THE ANALYSIS OF MULTIANNUAL VARIATION OF TEMPERATURE AND PRECIPITATION RELATED TO THE DESERTIFICATION RISK IN THE BANAT'S PLAIN

ANALIZA VARIAȚIEI MULTIANUALE A TEMPERATURII ŞI PRECIPITAȚIILOR ÎN RELAȚIE CU RISCUL DE DEŞERTIFICARE ÎN CÂMPIA BANATULUI

Veronica POPA, I. BORZA

Agricultural and Veterinary University of the Banat, Timişoara, România
Corresponding author: Veronica POPA, e-mail: vera.popa@gmail.com

Abstract: *The desertification risk is a real phenomenon in Romania and it is closely related to climate evolution. The study of multiannual variation of temperature and of precipitation, as well as its tendency emphasises the sinusoid oscillation translating the characteristic cyclicity on the basis of an increase of the first parameter and of a decrease of the second one.*

Rezumat: *Riscul de deşertificare este un fenomen real în Romania şi se află în strânsă legătură cu evoluția climatului. Studiul variației multianuale a temperaturii şi precipitaților precum şi a tendinței acesteia pune în evidență oscilația sinusoidală ce respectă ciclicitatea caracteristică, pe fondul creşterii primului parametru şi al descreşterii celui de-al doilea.*

Key words: *gliding average, temperature and precipitation variation and tendency, desertification risk*
Cuvinte cheie: *medii glisante, variația şi tendința temperaturii şi a precipitațiilor, risc de deşertificare*

INTRODUCTION

According to the United Nations Convention to Combat Desertification, desertification means the degradation of lands in arid, semi- arid, and dry- sub-humid areas, caused by different factors, including climate variations and human activities. Vulnerability to desertification is a concept defined by climate, relief, rock, soil, and vegetation conditions. Thus, from the climate point of view, in temperate areas we consider vulnerable areas whose P/ETP ratio has values below 0.65 (MUNTEANU, 1988). The risk has an indefinite prognosis character and indicates the probability or real possibility for a somehow expected phenomenon to occur, with serious consequences on both man and environment, both being passive (BOGDAN & NICULESCU, 1999).

MATERIALS AND METHODS

The study of climate risks onto 50-80 years periods of time allows a relatively satisfactory analysis of the phenomenon (BOGDAN & NICULESCU, 1999). The monitoring of the climate evolution has place apart due to its ability of determining certain risks such as the risk of desertification. Climate data can oscillate in time due to the environment changes or to random processes. The tendencies are often hidden by high variations that occur from one year to another but, if these variations indicate a relatively uniform increase or decrease, then we can talk about a tendency (STANCIU, 2005). A frequent method for the adjustment of short-term fluctuations in the data rows is the use of a type of ponderate average the most used being the gliding average method. The method consists of the calculus of the mean values over successive periods of 5, 10, or 30 years. For example, in 5 consecutive years, the average of the period, i.e. X3, is given by the formula (X1+X2+X3+X4+X5)/5 (STANCIU, 2005).

In our case, we processed data concerning annual temperature averages and annual amounts of precipitations for different periods, data from the meteorological station in Timişoara (1958-2006 – temperatures; 1873-2006 – precipitations), Banloc (1958-2006 – temperatures; 1950-2006 – precipitations), Sânnicolau Mare (1961-2006 – temperatures; 1950-2006 – precipitations), and Jimbolia (1986-2006 – temperatures; 1950-2006 – precipitations). We represented graphically the gliding averages for 5 years and their tendency line.

RESULTS AND DISCUSSION

The desertification could be incorporated into four major categories of global climate change research: mitigation assessment; accounting for land cover change in the carbon budget; land surface-atmosphere interactions and climate change impact forecasting (GRAINGER et al., 2000). Despite continuing increase of the ability of global climate models to simulate possible future climate changes it is difficult to predict the impacts these might have on the terrestrial environment, owing to the behavioural responses of human beings as climate zones shift (GRAINGER et al., 2000).

Taking into account the geographical and climate position of Romania, the desertification risk is a serious threat for about 30% of the country's territory, i.e. for southern and south-eastern areas and for part of the Western Plain located in the area whose values P/ETP < 65 (MUNTEANU et al., 2003). However, they have not yet identified deserted areas of significant surface in Romania, except for some small areas in Dobrogea with rocks, thin soils, or very eroded soils (MUNTEANU, 1988), so that it should be more appropriate to talk only of the risk of desertification and not of proper desertification (MUNTEANU et al., 2003). Some of the effects of global warming are the turning of steppe into semi-desert, the turning of sylvo-steppe into steppe, the turning of forest into sylvo-steppe, and the withdrawing of forests to higher altitudes, etc. (BERCA, 2003)

Analysing the graphs corresponding to the 4 meteorological stations and presenting the multiannual variation of annual temperature averages (gliding averages) and its tendency, we can see there is an increase (Fig. 1) of the value on the background of more obvious sinusoidal oscillations than in the case of precipitations both at the meteorological stations from which we took data for longer periods of time (Timişoara and Banloc – 49 years; Sânnicolau Mare – 46 years), and at the meteorological station from which we took data for shorter periods of time (Jimbolia – 21 years).

