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Simulation of the Cooking Organic Aerosol Concentration Variability in an Urban Area

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Cooking operations can be an important fine PM source for urban areas. Cooking emissions are a source of pollution that has been often ignored and are not included or are seriously underestimated in urban emission inventories. However, several field studies in cities all over Europe suggest that cooking organic aerosol (COA) can be an important component of the total organic PM. In this study we propose and evaluate a methodology for the simulation of the COA concentration and its variability in space and time in an urban area. The city of Patras, the third biggest in Greece is used for this first application for a typical late summer period. The spatial distribution of COA emissions is based on the exact location of restaurants and grills, while the emissions on the meat consumption in Greece. We estimated COA emissions of 150 kg d^{-1} that corresponds to 0.6 g d^{-1} per person. The temporal distribution of COA was based on the known cooking times and the results of the past field studies in the area. Half of the daily COA is emitted during dinner time (21:00-0:00 LT), while approximately 25% during lunch time (13:00-16:00 LT). The COA is simulated using the Volatility Basis Set with a volatility distribution measured in the laboratory and is treated as semivolatile and reactive. The maximum average COA concentration during the simulation period is predicted to be 1.3 μg m^{-3} in a mainly pedestrian area with a high density of restaurants. Peak hourly COA concentrations in this area exceed 10 μg m^{-3} during several nights. The local production of secondary COA is predicted to be slow and it represents just a few percent of the total COA.