Adaptation of a Commercial Greenhouse Gas Analyzer for Expanded Altitude Range

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The commercial availability of the Picarro cavity ring down spectrometer has advanced our community's ability to make highly stable and precise measurements of CO_2 and CH_4 mixing ratios in the atmosphere. We have expanded the Picarro's operating altitude range through a software modification to lower its cell pressure set point. This approach avoids the need for significant engineering of auxiliary systems, such as for upstream sample pumping or pressure control. We characterize the modified analyzer's performance through a series of laboratory tests, controlled field tests, and on an aircraft campaign that sampled at altitudes up to 14 km (150 mbar). The concept of a flexible cell pressure set point, without significant reductions in pressure control or measurement precision, opens up new possibilities for airborne platforms from which we can make continuous greenhouse gas measurements with minimal operational requirements.

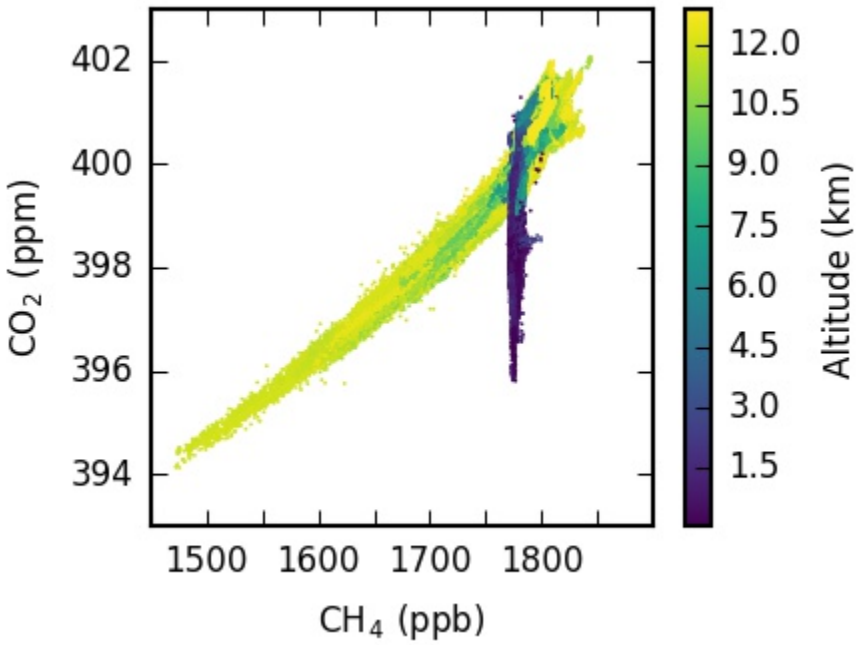

Figure 1. Unfiltered 1-second measurements of atmospheric CO_2 versus CH_4, colored by altitude, made by the modified Picarro analyzer during the ORCAS campaign over the Southern Ocean (30-75° S, 50-90° W) in January-February, 2016. The high-precision and stability of the low-pressure analyzer allow for the rendering of tight CO_2-CH_4 relationships across the broad altitudinal (0-13 km) range sampled of the campaign.