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ANALYSIS OF 'MIHOLJDAY SUMMER' FOR BELGRADE AND SERBIA REGION

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ABSTRACT

Typical weather conditions with dry and warm features occur in autumn months, with temperatures above the normal temperatures for this period of the year for the Belgrade and Serbia region. Temperatures have values like the ones for the end of summer. That period of fair weather is called Miholjday (St Michael) summer (MS). An analysis of temperature has been the most important criterion for defining MS. Synoptic situation and temperature conditions during that period are analyzed and typical and atypical MSs are defined for Belgrade and Serbia region. The frequency of MS in the period 1946–2004 for Belgrade region is also analyzed. The general definition (Glossary of Meteorology) is assumed and we gave the specific definition of MS for Belgrade and Serbia region on the basis of real weather for longer series of observations. Copyright © 2006 Royal Meteorological Society.

KEY WORDS: summer climate variability; weather singularity; weather classification; synoptic climatology

1. INTRODUCTION

Miholjday summer (MS) appears in autumn, in the period from the middle of September to the beginning of November. The name is related with Miholjday, the Christian feast celebrated on 12 October in the Orthodox Church (29 September in the Catholic Church). In Serbia MS is known as 'bablje leto', which can be translated as 'old women summer'.

A similar period of dry and warm weather occurs in other regions of the world with similar climatic characteristics at the same time of the year. It has different names in different parts of the world. The term 'Indian summer' is most often used in the northeast of the United States (Wahl, 1954; Baker *et al*., 1983; Lanzante, 1983; Suckling, 1989), but its usage goes beyond the borders of English-speaking countries. Its earliest written reference appears in 1778 (Glossary of Meteorology, 2000), although it had been used in everyday communication before. Its origin is not certain. The most probable suggestions relate it to the way that the American Indians availed themselves of this extra weather opportunity to increase their winter stores. Indian summer is an example of what is known as a 'weather singularity', that is, a discernable weather event that recurs around a specific calendar date each year.

In England, this period of fine, calm weather, depending on the date of occurrence, is called St Martin summer or St Luke summer (*All Hallow Summer* or the *summer of* the saint whose day falls closest to the autumnal period when the Indian summer weather occurs). In Poland, the period is called *God's Gift to Poland.* In New England, at least one killing frost and preferably a substantial period of normally cool

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weather with temperature below 0 °C must precede this warm spell to be considered a true Indian summer (Huschke, 1959).

According to the Glossary of Meteorology of American Meteorological Society, Indian (Miholjday) summer is a period of abnormally warm weather in mid- or late-autumn, generally clear skies, sunny but hazy days and cool nights (Glossary of Meteorology, 2000). MS is not, however, a strictly defined meteorological entity and is an emotional event as much as a scientific one. Precise criteria for MS definition do not exist in bibliography. The criteria depend on local weather conditions. Baker *et al*. (1983) suggest that the fact that a frost or even a killing frost must precede the Indian summer is inappropriate as part of the Indian summer definition for the North central region of USA.

Kalnicky (1999) defined the term Indian summer on the basis of daily weather records for the last 100 years for three representative locations: Medford in northwestern Wisconsin, New London in east central Wisconsin, and Madison in southern Wisconsin. An Indian summer day in Wisconsin meets all the following criteria:

- It occurs after the first frost – the first date in autumn in which the minimum temperature is 0 °C or lower.
- It is warm enough to enjoy outdoor activities in summer clothes – the maximum daily temperature must be 18 °C.
- The minimum daily temperature is above freezing (0 °C or higher).
- The weather is dry – there is no measurable precipitation.

According to the 100 year records, Indian summer day occurred as early as 31 August and as late as 19 November. Kalnicky's data showed 14 October to have the greatest frequency of Indian summer weather. The later the date of the first autumn frost, the smaller is the number of Indian summer days. The typical Indian summer day has a low temperature of 5 °C and a high temperature of 22 °C. Although this may seem cool when compared to typical summer highs, these temperatures are 6–10 degrees warmer than the autumn norms. Maximum and minimum temperatures from this definition are changed depending on the latitude.

2. DATA AND METHODOLOGY

The aim of this paper is the analysis of periods of dry and warm weather in autumn months in Belgrade region, known as MS, the precise definition as well as the analysis of the synoptic situation in which it appears, and its frequency.

The temperature, precipitation, pressure, wind, cloud cover and duration of sunshine were analyzed for the period from 16 September to 15 November from 1946 to 2004 for Belgrade Meteorological Observatory. The necessary data were collected from the Belgrade Meteorological Observatory, which did not change position during the period of study. The data set has no missing values. The station is situated at 131.6 m above mean sea level, and its geographical coordinates are $\varphi = 44°48'$N and $\lambda = 20°28'$E. Upon this analysis, days without precipitation (sunshine days) with maximum temperature above or appreciably above mean values were noticed and synoptic situation and weather types in which it appeared were analyzed. On the basis of the analyzed meteorological parameters and synoptic situations, taking the traditional term of Miholjday into account, the precise definition of Miholjday for Belgrade region is given. October 1995 is chosen as the typical period of MS to show main characteristics of weather conditions. Notions of typical and atypical MSs were introduced because of the particularity of the local weather.

