Field Evaluation
Air Quality Egg Monitor
(Version 1)

South Coast AQMD

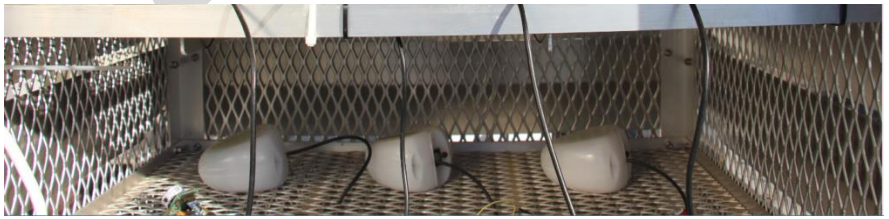
AQ-SPEC

Background

- From 6/5/2015 to 8/5/2015, three **Air Quality Egg v1 (w/ Particulate and Ozone add-ons)** sensors were deployed in Rubidoux and were run side-by-side SCAQMD Federal Reference/Equivalent Methods (FRM/FEM) instruments measuring the same pollutants

- Air Quality Egg (*3 units tested*):
  - Gas and Particle sensor (non-FRM/FEM)
  - Each unit measured the same pollutants: CO (ppm), NO2 (ppb), Ozone (ppb) and PM>1.0 um (counts/283mL)
  - Also, each unit measured Temp (C) and RH (%)
  - Unit cost: ~$200
  - Time resolution: 1-min
  - Units IDs: AQE1, AQE2, AQE3

- SCAQMD FRM/FEM instruments:
  - CO instrument; cost: ~$10,000
    - Time resolution: 1-min
  - NOx instrument; cost: ~$11,000
    - Time resolution: 1-min
  - O3 instrument; cost: ~$7,000
    - Time resolution: 1-min
  - MetOne BAM PM2.5 instrument; cost: ~$20,000
    - Time resolution: 1-hr
  - GRIMM PM instrument; cost: >$25,000
    - Time resolution: 1-min

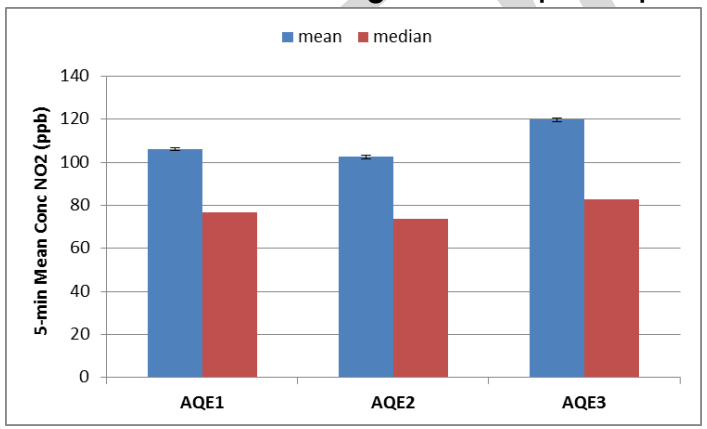


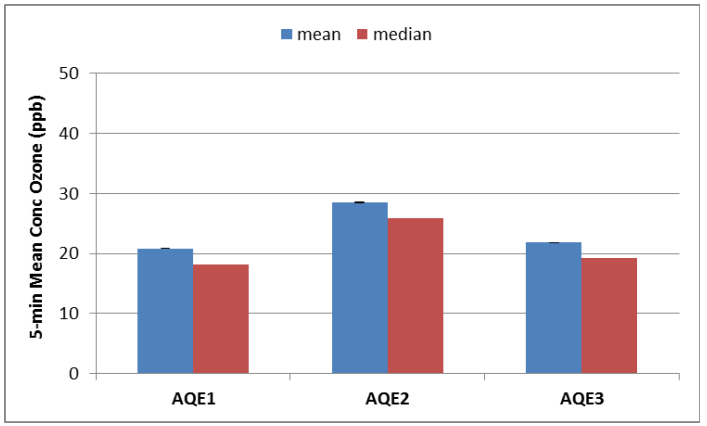
Data validation & recovery

- Basic QA/QC procedures were used to validate the collected data (i.e. obvious outliers, negative values and invalid data-points were eliminated from the data-set)
- PM data from all three AQE sensors were considered invalid and were not included in this analysis
- CO data from all three AQE sensors were out of range and were considered invalid for analysis/comparison to CO FRM data
- Data recovery for NO2 from AQE1, AQE2 and AQE3 sensors was 90, 96 and 95%, respectively
- Data recovery for Ozone from AQE1, AQE2 and AQE3 was 97, 40 and 92%, respectively

