



## **CO<sub>2</sub> vertical profile retrieval from ground-based IR atmospheric spectra**

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CO<sub>2</sub> vertical profile retrieval from ground-based IR atmospheric spectra

In this study, we developed an algorithm for retrieving the CO<sub>2</sub> vertical profile from atmospheric ground-based zenith spectra in the mid IR. Providing the CO<sub>2</sub> profile from continuous (24h/day) ground-based spectra would be a great potential for studying the carbon cycle, the evaluation of satellite measurements or the assessment of numerical models, which forecast the near-surface CO<sub>2</sub> flux. In order to retrieve the CO<sub>2</sub> profile, we used observations of the Atmospheric Emitted Radiance Interferometer (AERI) that was installed at the JOYCE (Jülich ObservatorY for Cloud Evolution), Germany in 2012. AERI measures downwelling infrared radiances from 520 cm<sup>-1</sup> (3.3 μm) to 3020 cm<sup>-1</sup> (19 μm) with a spectral resolution of 1 cm<sup>-1</sup> and a temporal resolution of 1 minute. In a first step, we performed sensitivity studies for finding the most-suited spectral bands with highest sensitivity to the mean column amount of CO<sub>2</sub> volume mixing ratio (VMR). Then an algorithm, known as AERIOe (Turner and Löhnert 2014), was applied to retrieve the mean column amount of CO<sub>2</sub> VMR using simulated radiances in clear sky cases. AERIOe is a variational retrieval algorithm to provide information on Temperature, humidity, trace gases and clouds. The simulated AERI radiances were generated by a line by line radiative transfer model (LBLRTM) using model temperature, humidity and CO<sub>2</sub> profile. The retrieval results of mean column amount of CO<sub>2</sub> VMR are in good agreement with the true ones. In addition to the mean column amount, we modified AERIOe to retrieve the CO<sub>2</sub> vertical profile. First results reveal that there is more than 1 degree of freedom for CO<sub>2</sub> profile. We will show results how the retrieval method is refined to optimally exploit the information on the CO<sub>2</sub> profile contained in the AERI measurements.