3. MS DEFINITION FOR BELGRADE AND SERBIA REGION

Dominant weather characteristics at MS in Serbia (continental part of the Balkan Peninsula and southern parts of Panonia lowland) are fresh, sometimes misty mornings and mostly sunny days with a weak wind (or without wind). Temperatures are above normal values for this period of year, and daily amplitude is large. There are typical and atypical MSs depending on the synoptic situation and meteorological parameter

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values. MS occurs in the period from mid-September to mid-November. By providing specific local weather conditions, we defined the criteria for determining MS periods for Belgrade and Serbia region according to the synoptic situation analysis and meteorological parameter values.

3.1. Typical MS

- It is qualified by a characteristic synoptic situation: extensive anticyclone with the center over mid-Europe.
- Weather type is an anticyclone-warm-dry (AWD).
- Wind is weak, without dominant direction.
- Weather is dry and cloudless, with possible misty mornings.
- The daily temperatures are greater than mean values. In this period, maximum temperature values are equal to or greater than the average maximum temperatures augmented by the standard deviation for longer series of observations ($T_{\max} \geq \overline{T}_{\max} + \sigma_{\max}$). Minimum temperatures are greater then the average minimum temperatures attenuated by the standard deviation for longer series of observations ($T_{\min} \geq \overline{T}_{\min} - \sigma_{\min}$).
- If the above conditions are satisfied for at least three successive days, then this period is called typical MS.

3.2. Atypical MS

- It is qualified by a characteristic synoptic situation: extensive anticyclone with the center over east Europe or cyclone with the center over northwest Europe or/and over the west Mediterranean.
- Weather type is an AWD or a cyclone-warm-dry (CWD).
- Wind has different speeds and directions (mostly moderate and strong southeast warm Koshava).
- Weather is mostly dry and cloudless. Appearances of misty mornings or certain degree of cloudiness are possible. Heliographic strip analysis indicates dominant sunny weather.
- The daily temperatures are greater than mean values. In this period, maximum temperature values are equal to or greater than the average maximum temperatures plus standard deviation for longer series of observations ($T_{\max} \geq \overline{T}_{\max} + \sigma_{\max}$). Minimum temperatures do not have to be greater than the average minimum temperatures attenuated for standard deviation for longer series of observations.
- If the above conditions are satisfied for at least three successive days, then this period is called atypical MS.

3.3. Typical and atypical MS combination

The combination of all days, which meets the criteria specified in Sections 3.1 and 3.2 for at least three successive days, is also called MS.

A temperature criterion for determining MS periods for Belgrade region for October 1995 (as a typical one) and for period 1936–2004 (period from 16 September to 15 November) is presented in Table II. $\overline{T}_{\min}$ and $\overline{T}_{\max}$ are the mean minimum and maximum temperatures and $\sigma_{\min}$ and $\sigma_{\max}$ are corresponding standard deviations for the study period 1936–2004.

The criteria for the first frost appearance, which may be found in some authors (Kalnicky, 1999), are not considered here, because of different climatic circumstances in the Balkan region (southeastern Europe), mainly because of lower latitude (similar consideration by Suckling (1989) and Baker *et al*. (1983)). In most years, MS occurs before the first frost at many locations in Serbia.

4. SYNOPTIC SITUATION, WEATHER CHARACTERISTICS AND TYPES

In this Section descriptions of synoptic situation, weather characteristics and types for typical and atypical MS defined above are given.

Periods of MS last for a minimum of 3 days. In some of the periods, typical or atypical MS or even a combination of both exists. Appearance of several periods of MS during the same autumn is possible. In some years MS does not occur.

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4.1. Typical MS

Typical MS is qualified by a characteristic synoptic situation: extensive anticyclone with the center over mid-Europe (typical example October 1995, Figure 1). Weather is an AWD type. This weather type is conditioned by a dry and stable air mass and its occurrence is more frequent in September and October (Paskota and Todorović, 2003). The frequency of AWD weather type occurrence is decreasing in the first half of September, and is increasing in the second half of September and in October (Table I), which coincides with the period of MS occurrence. Specified weather types are given in Table I according to the classification of weather types (Todorović and Paskota (2002a)). The wind is weak, without dominant direction. The weather is mostly dry and cloudless, with possible misty mornings. The average daily temperatures are greater than the mean values. An anticyclone dominates over a greater part of Europe in MS situation. Cyclonic circulation at all altitudes lingers at the north Atlantic, north Scandinavia and north Russia. The center of anticyclone in lower layers is dislocated from the Iberian Peninsula to middle and east Europe.

