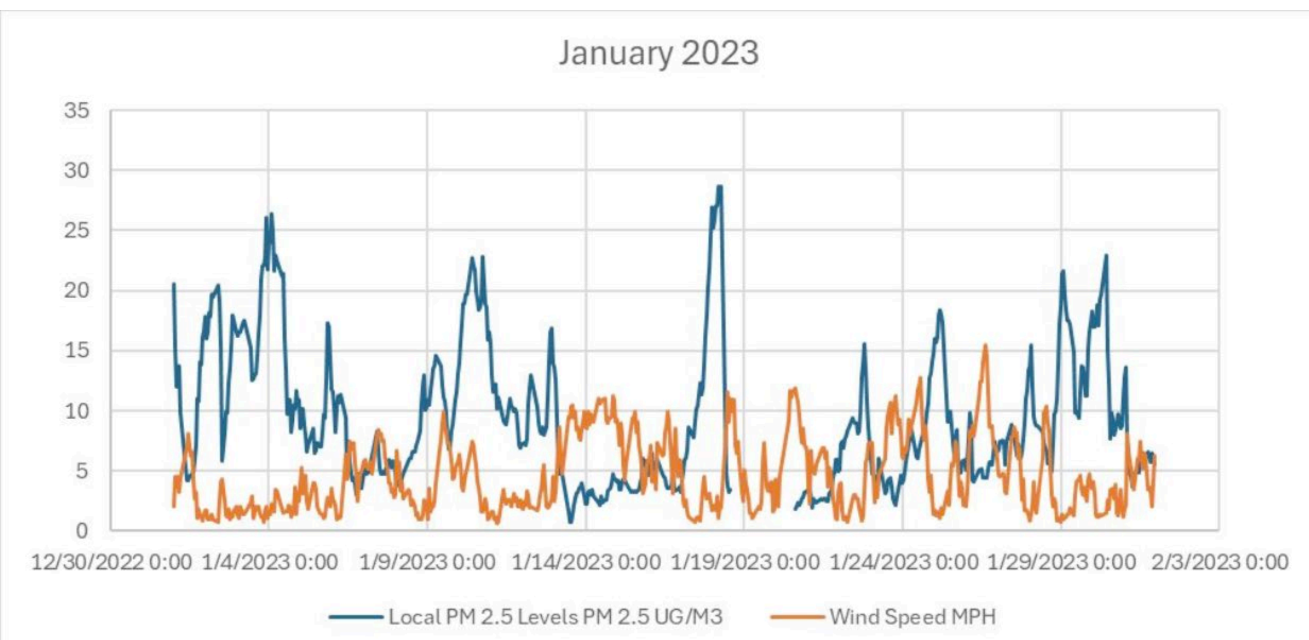
Lehigh Valley BREATHES

Welcome to Lehigh Valley Breathes May 2024 Update!

This spring, Lehigh University Professor Ben Felzer and data specialist Jeremy Mack have been working with two undergraduate students (Lizzie Hayes and Olympia Ransom) in the Department of Earth and Environmental Science to explore the impact of meteorological variables on PM2.5 pollution in the Lehigh Valley. Using data from the Pennsylvania Department of Environmental Protection's (DEP's) centralized air monitor, which precedes the start of the LVBreathes Project, the students looked at the impact of windspeed and temperature inversions on PM2.5 pollution during different months of 2023.

Windspeed is known to impact PM2.5 pollution. When windspeed is higher, it tends to disperse PM2.5 pollution more quickly, so higher windspeed is associated with lower levels of PM2.5 pollution. In studying this relationship between pollution and windspeed in the Lehigh Valley, the Lehigh students found that higher windspeeds in the Lehigh Valley are associated with lower PM2.5 levels.

