PRECIPITATION DEFICIT PERIODS IN THE DANUBIAN LOWLAND IN SLOVAKIA

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Abstract

Geographic position of Slovakia creates preconditions for existence of the temporary precipitation deficit periods resulting in drought mainly during transition seasons (spring and autumn) as well as summer. Not only precipitation deficit but also precipitation surplus represents a trouble that cause increasingly more significant and widespread damages. In the term of precipitation deficit period occurrence in the Danubian lowland region in Slovakia represent potentially the most endangered areas by drought. However our experience from climatological practice indicates increasing risk of the precipitation deficit incidence even in other region of Slovakia. The ascending extent of regional of precipitation deficit period is also very significant.
The long-term time series of daily precipitation totals available from the end of 19th century, respectively from the beginning of the 20th century to present period have made us possible to analyze the incidence of the precipitation deficit period in Slovakia. Selected meteorological stations from which the daily precipitation totals data sets are available within the above mentioned period are situated in different natural and climatological conditions in Slovakia.
In our previous statistical and regional analyses of precipitation deficit periods within the 1901-2006 period we have revealed the noticeable changes not only in occurrence frequency but also in annual regime of drought periods occurrence in the most southernmost regions within the Danubian lowland in Slovakia. The Danubian lowland represents from the economic viewpoint the most eminent and interesting region in Slovakia.
In the paper we deal with the statistical trend and frequency analysis as well as with the annual regime and regional extent analysis of the precipitation deficit periods incidence at selected meteorological stations in Slovakia, mainly in the Danubian lowland region. Recently climate in the Danubian lowland begins to show some features typical for the Mediterranean region with its warmer spells and aridization trends.

Keywords: *precipitation deficit periods, the Danubian lowland region, drought, aridization trends, Konček´s moisture index, climate scenarios.*

1 INTRODUCTION

Significant air temperature increase as well as slightly more difficult temporal and spatial precipitation variability are the most relevant results calculated by the global climate changes scenarios. Two principal annual precipitation regimes are conditioned by geographic position of Slovakia in the central Europe region and its various natural conditions as well. In the north-western, northern and north-eastern regions of Slovakia there we can observe a simple annual precipitation regime with a maximum in June or July, respectively with minimum in February or March. However largely, there is a complex, double-maximum annual precipitation regime (maximum in spring and autumn) in most of regions of Slovakia which is caused by activity of the Mediterranean cyclones moving ahead over Slovakia mainly in the transition-periods.

2 PRECIPITATION DEFICIT PERIODS (PDP) METHODS AND DATA

Besides annual precipitation distribution and its regional aspect certain criteria are needed to quantitatively define precipitation deficit periods. During the year the precipitation deficit periods occur particularly within transition-period (spring, autumn), while during summer and winner the probability of its incidence is lower (mainly in June and July) in Slovakia. The southernmost regions of Slovakia, mostly the Danube lowland regions break the mentioned rule. The precipitation deficit occurrence probability is equally high during all annual seasons in these regions. The rest of Slovakia territory is affected by thunderstorms and rain showers more considerably over the period of year so the occurrence probability has quite low rate. The drought regarding to lack of accessible water exists also in these regions, because the totals of effective precipitation produced by thunderstorms and showers are relatively poor. High daily temperature, long-time sunshine duration and specific wind conditions cause the significant increase of water deficit actually in region situated outside the Danube lowland.

The frequency of precipitation deficit period occurrence is minimal in the region with periodical precipitation, e.g. in the north-western and northern parts of Slovakia (Orava, Kysuce, etc.). Apart from the periodical precipitation existence relatively high rate of precipitation occurs in these regions. Moreover, comparable precipitation rates are observed in some other regions in Slovakia, but there are different annual precipitation regimes with more irregular temporal distribution of precipitation.

On the ground of the statistical analysis of daily precipitation long-term time series (1901-2006, respectively 1961-2006) at the proportional distributed meteorological stations we have tried to reveal some relation between regional extent as well as duration and annual regime of the precipitation deficit periods in Slovakia. Within the normal climate conditions the precipitation deficit periods occur mostly in March and October. In order to precipitation deficit periods assessment we have took over the following „drought periods“ definition criteria that have been used analogously in previous studies:

Criteria 1: Precipitation deficit period existing for at least 15 days with precipitation total below 1 mm,
Criteria 2: Precipitation deficit period existing for at least 20 days with precipitation total below 2,5 mm,
Criteria 3: Precipitation deficit period existing for at least 30 days with precipitation total below 5 mm.

Table 1 Geographical location of considered meteorological stations in Slovakia (and in the Danubian lowland)

Station name	Altitude [m n.m.]	Latitude [N]	Longitude [E]
Beňuš	550	48° 49´ 49´´	19° 45´ 36´´
Bratislava-Koliba	287	48° 10´ 07´´	17° 06´ 38´´
Bratislava-letisko	131	48° 10´ 05´´	17° 12´ 12´´
Hurbanovo	115	47° 52´ 23´´	18° 11´ 39´´
Jaslovské Bohunice	178	48° 29´ 31´´	17° 40´ 50´´
Kráľová	124	48° 11´ 44´´	17° 27´ 13´´
Kremnica	580	48° 42´ 38´´	18° 55´ 09´´
Liptovský Hrádok	640	49° 02´ 21´´	19° 43´ 31´´
Medzilaborce	305	49° 15´ 12´´	21° 54´ 50´´
Nitra	135	48° 16´ 44´´	18° 08´ 18´´
Oravská Lesná	780	49° 22´ 06´´	19° 10´ 59´´
Piešťany	163	48° 36´ 47´´	17° 49´ 58´´
Podhájska	138	48° 06´ 27´´	18° 20´ 21´´
Rimavská Sobota	215	48° 22´ 26´´	20° 00´ 38´´
Senica	195	48° 40´ 50´´	17° 20´ 37´´
Štrbské Pleso	1354	49° 07´ 26´´	20° 04´ 09´´
Trebišov (Milhostov)	104	48° 40´ 05´´	21° 44´ 05´´
Žihárec	111	48° 03´ 59´´	17° 52´ 04´´

3 PRECIPITATION DEFICIT PERIODS (PDP) ANALYSIS RESULTS

According to our expectation, criteria 1 with precipitation deficit period that exists for at least 15 days with precipitation total below 1 mm, have been realized the most frequently. From the regional viewpoint the occurrence of these periods has been concentrated mostly to south-east regions of Slovakia (excepting a summer season). This fact is caused by existing of more continental climate in the region. The similar situation has been revealed in the basins in the eastern part of Horehronie, Liptov and Spiš.