The existence of an anticyclone center over middle Europe (on surface and at all altitudes) is the most characteristic synoptic situation when MS occurs in Serbia. Strengthening of the cyclonic circulation over the northern parts of the continent occasionally causes progression of a colder air mass from the northwest of the continent (cyclone-cold front (CCF) weather type) that for a short time (a day or two) perturbs AWD weather type. Soon after the cold front passage, an anticyclone rises and a synoptic situation characteristic for MS is restored. The weather is dry and almost cloudless. Misty mornings are possible. The maximum temperature is above the mean values for this period of year.

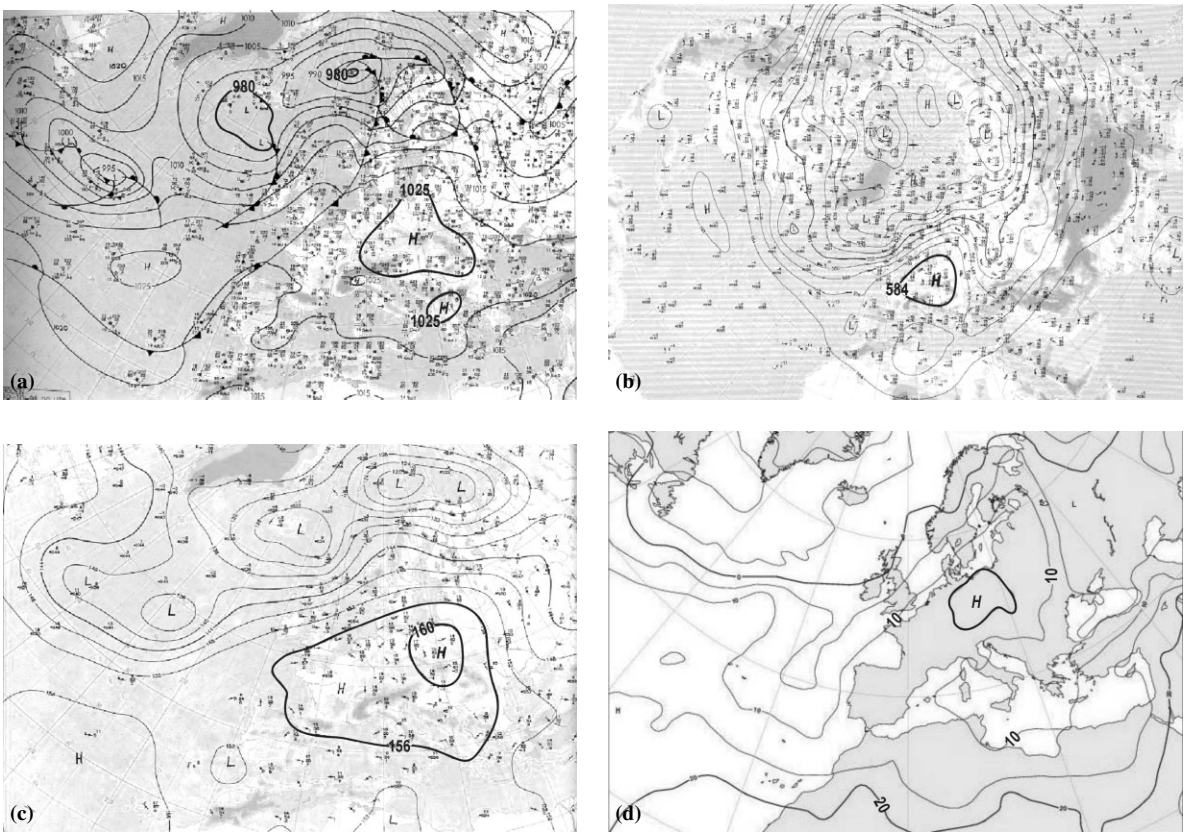

Figure 1. Synoptic situation for typical Miholjday summer (10 October 1995): (a) sea-level pressure map over Europe; (b) 500 hPa pressure map over North Hemisphere; (c) 850 hPa pressure map over Europe; (d) 850 hPa temperature (°C) map over Europe

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Table I. Weather type frequency on Belgrade region. Abbreviations used in the table are the following: CWD – cyclone-warm-dry, CWH – cyclone-warm-humid; CWF – cyclone-warm front, CCF – cyclone-cold front; CCH – cyclone-cold-humid; CCD – cyclone-cold-dry; ACD – anticyclone-cold-dry; ACH – anticyclone-cold-humid; AWD – anticyclone-warm-dry; AWH – anticyclone-warm-humid

