Ozone National Ambient Air Quality Standard Health Exceedances on September 6, 2018

Exceedance Locations and Levels

On Thursday, September 6, 2018, there were no exceedances in New Jersey of the National Ambient Air Quality Standard (NAAQS) for ozone (daily maximum 8-hour average of 70 ppb). See Table 1.

Table 1. New Jersey 8-hr Maximum Ozone Concentrations on September 6, 2018

STATION	Daily Maximum 8-Hr Average (ppb)
Ancora State Hospital	46
Bayonne	50
Brigantine	38
Camden Spruce St	60
Chester	51
Clarksboro	60
Colliers Mills	59
Columbia	42
Flemington	54
Leonia	60
Millville	44
Monmouth University	40
Newark Firehouse	56
Ramapo	44
Rider University	55
Rutgers University	59
Washington Crossing*	55
TOTAL EXCEEDANCES	0

*The Washington Crossing station is operated and maintained by EPA as part of the nationwide Clear Air Status and Trends Network (CASTNET).

From the out-of-state stations within New Jersey's ozone non-attainment areas, there were four (4) exceedances of the ozone NAAQS. See Table 2.

Table 2. 8-hr Maximum Ozone Concentrations for Out-of-State Monitoring Stations in New Jersey's Ozone Non-Attainment Areas on September 6, 2018

STATE	STATION	Daily Maximum 8-Hr Average (ppb)
CT	Danbury	53
CT	Greenwich	69

CT	Madison-Beach Road	74
CT	Middletown-CVH-Shed	61
CT	New Haven	66
CT	Stratford	78
CT	Westport	72
DE	BCSP (New Castle Co.)	58
DE	BELLFNT2 (New Castle Co.)	60
DE	KILLENS (Kent Co.)	45
DE	LEWES (Sussex Co.)	40
DE	LUMS 2 (New Castle Co.)	63
DE	MLK (New Castle Co.)	64
DE	SEAFORD (Sussex Co.)	44
MD	Fair Hill	72
NY	Babylon	48
NY	Bronx - IS52	56
NY	CCNY	59
NY	Fresh Kills	44
NY	Holtsville	49
NY	Pfizer Lab	59
NY	Queens	57
NY	Riverhead	57
NY	Rockland Cty	47
NY	White Plains	No Data
PA	BRIS (Bucks Co.)	65
PA	CHES (Delaware Co.)	45
PA	NEWG (Chester Co.)	60
PA	NORR (Montgomery Co.)	48
PA	LAB (Philadelphia Co.)	57
PA	NEA (Philadelphia Co.)	53
PA	NEW (Philadelphia Co.)	64
	TOTAL EXCEEDANCES	4

