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Analysis of the WRF-Chem simulations contributing to the AQMEII-Phase II exercise with respect to aerosol impact on precipitation

Johannes Werhahn (1), Allessandra Balzarini (2), Roccio Baró (3), Gabriele Curci (4), Renate Forkel (1), Marcus Hirtl (5), Luka Honzak (6), Pedro Jiménez-Guerrero (3), Matthias Langer (5), Christof Lorenz (1), Juan L. Pérez (7), Guido Pirovano (2), Roberto San José (7), Paolo Tuccella (4), and Rahela Žabkar (6)

(1) Karlsruhe Institute of Technology, Atmospheric Environmental Research Division (IMK-IFU), Garmisch-Partenkirchen, Germany (johannes.werhahn@kit.edu, +49-8821-183243), (2) RSE, Milano, (3) University Murcia, MAR-UMU, (4) University L'Aquila, CETEMPS, (5) ZAMG, Vienna, (6) University Ljubljana, SPACE-SI, (7) Technical University of Madrid, ESMG

Simulated feedback effects between aerosol concentrations and meteorological variables and on pollutant distributions are expected to depend on model configuration and the meteorological situation. In order to quantity these effects the second phase of the AQMEII (Air Quality Model Evaluation International Initiative; http://aqmeii.jrc.ec.europa.eu/) model inter-comparison exercise focused on online coupled meteorology-chemistry models. Among others, seven of the participating groups contributed simulations with WRF-Chem (Grell et al., 2005) for Europe. According to the common simulation strategy for AQMEII phase 2, the entire year 2010 was simulated as a sequence of 2-day time slices. For better comparability, the seven groups using WRF-Chem applied the same grid spacing of 23 km and shared common processing of initial and boundary conditions as well as anthropogenic and fire emissions. The simulations differ by the chosen chemistry option, aerosol module, cloud microphysics, and by the degree of aerosol-meteorology feedback that was considered. Results from this small ensemble are analyzed with respect to the effect of the different degrees of aerosol-meteorology feedback, i.e. no aerosol feedback, direct aerosol effect, and direct plus indirect aerosol effect, on large scale precipitation.

Simulated precipitation fields were compared against daily precipitation observations as given by E-OBS 25 km resolution gridded dataset from the EU-FP6 project ENSEMBLES (http://ensembles-eu.metoffice.com) and the data providers in the ECA&D project (http://www.ecad.eu). As expected, a first analysis confirms that the average impact of aerosol feedback is only very small on the considered spatial and temporal scale, i.e. due to the fact that initial meteorological conditions were taken every 3rd day from a one day non-feedback spin-up run. However, the analysis of the correlations between simulation and observations for the first and the second day indicates for some particular situations and regions a slightly better correlation when the aerosol indirect effect is accounted for.