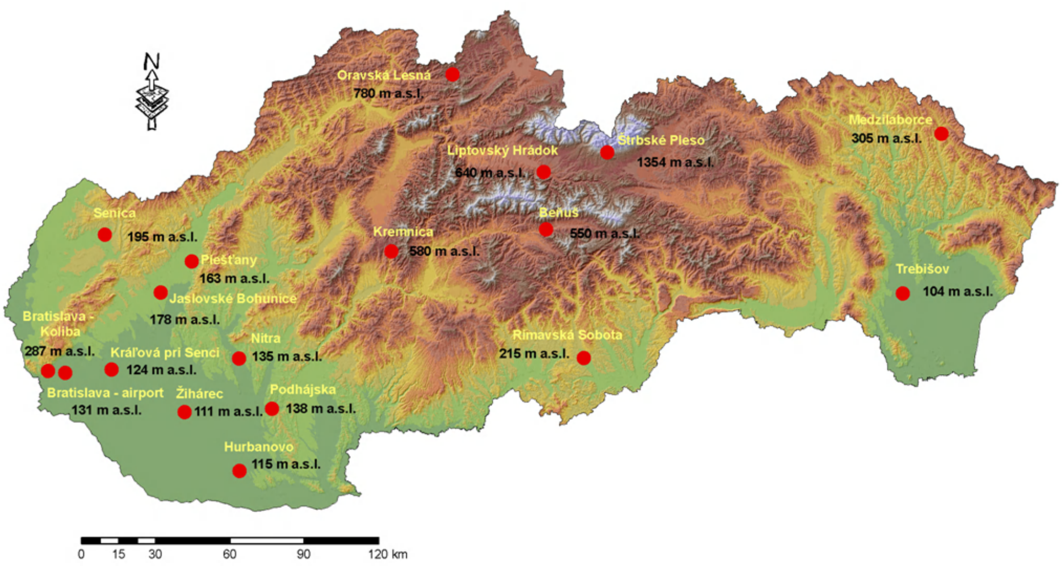

Fig. 1 Spatial distribution of selected meteorological stations in Slovakia

In the term of annual regime of precipitation deficit periods there have been recorded significant decrease of the criteria 1 periods number mainly in the Danube lowland as well as in north-western and north-eastern part of Slovakia particularly in December and January, respectively. Additional precipitation deficit periods defined according to Criteria 2 and 3 have had lower probability of incidence mainly in the mountainous regions with more oceanic climate features in the western and north-western part of northern Slovakia. In the case of long-time periods of precipitation deficit, usually existing at least one month, there have not been revealed any annual regime or spatial pattern in Slovakia. The intermontane basins represent an exception to the rule because in summer specific conditions exist there. The long-time deficit periods might by interrupt because of high probability occurrence of thunderstorms with heavy rainfalls (Beňuš and Liptovský Hrádok data represent above-mentioned annual regime of precipitation deficit periods).

Following the long-term time series statistical analysis results we have revealed the most remarkable changes in precipitation deficit periods occurrence during the last two decades particularly by using Criteria 1 and 2. The long-term time series of daily precipitation totals at Hurbanovo meteorological station represent the southernmost regions of Slovakia. In the region the precipitation deficit periods duration and count increase mainly in June and January, respectively in May and slightly markedly in July as well. On the contrary the most significant decrease of precipitation deficit periods duration and count has been observed (according to Criteria 1) in the region within the period from September up to November. From this point of view the annual precipitation regime of southernmost regions of Slovakia has begun to be similar to south Europe precipitation regime (Mediterranean region). It means more infrequent incidence of more intensive thunderstorm rainfalls on the one hand and wetter autumn weather on the other hand. The significant increase of precipitation deficit periods duration as well as count in January observed not only in Hurbanovo but also at other meteorological stations is also worth mentioning. In the connection with above-mentioned relations the air temperature above-normal January periods sequence (Table 2) is specially notable. The last air temperature subnormal January was recorded in Hurbanovo in 1987.
The precipitation deficit periods duration and count increase in summer season (according to above-mentioned criteria) has not been revealed in other regions within the comparable range as in Hurbanovo. The more frequent thunderstorms occurrence in these regions may be a likely reason of the distinction. In the northernmost regions of Slovakia the significant decrease of the precipitation deficit periods duration and count has been observed. The trend is in good accords with generally increased precipitation totals in the region.

Table 2 Monthly air temperature (T) in Hurbanovo (1951-2007) in comparison with monthly air temperature normal 1961-1990 (air temperature deviation values: NN – above-normal T; NP – above-average T; PP – below-average T; 0 – without T deviation; PN – subnormal T)

Rok	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
1951	**NN**	**NN**	PP	NP	PP	0	PP	**NN**	**NN**	PN	**NN**	NP
1952	NP	PP	PN	**NN**	PP	PP	**NN**	**NN**	PN	PN	PN	PP
1953	NP	PP	PP	NP	PN	NP	NP	PN	NP	**NN**	PN	NP
1594	NP	PP	PP	NP	PN	NP	NP	PN	NP	**NN**	PN	NP
1955	PP	PP	PN	PN	PN	PP	PP	PN	PP	PP	0	**NN**
1956	NP	PN	PN	PP	PP	PN	NP	PP	NP	PP	PN	NP
1957	PP	**NN**	NP	NP	PN	**NN**	NP	PN	PN	PP	**NN**	NP
1958	NP	**NN**	PN	PN	**NN**	PN	NP	NP	NP	NP	**NN**	**NN**
1959	NP	PP	**NN**	NP	PP	PP	NP	0	PN	PP	NP	**NN**
1960	0	PP	NP	PP	PP	NP	PN	0	PP	**NN**	**NN**	**NN**
1961	PP	NP	**NN**	**NN**	PP	NP	PN	NP	**NN**	**NN**	NP	PP
1962	NP	PP	PN	**NN**	PN	PN	PN	**NN**	PP	0	NP	PN
1963	PN	PN	PN	**NN**	NP	**NN**	**NN**	NP	**NN**	PP	**NN**	PN
1964	PN	PP	PN	NP	PP	**NN**	NP	PP	NP	PP	**NN**	PP
1965	NP	PN	0	PN	PN	PP	PP	PN	NP	PN	PN	NP
1966	PN	**NN**	PP	**NN**	PP	NP	PN	PP	PP	**NN**	NP	NP
1967	NP	NP	NP	PP	NP	0	**NN**	NP	**NN**	**NN**	PP	PP
1968	PP	NP	NP	**NN**	NP	**NN**	NP	PP	PP	PP	**NN**	PN
1969	PP	PN	PP	PP	**NN**	PP	NP	PP	NP	NP	**NN**	PN
1970	PP	PN	PP	PP	PN	NP	PP	0	PP	PP	**NN**	NP
1971	PP	NP	PN	NP	**NN**	PN	NP	**NN**	PN	PN	PP	**NN**
1972	NP	**NN**	**NN**	NP	PP	NP	NP	PN	PN	PN	NP	NP
1973	NP	NP	NP	PN	NP	NP	PP	NP	NP	PN	PN	NP
1974	**NN**	**NN**	**NN**	PP	PN	PN	PP	**NN**	PP	PN	**NN**	**NN**
1975	**NN**	PP	**NN**	PP	**NN**	PP	NP	NP	**NN**	PP	PN	NP
1976	**NN**	PP	PN	NP	PP	NP	**NN**	PN	PN	**NN**	**NN**	0
1977	PP	**NN**	**NN**	PN	0	**NN**	PP	PP	PN	NP	NP	PP
1978	**NN**	PP	NP	PN	PN	PP	PN	PN	PN	0	PN	NP
1979	PN	NP	**NN**	PN	NP	**NN**	PN	PP	PP	PN	NP	**NN**
1980	PP	NP	PP	PN	PN	PP	PN	PP	PN	PP	PN	PP
1981	PP	PP	**NN**	NP	NP	NP	PP	PP	NP	**NN**	PP	PP
1982	PN	PN	0	PN	NP	NP	NP	NP	**NN**	**NN**	NP	**NN**
1983	**NN**	PN	NP	**NN**	NP	NP	**NN**	NP	NP	PP	PN	PP
1984	NP	0	PP	PP	PP	PN	PN	PP	PP	**NN**	NP	PP
1985	PN	PN	PP	0	NP	PN	NP	NP	PP	PP	PN	**NN**
1986	NP	PN	PP	**NN**	**NN**	PP	PP	NP	PN	PP	NP	PP
1987	PN	PP	PN	PP	PN	0	**NN**	PN	**NN**	**NN**	NP	NP
1988	**NN**	NP	PP	PP	NP	PP	**NN**	NP	PP	PP	PN	0
1989	NP	**NN**	**NN**	**NN**	PP	PN	NP	PP	NP	NP	PN	NP
1990	NP	**NN**	**NN**	PP	NP	0	PP	**NN**	PN	NP	**NN**	PP
1991	NP	PN	**NN**	PN	PN	PP	**NN**	NP	**NN**	PN	NP	PN
1992	**NN**	**NN**	NP	NP	NP	**NN**	**NN**	**NN**	NP	PP	NP	PP
1993	NP	PN	PP	NP	**NN**	NP	PP	**NN**	NP	**NN**	PN	**NN**
1994	**NN**	NP	**NN**	NP	NP	NP	**NN**	**NN**	**NN**	PN	**NN**	**NN**
1995	NP	**NN**	PP	NP	PP	PP	**NN**	NP	PP	**NN**	PN	NP
1996	PP	PN	PN	NP	NP	**NN**	PN	NP	PN	NP	**NN**	PN
1997	PP	NP	PP	PN	NP	**NN**	PP	**NN**	PP	PN	**NN**	**NN**
1998	**NN**	**NN**	PP	**NN**	NP	**NN**	NP	**NN**	PP	**NN**	PN	PN
1999	NP	PP	**NN**	**NN**	NP	NP	**NN**	NP	**NN**	NP	PN	NP
2000	PP	**NN**	NP	**NN**	**NN**	**NN**	PP	**NN**	NP	**NN**	**NN**	**NN**
2001	**NN**	**NN**	**NN**	PP	**NN**	PP	**NN**	**NN**	PN	**NN**	PN	PN
2002	NP	**NN**	**NN**	0	**NN**	**NN**	**NN**	**NN**	PP	PP	**NN**	PP
2003	PP	PN	NP	NP	**NN**	**NN**	**NN**	**NN**	NP	PN	**NN**	NP
2004	PP	NP	PP	**NN**	PP	0	NP	**NN**	NP	**NN**	NP	NP
2005	NP	PP	PP	NP	NP	NP	NP	PP	**NN**	NP	PP	NP
2006	PP	PN	PP	**NN**	PP	**NN**	**NN**	PN	**NN**	**NN**	**NN**	**NN**
2007	**NN**	**NN**	**NN**	**NN**	**NN**	**NN**	**NN**	**NN**	PN	PP	PP	PP

