Case studies of O_3 and methane small sensor networks in LA and Colo Front Range

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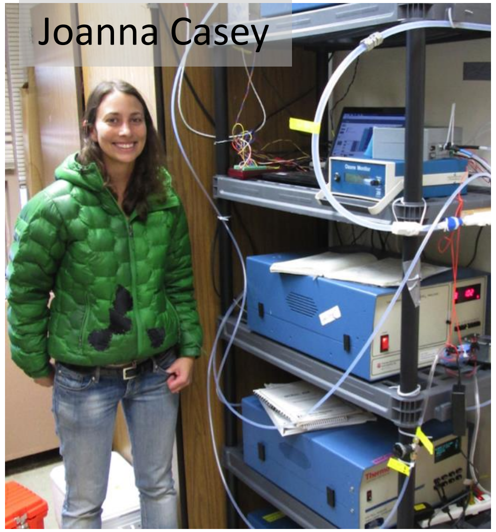
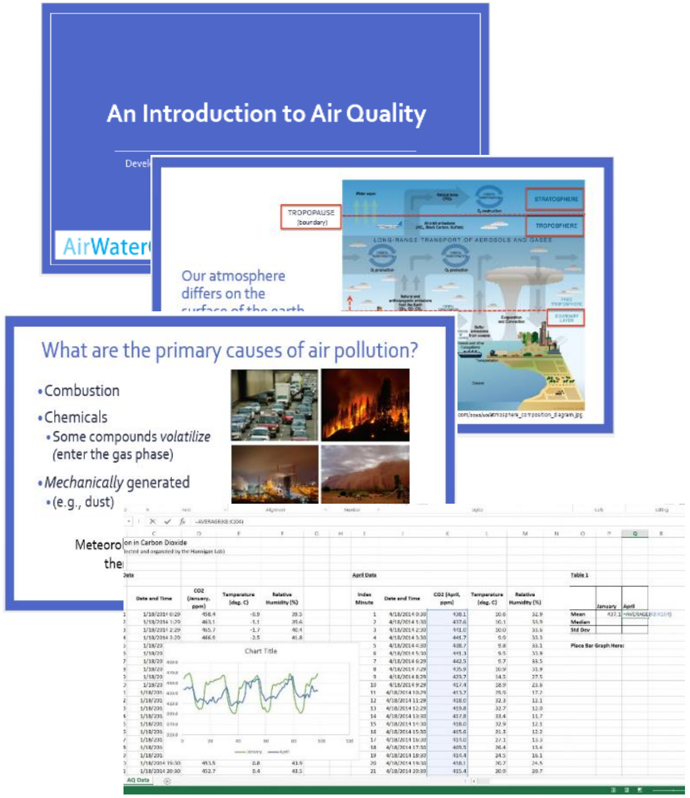


AirWaterGas Sustainability Research Network

AQ-IQ (Air Quality InQuiry)

Education & Outreach Program

1. Project-based Learning Curriculum

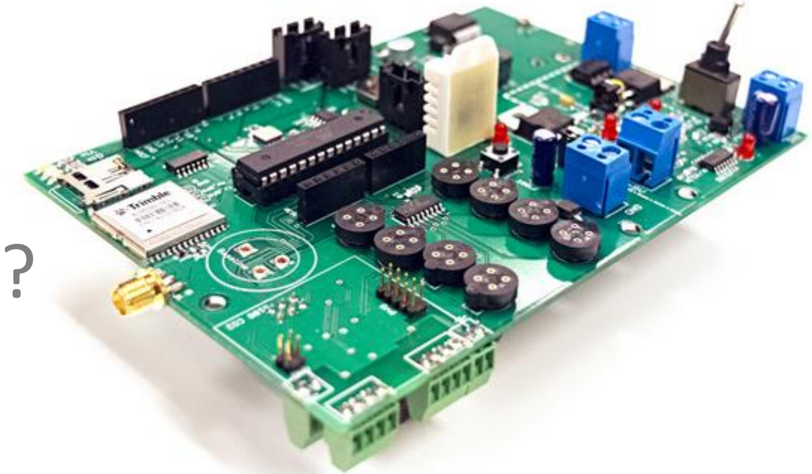


2. Technology Check-out Program

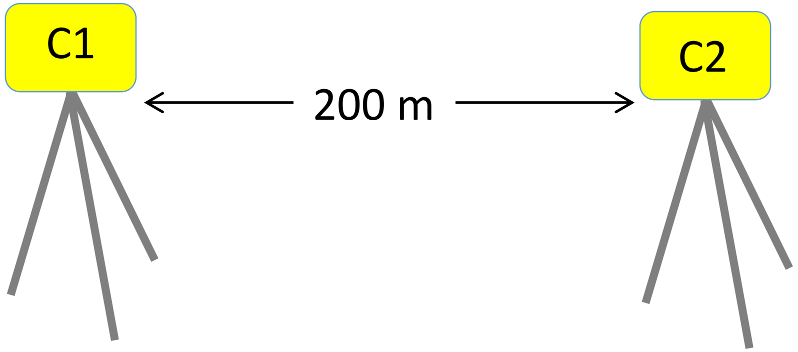
3. University Mentors

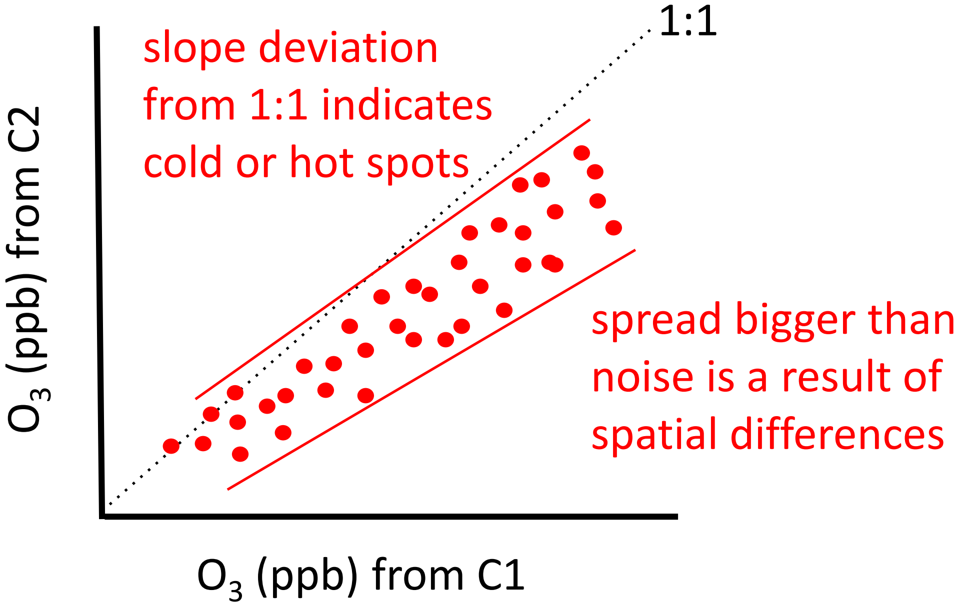
Can O_3 sensors be used to help site regulatory ozone monitors?

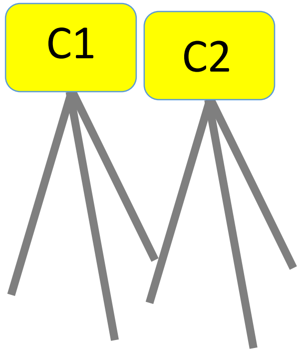
- **Can sensors find hot (or cold) spots for ambient O_3 between regulatory monitoring stations?**
- **What spatial (and temporal) scale do we observe O_3 concentration differences?**
- Do trees impact O_3 concentration?
- How much traffic does it take on a roadway to impact O_3 concentration?
- Does local industry impact O_3 concentration?

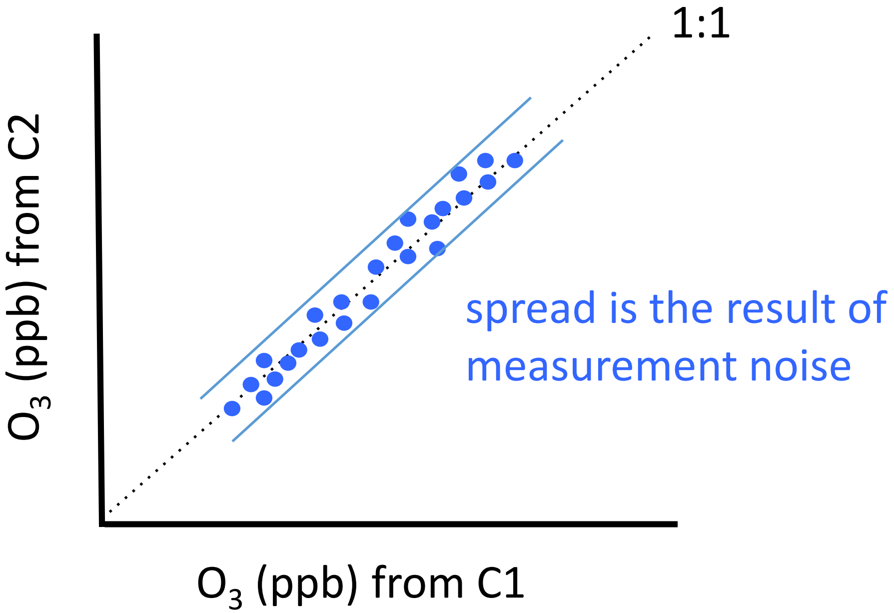


How do you design this experiment?

