

Does Wind Direction Contribute to Amount of Aerosols?



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Abstract

Our research is about aerosols and wind direction because we wanted to know if wind direction affects the amount aerosols. Our research question is does the wind direction affect the amount of aerosols. The GLOBE protocol we used was the Globe observer to test the clouds. The results of our research are: North we had an average of 3.5 aerosols, South we had an average of 4.1 aerosols, East we had an average of 5.1 aerosols, and West we had an average of 2.6 aerosols. We conclude that wind direction affects the amount of aerosols.

Research question

Our research question asks how does wind direction affect the amount of aerosols? Our hypothesis is that if the wind is blowing directly on the aerosol trap it will affect the amount of aerosols. If the wind is directly blowing on the aerosol trap there will be more aerosols and if the wind is blowing in a different direction there will be less aerosols. We are interested in researching this topic because we did an assignment in our class where we used sticky traps to collect aerosols. Aerosols affect life and health and we came up with this question. In class we learned about aerosols and what they are, and we wanted to find out more about if the direction of wind or wind speed would affect the amount of aerosols.

Introduction

An aerosol is a suspension of fine solid particles or liquid droplets in air or another gas. They can be natural or man made. Examples of natural aerosols are fog or mist, dust, forest exudates, and geyser steam. Examples of man made aerosols include air pollutants, mist from the discharge at hydroelectric dams, and irrigation mist. Aerosols also make clouds and contribute to climate change. Some of them cool the earth, while others heat it up. The end effect cools the earth a small amount.

Researching this topic is important because aerosols affect health, create clouds, and contribute to climate change. An aerosol is a particle that is in the atmosphere and not really visible to the naked eye. Even though they are so small, their impact on climate and health are significant. This topic addresses health because every time we breathe we inhale thousands of aerosols. For our research we used the Up In The Air Student Activity. We used this activity to collect data, to understand how aerosols work, and what they affect in the world.

THE RELATIVE SIZE OF PARTICLES

From the COVID-19 pandemic to the U.S. West Coast wildfires, some of the biggest threats now are also the most microscopic.

A particle needs to be 10 microns (μm) or less before it can be inhaled into your respiratory tract. But just how small are these specks?

Here's a look at the relative sizes of some familiar particles \blacktriangleright



