A Multi-tower Measurement Network Estimate of California's Methane Emissions

S. Jeong[1], Y. Hsu[2], A.E. Andrews[3], L. Bianco[3], P. Vaca[2], J.M. Wilczak[3] and M.L. Fischer[1]

[1]Lawrence Berkeley National Laboratory, Berkeley, CA 94720; 510-486-7216, E-mail: sjeong@lbl.gov
[2]California Air Resources Board, Sacramento, CA 95812
[3]NOAA Earth System Research Laboratory, Boulder, CO 80305

We present an analysis of methane (CH_4) emissions using atmospheric observations from five sites in California's Central Valley across different seasons (September 2010 to June 2011). CH_4 emissions for spatial regions and source sectors are estimated by comparing measured CH_4 with model Weather Reseach and Forecasting Stochastic Time-Inverted Lagrangian Transport predictions based on two CH_4 ("California-specific" (CALGEM) and EDGAR42)) emission models. Region-specific Bayesian analyses indicate that for California's Central Valley the CALGEM and EDGAR42 models provide consistent annual total CH_4 emissions after inversion (31.43±2.07 vs. 28.27±2.00 Tg CO_2eq yr^{-1}; 68% C.I.). Similarly, source analyses of state total emissions from livestock are consistent between CALGEM and EDGAR42 (31.25±2.77 vs. 27.24±3.13 Tg CO_2eq), because livestock emissions that are predominantly located in the Central Valley are constrained by the measurements. Summing across all regions of California, CH_4 emissions differ for CALGEM and EDGAR42 (46.10±4.93 vs. 62.18±9.07 Tg CO_2eq or 1.3-2.2 times the state inventory), because emissions from coastal urban regions (where landfill and natural gas emissions are much higher in EDGAR than CALGEM) are not strongly constrained by the measurements. Combining our results with those from a recent study of the South Coast air basin narrows the range of estimates to 1.3-1.7 times the current state inventory. This suggests that additional urban measurements would constrain total CH_4 emissions, and with additional tracers, differentiate which of the dominant source sectors (e.g., livestock, landfills) provide the most promising targets for CH_4 emissions mitigation activities.

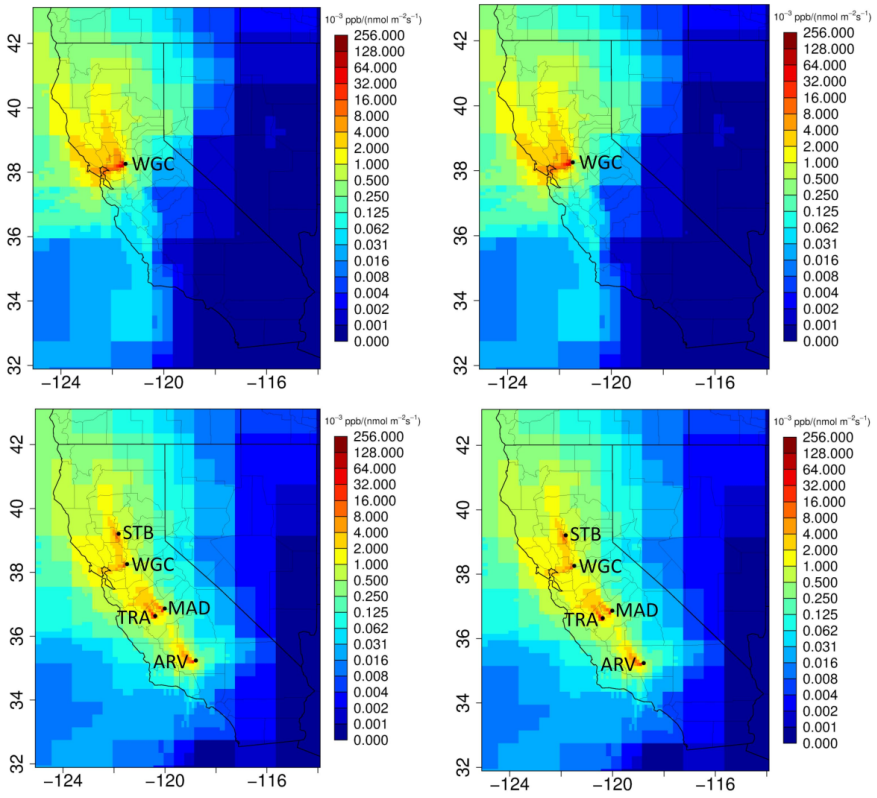

Figure 1. Averaged footprints during the noon-afternoon hours for the WGC site (top) and all five sites (bottom) during May – June 2011.