Episodes of high particle concentrations over Central Europe with emphasis on the Benelux/Rhine-Ruhr area as simulated with a complex chemistry transport model

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The Rhine-Ruhr area with its 10 Million inhabitants, located in the federal state of North-Rhine-Westphalia, is one of the regions in Europe which has the characteristics of a mega-city. Together with the nearby urban agglomerations in the Benelux area, including Brussels, Amsterdam and Rotterdam, it forms a region which is heavily burdened by air pollutants as PM_{10} and NO_2, mainly due to industry and traffic. Emissions of NH_3, which is an important gaseous precursors for secondary particles formed in the atmosphere, are also quite high in this region. It might be difficult to achieve the limit values as given in the EC air quality directive within parts of the Benelux/Rhine-Ruhr area.

Calculations with the EURAD model (Memmesheimer *et al., 2004, 2007)* have been performed to investigate characteristic features of air pollution episodes with high particle concentrations in the Benelux/Rhine-Ruhr area. Comparison of base case simulations with emission scenarios are used to illustrate the transport of air pollutants over long distances and to demonstrate the interactions between different areas. An example, including a scenario without anthropogenic emissions in Germany, is shown in Figure 1. It can clearly be seen that the high particle concentrations in the Benelux and France partly can be attributed to emissions from Germany. Other examples for different emission scenarios will be shown for the local as well as for the European scale. Air pollution episodes with high concentrations of PM_{10} are characterized by anticyclone conditions over Central Europe leading to accumulation of gaseous precursors and secondary aerosols as well as primary emitted particles. The frequency of those weather situations can influence the number of exceedances of the daily limit value for PM_{10} of 50 $\mu g/m^3$ for the year considered and therefore might lead to interannual variations caused by changing meteorological conditions. PM_{10} concentrations are to a larger extent influenced by transport than NO_2.

Future extensions of the model applications aim at the coupling to the global scale and the performance of long-term runs on the time-scale of a decade. The fluxes of atmospheric trace constituents will be considered in more detail within the recently established FP7 project Cityzen.

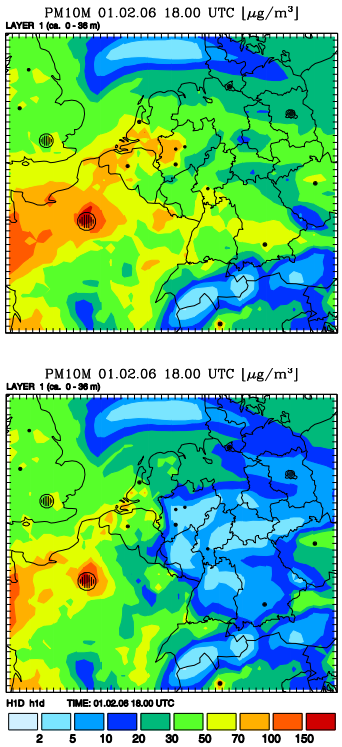

Figure 1. PM_{10} concentrations, upper part: base case, lower part: no anthropogenic emissions in Germany

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