Long-term Trends in Carbon Dioxide Enhancements in an Urban Region

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Urban regions are characterized by highly concentrated emissions of greenhouse gases, accounting for an estimated ~70% of global fossil fuel carbon dioxide (CO_2) emissions from energy usage. Here we present a unique, long-term record of CO_2 concentrations at five locations ranging from rapidly growing to fully mature urban regions in Utah's Salt Lake Valley (SLV), based on continuous measurements since 2001. Trends in concentration enhancements above background levels were found to vary throughout the valley, with mature urban areas (Salt Lake City) exhibiting stable CO_2 enhancements and areas undergoing suburban growth, having increasing CO_2 enhancements. Hypotheses to explain the trends in CO_2 enhancements will be discussed, including changes in socioeconomic (e.g., population, traffic) and meteorological (e.g., atmospheric mixing heights, temperatures) factors. This network also provides a case study for understanding factors relevant to the design of urban trace gas observatories.

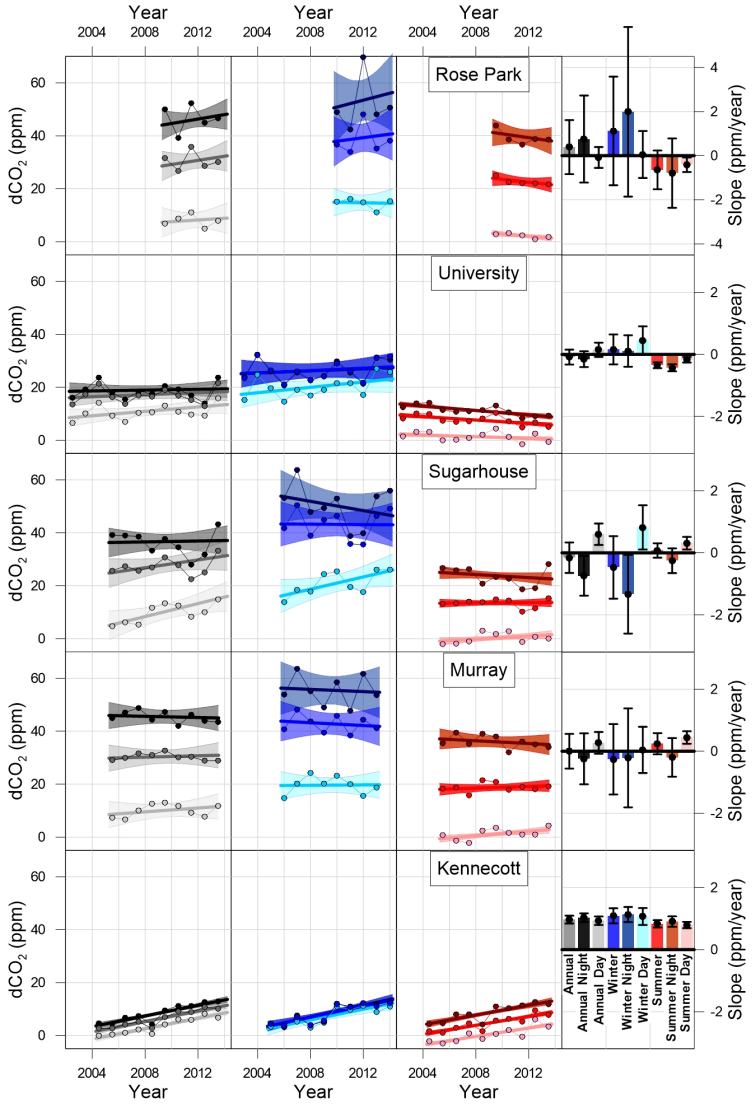

Figure 1. Trends in SLV CO_2 concentrations (± 2σ) calculated from weekly averaged data. Panels show annual, winter, and summer trends (left to right) for night, all day, and afternoon times of the day (top, middle, bottom) for the five sites in the SLV CO_2 monitoring network. Right panel shows the slope of the linear trend through the data.