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NCAR Scientist's Laser Technique Measures Long-Lived Trace Gases

Alan Fried, an atmospheric chemist at NCAR, has developed a high-precision laser spectrometer that accurately measures trace-gas concentrations in ambient air. Fried presented an invited paper outlining numerous applications of the system at the International Symposium on Monitoring Gaseous Pollutants at Freiburg, Germany, in October.

The laser technique, called tunable diode laser absorption spectroscopy (TDLAS), is a highly sensitive and selective method of measurement. Its precision allows scientists to accurately detect small fluctuations in the concentrations of long-lived atmospheric gases, including carbon dioxide (CO_2), methane(CH_4) and carbonyl sulfide (OCS). These fluctuations, sometimes as small as one percent of their respective ambient concentrations, contain important information about sources, sinks and potential secular trends.

In one application, Fried uses the TDLAS technique to measure background concentrations of carbonyl sulfide, an important nonreactive gas produced in nature and anthropogenically. Natural sources of OCS are the oceans and the biosphere, while humans produce it by burning coal and other fuels rich in sulfur. OCS eventually reaches the stratosphere, where it contributes to the background sulfate aerosol layer (the Junge layer) during nonvolcanic time periods. Because these aerosols have the capacity to absorb and efficiently scatter solar radiation, long-term enhancement of the Junge layer could ameliorate the greenhouse effect to some degree. However, this enhancement also contributes to ozone depletion via heterogeneous chemical reactions that occur on the aerosol particles.

In an attempt to understand the role of automobiles as a global source of OCS, Fried and his colleagues transported the TDLAS system to the Colorado Department of Health's automobile test facility in Aurora, where they tested a broad range of vehicles. They measured OCS emissions from new and old vehicles, with and without catalytic converters. The results of this study, recently accepted for publication by the *Journal of Geophysical Research*, indicate that automobiles are not a significant global source of carbonyl sulfide. However, this study also confirmed that measurements of background OCS concentrations can be severely perturbed by automobiles.

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