

Field Evaluation Elitech Temtop LKC-1000S+



Background

- From 01/27/2020 to 03/27/2020, three **Elitech Temtop LKC-1000S+** (hereinafter **Temtop LKC-1000S+**) sensors were deployed at the South Coast AQMD stationary ambient monitoring site in Rubidoux and were run side-by-side with a Federal Equivalent Method (FEM) instrument measuring the same pollutants
- Temtop LKC-1000S+ (3 units tested):
 - Particle sensor: **optical; non-FEM (PM300, Temtop)**
 - Each unit reports: $PM_{2.5}$ and PM_{10} ($\mu\text{g}/\text{m}^3$)
 - Unit also measures: TVOC and formaldehyde
 - Unit also displays: Temperature, Relative Humidity and AQI
 - **Unit cost: ~\$140**
 - Time resolution: 1-min
 - Units IDs: Unit 1, Unit 2 and Unit 3
- GRIMM (reference instrument):
 - Optical particle counter (**FEM $PM_{2.5}$**)
 - Measures $PM_{1.0}$, $PM_{2.5}$, and PM_{10} ($\mu\text{g}/\text{m}^3$)
 - **Cost: ~\$25,000 and up**
 - Time resolution: 1-min

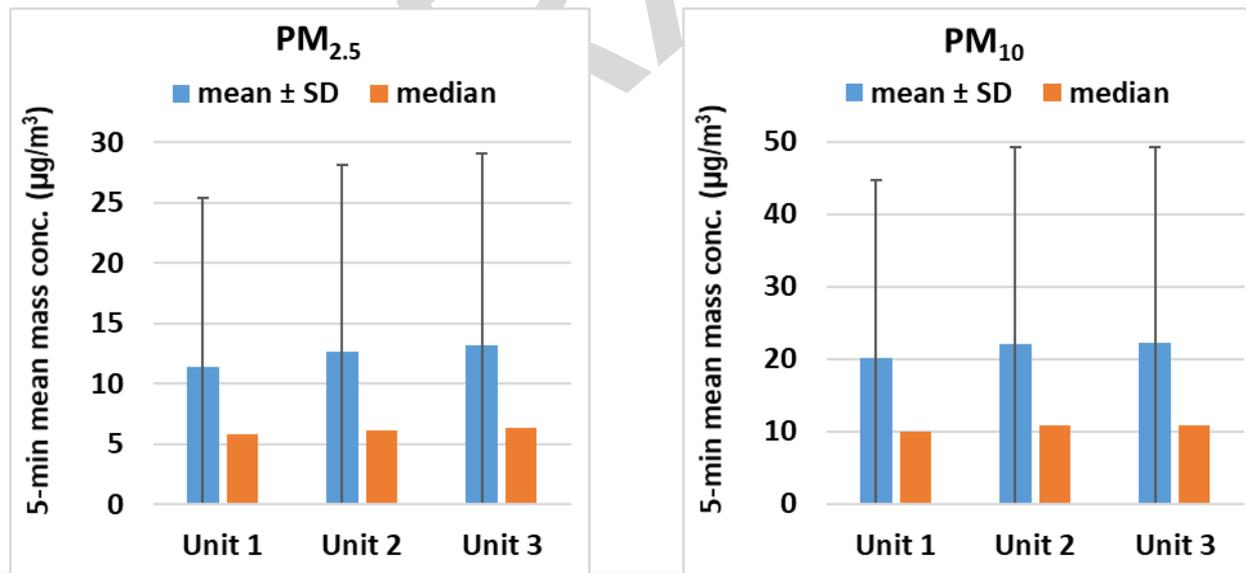


Data validation & recovery

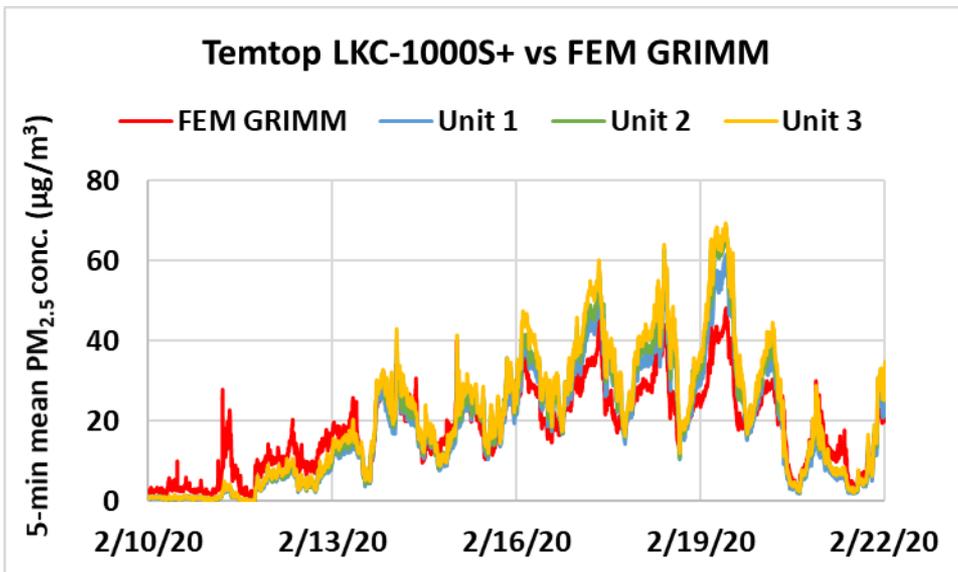
- Basic QA/QC procedures were used to validate the collected data (i.e. obvious outliers, negative values and invalid data-points were eliminated from the data-set)
- Data recovery from Unit 1, Unit 2 and Unit 3 was ~ 78%, ~ 100% and ~ 100%, respectively, for both PM_{2.5} and PM₁₀ measurements

