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Interannual variations and extremes of surface air temperature and precipitation in Northern Eurasia as a reflection of large-scale atmospheric circulation mechanisms

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A study on input of large-scale atmospheric circulation mechanisms in fluctuations of the surface air temperature and precipitation in the former USSR, and their extremes, is carried out. The time series of atmospheric circulation indices, most responsible for the variations of the air pressure field in extra-tropics of the Northern hemisphere, were analyzed. The indices characterize intensity of the atmospheric flow in the following regions of the hemisphere: NAO (zonal flow over Northern Atlantic), POL (zonal flow over Northern Eurasia), Scand (inter-latitudinal transport over Northern Eurasia), and PNA (inter-latitudinal transport over Pacific and Northern America). These indices are obtained as natural EOFs of the climatic pressure fields in the troposphere at the level of 700 hPa, so they are statistically independent, which is crucially important when investigating the role of each of the circulation mechanisms. It has been shown that interannual changes of average air temperature in Russia are explained by variations of the indices NAO, POL, Scand, and PNA for nearly 70%. It is concluded that the extreme values of surface air temperature are observed when several circulation indices get anomalous values simultaneously. For example, the years 1981, 1983 and 1995 were extremely warm in Russia due to positive anomalies of all four indices, while especially cold 1969 and 1977 resulted from negative anomalies of the four. Estimates are made on the circulation mechanisms in Northern Eurasia, most responsible for weather extreme events during the last decades. The four mentioned mechanisms were found to be very important for frequency and intensity of both temperature and precipitation extreme weather events. The results are important both for understanding of the mechanism of the climatic extremes formation, and for interpreting the results

obtained by global climate modeling.