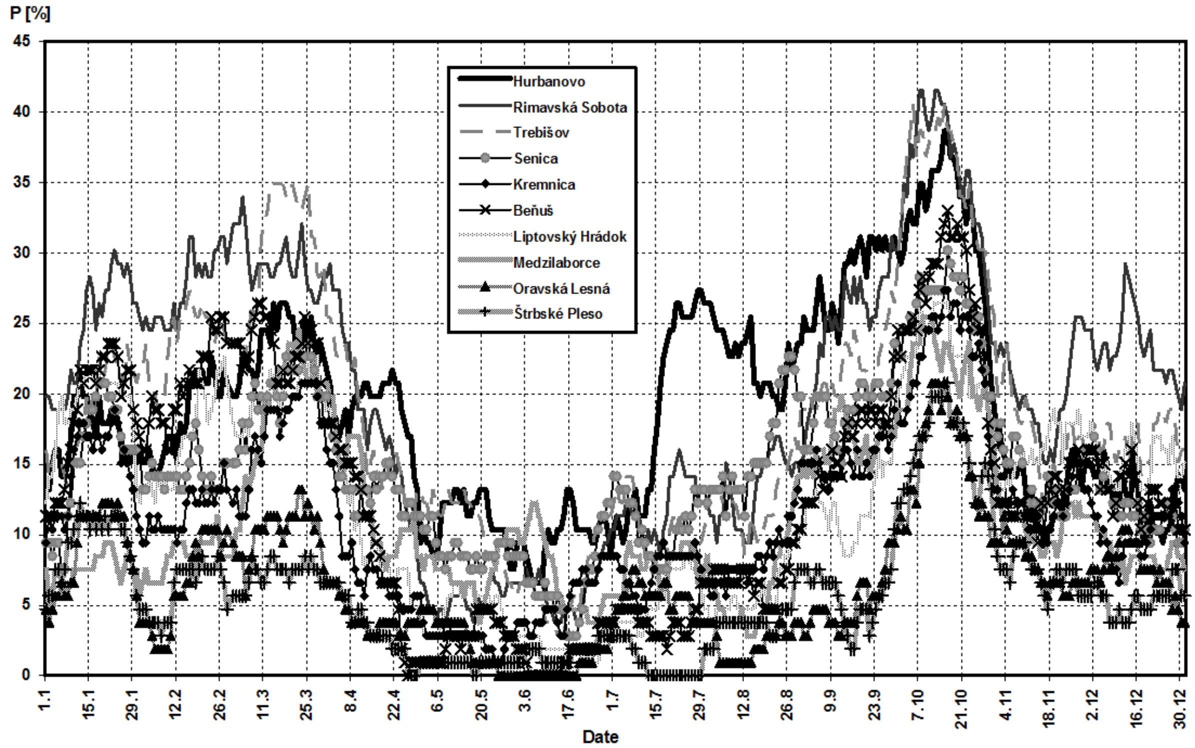

Fig. 2 Annual regime of the probability occurrence of days within PDP (according to criteria 1) at selected meteorological stations (1901-2006).

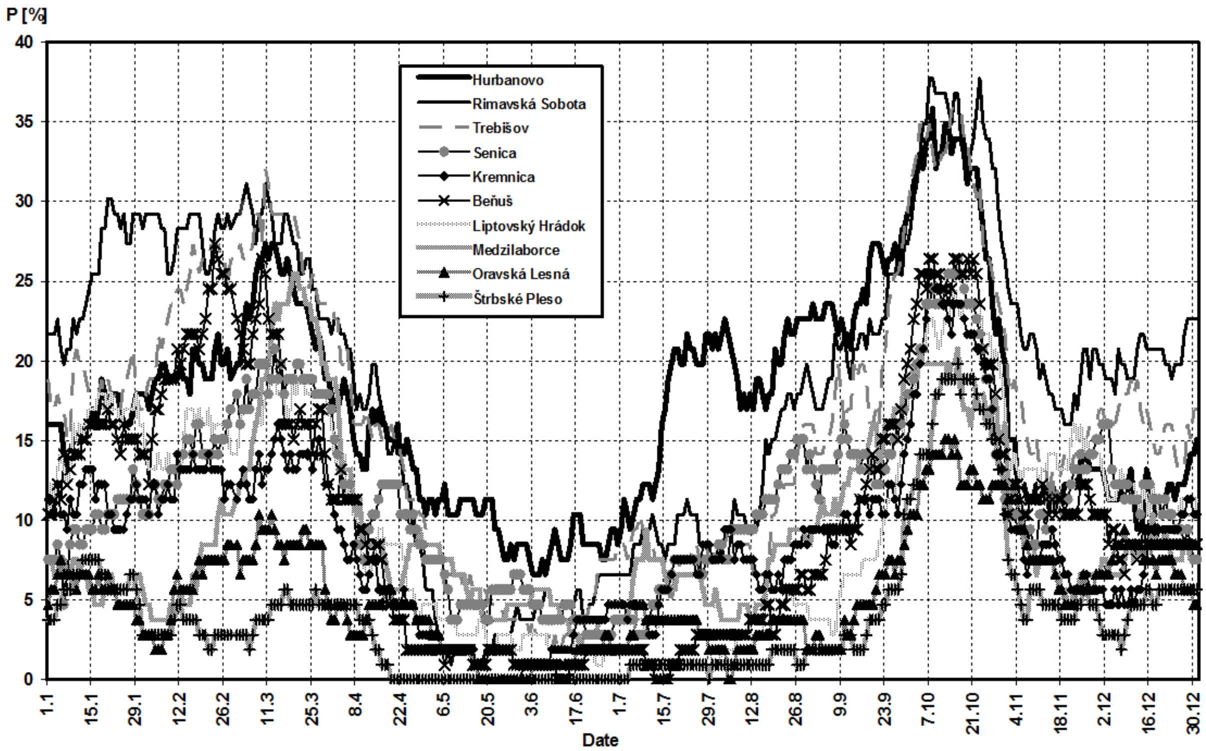

Fig. 3 Annual regime of the probability occurrence of days within PDP (according to criteria 2) at selected meteorological stations (1901-2006).

