Measurements of atmospheric oxygen using a newly built CRDS analyzer and comparison with a paramagnetic cell and an IRMS

Markus Leuenberger[1], Tesfaye Berhanu[1], David Kim-Hak[2], John Hoffnagle[2] and Minghua Sun[2]

[1]Climate and Environmental Physics Institute, University of Bern, Bern, Switzerland

[2]Picarro Inc., Santa Clara, USA

Corresponding author: leuenberger@climate.unibe.ch

Oxygen is a major and vital component of the Earth's atmosphere which is consumed or produced through biochemical processes such as combustion, respiration, and photosynthesis. Changes in its concentration and isotopic composition can be used to better understand different biogeochemical processes as well as to constrain the global carbon cycle. However, the variations of oxygen in the atmosphere are relatively small, in the order of a few ppm's, posing a technical challenge for accurate measurements since a very high level of precision is required.

Here we present atmospheric oxygen concentrations and isotopic measurements based on a new high-precision gas analyzer that utilizes the technique of Cavity Ring-Down Spectroscopy (Picarro G2207-*i*). The instrument's compact and ruggedness design combined with high precision and long-term stability allows the user to deploy the instrument in the field for continuous monitoring of atmospheric oxygen. Measurements have a 1-σ 5-minute averaging precision of 1-2 ppm for O_2 over a dynamic range of 0-50%. We will present comparative test results of this instrument against the incumbent technologies such as the mass spectrometer and the paramagnetic cell. In addition, we will demonstrate its long-term stability from a field deployment at the Beromünster tall tower and the High-Alpine research site Jungfraujoch in Switzerland.