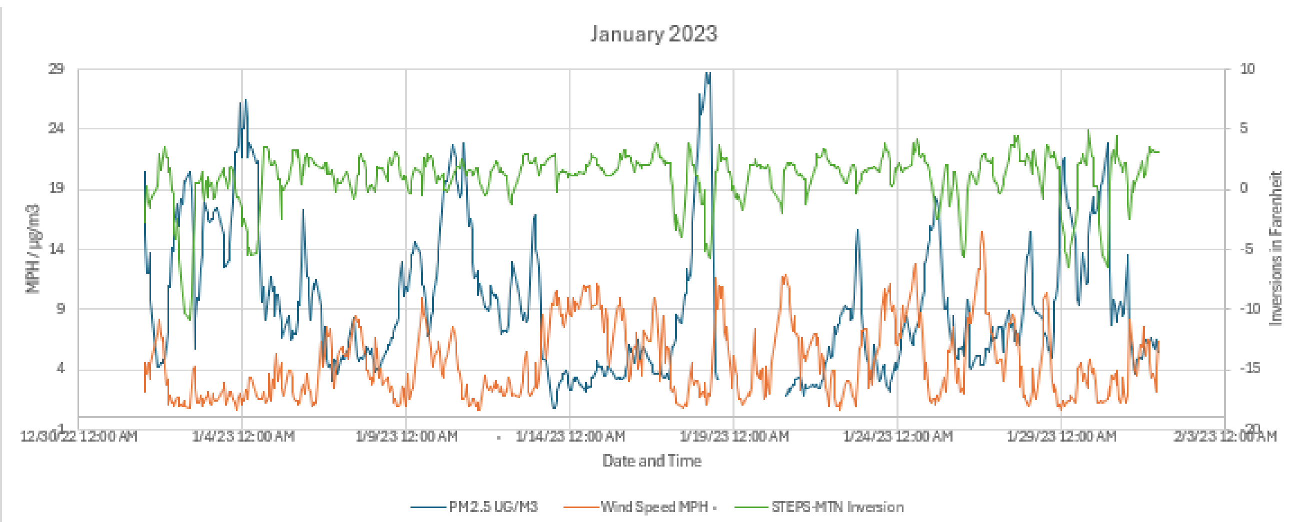
The graph below shows how the amount of PM2.5 pollution and wind speed varied over the month of January 2023. In most cases, the peaks in PM2.5 pollution (blue line) occur when the windspeeds (orange line) are low, and conversely, when windspeeds are high, PM2.5 pollution levels are low.



Temperature inversions are also known to impact PM2.5 pollution. A temperature inversion occurs when a layer of warmer air in the atmosphere traps colder air near the ground. The warmer air acts like a blanket or a cap on the colder air, locking in the colder air and the pollution near the earth's surface.

In looking at some preliminary data on temperature inversions in the Lehigh Valley, the Lehigh students found that lower air quality (higher pollution levels) is associated with the co-occurrence of temperature inversions (warmer air layered on top of colder air) and low windspeed. While low windspeed appears to have a bigger impact on PM2.5 pollution levels than temperature inversions, temperature inversions are likely to exacerbate the effect of low windspeed.

The graph below helps to visualize these findings. Like the previous graph, this graph also shows PM2.5 levels (blue line) and windspeed (orange line) for the month of January 2023. However, this graph also incorporates a green line, which characterizes temperature inversions over the same period. To understand the green line, you need to use the vertical scale on the right side of the graph. Any part of the green line that drops below zero on this scale on the right side of the graph (i.e., any negative number) represents a temperature inversion in which warmer air at a higher altitude is trapping colder air near the earth's surface. What is apparent in the green line is that the dips below zero on the graph (temperature inversions) often occur at the same time as higher PM2.5 levels, such that the peaks of the blue lines and valleys of the green lines often seem to be reaching out to each other.



The Lehigh students' preliminary study of temperature inversions is limited because they relied on temperature data from currently available stationary sensors located at different heights, as opposed to temperature gages suspended in the air by balloons at specified locations. Nonetheless, the data is helpful in identifying the broad range of factors shaping PM2.5 pollution. As we develop a better understanding of how PM2.5 pollution is distributed in the Lehigh Valley using the LVBreathes air monitors, this research on windspeed and temperature inversions will help us to distinguish the role that traffic plays in creating localized air pollution problems.

See you next month.