Integral index of blocking activity in the atmosphere of Northern Hemisphere during last decades

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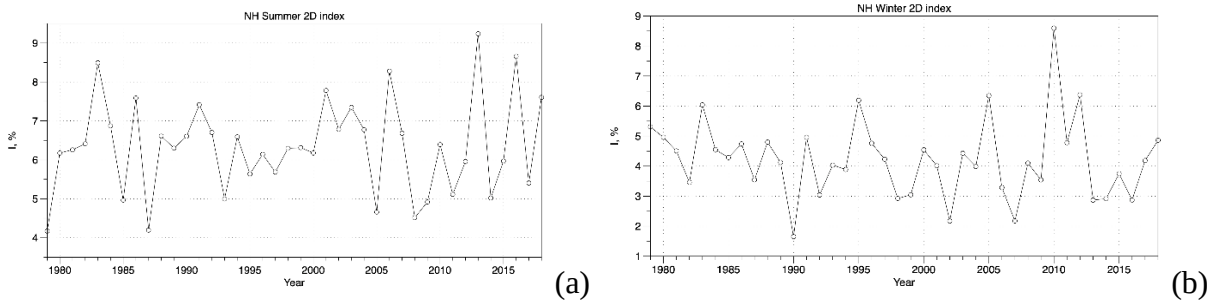
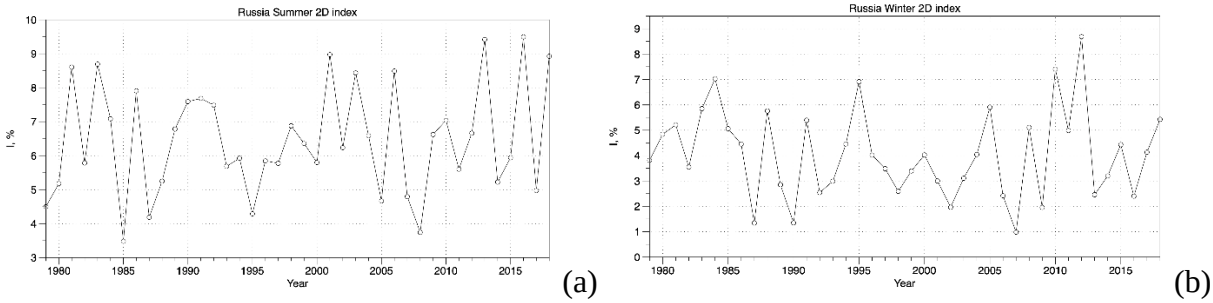
To characterize total activity of atmospheric blockings over extended areas and concrete time intervals (for instance: over the territory of Russia as a whole during vegetation period) an integral blocking index I_I was proposed using local diagnostics of atmospheric blockings in each longitudinal sector with $\Delta\lambda = 2.5°$. In particular, in [1], a variant of the integral index of blocking activity I_I was used when analyzing fire hazardous seasons for a specific time interval Δt from April to October in the Russian longitudinal sector 20°-180°E. The I_I value was determined by the percentage of the sum of days with diagnosed atmospheric blocking in all local sectors $\Delta\lambda$ of the Russian longitudinal sector to the maximum possible number of days with atmospheric blockings. The criterion proposed in [2] was used as a local blocking condition with the necessary condition for its fulfillment for at least 5 consecutive days.

Here, we present estimates of the integral blocking index for the Northern Hemisphere (NH) and for Russia as a whole based on the ERA-Interim reanalysis data for the 40-year period 1979–2018 with a two-dimensional (2D) local blocking condition according to [3].



(a) (b)

Fig. 1. Interannual variations of I_I for the NH as a whole for the summer (a) and winter (b) seasons.



(a) (b)

Fig. 2. Interannual variations of I_I for Russia as a whole for the summer (a) and winter (b) seasons.

Figures 1,2 show the interannual variations of I_I for the NH (Fig. 1) and for Russia as a whole (Fig. 2) for the summer (a) and winter (b) seasons. Table 1 shows annual and seasonal estimates of integral index of blocking activity I_I [%] in the Northern Hemisphere and Russia for two periods (1979-1998 and 1999-2018).

Table 1. Annual and seasonal integral index of blocking activity (%) in the Northern Hemisphere and Russia for two periods (1979-1998 and 1999-2018).

Region	Season	1979-1998 Mean Value (%) (±Standard Deviation)	1999-2018 Mean Value (%) (±Standard Deviation)
Northern Hemisphere	Annual	4.6 (±0.6)	4.6 (±0.6)
	Winter	4.3 (±1.1)	4.1 (±1.6)
	Spring	4.3 (±1.1)	4.1 (±1.0)
	Summer	6.2 (±1.1)	6.5 (±1.7)
	Autumn	3.4 (±0.9)	3.5 (±1.0)
Russia	Annual	4.2 (±0.8)	4.2 (±0.8)
	Winter	4.2 (±1.6)	4.0 (±1.9)
	Spring	3.6 (±1.2)	3.2 (±1.1)
	Summer	6.2 (±1.5)	6.7 (±1.7)
	Autumn	2.7 (±1.3)	3.0 (±1.3)

The estimates indicate a large interannual variability of I_I in all seasons for the NH as a whole and for different regions, including Russia as a whole. The highest average values of I_I were obtained for summer, while the lowest ones were estimated for autumn. Comparison of results for two 20-year periods in Table 1 shows relatively small changes of the I_I mean values, especially of the annual-mean values. Remarkable increase of the I_I standard deviations was obtained for the NH for Russia as a whole in summer and in winter.

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References

[1] Mokhov I.I., Sitnov S.A., Tsidilina M.N., Voronova O.S. (2021) NO_2 emission into the atmosphere from forest fires in Russia in relation with atmospheric blocking events. *Atmos. Ocean. Optics* **34** (6): 1-5. (in Russian)
[2] Tibaldi S., Molteni F. (1990) On the operational predictability of blocking. *Tellus* **42A**: 343-365.
[3] Scherrer S., Croci-Maspoli M., Schwierz C., Appenzeller C. (2006) Two-dimensional indices of atmospheric blocking and their statistical relationship with winter climate patterns in the Euro-Atlantic region. *Intern. J. Climatol.* **26**: 233-249.