



Application of Space Borne CO₂ and Fluorescence Measurements to Detect Urban CO₂ Emissions and Anthropogenic Influence on Vegetation

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The Orbiting Carbon Observatory 2 (OCO-2) is a NASA satellite mission dedicated to make global, space-based observations of atmospheric, column-averaged carbon dioxide (XCO₂). In addition, the OCO-2 also measures Solar Induced Chlorophyll Fluorescence (SIF).

In our research we have studied the combination of OCO-2's XCO₂ and SIF measurements for numerous urban areas on the different continents. Applying GIS and KML visualization techniques as well as statistical approaches we are able to reliably detect anthropogenic CO₂ emissions in CO₂ column concentration enhancements over urban areas. Moreover, we detect SIF decreases over urban areas compared to their rural vicinities. We are able to obtain those findings for urban areas on different continents, of diverse sizes, dissimilar topographies and urban constructions. Our statistical analysis finds robust XCO₂ enhancements of up to 3 ppm for urban areas in Europe, Asia and North America. Furthermore, the analysis of SIF indicates that urban construction, population density and seasonality influence urban vegetation, which can be observed from space.

Additionally, we find that OCO-2's SIF measurements have the potential to identify and approximate green areas within cities. For Berlin's Grunewald Forest as well as Mumbai's Sanjay Gandhi and Tungareshwar National Parks we observe enhancements in SIF measurements at sub-city scales.