

Field Evaluation AQMesh Monitor (v.4.0) (Discontinued Version)



Background

- From 06/26/2015 to 09/25/2015 three AQMesh (Version 4.0) gaseous monitors (PODs) were deployed in Rubidoux and run side-by-side SCAQMD Federal Reference Method (FRM) instruments measuring the same pollutants

- AQMesh (3 units tested):

- Electrochemical sensors (**non-FEM**)
- Each unit measures: CO, NO, NO₂, O₃, Temp, RH
- **Unit cost: ~\$10,000**
- Time resolution: 1- or 15-min
- Units IDs: POD 1, POD 2, POD 3



- SCAQMD FRM instruments:

- CO instrument; **cost: ~\$10,000**
 - Time resolution: 1-min
- NO_x instrument; **cost: ~\$11,000**
 - Time resolution: 1-min
- O₃ instrument; **cost: ~\$13,000**
 - Time resolution; 1-min
- Meteorological station (wind speed, wind direction temperature, relative humidity, and pressure); **cost: ~\$5,000**
 - Time resolution: 1-min

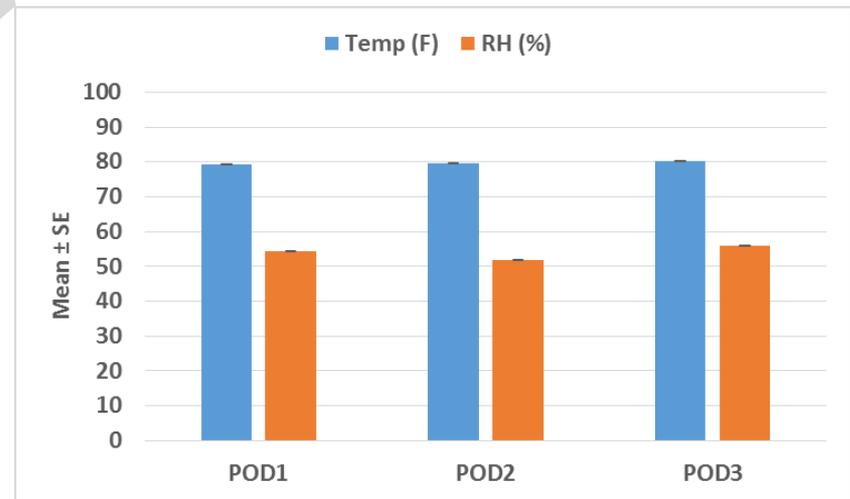
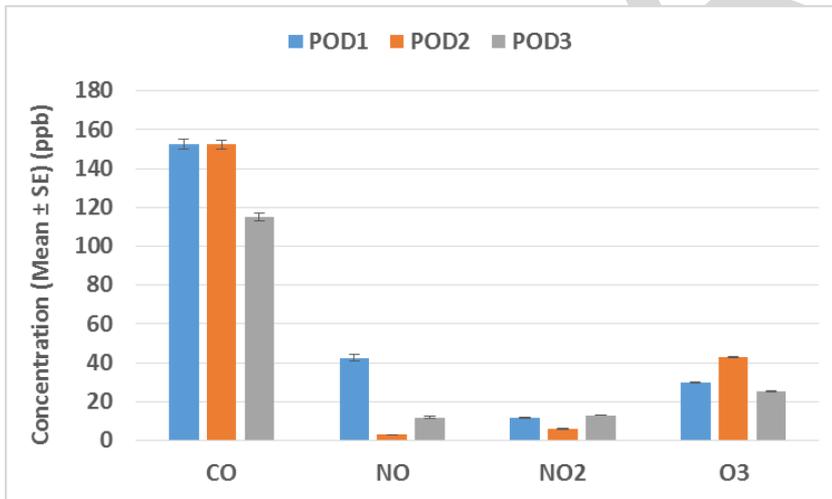