HUMAN HAIR 50-180 μm \blacktriangleright
FOR SCALE

FINE BEACH SAND 90 μm \blacktriangleright

GRAIN OF SALT 60 μm \blacktriangleright

WHITE BLOOD CELL 25 μm \blacktriangleright

GRAIN OF POLLEN 15 μm \blacktriangleright

DUST PARTICLE (PM₁₀) <10 μm \blacktriangleright

RED BLOOD CELL 7-8 μm \blacktriangleright

RESPIRATORY DROPLETS 5-10 μm \blacktriangleright

DUST PARTICLE (PM_{2.5}) 2.5 μm \blacktriangleright

BACTERIUM 1-3 μm \blacktriangleright

WILDFIRE SMOKE 0.4-0.7 μm \blacktriangleright

CORONAVIRUS 0.1-0.5 μm \blacktriangleright

T4 BACTERIOPHAGE 0.225 μm \blacktriangleright

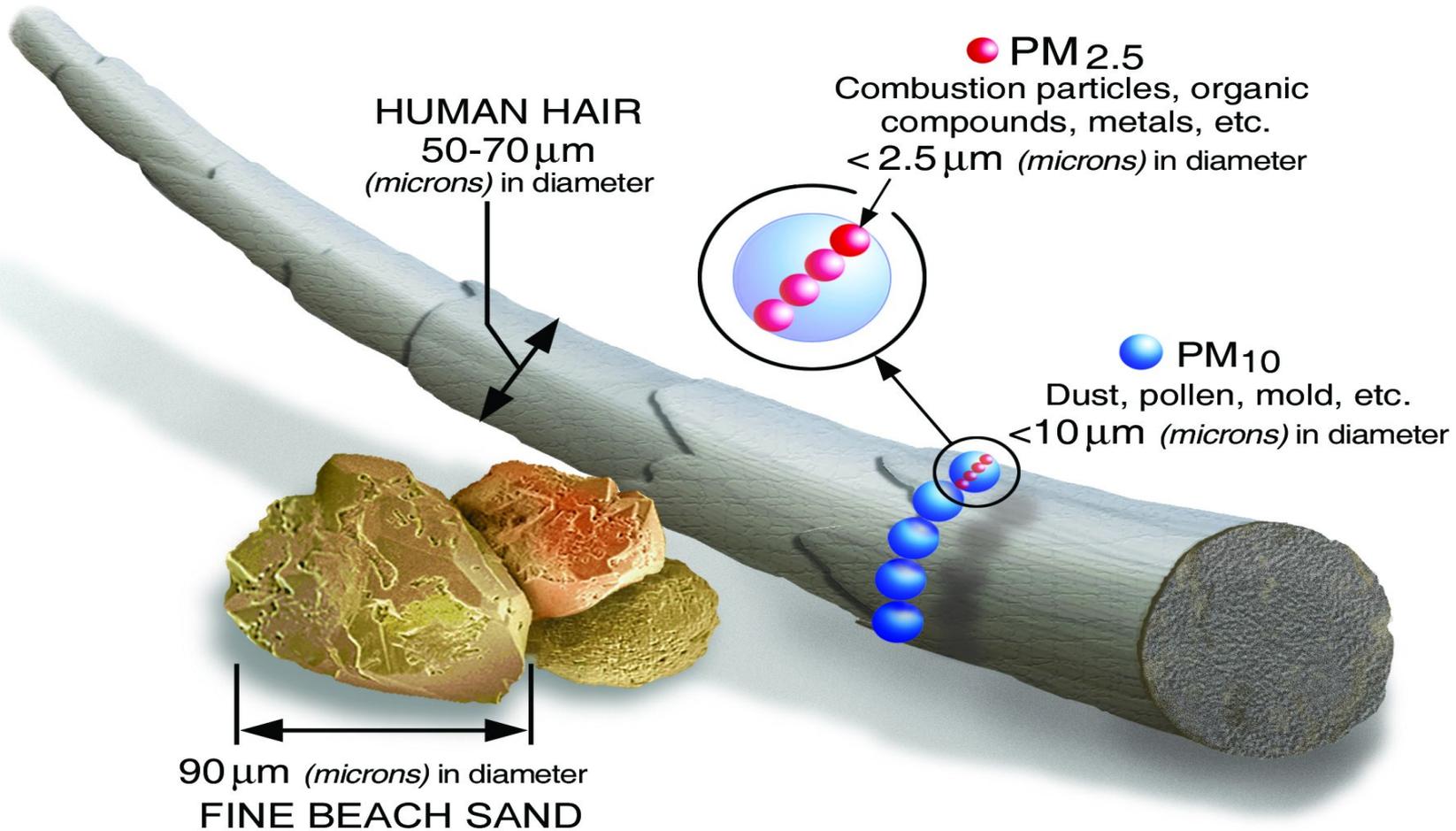
ZIKA VIRUS 0.045 μm \blacktriangleright

 Pollen can trigger allergic reactions and hay fever—which 1 in 5 Americans experience every year.
Source: Harvard Health

The visibility limits for what the naked eye can see hovers around 10-40 μm .

 Respiratory droplets have the potential to carry smaller particles within them, such as dust or coronavirus.

 Wildfire smoke can persist in the air for several days, and even months.



HUMAN HAIR
50-70 μm
(microns) in diameter

90 μm (microns) in diameter
FINE BEACH SAND

PM_{2.5}
Combustion particles, organic
compounds, metals, etc.
< 2.5 μm (microns) in diameter

PM₁₀
Dust, pollen, mold, etc.
< 10 μm (microns) in diameter

Research methods

Our plan for the investigation is putting up sticky sheets on four sides of milk crates and seeing what side gets the most aerosols. Our plan will produce data to test wind direction. The study site is located in Mansfield Ohio at St.Peter's school. It is an urban area. Our study site is a field or vacant lot, next to our school. It is in a high traffic area, also near trees. The GLOBE protocols we plan to use is the Up In The Air Activity. We plan to collect data 1 time for 24 hours after leaving four different crates out overnight.



