Seasonal Variations in CH_4 and N_2O Emissions from Central California

M.L. Fischer[1], C. Zhao[1], A.E. Andrews[2], L. Bianco[2], E. Dlugokencky[2], J. Eluszkiewicz[3], K. Masarie[2], T. Nehrkorn[3] and J. Wilczak[2]

[1]Lawrence Berkeley National Laboratory, Berkeley, CA 94720; 510-486-5539, E-mail: mlfischer@lbl.gov
[2]NOAA Earth System Research Laboratory, Boulder, CO 80305
[3]Atmospheric and Environmental Research, Inc., Lexington, MA 02421-3136

Methane and nitrous oxide mixing ratios measured at two tall-towers (Mt Sutro and Walnut Grove) in Central California are compared with model predictions to estimate surface emissions of CH_4 and N_2O from December, 2007 to November, 2008. Predicted mixing ratios are calculated based on spatially resolved *a priori* CH_4 and N_2O emissions and simulated atmospheric trajectories. Meteological fields are computed using the Weather Research and Forecast (WRF2.2) with a parameterization developed at the NOAA for simulations in California. Surface influence functions (footprints) are then calculated using the Stochastic Time-Inverted Lagrangian Transport model driven by the WRF output. Predicted winds and boundary layer heights compare favorably with measurements from radar wind profilers in the Central Valley. Footprints calculated for well-mixed periods at 91m on the Walnut Grove, California (WGC) tower vary with seasonal meteorology; broader footprints are obtained in winter due to more north-south winds, while narrower footprints oriented in the west direction area obtained in spring, fall, and particularly summer. Coupled with *a priori* emission models, predicted CH_4 and N_2O signals are computed and compared with measured mixing ratios. Predicted CH_4 is found to be statistically consistent with the measurements in winter but significantly under-predicted during the summer. Examination of the summer footprints reveals channeling from the Bay Area through the Sacramento delta to the WGC tower. This suggests that emissions from the Bay Area and the Delta region are likely stronger in summer or more concentrated on the footprint than in the inventory map. For N_2O, predicted mixing ratios are consistently lower than measured, suggesting that N_2O emissions are significantly underestimated. Further analysis will provide an update on predicted emissions from the Bay Area and Central Valley.

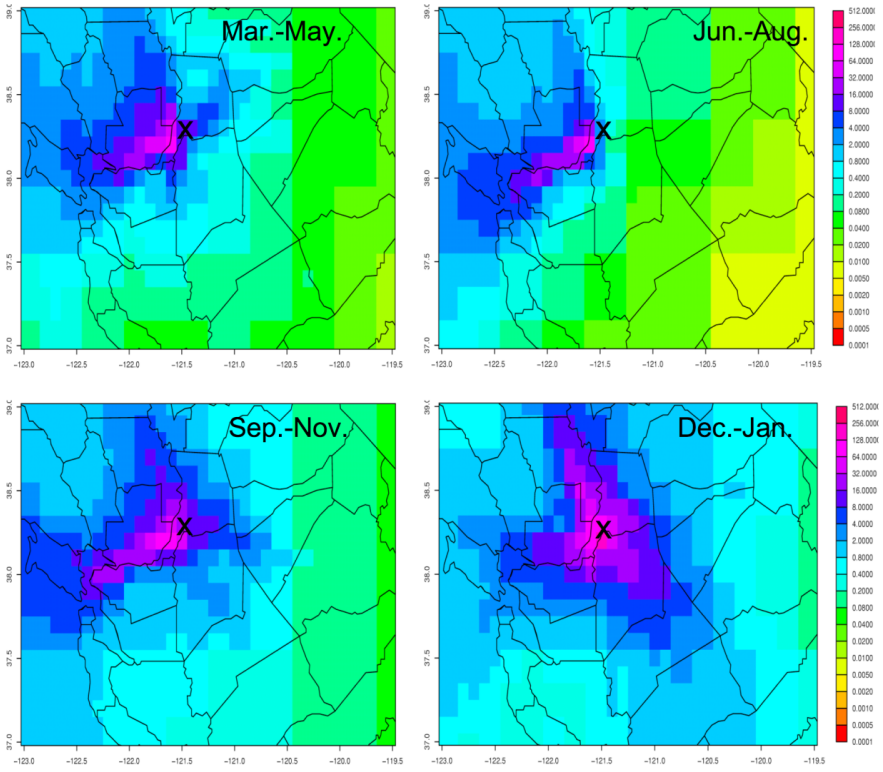

Figure 1. Seasonal well-mixed period footprints for 91m sample height on Walnut Grove Tower (marked with x) for December, 2007 to November, 2008.