Month	Week	CWD	CWH	CWF	CCF	CCH	CCD	ACD	ACH	AWD	AWH
January	1	8.8	1.4	5.4	23.1	14.3	6.1	19.0	7.5	13.6	0.7
	2	3.4	6.1	4.8	15.6	12.9	6.1	19.7	17.0	14.3	
	3	2.0	1.4	6.1	16.3	14.3	3.4	28.6	12.2	15.6	
	4	8.2	2.0	5.4	18.4	8.8	4.8	20.4	19.0	12.9	
February	5	6.1	2.0	2.7	23.8	9.5	8.8	25.2	8.8	12.2	0.7
	6	12.9	1.4	5.4	23.8	15.0	2.7	11.6	3.4	23.8	
	7	9.5	2.7	2.0	24.5	17.0	6.8	19.0	2.0	16.3	
	8	8.2	4.1	2.0	24.5	23.8	4.8	15.0		17.7	
March	9	10.9	2.7	4.1	21.8	10.2	5.4	17.0	2.7	24.5	0.7
	10	6.8	2.0	3.4	19.7	14.3	6.1	19.0	0.7	27.9	
	11	11.6	0.7	5.4	15.6	15.0	3.4	22.4	0.7	25.2	
	12	12.2	3.4	7.5	24.5	16.3	2.7	21.8	1.4	10.2	
	13	15.6	5.4	4.1	23.1	11.6	11.6	12.2		16.3	
April	14	27.2	5.4	2.0	23.8	7.5	6.8	6.8		20.4	
	15	14.3	3.4	1.4	24.5	23.8	9.5	12.9		10.2	
	16	11.6	6.1	5.4	19.7	19.7	10.2	7.5		18.4	1.4
	17	10.9	4.1	0.7	22.4	13.6	6.1	5.4		34.0	2.7
May	18	15.6	5.4	0.7	19.0	8.8	2.7	10.2	0.7	30.6	6.1
	19	8.8	8.2	2.7	21.8	12.2	3.4	8.8		29.3	4.8
	20	8.8	3.4	1.4	23.1	11.6	6.8	4.8		36.7	3.4
	21	6.8	4.8	1.4	27.2	8.2	7.5	15.6	1.4	24.5	2.7
June	22	10.9	3.4	2.0	26.5	16.3	1.4	11.6	1.4	25.2	1.4
	23	8.8	8.2	2.0	24.5	9.5	4.1	5.4	1.4	32.7	3.4
	24	4.8	6.8		30.6	16.3	6.8	10.2		19.0	5.4
	25	8.2	8.8		21.8	14.3	3.4	10.9		27.2	5.4
	26	6.8	0.7	0.7	25.9	15.0	4.1	12.2		29.3	5.4
July	27	6.8	2.0	0.7	24.5	10.2	4.8	10.9	0.7	36.7	2.7
	28	4.1	5.4	0.7	21.8	14.3	4.1	10.2		36.7	2.7
	29	8.2	1.4		21.1	11.6	4.8	15.0		33.3	4.8
	30	3.4	3.4	2.0	20.4	11.6	4.8	8.2	0.7	44.9	0.7
August	31	4.8	4.1		15.6	6.8	9.5	8.8		49.7	0.7
	32	6.8	6.1		19.0	8.2	1.4	6.8		49.7	2.0
	33	4.8	0.7		20.4	5.4	4.1	11.6		49.7	3.4
	34	6.8	4.8		21.1	6.1	2.0	15.0		40.1	4.1
	35	8.2	3.4	2.0	19.7	10.9	6.1	17.0	0.7	29.9	2.0
September	36	10.2	0.7		25.2	12.2	6.1	13.6		29.9	2.0
	37	7.5	1.4	0.7	14.3	10.2	6.1	12.9	0.7	43.5	2.7
	38	6.8	2.0	3.4	19.0	9.5	6.1	8.2		43.5	1.4
	39	6.1	2.0		19.0	9.5	6.8	21.1	0.7	33.3	1.4
October	40	10.2	3.4		21.1	8.8	5.4	8.8	0.7	41.5	
	41	7.5	2.7	1.4	18.4	8.8	7.5	15.6	0.7	37.4	
	42	4.1	2.7	1.4	19.7	4.1	4.8	21.1	4.8	37.4	
	43	6.8	3.4	2.0	19.0	4.8	5.4	34.0	1.4	23.1	

(*continued overleaf*)

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Table I. (*Continued*)

Month	Week	CWD	CWH	CWF	CCF	CCH	CCD	ACD	ACH	AWD	AWH
November	44	6.1	4.1	4.1	24.5	2.0	4.8	27.2	8.2	19.0	
	45	10.9	1.4	2.7	23.1	7.5	8.2	22.4	7.5	16.3	
	46	11.6	3.4	2.7	19.7	13.6	7.5	19.0	6.1	16.3	
	47	10.2	5.4	6.8	20.4	16.3	8.8	19.7	4.8	7.5	
December	48	7.5	5.4	2.0	17.0	9.5	9.5	19.7	15.6	12.2	1.4
	49	4.1	4.1	4.8	12.2	12.2	8.2	21.1	15.0	18.4	
	50	7.5	7.5	4.1	20.4	12.9	5.4	22.4	10.2	9.5	
	51	10.2	4.8	6.1	23.1	15.0	5.4	14.3	8.8	12.2	
	52	6.9	2.9	7.5	19.1	16.2	5.8	17.9	11.0	12.7	
	Year	8.6	3.7	2.6	21.2	11.9	5.7	15.3	3.5	26.0	1.5

