Real time, continuous measurements of CO₂ and H₂O isotopes in a forest using laser absorption spectrometers

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Measurements of CO₂ and H₂O isotope compositions are very powerful methods for investigating the carbon and water cycles. We had been deployed two infrared absorption laser spectrometers (Aerodyne Inc. for CO₂ and Los Gatos Research Inc. for H₂O) in the red-pine forest at the foot of Mt. Fuji for 10 days from the end of July, 2010 and had successfully measured CO₂ and H₂O isotopologues (16O12C16O, 16O13C16O and 18O12C16O for CO₂, D₂O and H₂18O for H₂O). The CO₂ isotope laser spectrometer can measure the isotope ratios (d₁³C, d₁₈O) of ambient air CO₂ in 10-second integration time with a precision of 0.1 permil in real-time. The height of the observation tower is 30 m. Air was sampled every 260 seconds from six vertical height locations from above the forest canopy to 2 m above the ground. The total interval time was 30 minutes including measurements of standard gases for the calibration. The 30-minutes interval measurements of the CO₂ and H₂O isotope ratios were repeated continuously during the 10 days. We did Keeling plot analysis regarding with delta13C every a few hours and found that the keeling plot intercepts showed clearly a diurnal pattern. We will discuss the details of the results at the meeting.

Keywords: CO₂ isotopes, H₂O isotopes, forest, laser spectroscopy, ecosystem, atmospheric CO₂