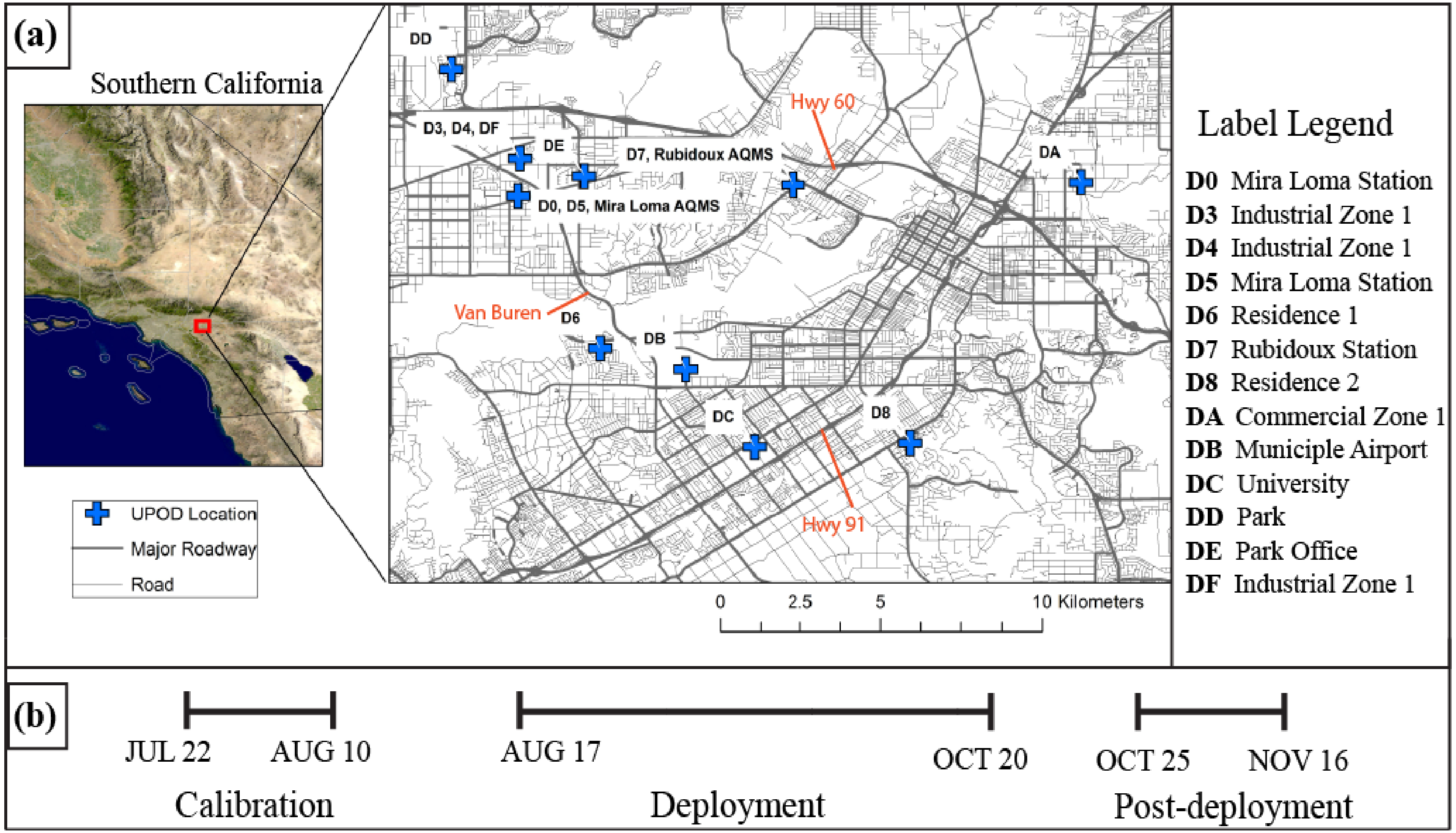


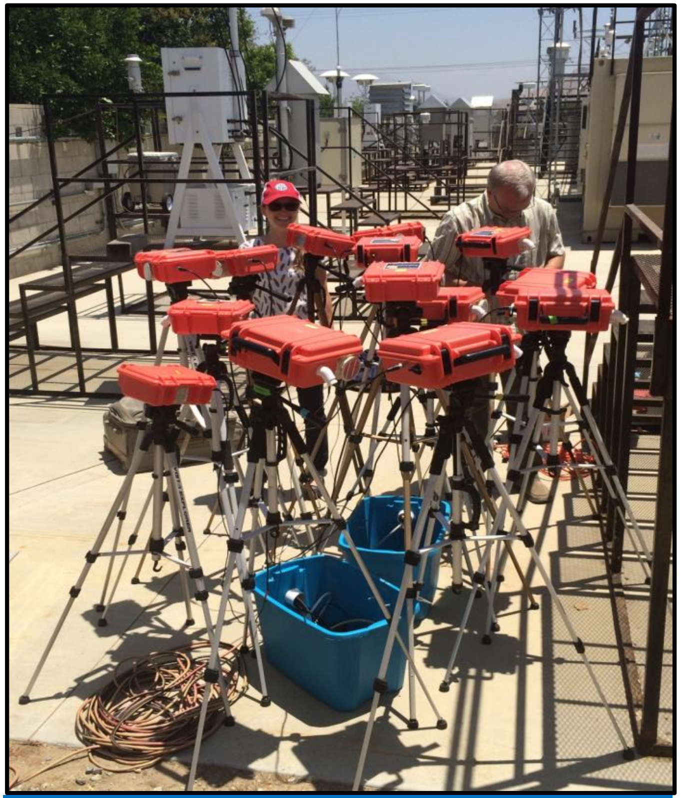




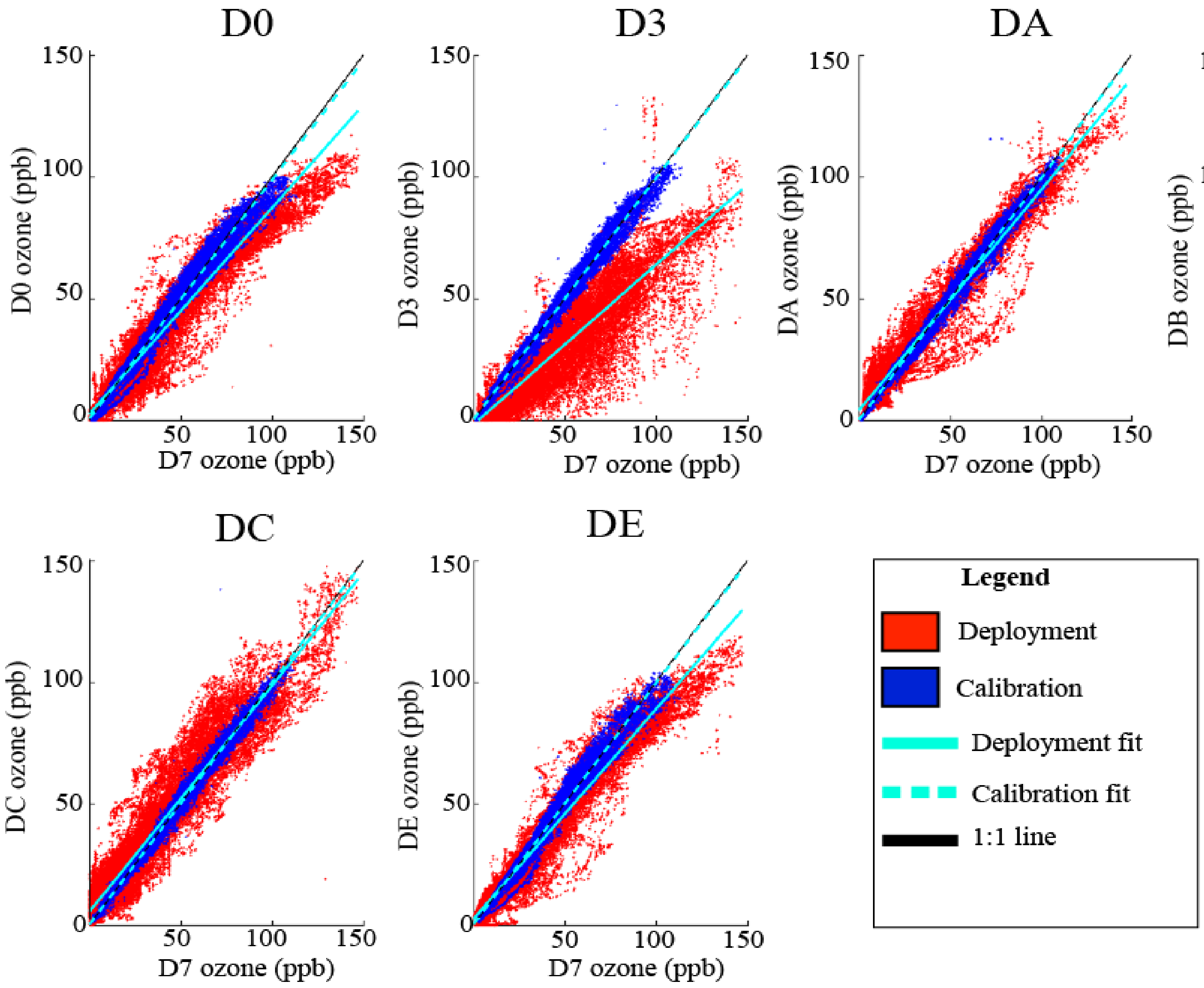


O_3 in Riverside during the summer 2015





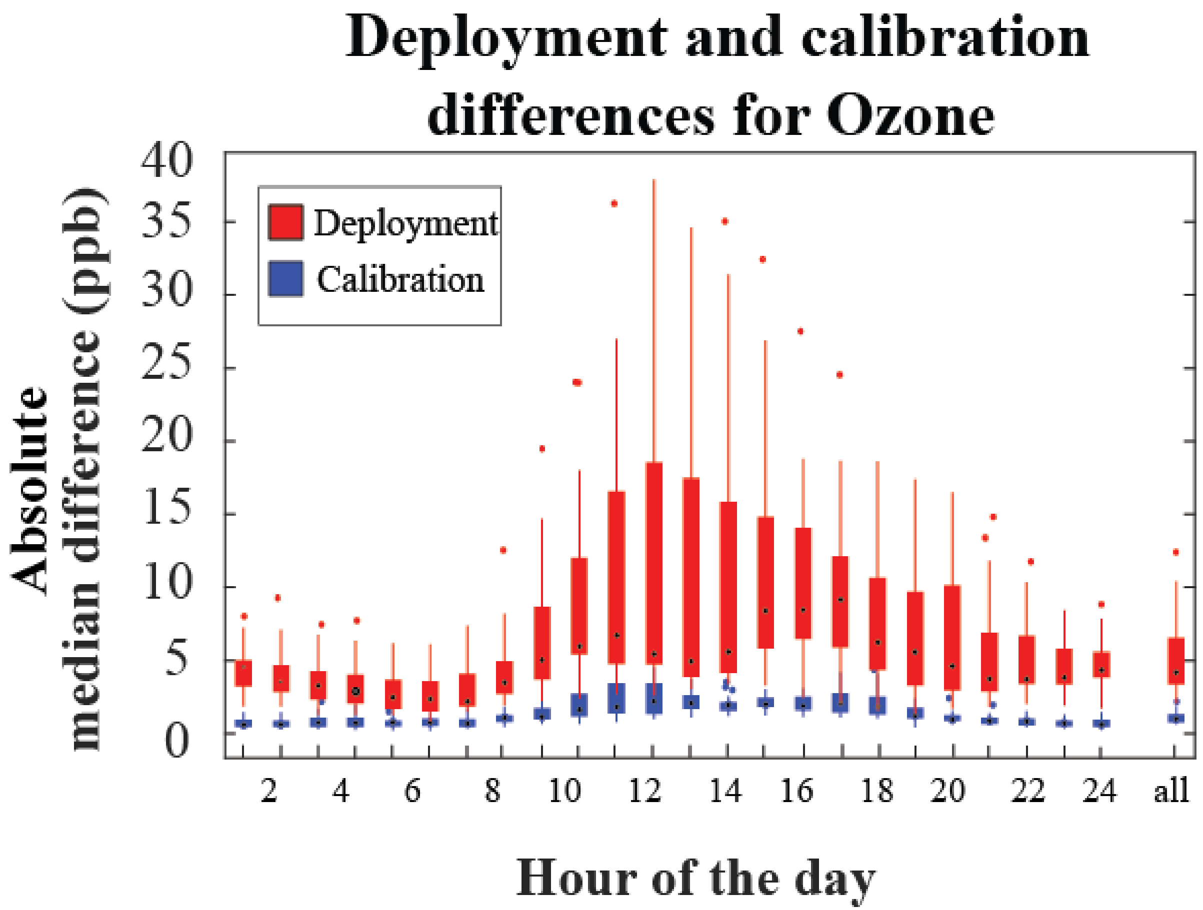
SCAQMD station in Riverside

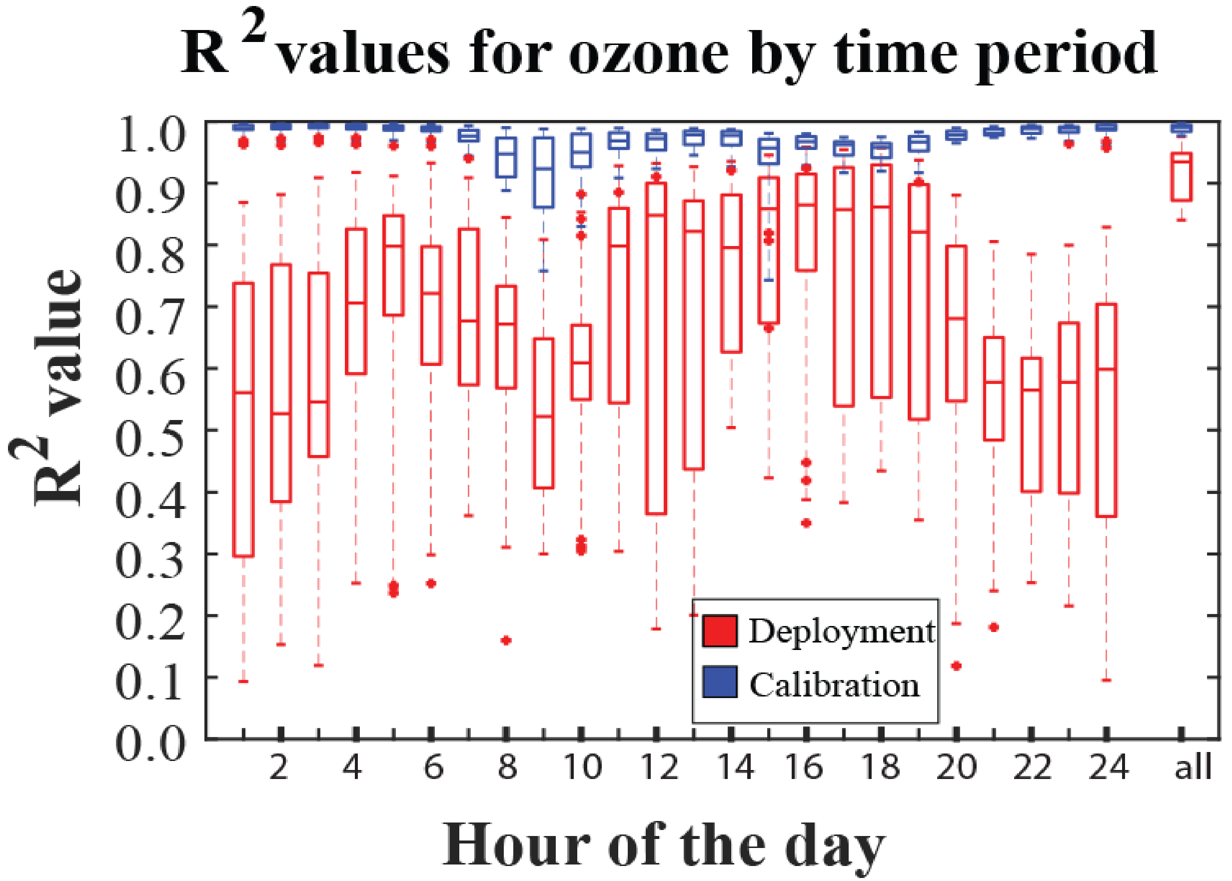


D7 stayed at Rubidoux SCAQMD site
D3 was in an industrial park
DC was closest to Highway 91
