

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

WADA, Ryuichi^{1*}, Masahiro Takemura², Mai Ouchi², Tomoki Nakayama², Yutaka Matsumi², Satoru Takanashi³, Yuichiro Nakai³, Kenzo Kitamura³, Naoyuki Kurita⁴, Yasushi Fujiyoshi⁵, Kenichiro Muramoto⁶, Gen Inoue⁷, Naomi Kodama⁸, Takashi Nakano⁹, Tetsuya Hiyama⁷

¹STE laboratory, Nagoya Univ., Teikyo Univ. of Sci., ²STE laboratory, Nagoya Univ., ³FFPRI, ⁴JAMSTEC, ⁵Inst. Low Temp. Sci., Hokkaido Univ., ⁶Ishikawa national College of Technology, ⁷Research Inst. For Humanity and Nature, ⁸National Inst. for Agro-Environ. Sci., ⁹Yamanashi Inst. of Environ. Sci.

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 (δ₁₃C, δ₁₈O) 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 δ₁₃C 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