Using Low-Cost Sensors to Probe Changes in Urban Aerosol on a Neighborhood Scale

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BEACO2N: A DENSE SENSOR NETWORK

Able to observe dynamic changes in aerosol concentrations within neighborhoods and quantify individual exposures.

Aerosol Sensor – Shinyei PPD42NS

Measures aerosol concentration using light scattering. We use calibration results from Holstius et al. [2014] to convert to mass concentration.

TEMPORAL TRENDS

We are able to observe distinct weekday trends among our network with precision better than 0.5 μg.m^{-3}. This suggests multiple regimes of sources and transport that can inform future work.

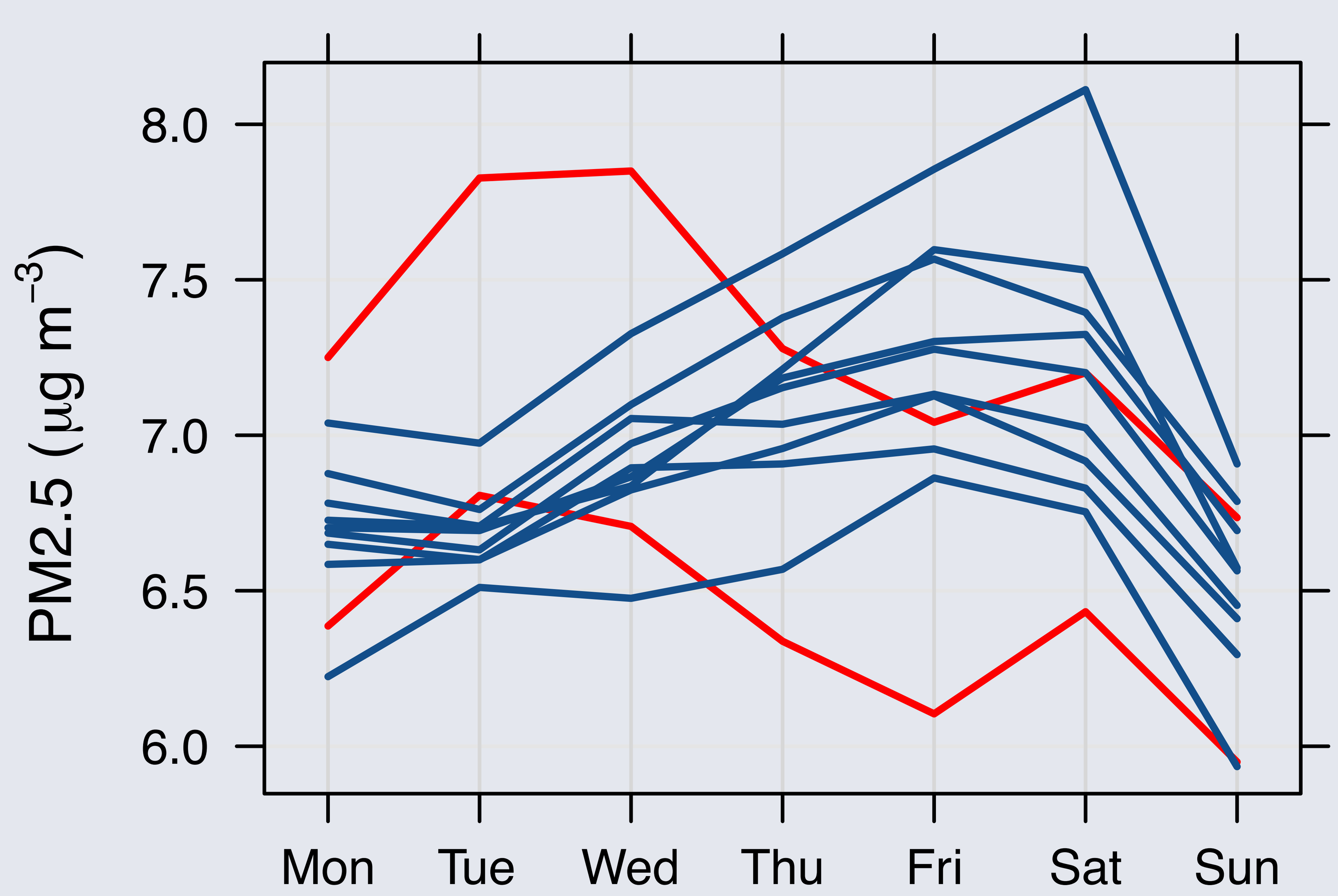

Figure 3. Median weekday aerosol concentration at BEACO2N sites in Richmond. Colors correspond to locations in Figure 1.