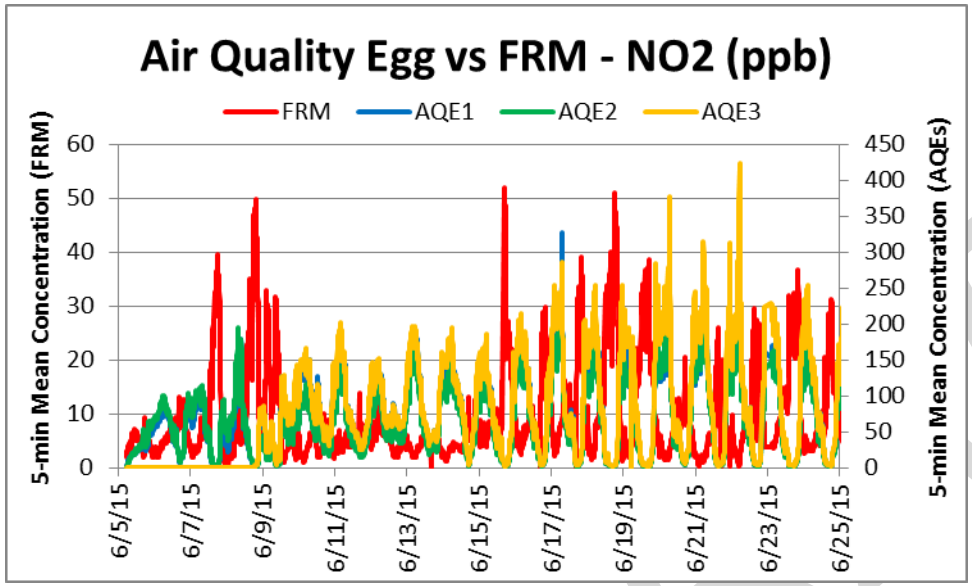
Air Quality Egg; intra-model variability

- Low measurement variation was observed between the three AQE sensors measuring NO2
- A substantial measurement variation was observed between AQE2 and the other two AQE1 and AQE3 sensors measuring Ozone, perhaps also due to about 60% of AQE2 data loss

