



## **Development of Raman Lidar for Remote Sensing of CO<sub>2</sub> Leakage at an Artificial Carbon storage experimental site.**

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We, for the first time, developed a Raman lidar system which can remotely detect surface CO<sub>2</sub> leakage and measure its volume mixing ratio (VMR). The Raman lidar system consists of the Nd:YAG laser of wavelength 355nm with 80mJ, an optical receiver, and detectors. Indoor CO<sub>2</sub> cell measurements show that the accuracy of the Raman lidar is calculated to be 99.89%. We also carried out the field measurement using our Raman lidar at an artificial CO<sub>2</sub> leakage site where a CO<sub>2</sub> leakage spot is located 0.2 km away from the Raman lidar instrument for four-day measurement campaign period. The results show good agreement between CO<sub>2</sub> VMRs measured by the Raman lidar system (CO<sub>2</sub> VMRRaman LIDAR) and those measured by in situ instruments (CO<sub>2</sub> VMRIn-situ). The correlation coefficient (R), mean absolute error (MAE), root mean square error (RMSE), and percentage difference between CO<sub>2</sub> VMRIn-situ and CO<sub>2</sub> VMRRaman LIDAR are 0.81, 0.27%, 0.37%, and 4.92%, respectively. This present study demonstrates a possibility of Raman lidar as an effective tool to detect a CO<sub>2</sub> leakage and measure CO<sub>2</sub> VMR at a distance from the instrument location.