Geophysical Research Abstracts
Vol. 17, EGU2015-4147-1, 2015
EGU General Assembly 2015

2-micron Double Pulsed IPDA Lidar for Atmospheric CO_2 Measurement

jirong yu (1), mulugeta petros (1), Tamer Refaat (1), Karl Reithmaier (2), Ruben Remus (1), Upendra Singh (1), Will Johnson (3), Charlie Boyer (1), James Fay (1), Susan Johnston (2), Luke Murchison (1), and Tory Scola (1)

(1) NASA Langley Research Center, Hampton, VA, United States (j.yu@nasa.gov), (2) Science Syatem & applications, Inc, One Enterprise Parkway, Hampton, VA , USA, (3) Montana State University, Dept. of Physics, Bozeman. Mt, USA

We have developed a high energy pulsed 2-micron IPDA lidar instrument to measure the atmospheric CO_2 column density. The IPDA lidar is operated on the long wavelength wing of R(30) CO_2 line at 2050.967 nm (4875.749 cm-1) in the side-line operation mode. The R(30) line is an excellent absorption line for the measurements of CO_2 in 2μm wavelength region with regard to the strength of the absorption lines, low susceptibility to atmospheric temperature variability, and freedom from problematic interference with other absorption lines. The Ho:Tm:YLF laser transmitter is designed to be operated in a unique double pulse format that can produce two-pulse pair in 10 Hz operation. Typically, the output energies of the laser transmitter are 100mJ and 45mJ for the first pulse and the second pulse, respectively. We injection seed the first pulse with on-line frequency and the second pulse with off-line frequency.

The IPDA lidar instrument size, weight and power consumption were restricted to small research aircraft payload requirements. The airborne IPDA lidar instrument measures the total integrated column content of CO_2 from the instrument to the ground but with weighting that can be tuned by controlling the transmitted wavelengths. Therefore, the transmitter could be tuned to weight the column measurement to the surface for optimum CO_2 interaction studies or up to the free troposphere for optimum transport studies.

The 2-μm CO_2 IPDA lidar airborne demonstration was conducted during March 20, 2014 through April 10, 2014. IPDA lidar airborne flights included various operating and environmental conditions. Environmental conditions included different flight altitude up to 8.3 km, different ground target conditions such as vegetation, soil, ocean, snow and sand and different cloud conditions. Besides, some flights targeted power plant incinerators for investigating the IPDA sensitivity to CO_2 plums. The lidar instrument is robust during all of the flights. This paper describes the development of the new 2-micron pulsed IPDA lidar instrument, and presents the initial data for the airborne measurements of atmospheric CO_2 concentration.