Data validation & recovery

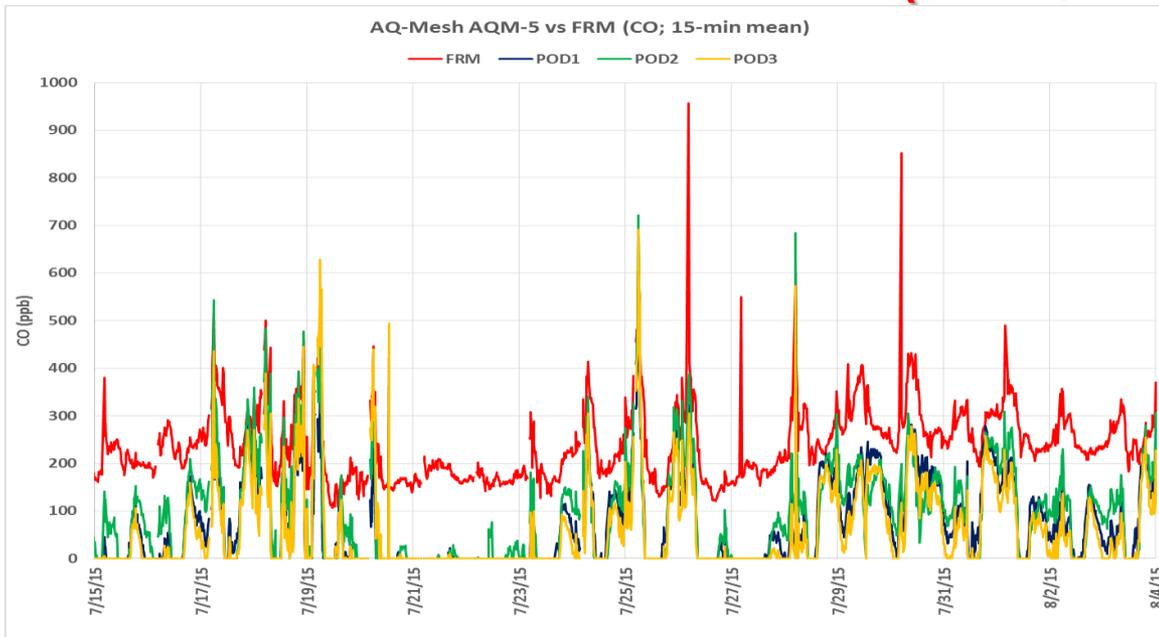
- Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, and invalid data-points were eliminated from the data-set)
- Data recovery for the three PODs was high (i.e. 93% for POD1, 100% for POD2 and 90% for POD3)

AQMesh; intra-model variability

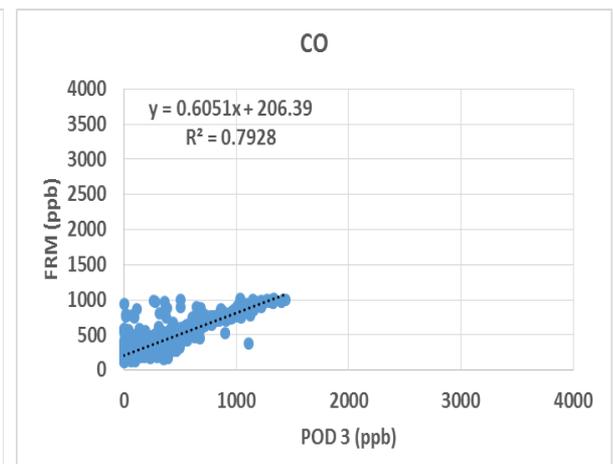
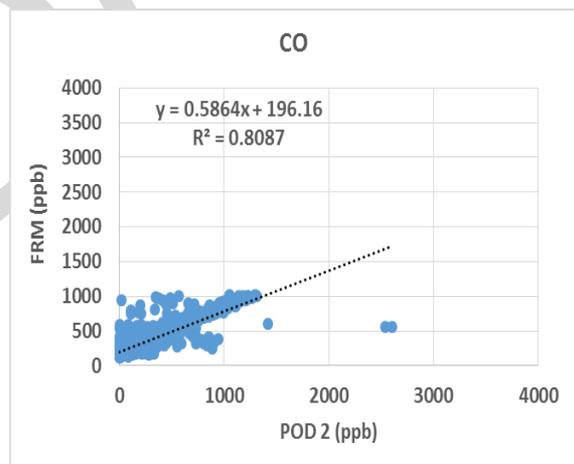
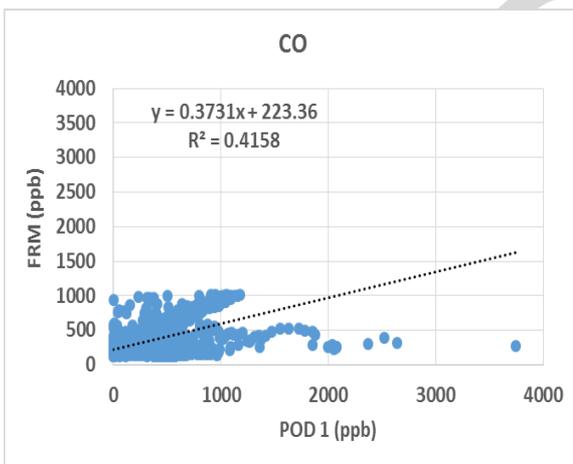
- Substantial measurement variations were observed between the three AQMesh units for all measured pollutants. PODs showed very low variations for T and RH