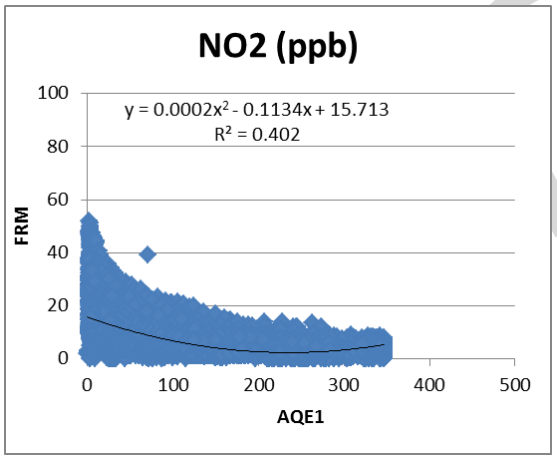


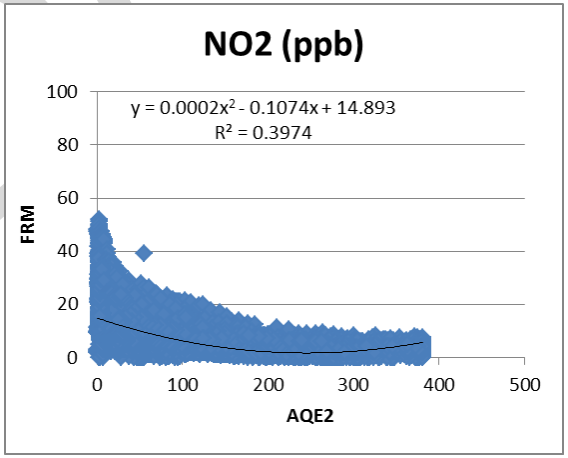


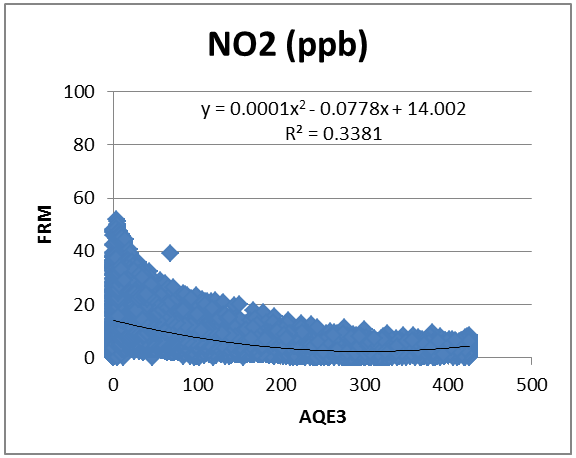
Air Quality Egg vs FRM (NO2; 5-min mean)



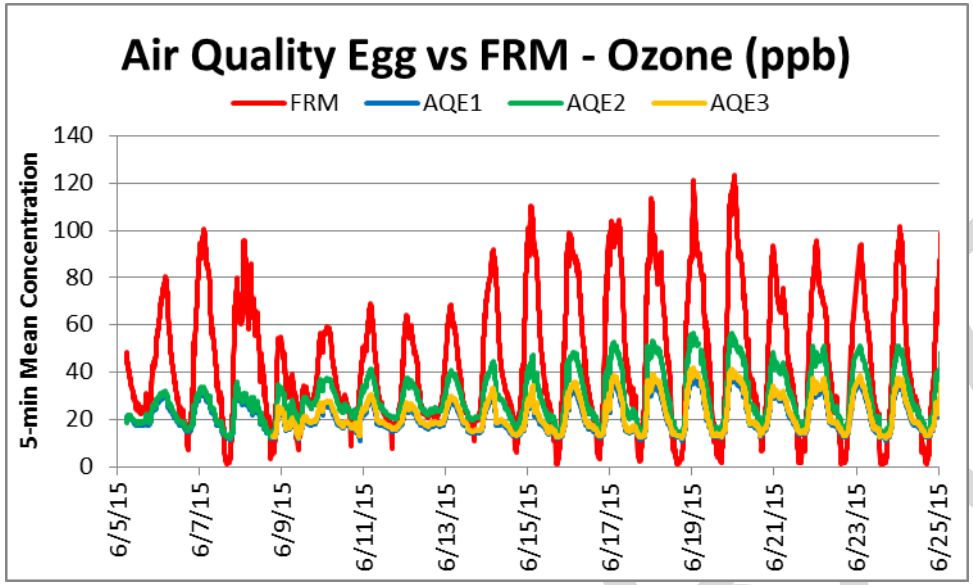
- NO2 measurements from all three AQE sensors correlate poorly with the corresponding FRM data (0.34<R2<0.40) and overall, they overestimate measured NO2 concentrations



