Toward Simultaneous Multi-station Data Pre-processing for Inversions of Greenhouse Gas Emissions and Uptake in California

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Atmospheric observations and inverse modeling offer an objective basis to evaluate bottom-up accounting of greenhouse gas (GHG) exchange between the land surface and atmosphere, including anthropogenic emissions that may be subject to regulatory policy. Here, we describe initial progress on a project to improve atmospheric inversion estimates of California's emissions and uptake of CO_2 and CH_4 from atmospheric measurements of these gases at multiple stations. These efforts focus on development of data filtering algorithms to prepare continuous GHG observations for use with an inversion system combining mesoscale meteorology computed with the Weather Research Forecast (WRF) model with the Stochastic Time Inverted Lagrangian Transport (STILT) particle dispersion model (Lin et al., 2003). We compute variations in local GHG signals from California by subtracting estimated GHG background signals from measurements and compare them with local signals predicted with WRF-STILT footprints and EDGAR (Olivier et al. 2001) prior emission maps. We analyze the performance of the filtering algorithms for different times of day and averaging intervals. We evaluate the sensitivity of these results to the prior emissions using two versions of EDGAR (3.2 and 4.1). We expect the resulting filtering algorithms will become a useful tool for incorporating continuous GHG data streams into the WRF-STILT inversion and other GHG data assimilation systems at regional scales.

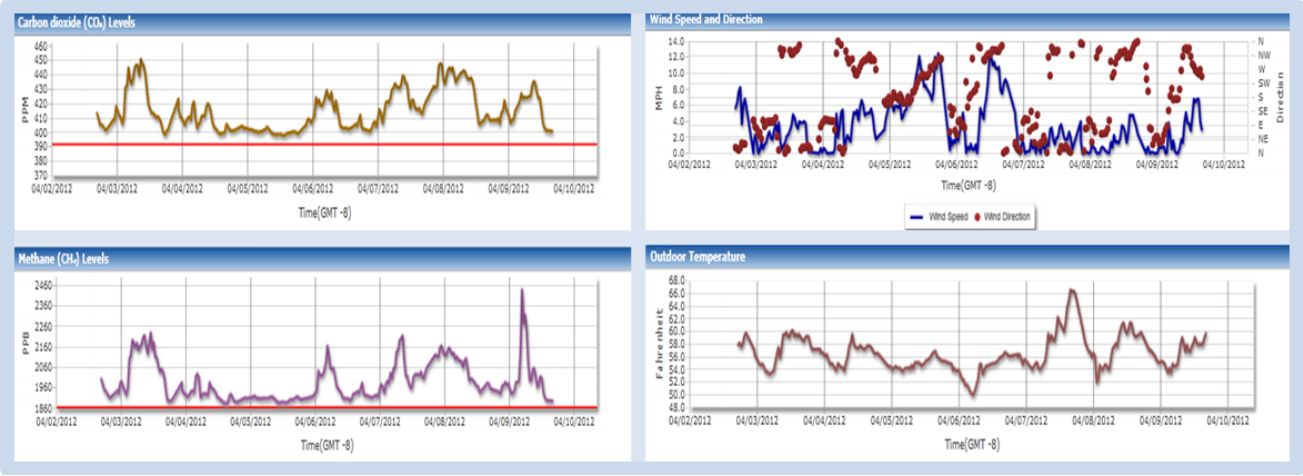

Figure 1. Observed CO_2 (top left), CH_4 (bottom left), wind speed and direction (right top), and temperature (right bottom) at La Jolla, CA site on April 4-10, 2012.