Temtop LKC-1000S+; intra-model variability

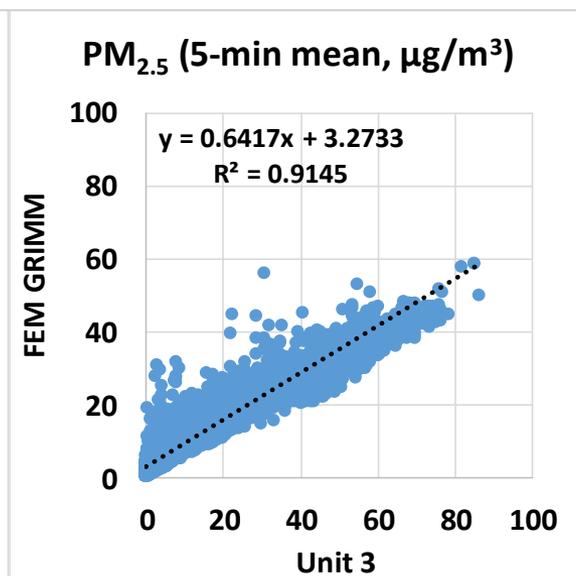
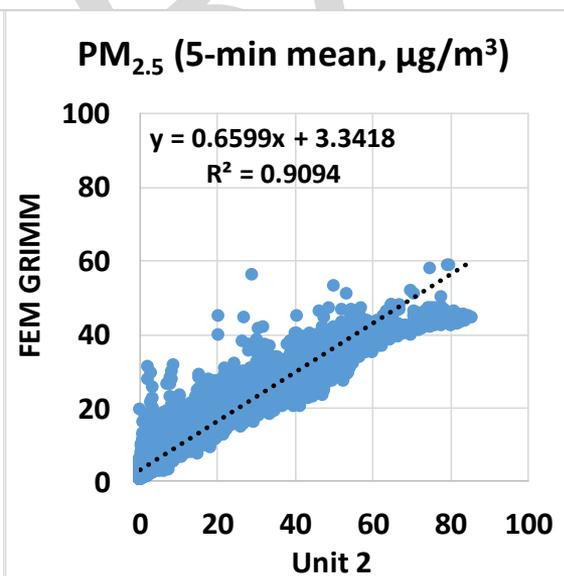
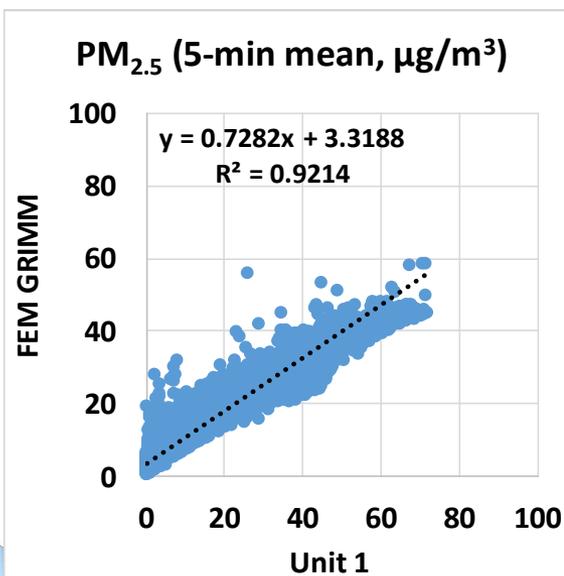
- Absolute intra-model variability was ~ 0.87 and 1.17 $\mu\text{g}/\text{m}^3$ for PM_{2.5} and PM₁₀, respectively (calculated as the standard deviation of the three sensor means)
- Relative intra-model variability was ~ 7.0% and 5.4 % for PM_{2.5} and PM₁₀, respectively (calculated as the absolute intra-model variability relative to the mean of the three sensor means)



