

Correlation between level of the first aquifer and rainfall in South Banat

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Abstract: In these study tendencies of the first aquifer at several locations in South Banat, on the base of monthly data for 30 years period was analysed. Time series were decomposed in four basic components: trend, seasonal, cyclical and irregular variations. The periodicity of dominant seasonal and cyclical components was examined by means of spectral analysis. On the basis of obtained results it may be concluded that both series, level of the first aquifer and rainfall, increase in vegetation period and decrease out of vegetation period. The relation between considered time series was explored by means of correlation and cross correlation coefficients. Time series were analysed for two periods: before and after constructing of the Djerdap reservoir.

Key words: seasonal, cyclical, irregular variations

INTRODUCTION

The Banat encompasses the area between the Tisa, Danube, Karas and Romanian frontier. The morphology of the area is peculiar, with the elevation of 300 a.m.s.l. at the slopes of the Carpathians and 67 a.m.s.l. at the mouth of the Karas river to the Danube. There are three geomorphologic units consisted of the eolian and fluvial sediments:

- Sandy terrain of Deliblato and the loess plateau of Banat, with the elevation above 100 a.m.s.l.. The water table level (WTL) is at the depth greater than 10 m from surface.
- Loess terrace of Banat with the elevation from 80 to 100 a.m.s.l.. The water table level (WTL) varies about 5 to 10 m from surface.
- The alluvial plains of Danube, Tisa, Begej, Tamis, Karas, Nera and Vrsac – Alibunar swamp, with the elevation below 80 a.m.s.l.. The water table level (WTL) exceeds 5 m.

RESULTS AND DISCUSSION

Three regime types are singled out in the investigated area, based on the formation conditions, alimentation, drainage and factors which, the WTL regime is under the influence of:

1. Climatic, in the loess plateau, Deliblato sandy terrain and Vrsac - Alibunar swamp.
2. Hydrological, in the alluvial plains of Danube, Tisa, Karas and Nera river.

3. Anthropogenic, in all geomorphologic units in the zone of deceleration influence. The climatic type of regime is defined in the parts of aquifer in the loess plateau and terrace. The average WTL-s is at the depth greater than 10 m (1b). In the season, primary and secondary maximum and minimum of the WTL are correlated with the rainfall regime STOJILJKOVIC (1997). The seasonal oscillation are determined with the amplitude less than 0.5 m. The cyclic oscillation with a period of $S_1=28-29$ years and $S_2=12$ years are dominant (Figure 1b), $S_3=6$ years and $S_4=2$. Periodic is complete in correlation with periods in precipitation regime ($S_1=5$ years, $S_2=2$, and $S_3=15$ years) in a part of Vrsac – Alibunar swamp (WTL 0,0 – 2,50 m) (Figure 1a.).