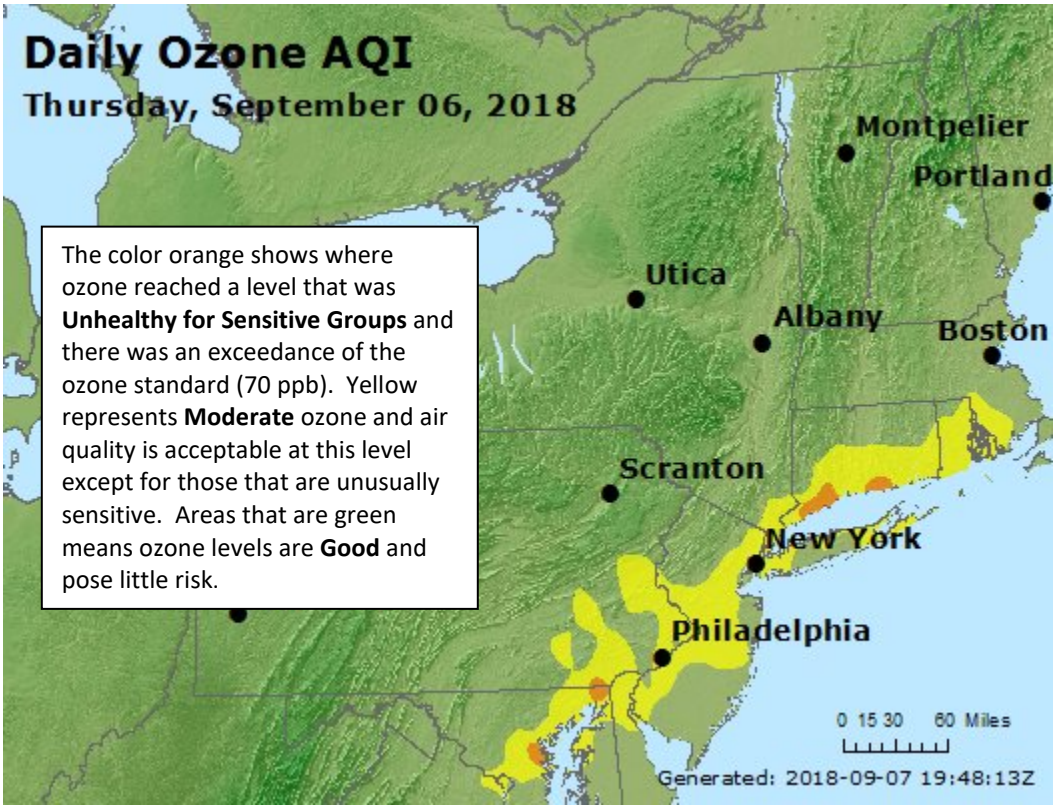
The number of days in 2018 on which exceedances of the ozone NAAQS were recorded for all the states is summarized in Table 3. Figure 1 shows graphically the regions ozone concentrations on September 6, 2018.

Table 3. Number of Days Ozone NAAQS was Exceeded in NJ's Non-Attainment Areas in 2018

STATE	# of Days NAAQS was Exceeded January 1 – Sept. 6, 2018 NAAQS = 70 ppb

Connecticut	23
Delaware	9
Maryland	7
New Jersey	21
New York	21
Pennsylvania	15

Figure 1. Ozone Air Quality Index for September 6, 2018



Source: www.airnow.gov

For ozone terminology definitions see NJDEP Air Quality Planning's Glossary and Acronyms webpage: http://nj.gov/dep/baqp/glossary.html

Weather

Localized transport with the support of favorable weather conditions, including vertical mixing in the atmosphere, led to exceedances along the Connecticut coast and in northeastern Maryland on September 6, 2018.

High pressure, which had been dominating the weather pattern for much of the eastern United States for multiple days, pushed offshore early on September 6th as a cold front slowly approached the region from the northwest. Ahead of this front, a mix of sun and clouds was observed throughout the area with

southwesterly winds ushering in hot temperatures. In addition, a surface trough was noted over the Mid-Atlantic region during this time. As the front approached in the afternoon and evening hours, showers and thunderstorms began to impact the region. Some of these thunderstorms were severe in nature, producing strong and damaging winds. Specifically, severe weather was noted along coastal Connecticut and in northeast Maryland where exceedances were observed. Severe thunderstorms are known for violent vertical mixing in the atmosphere which, in this case, may have allowed ozone aloft to mix down to the surface, enhancing an increasingly polluted atmosphere.

Favorable weather conditions for ozone production in the days and hours leading up to the abovementioned frontal passage, boosted localized transport throughout the region. Vertical motion, associated with the frontal passage, seems to have been the final puzzle piece that enhanced ozone levels at the surface and led to the exceedance episode on this day.

Where Did the Air Pollution that Caused Ozone Come From?