DA was in a commercial zone

Sadighi, K., et al: Intra-urban spatial variability of surface ozone and carbon dioxide in Riverside, CA: viability and validation of low-cost sensors, Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2017-183, in review, 2017.

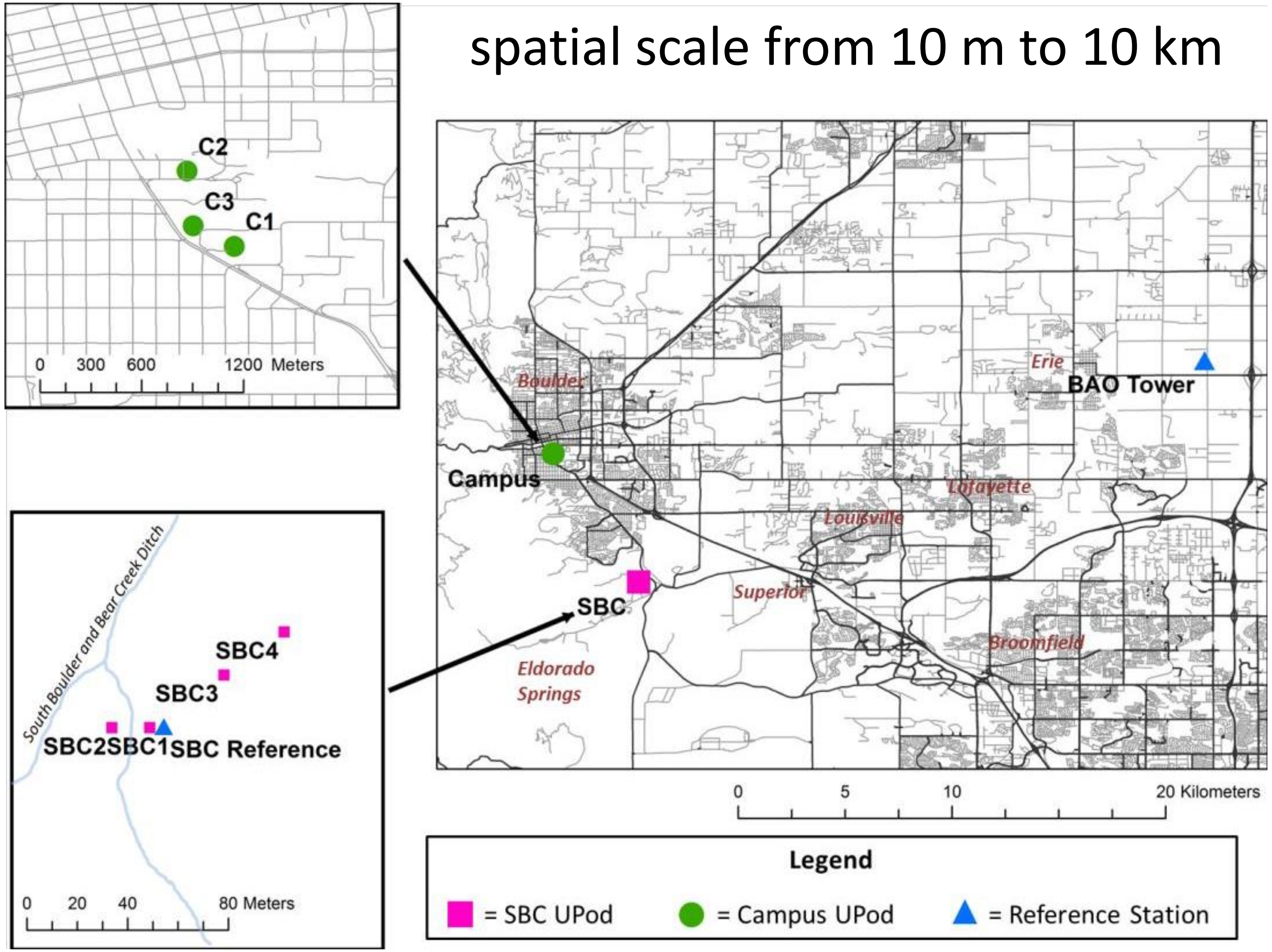
Since O_3 has a nice daily cycle, we should look at the data that way …