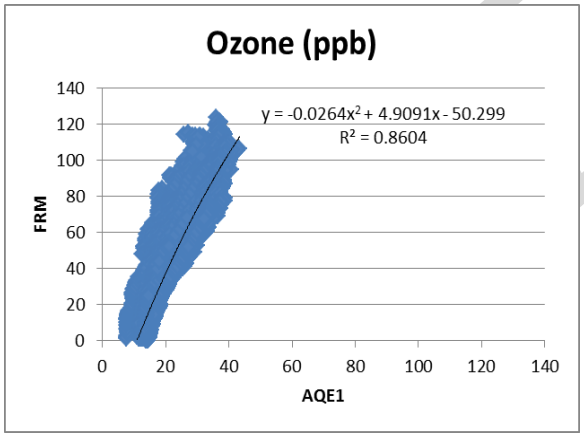


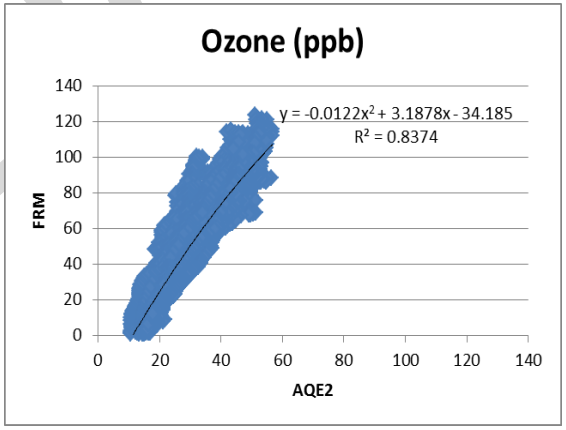


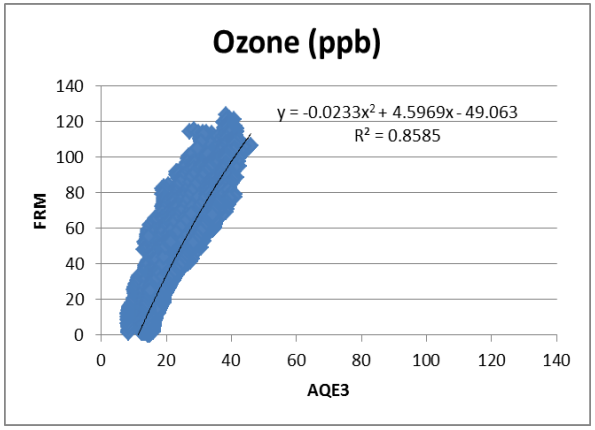
Air Quality Egg vs FRM (Ozone; 5-min mean)



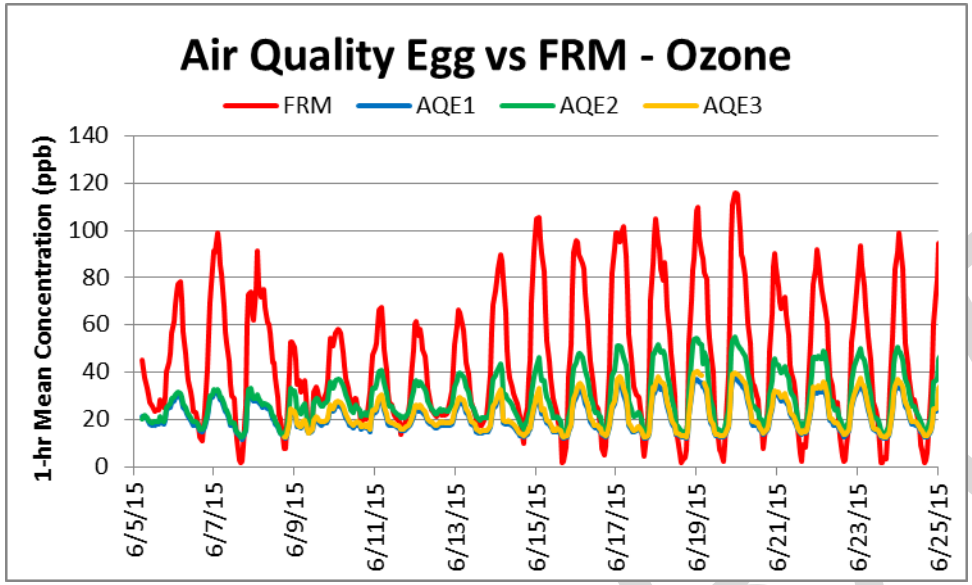
- Ozone measurements from all three AQE sensors correlate very well with the corresponding FRM data (0.84<R2<0.86), but they largely underestimate FRM measured Ozone concentrations