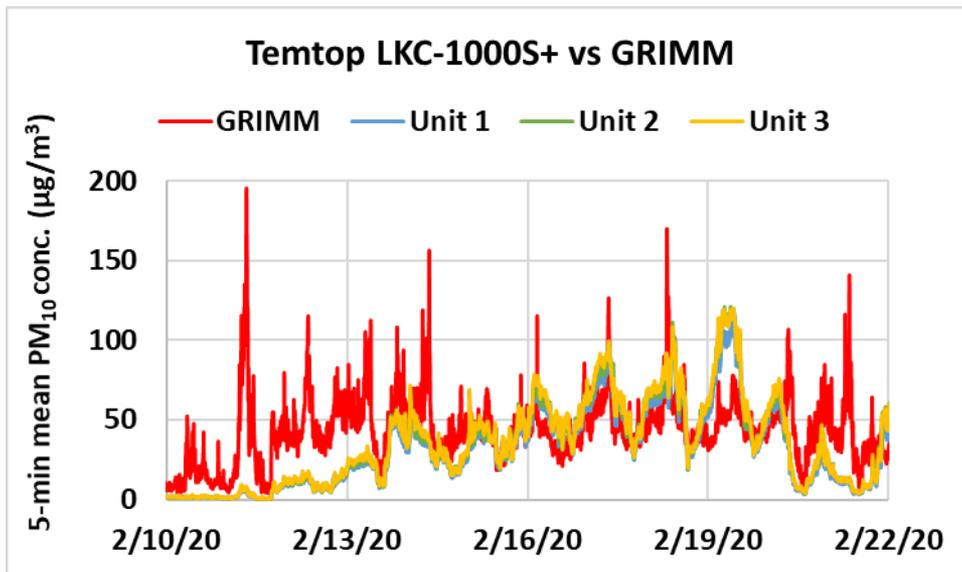
Temtop LKC-1000S+ vs FEM GRIMM (PM_{2.5}; 5-min mean)



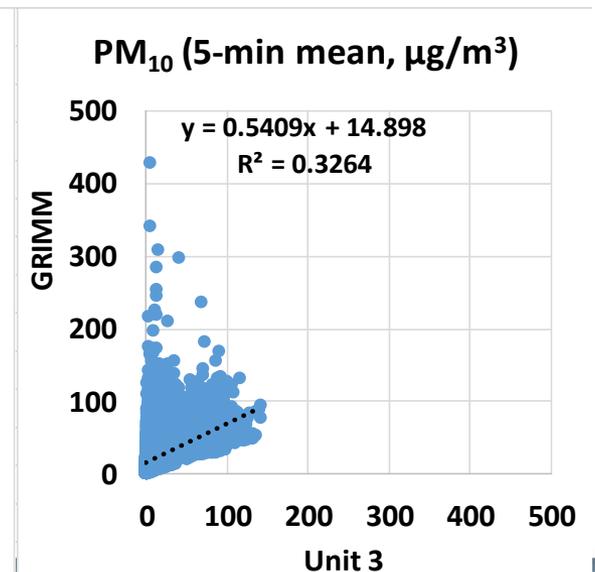
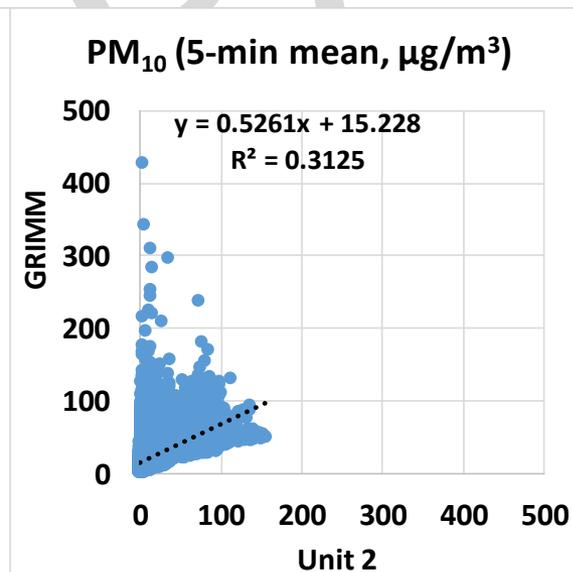
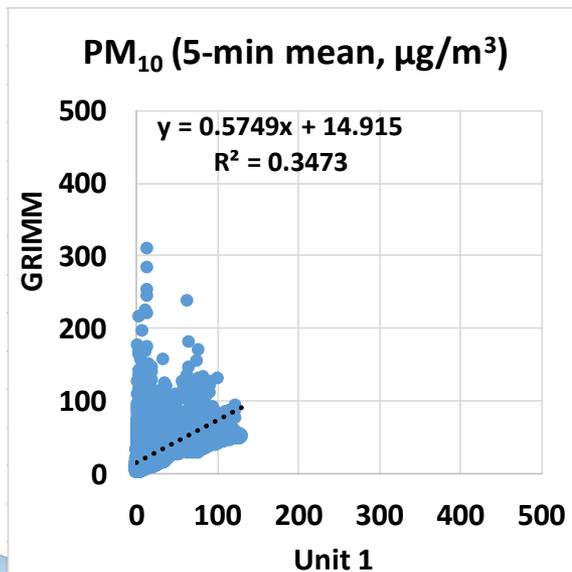
- Temtop LKC-1000S+ sensors showed very strong correlations with the corresponding FEM GRIMM data ($R^2 \sim 0.91$)
- Overall, the Temtop LKC-1000S+ sensors overestimated the PM_{2.5} mass concentrations as measured by FEM GRIMM
- The Temtop LKC-1000S+ sensors seemed to track the PM_{2.5} diurnal variations as recorded by FEM GRIMM