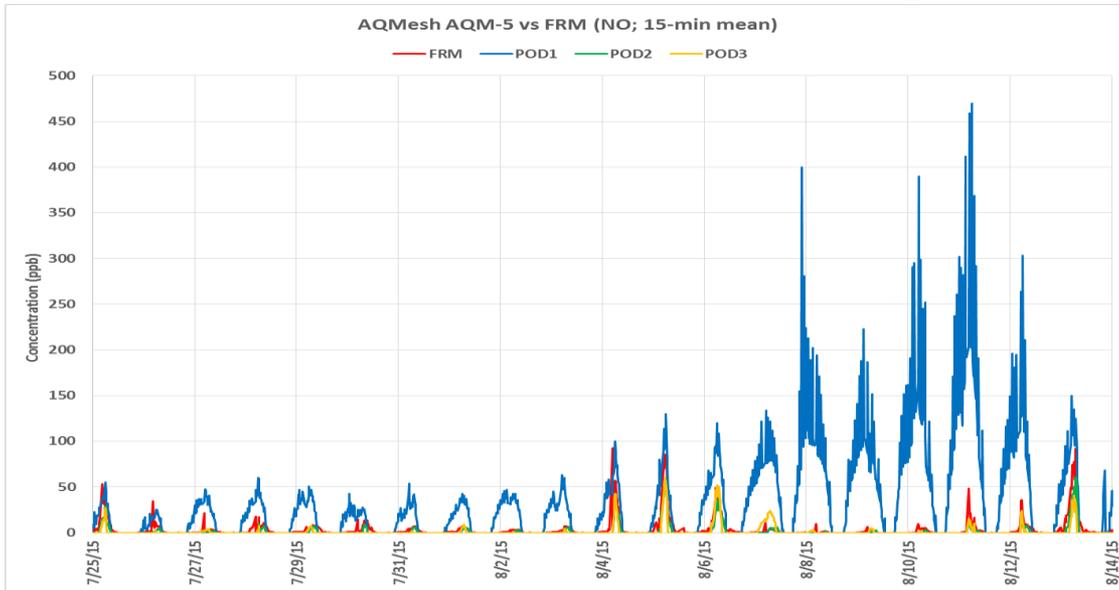
AQMesh vs FRM (CO; 15-min ave)



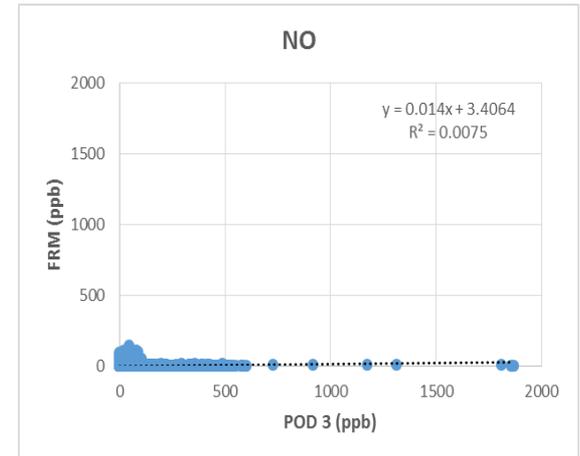
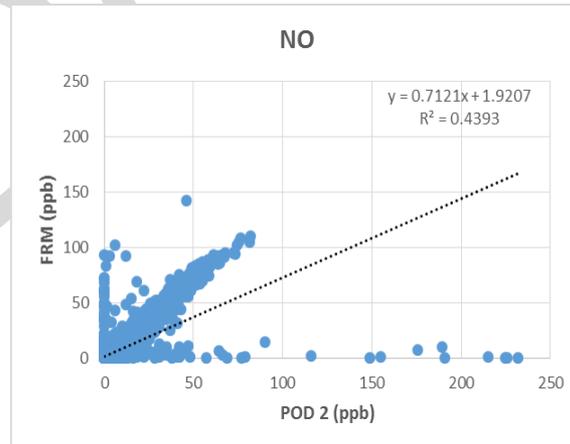
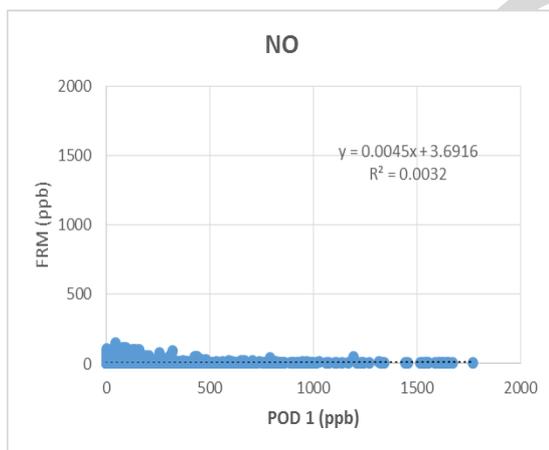
- AQMesh CO measurements show a fair-to-good correlation with the corresponding FRM data ($0.42 < R^2 < 0.80$)
- The AQMesh PODs seem to underestimate the CO concentration levels measured by the FRM instrument



