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A multi-model approach to constrain emissions from an urban-industrial complex

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Greenhouse gas observations around cities can be used to independently quantify fossil fuel emissions and monitor the effectiveness of emission reduction policies. In this study we show that a relatively small network measuring CO_2 and CO concentrations in combination with high-resolution modelling can constrain the emissions of a heterogeneous urban-industrial landscape. We apply a unique and promising combination of a plume and grid model. We use the WRF/Chem grid model to simulate concentrations at 1km horizontal resolution and to quantify biogenic CO_2 fluxes. A Gaussian plume model is used to better represent the concentrations downwind of industrial stacks. Our network of (semi-)urban and rural sites detects fossil fuel signals from distinct source regions in the urban port area of Rotterdam. The impact of biogenic fluxes on the observed CO_2 concentrations is in the order of several ppm due to the large fraction of grassland in the footprints of the measurement sites. We will also show that monitoring multiple combustion tracers helps to identify source regions, including the inner city, sea port, glasshouses and local biogenic activity.