

# Overview of the development of a methodology to monitor PM<sub>10</sub> with UAS

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## **Abstract:**

The use of unmanned aerial systems (UAS) to monitor dust and gas plumes is a known area of opportunity for the industry and science. UAS have been mostly used for acquiring airborne imagery of sites for environmental, industrial and government related research topics. The capability of small and micro UAS to accurately characterise atmospheric parameters and use them to report emissions has not been explored in depth.

In this research fixed wing and multi-rotor UAS were tested with dust monitoring sensors. Experiments were conducted to demonstrate that low-cost and lightweight optical sensors could be coupled with small UAS to study smoke and dust plumes. We use UAS telemetry data, as well as physicochemical and contaminant air quality data, as inputs for advection-dispersion modeling. Through several experiments, it was possible to collect data from dust emission and use it in modeling to successfully describe the behaviour of PM<sub>10</sub> concentrations in the laboratory and controlled field experiments. Gaussian distribution and artificial neural networks (ANN) models were used to analyse the data.

The methodology developed will assist in measuring pollution concentrations and their emission rates from fugitive emissions at sites where UAS can be operated. This research seeks to improve fugitive emission estimates by collecting data directly from the source as an alternative to using approximations from equations developed with data commonly obtained from external sources or using laboratory data. Current methods usually over or underestimate concentrations, which can result in inappropriate corrective strategies.