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Regional modelling and assessment of atmospheric particulate matter concentrations at rural background locations in Europe

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Temporal and spatial variability of observed particulate matter (PM) was investigated at available rural background stations in Europe during 2011. A special attention was given to the regional characteristics and sources of the PM in Eastern and Central Europe of regionally observed high daily PM concentrations ($\sim$75 μg/m3) at background stations during $\sim$10 days in November 2011. The episode was analysed using monitored and modeled air quality and meteorological data. Two different regional air quality modelling systems (offline EMEP and online WRF-Chem) were applied to simulate the transport of pollutants as well to test their individual performance using background measurements from stations classified according to the altitude in order to provide practical information's for air quality assessment with focus on stable atmospheric conditions. The models were validated against measurements from mast tower of Karlsruhe Institute of Technology and Cabaw tower as well as against soundings and surface measurements. Within the analysed episode, the accumulation of pollutants was governed by large-scale anticyclones conditions that prevailed over the Eastern and Central Europe, enabling long-lasting statically stable atmospheric conditions characterized with low dispersion. The effect of different planetary boundary layer parametrisations and resolutions was investigated in the WRF-Chem model during the episode of increased PM concentrations in stable atmospheric conditions. Although relatively good overall model performance is found for both models, the underestimated modelled PM concentrations indicated the importance of accurate assessment of regional air pollution transport in stable atmospheric conditions and the necessity of further model improvements. These results contribute to the better understanding of available regional air quality model's performance in simulating background aerosol distribution, particularly in stable atmospheric conditions. The systematic and continuous evaluation of model's abilities is very important, as models are inherent scientific and regulatory tools for air quality assessment.