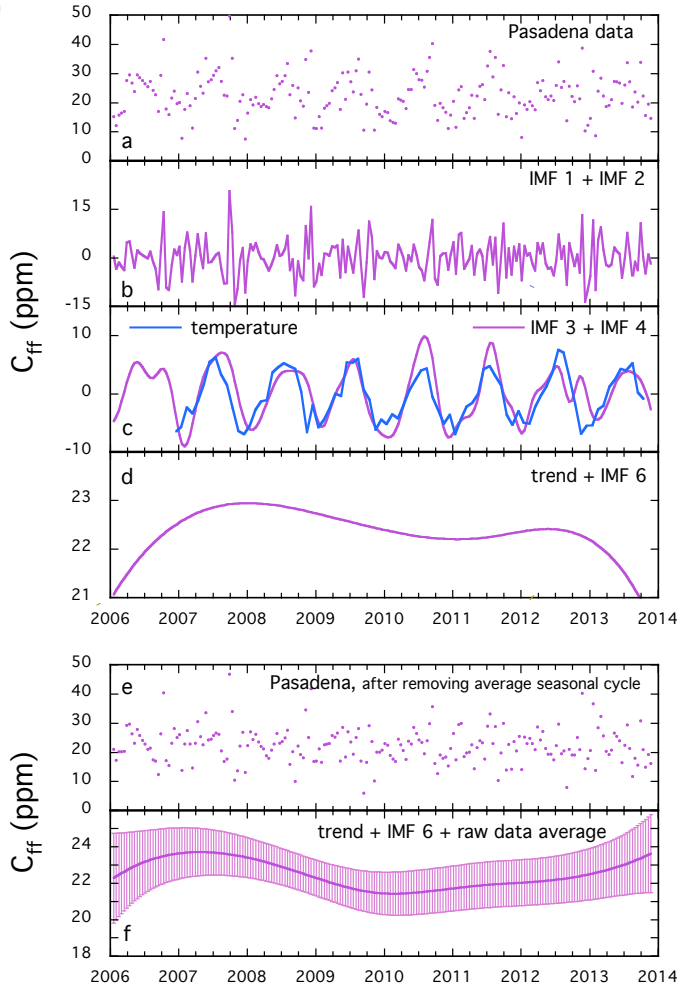

Figure 10. Results of ensemble empirical mode decomposition (EEMD) (Huang et al., 1998; Wu and Huang, 2009) of the C_{ff} time series calculated using Eq. (3) and the average, constant $\Delta^{14}C$ of -954 ‰ for fossil fuel. The top set of panels show the raw data (a), noise (b), annual and semi-annual mode (c), and the trend + IMF 6 (d). The pattern of the trend + IMF 6 shown in (d) is within 1σ uncertainty of no variation over this time period. The bottom two panels include the raw data after subtracting the average annual cycle (centered at zero) (e) and the trend + IMF 6 for the modified data set (f). 30-day average temperatures (minus the overall average and scaled to match the magnitude of the C_{ff} IMF; blue curve) are superimposed on the plot of IMF 3 + IMF 4 (c). Shaded regions in (f) indicate 1σ standard deviation of 300 Monte Carlo realizations with 13.7 % noise added, the ratio of the uncertainty in C_{ff} to the standard deviation of the data.

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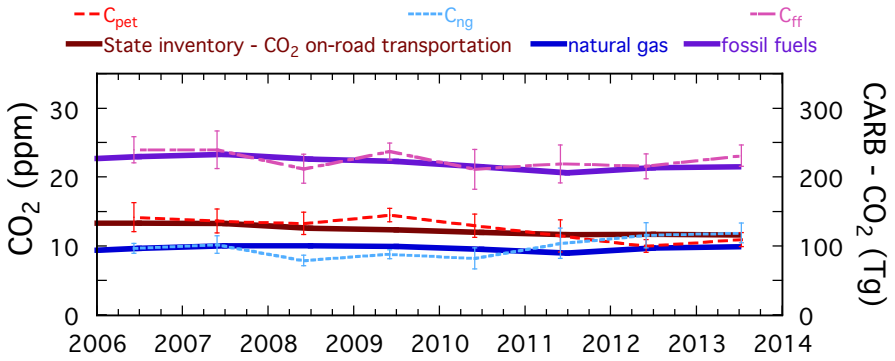

Figure 11. Comparison of annual average CO_2 emissions from bottom-up California Air Resources Board (CARB) inventories (thick lines; right axis labels) for fossil fuel-derived emissions with top-down annual averages from the Pasadena data, using the Miller and Tans (2003) approach to attribute CO_2 emissions from petroleum and natural gas combustion from the $\delta^{13}C$ measurements. Annual curves showing the attribution of C_{xs} averaged from the seasonal values from Fig. 6b are shown as thinner lines. The error bars on the results from the flask sample data are 1σ standard errors of the means. The annual trends from the bottom-up CARB inventories are plotted on a scale exactly 100 times that of the trends derived from the CO_2 measurements, showing that the relative proportions are very similar through 2013.

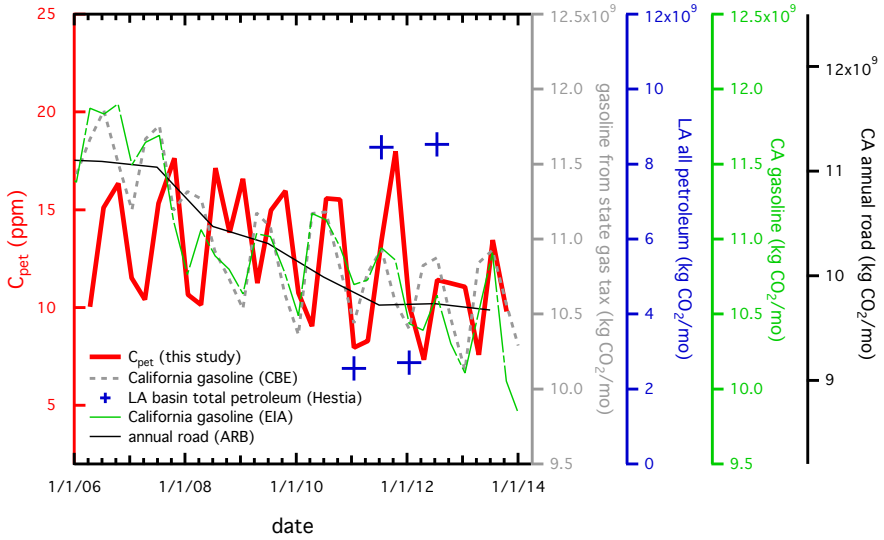

Figure 12. Comparison of the Pasadena C_{pet} atmospheric concentration with all available area-integrated bottom-up fossil fuel CO_2 emissions per month (mo), including gasoline sales based on taxes paid to the California Board of Equalization (CBE, 2014), gasoline provided in California by prime suppliers, the California Air Resources Board's annual road emissions (CARB, 2015), and the Hestia-LA gridded total petroleum. The Hestia-LA data product is specific to the Los Angeles megacity domain; all inventories are statewide estimates. Since the Hestia-LA product is gridded, we show the emissions emanating from different regions for January (northeast quadrant, Fig. 13a) and July (southwest quadrant), based on prevailing winds during those periods (Figs. 7 and 13a). The axis for each inventory has been adjusted to allow easy comparison. The seasonality of the C_{pet} data lags the bottom-up inventories by a few months. This analysis is consistent with the observed decrease in gasoline combustion during 2008-2011.