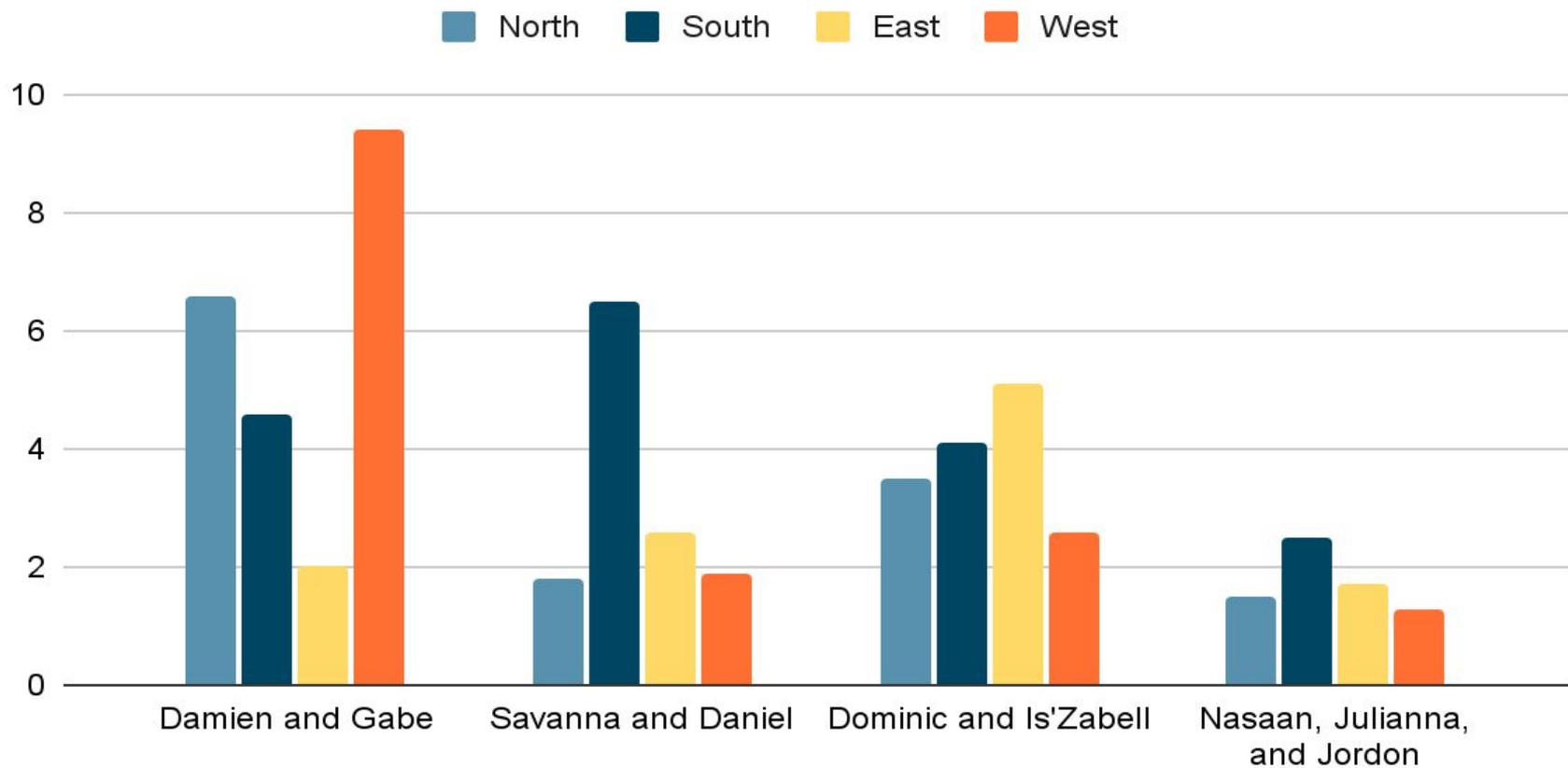
Research Methods

The GLOBE protocol we used was a worksheet called the Up In The Air Student Activity. We were in downtown Mansfield near a large tree, and the air was 20 degrees Celsius. When we collected data it had slightly rained overnight but the sticky sheets were fine. We collected a total of 4 data sheets after 24 hours. We analyzed the data using GLOBE procedures. Our methods help to answer the research questions because we saw if the wind direction affected the amount of aerosols.

