

Lidar Measurements of Atmospheric Column CO₂ from Regional to Global Scales Lidar Measurements of Atmospheric Column CO₂ from Regional to Global Scales

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Atmospheric CO₂ is a critical forcing for the earth's climate and the knowledge on its distributions and variations influences predictions of the Earth's future climate. Large uncertainties in the predictions persist due to limited observations. This study uses the airborne Intensity-Modulated Continuous-Wave (IM-CW) lidar developed at NASA Langley Research Center to measure regional atmospheric CO₂ spatiotemporal variations. Further lidar development and demonstration will provide the capability of global atmospheric CO₂ estimations from space, which will significantly advance our knowledge on atmospheric CO₂ and reduce the uncertainties in the predictions of future climate.

In this presentation, atmospheric CO₂ column measurements from airborne flight campaigns and lidar system simulations for space missions will be discussed. Data analysis shows that airborne lidar CO₂ column measurements over desert and vegetated surfaces agree well with in-situ measurements. A measurement precision of ~0.3 ppmv for a 10-s average over these surfaces has also been achieved. Generally, airborne flight campaigns have demonstrated that the column CO₂ measurements of the current IM-CW lidar systems meet the accuracy and precision requirements of atmospheric CO₂ sciences. Furthermore, analyses of space CO₂ measurements shows that the current IM-CW lidar technology and approach will enable space missions to achieve their science goals.

キーワード: atmospheric CO₂, lidar measurements, regional, global
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