PLUME EVOLUTION

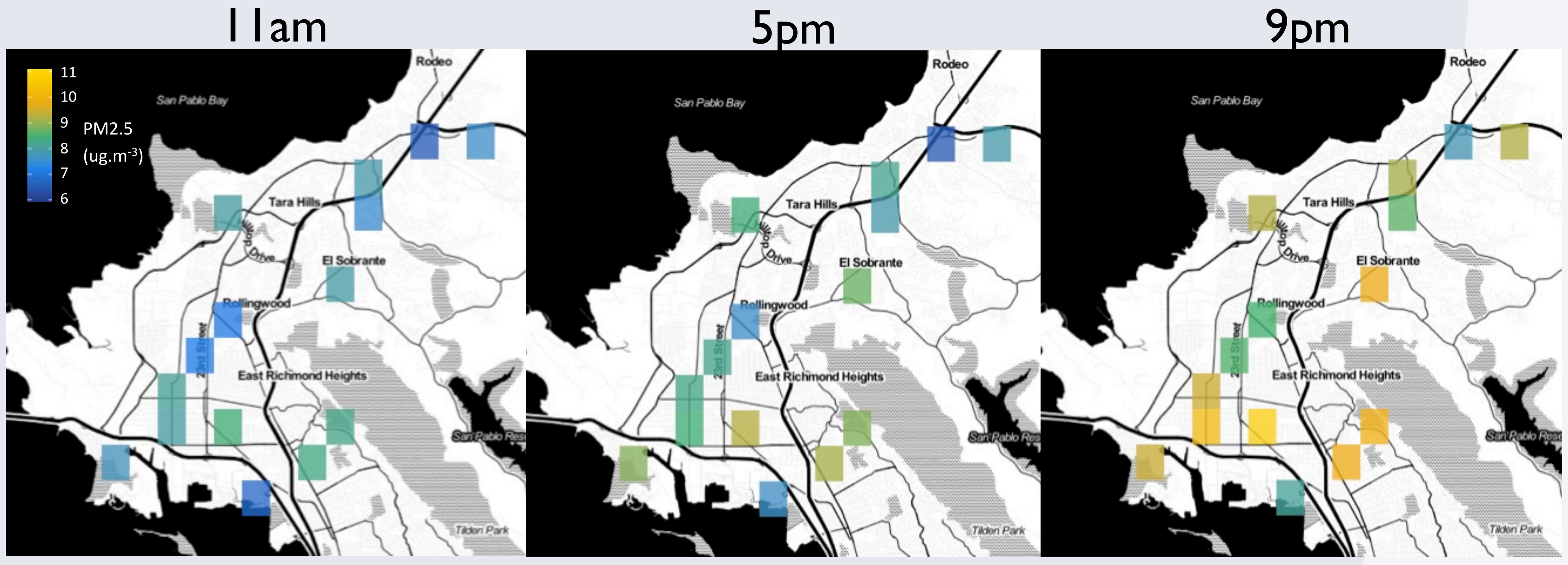

Figure 4. PM2.5 concentrations across the Richmond network on July 1, 2017.

With such dense observations we are able to visualize the movement of air parcels of high concentrations across the network, helping to constrain transport.