Figures 2, 3, and 4 show the back trajectories starting at different wind heights for the monitored exceedances on September 6, 2018. The figures illustrate where the winds came from during the 48 hours preceding the high ozone event. Four (4) monitoring stations with 8-hr ozone exceedances were used to run back trajectories. The selected sites and the maximum 8-hr ozone levels recorded are listed in Table 4 below:

Table 4. Monitoring Station with an 8-hr Ozone Exceedance that Was Selected to Run 48-hr Back Trajectories

STATE	STATION	Daily Maximum 8-Hr Average (ppb)
CT	Madison – Beach Road	74
CT	Stratford	78
CT	Westport	72
MD	Fair Hill	72

Back trajectories from September 6th show that air, at all levels of the atmosphere, was highly influenced by high pressure circulation over the eastern United States. Localized transport throughout the region resulting from recirculation under the presence of favorable weather conditions, and the potential influence from industrial units upwind led to several exceedances in the nonattainment area.

Surface-level backward trajectories (Figure 2) traveling into Connecticut originated over the Atlantic Ocean in the evening of September 4th and gently recirculated over the water as they grazed the New Jersey Coastline on September 5th. Surface trajectories then traveled northeastward entering Long Island on the morning of September 6th and passed over the Sound where they may have picked up emissions from industrial units operating in addition to emissions from cars and trucks. Low level trajectories then entered Connecticut where they reached their destination along the Connecticut coast. The one exceedance monitor in the southern nonattainment area originated in southern Maryland and traveled very slowly through the Chesapeake Bay region which saw widespread moderate ozone levels the previous day. This trajectory continued to travel northward through Maryland until it reached its

destination at the Fair Hill monitor. Trajectories at the surface remained at the surface for the duration of their path.

Trajectories at the mid-levels (Figure 3) originated in a variety of locations including the Chesapeake Bay, the Atlantic Ocean, and Virginia. All mid-level trajectories shown in Figure 3 experienced some recirculation at the beginning of their path regardless of their origin. This is likely due to air traveling around the center of high pressure the day prior to the exceedance. The mid-level trajectory traveling to Maryland originated over the ocean and recirculated around Virginia and Maryland before traveling through the Chesapeake Bay and arriving at its destination in Fair Hill, MD. Mid-level trajectories traveling to Connecticut traveled northward from Virginia and passed through Maryland and Pennsylvania. These trajectories then entered New Jersey and the Long Island Sound before reaching their destinations in Connecticut. Upper level trajectories (Figure 4) originated in northern Virginia and traveled around the perimeter of high pressure. This path led trajectories through West Virginia, western Ohio, and across the state of Pennsylvania. Upper level trajectories then crossed through the New York City metropolitan area before reaching their destinations in Connecticut. One trajectory traveling to Maryland in the southern nonattainment area recirculated around northern Virginia and western portions of Maryland before reaching its endpoint in Fair Hill, MD.

It should be noted that the day prior, September 5th, 2018 was deemed a High Electric Demand Day (HEDD) for power plants within the PJM Mid-Atlantic sector. A HEDD is called when peak hourly loads will be greater than 50,000 MWh. During HEDD events, additional generating units are called upon to operate to meet the demand on the electrical grid caused by increased cooling needs. The addition of ozone precursor emissions from these upwind generating units to satisfy that demand likely contributed to more ozone production, which was then transported into the region and contributed to the ozone exceedances.

Figure 5 shows the national ozone concentration observed on September 5th, the day prior to this high ozone event. As shown in the figure, scattered moderate and isolated USG air quality was observed throughout the nonattainment area. Back trajectories from September 6th suggest that recirculation around the center of high pressure and the potential influence from industry in an already polluted environment under favorable weather conditions led to these exceedances.

