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Development of a High Precision and Stability Ambient N_2O and CO Analyzer

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With a global warming potential of nearly 300, N_2O is a critically important greenhouse gas, contributing about 5 % of the US total GHG emissions. Agriculture soil management practices are the dominant source of anthropogenic N_2O emissions, contributing nearly 75 % of US N_2O emissions. In urban areas, vehicle tailpipe emissions and waste water treatment plants are significant sources of N_2O.

We report here a new mid-infrared laser-based cavity ring-down spectrometer (Picarro G5310) that was recently developed to simultaneously measure sub-ppb ambient concentrations of two key greenhouse gas species, N_2O and CO, while measuring H_2O as well. It combines a quantum cascade laser with a proprietary 3-mirror optical cavity. The ambient N_2O and CO measurement precisions are 0.1ppb (10sec), 0.014ppb (600sec), and 0.006ppb (3000sec); and the measurements could even be averaged down over 3 hours, giving measurement precisions of 0.003ppb. The measurable N_2O and CO ranges have been tested up to 2.5ppm. With the high precision and unparalleled stability, G5310 is believed a promising tool for long-term monitoring in atmospheric sciences.

The new optical analyzer was set up to monitor N_2O and CO (G5310), along with CO_2 and CH_4(G4301), in ambient air obtained from a 10 meter tower in Santa Clara, California. Evidence of contributions from traffic and a nearby sewage treatment facility were expected in the measurement data.