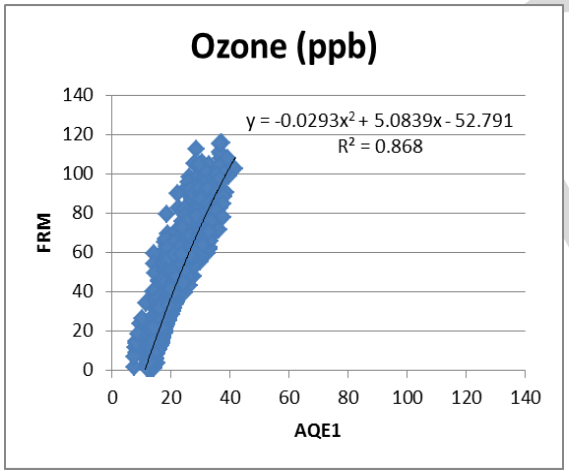


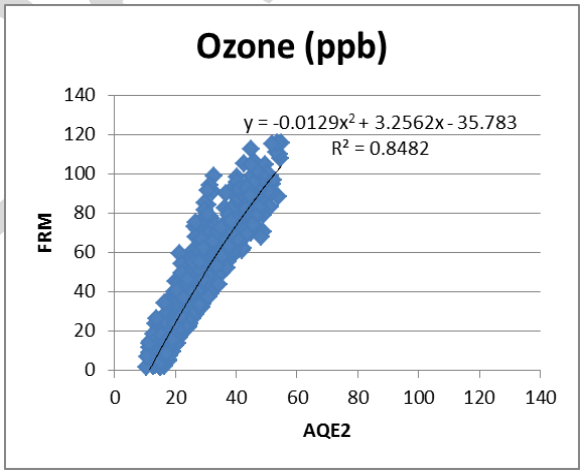


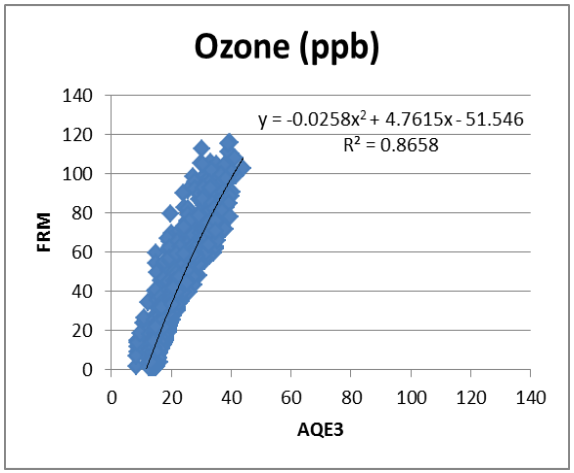
Air Quality Egg vs FRM (Ozone; 1-hr mean)



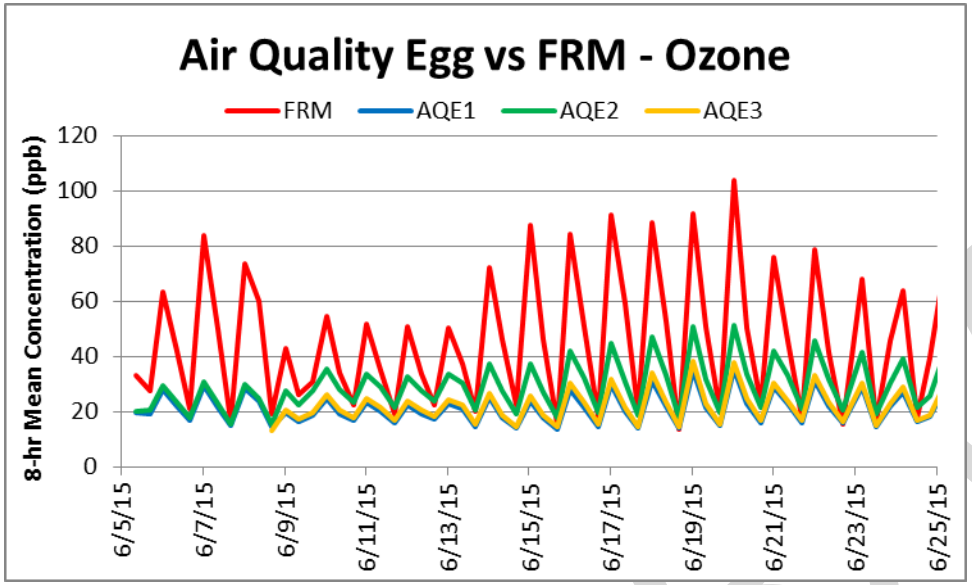
- Ozone measurements from all three AQE sensors correlate very well with the corresponding FRM data (0.85<R2<0.87), but they largely underestimate FRM measured Ozone concentrations