4.2. Atypical MS

An atypical MS appears in two typical weather situations. In the first, an anticyclone dominates and weather type is an AWD. In Belgrade region, moderate and strong southeastern wind known as Koshava blows (Todorović and Paskota, 2002b) because the anticyclone center is dislocated over the eastern part of Europe. In the second, cyclonic circulation with the center over the northwestern Europe and/or in the western Mediterranean dominates. Warm air advection exists over southeast Europe and weather is a CWD type. Also, atypical MS days are those with minimum temperatures slightly below values of typical MS definition. The weather is dry and mainly cloudless (sunny). Misty mornings are possible and also a cloudiness percentage. A heliographic strip analysis indicates dominant sunny weather.

5. ANALYSIS OF TYPICAL MS (OCTOBER 1995 CASE)

The analysis of temperature, precipitation, pressure, wind, cloud cover and duration of sunshine for the period from 16 September to 15 November from 1946 to 2004 indicated that typical MS at Belgrade was most frequent in October. The average maximum and minimum temperatures, and appropriate standard deviations were calculated for 1936–2004 data series. October 1995 was chosen as the typical period of MS. According to the above definition, the maximum temperatures satisfied conditions during the following periods: 3–14 October (12 days), 17–21 October (5 days) and 29–30 October (2 days). The minimum temperatures satisfied conditions at periods from 3 to 21 October (19 days), 23 October (1 day), and from 30 October to 2 November (4 days). The maximum and minimum temperatures satisfied established conditions simultaneously during periods 3–14 October (12 days), 17–21 October (5 days), and 30 October (Figure 2). There was no precipitation during these periods. During the period 3–14 October, 5 days were with misty mornings while during the period 17–21 October, 4 days were with misty mornings. Fog was observed on 30 October. According to the above definition, the first two periods may be regarded as MS. Thirtieth October cannot be regarded as MS because it does not satisfy the criterion 'lasting at least three consecutive days'.

A high frequency of clear days during autumn is associated with high atmospheric pressure as a result of the subsistence of accompanying anticyclones, downward motion and consequently cloud dissolving. Thus, if the observed cloud-free period is a real weather feature, evidence of it should be found in atmospheric pressure records. The mean pressure for October was 1003.6 hPa, for the first analyzed period (3–14 October) 1002.5 hPa and for the second one (17–21 October) 1001.3 hPa (period 1936–2004), while for the same periods of MS for October 1995 (3–14 and 17–21) mean pressure was 1009.5 hPa (7 hPa higher) and 1009.9 hPa (8.6 hPa higher), respectively, which correspond with Baker *et al*. (1983) and Wahl (1954). Sea-level pressure for 1995 and mean sea-level pressure for 1936–2004 (from 16 September to 15 November) are shown in Figure 3.

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Table II. Minimum and maximum temperature, precipitation and weather type in October 1995, mean temperatures for October 1936–2004 and temperature criteria for Belgrade region