NETWORK DETAILS

- ~ 50 nodes
- 2 x 2 km spatial grid
- Synchronous measurements of CO_2, CO, O_3, NO and NO_2
- Measurements every 5-10 seconds

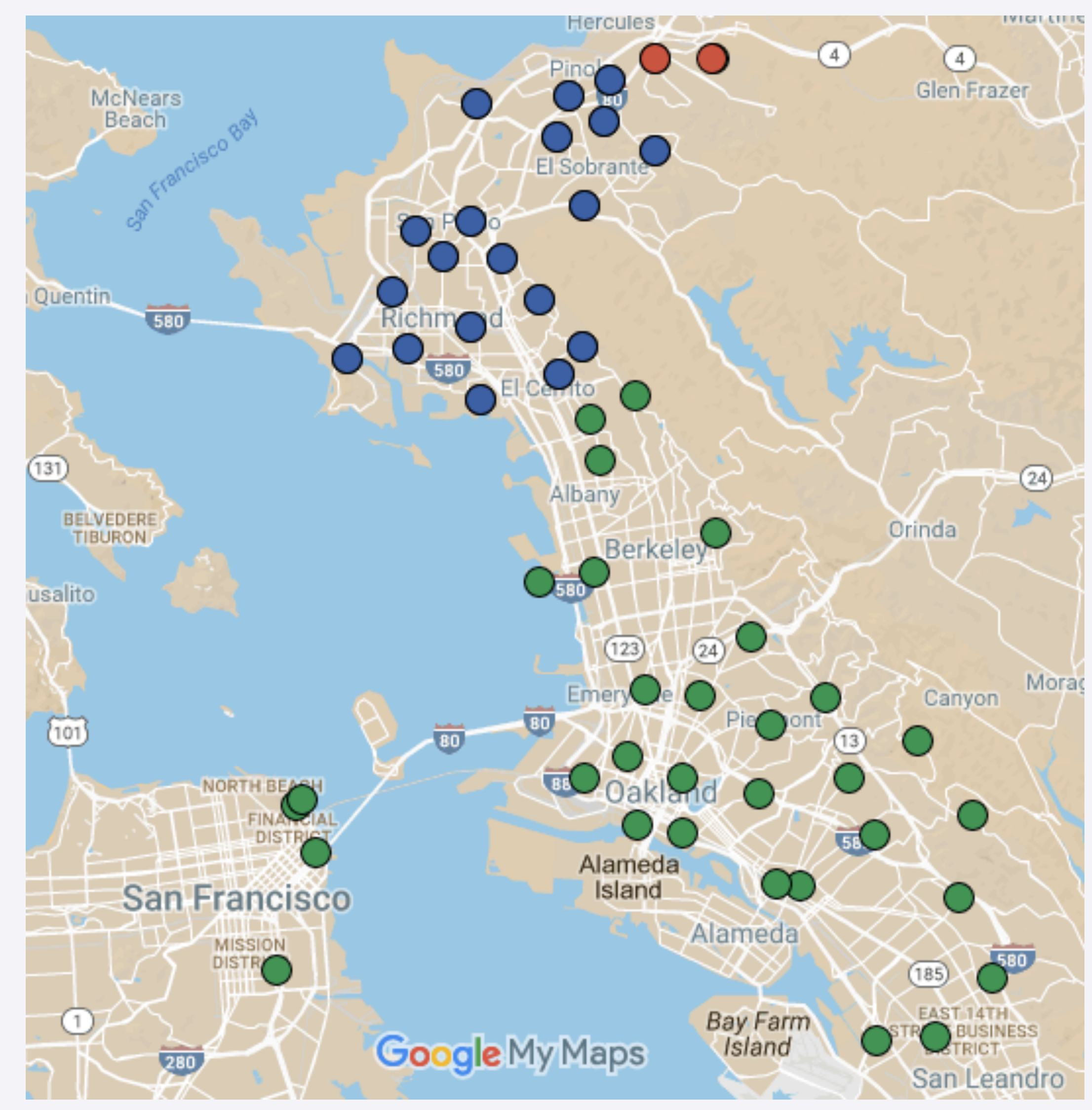

Figure 1. Map of current BEACO2N node locations.

