Atmospheric blocking characteristics in the Northern Hemisphere: Comparison of two climatologies

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In this study, two 30-year climatologies of NH atmospheric blocking events are compared. The blocking characteristics were stratified into seasonal and three regional categories using the NCEP re-analyses for the period of January 1968 - June 1998 (Wiedenmann et al., 2001) and data from RIHMI-WDC (Russian Institute of Hydrometeorological Information - World Data Center) for the period of December 1965 - December 1995 (CPAC, 1988; MAGC, 1997; Mokhov and Tikhonova, 2000). Several characteristics of blocking anticyclones were included in the study and these were frequency of occurrence, preferred formation regions, duration, blocking days, and intensity.

The NCEP data were analyzed using the modified Lejenas-Okland (LO) criterion for blockings (Lejenas and Okland, 1983) defined as the difference between the 500 hPa geopotential height at 42.5^{o}N and 60^{o}N (Lupo and Smith, 1995; Lupo et al., 1997; Wiedenmann et al., 2001). The RIHMI data for blocking anticyclones were obtained from a synoptic analysis of quasi-stationary anticyclonic circulations found on 500 hPa and 300 hPa maps. In this analysis the minimum threshold of τ_{cr}=5 days for blocking persistence was used (Mokhov and Tikhonova, 2000). The winter, spring, summer and fall seasons are defined as January to March, April to June, July to September, and October to December, respectively, as in Lupo et al. (1997) and Wiedenmann et al. (2001).

Different blocking characteristics were analyzed for the Northern Hemisphere both as a whole and for different regions: RIHMI - Atlantic-European region (90^{o}W-20^{o}E), Pacific Ocean region (140^{o}E-90^{o}W), Eurasian continental region (20^{o}E-140^{o}E); NCEP - Atlantic-European region (80^{o}W-40^{o}E), Pacific Ocean region (140^{o}E-100^{o}W), Asian and North American continental regions (40^{o}E-140^{o}E, 100^{o}W-80^{o}W) .

It should be noted that the regions with blocking activity are wider in the RIHMI climatology with respect to the 42.5-60N belt than in the NCEP analysis with the modified LO criterion. Therefore for this comparison we selected blocking anticyclones from RIHMI-climatology with latitudinal overlap of their centres with the 42.5-60N belt. There is much better agreement between the two climatologies after selection for the number of NH blocking events over the 30 year periods as a whole (1966-1995 and 1968-1997, respectively): RIHMI (with selection) - 24.1 (per year) and NCEP - 24.8, while RIHMI (without selection) - 31.9. But there are remarkable differences for different years. Standard deviations are: RIHMI (with selection) - 7.6, NCEP - 4.1, RIHMI (without selection) - 13.8.

We also examined another sample of blocking events which were extracted from the RIHMI data: only anticyclones with a minimum latitude (during life time) of their centres inside 42.5-60N. According to Table 1 there is substantial agreement between two climatologies for normalized intensities (normalized on the annual-mean hemispheric-mean intensities), in particular.

Table 1. Block Intensities for the Northern Hemisphere from the RIHMI/NCEP analyses: values normalized to the total annual-mean intensity

RIHMI/NCEP	summer	Fall	winter	spring	total
all events	0.8 / 0.7	1.0 / 1.2	1.3 / 1.3	0.9 / 0.9	1 / 1
Atlantic	0.8 / 0.7	1.0 / 1.2	1.2 / 1.3	0.9 / 0.8	1.0 / 1.1
Pacific	0.7 / 0.7	1.1 / 1.2	1.2 / 1.3	0.9 / 0.8	1.0 / 1.0
Continental	0.8 / 0.6	0.9 / 1.1	1.3 / 1.0	0.9 / 0.9	1.0 / 0.8

Both climatologies demonstrate that cold season (winter and fall) blocking events are stronger than warm season (spring and summer) both in general and in each climatology. Winter season blocking events were stronger than fall season events, while summer season blocking events were the weakest events. The agreement between two climatologies is better within the Atlantic and Pacific regions. Less agreement was found for the continental region, and this can be attributed to the remarkable difference in the definition of these regions in the two climatologies.

This work was supported by the Russian Foundation for Basic Research.

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