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Air quality modelling for the mid-21th century in the greater Paris area under 2 climate scenarios

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There has been an increasing interest on the impact of climate change on future air quality at both global and regional scales. The largest amount of research up to now used global-scale modelling tools to address the issue, while few recent papers use regional scale models to assess the impact of climate change on large urban agglomerations. The main issues of concern related to a regional scale set-up focusing on a city are the representativeness of the emission estimates of a regional inventory for the city as well as uncertainties in the emission projections. Regional scale projections, may be consistent with global scale climate scenarios but they are not representative of the future trend of a specific city. In this study we modelled air quality in the city of Paris, France at a mid-21st century horizon (2045-2055) under two emission and climate scenarios. The emission scenarios were developed for Europe from the Global Energy Assessment (GEA) to be consistent with the IPCCs recently developed Representative Concentration Pathways (RCPs) which incorporate only climate change actions. The emission scenarios include both climate (RCP consistent) and regional air quality policies. To cope with the aforementioned problems we combined two sources of information to project emissions for the city of Paris to the mid-century horizon. The first stems from a local agency (AIRPARIF) and includes a bottom-up high resolution emission inventory compiled for the year 2008 based on information on local activity and statistics. This inventory is projected by AIRPARIF to the year 2020 based on various air-quality policies already in place or planned for the next years. The second is a set of projection coefficients extracted from the two GEA scenarios for France and applied to the 2020 local inventory in order to obtain an emission inventory for 2050. Global scale concentrations were modelled with the coupled LMDz-INCA system and then downscaled with the regional scale air-quality model CHIMERE using two-level one-way nesting first at 0.5º (50km) grid covering Europe and then at a 4km horizontal resolution grid over the greater Paris area (Ile-de-France region). The IPSL-CM5-MR global-scale model was used to drive the WRF meteorological model for a regional domain in 50km resolution covering Europe which was subsequently downscaled to 10km resolution in order to derive meteorology for the Ile-de-France region. Two sets of simulations are performed: a continuous control run from 1995 to 2004 representing present time air-quality and a continuous run over the 2045-2054 decade representing air-quality projection to the mid-21st century. This effort aims in the development of a health impact assessment study for ozone and PM2.5 in the area and the potential differences that arise in air quality and health by using a local scale setup-up compared with a regional scale setup-up.