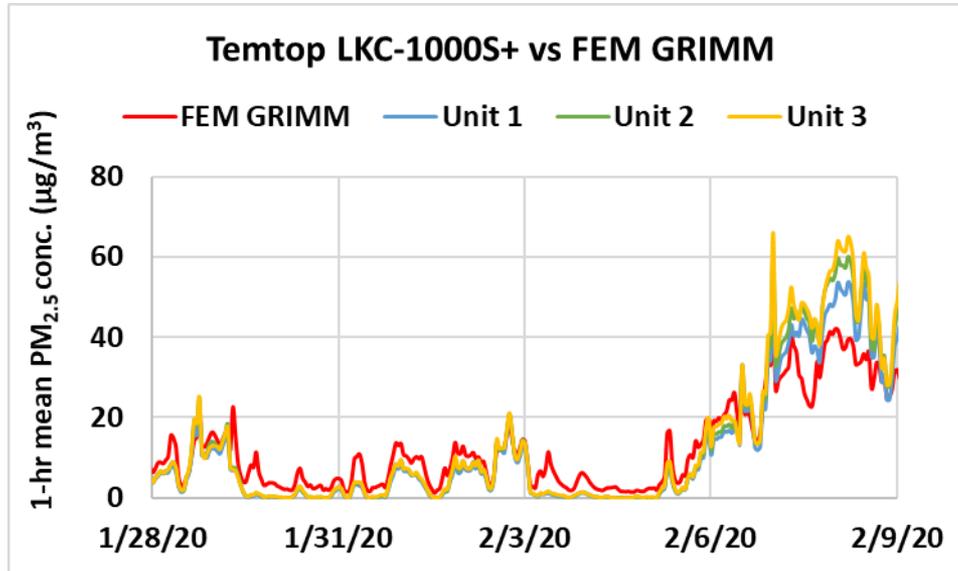
Temtop LKC-1000S+ vs GRIMM (PM₁₀; 5-min mean)



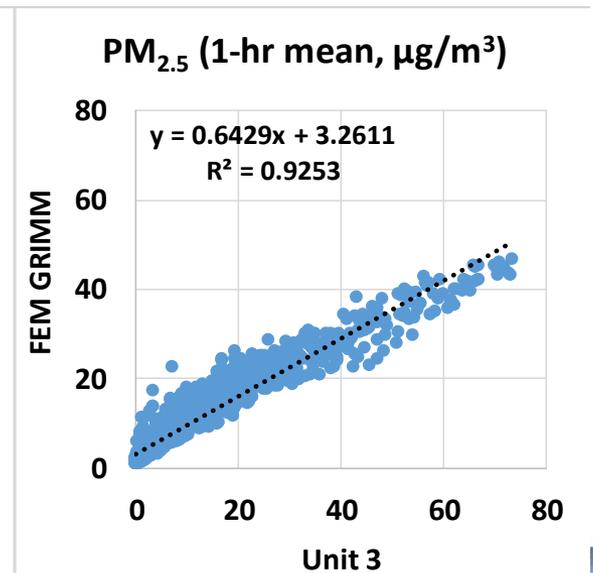
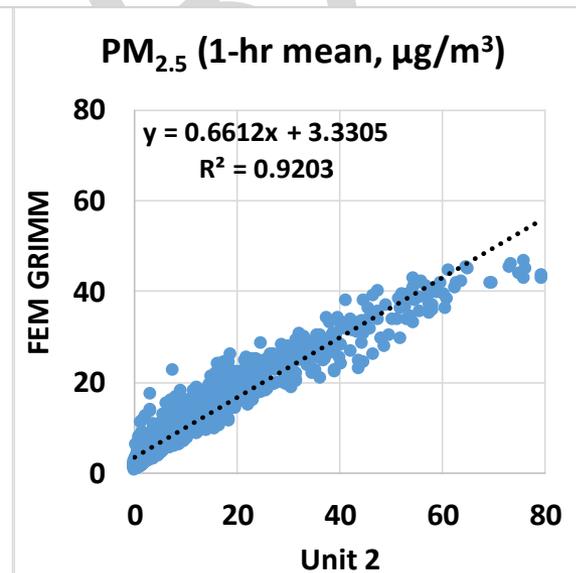
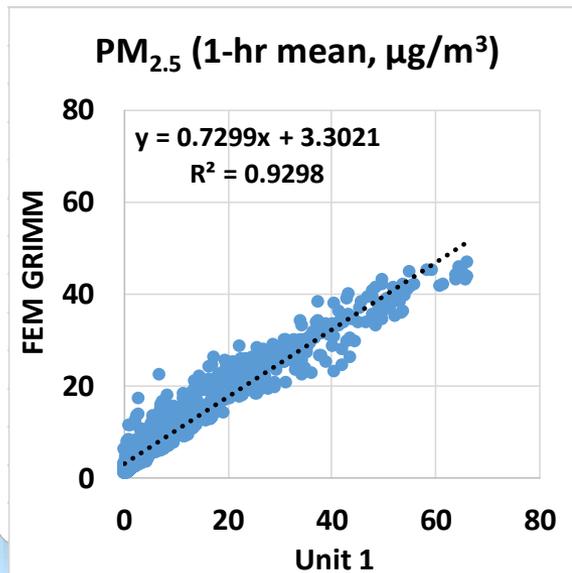
- Temtop LKC-1000S+ sensors showed weak correlations with the corresponding GRIMM data ($R^2 \sim 0.33$)
- Overall, the Temtop LKC-1000S+ sensors underestimated the PM₁₀ mass concentrations measured by GRIMM
- The Temtop LKC-1000S+ sensors did not seem to track the PM₁₀ diurnal variations as recorded by GRIMM



