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Boundary layer resolution of CO_2 using IR and NIR measurements

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Since CO_2 concentrations in the boundary layer (BL) are primarily sensitive to surface fluxes mixing within the BL, closing the global carbon budget is best achieved by discriminating between CO_2 in the BL from CO_2 in the free troposphere. Previous studies shown that adding CO_2 laser band increases sensitivity to lower troposphere and that near IR measurement (NIR) can be used to obtain "column" CO_2 measurements with sufficient precision to obtain CO2 sources and sinks. In this study we used simulated retrieval approach using IR, NIR and combined radiances. Jointly estimate the atmospheric temperature, water, surface temperature, emissivity and CO_2 using optimal estimation provided a fully characterization of errors and sensitivity of the estimate to a simulated "true" CO_2 distribution. A linear retrieval is used to examine the impact of using different spectral bands on a CO_2 estimate. The results show that combined radiance retrieval i.e. using NIR and IR have the potential to resolve the boundary layer CO_2 from free tropospheric CO_2 and therefore to increase sensitivity to surface fluxes and to reduce transport error in inverse estimates of global carbon budget.