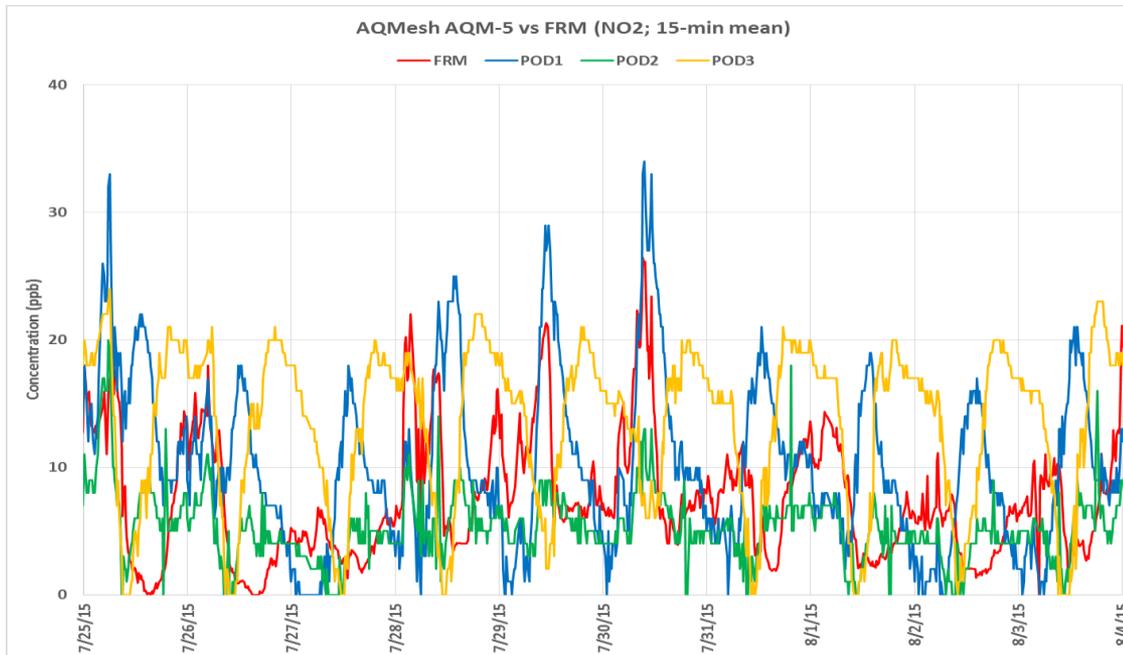
AQMesh vs FRM (NO; 15-min ave)



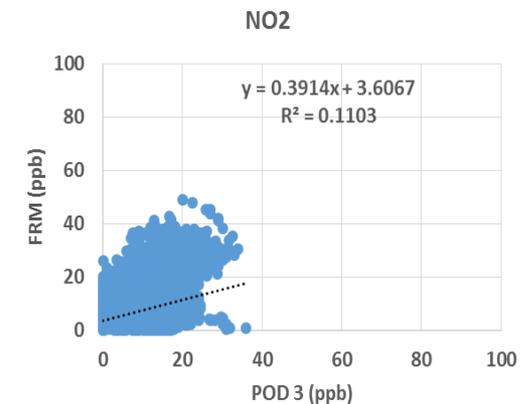
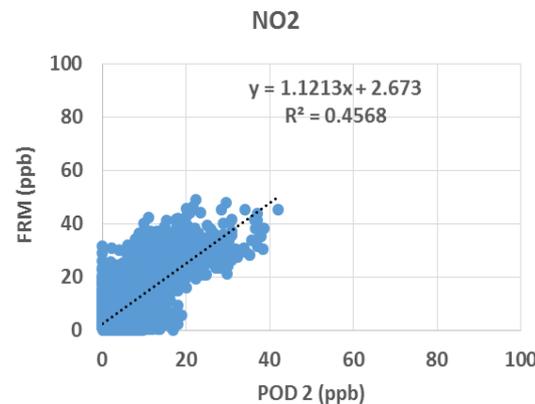
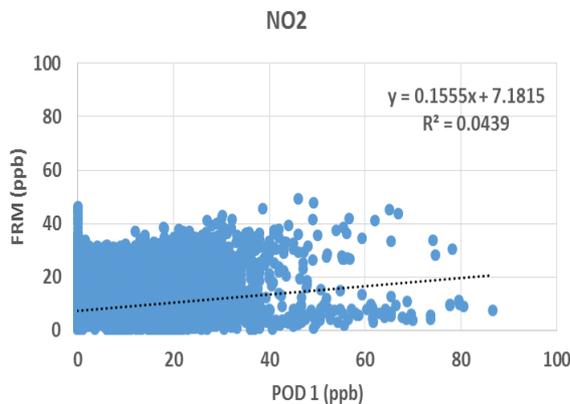
- AQMesh NO measurements from PODs 1 and 3 do not correlate well with the corresponding FRM data ($R^2 \sim 0.0$).
- AQMesh NO measurements from POD 2 show a fair correlation with the corresponding FRM ($R^2 = 0.44$).
- POD 1 largely overestimates FRM NO measurements



