

# Urban Flux and Other Micrometeorological Applications of the Picarro G2311-*f* Methane, Carbon Dioxide, and Water Vapor Analyzer<sup>[1]</sup>

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## Abstract

As requirements for accurate measurement of greenhouse gas fluxes become more demanding, the need for testing new technology in diverse research settings is imperative for full characterization of instrument performance & capability. Picarro has developed a new, high speed, closed path analyzer for measuring carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and water vapor (H<sub>2</sub>O), using Cavity Ring-Down Spectroscopy (CRDS) technology. Picarro model G2311-*f* makes concentration measurements at a 30-Hz rate with the result that all three molecules are measured at 10 Hz with high precision and accuracy. The new flux analyzer has recently been deployed for testing and validation in three different flux research settings: On the largest green roof in New York City with Dr. Wade McGillis, at a desert site in Railroad Valley, Nevada with Dr. Emma Yates, and at the Wetzstein spruce site with Dr. Olaf Kolle from the Max Plank Institute in Germany. Summaries of these deployments to date are presented to show the instrument's actual performance in highly varied field sites. The new flux instrument has proven capable of meeting the specified performance of raw 10 Hz precision (one standard deviation) better than 110 parts-per-billion (ppb) for carbon dioxide, better than 3 ppb for methane and better than 6 ppm + 0.3 % of reading for water vapor. Dry mol fractions of CO<sub>2</sub> and CH<sub>4</sub> are reported in real time with corrections for both dilution and spectroscopic effects made automatically. These corrections provide the ability to measure low level carbon fluxes accurately even during periods of high latent heat flux. A key new feature being tested is the automatic time-synch and integration of concentration data with 3D sonic anemometer data. Multiple measurement modes provide flexibility for using the same instrument for long term monitoring or for measuring fluxes using the eddy-covariance or other techniques such as the gradient flux method, relaxed eddy-covariance, or eddy accumulation.

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