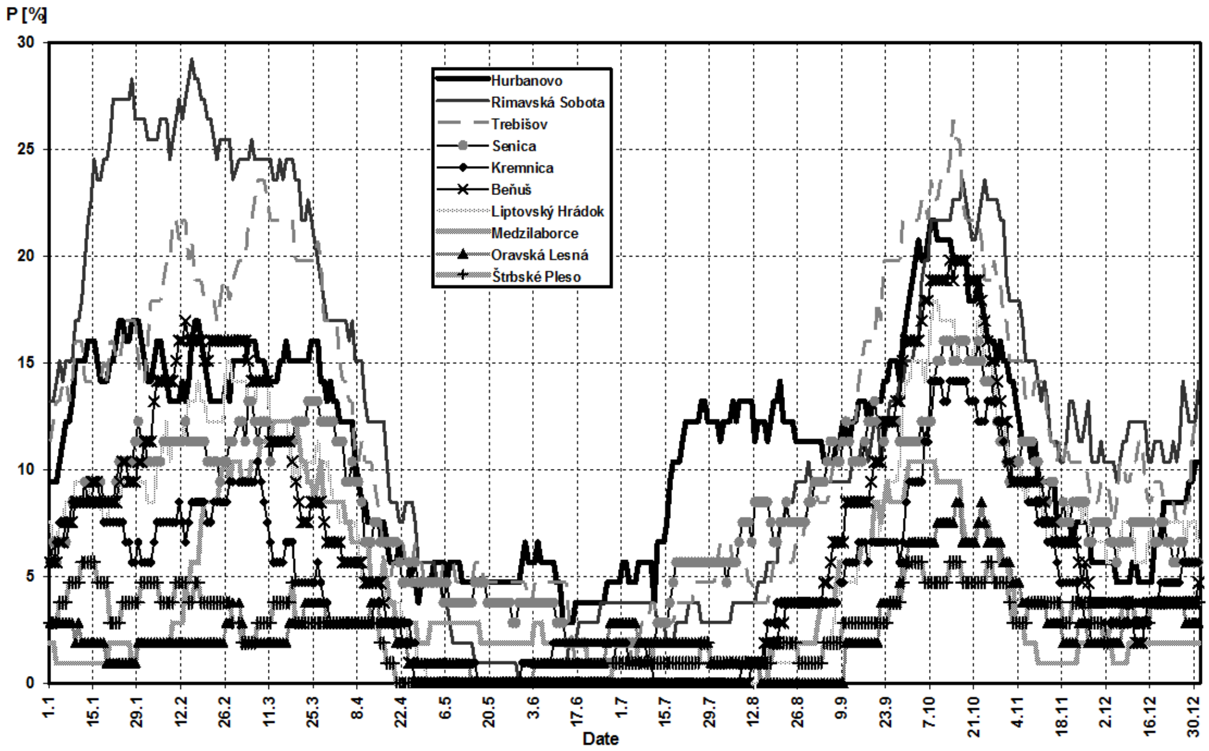

Fig. 4 Annual regime of the probability occurrence of days within PDP (according to criteria 3) at selected meteorological stations (1901-2006).

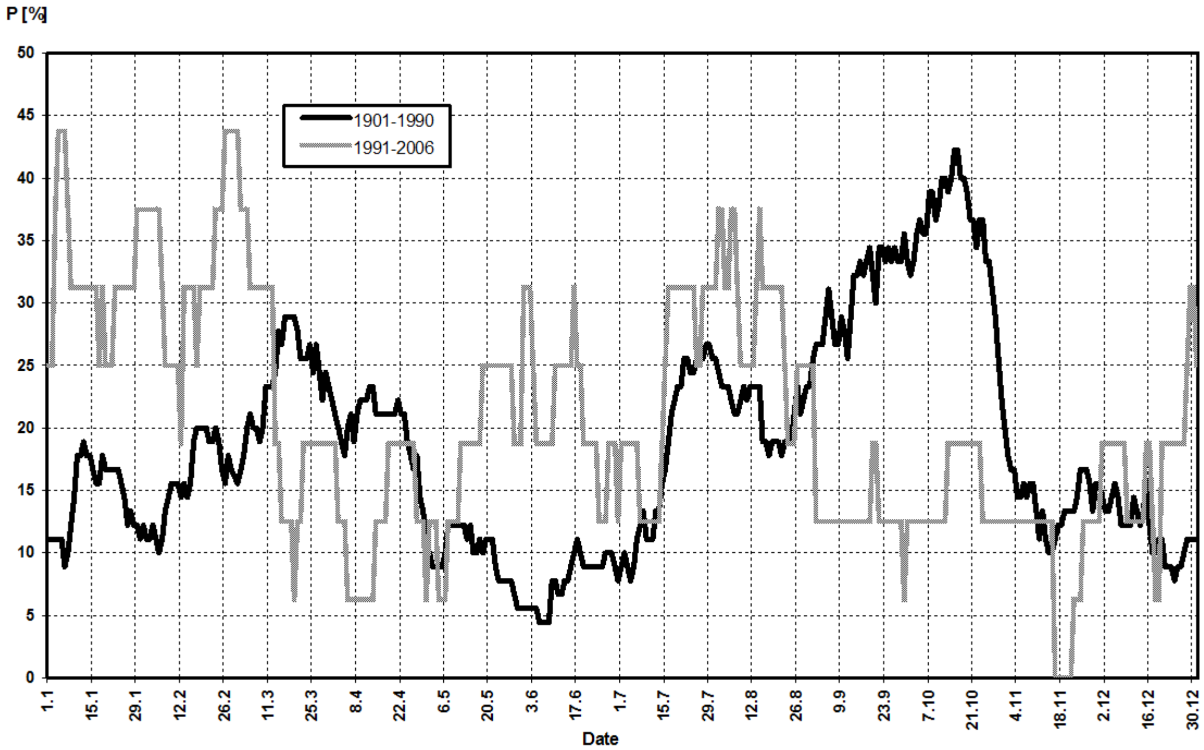

Fig. 5 Annual regime of the probability occurrence of days within PDP (according to criteria 1) in the 1901-1990 and 1991-2006 period in Hurbanovo.

