Air Quality Modelling with WRF-CMAQ over Europe – Focus on Ozone and Particulate Matter

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The air quality modelling system WRF-CMAQ running at the National Institute of Meteorology and Hydrology in Sofia was applied to the European domain for the year 2010 in the frame of the Air Quality Model Evaluation International Initiative (AQMEII), Phase 2.

The model system was set up for a domain of 5000x5000 km2 size with horizontal resolution of 25 km. The mesoscale weather prediction system WRF v.3.3 was run with analysis nudging to NCEP GFS data with spatial resolution of $1°x1°$ and time resolution 6 hours. The model was run with well-tried and cited in the literature parametrization schemes, 27 vertical layers with increasing heights up to 50mb. The chemistry transport model CMAQ v. 4.6 was run with the predefined chemical mechanism "cb4_ae4_aq" on 14 vertical levels. The MCIP v.3.6 interface was used to link both models. The anthropogenic emissions are based on TNO-MACC emission inventory, wild fire emissions were estimated in the frame of IS4FIRES project and provided by FMI. The emission module SMOKE was partially used - for estimation of the biogenic emissions and for merging of all type of emissions in a single input file for CMAQ.

Model performance was investigated based on graphical plots and statistical indexes obtained by the web-based model evaluation platform ENSEMBLE, developed and maintained by EC-JRC, Ispra. A preliminary operational model evaluation for ozone and particulate matter was conducted, comparing simulated and observed concentrations at ground level in different sub-domains of Europe. The monitoring data are from the AIRBASE and EMEP networks. The analysis shows model overestimation for ozone and model underestimation for particulate matter. Trying to understand ozone overestimation, analysis of some surface level meteorological parameters (temperature, precipitation, and humidity) was also carried out. Vertical profiles of ozone and meteorological parameters were analysed on MOZAIC data at Frankfurt.