Lidar atmospheric column CO_2 mixing ratio estimates obtained during ACT-America flight campaigns

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The Multi-functional Fiber Laser Lidar (MFLL) instrument is an Intensity-Modulated Continuous Wave (IM-CW))Lidar designed to measure differential transmission due to CO2 and the path length between the platform and the ground from two closely spaced laser lines. This information can be used with knowledge of the atmospheric state and the absorption cross-section determine the average column dry air mixing ratio XCO2.

MFLL uses three intensity-modulated range-encoded waveform lasers. The On channel is the laser at the center of a CO2 absorption line at 1.571nm. The two Off line channels correspond the lasers at plus and minus 50pm away from the Online, named Off_long and Off_short, respectively. The received power differences between On and Off lines are mainly due to atmospheric CO2 absorption.

Thus, the power ratio of On and Off lines is used to derive the differential absorption optical depth at the CO2 absorption band.

MFLL has been flown onboard the NASA C-130 research aircraft during the first two of five planned Atmospheric Carbon and Transport America (ACT-America) campaigns in the summer of 2016 and winter 2017, along with other in situ greenhouse gas monitoring instruments.

ACT-America airborne field campaigns are focused on three regions in the eastern United States and designed to cover different seasons and weather conditions like fair weather and frontal crossings.

The planned remaining campaigns are fall 2017, summer 2018, and spring 2019. The choice of different seasons, weather conditions, and regions are to span a range of surface fluxes and atmospheric transport regimes. The XCO2 results derived from MFLL for the first two flight campaigns and their comparisons with in-situ observations obtained during ACT-America will be presented.

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