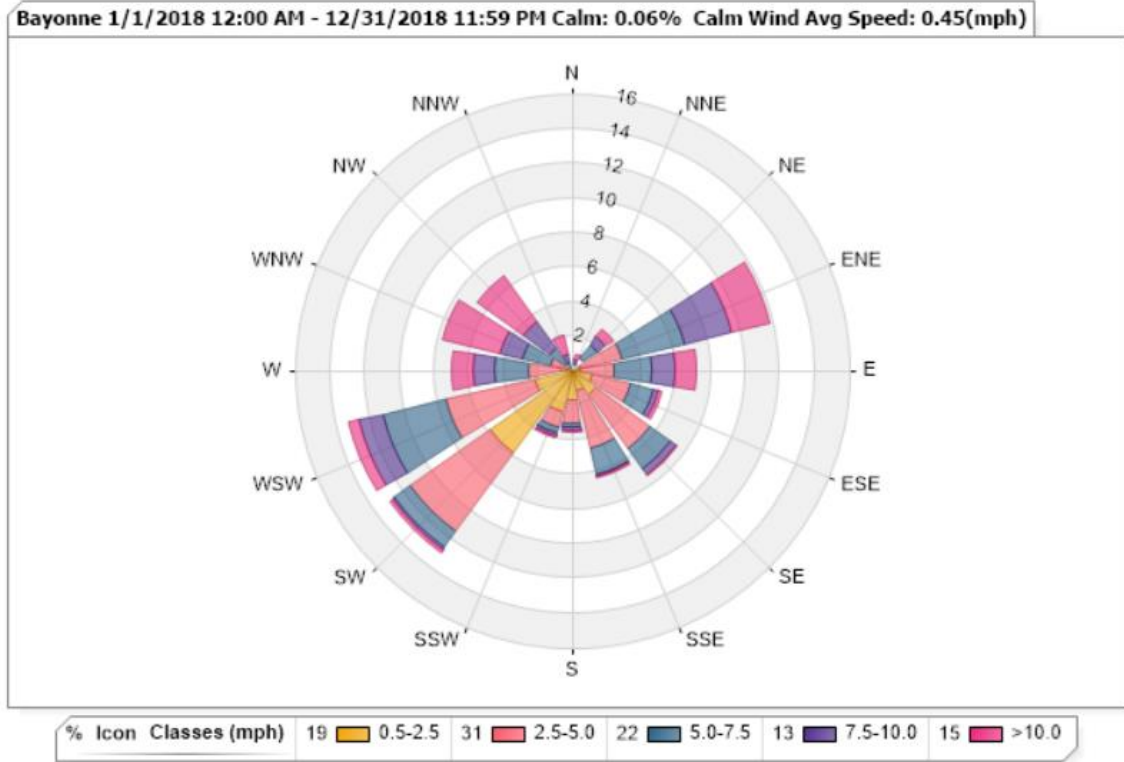
SITE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Bayonne	30.16	30.19	29.90	29.96	30.01	29.91	30.04	29.98	30.13	30.01	30.02	30.07	30.03
Camden Spruce St	30.18	30.20	29.92	29.97	30.01	29.91	30.03	29.99	30.12	30.02	30.03	30.07	30.04
Columbia	29.63	29.67	29.39	29.45	29.51	29.42	29.55	29.50	29.64	29.51	29.51	29.55	29.53
Elizabeth Trailer	30.17	30.18	29.89	29.95	30.00	29.90	30.03	29.97	30.12	30.00	30.01	30.06	30.02
Flemington	30.00	30.04	29.76	29.81	29.86	29.76	29.89	29.84	30.01	29.85	29.88	29.92	29.89
Fort Lee Near Road	29.82	29.86	29.57	29.64	29.70	29.61	29.74	29.68	29.83	29.69	29.70	29.74	29.72
Newark Firehouse	30.04	30.08	29.79	29.85	29.90	29.80	ND	ND	ND	ND	ND	ND	*
Rider University	30.06	30.09	29.81	29.87	29.91	29.81	29.92	29.89	30.02	29.91	29.94	29.97	29.93

