Comparing observations of fossil fuel-derived CO_2 in California with predictions from bottom-up inventories

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The US state of California has a progressive climate change mitigation policy, AB-32, enacted in 2006 to reduce greenhouse gas emissions 15% by 2020 and then a further 80% by 2050. Bottom-up inventories indicate California's fossil fuel CO_2 emissions are currently about 100 Mt C per year, but different inventories show discrepancies of ±15% in the state-wide total, and some larger discrepancies in various sub-regions of the state. We are developing a top-down framework for investigating fossil fuel and biospheric CO_2 fluxes in California using atmospheric observations and models. California has a relatively dense collaborative network of greenhouse gas observations run by several universities, government laboratories and Earth Networks. Using this collaborative network, we conducted three field campaigns in 2014-15 to sample flasks at 10 tower sites across the state. Flasks were analysed for atmospheric CO_2 and CO concentrations and for stable isotopes and radiocarbon in CO_2. The flask observations of radiocarbon in CO_2 allow patterns of fossil fuel-derived and biospheric CO_2 to be distinguished at relatively high resolution across the state. We will report initial results from the observations showing regional gradients in fossil fuel-derived CO_2 and fluctuations from changing weather patterns. We will compare the observations of fossil fuel-derived CO_2 to predictions from several bottom-up inventories and two atmospheric models. Linking the flask data with observations from OCO-2, TCCON, aircraft flights and ground-based in situ analyzers, we will examine the variation in total CO_2 and its drivers over California. Further analysis is planned to integrate the data into an inversion framework for fossil fuel and biospheric CO_2 fluxes over California.