VERY HIGH-RESOLUTION AND URBANISED SIMULATIONS WITH THE LOKALMODELL AND THEIR APPLICATION TO AIR POLLUTION MODELS FOR POLLUTION EPISODES IN EUROPEAN CITIES

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With increasing resolution, mesoscale numerical weather prediction (NWP) models become suitable to provide input to air pollution models for urban air quality and emergency forecasting and are being urbanised and tested for this purpose in the current EU project FUMAPEX (Integrated Systems for Forecasting Urban Meteorology, Air Pollution and Population Exposure).

The operational non-hydrostatic mesoscale NWP model Lokalmodell (LM) of the German Weather Service was developed and evaluated for very high resolution nested down to 1km for various urban air pollution episodes (as part of the model inter-comparison in FUMAPEX).

Simulations were performed with the operational model set-up with increased resolution but yet without improved parameterisations. Results for winter inversion-induced episodes in Helsinki and Oslo and an ozone episode in Valencia show no clear improvement with increasing resolution except near coastal stations where it is due to the better land-sea distribution and consequently improved soil and meteorological parameters including turbulent surface fluxes. The LM (like most mesoscale models) often fails to simulate intense inversion strength and near-surface temperatures in winter episodes. However, it captures the development of the complex breeze and upslope circulations determining the regional pollutant concentrations for the Valencia ozone episode. Potential reasons for LM deficiencies are discussed, i.e. insufficient stability dependance of parameterisations, large turbulent mixing and horizontal diffusion, but predominantly the lack of urbanised and high-resolution soil and surface layer parameterisations as in other operational NWP models so far.

As a first step towards urbanisation, urbanised external parameters and an anthropogenic heat source were introduced into LM leading to improved turbulent fluxes, increased heat storage and a heat island effect. The efficiency of urbanisation measures is analysed with respect to the urban characteristics described by Grimmond and Oke (1999).

Finally, the dispersion models operational in the German radioactivity emergency system (trajectory and Lagrangian particle dispersion models, mixing height pre-processor) were run with the modified LM results and their sensibilities to high model resolution and urbanised parameters investigated.

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