



Where: Hamilton, New York, USA

Product: Series 200 with PM₁₀/ PM_{2.5} sensor head

Installed: March 2018

Result: A robust easy to use tool that gives students a way to gather scientifically credible data and advance their understanding of air pollution processes

THE CUSTOMER



Colgate University is a selective liberal arts college located in Hamilton, NY, USA. With just under 3,000 undergraduate students, Colgate provides a university experience in a residential, rural college setting.

The Department of Geology focuses on providing students with hands-on opportunities to explore the earth around them. Colgate Geology prides itself on providing outdoor and field-based learning opportunities, from on-campus outcrops to student-led research. Majors in geology or environmental geology provide students with the opportunity to pursue careers in the geological and environmental sciences, business, and education, as well as government and public service. Many geology majors attend graduate school in geology, hydrology, oceanography, environmental sciences, and environmental policy and law.

“The PM₁₀/PM_{2.5} sensor provides rapid response times, allowing students to discover transient particulate plumes emanating from construction vehicles, fixed smokestacks, passing vehicles, agricultural dust, and even students using e-cigarettes. We’re looking forward to more years of teaching with the Series 200 monitors and PM sensors!”

– Asst. Prof. Joseph Levy

THE PROBLEM

One of Colgate University’s key introductory courses is Environmental Geology (GEOL 101), which attracts students interested in understanding humans’ role in earth system processes. Colgate were looking to develop a new laboratory module (‘PM lab’) focused on air pollution - in particular, understanding particulate matter (PM) and ozone.

As Colgate University is a largely rural campus, PM dominates its air quality. The challenge was to find a PM sensor that is easy to use but is research-grade for students to identify sources of PM at and around Colgate’s campus.

THE SOLUTION

Colgate University selected the Aeroqual Series 200 portable monitor with the PM₁₀/PM_{2.5} sensor head. The Series 200 had previously been used for methane sensing in Geology department projects under harsh environments, so they were confident of its robustness. A key feature of the Aeroqual portable

monitor range is the ability to replace one sensor head (e.g. methane) with another (e.g. PM₁₀/PM_{2.5}). The change out takes seconds and no recalibration or adjustment is necessary.

Having converted the Series 200 monitors to measure PM, here's how the students used them:

- GEOL 101 students were engaged in a one-hour PM scavenger hunt around campus on identified sources, as well as, interesting PM plumes based on the hypotheses they had developed while mapping out known sources.
- On return to the computer lab, students evaluated the air quality measurements they had made using the EPA AIRNow toolset. They determined the local air quality (assuming a 24-hour duration for the sources) and then evaluated whether the assumed duration was reasonable or not.



Scavenger Hunt Map

- Students examined archival AIRNow datasets to see how PM pollution varied over time in geographical regions that are important to them. They compared environmental factors controlling PM pollution by relating season patterns of PM AQI to seasonal weather conditions.
- The students devised potential mitigation plans for urban vs. rural PM pollution, while considering how rural campus sources of PM (diesel vehicles, agricultural dust, wood smoke, etc.) might differ from urban sources, and how community dynamics between urban and rural communities might affect the implementation of those plans.

EVALUATION

According to Assistant Professor Joseph Levy: "The PM lab was a tremendous success! Students loved independent data collection - the instruments were easy to use, easy to learn, and rugged enough to withstand use by even the most deviously enterprising student looking to find an extreme PM source. One student even borrowed the instruments after class to explore air quality in his dorm and at some favourite hangout sites like the rock gym."

Colgate University's PM lab has become one of the favourites. The scavenger hunt using the Aeroqual PM sensor allowed students to build from prescribed measurements into their own exploration.