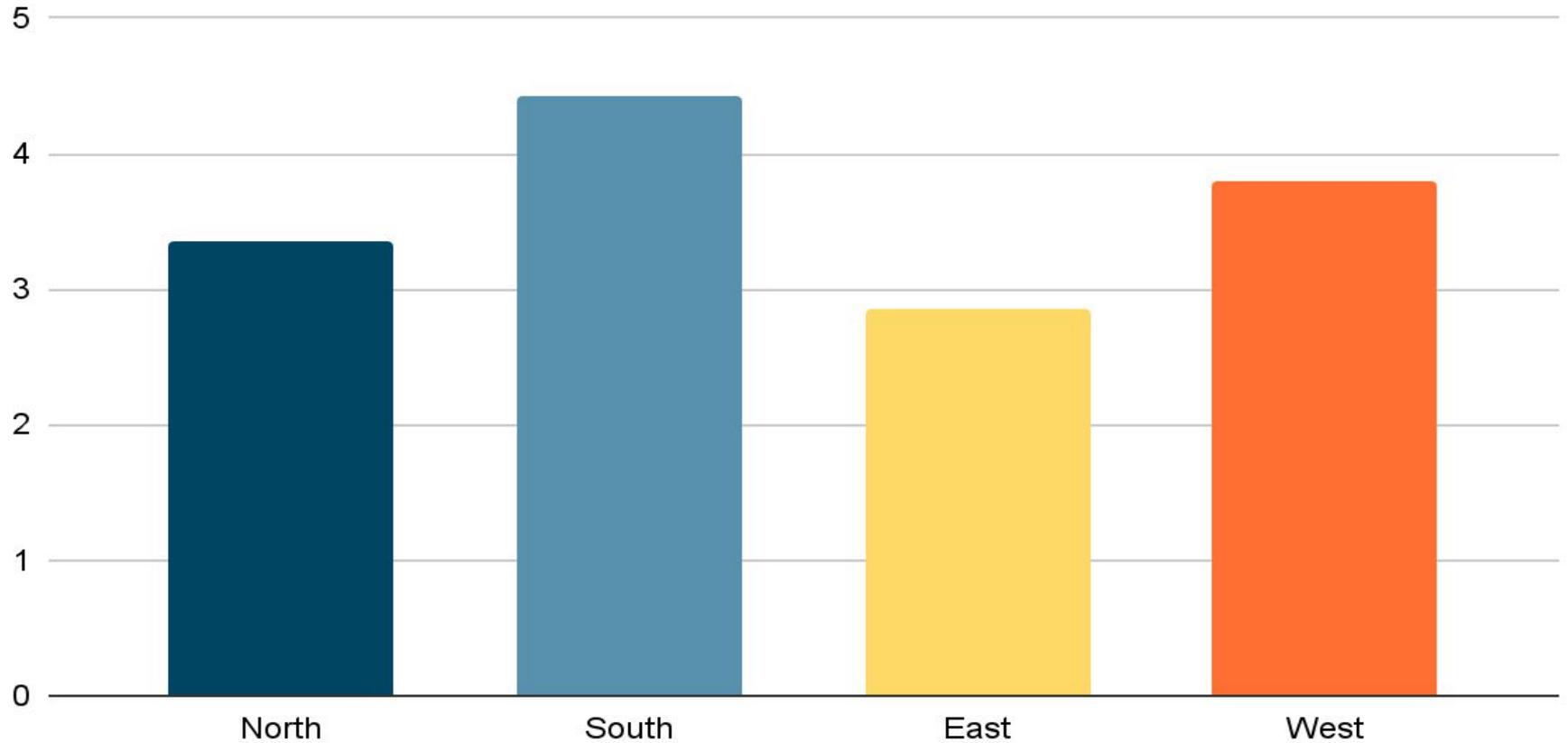
Student Aerosol Data Collection

	North	South	East	West
Damien, Gabe	6.6	4.6	2.0	9.4
Savanna, Daniel	1.8	6.5	2.6	1.9
IsZabell, Dominic	3.5	4.1	5.1	2.6
Nasaan, Julianna, Jordon	1.5	2.5	1.7	1.3
Total	13.4	17.7	11.4	15.2
Average	3.35	4.43	2.85	3.8