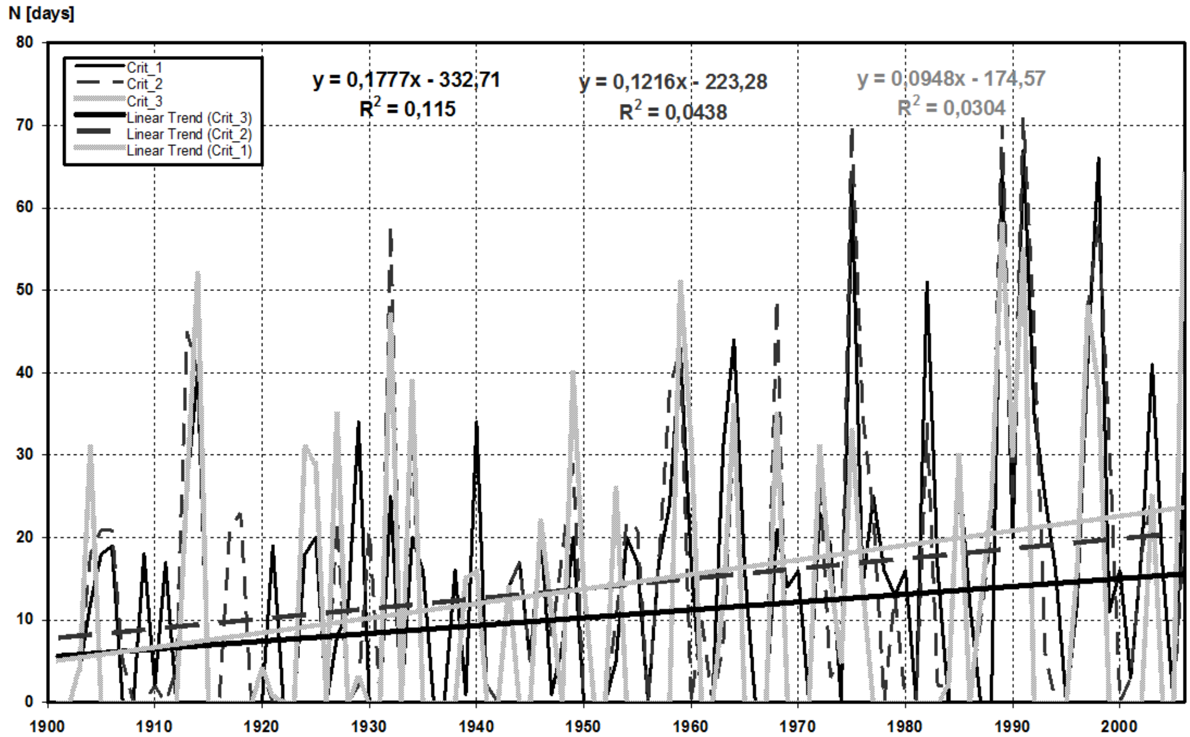

Fig. 6 Number of the precipitation deficit period days (all criteria) during the winter season (December-February) in Hurbanovo (1901-2006).

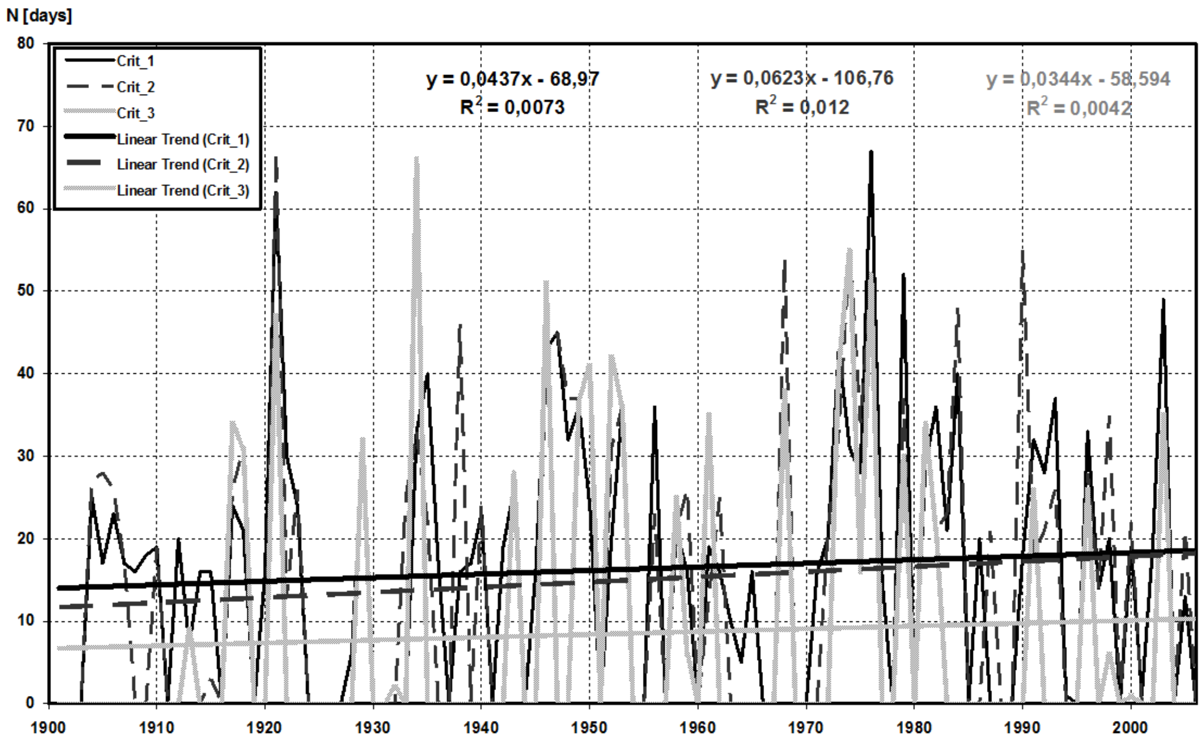

Fig. 7 Number of the precipitation deficit period days (all criteria) during the spring season (March-May) in Hurbanovo (1901-2006).

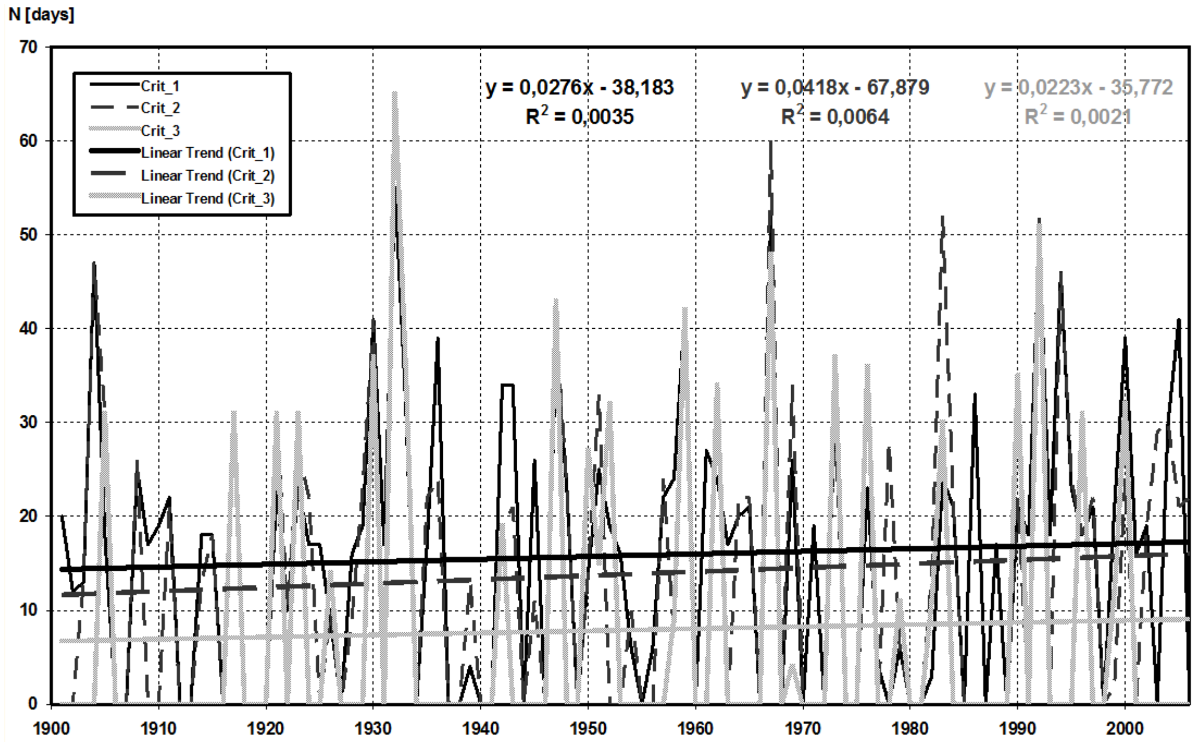

Fig. 8 Number of the precipitation deficit period days (all criteria) during the summer season (June-August) in Hurbanovo (1901-2006).

