Field Evaluation of the Met One Neighborhood Monitor

South Coast AQMD

AQ-SPEC
Air Quality Sensor Performance Evaluation Center

Background

- From 06/01/2015 to 07/15/2015, two **MetOne Neighborhood Monitor** units were deployed in Rubidoux and run side-by-side two different Federal Equivalent Method (FEM) instruments for measuring $PM_{2.5}$ [i.e. a MetOne $PM_{2.5}$ BAM monitor (model 1020) and a GRIMM PM monitor (model EDM180)]

- MetOne (*2 units tested*):
  - Forward light scatter laser Nephelometer (non-FEM)
  - Measures $PM_{2.5}$
  - Cost: ~$1,900
  - Time resolution: ~15-min
  - Range: 0 to 100 mg/m^3
  - Wireless modem and GPS included

- MetOne BAM (*reference method*):
  - Beta-attenuation monitor (FEM)
  - Measures $PM_{2.5}$
  - Cost: ~$20,000
  - Time resolution: 1-hr

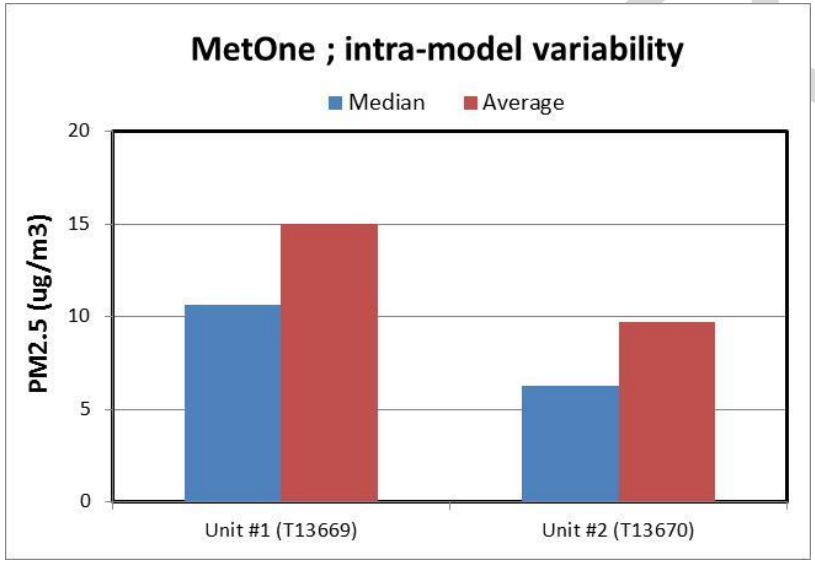
- GRIMM (*reference method*):
  - Optical particle counter (FEM)
  - Uses proprietary algorithms to calculate total PM, $PM_{2.5}$, and $PM_{1.0}$ from particle number measurements
  - Cost: ~$25,000 and up
  - Time resolution: 1-min

Data validation & recovery

- Basic QA/QC procedures were used to validate the collected MetOne data (i.e., obvious outliers, negative values, and invalid data-points were eliminated from the data-set)
- Good data recovery (91-96%)

MetOne; intra-model variability

- Substantial measurement variations were observed between the two MetOne units.



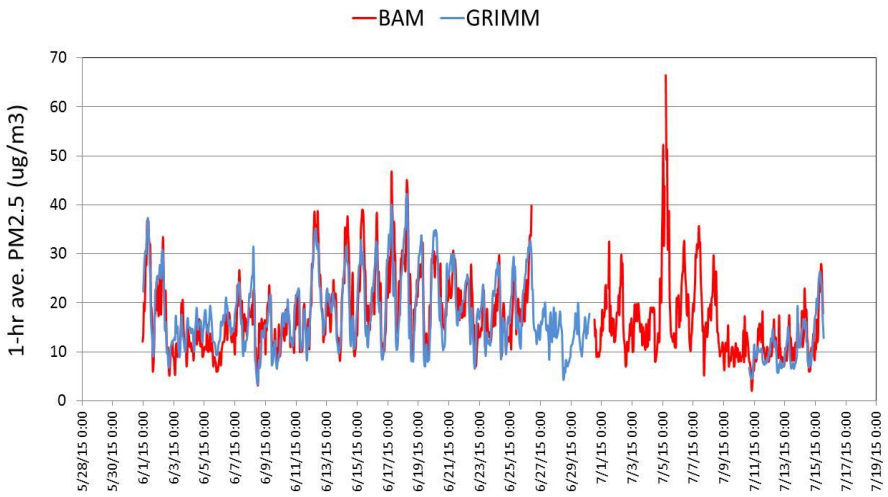
	MetOne; ave PM2.5 (ug/m3)	
	Unit #1 (T13669)	Unit #2 (T13670)
Min	2.70	0.00
Max	70.13	48.00
Average	15.01	9.72
Median	10.64	6.27
5 %-ile	4.77	2.00
95 %-ile	41.57	29.70