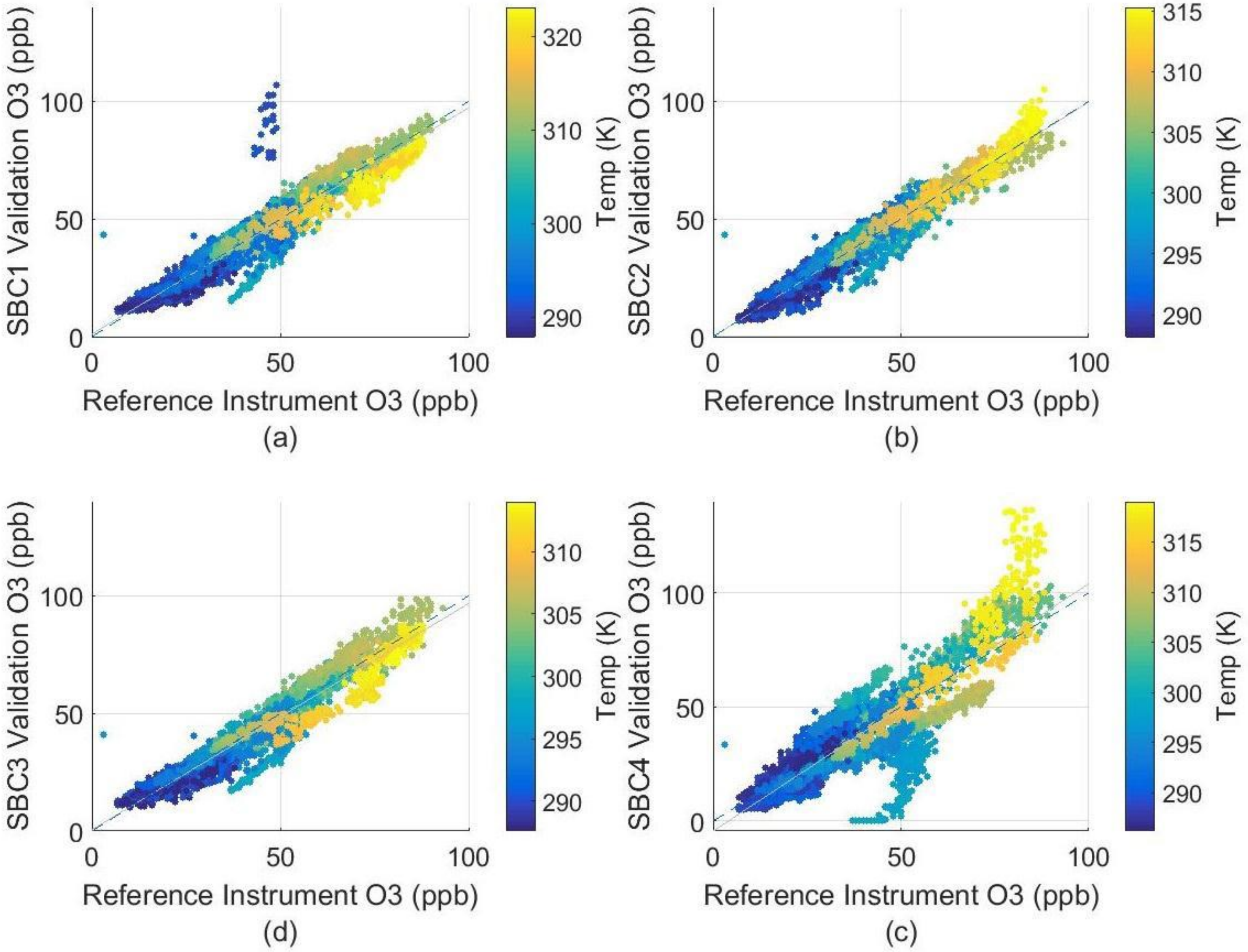
O_3 in and around Boulder during summer 2015

spatial scale from 10 m to 10 km



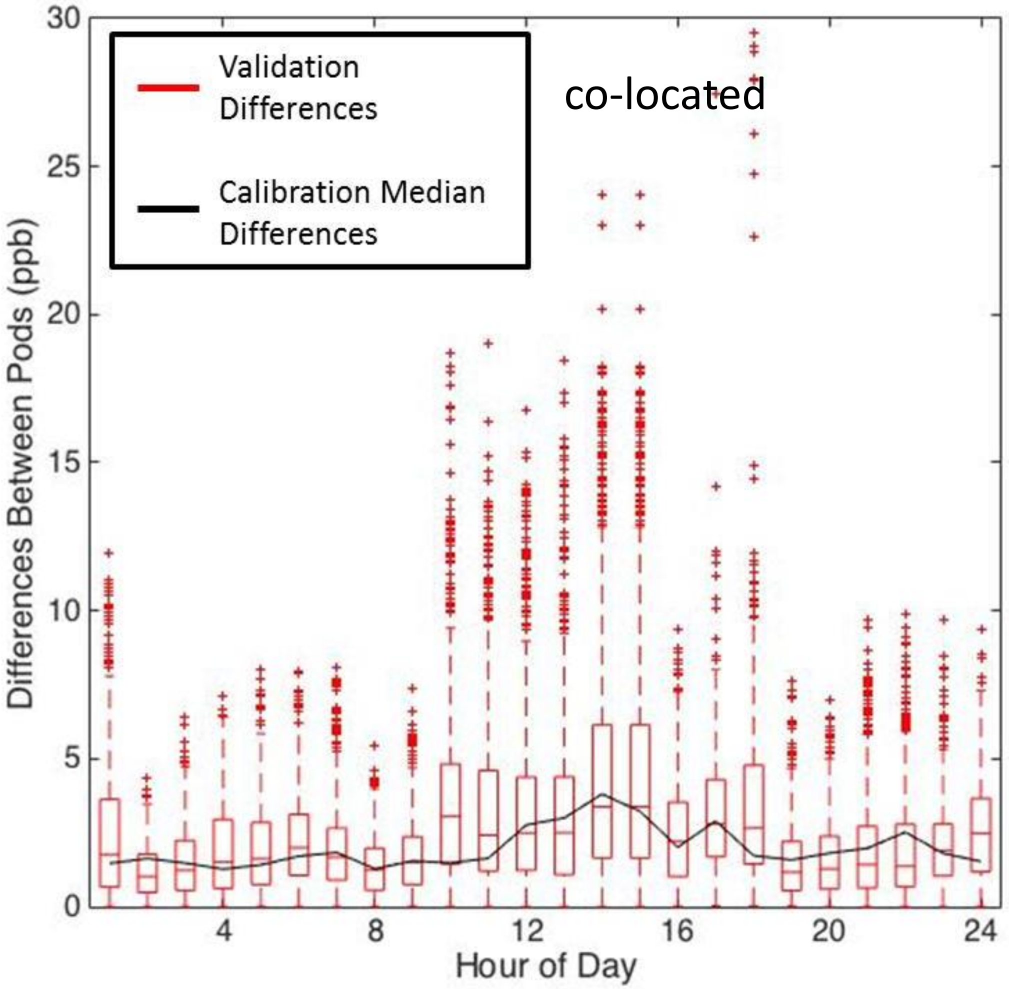
South Boulder Creek & CU campus

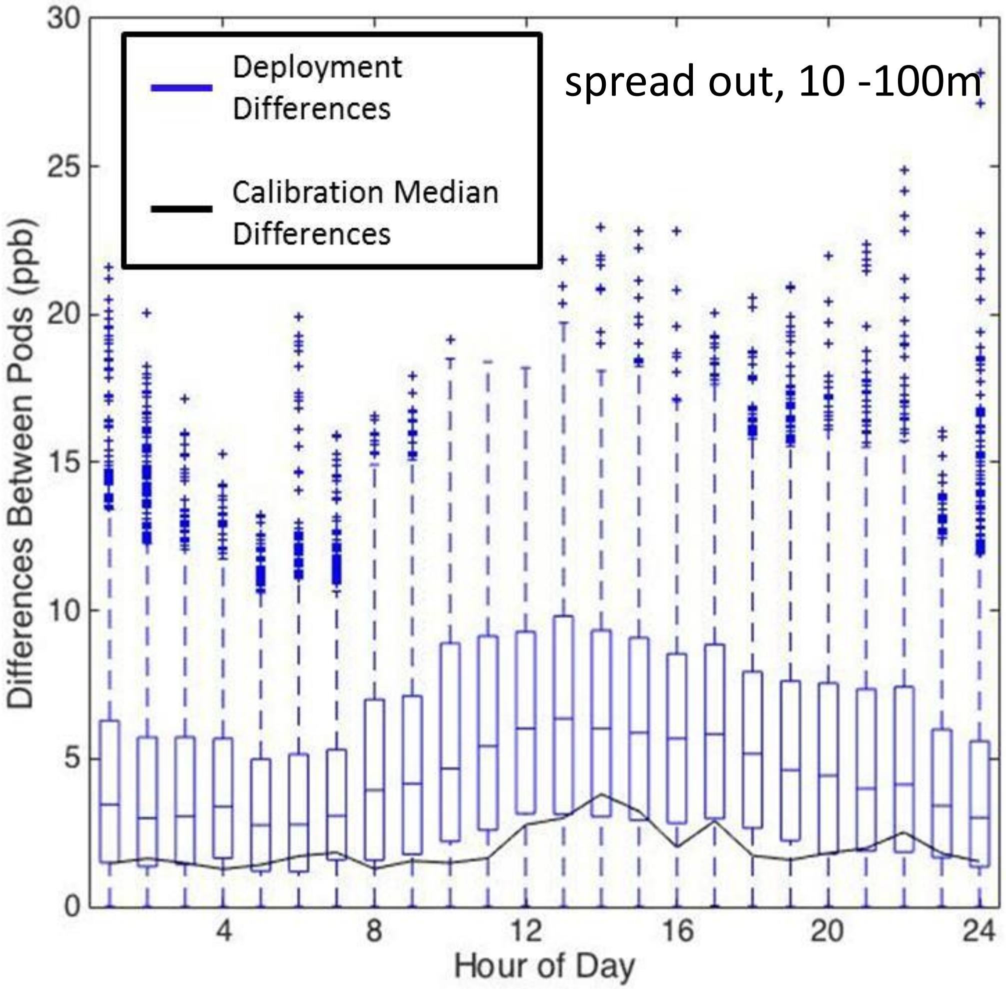
How is the calibration/normalization working?



