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The role of emission inventories and chemical mechanisms on simulating PM2.5 and organic aerosols with WRF-CHEM

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Air pollution from fine particulate matter ($PM_{2.5}$) is a major environmental health risk associated with morbidity and excess mortality. In Europe, despite the multiple efforts for minimizing air pollution levels, it exceeds the recommended WHO guideline limits in many regions. Since observational data of air pollutant concentrations are spatially incomplete, regional air quality modeling is used to simulate ambient pollutants levels. However, air quality models are not always accurate and many sources of uncertainties are being involved. For example, input data e.g. from emission inventories can play a crucial role in the simulated concentration of air pollutants. Also, several studies have shown that organic aerosols are very prone to model biases and are usually underestimated by the models. This is because organic aerosols are mostly composed of secondary organic aerosols that are formed through chemical reactions in the air, from pathways which are not fully known and are not all included in models. Here, we use the Weather Research and Forecasting model, coupled with chemistry (WRF-CHEM) for simulating the annual mean concentration of $PM_{2.5}$ and the organic components over Europe. The EDGARv.5 global emission inventory is used as the basic input data for the anthropogenic emissions, and is also combined with the newly updated CAMS-REG-v4-Ref2 emission inventory for the VOCs emissions that originate from residential wood combustion. The latter is used as a complementary source of data for VOCs which are precursors of secondary organic aerosols and are often not well documented in emission inventories. However, CAMS-REG-v4-Ref2 was constructed from updated and harmonized emission factors for residential combustion, thus giving a better representation of these emissions over Europe. This work investigates the role of emission inventories in the simulation of $PM_{2.5}$ and organic aerosols and aims to quantify their impact on health assessments. We particularly focus on organic aerosols since these are considered more toxic and hazardous to human health than other inorganic fine particles.