During the most recent decades significant regional climate anomalies associated with atmospheric blocking anticyclones have been noted (Mokhov et al., 2011). According to (Mokhov et al., 1995; Mokhov and Petukhov, 1997) we have to expect the increase in characteristic life time $\tau_o$ for blocking anticyclones with the increase of surface temperature $T$ from analysis of data for the Northern Hemisphere (NH) as a whole. With the use of exponential approximation $N=N_0 \exp(-\tau/\tau_o)$ for the number of blocking events $N$, and depending on their duration $\tau$, it was estimated that $(\Delta \tau_o/\Delta T)/\tau_o = 0.13$ K$^{-1}$ from a comparison of the 10 warmest and 10 coldest years in the NH from the data for the period 1950-1990. Model simulations also display a similar tendency with more persistent blocking events for a warmer climate (Lupo et al., 1997).

Here we analyze data for the NH blocking events (with a minimum duration 5 days) from (http://solberg.snr.missouri.edu/gcc/) for the period 1969-2011 (see also (Wiedenmann et al., 2002)) together with the NH surface temperature data from (http://www.cru.uea.ac.uk/cru/data/temperature/). There is general agreement between the data for blockings used in (Mokhov and Petukhov, 1997) and the data analyzed here (Mokhov et al., 2001).

Figure 1 shows the number $N$ of the NH blocking events depending on their duration $\tau$ (days) by data for all analyzed years. According to the linear regression $\ln N = -0.17 \tau + 1.15$ (with coefficient of correlation $r = 0.85$) the characteristic time $\tau_o$ in the exponential model $N=N_0 \exp(-\tau/\tau_o)$ is equal to 5.9 days. The annual-mean number $N_m$, duration $\tau_m$, and total duration $(N\tau)_m$ for the NH blocks during 1969-2011 were estimated to be equal to 27.7, 8.7, and 241.3 days, respectively.

![Figure 1. Blocking numbers N depending on their duration $\tau$ (days) from the data for the Northern Hemisphere (1969-2011).](image)

\[ y = -0.17x + 1.15 \]  
\[ r^2 = 0.72 \]
We compared also characteristics of blocking events for the 10 warmest years (1998, 2001-2007, 2009, 2010) and for the 10 coldest years (1969-1972, 1974-1976, 1978, 1984, 1985) in the Northern Hemisphere. The annual-mean number $N_m$ of blocking events in the Northern Hemisphere for the 10 warmest years was estimated as 32.4, while for the 10 coldest years it was obtained equal to 26.6 (36% difference). The mean duration $\tau_m$ of blockings in the Northern Hemisphere for the 10 warmest years was equal to 9.8 days, while for the 10 coldest years it was estimated as 7.8 (23% difference). The total annual-mean duration $(N\tau)_m$ of blockings for the 10 warmest years was equal to 371.8 days, while for the 10 coldest years it was estimated as 206.8 days (57% difference). The characteristic time $\tau_o$ in the exponential approximation for blockings number $N$ for the 10 warmest years was equal to 7.9 days, while for the 10 coldest years it was estimated as 5.5 (36% difference).

Similar to (Mokhov and Petukhov, 1997), it is possible to estimate the sensitivity of blockings characteristics to general warming with the use annual-mean difference in the NH temperature near surface $\Delta T$ between warm and cold decades (0.72 K). According to our estimates for a $\Delta T = 1$ K the mean number of blocking events $N_m$, duration $\tau_m$ and total duration $(N\tau)_m$ are increasing on 49, 32% and 79%, respectively. The appropriate parameter of sensitivity $(\Delta \tau_o/\Delta T)/\tau_o = 0.50$ K$^{-1}$ for characteristic life time in the exponential approximation for the blocking number $N$ corresponds to an increase in $\tau_o$ of 50% for $\Delta T = 1$ K. This estimate is remarkably larger than that obtained by (Mokhov and Petukhov, 1997).

The characteristic time $\tau_o$ was estimated separately for blocking events persisting less than 20 days and for more persistent blockings. In the first case, $\tau_o$ was equal to 3.8 days. In the second case, the characteristic time $\tau_o$ was estimated to be three times larger (11.4 days).

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References


