

Integrated Path Differential Absorption (IPDA) LIDAR Measurement of CO₂, CH₄, and H₂O

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We present IPDA LIDAR measurements of carbon dioxide (CO₂), methane (CH₄), and water (H₂O) using a ground-based system developed at the National Institute of Standards and Technology (NIST). The transmitter of the system is based on an external cavity diode laser (ECDL) which is spectrally filtered, rapidly scanned using electro-optic sidebands, and amplified using a booster optical amplifier. The transmitter is operating at eye-safe power levels. The tuning range covers 37.5 GHz across absorption features of CO₂, CH₄, and H₂O in the wavelength region of 1602 nm and 1645 nm.

Nighttime IPDA LIDAR measurements of CO₂, CH₄, and H₂O over a path length of 5.5 km were performed in October 2015 in Boulder, CO, USA. Simultaneously, the atmospheric boundary layer was monitored during the IPDA LIDAR measurements using a backscatter LIDAR at 1064 nm. IPDA LIDAR concentrations of CO₂, CH₄, and H₂O were compared with those obtained from a commercial cavity ring-down instrument (Picarro G2301^(*)).

Further details of the IPDA LIDAR system and measurements will be presented at the conference.

^(*) Certain equipment, instruments or materials are identified in this paper in order to adequately specify the experimental details. Such identification does not imply recommendation by the National Institute of Standards and Technology nor does it imply the materials are necessarily the best available for the purpose.

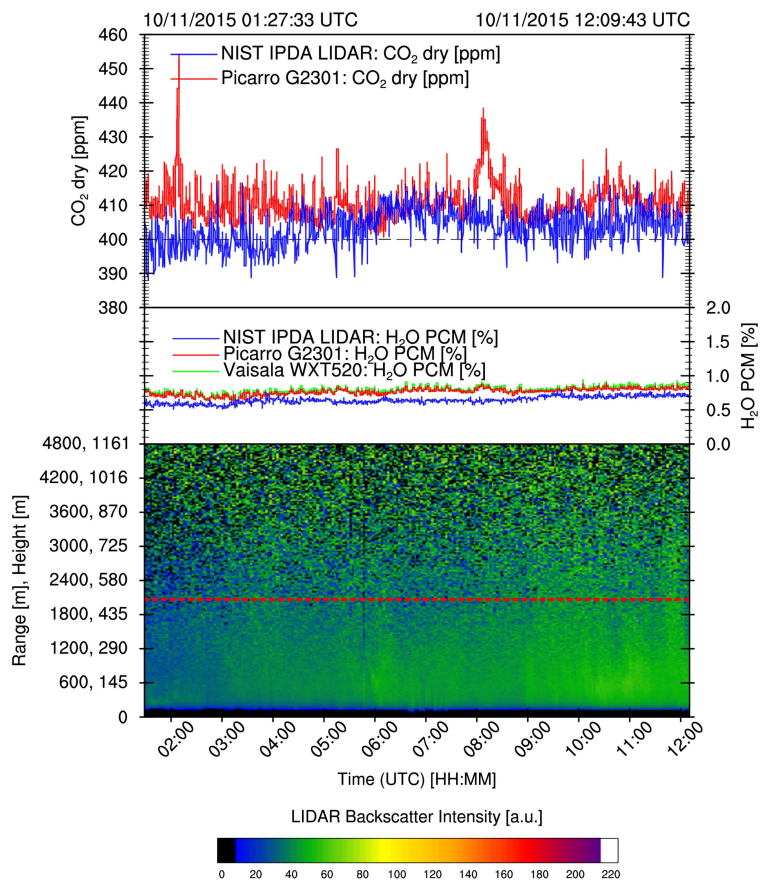


Figure 1. The nighttime CO₂ dry air mixing ratios measured using the IPDA and CRD instruments (top panel) on October 11, 2015 (UTC). The water concentrations measured with the IPDA system are shown in the middle panel together with the data from the CRD and humidity sensors. The background- and range-corrected signal intensity of the backscatter LIDAR is shown in the lower panel.