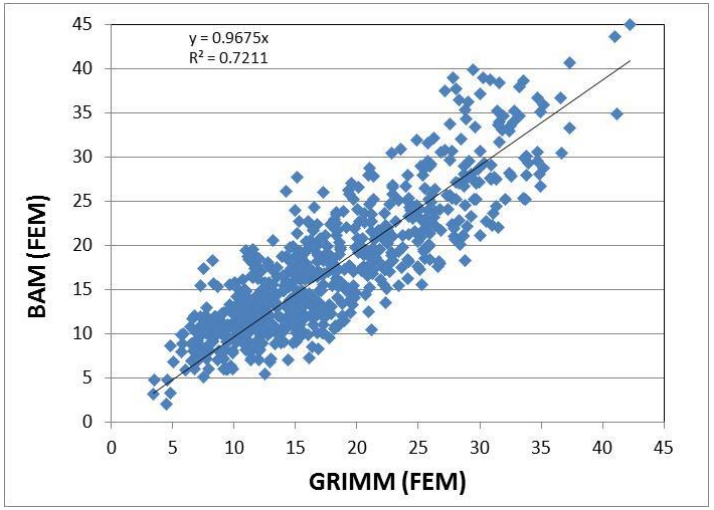
Data validation & recovery

- Basic QA/QC procedures were used to validate the collected FEM data (i.e., obvious outliers, negative values, and invalid data-points were eliminated from the data-set)
- Data recovery: BAM (~90%) > GRIMM (~77%)

