SPRING-SUMMER CLIMATE EXTREMES IN EURASIAN MIDLATITUDINAL REGIONS

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Extremely dry and wet regimes in the Eurasian mid-latitudinal regions from the end of the XIX century to the beginning of the XXI century have been analyzed. In particular, statistically significant tendency of increase for the frequency and area of meteorological droughts during May-July (growing season) in the Eastern European (EER) and Western Asian (WAR) mid-latitudinal regions by data from (Meshcherskaya and Blazhevich, 1997) under the regional and hemispheric warming at the surface during last hundred years is noted (Mokhov, 2000; Mokhov et al., 2002). It is related to the statistically significant decrease of precipitation in spring and summer under the increase the surface air temperature both in EER and WAR though no statistically significant trends are found both for regional precipitation and for temperature during last century.

Table 1 shows parameters of temperature sensitivity of normalized precipitation (P) and indices of drought and extremely wet regimes (estimated by coefficients of appropriate linear regressions) during May-July by updated data from (Meshcherskaya and Blazhevich, 1997) for EER and WAR during 1891-2002. Index D characterizes the drought conditions with the negative precipitation anomalies δPr (normalized on the long-term mean value of precipitation) larger than -20% and positive temperature anomalies δT larger than 1K. Index M characterizes the wet conditions with $\delta Pr>20\%$ and $\delta T<-1K$. Two additional indices are used: D-M and $S=(\delta T/\sigma_{\delta T} - \delta P/\sigma_{\delta P})$, where $\sigma_{\delta T}$ and $\sigma_{\delta P}$ are respective standard deviations.

Table 1. Estimates of temperature sensitivity (with standard deviations) of normalized precipitation (P) and indices of drought and extremely wet regimes (D, M, D-M and S) for May-July from observations (1891-2002) in East European and West Asian mid-latitudinal regions (r – coefficient of correlation).

Sensitivity Parameters (1891-2002)	East European Region	West Asian Region
$D(P/P_o)/dT$, K^{-1} (r)	-0.08±0.01 (0.52)	-0.11±0.02 (0.58)
dD/dT, $\%K^{-1}$ (r)	11.1±0.7 (0.83)	12.7±0.8 (0.80)
dM/dT, $\%K^{-1}$ (r)	-9.2±0.7 (0.77)	-9.4±0.7 (0.79)
$d(D-M)/dT$, $\%K^{-1}$ (r)	20.3±0.9 (0.91)	22.1±1.0 (0.90)
dS/dT, K^{-1} (r)	0.72±0.03 (0.91)	0.77±0.03 (0.93)

According to Budyko et al. (1981), a remarkable increase of the droughts probability was expected from the analysis of different data in midlatitudinal Eurasian regions under the global warming at the end of the XX century. Observations show no statistically significant trends in drought regimes for EER and WAR during the last decades. It should be related with the regional changes in atmospheric circulation accompanying global warming during the last decades, and, in particular, related with changes of North Atlantic Oscillation and El-Nino phenomena (Mokhov, 2000). Figure 1 shows that probability of droughts during spring-summer in EER is less after positive anomalies of the sea surface temperature T_{Nino3} in January for the El-Nino formation region (Nino3) in the equatorial Pacific.

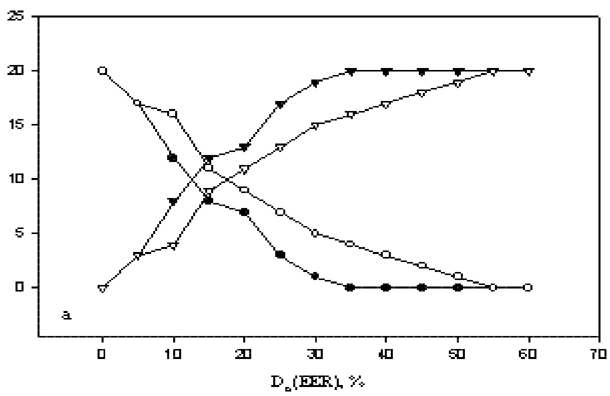

Fig. 1. Cumulative distributions of the number of years N_{cum} with $D>D_o$ (circles) and $D<D_o$ (triangles) for EER during 1950-1995: T_{Nino3}(January)>25.6°C (black) or T_{Nino3}(January)<25.2°C (white).

Cumulative distribution function $N_{cum}(D)$ can be approximated by an exponential function (similar to distributions for blocking characteristics). In particular, $N_{cum}(D)$ for EER is approximated by $N_o\exp[-(D/D_c)^2]$ slightly better than by $N_o\exp(-D/D_c)$. More detailed analysis of parameterization $N_{cum}(D)=N_o\exp(-D/D_c)$ shows different values of D_c for weak, moderate and strong droughts (D_c decreases with the increase of D).

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