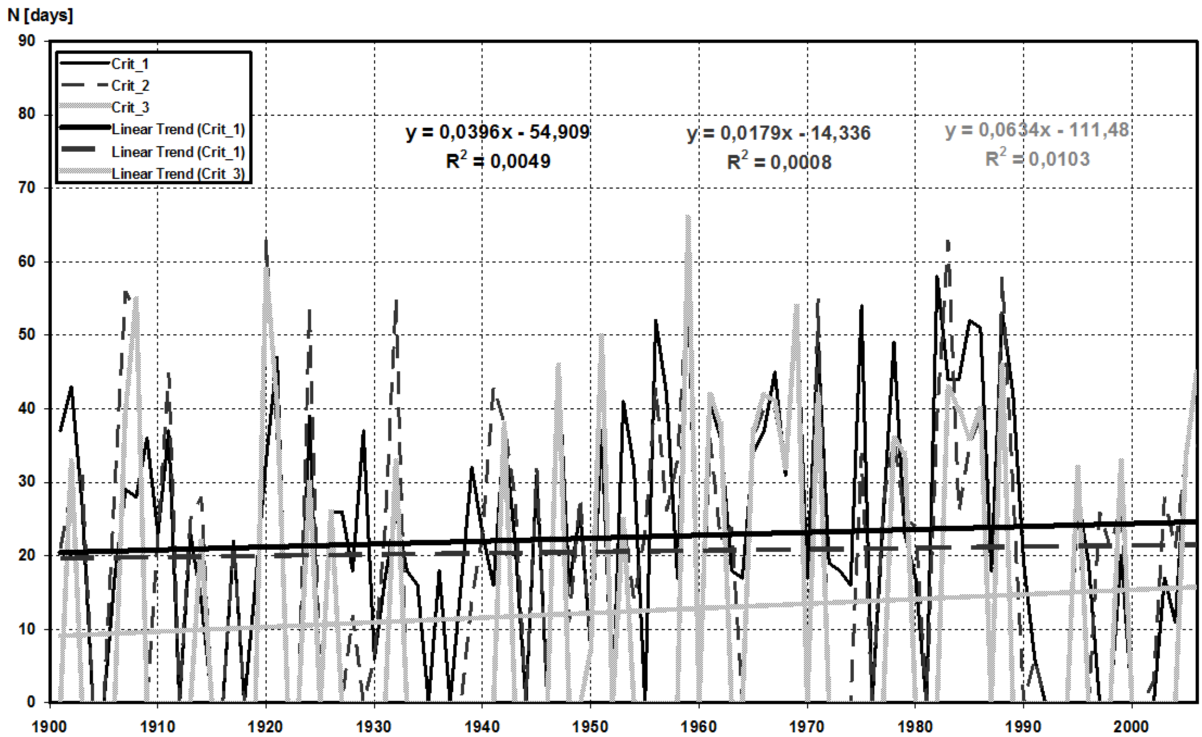

Fig. 9 Number of the precipitation deficit period days (all criteria) during the autumn season (September-November) in Hurbanovo (1901-2006).

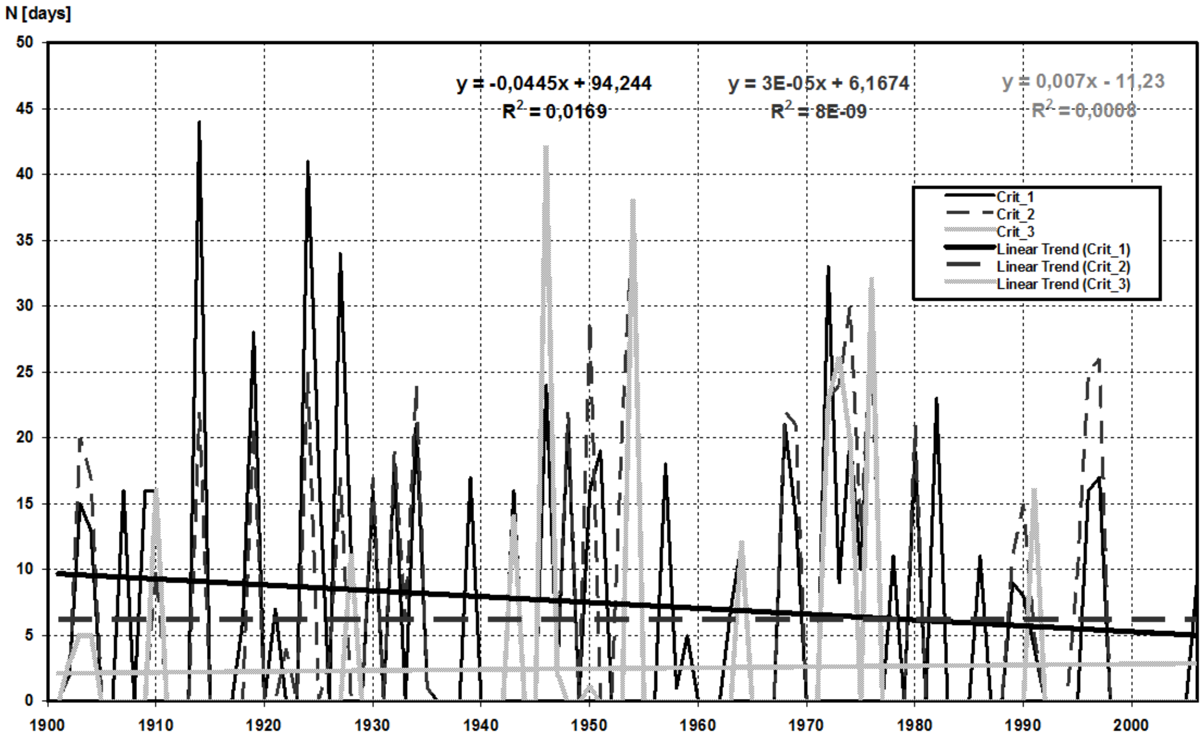

Fig. 10 Number of the precipitation deficit period days (all criteria) during the winter season (December-February) in Medzilaborce (1901-2006).

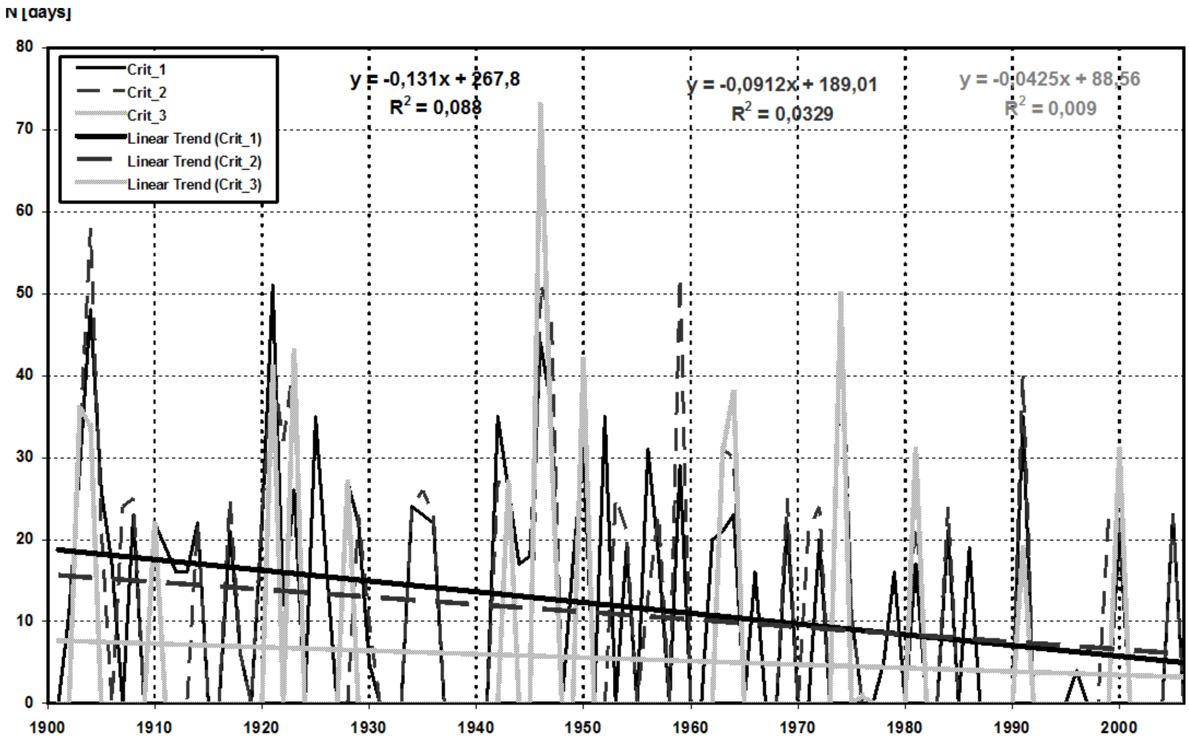

Fig. 11 Number of the precipitation deficit period days (all criteria) during the spring season (March-May) in Medzilaborce (1901-2006).