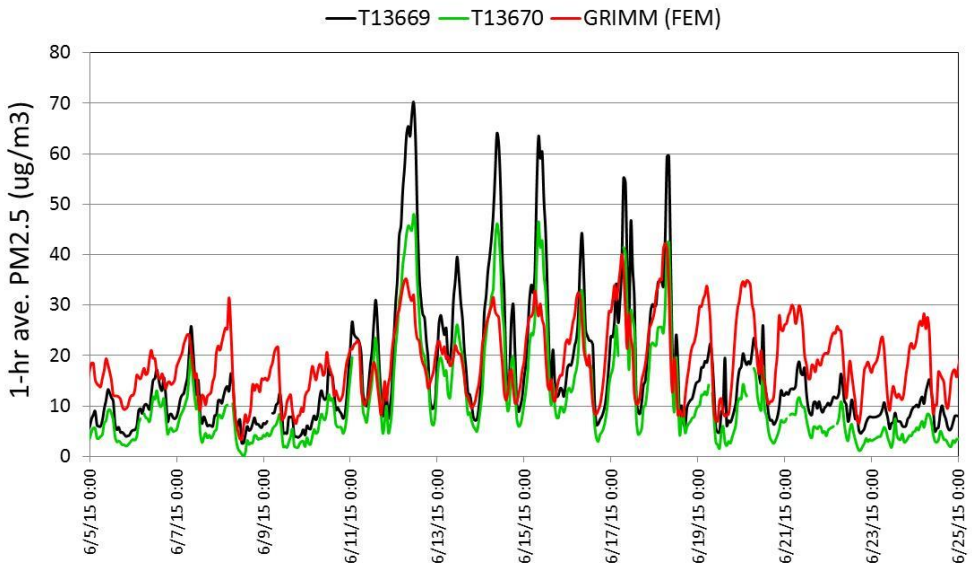
Equivalent methods: BAM vs GRIMM

- Good correlation between the two equivalent methods

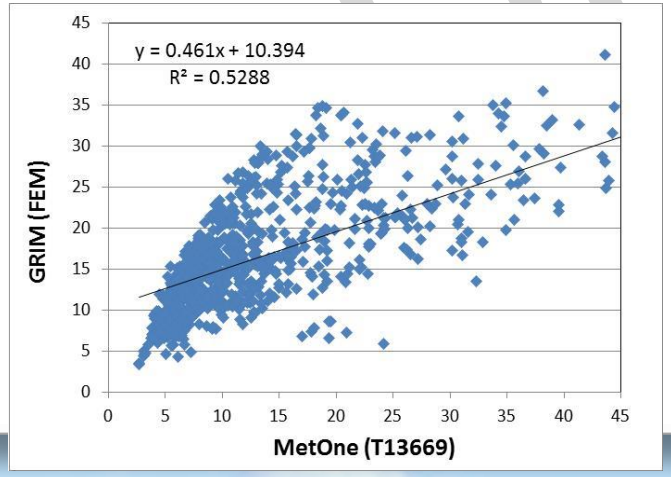


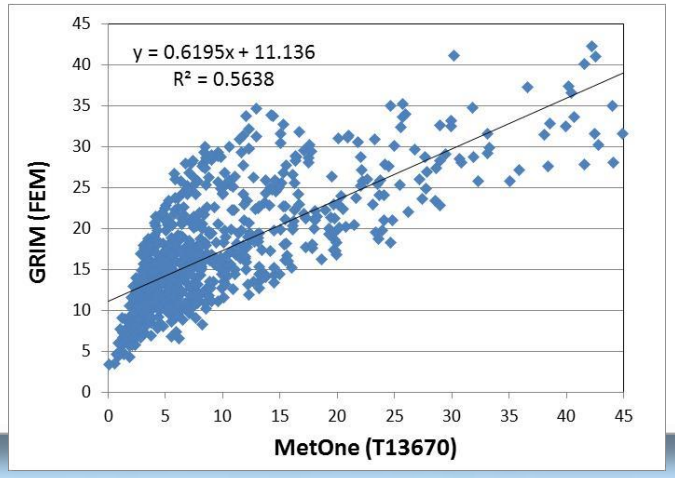


Met One Sensor vs FEM GRIMM (1-hr ave.)

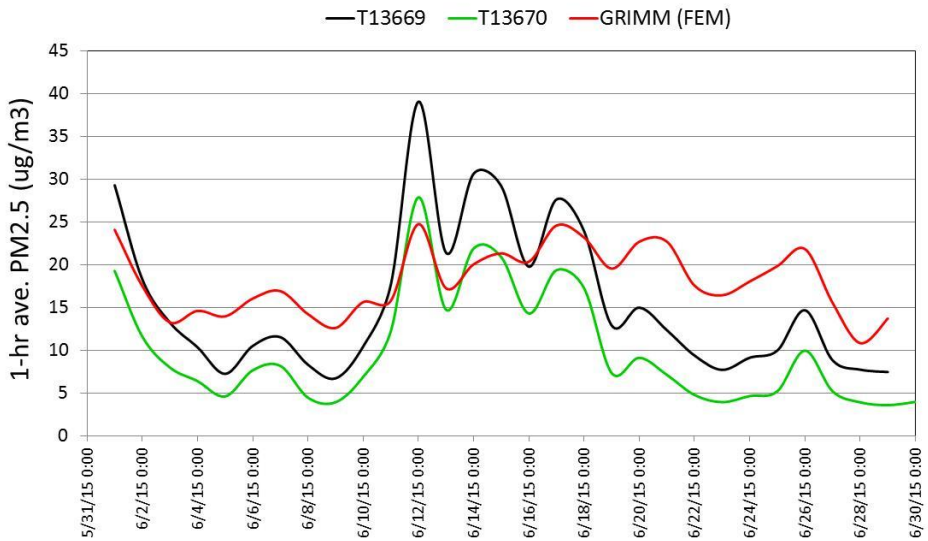


- Moderate correlation between Met One sensor measurements and the corresponding FEM GRIMM data (R^2: 53-56%)
- The two neighborhood monitors seem to underestimate $PM_{2.5}$ at low concentrations and to overestimate $PM_{2.5}$ at high concentrations

