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Evaluating NOY and BC emission inventories for the Paris region from MEGAPOLI aircraft measurements

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The estimation of pollutant emissions inventories in megacities is of major concern for the improvement of air pollution modelling. Within the framework of the FP7 / EU project MEGAPOLI, an intensive campaign of both airborne and ground-based pollutant measurements was carried out in the Paris region in July, 2009 and January-February, 2010 with the major objective to quantify the sources of organic aerosol and to improve our understanding of the secondary aerosol formation.
The aim of this study is to evaluate two emissions inventories delivered by TNO, without and with refined treatment of Paris emissions (Airparif data). Those two emissions inventories differ in resolution and spatial distribution for both species, and also in absolute emission totals for Paris (particularly for BC where the emission totals differ up to a factor of two) but the French national total is kept constant. Several chemically inert tracer species are considered, NOY and BC, for which plume measurements are available from the French ATR-42 aircraft. A 3x3km-resolved modelisation with the regional chemistry transport model CHIMERE, coupled with those inventories, is used to simulate tracer concentrations in the plume. For all flights and simulations, the Paris plume is well distinguishable against background. For both observations and simulations, along the flight path perpendicular to the plume, the plume integral of tracer concentration above background is calculated, giving for each flight spatialy averaged emission correction factors for the Paris region. The method allows to ignore some potential errors in the structure of the simulated plume (direction, lateral dispersion).
However, several error sources were carefully inspected : (i) the wind speed that directly links the diurnal emission profile to the rate of decrease of concentrations in the plume, (ii) the degree of vertical mixing that determines the representativeness of the airborne measured concentrations, (iii) the wet and dry deposition of the tracers that can lead to discrepancies in the emissions factors if it is not well simulated in the model, and (iv) the boundary layer height and its horizontal variability over the aircraft trajectory which directly affects the level of concentrations.
At this abstract submission time, preliminary results are available for the TNO inventory without refined Paris emissions during summer 2009 for both NOY and BC that gives average emission correction factor of 1.39 and 1.36 respectively, which means an emission overestimation of about 40%. Results will be completed for TNO inventory with refined Paris emissions. Finally, the corrected emission ratio NOY/BC over Paris region will be compared to surface NOY/BC measurements inside Paris. The availability of evaluated and corrected emissions inventories is of great importance for assessing pollution transformation processes within the MEGAPOLI project. It is of great interest if the combination of modeling and observational data is able to put constraints on the emission data and/or ratios of the emitted species. This will reduce uncertainties and provide guidance how local inventories can be merged with regional inventories to support air pollution assessments across various scales.