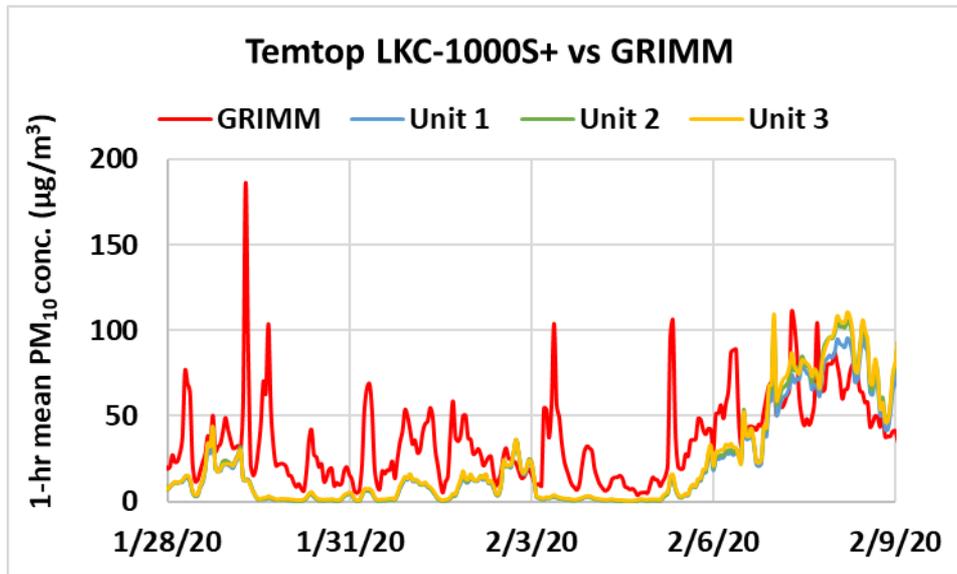
Temtop LKC-1000S+ vs FEM GRIMM (PM_{2.5}; 1-hr mean)



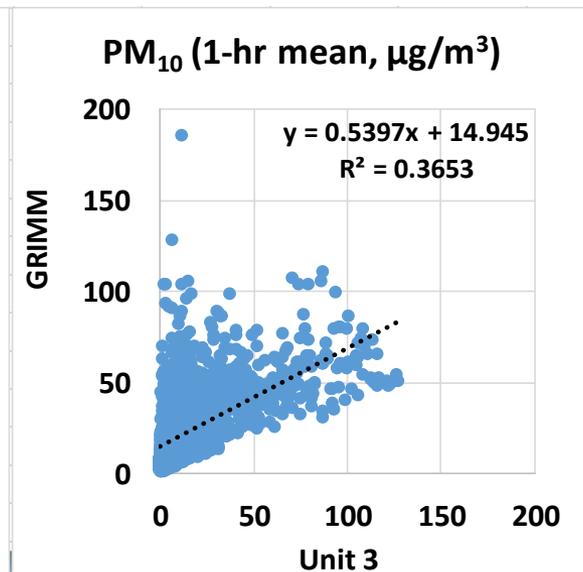
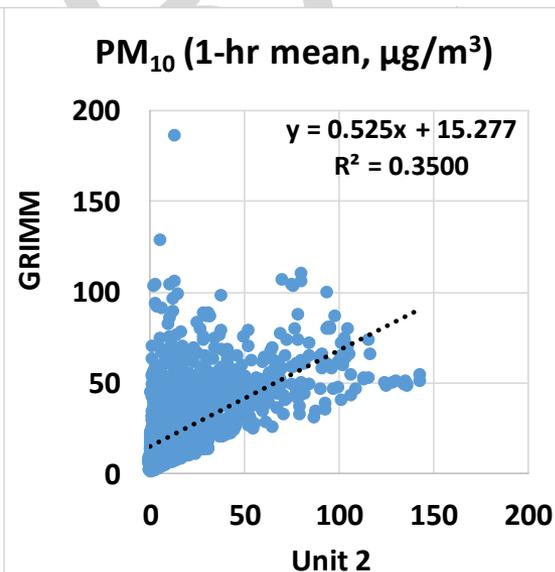
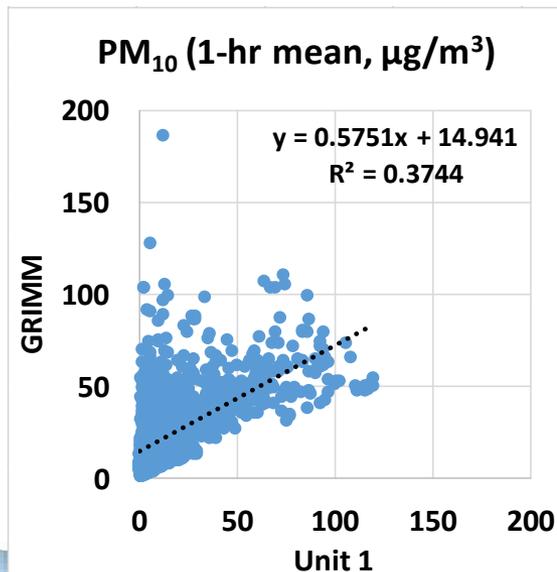
- Temtop LKC-1000S+ sensors showed very strong correlations with the corresponding FEM GRIMM data ($R^2 \sim 0.92$)
- Overall, the Temtop LKC-1000S+ sensors overestimated the PM_{2.5} mass concentrations as measured by FEM GRIMM
- The Temtop LKC-1000S+ sensors seemed to track the PM_{2.5} diurnal variations as recorded by FEM GRIMM



