Abstract
As requirements for flux measurement of greenhouse gases become more demanding, the need for testing new technology in diverse research settings is imperative for full characterization of instrument performance & capabilities. Picarro has developed a new, high speed, cavity Ring-Down Fluorescence spectroscopic (CRDS) based analyzer for measuring mixing ratios of CO2, methane (CH4), and water (H2O), the Picarro G2311-f. Concentration measurements are taken at a 30 Hz rate with the result that three species are measured at 1 Hz with extremely high precision and accuracy. This new technology has 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 Ralleva Road, Nevada with Dr. Emma Yates, and at the Wetzstein spruce site with Dr. Olaf Kolle from Lamont-Doherty Earth Observatory in New York State. 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 new 1 Hz precision (standard deviation) better than 1.0 parts-per-billion (ppb) for carbon dioxide, better than 0.1 ppm of methane and better than 0.0 ppm + 0.3% of reading for water vapor. Dry mol fractions of CO2 and CH4 are reported in real time with connections for both dilution and spectrscopic effects made automatically. Low level carbon fluxes have been measured even during periods of high latent heat flux. A key additional feature tested is the automatic time-synch and integration of concentration with 3D dilution and spectroscopic effects made automatically. Low level carbon fluxes have been measured even during periods of high latent heat flux. A key additional feature tested is the automatic time-synch and integration of concentration with 3D dilution and spectroscopic effects made automatically. Low level carbon fluxes have been measured even during periods of high latent heat flux. A key additional feature tested is the automatic.

Railroad Valley: Instrument Deployment #2

Data courtesy of Dr. Wade McGillis

Summary
The railroad valley vicarious calibration campaign, a collaboration between the Japan Aerospace Exploration Agency (JAXA) and NASA’s jet propulsion laboratory (JPL), Pasadena, Calif., is an international, multi-year effort to calibrate space-based observations of CO2 and CH4, collected by the Japanese Greenhouse Gas Observing Satellite (GOSAT), using ground and airborne data. It involves more than 30 scientists and engineers from JAXA, the University of Wisconsin, Madison, Colorado State University, Fort Collins and JPL. Railroad Valley is a dry lake bed, or playa, in Nevada. The NASA Ames team deployed the new Picarro flux instrument at ground level and two additional Picarro instruments in aircraft (Unmanned Aerial Vehicles or UAVs). This deployment tested the stability of the new Picarro flux instrument as well as its performance in Nevada desert conditions. Daily average drift of the G2311-f over the 15 day period was 109 ppm for CO2 and 0.01 ppm for CH4.

Instrument Set Up
The surface Picarro was deployed in a small tent (Figure 1) and air was drawn from a short (5 m) tower. The Picarro was operated in slow flow mode giving cell turnover of 0.5 Hz. The Picarro pneumatic and stored concentration measurements with 10 Hz data from an R925 Young 3D Sonic Anemometer.

Instrument Stability Data
The Picarro was calibrated at NASA lab before and after deployment with primary standard calibrations done to ascertain the instrument offset and precision. The average (ppm & ppm) precision was found to be 1.1 ppm for CO2 and 0.09 for CH4. Secondary standards were used to calculate the total daily average of the instruments (shown in above graphs) with a comparison to the other Picarro instruments. The total (15 day) measured drift of the instrument (post - prep) was 1.52 ppm for CO2 and 0.17 for CH4. Reacting the data to the 10 ppm for CH4.

Further results from this deployment can be found in an upcoming NASA publication and will also be presented at AGU in San Francisco.

Wetzstein: Instrument Deployment #3

Data and Analysis courtesy of Dr. Wade McGillis

Summary
The Wetzstein spruce site, in Thuringia, Germany, was established as part of the CarboEurope-IP Flux Network and has been making eddy covariance measurements since December 2001. The site is located on a hill subject to strong winds and high levels of turbulence for continuous periods, and thus will be a good test of the new flux analyzer’s capability to measure high frequency eddies. The new Picarro flux instrument was deployed along with existing Picarros (G2301-f, G2311-f) in 2005. The new instrument was calibrated by NOAA gas standards and Licor Dew Point generator and the Picarro was then deployed with the factory calibration.

The instrument is an international, multi-year effort to calibrate space-based observations of CO2 and CH4, collected by the Japanese Greenhouse Gas Observing Satellite (GOSAT), using ground and airborne data. It involves more than 30 scientists and engineers from JAXA, the University of Wisconsin, Madison, Colorado State University, Fort Collins and JPL. Railroad Valley is a dry lake bed, or playa, in Nevada. The NASA Ames team deployed the new Picarro flux instrument...