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Urban 'Dry Island' in Moscow

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The urban 'dry island' (UDI) phenomenon over Moscow city has been studied and analyzed for the period since the end of the 19th century till recent years using the data of the ground meteorological network. It concludes into less values of relative humidity in a city in the comparison with surrounding rural zone. The reason of this phenomenon is, firstly, limited areas of forest zones and less number of other water vapor sources inside a city and, besides, indirect influence of the urban heat island (UHI), i.e. higher air temperature T inside a city.
Mean-annual water vapor pressure E doesn't demonstrate systematic changes in Moscow during the last 146 years. The linear regression coefficient K of its course is equal to only 0.0015 [hPa/year], thus since 1870 the average water content in the ground air layer above Moscow increased on average only a little: by 0.2 hPa; such a small difference seems to be negligible and statistically non-significant. Unlike this parameter mean-annual relative humidity F demonstrates quick and systematic (steady in time) fall with the average rate of K = –0.06 [%/year] during the last 146 years; in other words, it decreased from 81 % in 1870s to nearly 72 % in recent years. Inside the city it is the result of general T increase due to both global warming and, besides, intensification of Moscow UHI.
Long-term changes of the F spatial field in Moscow city have been studied in details for separate periods since 1890s till recent years. As a result the urban 'dry island' is found as a real physical phenomenon which is closely connected with UHI; the absolute value of its intensity as well as for the UHI is increasing in time: from –4 % at the end of the 19th century to –8 ÷–9 % now. During last two decades UDI as well as UHI became much stronger in Moscow than before. For instance, on average of five years from 2010 to 2014 the F value at 'Balchug' station at the city centre (close to Moscow Kremlin) is the lowest among all other stations in the region: 68.0 %; the mean F values in urban and rural areas by the data of 5 urban and 13 rural stations for the same period are 73.2 and 76.6 % accordingly. Hence the maximum intensity of UDI, i.e. a difference between values from central urban station and rural stations, is equal to –8.6 % whereas the spatial-averaged intensity that is a difference between average values from all urban and all rural stations is –3.4 %. Thus, the UDI in recent years is mapped by two isovapores: 70 and 75 %.
The difference between values of E inside and outside the city is small. For example, on average of 7 years from 1991 to 1997 it was only 0.1 hPa so it is not statistically significant. Thus, unlike average dryness, average humidity does not demonstrate stable in time local effects such as urban island.