Figure 2. 48-hour Back Trajectories for September 6, 2018 at 10 meters

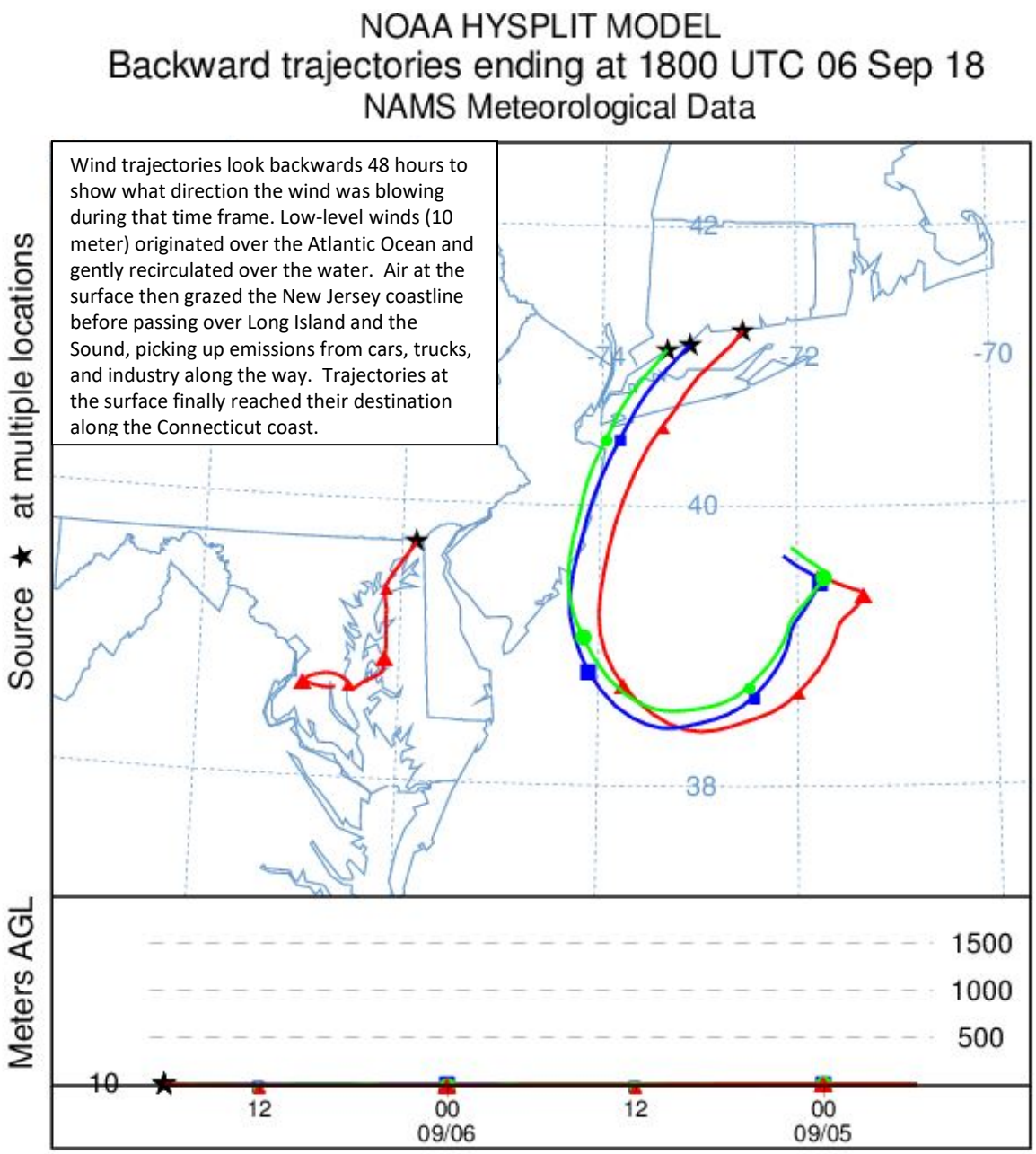
