Calibration Methodology for Vertical Inversion Atmospheric Measurement System

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Air pollution must be measured so that its sources can be remediated. The AtmoSniffer provides measurements during pollution events. Its sensors are sensitive to five of the EPA primary pollutant gases. They arrive uncalibrated, are circuit-dependent, and are intended for detecting emergency levels, but are used in the AtmoSniffer for background level detection. In this study, calibration methods were developed for NO2, CO, NH3, SO2, and O3. Clean air was combined with diluted calibration gases, which flowed through the AtmoSniffer, then through calibrated sensors. For NH3 a vacuum chamber was filled with known partial pressures of this gas then backfilled to ambient pressure. Concentrations ranged from zero to 100 times the EPA exposure standards. Results were compared to the sensors' voltage outputs. Calibration curves and sensor response times were determined. Final calibrations resulted in uncertainties of CO ± 500 PPB, NO3 ±20 PPB, and NH3 ±300 PPB. SO2 and O3 sensors were too noisy at low concentrations, but are being refined for future calibration. Another problem was that the zero point tended to drift, which could be corrected by starting measurements with filtered air. Design and sensor selection resulted in a light-weight monitoring system, which can measure typical levels of EPA-regulated gases and is capable of flight under research balloons. These calibrations can enhance understanding of how inversions form, and of what factors create NH3 which combines with NO2 to form ammonium nitrate. This composes 3090% of PM2.5 emissions, a component of air pollution that poses serious health risks.

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