# An Ultra-stable and High-precision N_2O/CO Analyzer for Continuous Ambient Monitoring

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With a global warming potential of nearly 300 times that of carbon dioxide (CO_2) at a 100-year time horizon, nitrous oxide (N_2O) has become a critically important greenhouse gas with a contribution of ~5 % of the U.S. total GHG emissions. It is also well-known that N_2O has been one of the most important species that has been causing stratospheric ozone depletion and will be remain in the atmosphere for centuries due to its long life time. Agriculture soil management practices are the dominant source of anthropogenic N_2O emissions, contributing nearly 75 % of U.S. N_2O emissions. In urban areas, vehicle tailpipe emissions and waste water treatment plants are significant sources of N_2O. However, the variation of N_2O in the atmosphere is very small with an average growth rate of <0.8 ppb per year. Therefore, an inter-laboratory comparability goal of ±100 ppt is recommended by WMO for ambient monitoring 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 two key greenhouse gas species, N_2O and carbon monoxide (CO) with both high precision and high stability. It combines a quantum cascade laser with a 3-mirror optical cavity. Over an 8-day continuous measurement of a stable source without any calibration, the peak-to-peak variation is 53 ppt for CO and 33 ppt for N_2O. With such a high precision and unparalleled stability, the analyzer is a promising tool for long-term global monitoring of N_2O/CO in ambient air.
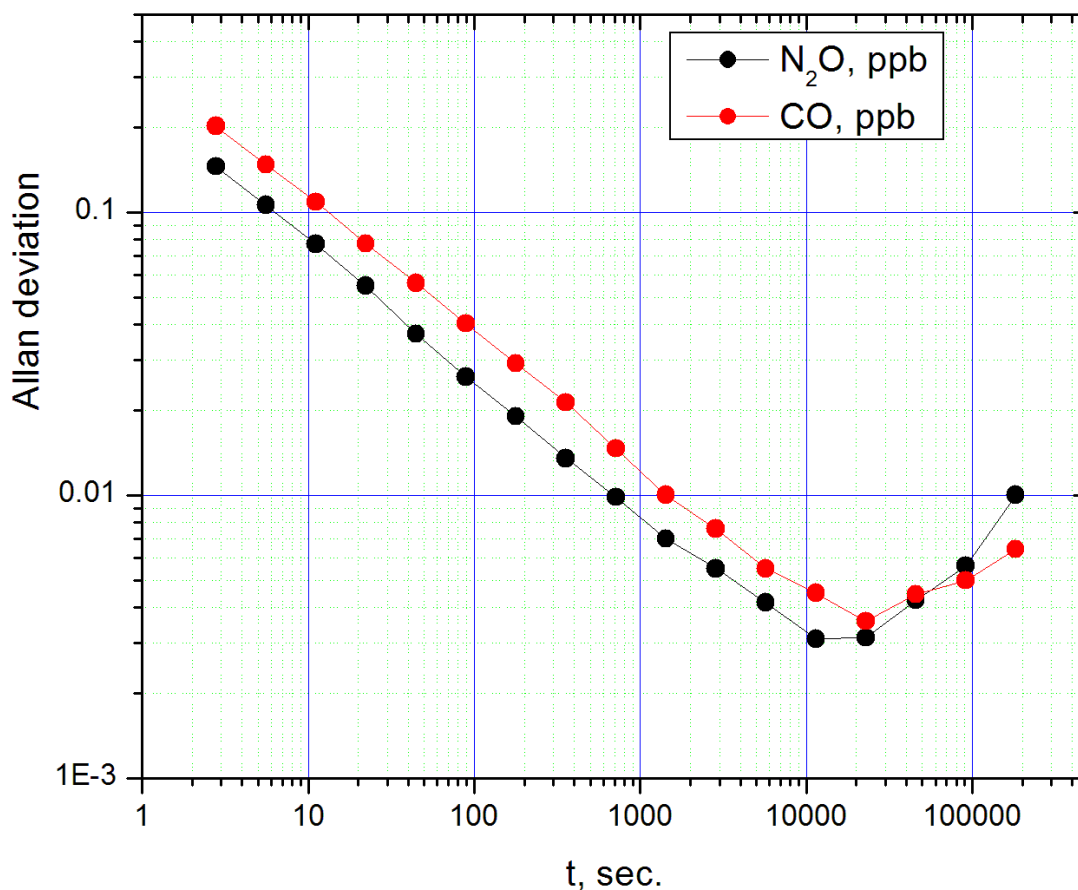
Figure 1. Allan Deviation plot of measured N_2O and CO in dry air.