Air Pollution: Optimizing Personal Air Monitors

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Black carbon is an air pollutant that is produced from the burning of fossil fuels. It is a black, sooty material that contributes to growing concerns of climate change and can have detrimental impacts to human health. In heavily populated areas such as New York City, where vehicle traffic is frequent, gas and diesel emissions are prevalent in the air. Individuals that choose to do their daily commutes via bike ride are often exposed to these emissions for short times as they ride throughout traffic. In order to better understand the relationship between short term black carbon exposure and its impact on human health, a biking study at Lamont Doherty Earth Observatory has been launched and in progress for several years. The main goals of this study are to measure how much black carbon bikers are potentially inhaling as they ride near traffic, as well as any health effects that arise from this exposure. One of the key instruments used in this study is the MicroAeth ae51 unit, which is a personal monitor that records the amount of black carbon in the air around it. While it has proved to be an informational tool, it is not entirely efficient. Each ae51 unit shares a similar problem with occasional false black carbon measurements. Analysis of MicroAeth data from various bikers show that similar black carbon readings were measured during periods where there is significant temperature change. Based on these observations, our hypothesis was that temperature change influenced ae51 units to register false black carbon measurements. After various controlled temperature tests with several units, our results proved to be consistent with this hypothesis. The internal temperature registered by MicroAeths influences raw data signals that are used to calculate black carbon readings. This indicates that temperature stability is essential to obtaining the most accurate black carbon measurements in these instruments. Personal air monitors are widely used tools in air pollution studies around the world, thus making their optimization necessary in order to collect the most accurate data.