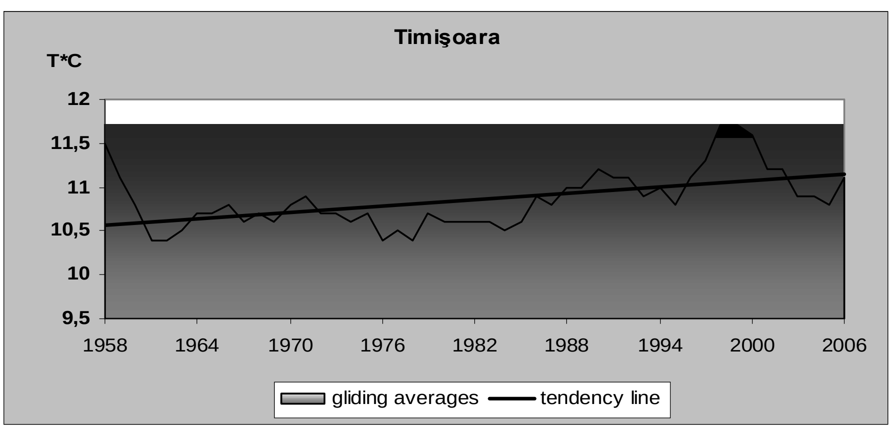


Fig.1a. Variation tendency of gliding averages of annual temperature average

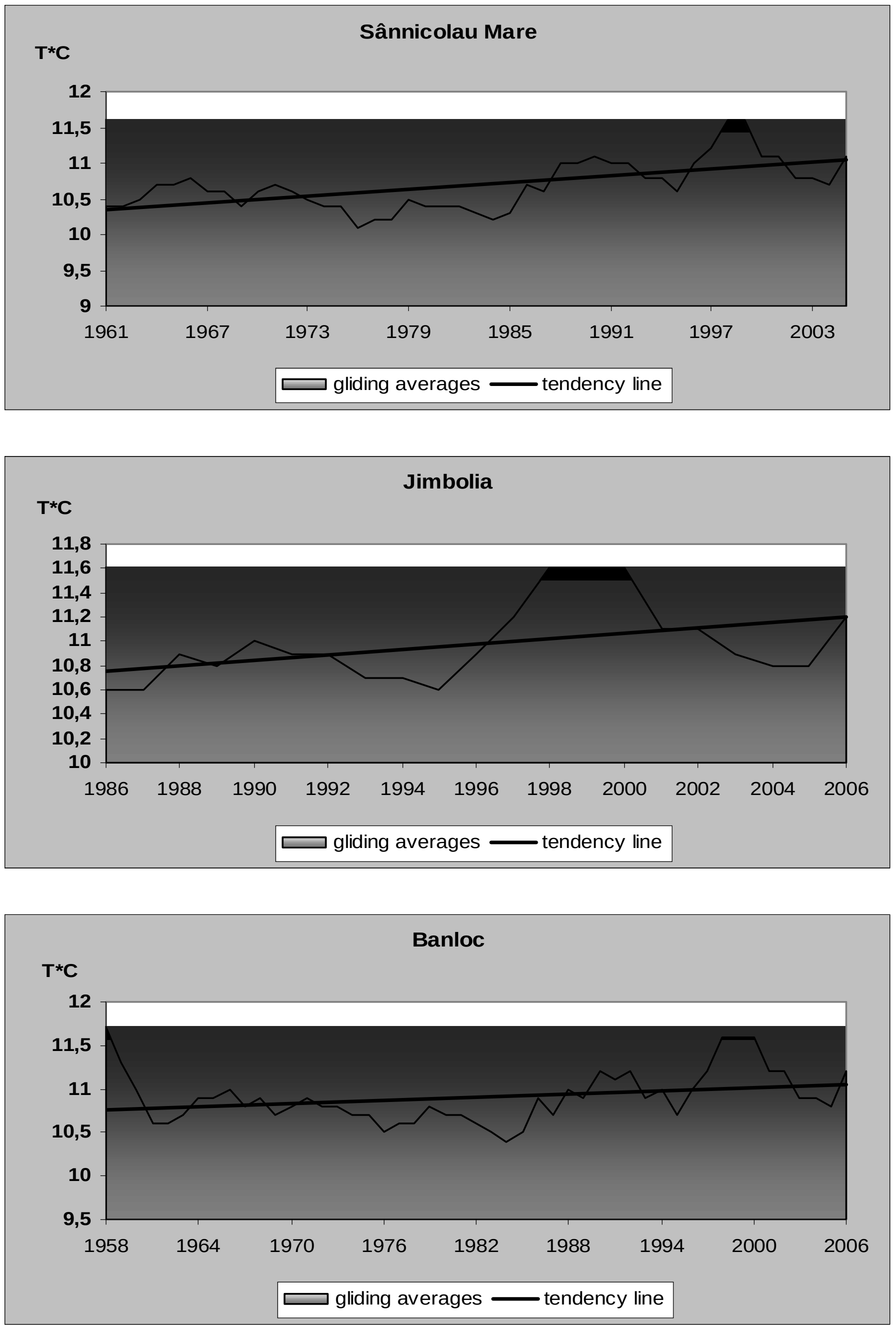


Fig.1b. Variation tendency of gliding averages of annual temperature average

Following the increasing tendency, there are also periods of decrease of annual temperature average, such as that between 1975 and 1985, in Timişoara, Sânnicolau Mare, and Banloc, as well as in the gliding averages which content the year 2005. What is characteristic for the year 2005 is that the decrease of temperature overlaps the increase of the amounts of precipitations contributing to massive flooding. A more obvious increase of the annual average temperature is in Timişoara and Sânnicolau Mare, which may be due to the processing of a long series of data, and temporally point of view, after 1985.