Groups Aerosols Collected

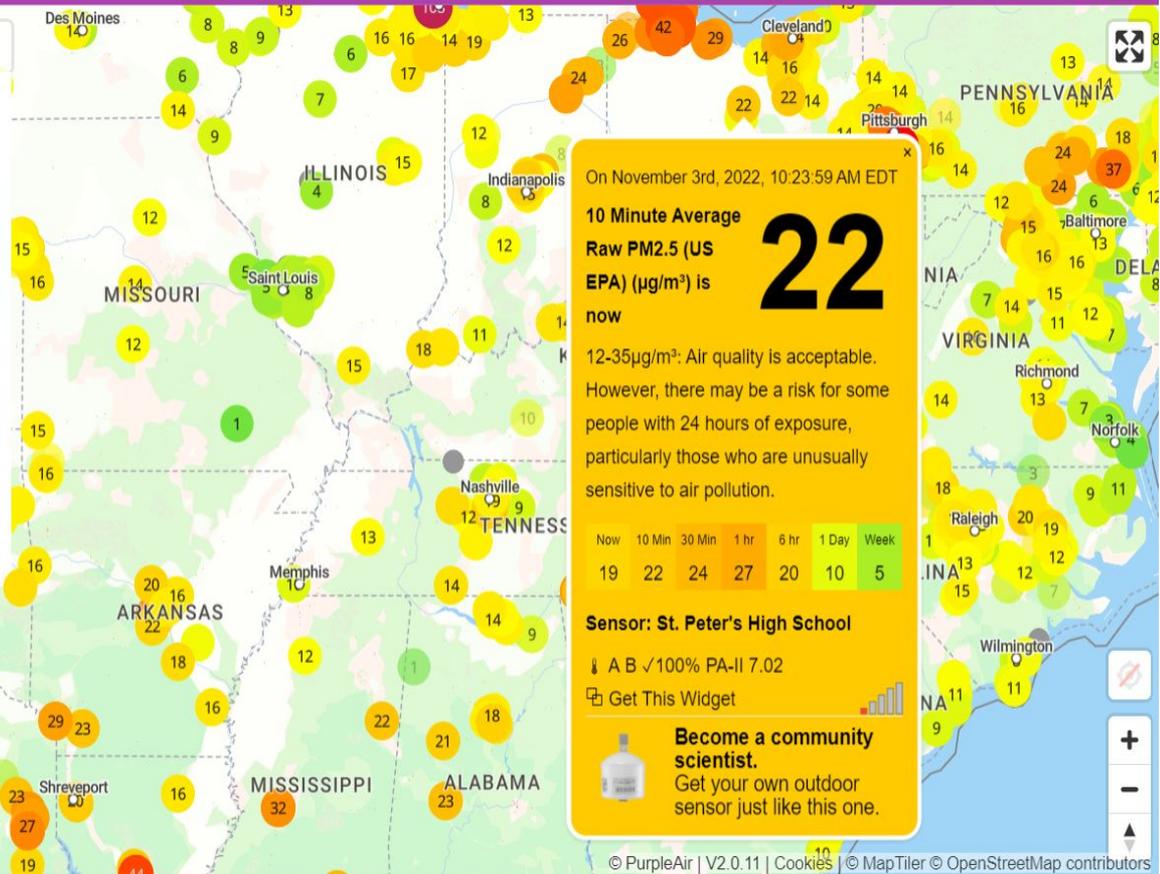
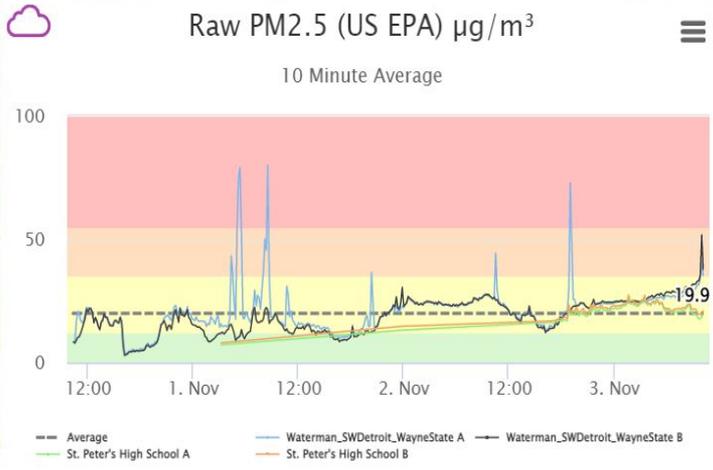


Average Aerosols Collected From Cardinal Directions





Click & drag to zoom. Shift + click & drag to pan. [How to use the graph.](#)



On November 3rd, 2022, 10:23:59 AM EDT

10 Minute Average
Raw PM2.5 (US EPA) ($\mu\text{g}/\text{m}^3$) is now

22

12-35 $\mu\text{g}/\text{m}^3$: Air quality is acceptable. However, there may be a risk for some people with 24 hours of exposure, particularly those who are unusually sensitive to air pollution.

