



Atmospheric measurements of carbon dioxide and methane at Railroad Valley playa, Nevada, USA

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Ground based in-situ measurements of carbon dioxide (CO₂) and methane (CH₄) at the dry lakebed at Railroad valley (RRV) playa, Nevada, USA (38°30.234'N, 115°41.604'W, elevation 1437 m) were conducted over a five day period from 20-25 June 2010. The playa is a flat, desert site with virtually no vegetation, an overall size of 15 km x 15 km and approximately 110 Km south-west of the nearest city, Ely (elevation 1962 m, inhabitants 4000). The measurements were taken as support and for the vicarious calibration experiment to validate column-averaged dry air mole fractions of CO₂ and CH₄ (XCO₂ and XCH₄) retrieved from the Greenhouse Gases Observing Satellite (GOSAT) which was launched in January 2009. This work reports on ground-based in-situ measurements of CO₂ and CH₄ from RRV playa and comparisons made with XCO₂ and XCH₄ from GOSAT. Also presented are a comparison of XCO₂ and XCH₄ with in-situ airborne measurements of CO₂ and CH₄.

The ground based CO₂ and CH₄ measurements were conducted using Wavelength-Scanned Cavity Ring-Down Spectroscopy (WS-CRDS) technique. The analyzer (Picarro Inc., CA, USA, model G1302) relies on the use of a high-finesse optical cavity, two lasers, a high-precision wavelength monitor, three high-reflectivity mirrors (>99.995%) and photodetectors to enable extremely precise and simultaneous measurements of CO₂ and CH₄. Instrument precision was calculated from the average 1-sigma during standard sampling, operating at 2 s temporal resolution, the precision was below 0.17 ppm for CO₂ and 0.56 ppb for CH₄. Drift was estimated to be -1.9 ppb/day for CO₂ and -0.002 ppb/day for CH₄.

The minimum and maximum concentrations over the measurement campaign were 358.39 – 404.22 ppm and 1.78 – 1.81 ppm for CO₂ and CH₄ respectively. As expected for this remote, desert site the mean CO₂ and CH₄ concentrations on each overpass day were close to the global average of 390 ppm and 1.77 ppm respectively (<http://www.esrl.noaa.gov/gmd/dv/iadv/>). Daily observed fluctuations (up to 20 ppm for CO₂) around the mean concentrations are reported and the reasons for these fluctuations are analysed and discussed.

Comparisons are made between ground based in-situ CO₂ and CH₄ measurements and meteorological parameters (temperature, humidity, wind speed and direction) and with GOSAT XCO₂ and XCH₄ retrievals. Comparisons are also made of GOSAT XCO₂ and XCH₄ with aircraft in-situ measurements up to 12 km altitude over the RRV playa site on 12 July 2010.