Geophysical Research Abstracts
Vol. 17, EGU2015-4668, 2015
EGU General Assembly 2015
© Author(s) 2015. CC Attribution 3.0 License.

Advances in High Energy Solid-State Pulsed 2-micron Lidar Development for Ground and Airborne Wind, Water Vapor and CO_2 Measurements

Upendra Singh, Jirong Yu, Mulugeta Petros, Tamer Refaat, Michael Kavaya, and Ruben Remus
MS 43, NASA Langley Research Center, Hampton, Virginia 23681, USA (upendra.n.singh@nasa.gov)

NASA Langley Research Center has a long history of developing 2 μm lasers. From fundamental spectroscopy research, theoretical prediction of new materials, laser demonstration and engineering of lidar systems, it has been a very successful program spanning around two decades. Successful development of 2 μm lasers has led to development of a state-of-the-art compact lidar transceiver for a pulsed coherent Doppler lidar system for wind measurement with an unprecedented laser pulse energy of 250-mJ in a rugged package. This high pulse energy is produced by a Ho:Tm:LuLiF laser with an optical amplifier. While the lidar is meant for use as an airborne instrument, ground-based tests were carried out to characterize performance of the lidar. Atmospheric measurements will be presented, showing the lidar's capability for wind measurement in the atmospheric boundary layer and free troposphere. Lidar wind measurements are compared to a balloon sonde, showing good agreement between the two sensors.

Similar architecture has been used to develop a high energy, Ho:Tm:YLF double-pulsed 2 μm Integrated Differential Absorption Lidar (IPDA) instrument based on direct detection technique that provides atmospheric column CO_2 measurements. This instrument has been successfully used to measure atmospheric CO_2 column density initially from a ground mobile lidar trailer, and then it was integrated on B-200 plane and 20 hrs of flight measurement were made from an altitude ranging 1500 meter to 8000 meter. These measurements were compared to in-situ measurements and NOAA airborne flask measurement to derive the dry mixing ratio of the column CO_2 by reflecting the signal by various reflecting surfaces such as land, vegetation, ocean surface, snow and sand. The lidar measurements when compared showed a very agreement with in-situ and airborne flask measurement. NASA Langley Research Center is currently developing a triple-pulsed 2 μm Integrated Differential Absorption Lidar (IPDA) instrument for simultaneous measurement of water vapor and carbon-dioxide column density measurement from an air-borne platform.

This presentation will give an overview of the 2 decades of 2 μm coherent and direction detection of laser/lidar development at NASA Langley Research Center and will present the ground and airborne wind and column CO_2 measurement intercomparison with in-situ, balloon and flask measurements.