CONTROL ID: 947725

TITLE: Atmospheric Airborne Pressure Measurements using the Oxygen A Band for the ASCENDS Mission

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

CURRENT SECTION/FOCUS GROUP: Atmospheric Sciences (A)

CURRENT SESSION: A35. Greenhouse Gas Measurements Using Active Optical Remote Sensing

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ABSTRACT BODY: We report on airborne atmospheric pressure measurements using new fiber-based laser technology and the oxygen A-band at 765 nm. Remote measurements of atmospheric temperature and pressure are required for a number of NASA Earth science missions and specifically for the Active Sensing of CO2 Emissions Over Nights, Days, and Seasons (ASCENDS) mission. Accurate measurements of tropospheric CO2 on a global scale are very important in order to better understand its sources and sinks and to improve predictions on any future climate change.
The ultimate goal of a CO2 remote sensing mission, such as ASCENDS, is to derive the CO2 concentration in the atmosphere in terms of mole fraction in unit of parts-per-million (ppmv) with regard to dry air. Therefore, both CO2 and the dry air number of molecules in the atmosphere are needed in deriving this quantity. O2 is a stable molecule and uniformly mixed in the atmosphere. Measuring the O2 absorption in the atmosphere can thus be used to infer the dry air number of molecules and then used to calculate CO2 concentration. With the knowledge of atmospheric water vapor, we can then estimate the total surface pressure needed for CO2 retrievals.
Our work, funded by the ESTO IIP program, uses fiber optic technology and non-linear optics to generate 765 nm laser radiation coincident with the Oxygen A-band. Our pulsed, time gated technique uses several on- and off-line wavelengths tuned to the O2 absorption line. The choice of wavelengths allows us to measure the pressure by using two adjacent O2 absorptions in the Oxygen A-band. Our retrieval algorithm fits the O2 lineshapes and derives the pressure. Our measurements compare favorably with a local weather monitor mounted outside our laboratory and a local weather station.