Now	10 Min	30 Min	1 hr	6 hr	1 Day	Week
19	22	24	27	20	10	5

Sensor: St. Peter's High School

↓ A B ✓ 100% PA-II 7.02

🔗 Get This Widget

Become a community scientist.
 Get your own outdoor sensor just like this one.

Legend for map colors:

No Data	0	12	35	55	150	250
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November 3rd, 2022, 10:24:49 AM EDT

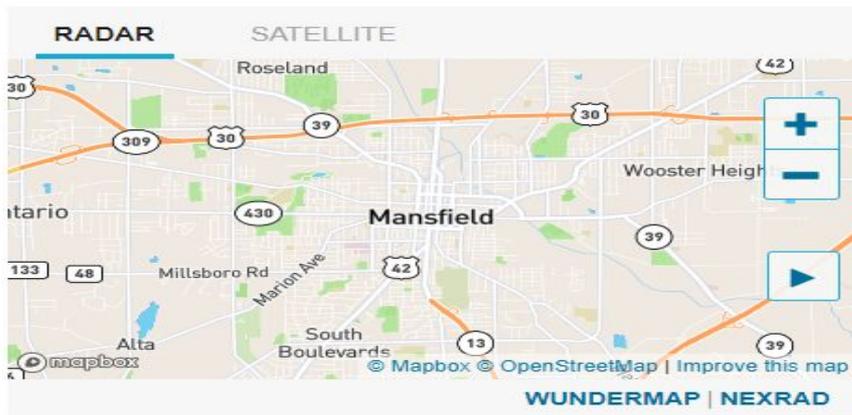
🕒 1:17 PM EDT on November 2, 2022 (GMT -4) | Updated 2 minutes ago



Sunny



Gusts 4 mph



Today's temperature is forecast to be **NEARLY THE SAME** as yesterday.

 **TODAY**
WED 11/02
HIGH 64 °F

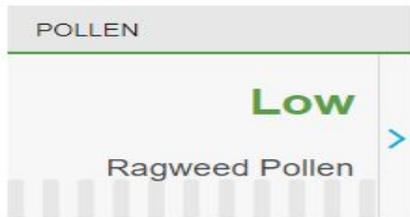
[1% Precip. / 0.00 in](#)
Cloudy skies. Areas of patchy fog. High 64F. Winds light and variable.

 **TONIGHT**
WED 11/02
LOW 44 °F

[9% Precip. / 0.00 in](#)
Clear to partly cloudy. Low 44F. Winds light and variable.

 **TOMORROW**
THU 11/03
HIGH 67 | 51 °F

[9% Precip. / 0.00 in](#)
A mainly sunny sky. High 67F. Winds S at 5 to 10 mph.

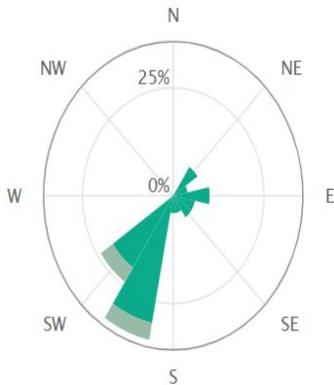




Wind Rose

SPHS Weather Station

Last updated: November 2, 2022 / 5:10 PM

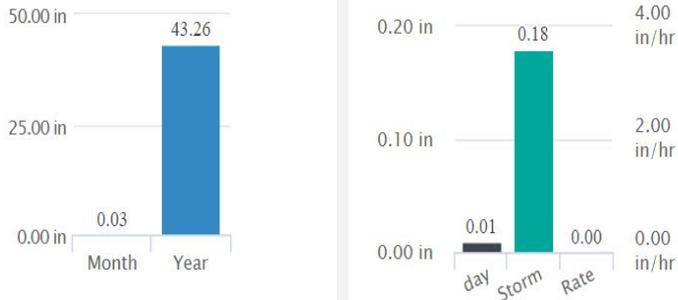


DAY WEEK MONTH

- 0 - 2 mph
- 2 - 4 mph
- 4 - 6 mph
- 6 - 8 mph
- 8 - 10 mph
- 10 - 20 mph
- > 20 mph

