Geophysical Research Abstracts
Vol. 18, EGU2016-1404-1, 2016
EGU General Assembly 2016


# Modelling of Black and Organic Carbon Variability in the Northern Hemisphere

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Black and organic carbon as short-lived climate forcers have influence on air quality and climate in Northern Europe and Arctic. Atmospheric dispersion, deposition and transport of these climate forcers from remote sources is especially difficult to model in Arctic regions due to complexity of meteorological and chemical processes and uncertainties of emissions.
In our study, the online integrated meteorology-chemistry/aerosols model Enviro-HIRLAM (Environment – High Resolution Limited Area Model) was employed for evaluating spatio-temporal variability of black and organic carbon aerosols in atmospheric composition in the Northern Hemisphere regions. The model setup included horizontal resolution of 0.72 deg, time step of 450 sec, 6 h meteorological surface data assimilation, 1 month spin-up; and model was run for the full year of 2010. Emissions included anthropogenic (ECLIPSE), shipping (AU_RCP&FMI), wildfires (IS4FIRES), and interactive sea salt, dust and DMS. Meteorological (from IFS at 0.75 deg) and chemical (from MACC Reanalysis at 1.125 deg) boundary conditions were obtained from ECMWF.
Annual and month-to-month variability of mean concentration, accumulated dry/wet and total deposition fluxes is analyzed for the model domain and selected European and Arctic observation sites. Modelled and observed BC daily mean concentrations during January and July showed fair-good correlation (0.31–0.64) for stations in Germany, UK and Italy; however, for Arctic stations (Tiksi, Russia and Zeppelin, Norway) the correlations were negative in January, but higher correlations and positive (0.2-0.7) in July. For OC, it varied 0.45-0.67 in January and 0.19-0.57 in July. On seasonal scale, during both summer and winter seasons the BC and OC correlations are positive and higher for European stations compared with Arctic. On annual scale, both BC and OC correlations are positive and vary between 0.4-0.6 for European stations, and these are smoothed to negligible values for Arctic stations. Results of simulations showed that in general the model tends to underestimate both black and organic carbon concentrations for the Arctic and European stations.