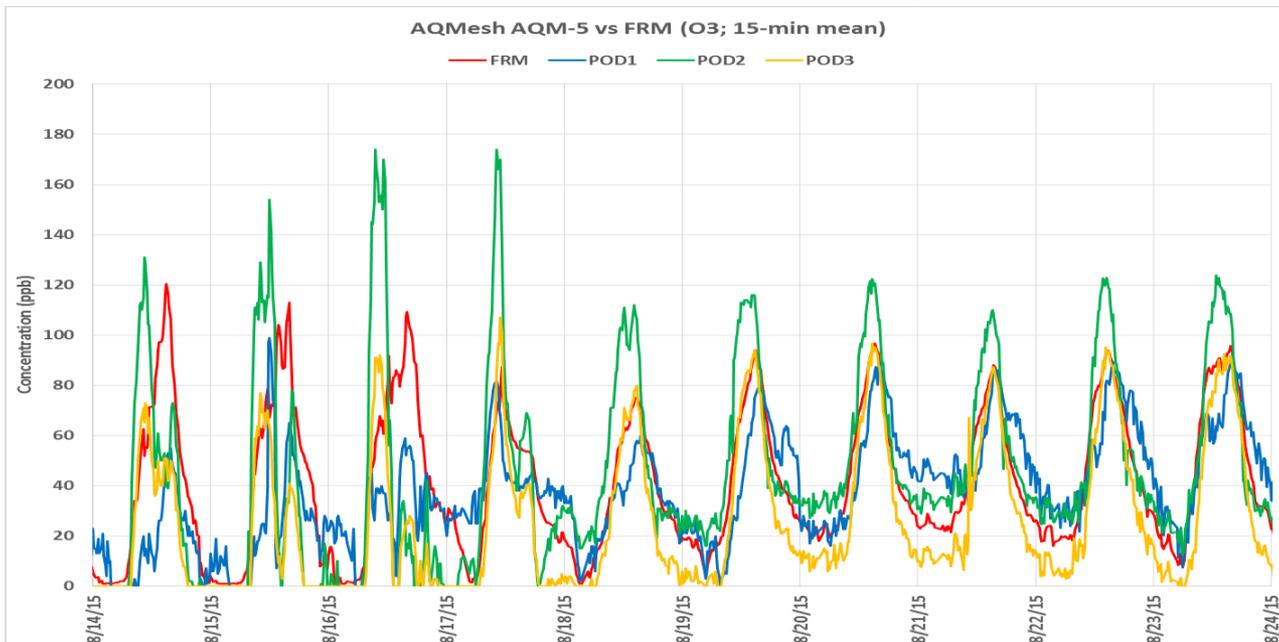
AQMesh vs FRM (NO₂; 15-min ave)