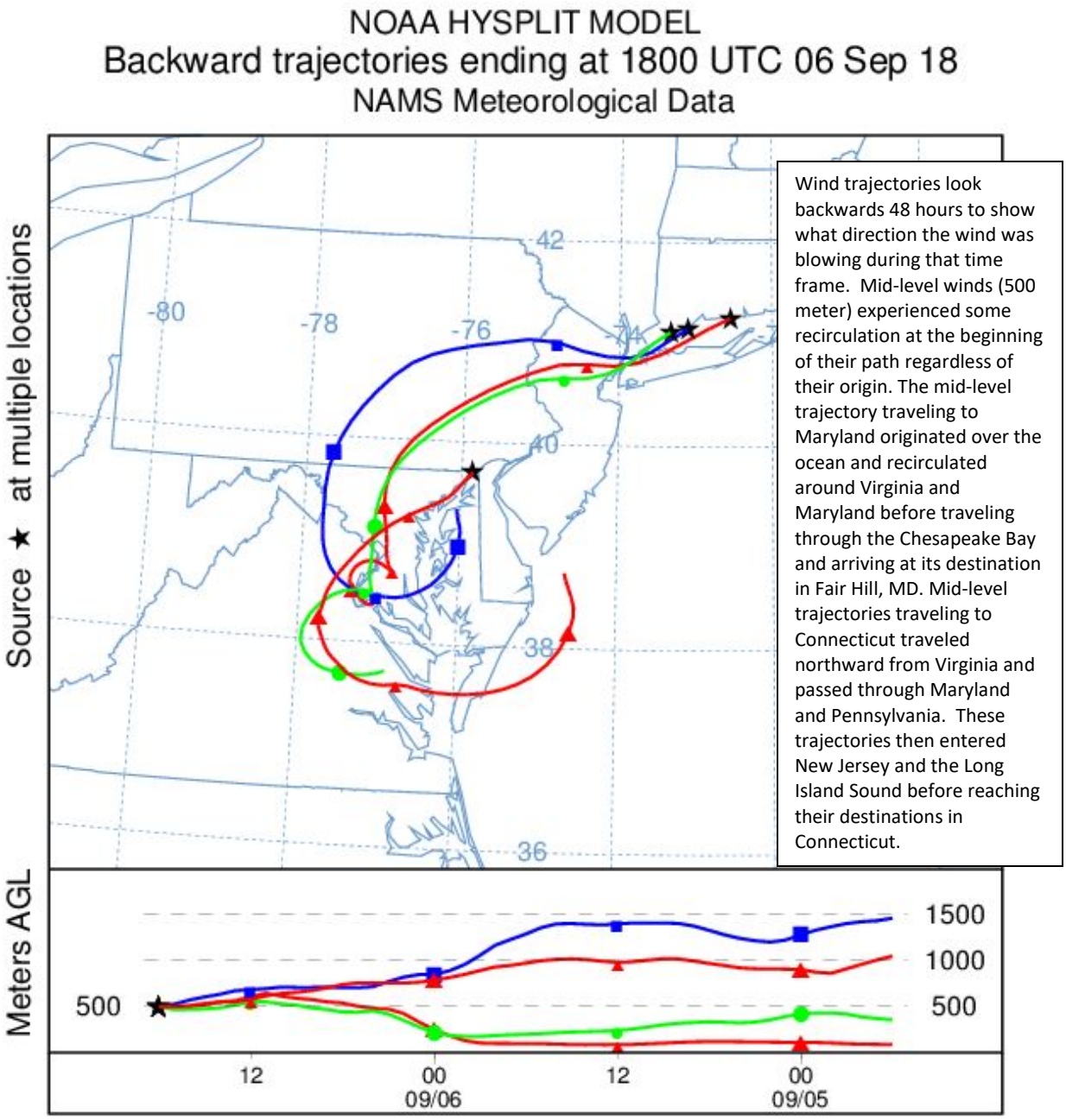
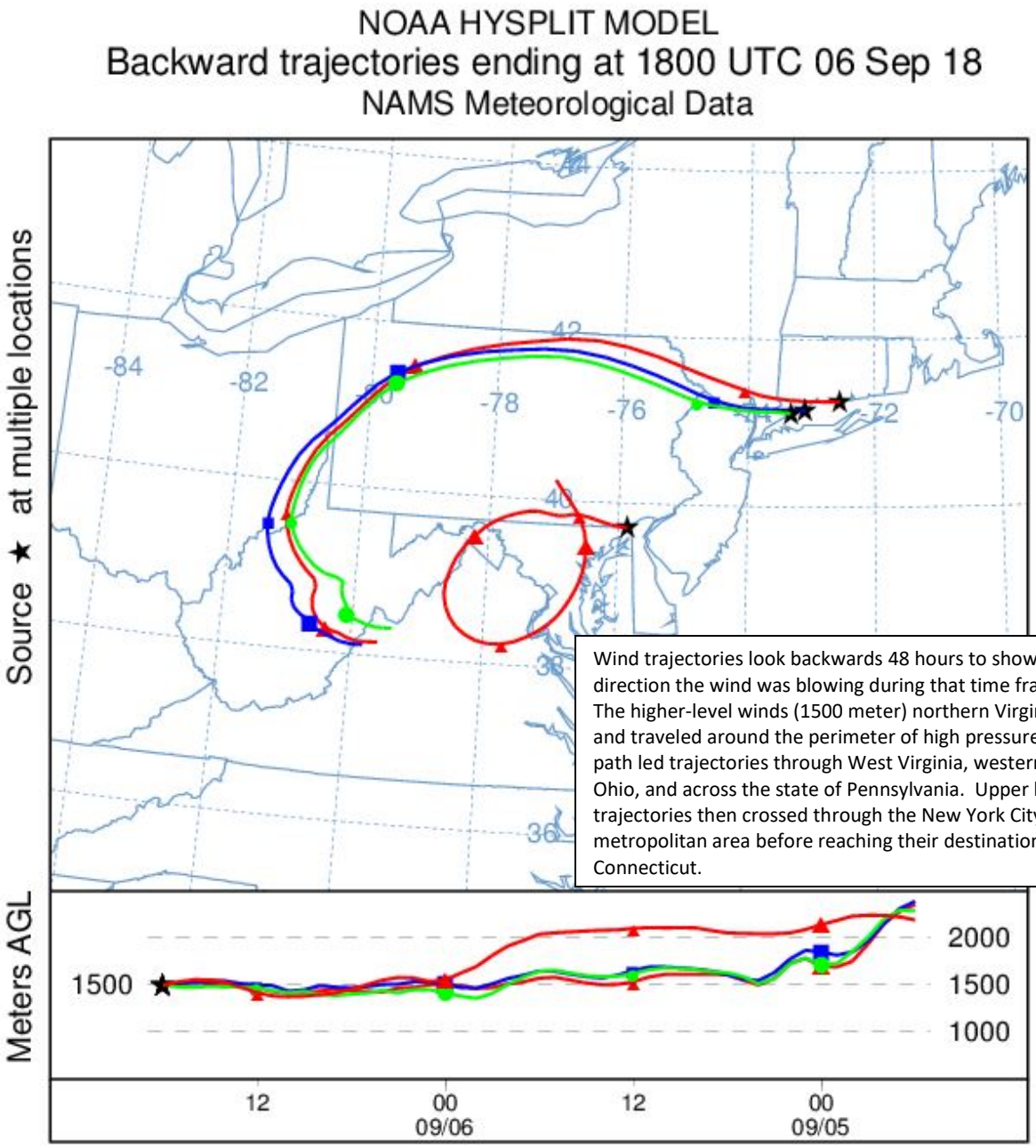


