

LOW-COST OZONE AND NITROGEN DIOXIDE MEASUREMENT INSTRUMENTS FOR MONITORING AIR QUALITY AT OUTDOOR NETWORKED SITES



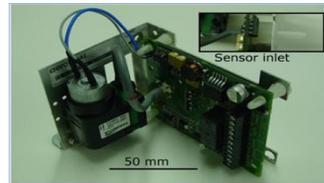
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Measuring O₃ and NO₂ is limited by current instrumentation that is bulky, expensive, requires significant power and a rigorous calibration and maintenance program. We have developed a small, robust and low-cost alternative.

AQM Sensor and Instrument Module

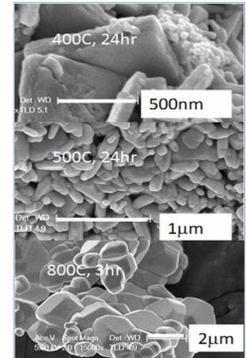


Controls: sensor operation; measures the sensor conductivity; applies the calibration, and gives a digital output of gas concentration.

Sensor Based on Gas Response of Tungsten Oxide at Elevated Temperature

Benefits of WO₃:

- Easily prepared in nano-crystalline form by the decomposition of tungstic acid.
- Fine grain promotes high gas sensitivity.
- O₃ signal free from inference, NO₂ requires removal of O₃ and VOC inference.

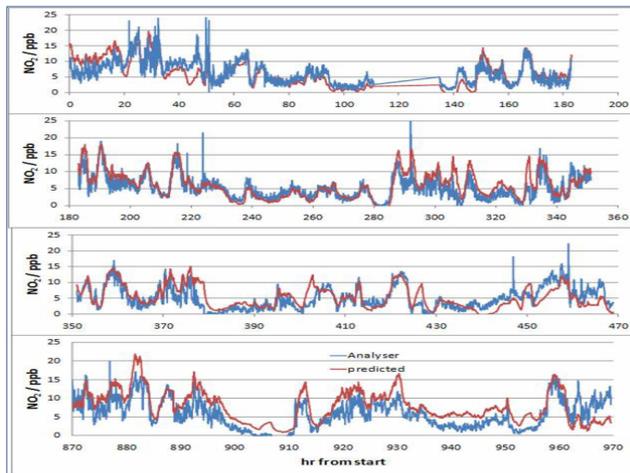


AQM Instrument Performance

NO₂

Interferences to O₃ and VOCs removed by simple thermal scrubber and silicone "kicker". No response to NO.

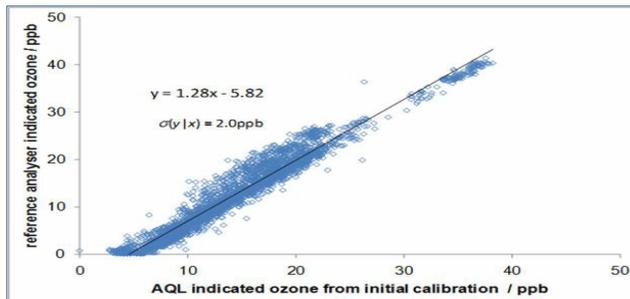
The instrument tracked the analyser-indicated daily mean to less than 2 ppb over the entire period of 1000 hours.



O₃

Periodic zero flow conditions and temperature cycling were implemented to compensate for drift and interference.

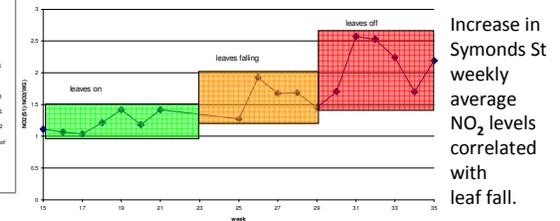
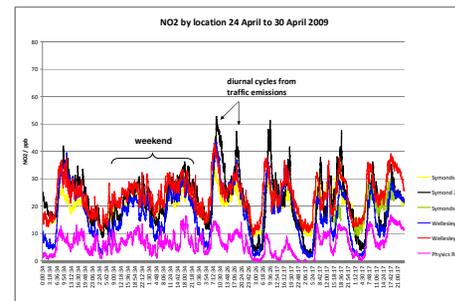
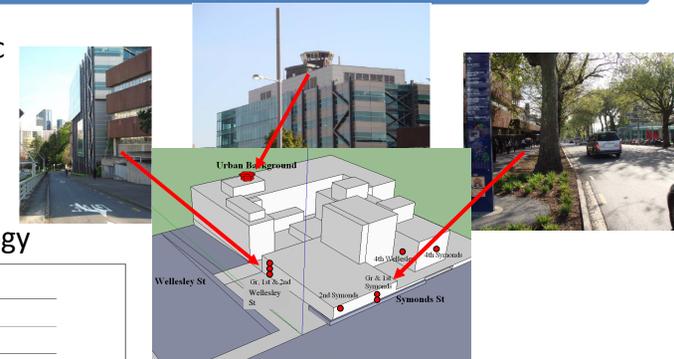
Instruments were accurate to <+/- 10 ppb over periods of months without recalibration.



Correlation of WO₃ instrument and O₃ photometer, per minute over 48 hours. Atmospheric sampling at University of Auckland site.

High Density Urban Mapping of NO₂

5 month study of a traffic intersection showed NO₂ concentrations varied considerably in time and space due to local geometry and meteorology



Conclusion

Low-cost devices for deployment over air quality networks have been developed using WO₃ semiconductor sensors. They have successfully tracked reference analysers for periods for months and enable NO₂, NO_x and O₃ measurements to be made at high spatial resolution. Commercial instruments are now available for high density air quality networks, traffic control, survey and urban planning applications.