As for the annual amounts of precipitations, they record a decrease of the value in time (Fig.2), which is emphasised also by the ascending position of the tendency line on the background of characteristic cyclicity. If the increase of the temperature is certain no matter the period the data were processed, the rate of precipitations decrease is smaller and it is visible only when analysing a longer series of data. The longest period we have taken into account is that between 1873 and 2006 (134 years) at the meteorological station in Timişoara, where the tendency line shows a decrease. Data are interrupted during and after World War I (1916-1921).

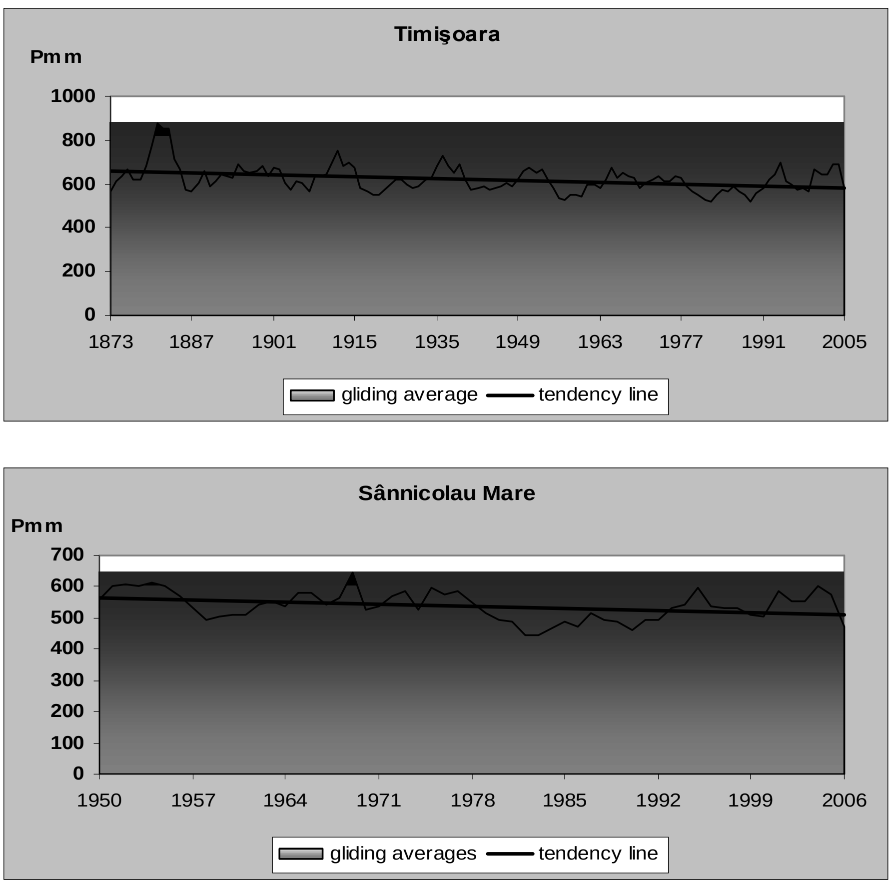
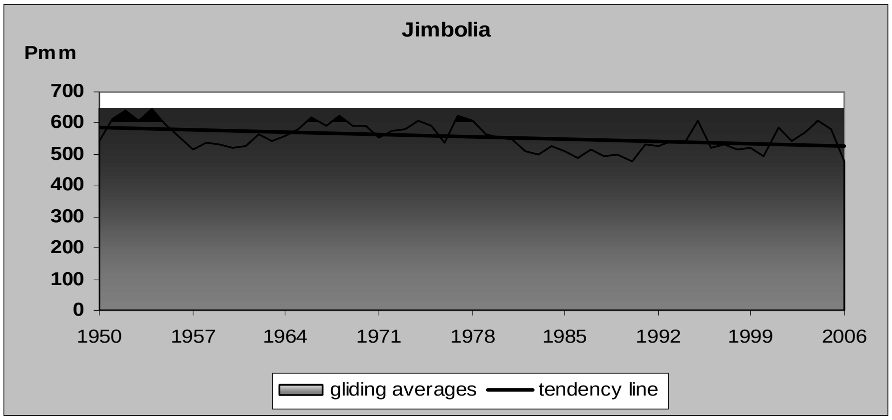