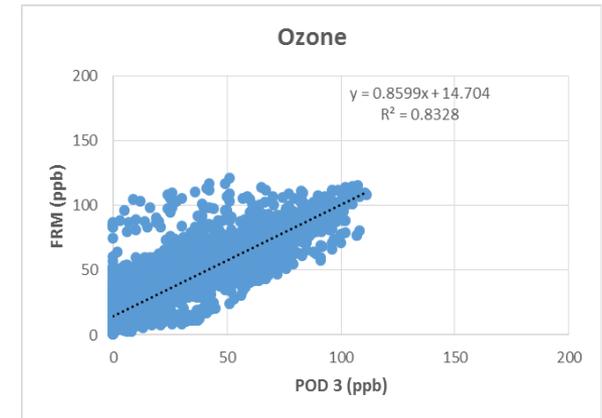
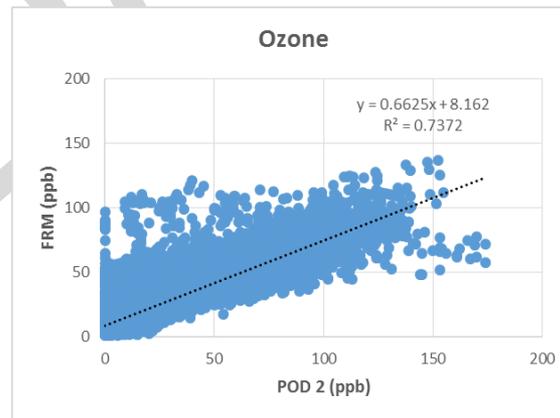
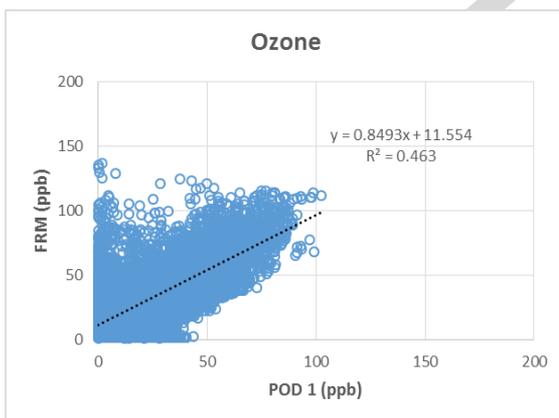
- AQMesh NO₂ measurements from PODs 1, 2 and 3 do not seem to track the typical NO₂ diurnal variations recorded by the FRM instrument.
- PODs 1 and 3 measurements correlate poorly ($0.0 < R^2 < 0.11$) with the corresponding FRM data. However, POD 2 shows a fair correlation ($R^2 = 0.46$) with the corresponding FRM NO₂ measurements



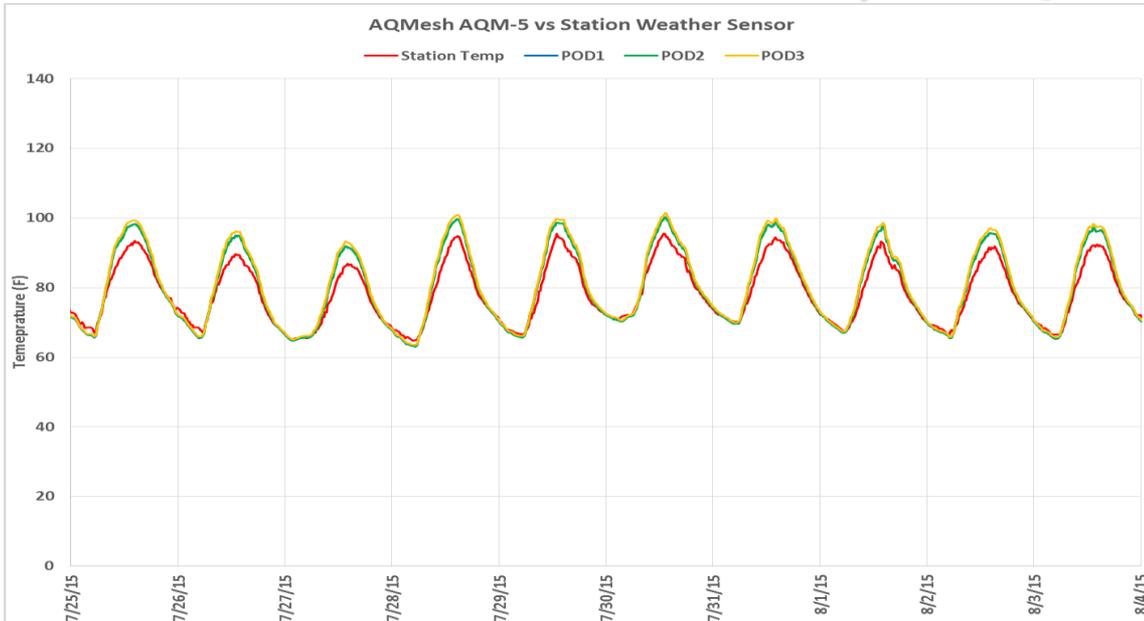
AQMesh vs FRM (O3; 15-min ave)



