Skies of Blue

Cleaner cars are emitting fewer pollutants

By Leigh Cooper

From Venice Beach to Disneyland, people in the greater Los Angeles area are breathing easier, as the addition of catalytic converters and the removal of some volatile compounds from fuel has improved LA air quality during the last half century. "Every generation of cars gets more efficient and burns fuel more cleanly," says Carsten Warneke, a CIRES scientist at NOAA's Earth System Research Laboratory (ESRL).

For the last 50 years, scientists have meticulously measured air pollution in the LA Basin, documenting the results of strict vehicle emissions policies initiated since the 1960s. Gasoline consumption has tripled in the basin since then, but vehicular emissions have declined. "All pollutants, such as nitrogen oxides (known as NO_x), particulate matter, and volatile organic compounds (or VOCs), have dropped solidly since the '60s," Warneke says. "VOCs are dropping at a rate of 7.5 percent per year, which is huge."

CIRES and NOAA scientists and their colleagues collected some of the most recent data by flying instrumented research aircraft over the basin to study air quality and comparing those measurements to historical data. In the LA Basin, VOCs (which are mainly emitted from passenger cars), NO_x (which now has very large sources from diesel-fueled vehicles), and sunlight are the primary ingredients that form ozone, a pollutant harmful to human and plant health and a major component of smog.

"Policymakers at the time decided to reduce ozone by reducing emissions of VOCs," says Ilana Pollack, a CIRES scientist at ESRL. "Historical measurements spanning 50 years (1960 to 2010) show ozone and some other pollutants have decreased because of the strict emission standards placed on cars."

Although ozone has been the primary target for reductions, the chemical reactions occurring in LA's atmospheric soup form other gaseous pollutants as well. One of these, peroxyacetyl nitrate (PAN), causes eye irritation. "The cleanup of LA's air has reduced both ozone and PAN," Pollack says. "Because of this, LA's air has lost a lot of its 'sting.'"

Emissions standards have had success beyond LA, and vehicle emissions have decreased nationwide, Pollack says. NOAA and CIRES researchers and their colleagues will soon compare the pollutant-forming atmospheric chemistry of LA with other regions of the country. Measurements from a 2013 field study in the southeastern United States—a region where cars, electric power plants, and vegetation emit pollutant precursors—will provide insight into how vehicle emissions interact with natural emissions to form pollutants.

Beyond ozone pollution

Volatile organic compounds can react to create ozone, but they also can react in sunlight to produce fine airborne particles known as secondary organic aerosols (SOAs). SOAs have been linked to negative effects on human health and visibility and can also affect climate. Jose-Luis Jimenez, a CIRES scientist, studies the origin of these particles. Jimenez has used weekend traffic trends to determine whether diesel trucks, which decrease in number on weekends, have a greater influence on the production of SOAs than gasoline cars, which remain the same on weekends. Jimenez's preliminary work points to gasoline cars as the main source of SOAs. "Where secondary organic aerosols originate is a very important question, because it influences the effectiveness of different possible policy approaches," Jimenez says.