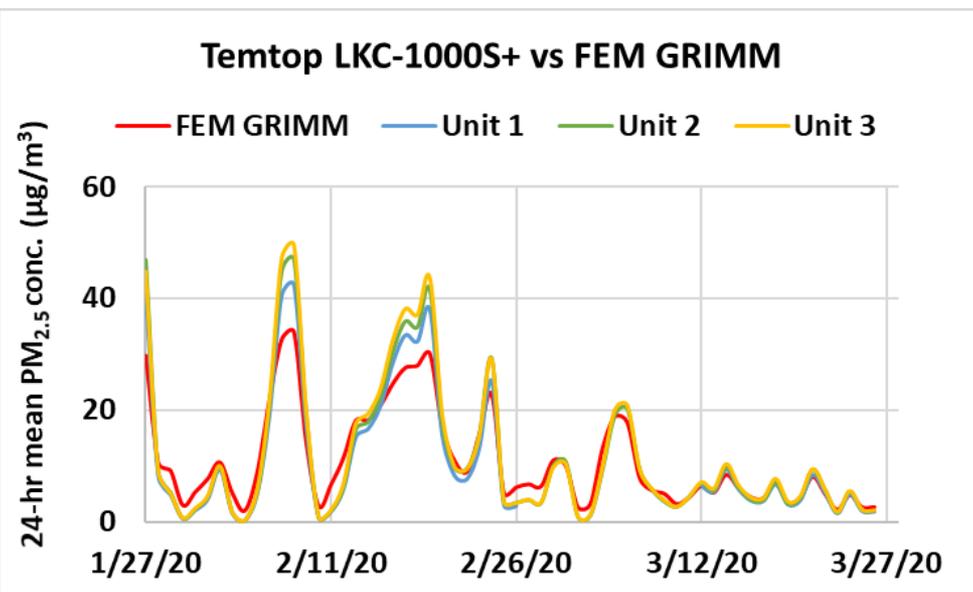
Temtop LKC-1000S+ vs GRIMM (PM₁₀; 1-hr mean)