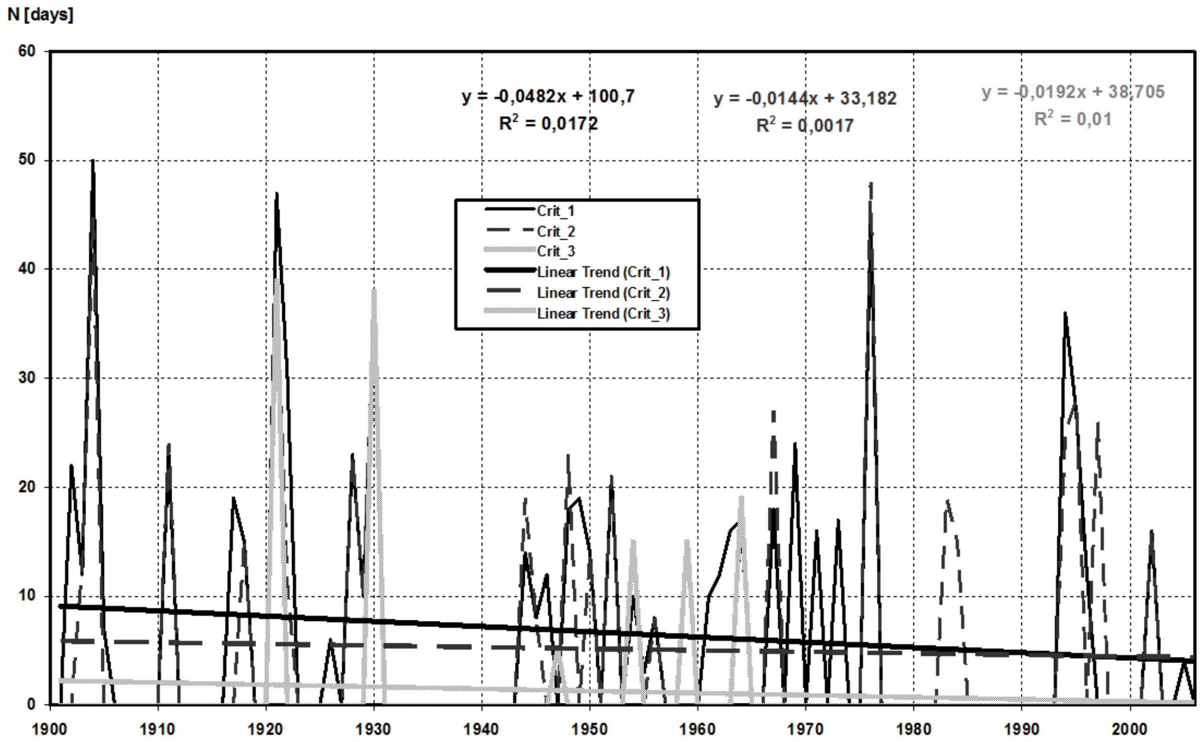

Fig. 12 Number of the precipitation deficit period days (all criteria) during the summer season (June-August) in Medzilaborce (1901-2006).

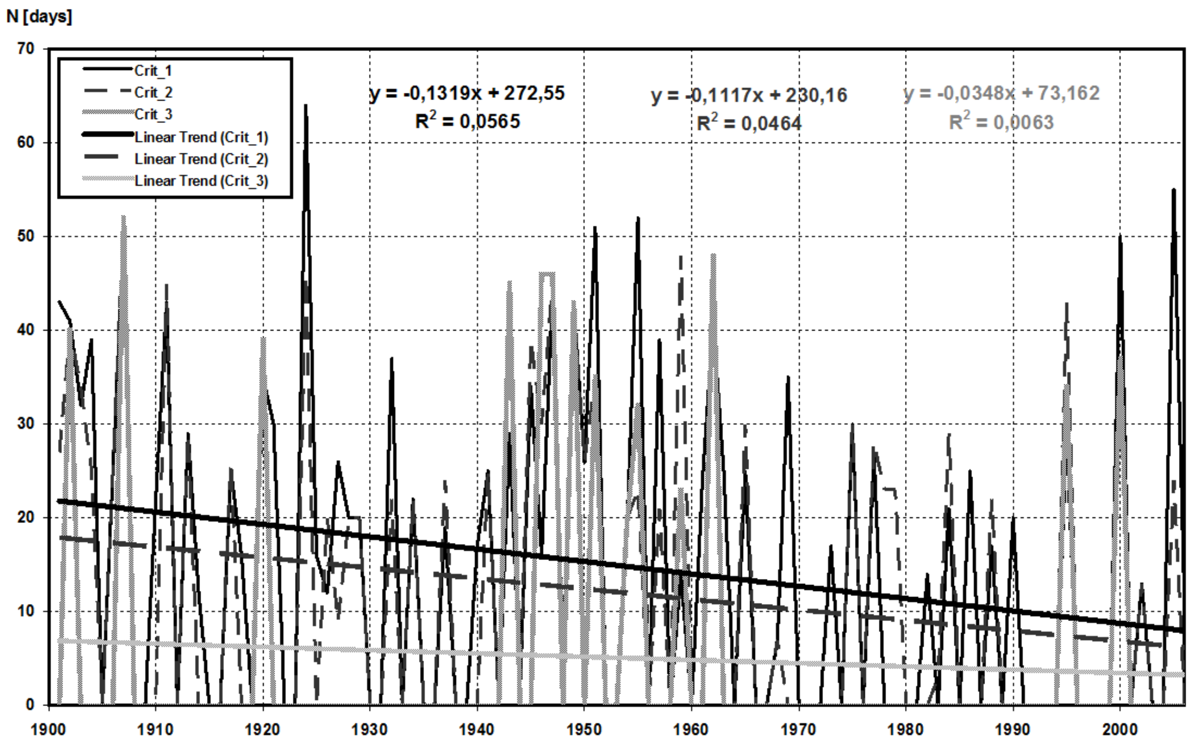

Fig. 13 Number of the precipitation deficit period days (all criteria) during the autumn season (September-November) in Medzilaborce (1901-2006).

Additional statistical and trend analysis of precipitation deficit periods at some other meteorological stations in the Danube lowland (e.g. Bratislava-airport, Žihárec, Jaslovské Bohunice, etc.) explicitly confirm some long-term tendencies that are similar to those which we described in the case of Hurbanovo station. The most expressive similarity between selected meteorological station precipitation time series have been revealed in case of Hurbanovo and Žihárec. In Podhájska there have been recorded obvious precipitation deficit periods increase in late spring and summer, although decrease of these periods in early spring and autumn haven´t been as significant as in Hurbanovo or Žihárec. Noticeable decrease of precipitation deficit period number in western part of the Danube lowland in autumn is also quite readable (Bratislava-airport, Jaslovské Bohunice, Kráľová pri Senci), however it isn´t as sharp as in the north-east part of lowland (Nitra, Podhájska). Within quite homogenous lowland region there exist some significant differences in the daily precipitation time series. Of course it is not so astonishing because there exist natural precipitation regions within the Danube lowland resulting from different humid air masses expositions of the terrain. Our analysis confirms existence of precipitation boundary-line between western and eastern parts of the Danube lowland which is defined from the precipitation regime and rate viewpoint. The above-mentioned differences are nicely express during different synoptic situations.

