Top-down Estimate of Methane Emissions in California Using Aircraft Measurements During the CalNex 2010 Field Campaign

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Methane (CH_4) has a large global warming potential and mediates global tropospheric chemistry, but there are large uncertainties in the spatial distribution, magnitude and trends of methane emissions. In the United States, major anthropogenic sources of CH_4 include oil and natural gas (ONG) extraction, processing, and distribution, livestock management, agriculture, trash disposal, and wastewater treatment. Some of these sources have been changing rapidly in recent years. In the U.S. state of California, CH_4 emissions estimates derived from "top-down" methods based on atmospheric observations have been found to be greater than expected from "bottom-up" population-apportioned national and state inventories. Differences between bottom-up and top-down estimates suggest that the understanding of California's CH_4 sources is incomplete, leading to uncertainty in the application of regulations to mitigate regional CH_4 emissions. In this study, we use airborne measurements from the California research at the Nexus of Air Quality and Climate Change (CalNex) campaign in 2010 to estimate CH_4 emissions in the South Coast Air Basin (SoCAB), which includes California's largest metropolitan area (Los Angeles), and the Central Valley, California's main agriculture and ONG production area. Measurements of 12 daytime aircraft flights, prior information from national and regional official inventories (e.g. U.S. Environmental Protection Agency's [EPA] National Emission Inventory [NEI] and California Greenhouse Gas Emissions Measurement [CALGEM]), and the FLEXPART-WRF transport model are used in our mesoscale Bayesian inverse system. This presentation will focus on comparing our optimized posterior CH_4 emissions to prior bottom-up inventories, quantifying uncertainties in our CH_4 emissions estimates, analyzing spatial distributions of CH_4 surface fluxes in California, and discussing the significant role of local ONG industry and livestock sources in this region.

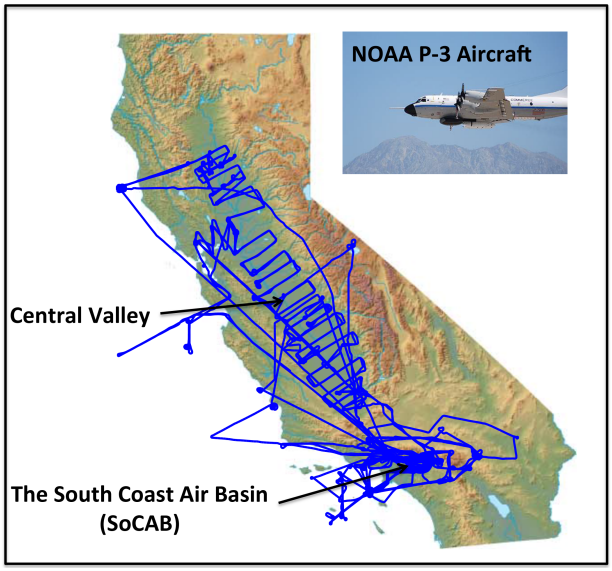

Figure 1. Blue lines are flight tracks of 12 daytime NOAA P-3 flights over California during the CalNex 2010 field campaign, including the South Coast Air Basin (SoCAB) and the Central Valley regions.