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The quantification of anthropogenic CO_2 emissions over urban areas using a high resolution dispersion model and satellite observations.

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The concentration of carbon dioxide (CO_2) has increased from 280 ppm at the start of the industrial revolution to 410 ppm today, caused by the extensive burning of fossil fuel, and cement production. Emissions from urban areas, which are connected to the burning of fossil fuel, contribute 70% of global anthropogenic emissions. The main purpose of this work is to explore the capability of the NASA OCO-2 satellite to study carbon emissions from mega cities, urban areas and other emission hot spots in order to evaluate and improve the current emission estimates.

Initially, we focus on the area of Los Angeles (LA) and using OCO-2 overpasses over this large urban area, we have investigated regional enhancements in XCO_2 over the city compared to the background. To evaluate which part of an urban area has been probed by the satellites observations, column footprints using the high-resolution Numerical Atmospheric-dispersion Modelling Environment (NAME) have been calculated. These footprint calculations can then be combined with fluxes from different emission inventories for the LA area to calculate the CO_2 enhancement. To compare these calculations to the satellite observations, we also need to estimate the background concentration of CO_2 which we will estimate from a global chemistry transport model and the NAME calculation of the airmass history.

As a next step, we will apply the developed framework for evaluation of urban-scale emissions from satellite observations using high-resolution atmospheric transport modelling to different key urban areas globally and to evaluate different emission inventories such as EDGAR & ODIAC.