Sensors **2017**, *17*, 2072; doi:10.3390/s17092072

Diurnal differences at South Boulder Creek

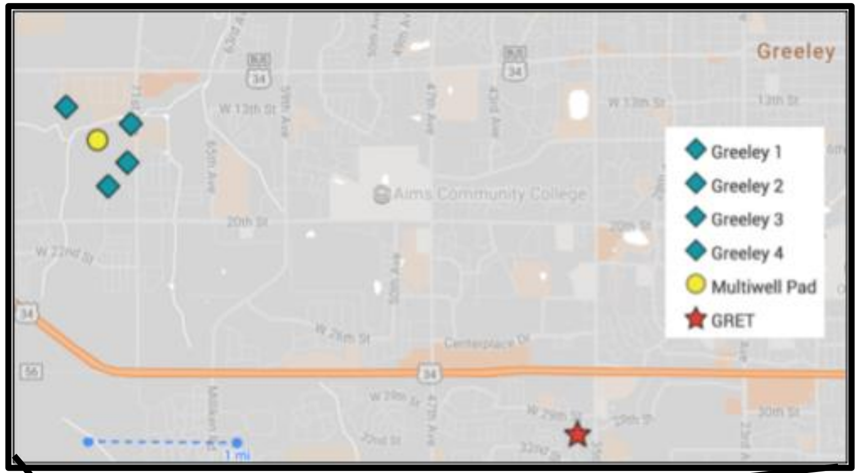


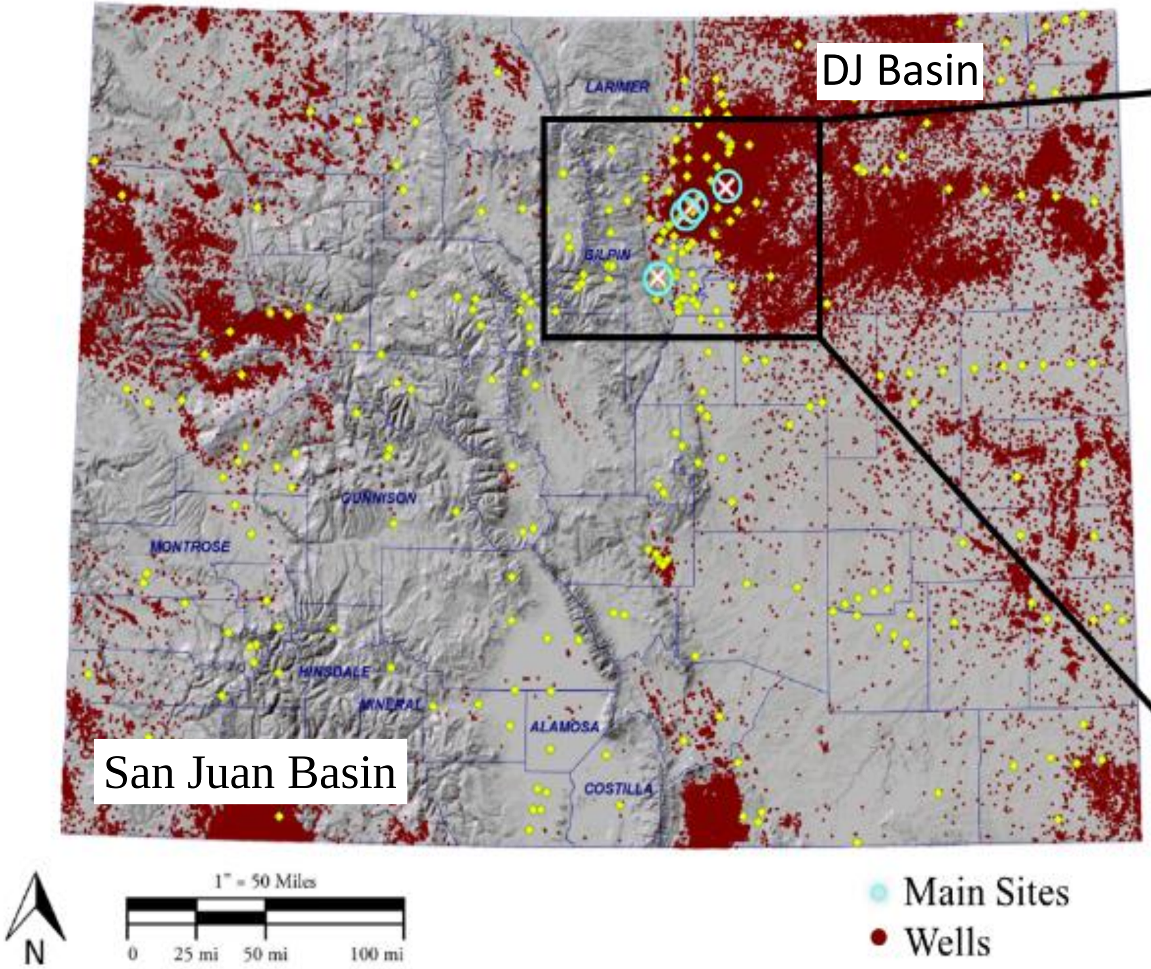


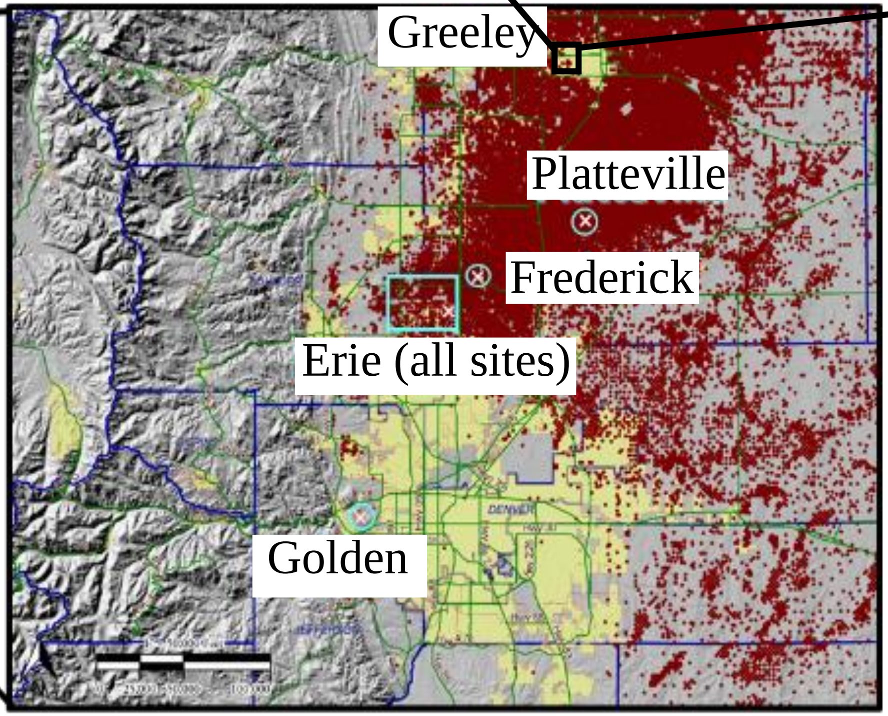
Can a sensor system be used for community scale methane monitoring?

- **What is the range of ambient methane concentrations in communities in oil and gas development basins?**
- **Can a sensor system “see” that range or is the spatial variability less than the instrument noise?**
- If we can observe spatial differences, then what activities and/or processes are causes those differences?

