Development of Raman Lidar for Remote Sensing of CO₂ Leakage at an Artificial Carbon storage experimental site.

Daewon Kim and Hanlim Lee
Pukyong national university, Division of Earth Environmental System Science Major of Spatial Information Engineering, Busan, South Korea, Korea, Republic Of (k.daewon91@gmail.com)

We, for the first time, developed a Raman lidar system which can remotely detect surface CO₂ 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 CO₂ 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 CO₂ leakage site where a CO₂ 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 CO₂ VMRs measured by the Raman lidar system (CO₂ VMRRaman LIDAR) and those measured by in situ instruments (CO₂ VMRIn-situ). The correlation coefficient (R), mean absolute error (MAE), root mean square error (RMSE), and percentage difference between CO₂ VMRIn-situ and CO₂ 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 CO₂ leakage and measure CO₂ VMR at a distance from the instrument location.