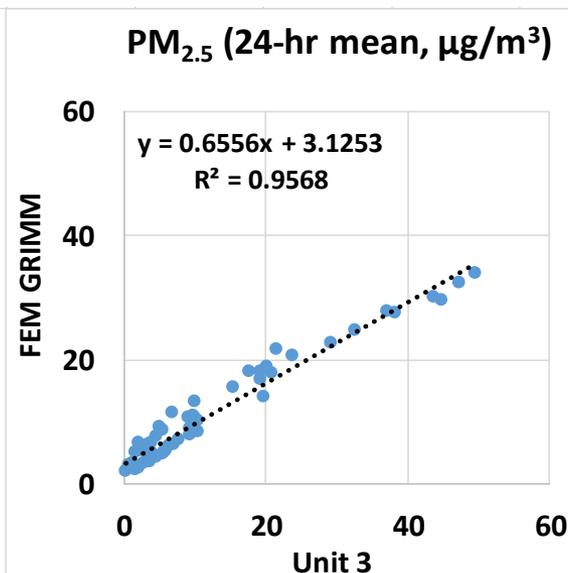
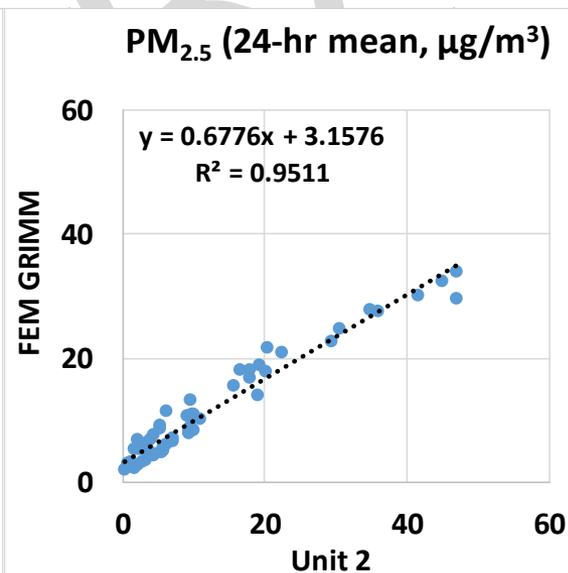
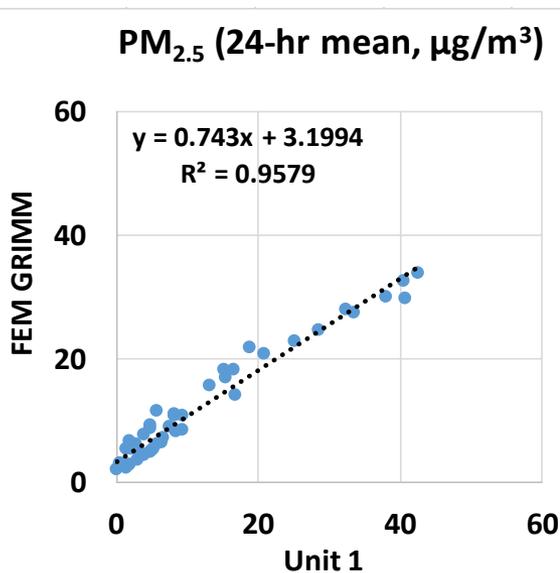
- Temtop LKC-1000S+ sensors showed weak correlation with the corresponding GRIMM data ($R^2 \sim 0.36$)
- Overall, the Temtop LKC-1000S+ sensors underestimated the PM₁₀ mass concentrations measured by GRIMM
- The Temtop LKC-1000S+ sensors did not seem to track the PM₁₀ diurnal variations as recorded by GRIMM



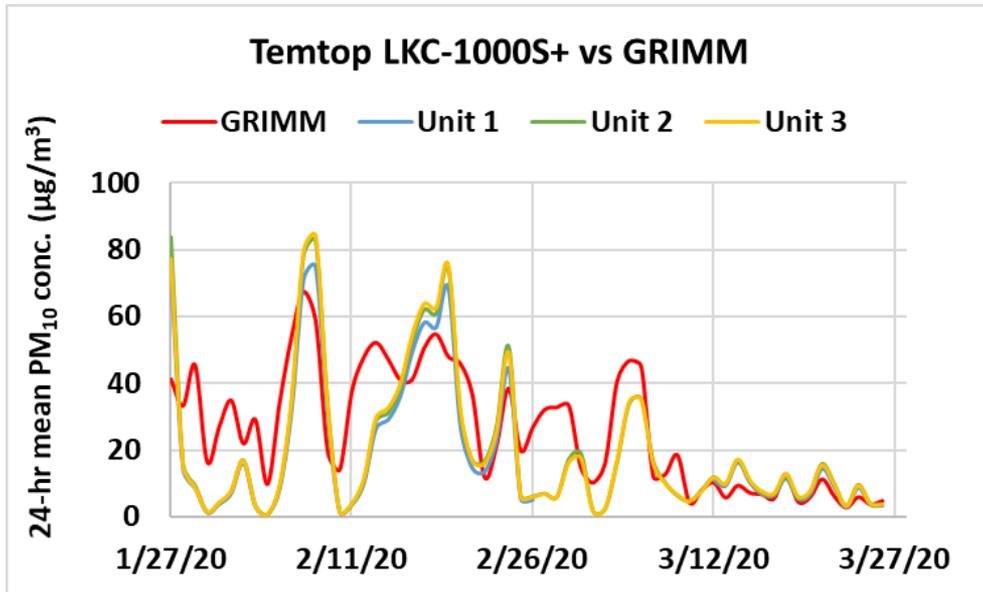
Temtop LKC-1000S+ vs FEM GRIMM (PM_{2.5}; 24-hr mean)



