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Long-term simulations of European air quality using the Danish Eulerian Hemispheric Model

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Effects of air quality on nature and human health have been on the agenda for several decades. Air quality monitoring sites have been established throughout Europe and several of the sites have been operating for more than two decades. Long term evaluation of air quality from specific monitoring sites or smaller regions has been performed in several studies. For studies of larger regions, models with comprehensive chemistry schemes have been developed and applied to study atmospheric transport, transformation and deposition of various air pollutants. With faster and faster computers, the development over the years has been towards more complex chemistry schemes and higher spatial and temporal resolution of model output. This often limits the studied period to single or a few years. We will present a study of European air quality covering 18 years, simulated with a state-of-the-art atmospheric chemistry transport model. The Danish Eulerian Hemispheric Model (DEHM) covers the majority of the Northern Hemisphere with a horizontal grid resolution of 150 km X 150 km. DEHM has 29 vertical layers in terrain-following sigma-coordinates extending up to a height of 100 hPa. Two-way nesting options with a nesting factor of three can be applied with higher resolution over a limited area of the model. At present the model can be run without nests or with one, two or three nests, each with grid resolutions of 50 km X 50 km, 16.7 km X 16.7 km, and 5.6 km X 5.6 km, respectively. The model includes a comprehensive chemistry scheme with more than 100 reactions and 67 atmospheric constituents, of which 4 relate to primary particulates (PM2.5, PM10, TSP and sea salt); other species are SOx, NOx, NHx, VOCs, and secondary inorganic particulates. DEHM is driven by meteorological data from the numerical weather prediction model MM5v3. One long-term simulation was performed with DEHM covering the period from 1989 to 2006. The predicted concentrations were evaluated against measurements from the EMEP monitoring network.