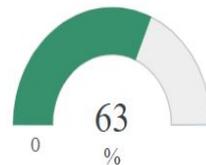
Current Rain

SPHS Weather Station



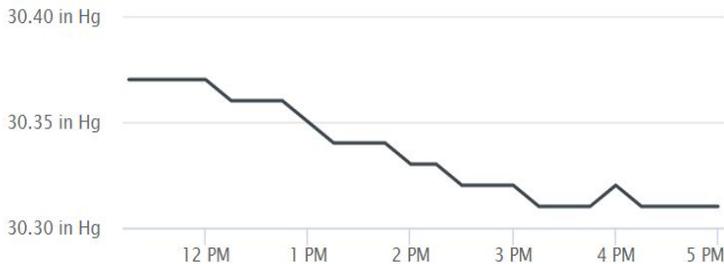
Humidity

SPHS Weather Station



Barometer

WeatherLink Live



Local Forecast

WeatherLink Live

Evening



49 °F | 0%
Clear



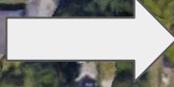
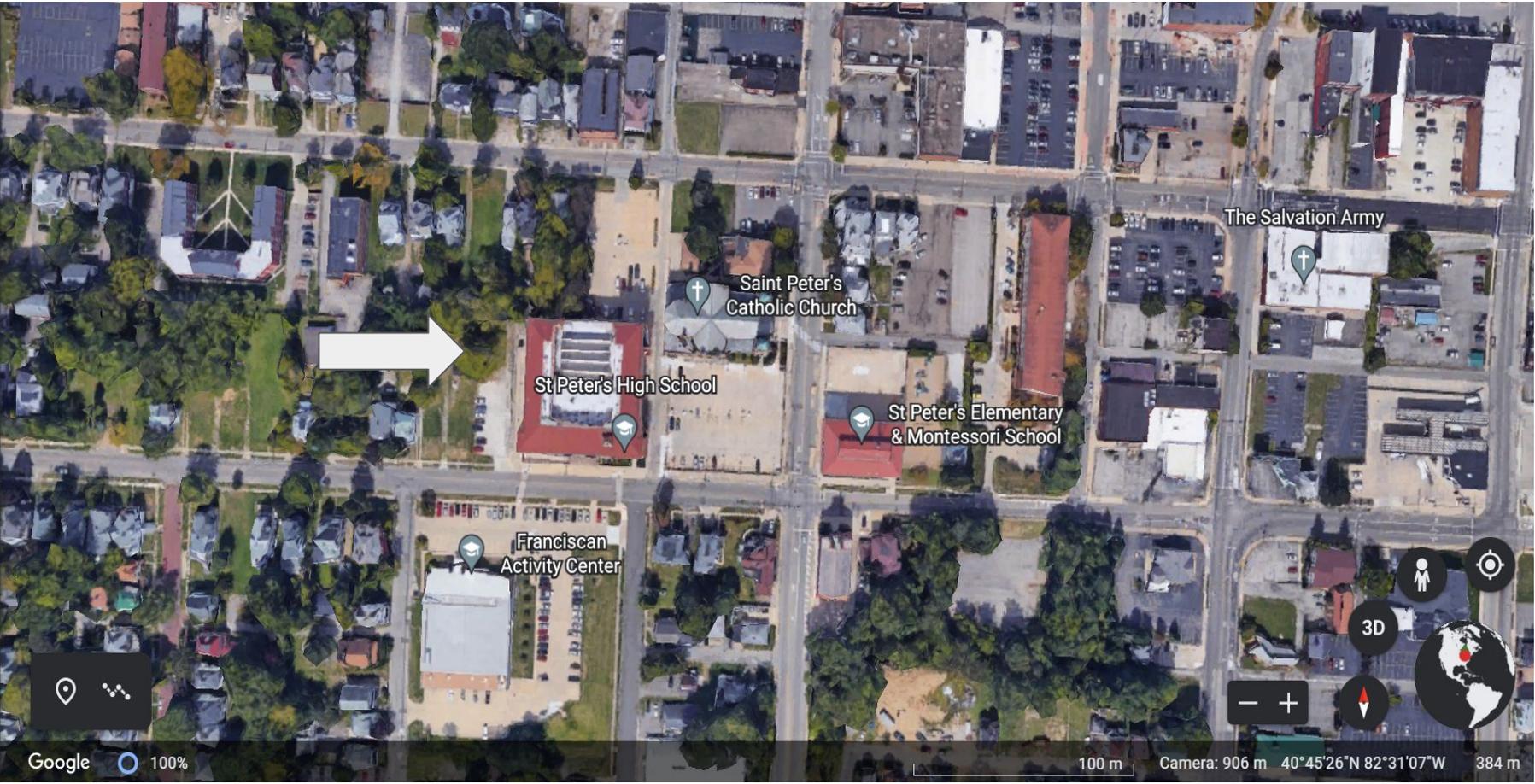
WLL St. Peter