	October 1995				October 1936–2004, $\sigma_{min} = 1.6\,^{\circ}C$, $\sigma_{max} = 2.1\,^{\circ}C$				
	T_{min}	T_{max}	P	Weather type	$\overline{T}_{min}$	$\overline{T}_{max}$	$\overline{T}_{sr}$	$\overline{T}_{min} - \sigma_{min}$	$\overline{T}_{max} + \sigma_{max}$
01/10	8.0	16.8	–	CCF	11.2	21.3	15.7	9.6	23.4
02/10	3.6	19.8	0.3	AWD	10.9	20.7	15.2	9.3	22.8
03/10	10.1	24.8	–	AWD	11.1	20.1	14.8	9.5	22.2
04/10	15.0	23.5	–	AWD	10.4	20.6	14.7	8.8	22.7
05/10	13.3	25.4	–	AWD	9.8	20.0	14.3	8.2	22.1
06/10	13.0	25.7	–	AWD	9.9	19.7	14.0	8.3	21.8
07/10	12.9	23.9	–	AWD	9.5	20.1	14.1	7.9	22.2
08/10	11.1	23.2	–	AWD	9.9	19.6	14.0	8.3	21.7
09/10	12.3	23.0	–	AWD	9.8	19.2	13.9	8.2	21.3
10/10	11.8	23.4	–	AWD	9.6	19.0	13.7	8.0	21.1
11/10	11.2	24.1	–	AWD	9.5	19.7	13.8	7.9	21.8
12/10	10.2	23.9	–	AWD	9.2	19.0	13.4	7.6	21.1
13/10	11.3	27.0	–	AWD	8.8	18.6	12.9	7.2	20.7
14/10	10.0	23.0	–	AWD	8.7	18.8	13.0	7.1	20.9
15/10	11.4	14.4	–	CCF	8.8	18.5	12.8	7.2	20.6
16/10	13.4	19.4	0.0	AWD	8.1	18.4	12.6	6.5	20.5
17/10	10.2	21.2	–	AWD	8.5	18.4	12.7	6.9	20.5
18/10	9.1	20.8	–	AWD	8.0	18.5	12.2	6.4	20.6
19/10	8.0	19.4	–	AWD	7.6	17.0	11.5	6.0	19.1
20/10	10.4	21.6	–	AWD	7.1	16.7	11.3	5.5	18.8
21/10	9.4	18.7	–	CCF	7.1	16.0	10.9	5.5	18.1
22/10	4.5	15.8	–	ACD	6.8	16.2	10.7	5.2	18.3
23/10	5.2	15.2	–	ACD	6.7	16.0	10.6	5.1	18.1
24/10	3.3	15.1	–	ACD	6.6	15.7	10.5	5.0	17.8
25/10	3.5	16.0	–	ACD	6.5	16.3	10.7	4.9	18.4
26/10	4.9	11.4	–	ACD	6.8	15.8	10.4	5.2	17.9
27/10	1.8	15.7	–	ACD	6.2	14.7	9.8	4.6	16.8
28/10	3.2	16.4	–	ACD	6.0	15.4	10.2	4.4	17.5
29/10	3.5	17.7	–	AWD	6.4	15.3	10.1	4.8	17.4
30/10	7.3	21.8	–	AWD	6.5	14.4	10.0	4.9	16.5
31/10	12.0	14.8	0.0	CCF	6.6	14.4	9.9	5.0	16.5

6. FREQUENCY ANALYSIS

Statistical analysis for the period from 1946 to 2004 has confirmed traditional beliefs of the MS existence during autumn months in Belgrade region. The most frequent appearance is in the first half of October, about Miholjday (it is the period from 2 to 13 October). The primary maximum of MS (maximum number of days) is in that period; typical MS predominates, while the number of atypical days is appreciably less (Figure 4). The secondary maximum is at the end of the second ten-day interval of September, which is to some extent a consequence of the real late summer. In that period atypical MS is dominant. During the third ten-day interval of October, two minor maximums with equal frequency (6 days) of typical and atypical MS occur. In the first half of November MS frequency substantially decreases in comparison with October, and atypical MS frequency is somewhat greater than typical. A day with the greatest frequency of typical MS (10 days) is on 7 October (Figure 4).

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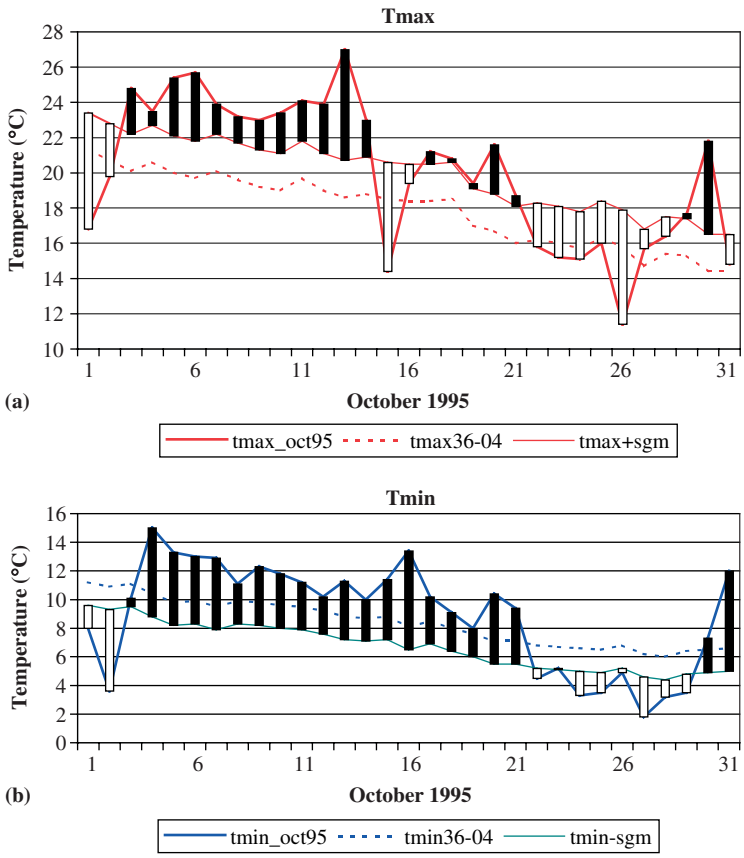