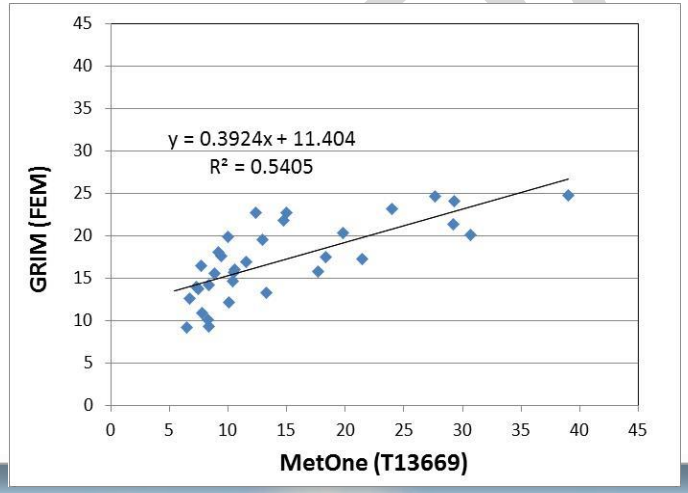


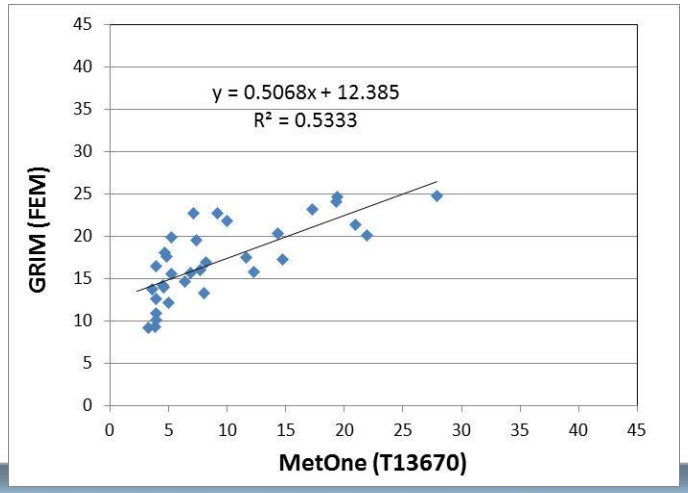


Met One Sensor vs FEM GRIMM (24-hr ave.)

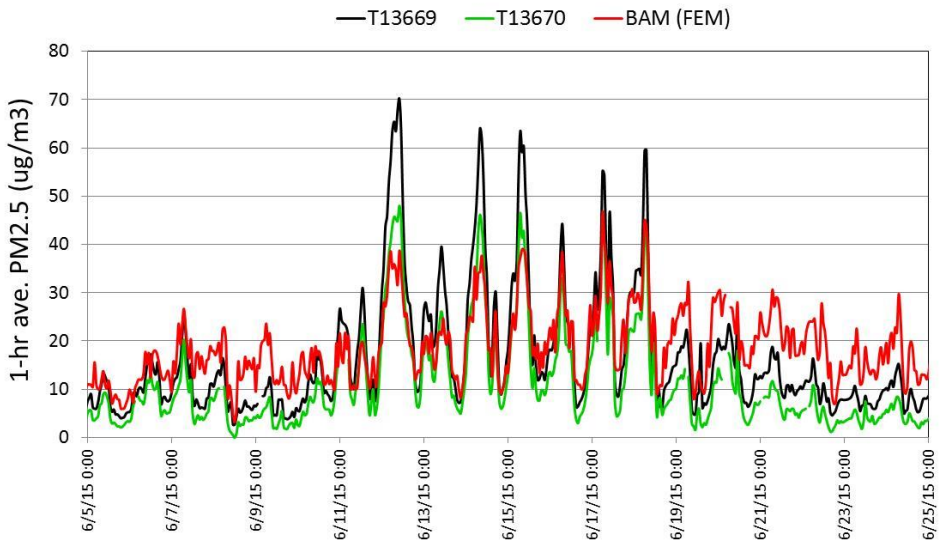


- Moderate correlation between Met One sensor measurements and the corresponding FEM GRIMM data (R^2:53-54%)
- The two neighborhood monitors seem to underestimate $PM_{2.5}$ at low concentrations and to overestimate $PM_{2.5}$ at high concentrations

