



Project

Antarctica STEMM Leadership Voyage

Application

Outdoor Air Monitoring

Scope

Measuring air quality across the Antarctic Peninsula using handheld technology, in compliance with strict local regulations.



Equipment and services

Aeroqual Ranger
NO₂, CO₂, PM_{2.5}, PM₁₀

Consultants

Kirsty Robinson
Technical Director, Mott MacDonald

Date

Jan - Feb 2025

Monitoring air quality in Antarctica

Aeroqual's handheld Ranger, known for its diverse range of applications, was recently used to measure air quality throughout the Antarctic Peninsula as part of a STEMM leadership voyage.

Kirsty Robinson, an environmental consultant and Technical Director at Mott MacDonald, wanted to gain a better understanding of air quality in Antarctica as part of a month-long Homeward Bound voyage. As the expedition's resident AQ expert, alongside a global cohort of leading researchers and scientists, Kirsty set out to "measure NO₂, PM₁₀ and PM_{2.5} emissions" to get an understanding of the impact of human activities on air quality in Antarctica." Of particular interest was the potential air quality impact of diesel-powered ships, given "tourism and the operation of several research facilities." The impact of active volcanoes, such as Deception Island, on CO₂ levels was also a point of interest, along with the air quality impact of natural penguin waste on densely populated Paulet Island.

Project challenges

Scientific studies in Antarctica require special permits and are governed by a series of complex regulations (e.g., the Antarctic Treaty System). Without such permits, as was the case while travelling as part of a leadership voyage, any activities must not remove anything or leave an impact on the pristine environment. The current avian flu epidemic added further restrictions with participants required to minimise touching of rocks and surfaces, other than walking, and not being able to place any equipment on the ground. Even if fixed monitors were allowed, transferring large equipment while disembarking the small Zodiac boats used to reach the mainland would be extremely challenging. The unpredictable and extreme weather, and rocky terrain, incentivizes the use of compact solutions to help mitigate safety concerns. While the remote location requires solutions be battery-powered, the extreme cold can potentially have a negative impact on battery life.

Project outcome

The Ranger was successfully deployed throughout the voyage, navigating all potential challenges. As a lightweight, handheld solution, the Ranger "can be considered similar to a thermometer, as it's not taking any samples away, it's just taking a reading, so there's no actual impact on the environment of Antarctica". Ultimately, the Ranger showed good air quality across the measured locations, aside from elevated particulate across the Drake Passage (expected to be predominantly caused by sea spray given the harsh conditions, including strong winds and four-metre swell).

Kirsty praised the Ranger's battery life and ease of use, switching between sensor heads in the field "without having to lose that extra time turning it off and on, or making lengthy calibrations". Along with gathering accurate data, "undertaking these measurements whilst surrounded by STEMM leaders from around the globe helped bring an understanding of air quality to the forefront of conversations on the voyage." Kirsty considered the boost in air quality awareness that came from using the Ranger around her fellow STEMM leaders, "sparking unique conversations and ideas which wouldn't have otherwise been explored", to be a key positive outcome.

"The Ranger was compact, easy to use, and stood up to the Antarctic conditions. Having air quality be front of mind among the other researchers on the voyage was a great outcome too."

Kirsty Robinson
Technical Director, Mott MacDonald