



Thermal structure of the lower troposphere during extreme summer 2010 in Moscow

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For most of the regions in the world weather conditions in summer 2010 were unusually hot. The strongest heat wave was observed in the European part of Russia for 2 months – from 20th of June to 19th of August (in total 61 days successively with the mean daily temperature exceeding mean climatic value). By the data of Moscow State University Meteorological observatory (MO MSU, south-west of Moscow city) the mean monthly temperatures in July and August reached their maximal values ever recorded for the whole period of meteorological observations: +26.4 °C and +22.2 °C correspondingly. Maximal mean daily temperature in Moscow was recorded on 4th of August 2010 and was equal to +31.4 °C. The maximal air temperature by the data of MO MSU ran up to +38.1 °C. Besides the extremely high temperatures in Moscow, that summer was also one of the driest summers during the historical period of in-situ measurements of precipitations. By the data from MO MSU precipitation sum in July 2010 was only 7.4 mm, whereas the mean climatic value is 91 mm.

These extreme and extraordinary long-term weather conditions were connected with the influence of the blocking high-pressure system, which extended in the atmosphere above European part of Russia (Eastern Europe) from the ground up to at least 5-7 km. As a consequence, the weather was sunny and dry, which contributed to an increase of air temperatures. In addition to local heating, an advection of tropical air masses from Central Asia and Near East to European Russia took place. However, besides tropical air masses, there were several periods with the other air mass types above central part of Russia. Detailed air mass analysis with the use of synoptic maps, air trajectories and typical values of the main meteorological parameters was carried out.

During the period from June 20th to August 19th in 2010 extremely high temperatures were revealed not only in the air ground layer but also in the lower troposphere up to at least 4 km. At this study the air temperature vertical distribution during heat wave was analyzed. The data of radiosondes in Dolgoprudny (5 km to the north from Moscow city) was used. At all heights up to at least 4 km the mean temperature for summer 2010 was higher than the summer-mean temperatures in average of previous nine (2001-2009) years. For example, on 03 p.m. the exceeding of the air temperature values in summer of 2010 at any level from 2 m to 1 km was 4.5–4.8 °C. Because the main source of the heat is the surface, this difference above becomes less with a height: 3.8 °C on 2 km and 3.1 °C on 4 km. At the middle of night (on 03 a.m.) the summer 2010 was noted by more frequent and stronger ground inversions, which mean intensity in summer of 2010 was 3.3 °C whereas in average of 2001-2009 from June to August it was less: only 2.2 °C.