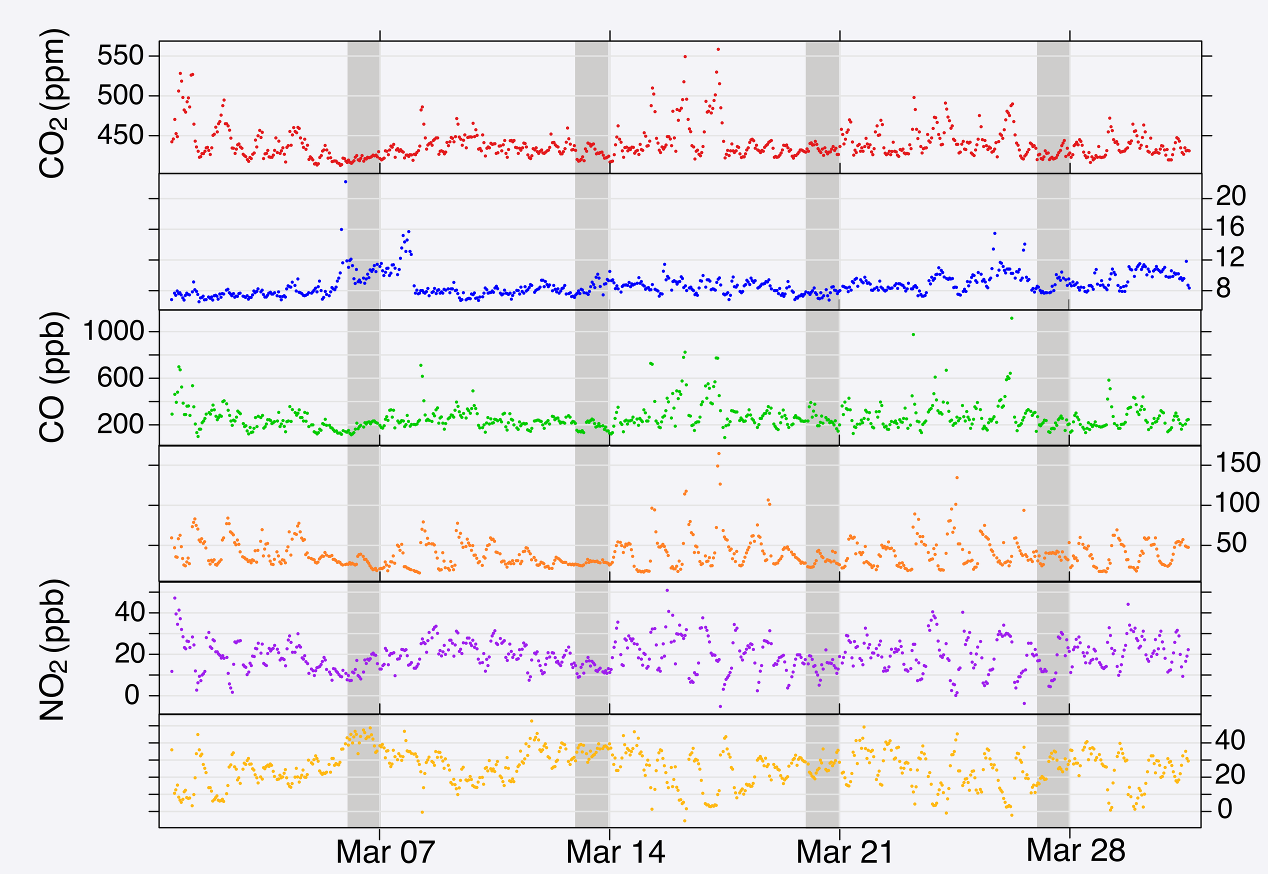

Figure 2. Observations from March, 2016 of all species measured at a typical BEACO2N site.

CONCLUSION

- Two distinct weekly cycles observed in Richmond.
- Able to watch aerosol plumes evolve through communities over a single day.
- Better than 0.5 μg.m^{-3} precision.
- Synchronous CO_2, CO, O_3, NO and NO_2 observations allow investigation of sources.