1 SPHS Weather Static

Update

Clear all

Select all



St Peter's High School

Saint Peter's Catholic Church

St Peter's Elementary & Montessori School

Franciscan Activity Center

The Salvation Army

Google 100%

100 m

Camera: 906 m 40°45'26"N 82°31'07"W 384 m





Search location...



Login



3D



Radar & Satellite



Wind



Wind gusts



Rain, thunder



Temperature



Clouds



Waves



Air quality



More layers...



Surface

particles animation pressure



More layers...

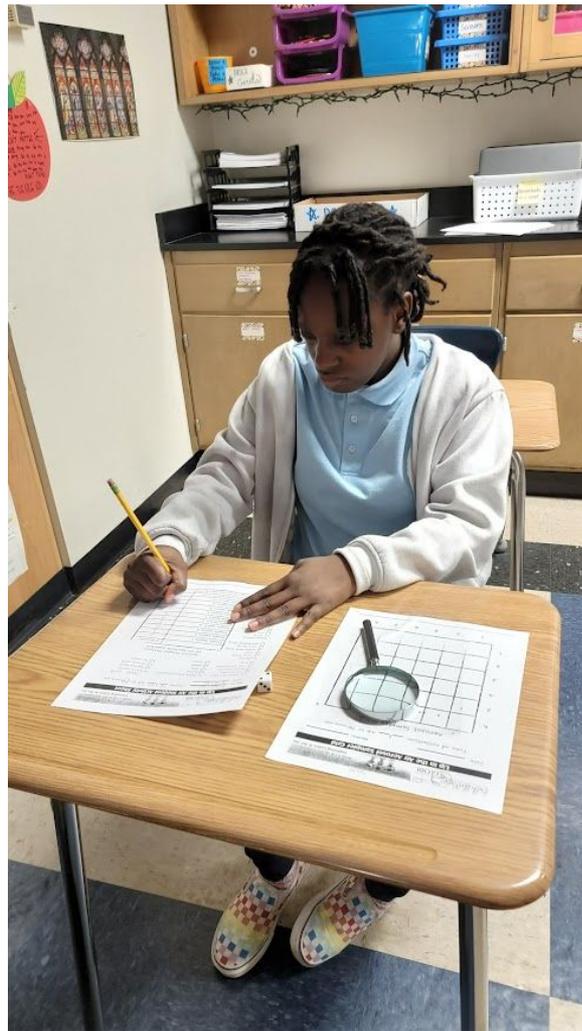
ECMWF GFS HRRR 2 more

kt 0 5 10 20 30 40 60

Wednesday 2 - 9 AM

Wed 2 Thu 3 Fri 4 Sat 5 Sun 6 Mon 7 Tue 8 46° Wed 9 Thu 10 Fri 11

Morgan OpenStreetMap contributors



Discussion

The most important results are the amount of aerosols from the south side. The results mean that wind affects the amount of aerosols. The data are important to science and our community because now we know wind affects the amount of aerosols. The results do help answer the research question because the windy direction had the most aerosols for us. If aerosols are carried by the wind then this makes sense to us that we got this result but really much more testing needs to be done.

Conclusions

Our conclusions is our hypothesis was correct because most of our aerosols came from the south side.

Improvements to our research can be having more aerosol traps out and a day with more wind and our other fellow scientists had more aerosols from different directions so maybe a different place or putting the traps higher off the ground. We appreciated doing this research for GLOBE and NASA because it helped us learn about aerosols.

References

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