

Airborne lidar measurements of atmospheric pressure made using the oxygen A-band

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Accurate measurements of greenhouse gas mixing ratios on a global scale are currently needed to gain a better understanding of climate change and its possible impact on our planet. In order to remotely measure greenhouse gas concentrations in the atmosphere with regard to dry air, the air number density in the atmosphere is also needed in deriving the greenhouse gas concentrations. Since oxygen is stable and uniformly mixed in the atmosphere at 20.95%, the measurement of an oxygen absorption in the atmosphere can be used to infer the dry air density and used to calculate the dry air mixing ratio of a greenhouse gas, such as carbon dioxide or methane.

Our technique of measuring Oxygen uses integrated path differential absorption (IPDA) with an Erbium Doped Fiber Amplifier (EDFA) laser system and single photon counting module (SPCM). It measures the absorbance of several on- and off-line wavelengths tuned to an O₂ absorption line in the A-band at 764.7 nm. The choice of wavelengths allows us to maximize the pressure sensitivity using the trough between two absorptions in the Oxygen A-band. Our retrieval algorithm uses ancillary meteorological and aircraft altitude information to fit the experimentally obtained lidar O₂ lineshapes to a model atmosphere and derives the pressure from the profiles of the two lines.

We have demonstrated O₂ measurements from the ground and from an airborne platform. In this paper we will report on our airborne measurements during our 2011 campaign for the ASCENDS program.