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Busting the Sea Air Myth: **Air Quality Monitoring** at Dorset and BCP Schools

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Background and Context

The “Clean Air Schools Project” is a campaign run by the charity Walk Wheel Cycle Trust (formerly Sustrans) in partnership with BCP Council (Bournemouth, Christchurch & Poole) and has been funded by Public Health Dorset (PHD) and DEFRA to teach children and their families about air pollution, what causes it and how it can be reduced^{1,2}.

Air pollution has a significant effect on public health³, and children are particularly vulnerable to air pollution because their airways are smaller and still developing. They also breathe more rapidly than adults, meaning they take in more polluted air in proportion to their body weight. As children typically spend a quarter of their waking hours at school, air quality in and around schools has a significant impact on their health and development⁴.

Since the Clean Air Schools Project launched in 2022, a frequently encountered public misconception was that Dorset’s coastal setting and sea breezes reduce air pollution, leaving little cause for concern.

To challenge this, BCP and Dorset Councils monitored air quality outside local schools. Data analysis by the University of Southampton, funded by the Southampton Sustainability and Resilience Institute, revealed that pollution levels remain a significant issue – despite the coastal location.

Objectives and Data

The key aim of this study was to determine whether school term times influence local air pollution levels, with a particular focus on peak traffic periods during school drop-off and pick-up times.

This study analysed air quality around four schools in the Bournemouth, Christchurch and Poole area and in the wider Dorset region to understand the effect of school runs on local pollution. These data were drawn from DEFRA AURN and AQmesh monitoring stations nearby the schools, recorded every 15 minutes and aggregated to hourly means.

The 2021/22 academic year was used as the main comparison period to capture like-for-like seasonal variation. Data collected on weekdays during term-time were distinguished from data collected during holiday periods. Results were then further divided into winter, spring, summer, and autumn.

The pollutants assessed were Nitrogen Monoxide/Nitric Oxide (NO), Nitrogen Dioxide (NO₂), as well as particulate matter less than 2.5 µm (PM_{2.5}), and less than 10 µm (PM₁₀).

Key Findings

Nitric Oxide (NO) levels are significantly higher during school terms among the pollutants assessed, making it the clearest marker of school-run traffic.

- Figure 1 shows that NO concentrations are substantially higher in term time than in holidays, highlighting the strong influence of school-run traffic on local air quality.
- In urban areas, the main source of NO is from vehicle exhaust (high-temperature combustion processes)⁵.
- During term-time mornings (07:00 – 10:00), NO concentrations consistently rise when compared to holidays as shown in Figure 1 which may reflect car use for drop-offs. NO peaking in cold weather such as Autumn and Winter is attributed to increased car dependence and the fact that emissions treatment systems in diesel vehicles often operate less efficiently in the cold⁶.
- During evening peak hours (15:00 – 17:00), there is a smaller increase in NO concentrations, as it more readily converts to NO₂ in the presence of Ozone (O₃) that has built up during the day.

Nitrogen Dioxide (NO₂) shows a weaker school day dependence but is strongly photochemistry dependent.

- Term-time NO₂ concentration levels are consistently higher than during holidays, yet levels align closely with temperature, regardless of the season. NO₂ forms when NO rapidly oxidises in the presence of sunlight and ozone, so it peaks often later in the day as solar intensity and temperature increases. This means weather and seasonal conditions strongly influence when and how much NO₂ builds up⁷.

Concentrations of fine particles (PM_{2.5} and PM₁₀) do not exhibit sharp school-run spikes.

- Fine particles have a longer atmospheric lifetime than gaseous pollutants (eg. NO & NO₂) and therefore do not show sharp rises or drops during school drop-off and pick-up hours. Instead, their concentrations reflect broader urban and meteorological conditions⁸, with their highest levels in spring, as shown in Figure 2.

The average changes of pollutant level during school vs holiday period peak hours (07:00 – 10:00) varied by season.

- From Figure 3, the analysis of peak school-run hours shows the largest change for NO, with winter term-time levels more than ten times higher than holidays. NO₂ also rises sharply in winter around 3.7 times but shows little changes in warmer months. By contrast, PM₁₀ and PM_{2.5} show more modest increases, with the largest differences in autumn and spring. This variation highlights that school-run impacts are pollutant- and season-dependent, reinforcing the need for targeted, time-sensitive measures.
- The average changes also varied across the schools due to local factors such as traffic, school size, and surrounding environment. Schools with a higher number of pupils and in more urban areas showed a higher average change.

