EMS Annual Meeting Abstracts
Vol. 11, EMS2014-145, 2014
14th EMS / 10th ECAC

Observations based analysis of hot summers over European Russia

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Under global warming scenario temperature extremes are expected to be more frequent, longer-lasting and more severe. To show how it works over European Russia we analyzed a probability distribution function (PDF) of the summer (June-August) near-surface temperatures. Station data for several cities (e.g., Moscow, Kostroma, Tambov) and reanalysis data are used to investigate spatial patterns of the heat waves. The period of analysis is 1949-2013.
The analysis shows that for summer daily temperatures skewness of the PDF has increased dramatically for the last 65 years. For June it became positive, while over 20th century it was negative. Along with the mean temperature increase we found that the form of the PDF for June temperatures has changed as well and turned into the normal. For July and August skewness became more positive. This process leads to the higher probability of the occurrence of such extremes as the Russian heat wave of 2010.
Extreme hot events calendar was constructed for the period 1949-2013. Preconditioning and interrelation of the hot summers and heat waves over European Russia have been investigated.
Intraseasonal variability of air temperature during Russian hot summers was analyzed. It is shown that the climatological background for development of the hot summer conditions was quite different in different years. In particular, for the two hottest summers (2010 and 1972) sea surface temperature anomaly (SST) patterns in the North Atlantic were different, with an almost basin-scale positive SST anomaly in 2010 and a so-called “horseshoe” pattern in 1972. Sea level pressure anomalies indicate that the dominant regimes of the atmospheric dynamics were also different between 2010 and 1972, with the summer of 1972 characterized by a positive phase of the North Atlantic Oscillation (NAO) and the summer of 2010 characterized by the slightly negative phase of the NAO.