Figure 2. Maximum (a) and minimum (b) temperatures conditions for typical Miholjday summer (October 1995). This figure is available in colour online at www.interscience.wiley.com/ijoc

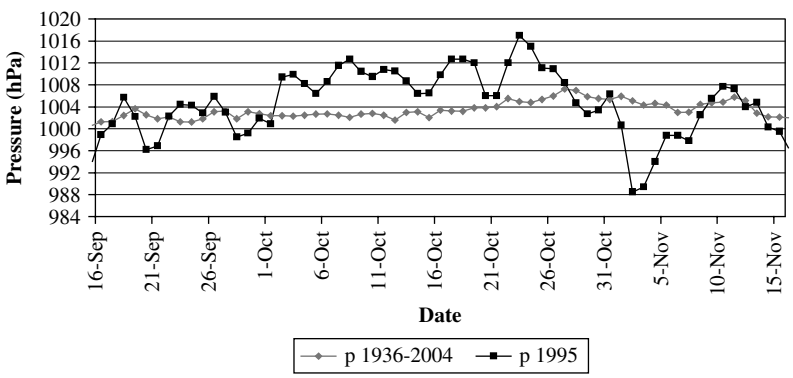

Figure 3. Sea-level pressure from 16 September to 15 November 1995 (black line) and daily mean sea-level pressure for 1936–2004 (grey line) at same period at Belgrade-Observatory

MS frequency has not substantially changed in the analyzed period. However, typical MS frequency in the last 59 years has an increasing trend, while atypical MS frequency has no significant increasing trend (Figure 5). Figure 5(a) shows that the number of typical MS days increased at the rate of 0.0434 days/year. Climate changes, the increasing extreme events frequency (global warming) and solar variability can explain this increase. The year characteristic for the appearance of typical MS was 1995

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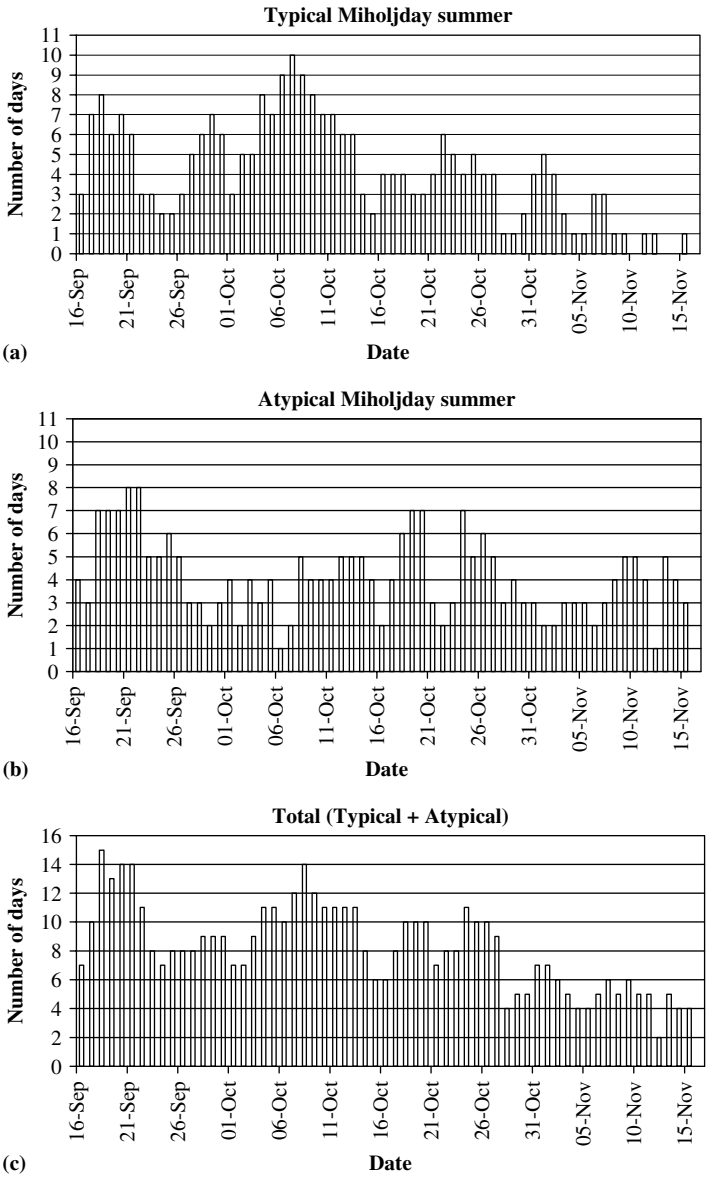

Figure 4. Frequency of: (a) typical, (b) atypical and (c) total (sum of the typical and atypical) Miholjday summer per day

with the frequency of 17 days in October (3–14 and 17–21). This is why October 1995 was chosen as a typical one.