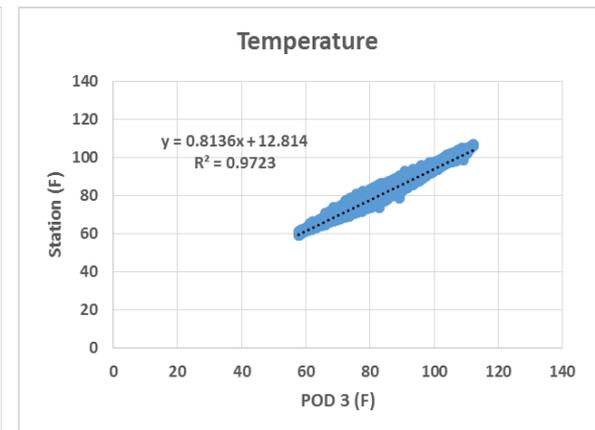
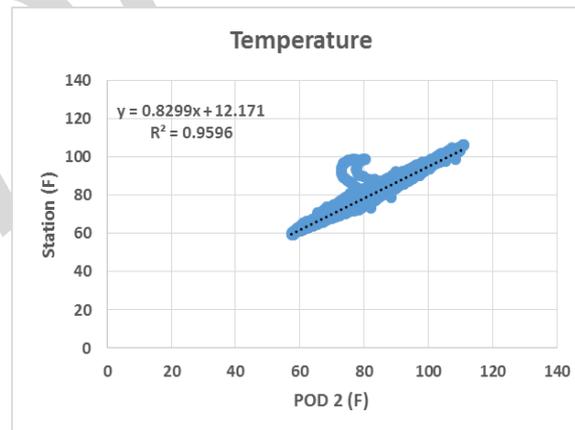
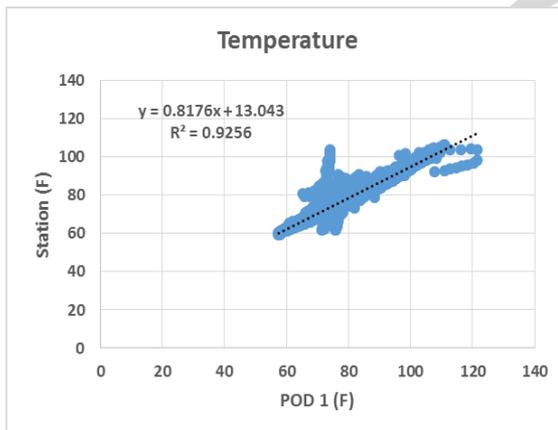
- AQMesh Ozone measurements show fair-to-good correlation with the corresponding FRM measurements ($0.46 < R^2 < 0.83$)
- AQMesh POD 2 largely overestimates FRM O₃ measurements



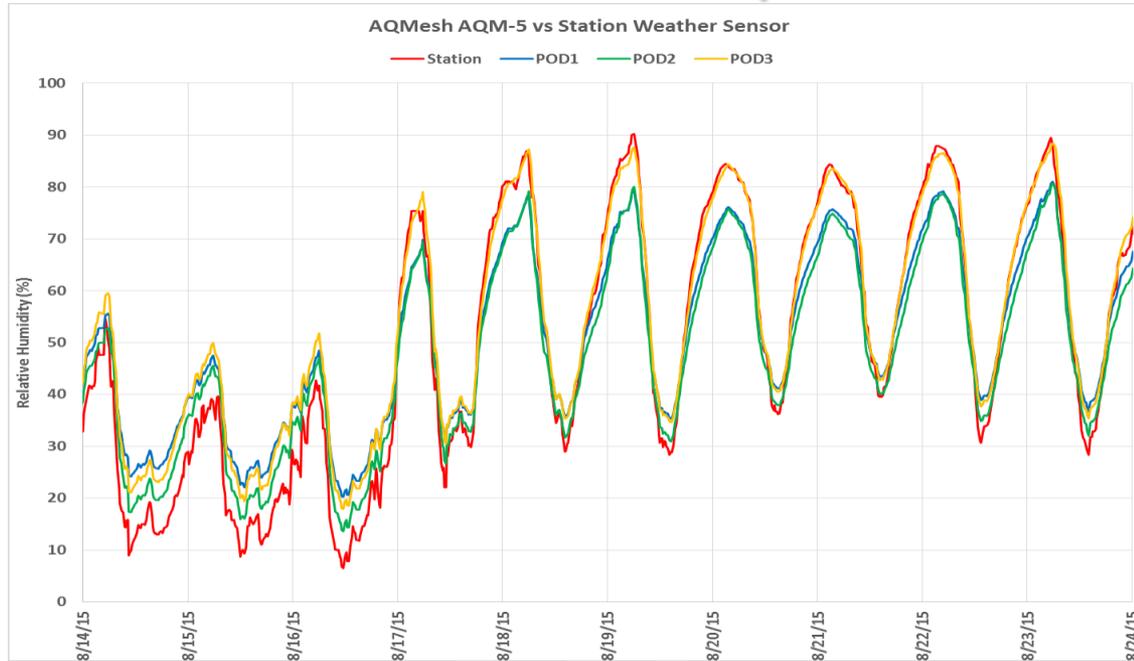
AQMesh vs FRM (Temp; 15-min ave)