Recommendations and Strategies

Reduce local vehicle traffic during school hours.

- The influence of local vehicle exhaust is clearly visible in the observed increase in NO concentrations during school hours; therefore, reducing vehicle traffic nearby schools is essential to improve air quality at schools.
- Immediate actions at the school gate can be taken by enforcing no-idling zones during drop-off and pick-up to cut morning NO peaks. Staff or volunteers can support soft enforcement, and visible signage helps make the law clear to parents.
- Programmes encouraging more active travel for the school run would reduce local vehicle traffic and improve air quality at schools.

Sustain long-term monitoring for robust evidence.

- Regulatory limits focus on NO₂ concentrations instead of NO. The WHO and UK regulations do not provide a specific air quality guideline for NO alone, as NO rapidly converts to NO₂ in the atmosphere.
- Extending data collection over multiple academic years will build stronger trend analysis, particularly for NO₂. Since NO₂ is influenced by both traffic and photochemical processes, longer datasets are essential to separate seasonal variability from school-run impacts.

Further data to explain local variations.

- Collecting metadata including temperature, wind speed, wind direction and traffic count data alongside pollutant monitoring will help distinguish traffic-driven peaks from weather-driven effects. Embedding these factors in future analyses will improve attribution, strengthen school-specific advice, and guide targeted interventions.

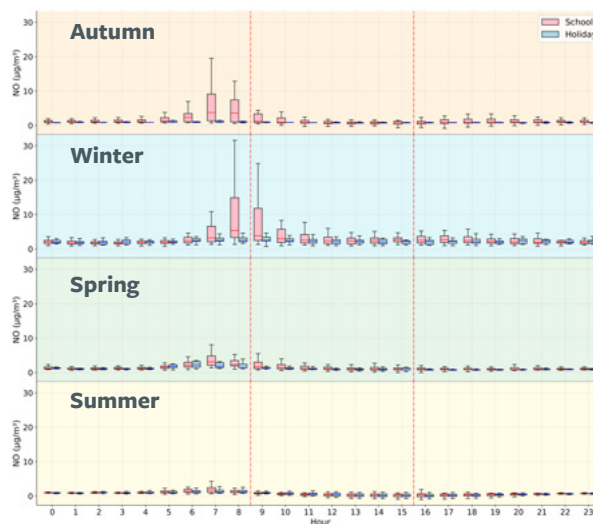


Figure 1. Hourly variation of the average NO levels across all schools comparing school vs holiday period by season for weekdays only. The two red dotted lines indicate the school start and end times.

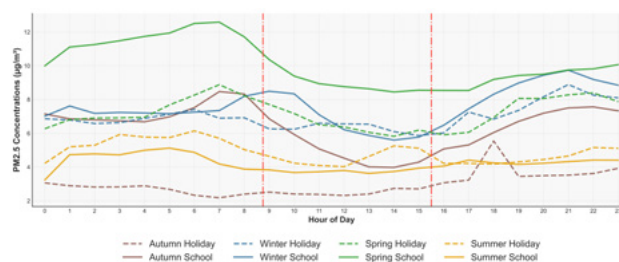


Figure 2. Average PM_{2.5} levels across all schools for weekdays only, showing that although values do not exhibit sharp peaks during the daytime, concentrations on school days often exceed those on holidays. The two red dotted vertical lines indicate the school start and end time.

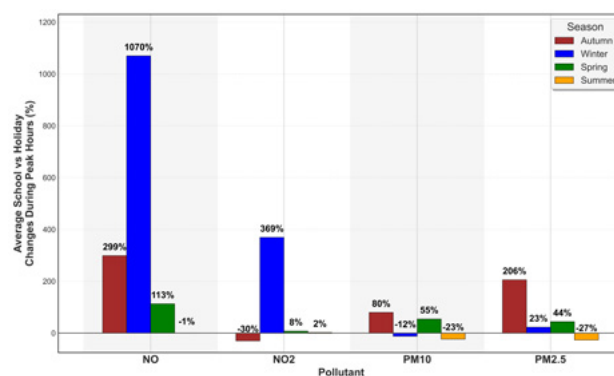


Figure 3. Average percentage change of air pollution levels between school days and holidays during peak school hours (07:00–10:00) across all schools weekdays only. These numbers reflect the relative increase or decrease in pollutant concentration during school periods compared to holidays, where a positive value indicates an increase attributed to the school run.

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