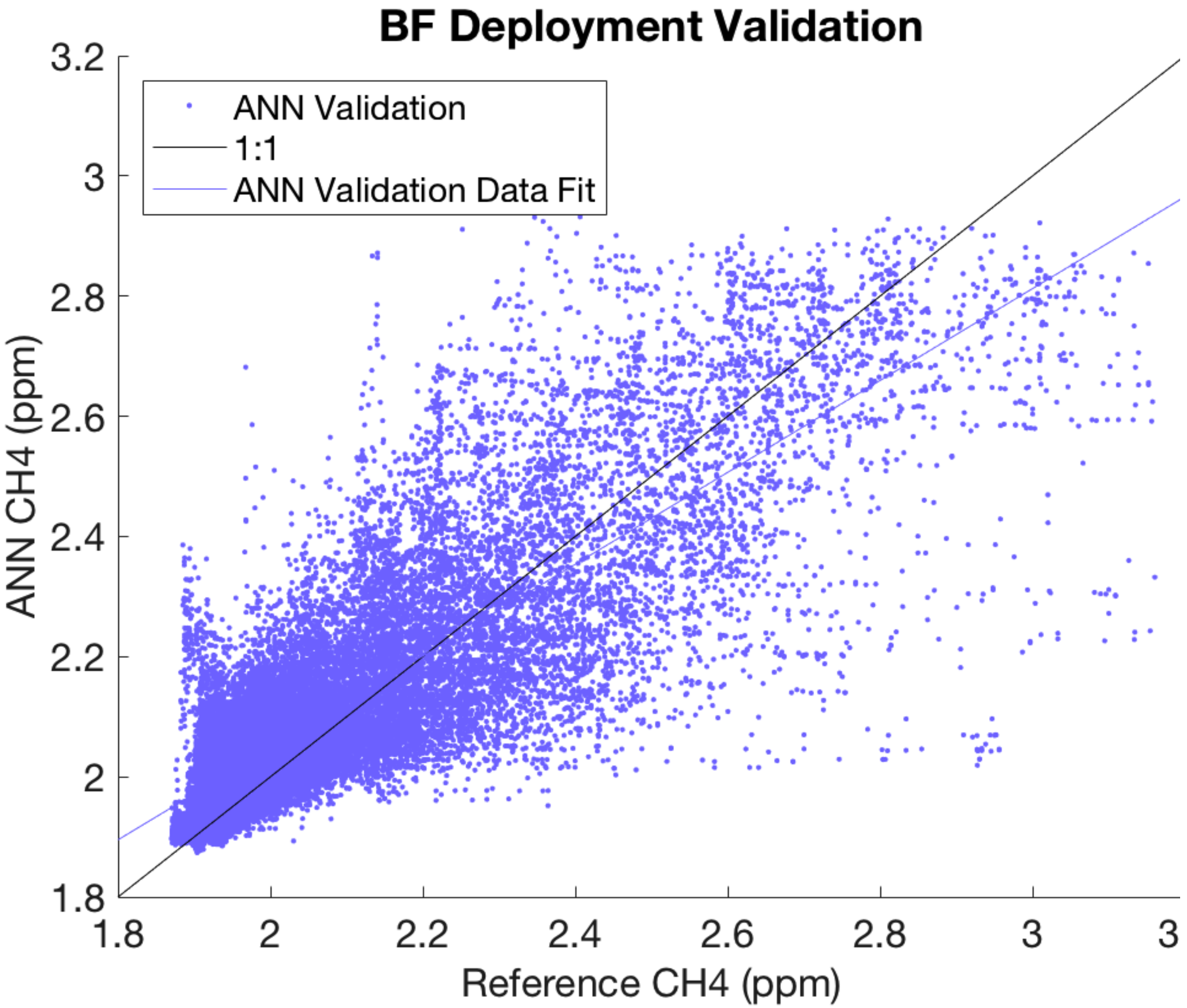
Colorado sampling …

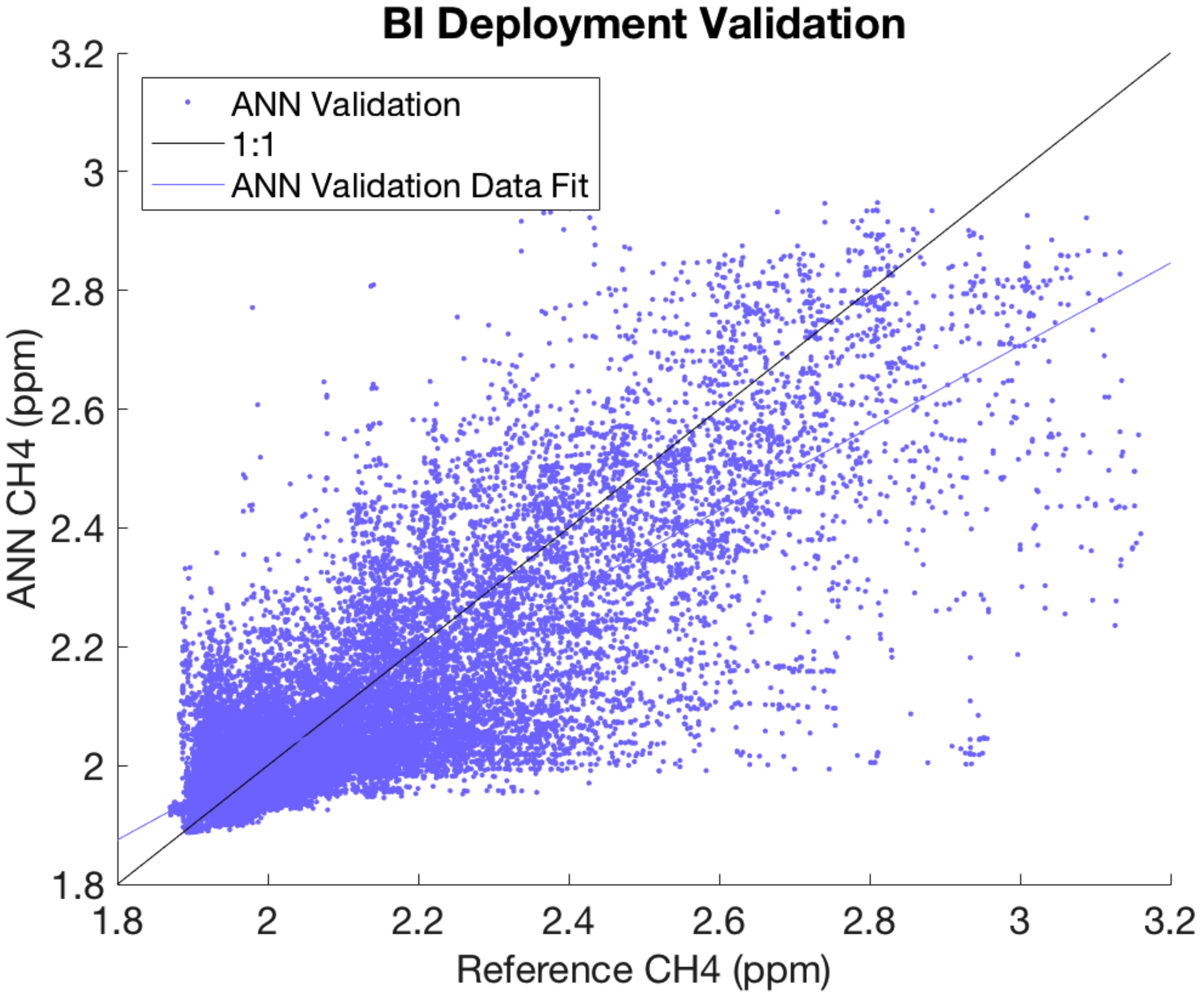




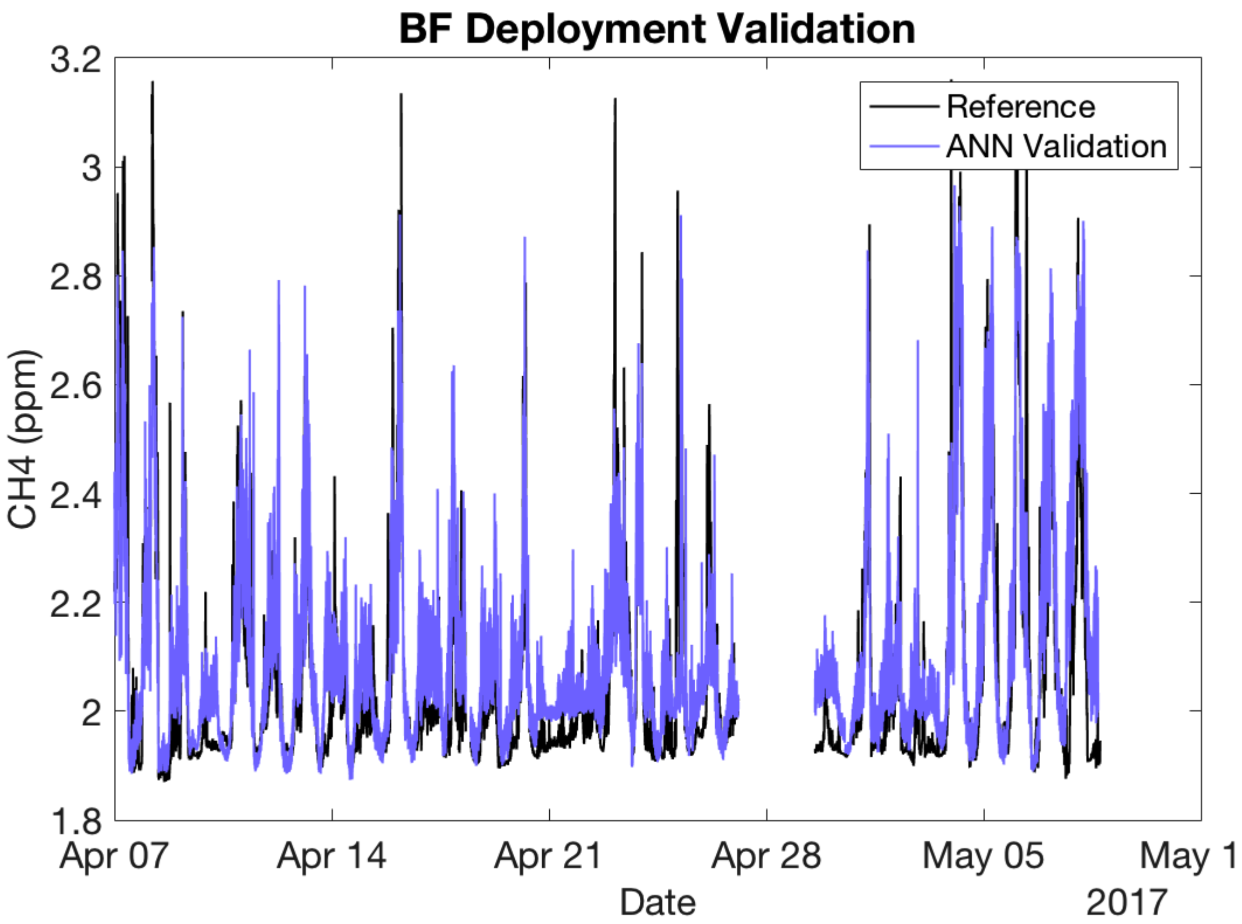


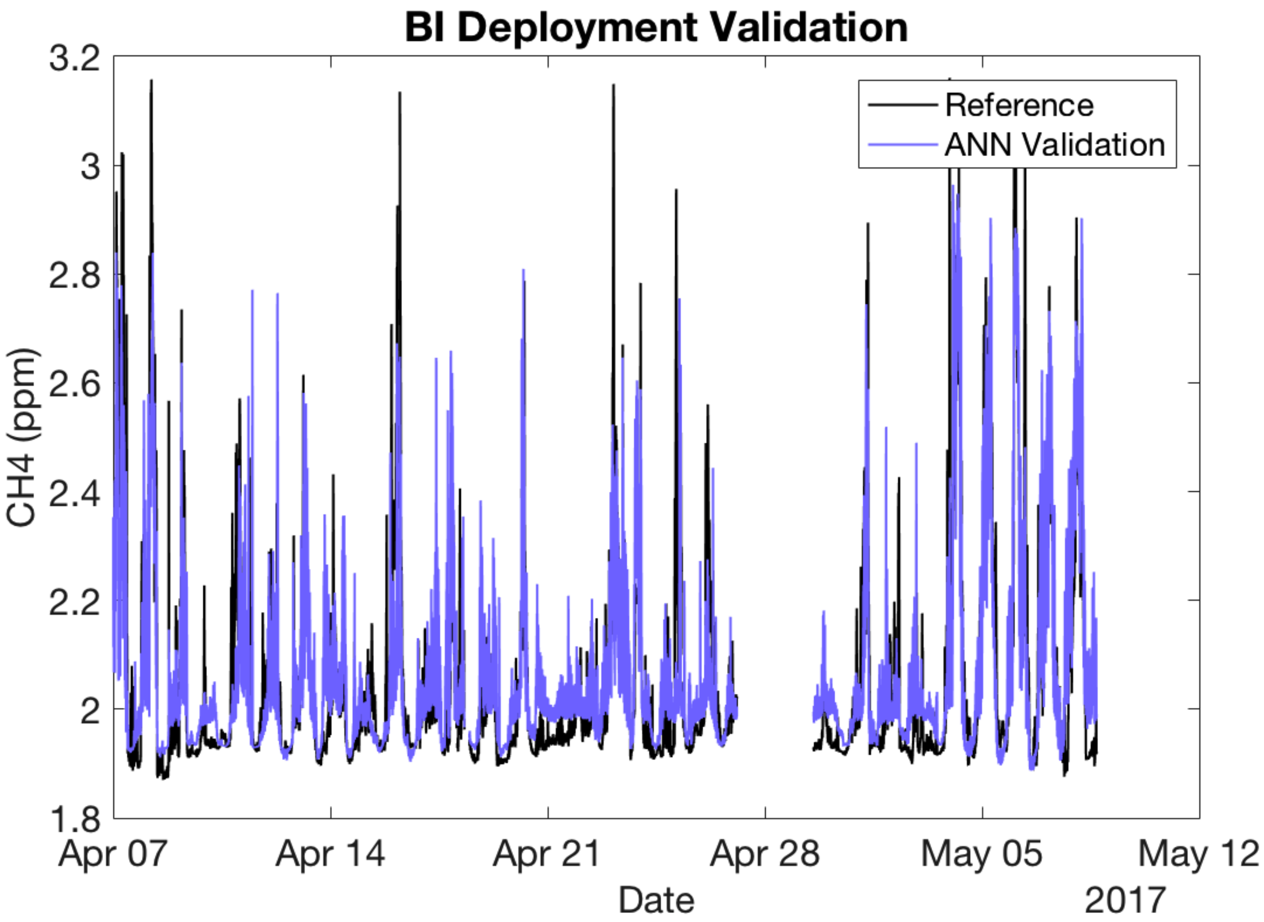
Lots of work trying to “see” methane at relevant concentration range …



