Airborne Laser Remote Measurements of Atmospheric Carbon Dioxide


1 NASA Langley Research Center, Hampton, Virginia 23681, Edward.V.Browell@nasa.gov; 2 ITT Corporation, Fort Wayne, Indiana 46801, Mike.Dobbs@itt.com; 3 Climate Central, Inc., Princeton, New Jersey 08542, BMoore@climatecentral.org; 4 AER, Inc., Lexington, Massachusetts 02421, SZaccareo@aer.com

Abstract

A unique, multi-frequency, single-beam, laser absorption spectrometer (LAS) that operates at 1.57 microns has been developed at ITT Corporation. This instrument can be used to study the global distribution of sources and sinks of atmospheric carbon dioxide (CO2). A proof-of-concept LAS system was developed by ITT, and it has been successfully flight tested in two airborne configurations conducted in different geographic regions over the last four years.

Flight tests were conducted over Oklahoma, Michigan, New Hampshire, and Virginia under a wide range of atmospheric conditions. Results LAS measurements were compared to high-quality in situ data obtained from a Twin Otter aircraft and ACCLAIM flight test results. The LAS system was characterized using primary calibration sources of CO2, and the system performance was evaluated using the CO2 column measurement technique over a wide range of atmospheric conditions. The LAS system was shown to be capable of accurately measuring CO2 column densities with a precision of ±2 parts per million (ppm) at an altitude of 2.3 km and ±4 parts per million (ppm) at an altitude of 4.6 km.

Results from Flight Tests and Future Applications

LAS measurements have been made during two airborne campaigns conducted in different geographic regions over the last four years. The LAS system was shown to be capable of accurately measuring CO2 column densities with a precision of ±2 parts per million (ppm) at an altitude of 2.3 km and ±4 parts per million (ppm) at an altitude of 4.6 km. The LAS system was characterized using primary calibration sources of CO2, and the system performance was evaluated using the CO2 column measurement technique over a wide range of atmospheric conditions. The LAS system was shown to be capable of accurately measuring CO2 column densities with a precision of ±2 parts per million (ppm) at an altitude of 2.3 km and ±4 parts per million (ppm) at an altitude of 4.6 km.