ND = no data

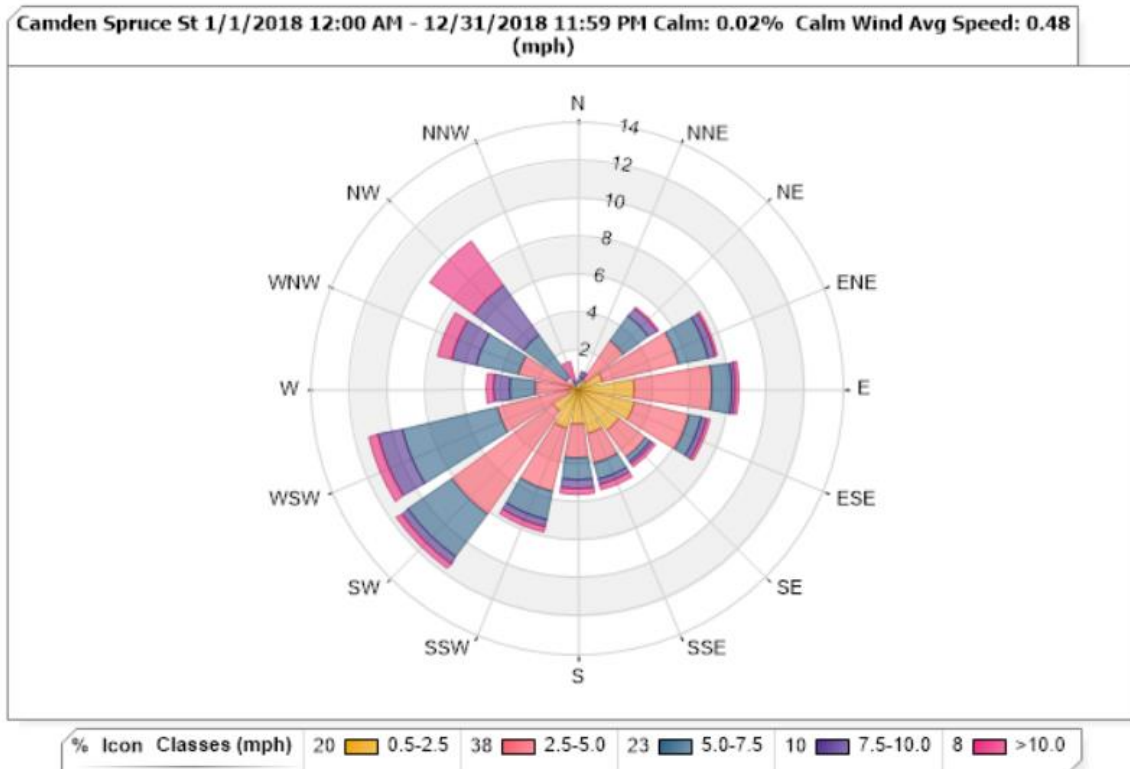
\*Not able to determine an annual statistic because of missing data.

## Wind Roses - Distribution of Wind Speed & Wind Direction

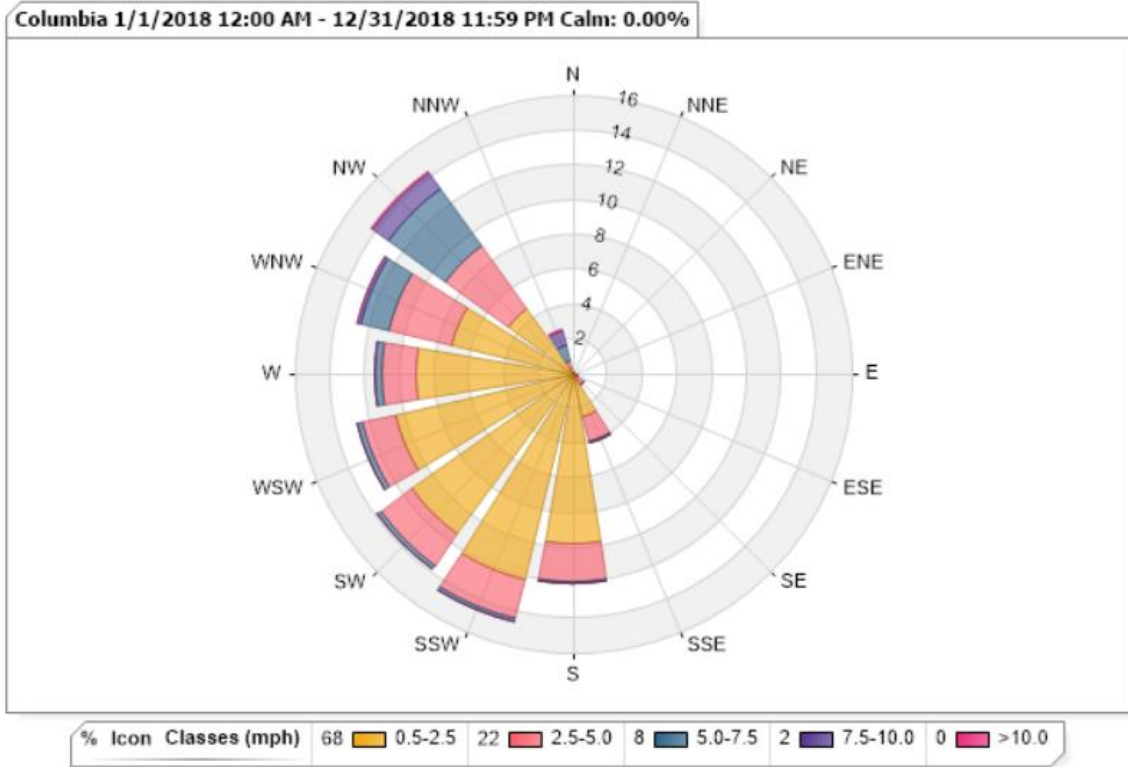
**Figure 11-5. 2018 Wind Rose for Bayonne**