Fig.2a. Variation tendency of gliding averages of annual amounts of precipitations



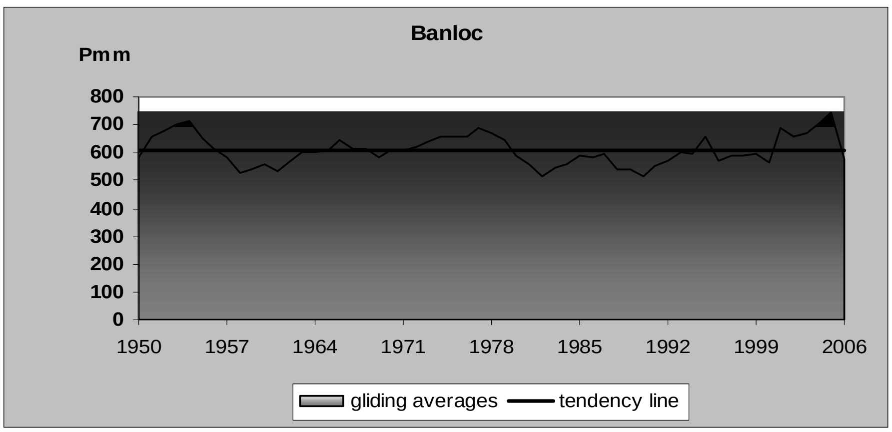


Fig.2b. Variation tendency of gliding averages of annual amounts of precipitations

The diminution process is even more obvious after 1950 and it kept its tendency even if these last years have been isolated years with floods such as 1996 or 2005. At the meteorological stations in Banloc, Sânnicolau Mare, and Jimbolia we analysed data for over 57 years, and the tendency line is descending, less at the meteorological station at Banloc, where it overlaps almost completely the multiannual average. A decreasing period present in almost all the meteorological stations is that between 1978 and 1993.

There is a slight increase tendency of the extreme annual average values and high differences between consecutive years (e.g. 1999-2000; 2005-2006), which implies more intense and longer droughts and more devastating floods. Increases in temperature and decrease in precipitations lead to dryness through the increase of potential evapotranspiration and, implicitly, to the increase of the aridity index specific to the area.

Climate has an important but often subtle influence on desertification processes through its impact on dryland soils and vegetation, on the hydrological cycle in drylands, and, ultimately, on human land use (WILLIAMS, 1995).Different degrees of climate variations (especially precipitation) have impact on vegetation cover characteristics, such as albedo, leafarea index, canopy density and height and this temporal land-cover variability may in turn, be a product of totally different mechanisms of vegetation–climate feedback controlling climate during the wet and dry time intervals in the climate (LIOUBIMTSEVA, 2004).

CONCLUSIONS

Even if the evolution of annual average temperature and of annual amounts of precipitations follow the characteristic cyclicity, the tendency line emphasises an increase in temperature and a decrease of the amounts of precipitations. The increase rate in temperature is higher than that of decrease of precipitations. This latter process can be underlined only by analysing a long series of data. Between the meteorological stations are not profound differences. The graphs point out that the method of gliding averages is more efficient in adjusting the values of the precipitations than in adjusting the values of the temperatures. Taking into account the fact that reaching satisfactory conclusions as far as the risk of desertification is concerned depends on the processing of data for longer periods of time, we need to complete climate data recorded at meteorological stations with other supplying sources of similar data such as tree rings.

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9.***The data was processed based of the values supplied by C.M.R. Banat-Crişana.