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Aerosol accumulation intensity and composition variations under different weather conditions in urban environment

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During the last decade aerosol (PM10, PM2.5) mass and composition measurements were done in different urban environments – parallel street canyons, industrial sites and at the background level in Riga, Latvia. Effect of meteorological parameters on the accumulation and ventilation intensity was investigated in order to understand microclimatological parameters affecting aerosol pollution level and chemical composition changes. In comparison to industrial sites (shipping activities, bulk cargo, oil and naphtha processing), urban street canyon aerosol mass concentration was significantly higher, for PM10 number of daily limit exceedances are higher by factor 3.4 - 3.9 in street canyons. Exceedances of PM2.5 annual limits were identified only in street canyons as well. Precipitation intensity, wind speed, days with mist highly correlates with aerosol concentration; in average during the year about 1 - 2 % presence of calm wind days, 20 - 30 days with mist facilitate accumulation of aerosols and mitigating growing of secondary aerosols. It has been assessed that about 25 % of daily exceedances in street canyons are connected with sea salt/street sanding factor. Strong dependency of wind speed and direction were identified in winter time – low winds (0.4 - 1.7 m/s) blowing from south, south-east (cross section of the street) contributing to PM10 concentrations over 100 - 150 ug/m3. Seasonal differences in aerosol concentrations were identified as a result of recombination of direct source impact, specific meteorological and synoptical conditions during the period from January until April when usually dominates extremely high aerosol concentrations. While aerosol mass concentration levels in monitoring sites significantly differs, concentrations of heavy metals (Pb, Ni, Cd, and As) are almost at the same level, even more - concentration of Cd for some years was higher in industrial area where main pollution is caused by oil processing and storage, heavy traffic activities and transportation by rail. The type of prevailing secondary aerosol formation was estimated by linear regression analysis which shows NO_x prevalence in street canyons and urban background and SO_2 associated reactions in industrial sites. Linear regression of traffic intensity in connection with aerosol pollution level shows domination of exhaust emissions during traffic jams and resuspension intensity during middle of the week.