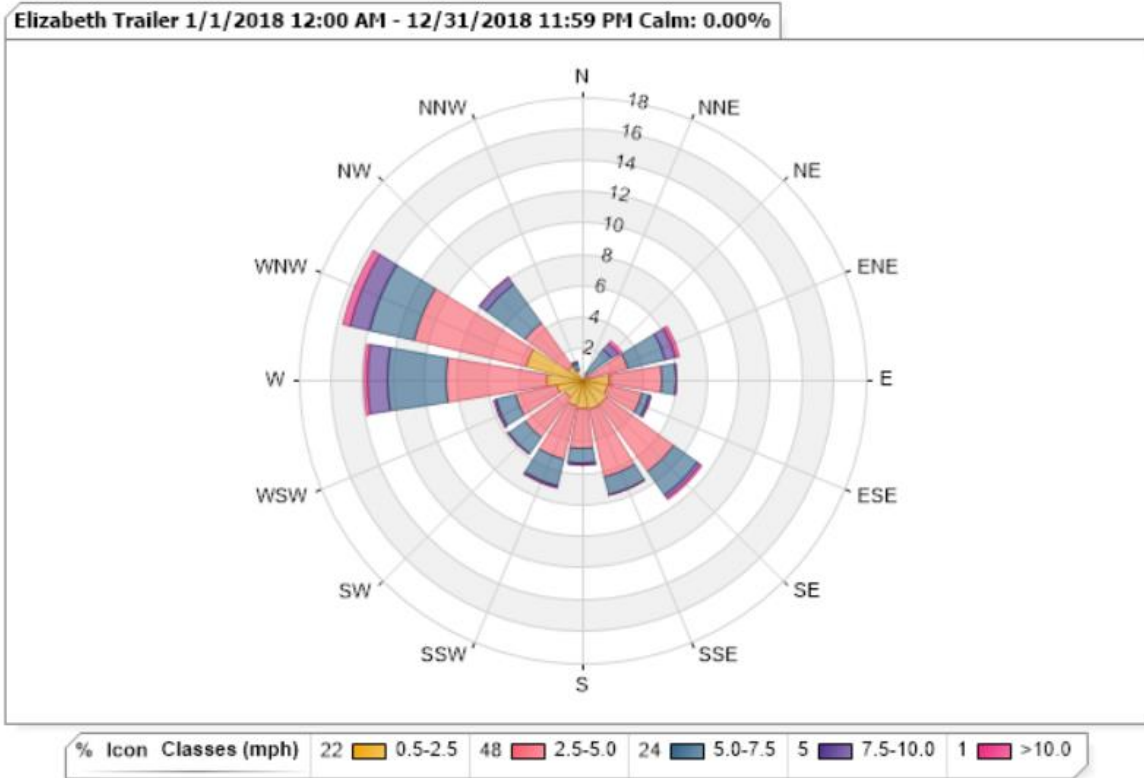
**Figure 11-6. 2018 Wind Rose for Camden Spruce Street**