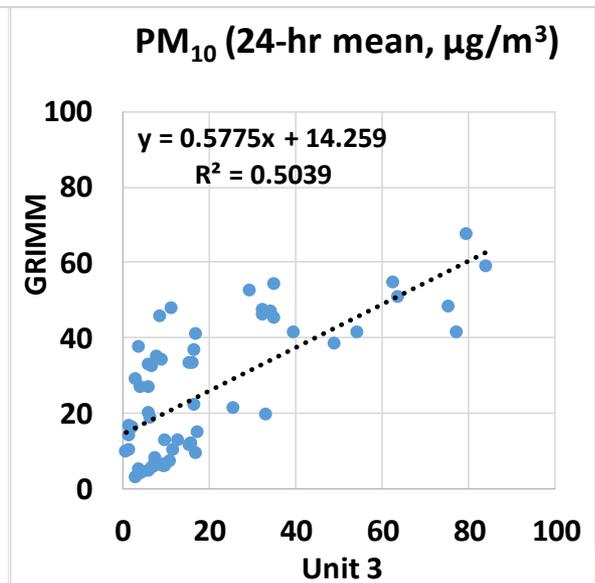
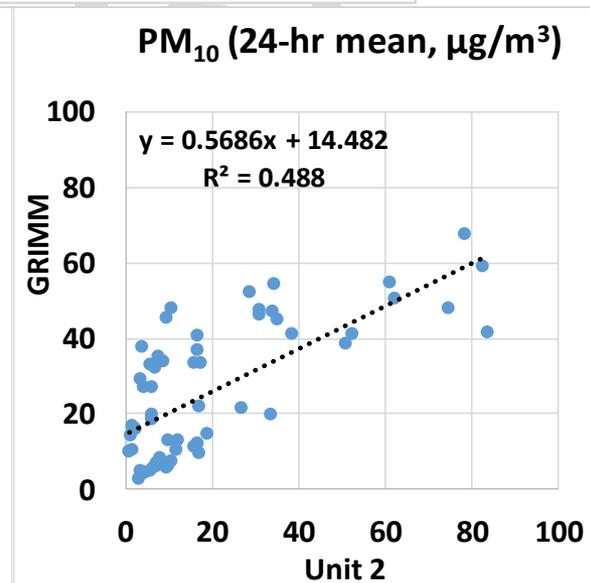
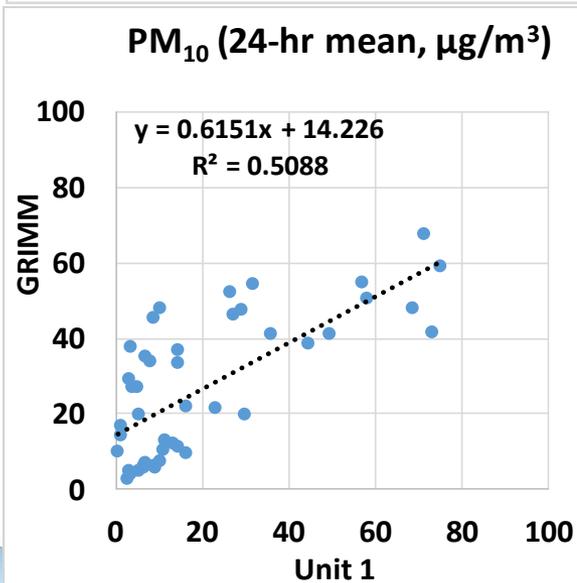
- Temtop LKC-1000S+ sensors showed very strong correlations with the corresponding FEM GRIMM data ($R^2 \sim 0.95$)
- Overall, the Temtop LKC-1000S+ sensors overestimated the PM_{2.5} mass concentrations as measured by FEM GRIMM
- The Temtop LKC-1000S+ sensors seemed to track the PM_{2.5} diurnal variations as recorded by FEM GRIMM



Temtop LKC-1000S+ vs GRIMM (PM₁₀; 24-hr mean)



- Temtop LKC-1000S+ sensors showed moderate correlations with the corresponding GRIMM data ($R^2 \sim 0.50$)
- Overall, the Temtop LKC-1000S+ sensors underestimated the PM₁₀ mass concentrations measured by GRIMM
- The Temtop LKC-1000S+ sensors did not seem to track the PM₁₀ diurnal variations as recorded by GRIMM



Discussion

- The three **Temtop LKC-1000S+** sensors' data recovery from units Unit 1, Unit 2 and Unit 3 was ~ 78%, ~ 100% and ~ 100%, respectively, for both PM_{2.5} and PM₁₀ measurements
- The absolute intra-model variability was ~ 0.87 and 1.17 µg/m³ for PM_{2.5} and PM₁₀, respectively
- PM_{2.5} mass concentrations measured by Temtop LKC-1000S+ sensors showed very strong correlations with the corresponding FEM GRIMM data ($R^2 \sim 0.92$, 1-hr mean). The sensors overestimated PM_{2.5} mass concentrations as measured by FEM GRIMM.
- PM₁₀ mass concentrations measured by Temtop LKC-1000S+ sensors showed weak correlations with the corresponding GRIMM data ($R^2 \sim 0.36$; 1-hr mean) and underestimated PM₁₀ mass concentrations measured by GRIMM
- No sensor calibration was performed by South Coast AQMD Staff prior to the beginning of this test
- Laboratory chamber testing is necessary to fully evaluate the performance of these sensors under known aerosol concentrations and controlled temperature and relative humidity conditions
- All results are still preliminary