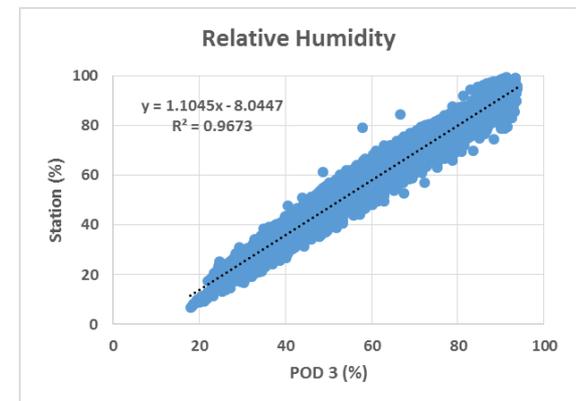
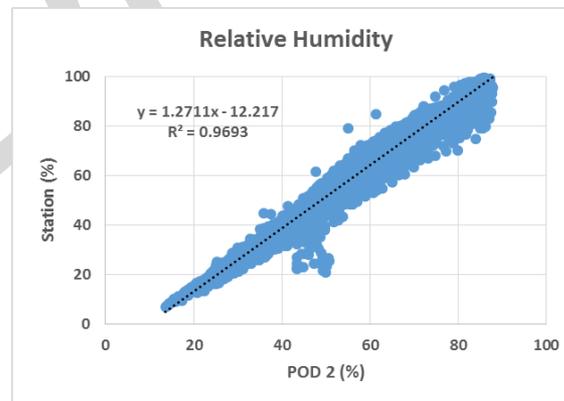
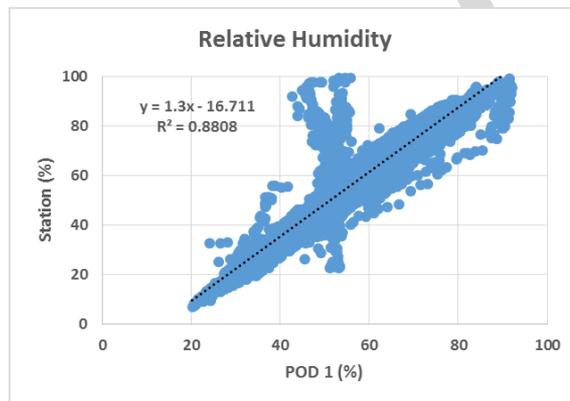
- AQMesh Temperature measurements are very well correlated with the corresponding FRM data ($0.93 < R^2 < 0.97$)



AQMesh vs FRM (Rel.Hum.; 15-min ave)



- AQMesh Relative Humidity measurements are very well correlated with the corresponding FRM data ($0.88 < R^2 < 0.97$)



Discussion

- Overall, the three AQMesh v.4.0 PODs showed substantial intra-model variability for all measured pollutants. Very low POD measurement variation was observed for T and RH
- Unlike for O₃ and CO, the NO and NO₂ measurements taken with the AQMesh v.4.0 sensors correlated poorly with the corresponding FRM data
 - O₃: $0.46 < R^2 < 0.83$
 - CO: $0.42 < R^2 < 0.80$
 - NO: $R^2 \sim 0.0$ (POD 1 and POD 3); $R^2 = 0.44$ (POD 2)
 - NO₂: $R^2 < 0.1$ (POD 1 and POD 3); $R^2 = 0.46$ (POD 2)
- It should be noted that no sensor calibration was performed prior to the beginning of this field testing
- Field test results for the first version (v.3.0) of the AQMesh air quality sensor can be found on the AQ-SPEC website (www.aqmd.gov/aq-spec).
- Laboratory chamber testing is necessary to fully evaluate the performance of these sensors under controlled T and RH conditions and known gaseous concentrations.
- All results are still preliminary
- AQMesh Version 4.0 has been discontinued by the manufacturer.