Air Quality Egg vs FRM (Ozone; 8-hr mean)



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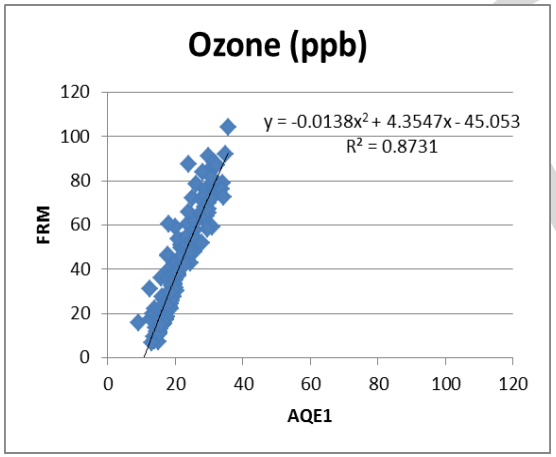

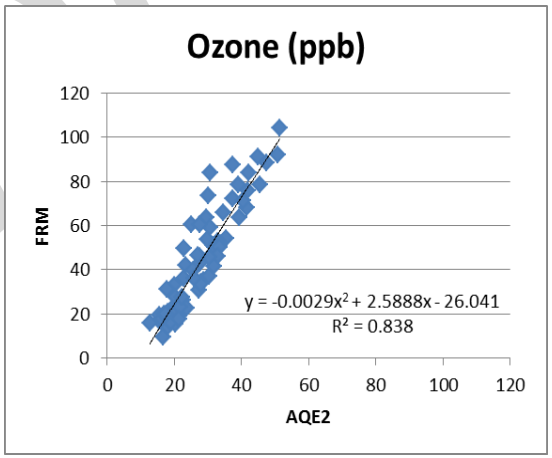

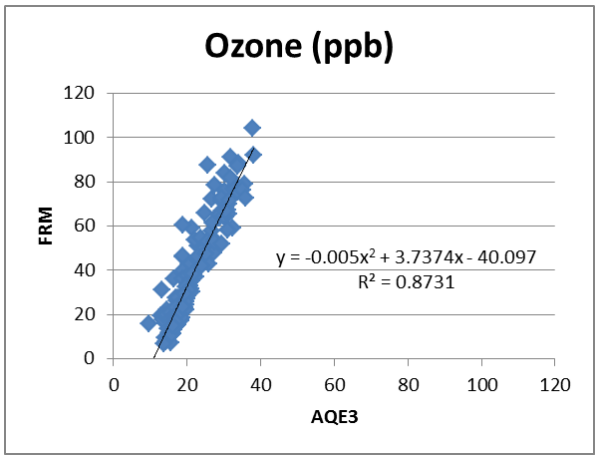

Discussion

- Overall, the three Air Quality Egg Sensors were reliable (i.e. no down time over a period of about two months) with a very high data recovery >90% and low intra-model variability except in the case of AQE2 – Ozone that reported data loss of about 60%
- Ozone data measured using the Air Quality Egg sensors correlate very well with the corresponding FRM data
- Despite the good correlation (R2) with substantially the more expensive FRM Ozone instrument, the AQEs Ozone data was largely underestimated. It should be noted that no sensor calibration had been performed by SCAQMD Staff prior to the beginning of this field testing
- NO2 data measured using the Air Quality Egg sensors correlate poorly with the corresponding FRM data
- CO data from all three sensors were out-of-range and were considered invalid
- PM data from all three sensors were also out-of-range and were considered invalid
- Chamber testing under temperature- and relative humidity- controlled conditions is necessary to fully evaluate the performance of the three Air Quality Egg v1 (w/ Particulate and Ozone add-ons) sensors
- A new Version 2 model of Air Quality Egg has been released. Testing of this improved model will begin later this year.
- All results are still preliminary