Geophysical Research Abstracts
Vol. 14, EGU2012-6986-2, 2012
EGU General Assembly 2012

Initial results from a CO_2 monitoring network in the Los Angeles megacity

S. Newman (1), Y. K. Hsu (2), E. A. Kort (1,3), S. P. Sander (3), A. Eldering (3), R. M. Duren (3), C. E. Miller (3), and Y. L. Yung (1)

(1) California Institute of Technology, Pasadena, CA, United States, (2) California Air Resources Board, Sacramento, CA, United States, (3) Jet Propulsion Laboratory, Pasadena, CA, United States

Urban regions, such as Los Angeles, CA, contain more than half of the world's population and contribute an even larger fraction of its greenhouse gas (GHG) emissions. One practical method for tracking these emissions is by high-resolution space-borne remote-sensing instruments, such as the Orbiting Carbon Observatory (OCO-2, spatial resolution of $\sim$3 km^2). In conjunction with space-borne measurements, in situ measurements can be used to elucidate the details of urban emission patterns and trends. Indeed, to understand GHG emissions in complex urban regions, we must sample in multiple locations with the goal of obtaining specific information from each site.

We have studied CO_2 in Los Angeles from three sites that form the anchor points of a developing megacity monitoring network. The sites form a $\sim$45 km transect that extends from the Pacific Ocean coastline to the southwest, over the Los Angeles basin, to the San Gabriel Mountains that form the northern boundary of the basin. Using in situ measurements of CO_2 from Palos Verdes peninsula (PV), Pasadena, and Mt. Wilson (MW), from May 2010 – April 2011, with additional analysis of data since 2001 in Pasadena, we determined the seasonal variations of boundary layer CO_2 mixing ratios. The amplitude of the seasonal and diurnal variations is much larger in Pasadena than at the other two sites, and the PV site shows more variability than the MW site. PV is on the coast, with dominant westerly breezes bringing air from the ocean, except when unusual weather patterns occur. The average patterns here reflect the global clean-air pattern, with lowest mixing ratios during the summer and highest during the winter. Pasadena is inland, in the San Gabriel Valley close to the mountains, and is a good receptor site for receiving the emissions signal from the Los Angeles basin. The CO_2 signal here is strongly affected by diurnal changes in boundary layer height, reflected in diurnal variations averaging 70 ppm during winter, with the lowest mixing ratios during mid-day. Mt. Wilson is at 1.7 km elevation in the San Gabriel Mountains, and is above the mixed layer for much of the time, except during mid-day when the boundary layer frequently expands above its location and when upslope flow brings a small signal from the basin, resulting in a peak in mid-afternoon. Our calculations indicate that, when space-borne remote-sensing instruments look at these three sites, they will observe the clean-air signal at both PV and MW, whereas the anthropogenic signal, including its seasonal cycle, will be clearly seen within the Los Angeles basin at the Pasadena site.