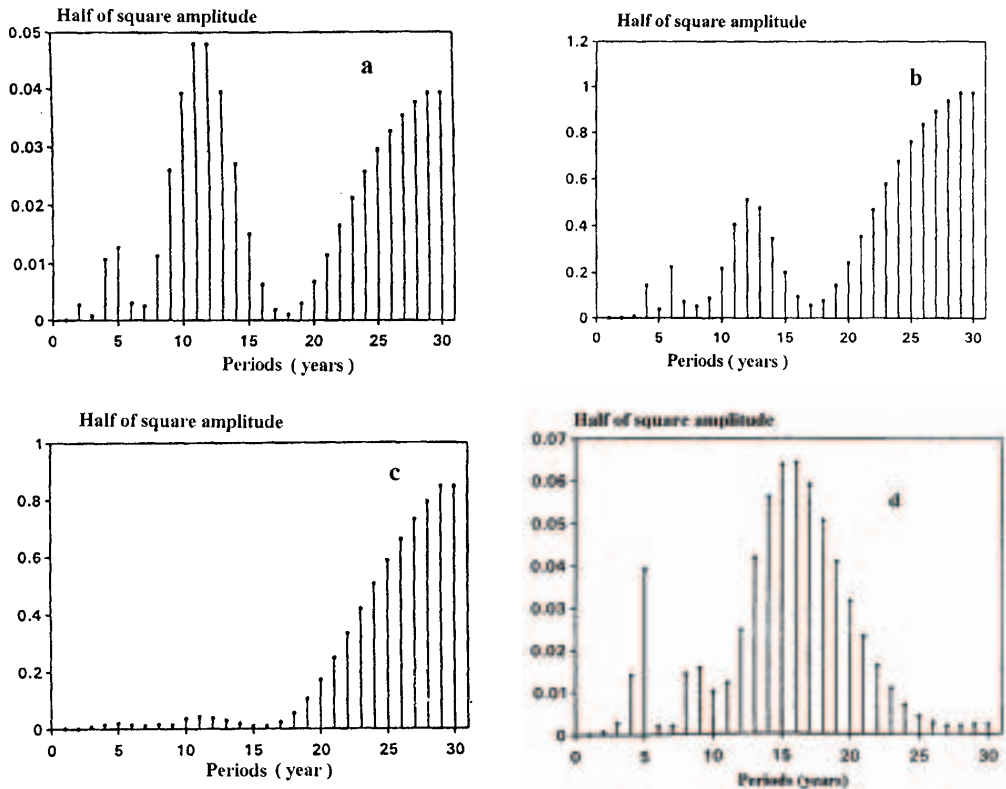


Figure 1. The periodograms of average year WTL (1961-1990)

- a) The regime type is climatic and hydrological (WTL from 0.0 – 5.0 m); b) The regime type is climatic (WTL > 10.0 m); c) The regime type anthropogenic; d) The regime is hydrological

Hydrological type of regime is characteristic for parts of aquifer in alluvial plains with natural regime (1961-1971). Prevailing factor to influence the regime was hydrologic regime of water currents Karas, Nera, Tisa and Danube. The oscillation during the hydrologic year had one maximum and one minimum WTL, in correlation with the rainfall regime and water level in the river basin of Carpathian area (Figure 1a,d). The seasonal variations with

the amplitude over 1.0 m are dominant, with the characteristic cyclic oscillation with period $S_1=11-15$ years, $S_2=28$ years, $S_3=5$ years. After Djerdap accumulation, Kajtasovo water gate and defense line building, the correlation relationship does not exist and is not statistically defined. For 1972-1990 period the seasonal oscillation are deadened with the amplitude less than 0.5 m and dominant cycle with the period $S_1=28$ years (Figure 1c).

Practically, in the deceleration zone the anthropogenic type of regime is dominant, which is in correlation with the working regime of Kajtasovo water gate, drainage lines and Djerdap accumulation. This regime prevails in the alluvial plains of Nera and Karas in our area and in the edged parts of the aquifer in the higher geomorphologic units, STOJILJKOVIC (1998,1999, 2001.).

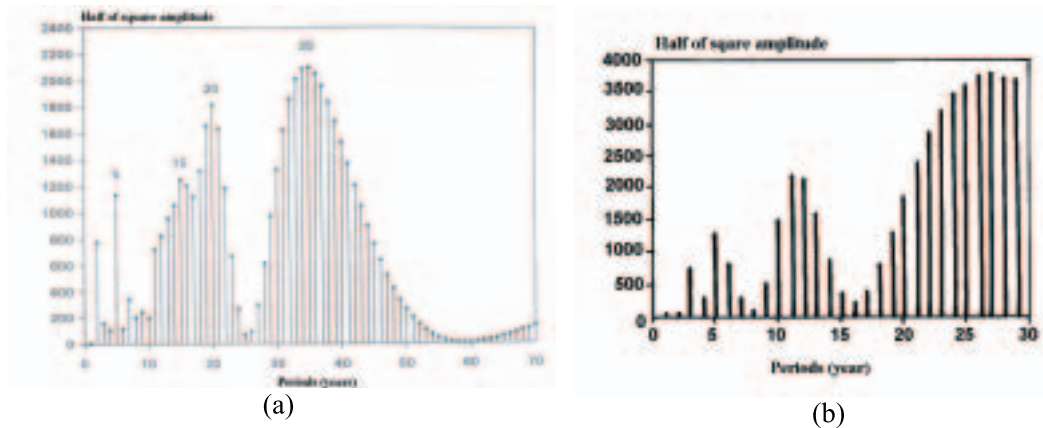


Figure 2. The periodograms of rainfall M.S. Vrsac, a) 30 years, b) 70 years

Conclusions

Dominant periods for precipitation at meteorological station Vrsac are estimated by line spectral method. The length of time series, which included at least two of three cycles, are required by confidence degree of cyclic analyzes. Correlation is found in case when time series of precipitation is as long as time series of ground water level. Three periods are separated: Dominant period $S_1=5$, $S_2=2,14$ and $S_3=11$ (Figure 2b). For analyzed time series of precipitation for 70 years (from 1925 to 1994), dominant is period $S_1=35$, $S_2=20$, $S_3=15$, $S_4=2$ (Figure 2a).

Because of accurate period depend on time series length it could be concluded that periodical correlation between precipitation regime and ground water level are exist for periods $S_1=2$, $S_2=5,0$ and $S_3=11$ (15) years in a part of Vrsac – Alibunar swamp (WTL – 2,5).

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