Figure 3. 48-hour Back Trajectories for September 6, 2018 at 500 meters



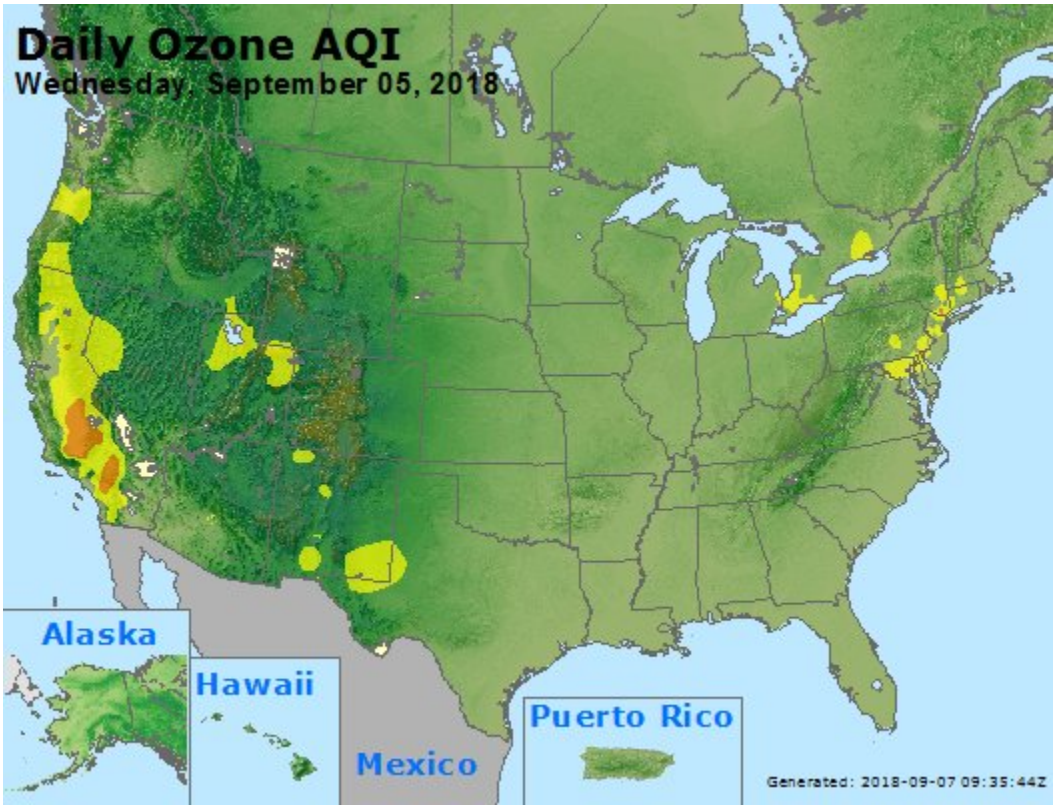
Wind trajectories look backwards 48 hours to show what direction the wind was blowing during that time frame. Mid-level winds (500 meter) experienced some recirculation at the beginning of their path regardless of their origin. The mid-level trajectory traveling to Maryland originated over the ocean and recirculated around Virginia and Maryland before traveling through the Chesapeake Bay and arriving at its destination in Fair Hill, MD. Mid-level trajectories traveling to Connecticut traveled northward from Virginia and passed through Maryland and Pennsylvania. These trajectories then entered New Jersey and the Long Island Sound before reaching their destinations in Connecticut.

Figure 4. 48-hour Back Trajectories for September 6, 2018 at 1500 meters



Wind trajectories look backwards 48 hours to show what direction the wind was blowing during that time frame. The higher-level winds (1500 meter) northern Virginia and traveled around the perimeter of high pressure. This path led trajectories through West Virginia, western Ohio, and across the state of Pennsylvania. Upper level trajectories then crossed through the New York City metropolitan area before reaching their destinations in Connecticut.

Figure 5. Ozone Air Quality Index for the United States on September 5, 2018



How is Ozone Created?

Ground-level ozone is an air pollutant known to cause a number of health effects and negatively impact air quality and the environment in New Jersey. Ozone is formed when oxides of nitrogen (NOx) and volatile organic compounds (VOCs) react in the presence of sunlight. Ozone can irritate any person's lungs, but the effect may be more pronounced for those with existing lung-related deficiencies, and therefore, one should take extra precautions on bad ozone days.

Find Out About Air Quality Every Day

The "What's Your Air Quality Today?" page at http://www.nj.gov/dep/cleanairnj/ tells you how to sign up to receive notifications and find out when your local air has reached unhealthy ozone levels.