Quantifying California's Anthropogenic Greenhouse Gas Budget

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Sustainable environmental and energy solutions require verifiable agreements to reduce anthropogenic greenhouse gas (GHG) emissions to the atmosphere. Supporting a vision for verified emissions reductions, we are quantifying anthropogenic GHG emissions at local to regional scales in California. We estimate California's GHG emissions using a combination of atmospheric measurements and inverse models that balance prior knowledge and measured information, each weighted by their respective uncertainties. Multi-species GHG measurements made over California are compared with high-resolution transport simulations that are carefully evaluated using the combination of radar-wind and lidar-aerosol profilers.

Fossil fuel CO_2 emissions, quantified using one year of radiocarbon $^{14}CO_2$ measurements at both Central (WGC) and one month at the Southern California (CIT) site, are consistent with existing emission inventories to within ~ 10%. CH_4 emissions, quantified by a five-tower network over a one-year period, are 1.6 +/- 0.1 times higher than a California inventory estimates, with significant seasonal variation (1-3) in scaling factor. N_2O emissions, estimated using two years of flask measurements at WGC, are 2 +/- 0.4 times higher than the EDGAR emission map for Central CA, again with seasonal dependence (1.6-2.5) in scaling factor. In contrast to CH_4 and N_2O, initial evaluation of select industrial GHGs (e.g., HFC 134a) suggest emissions may be smaller than the EDGAR emissions. Taken together, these results suggest CH_4 and N_2O emissions may comprise ~ 20% of California's total GHG emission budget. We are now increasing the coverage of measurement sites across California and, in broader collaborations, expect to provide comprehensive regional GHG emissions measurements for California.

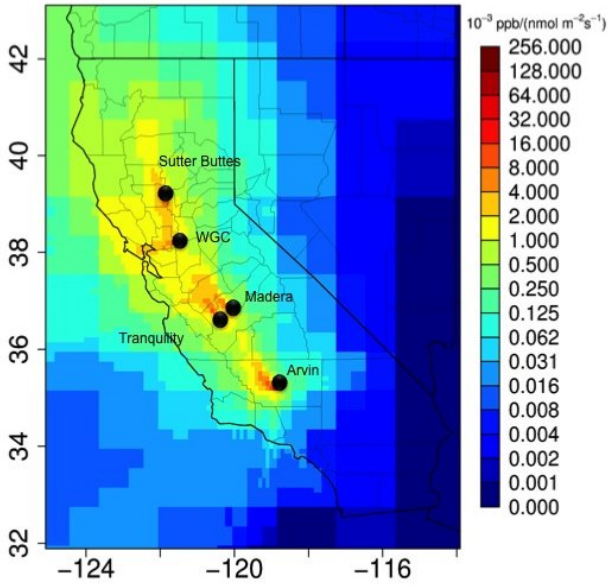

Figure 1. Footprint map showing afternoon sensitivity to surface emissions at Central Valley GHG measurement sites for May-June, 2011.