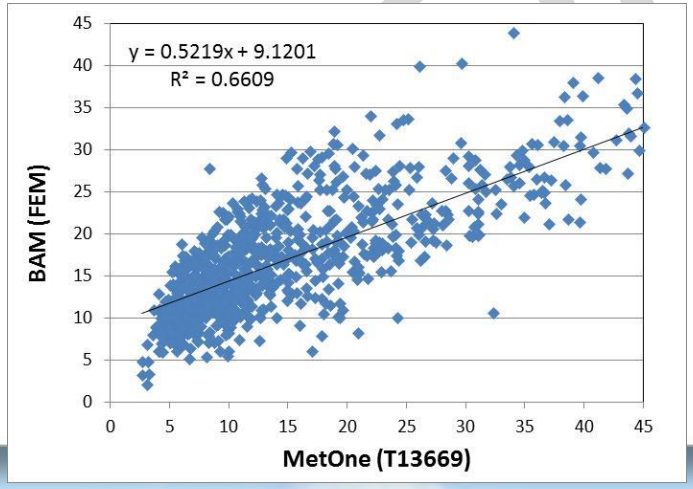


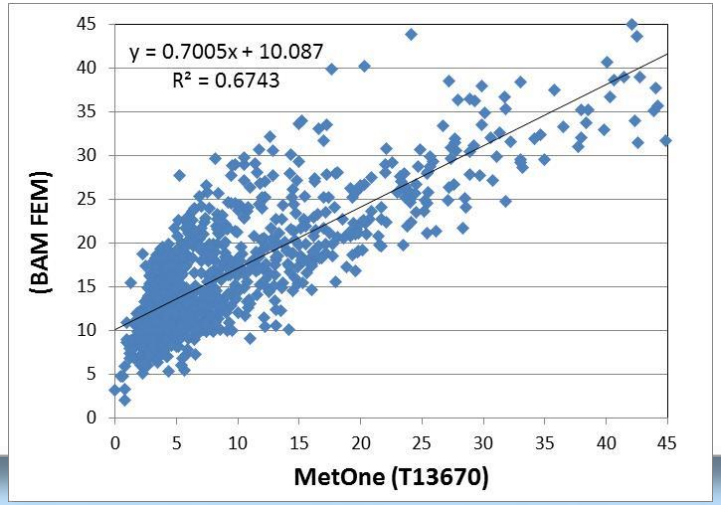


Met One Sensor vs FEM BAM (1-hr ave.)

