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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 advances 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.

Keywords: atmospheric CO2, lidar measurements, regional, global