The New Picarro G2311-*f* Methane, Carbon Dioxide, and Water Vapor Analyzer For Micrometeorological Applications

C. Rella[1], G. Jacobson[1], C. Sweeney[2], W. McGillis[3], A. Karion[2], C. Thomas[4] and E. Crosson[1]

[1]Picarro Inc, 3105 Patrick Henry Drive, Santa Clara, CA 94054; 408-962-3941, E-mail: crella@picarro.com
[2]Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO 80309
[3]Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964
[4]College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, OR 97731

Picarro has developed a new analyzer, the G2311-*f*, a high speed Cavity Ring-Down Spectroscopy (CRDS) based analyzer for measuring carbon dioxide (CO_2), methane (CH_4) and water (H_2O) at 10 Hz with both high precision and high accuracy. The new analyzer includes new capabilities and improves upon the performance demonstrated in the previous version, the G2301-*f*, launched in 2010. In an effort to prove out the viability of the G2301-*f* for micrometeorological applications, a number of land- and sea-based tests have been performed by research teams from NOAA, Oregon State University, and Columbia University using the G2301-*f*, including eddy covariance tests on land and at sea, and sea water head space equilibration tests in the Gulf of Mexico. As a result of this validation effort, Picarro has developed a new analyzer, the G2311-*f*, which is capable of measuring carbon dioxide to a precision (one standard deviation) of 200 parts-per-billion (ppbv), methane to a precision of 2 ppbv, and water vapor to a precision of 20 ppm. Concentration measurements are taken at a 30-Hz rate with the result that all three species are measured at a 10-Hz rate with extremely high accuracy. Water vapor is measured with sufficient precision for direct measurement of the latent heat flux as well as dilution and spectroscopic correction for carbon dioxide and methane. In addition, the data stream from a 3D sonic anemometer has been time-synched and integrated into the instrument graphical user interface and data logging software, and the environmental temperature range has been expanded to allow measurements over an even broader range of environmental conditions. This flexible device is capable of simultaneously measuring fluxes of carbon dioxide, methane, and latent heat using the eddy-covariance technique, but it can also be employed with other techniques that require the high accuracy and precision inherent to the time-based CRDS method, including the gradient flux method, relaxed eddy-covariance, headspace equilibration chambers, leaf / soil chambers, long-term tall-tower measurements, mobile plume mapping, and much more. We report the results of the validation test of the G2301-*f* and on the development of the new G2311-*f* instrument.

[1] This material is based upon work supported by the Department of Energy (DOE) Small Business Innovation Research Program under Grant No. DE-FG02-07ER84902 and does not constitute an endorsement by DOE of the views expressed in this presentation.

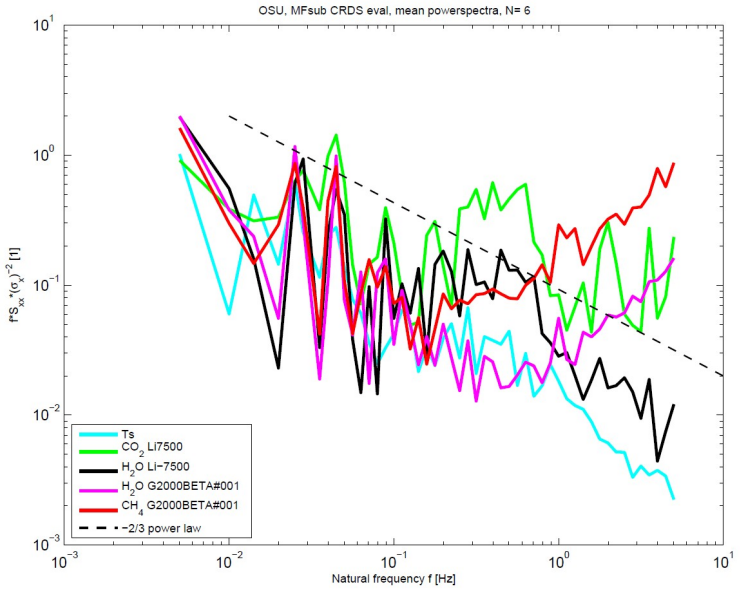

Figure 1. CH_4 and H_2O co-spectra of the Picarro Model 2301-*f* and CO_2 and H_2O co-spectra of the Licor Li-7500. Data taken at the Mary's River site.