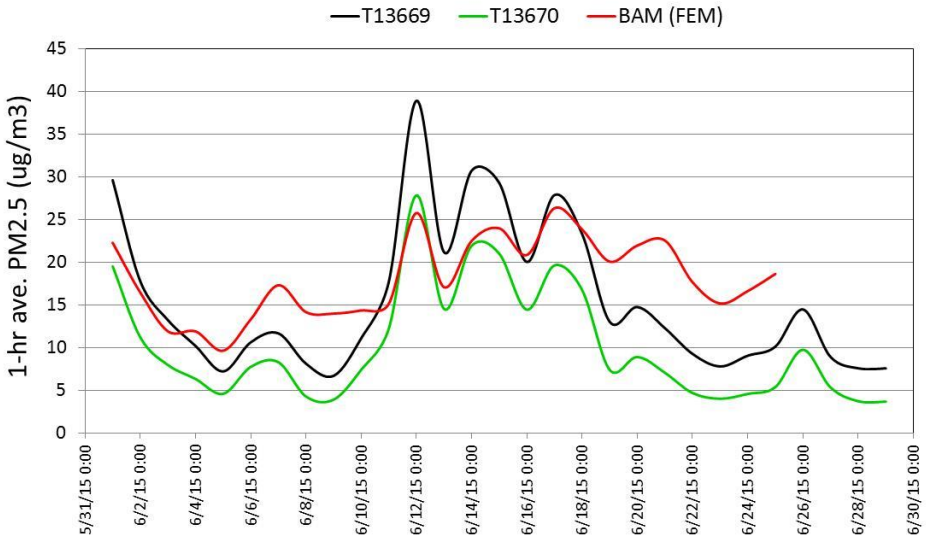


- Moderate correlation between Met One sensor measurements and the corresponding FEM GRIMM data (R^2:66-67%)
- The two neighborhood monitors seem to underestimate $PM_{2.5}$ at low concentrations and to overestimate $PM_{2.5}$ at high concentrations

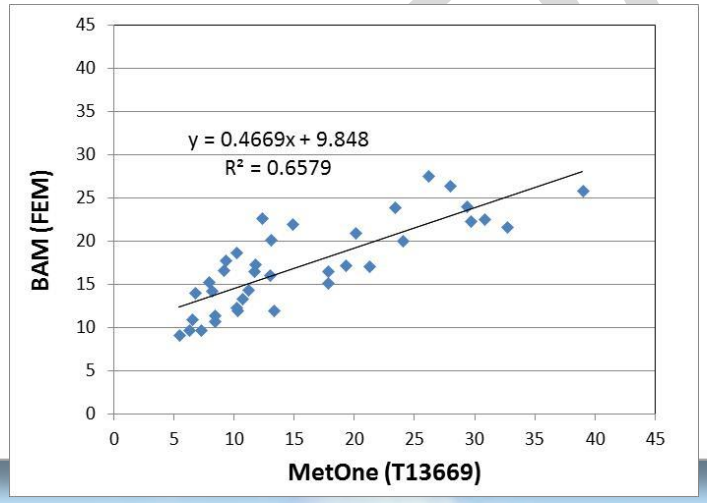


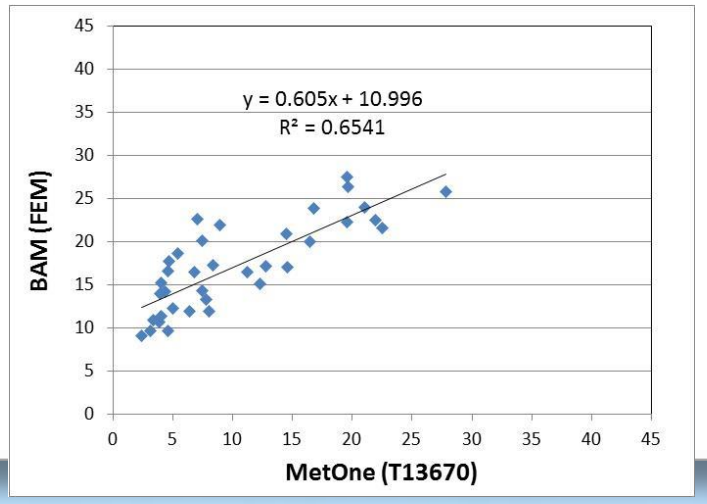


Met One Sensor vs FEM BAM (24-hr ave.)



- Moderate correlation between Met One sensor measurements and the corresponding FEM GRIMM data (R^2:65-66%)
- The two neighborhood monitors seem to underestimate $PM_{2.5}$ at low concentrations and to overestimate $PM_{2.5}$ at high concentrations





Discussion

- Overall, the two Met One Neighborhood Monitor units were reliable (i.e. no down time over a period of about six weeks) but were characterized by substantial intra-model variability

- Although the two sensor units tested in this project were able to reliably measure temporal variations in $PM_{2.5}$ concentration, their data was only moderately correlated with the corresponding GRIMM (FEM) and BAM (FEM) data

- Laboratory chamber testing is necessary to fully characterize the performance of these monitors under known PM concentrations/size ranges and controlled conditions of temperature and relative humidity

- All results are still preliminary