**Figure 11-7. 2018 Wind Rose for Columbia**

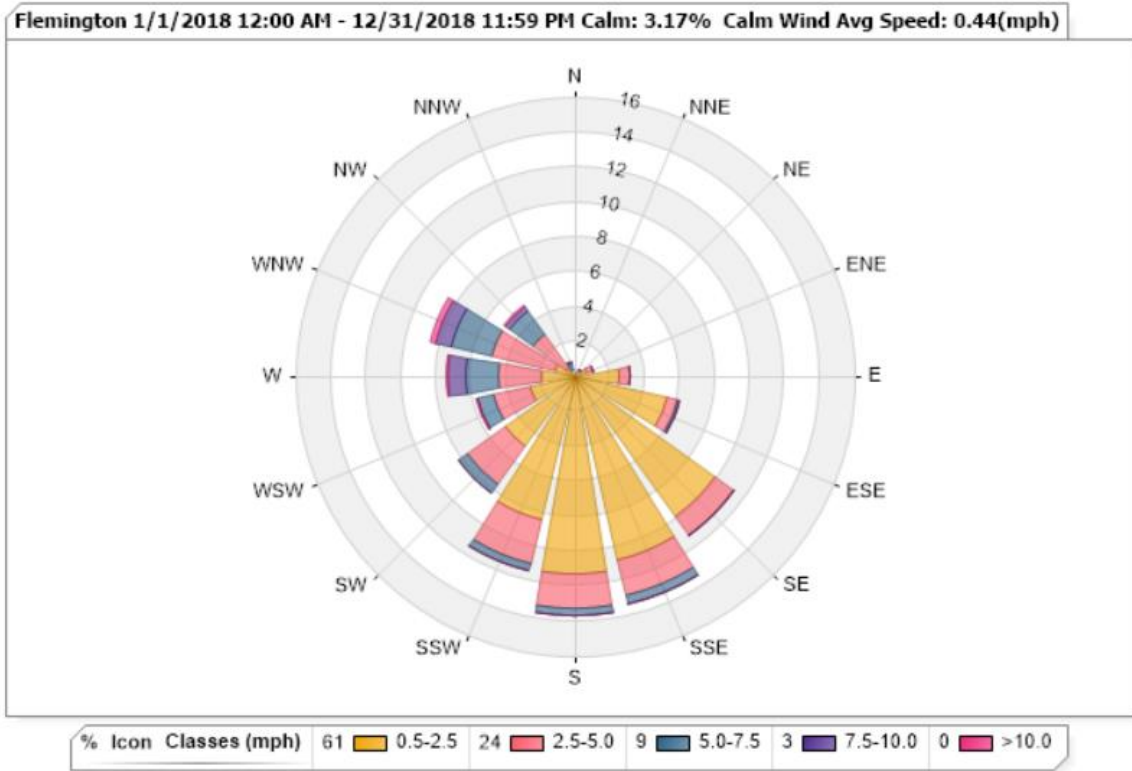


**Figure 11-8. 2018 Wind Rose for Elizabeth Lab**

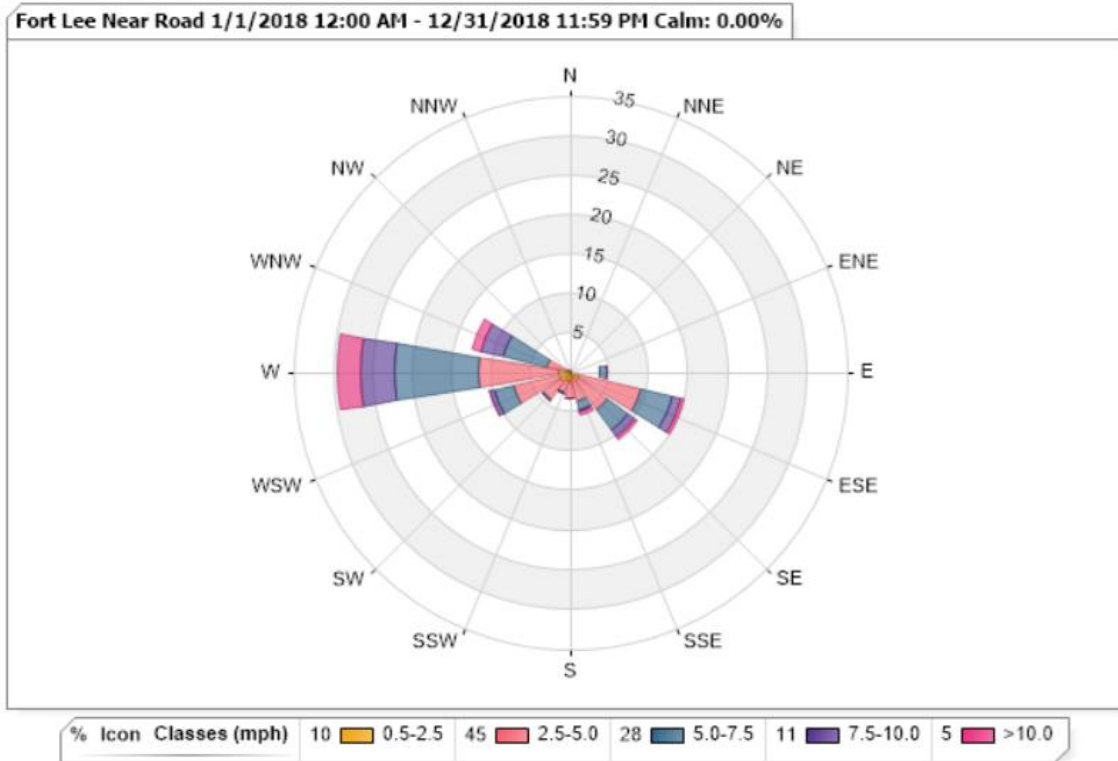




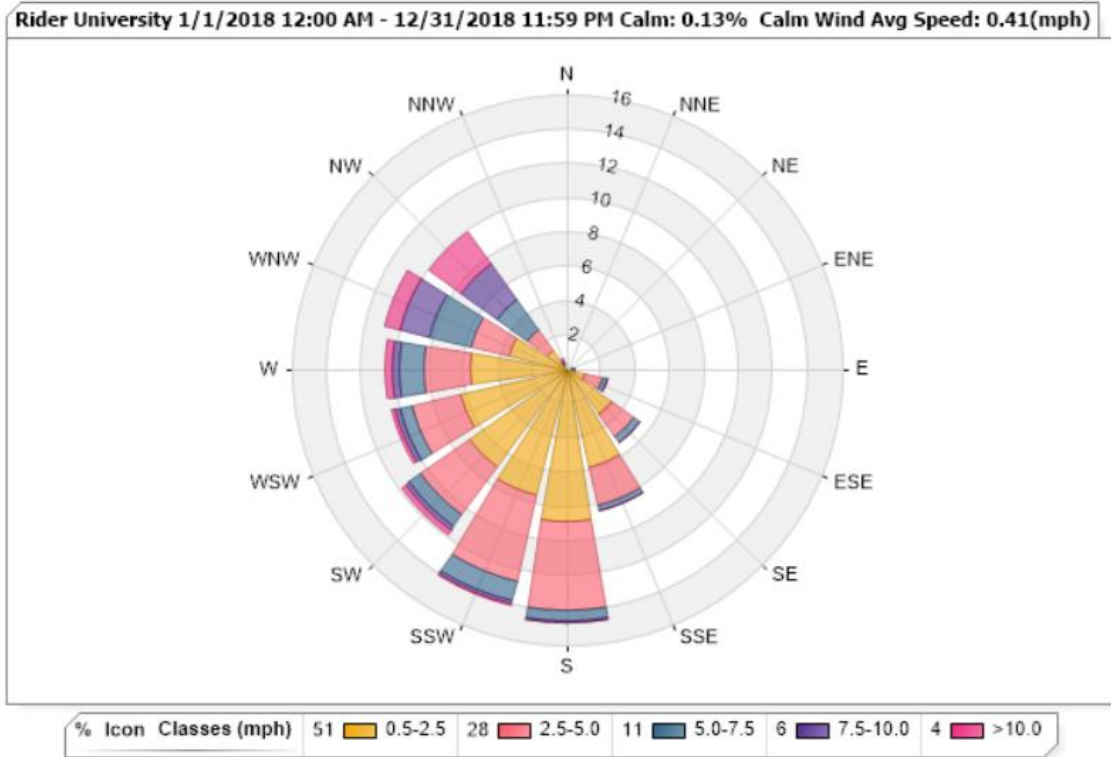
**Figure 11-9. 2018 Wind Rose for Flemington**



**Figure 11-10. 2018 Wind Rose for Fort Lee Near Road**



**Figure 11-11. 2018 Wind Rose for Rider University**



## REFERENCES

New Jersey Weather & Climate Network. A Fitting Finale: December 2018 Recap and Annual Summary, including the Top 10 Events of 2018. [www.njweather.org/content/fitting-finale-december-2018-recap-and-annual-summary-including-top-10-events-2018](http://www.njweather.org/content/fitting-finale-december-2018-recap-and-annual-summary-including-top-10-events-2018). Accessed 5/6/19.

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