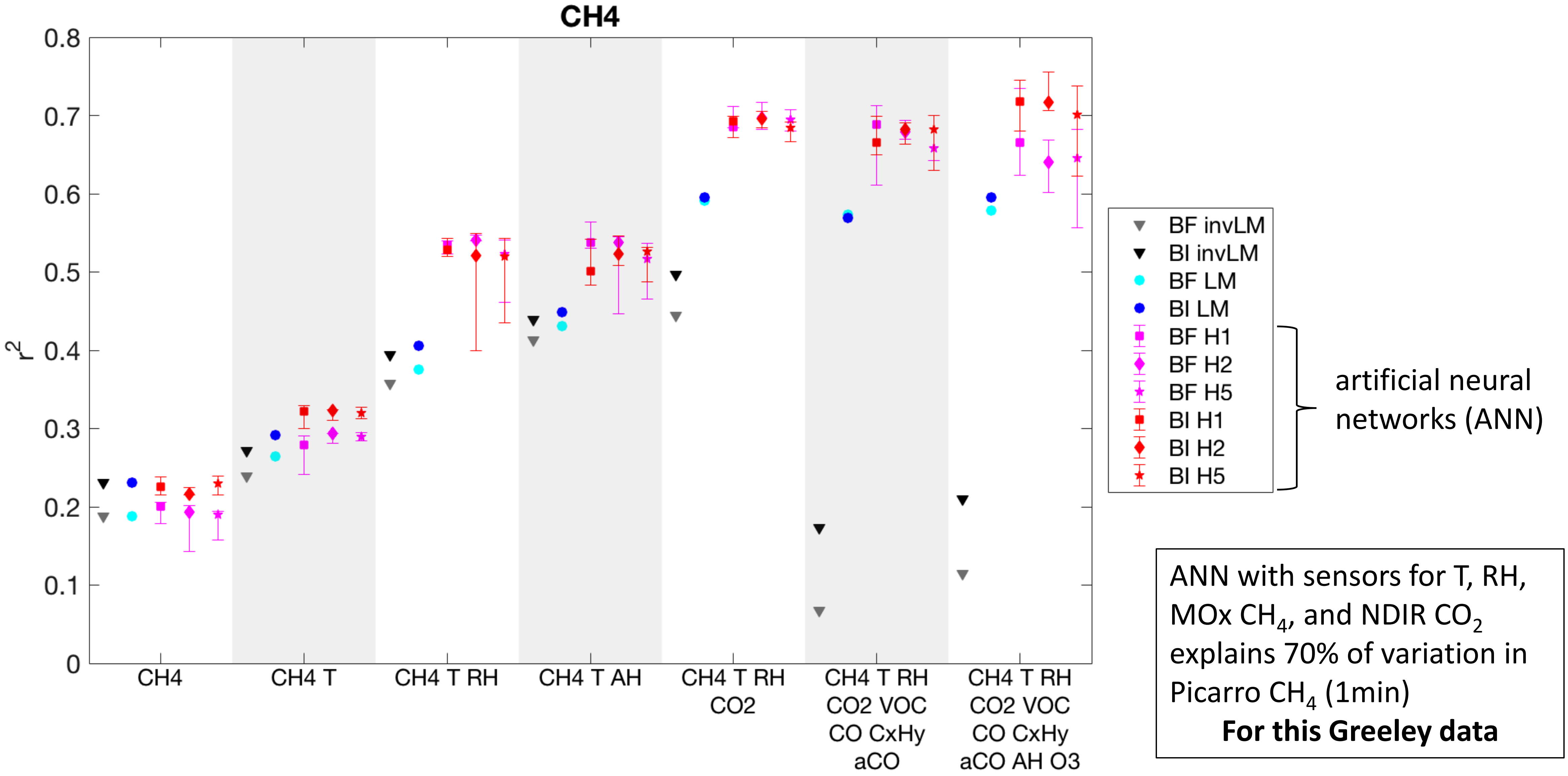


How does that look in a time series …





Pushing calibration to improve our ability to observe differences …

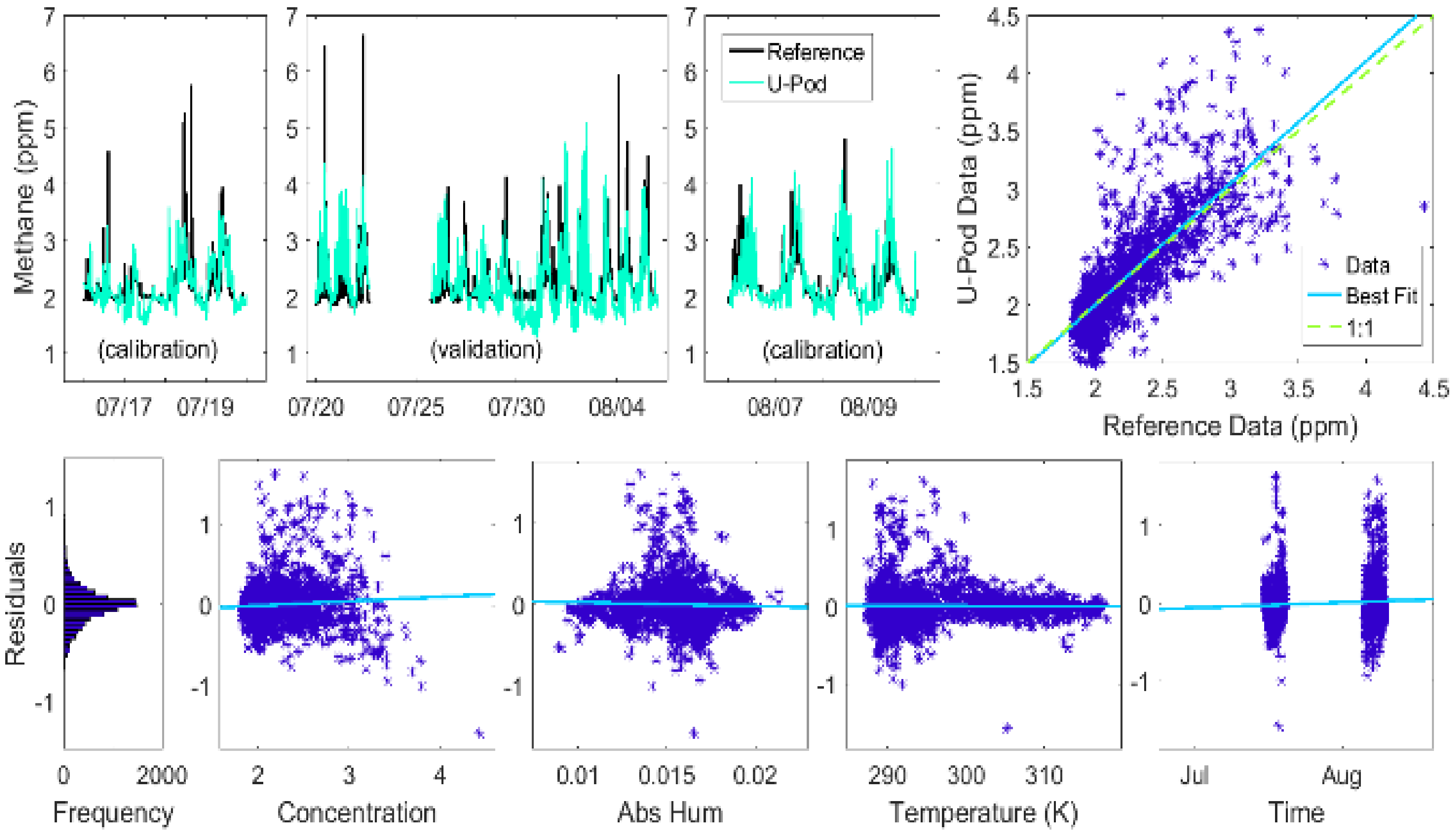


ANN with sensors for T, RH, MOx CH_4, and NDIR CO_2 explains 70% of variation in Picarro CH_4 (1min)