4 ARIDIZATION TRENDS IN THE DANUBIAN LOWLAND

Characteristic of precipitation deficit period occurrence can outline drought conditions in the land design. More comprehensive picture in real drought conditions in the land gives complex of some climatic characteristic, e.g. atmospheric precipitation, air temperature, evaporation, wind speed, etc. In our opinion Konček's moisture index is appropriate climatic characteristic to describe situation in land aridity (Melo et al. 2007b). We are also interested how the ongoing climate change can influence the aridization trend in the Danubian lowland in Slovakia. Previous studies about detection of some expected changes in the climatological regime due to climate change were introduced by Lapin (2004), Melo et al. (2007a).

Value of Konček's moisture index is calculated by the formula (Konček 1955):

$$\mathbf{Iz = 0.5\,R + r - 10\,T - (30 + v^2)}$$

where R [mm] – means precipitation total in the vegetation period (Apr.-Sep),
r [mm] – precipitation total exceeded in average 105 mm for winter season (Dec.-Feb.),
T [°C] - mean air temperature in the vegetation period,
v [$m.s^{-1}$] – mean wind speed measured at 14 h in the vegetation period.

Value Iz ≥ 120 means very moist region, Iz = 60 - 120 means moist region, Iz = 0 - 60 means moderately moist region, Iz = -20 - 0 means moderately dry region, Iz = -40 to -20 means dry region, Iz < -40 means very dry region.

Based on these values (Konček's moisture index) together with some air temperature characteristics the climatic regions in Slovakia have been specified (for period 1931-

1960 in Konček 1980, for period 1961-1990 in Lapin et al. 2002). Three regions are divided by this method (warm, moderately warm and cool regions). Warm region has 50 or more so called summer days annually in average (with daily maximum air temperature ≥25 °C), moderately warm region has less than 50 summer days annually in average (with daily maximum air temperature ≥25 °C) and the July mean temperature is 16 °C or more. Cool region has the July mean temperature < 16 °C. Warm region has 7 subregions (differences are in values of January air temperature and in values of Iz). Moderately warm region has 7 subregions (differences are in values of January and July air temperatures and in values of Iz). Cool region has 3 subregions (all three subregions are considered as very humid, differences are only in July temperature, 12 and 10 °C limits), Lapin et al. 2002.

Calculations have been carried out for different periods of some meteorological stations in Danubian lowland (Tab.1). The Hurbanovo Observatory is representative site for this region and it ranks among the best meteorological stations in central Europe with sufficiently long and good-quality observations. Climatic series at the Hurbanovo observatory in 1871-2006 is analyzed. Other meteorological stations in 1961-2007 are analyzed. In case of Hurbanovo also we study the possible aridity development by the end of the 21st century. The Canadian CGCM2 model output using SRES-A2 emission scenario has been considered (Boer et al.1992, Flato and Boer 2001, McFarlane et al. 1992).

Precipitation totals decrease and air temperature increase cause growth of aridization in landscape. We can state that aridization trends appear in the Danubian lowland in the whole 20th century (values of Iz decreased continuously in the 20th century) (Tab. 2, Tab. 3). Even new climatic subregion arose in the Danubian lowland in 1951-1980. In 1901-1950 (Iz = -32.5) likewise in 1931-1960 (Iz = -39.3) was typical for this region warm and dry climate (warm region and dry subregion) (Konček 1980). Boundary value Iz = -40 was adjusted in the period 1951-1980 (Iz for Hurbanovo = -46.9). From this time in the Danubian lowland we have warm and very dry climate (warm region and very dry subregion) (e.g. 1961-1990 period in Lapin et al. 2002). Also other shifts of climatic regions and subregions were registered in Slovakia in the 20th century (Konček 1980, Lapin et al. 2002). In recent period 1991-2007 warm and very dry climate extends its area in Danubian lowland towards near Malé Karpaty Mts (values Iz for Bratislava-airport = -58.6, Iz for Piešťany = -43.7, Iz for Jaslovské Bohunice = -63.1 in 1991-2007, closer in Tab. 3). Values Iz in 1961-1990 were for the same meteorological stations following: Iz for Bratislava-airport = -26.4, Iz for Piešťany = -28.8 and Iz for Jaslovské Bohunice = -38.7.

Table 3 Values of Konček's moisture index Iz for different periods (1901-1950, 1931-1960, 1951-1980, 1961-1990 and 1991-2006) and climate scenario based on the CGCM2 (SRES-A2) model for 2051-2100 at Hurbanovo.

Period	1901-1950	1931-1960	1951-1980	1961-1990	1991-2006	2051-2100
Iz	-32.5	-39.3	-46.9	-56.5	-58.6	-115.0

In the period 1991-2006 the value of Iz for Hurbanovo is –58.6 (especially because of higher mean air temperature; precipitation total is slightly higher in this period as well). We believe that this value does not give a completely true picture on real climate in the Danubian lowland in the recent years because of precipitation distribution changed during the year. Annual precipitation total is similar to the previous periods but we have less number of days with precipitation on the one hand and precipitation intensity is higher on the other. Major part of precipitation runoffs and so less influences the soil moisture in this region. Konček's moisture index is appropriate to modify considering this reality in the future (Melo et al. 2007b).

Table 4 Values of Konček's moisture index Iz for different periods (1961-1975, 1976-1990, 1991-2007) for some meteorological stations in Danubian lowland.

	1961-1975	1976-1990	1991-2007
Bratislava-airport	-15.2	-37.8	-58.6
Jaslovské Bohunice	-32.4	-45.0	-63.1
Kráľová pri Senci	-38.2	-73.9	-60.2
Piešťany	-25.2	-32.3	-43.7
Podhájska	-42.9	-43.0	-55.3
Žihárec	-41.8	-33.5	-37.4

The best indicator of the climate change is appearance of new species in the study locality. The first records of new species of fauna introduction into the Danubian lowland are a reality. New species come mainly from the Mediterranean to this locality. Halgoš and Benková (2004) recorded first appearance of Anopheles hyrcanus (Cilicidae, Diptera) in Slovakia (in Danubian lowland). Abundance of some rare Mediterranean species (e.g dragonfly Crocothemis erythraea) increases in Danubian lowland (Bulánková 1999). Recorded changes in occurrence of beetle species in Veľký Báb near Nitra (Danubian lowland) show that some aspects of desertification can be observed on the research area (Šiška and Cunev 2007).

Next the climate scenario for the 21st century is outlined. This scenario is based on the Canadian global climatic General Circulation Model outputs. In 2051-2100 the approximate value (climate scenario) of Konček's moisture index Iz for Hurbanovo = -115.0 (Tab. 2) according to the Canadian CGCM2 (SRES-A2) model (especially because of higher mean air temperature and lower values of precipitation total in the vegetation period (IV-IX) in the 21st century by model). It means region of Danubian lowland will be still more arid.

5 CONCLUSIONS

Climate in the Danubian lowland (SW Slovakia) transformed from the warm and dry to warm and very dry in the 20th century. Recently climate in this region begins to show some features typical for the Mediterranean region with its warmer spells and aridization trends.

The precipitation deficit periods and moisture index issue analyzing in the contribution is only one liable aspect of drought phenomena solution. Drought and its regarding problem of precipitation deficit begin to pose a serious and dominating threat to mankind. We have been registering some indications of annual regime disturbance of selected meteorological characteristics in Slovakia. From the integrated geographical viewpoint the above-mentioned facts have must been appeared in hydrological regime as well as in soil complex and biosphere. Comprehension of these very complex interaction feedbacks requires teamwork of scientists covering different parts of geosystem exploration.

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