Aerosol effects on the physical weather in the Harmonie model

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Modern numerical weather prediction (NWP) models are able to represent a wide spectrum of atmospheric processes and transformations in explicit manner. Chemical transport (CTM) models explore physical atmospheric fields as drivers for simulating numerous chemical reactions and conversions on temporal scales from seconds to years with appropriate accuracy. The high resolution limited area Harmonie model allows as well to consider feedbacks from chemical and aerosol effects to physical variables. To highlight the impact of aerosols on atmospheric conditions, sensitivity experiments were performed with modified concentrations in set of aerosol types (sea salt, soot, land aerosols, desert aerosols). The area of interests covered the Atlantic-Europe-Northern Africa region. The Harmonie runs were carried out on the model grid with horizontal resolution 25 x 25 km for the period 11-16 August 2010. Results showed that all simulated atmospheric variables are sensitive to the aerosol presence. This effect appears in a form of mesoscale cells irregularly distributed over the whole domain. Largest influence is revealed along high gradients frontal zones. Shortwave radiation fluxes are mainly increased at the top of the atmosphere, while decreasing in fluxes occurs near the surface. The aerosol impact on the air temperature and specific humidity fields is most prominent within the planetary boundary layer (PBL) with a maximum near its top. This fact partly may be addressed to higher aerosol concentrations within the PBL. Variations in physical atmosphere values due to aerosols are associated with the intensity of vertical flows and dynamics. Thus, aerosols act as a trigger reorganizing a chain of complex interactions and transformations in the atmosphere on mesoscales. However, aerosol induced changes in weather parameters averaged over the domain are negligible.