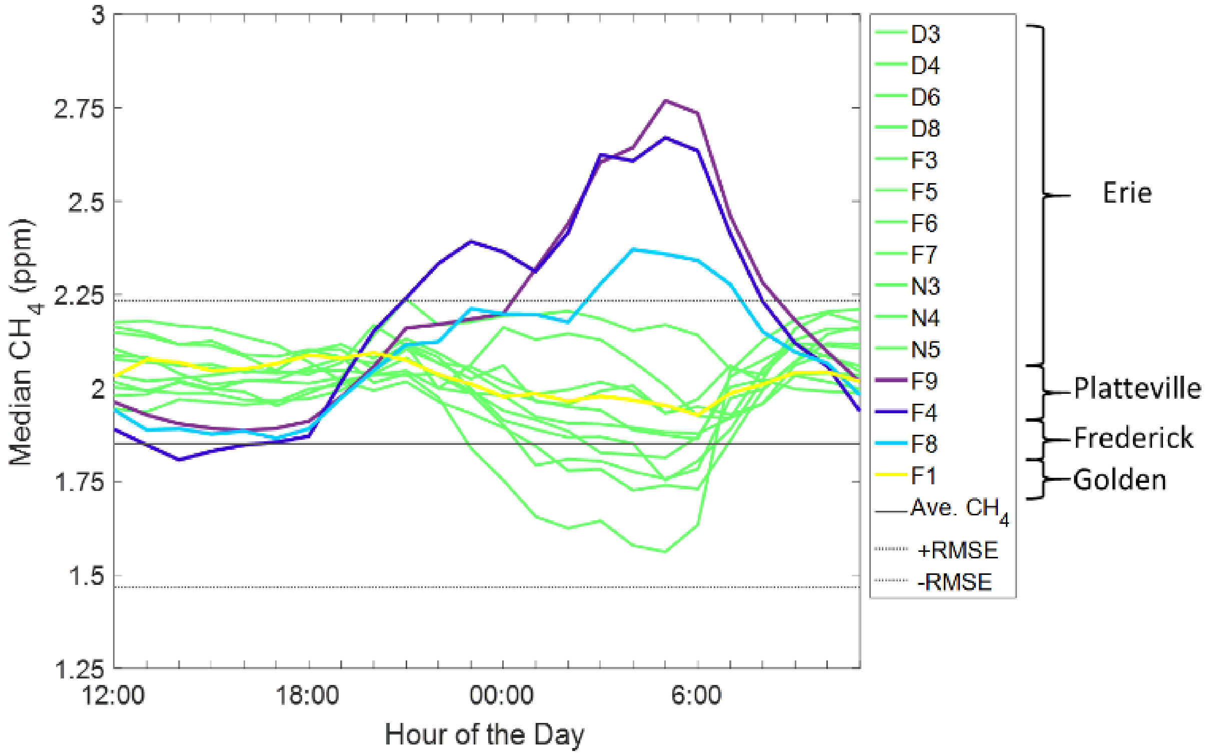
For this Greeley data

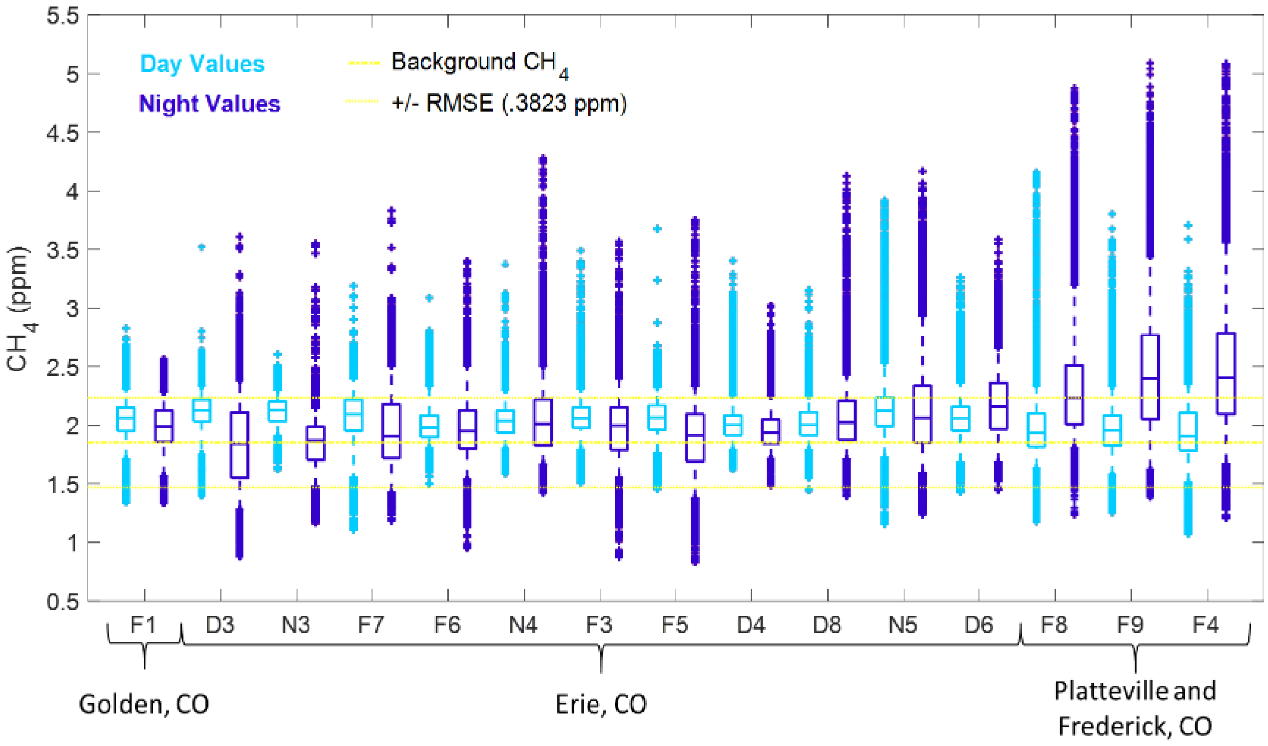
If we are within a km of a well pad, linear is OK

Platteville

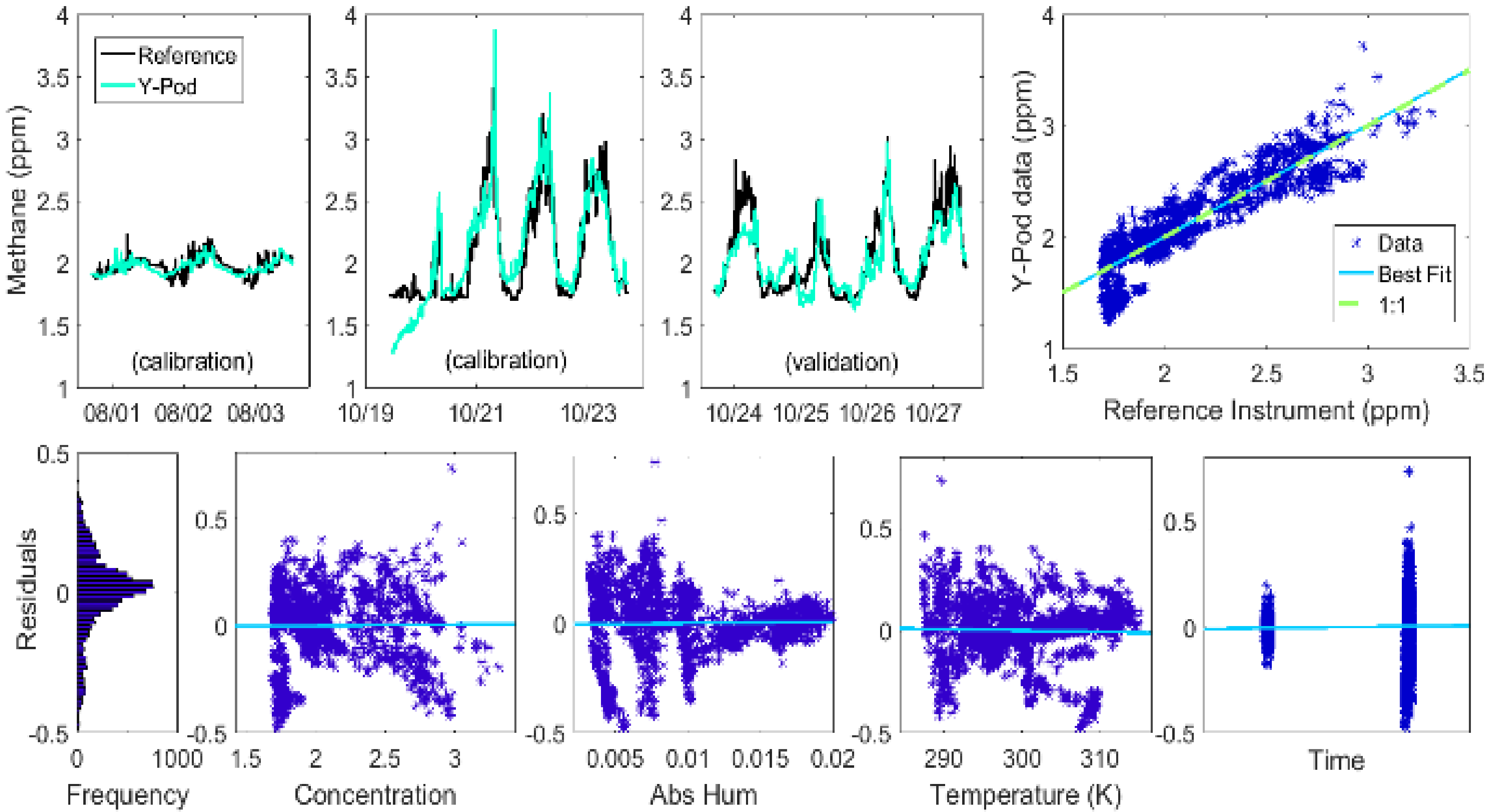


So, can we see spatial differences …





In LA, methane range is also “better” …



How do oil development processes compare to major freeways in terms of their impact on south LA community-scale VOC and O_3 concentrations?