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Evaluation of Enviro-HIRLAM model and aerosols effect during wildfires episodes in Europe and Central Russia in summer 2010

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The summer of 2010 was characterized by severe weather events such as floods, heat waves and droughts across Middle East, most of Europe and European Russia. Among them the wildfires in Portugal and European Russia were some of the most prominent and led to substantial increase of atmospheric aerosols concentration. For instance, pollution from Russian wildfires, which were the most noticeable, spread around the entire central part of the country and also dispersed towards the Northern Europe.
This study is devoted to Enviro-HIRLAM (Environment – HIgh Resolution Limited Area Model) model evaluation and analysis of radiation balance change due to increased aerosol burden caused by wildfires in Russia. For this purpose the model was forced by boundary and initial conditions produced by ECMWF (European Center for Medium-Range Weather Forecast) IFS and MOZART models for meteorology and atmospheric composition, respectively. The model setup included aerosol microphysics module M7 with simple tropospheric sulfur chemistry, anthropogenic emissions by TNO, wildfires emissions by FMI and interactive sea-salt and dust emissions. During the model run surface data assimilation of meteorological parameters was applied. The HIRLAM Savijarvi radiation scheme has been improved to account explicitly for aerosol radiation interactions. So that the short-wave radiative transfer calculations are performed as standard 2-stream calculations for averages of aerosol optical properties weighted over the entire spectrum.
The model shows good correlation of particulate matter (PM) concentrations on diurnal cycle as well as day-to-day variability, but one always has negative bias of PM. The Enviro-HIRLAM is able to capture concentration peaks both from short-term and long-term trans boundary transport of PM and predicted the Aerosol Optical Thickness (at 550 nm) up to 2 over wildfire-polluted regions. And the direct radiative forcing is less than -100 W/m2.