7. CONCLUSION

The definition of MS is given and proved on the basis of real weather that this definition fits well to the phenomenon. The MS period lasts for three or more days. In some of the periods typical or atypical MS or their combination exists. Appearance of several MS periods is possible during the same autumn. During some years, periods of autumn, warm and dry weather cannot be regarded as MS because of the strong temperature criteria. Accordingly, MS does not look like a typical weather singularity.

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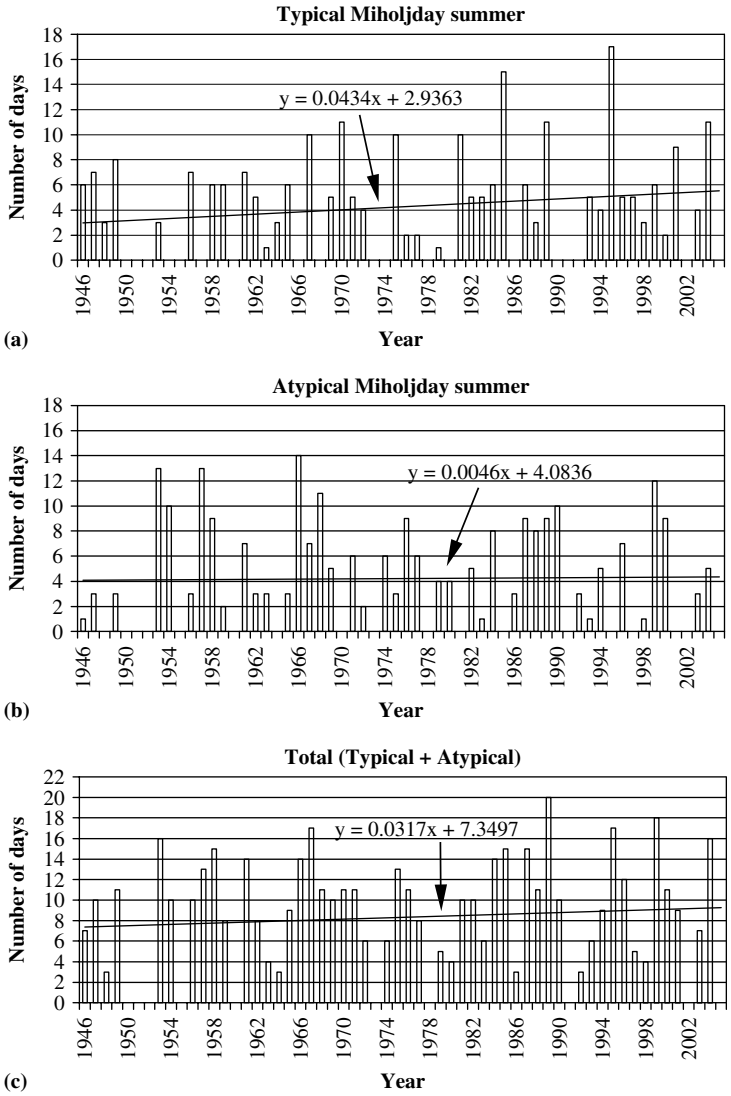

Figure 5. Frequency and trends of: (a) typical, (b) atypical and (c) total (sum of the typical and atypical) Miholjday summer per year

MS appears in autumn, during the period from the middle of September to the beginning of November. Typical and atypical MSs depending on synoptic situation and meteorological parameter values are defined. Typical MS is qualified by extensive anticyclone with the center over mid-Europe. Weather is AWD type. The wind is weak, without dominant direction. The weather is mostly dry and cloudless, with possible misty mornings. The daily temperatures are greater than the mean values. In this period, maximum temperatures have values equal to or greater than the average maximum temperatures plus the standard deviation for longer series of observations. Minimum temperatures are greater than the average minimum temperatures attenuated by the standard deviation for longer series of observations. Atypical MS is qualified by two synoptic situations. In the first, as with typical MS, extensive anticyclone dominates, but because of its different center position (in the east of Europe), a moderate or strong southeast wind named Koshava blows in Belgrade region. In the second, a cyclone with the center over northwestern Europe or/and over the western Mediterranean dominates. Then above southeastern Europe there is a warm air advection and weather is CWD type. Also, minimum temperatures of atypical MS days do not have to be greater than the values given in the criteria for the typical one.

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Meteorological parameter analysis for the period from 1946 to 2004 confirmed traditional beliefs of MS existence for Belgrade region. The most frequent appearance is in the first half of October, about Miholjday (it is the period from 2 to 13 October). In that period there is the primary maximum of MS (maximum number of days); typical MS predominates, while the number of atypical days is much less. A day with the greatest frequency of typical MS (10 days) is on 7 October. MS frequency is not substantially changed in the analyzed period. However, typical MS frequency in the last 59 years has an increasing trend (0.0434 days/year), while atypical MS frequency has no significant increasing trend.

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