Observations-Based Analysis of Moscow Heat Spells

Yulia Zyulyaeva (1), Igor Zveryaev (1), and Klaus Peter Koltermann (2)

(1) P.P. Shirshov Institute of Oceanology, RAS, Laboratory of Ocean-Atmosphere Interaction and Monitoring of Climate Change, Moscow, Russian Federation, (2) Faculty of Geography, Moscow State University, Moscow, Russian Federation

Air temperature (AT) station data and gridded data from the NCEP/NCAR reanalysis and the CRU data set are used to investigate the structure and history of the summer heat spells over Moscow region during 1949-2012. Significant interdecadal changes in different characteristics of the heat spells are revealed. Our results demonstrate that regional manifestation of the global warming during recent decades was associated not only with increase of the seasonal mean AT (which is reflected in the increase of the mean of PDF), but also with significant changes in the shape of the PDF of the AT anomalies reflected in increase of the skewness, which implies enhanced probability of the positive AT anomalies. These changes suggest an increase in probability of anomalously hot days over European Russia during the summer season. Statistically significant positive (negative) trends in the number of anomalously hot (cold) days since the mid 1970-s are detected. We find that in 1981-2012 the number of extremely hot events has doubled compared to earlier period (1949-1980).

A calendar of extreme events over Moscow region has been constructed, that can be used as a diagnostic tool allowing the detection of the heat (and cold) spells, their dates, duration and intensity.

An analysis of regional sea level pressure fields associated with Moscow heat spells revealed three major patterns. These patterns suggest such mechanisms of the extremely hot temperatures formation as local heating caused by enhanced solar radiation effects, hot air advection from Central Asia and hot air advection from the Mediterranean region.